INDUSTRIAL HISTORY

OF THE

UNITED STATES,

From the Earliest Settlements to the Present Time:

BEING

A COMPLETE SURVEY OF AMERICAN INDUSTRIES,

EMBRACING

AGRICULTURE AND HORTICULTURE; INCLUDING THE CULTIVATION OF COTTON, TOBACCO, WHEAT; THE RAISING OF HORSES, NEAT-CATTLE, ETC.; ALL THE IMPORTANT MANUFACTURES, SHIPPING AND FISHERIES, RAILROADS, MINES AND MINING, AND OIL; ALSO A HISTORY OF THE COAL-MINERS AND THE MOLLY MAGUIRES; BANKS, INSURANCE, AND COMMERCE; TRADE-UNIONS, STRIKES, AND EIGHT-HOUR MOVEMENT;

TOGETHER WITH A DESCRIPTION OF

CANADIAN INDUSTRIES.

In Seven Books.

COPIOUSLY ILLUSTRATED WITH ABOUT THREE HUNDRED ENGRAVINGS BY THE MOST EMINENT ARTISTS.

BY

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THE HENRY BILL PUBLISHING COMPANY:

NORWICH, CONN.; CINCINNATI, O.;

PEORIA, ILL.

[1878]

Franklin Press:
Electrotyped and Printed by
Rand, Avery, & Co.,
Boston.

PREFACE.

THE present work was projected by the author several years ago, and is now given to the public in the belief that it will prove really useful, inasmuch as nothing worthy of the name has appeared, while the field itself is quite as deserving of study as any other portion or phase of American history.

A great variety of materials have been collected and used in the present undertaking: many facts, also, have been gathered from conversation with persons who were more or less familiar with some special branch of American industry. The author has sought to make proper acknowledgment for all facts and incidents herein related, though doubtless he has failed to do justice to every work and author from whom special information has been drawn. On page 56 he omitted to state that the statistics relating to shipments of cotton were taken from Mr. Dana's valuable work entitled "Cotton from Seed to Loom;" while it ought to be mentioned, that, in the introductory chapter, free use has been made of the short but excellent sketches of Ben: Perley Poore and Charles L. Flint of the History of Agriculture contained in the United-States Agricultural Reports, as well as the paper of the latter on American Horses which is to be found in the same publication. Likewise, in describing the Pittsburgh riots of 1877, liberal use was made of the message of Gov. Hartranft, which contained a very concise and truthful account of that shocking affair.

Nor would I fail to express my very great indebtedness to Henry Hall of "The New-York Tribune," and James Hall of Norwich, Conn., without whose assistance the preparation of this work for the press would have been much longer delayed.

To Mr. C. A. Cutter, Librarian of the Boston Athenæum, my sincerest

thanks are due, and are hereby tendered, for the exceedingly liberal use of the books of that institution; and also to the Librarian of the Boston Public Library for special privileges of a similar character. I would further add my obligations to the Librarian of the Astor Library for the privilege of consulting to my best advantage the treasures of that collection. The aids thus obtained from these three noble institutions were invaluable: indeed, without them, it would have been impossible for the author to have executed the present work.

NORWICH, CONN., Oct. 15, 1878.

PREFACE TO THE THIRD EDITION.

THAT two editions of this work should be exhausted within a few months strongly verifies the author's belief, when writing it, that such a work was needed. Since the first edition was issued, changes and improvements in the text and illustrations have been made, which, it is believed, will render the work still more valuable to the reader.

THE AUTHOR.

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INDUSTRIAL HISTORY OF THE UNITED STATES.

CHAPTER I.

GENERAL HISTORY.

INTRODUCTORY.

FOR ages historians have been busy in writing about political and military events, leaving quite out of sight the social and industrial life of nations, as unworthy of notice. To recent historians a truer historic instinct has been given; and, by uniting with it a broader and more profound culture, they are setting before the world juster, more varied, and more complete pictures of the civilization of the past. Other historians there are who exhibit only a single side or phase of material life, but, unlike their predecessors, are concerned not less with political or military events than with social and industrial characteristics.

Different methods of writing history.

It is true that a history of agriculture is free from those startling sensations which spring from the vivid description of battles and other operations of war, the intrigues of diplomacy, the uncertain and checkered course of legislation, the wild freaks of rulers, or the tragedies and comedies of social life. But agriculture possesses an interest for us as deep and abiding as any other phase of history. It is a healthy study; for we are taken out of doors, are brought into intimate relationship with Nature, and learn of her boundless generosity and rewards for well-doing. Moreover, it is a history of some of man's greatest triumphs, won, not by striking down his brother, but by conquest over Nature through accident or experiment.

Importance of history of agriculture.

No wonder, then, that the cultivation of the soil has proved so attractive to the world's greatest men. When the Roman patrician, Cincinnatus, left his farm to assume the dictatorship of Rome, he betook himself to his gentle occupation as soon as he had delivered his country from the enemy. And likewise Washington, when retiring from the cares of state, fled to Mount Vernon, where, amid his rich and numerous acres, he daily drank heavy draughts of pure enjoyment, for which he had often longed during an anxious civil career and the still

The greatest men have been agriculturists.

more troubled days of the Revolution. Even of Webster it may be questioned, whether, with all his fitness and fondness for the national Senate, he did not derive greater happiness from his farm in Marshfield; for what fact can more touchingly attest his attachment to it than his dying request for his cattle to be driven one by one past the window of the room where he lay, that he might look once more upon them before his eyes were forever closed?

Remembering how vast is the space filled by agriculture in the industries of our country, no further justification is required for writing its history. For a long period, agricultural products have led the list of exports to other countries, and will lead them for years and centuries to come. If a history of the efforts to destroy life be worth preserving, surely a history of those means in which so many are engaged to sustain life is not less worthy of preservation. The famous minister of Henry IV. of France, Sully, called agriculture, including both tillage and pasturage, "the two breasts of the state." Strikingly true as the figure is, will not a review of the subject, by showing what has been already accomplished, excite the farmer to new experiments and inquiry?

Justification for writing a history of agriculture.

INDIAN AGRICULTURE.

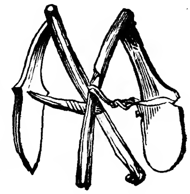
The North-American Indian was not an agriculturist: he regarded the cultivation of the soil as degrading. Yet, as it was necessary for some one to cultivate it in order to obtain a living, the task fell to the old women and children. Though the Indian was slack, careless, and lazy, he exercised more forethought and care about his corn-crop than any thing else. When Capt. John Smith visited Virginia in 1609, in writing of the Indians he says, "The greatest labor they take is in planting their corn; for the country is naturally overgrown with wood. To prepare the ground, they bruise the bark of trees near the roots; then do they scorch the roots with fire, that they grow no more." Very likely from them our ancestors learned the process of belting or girdling trees by cutting through the sap-wood; thus causing the fall of the spray and the decay of the smaller branches, and admitting the sun and air in sufficient quantities for corn to grow and bear fruit.

Indians raised corn.

The mode of planting and cultivating corn was rude enough, and betokens as clearly as any other trace of their civilization how simple and low it was. Every spring-time, the dead wood on the ground, and perhaps other branches and brush, were collected and burned to obtain ashes to enrich the soil; after which the surface of the ground was scratched with the flat shoulder-blade of the moose, or with crooked pieces of wood. Then hills were made with the rudest sort of wooden hoes or clam-shells, about four feet apart, in each of which was placed an alewife caught from the adjoining stream, or a horseshoe crab picked up from the seashore. Upon this stimulant were dropped half a dozen grains of corn, which were covered;

Mode of planting.

and a hut was then built in the middle of the field, wherein lived the police to protect their work from the ravages of birds. One can very easily imagine, in those times, when the forests were alive with birds, what would be the fate of a cornfield if left to itself. While the smaller birds and animals were prevented from eating up the tender blade only by constant watchfulness, the stronger stalk and full-grown corn were preserved by the exercise of the same ceaseless vigilance.



INDIAN HOES.

As the corn grew the earth was scraped around it, until the hills were two feet high, — a custom still followed in many parts of the country. Before the corn was fully ripe, it was plucked; and the seed for the next year was selected from those stalks containing the largest number of ears, and hung up in the wigwam. The remainder was dried in the husk, over smouldering fires, or in the sun; after which process it was husked, shelled, packed in birch-bark boxes, and buried in holes in the earth, which were lined with bark to protect the grain more perfectly from frost and moisture. A writer says 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.

Harvesting and storing the corn.

Corn thus dried, cracked in a stone-mortar and boiled, was called "o-mo-nee;" and "sup-paun," when pounded into meal and sifted through a basket for ash-cakes. When on the war-path, the Indian warrior lived upon parched corn called "no-kake." When Roger Williams journeyed through the forests on the way to his future home, near Narragansett Bay, accompanied by the Indians whom he loved, and who never proved treacherous to him, he says that each man carried a little basket of this kind of food, — enough to last for several days. The Indians also prepared corn in another way, which has become well known, and will probably be long continued. We allude to the mode of mixing corn with beans, and preparing a dish known among them as "mu-si-quatash," which in these days has been abbreviated to succotash. The original dish, however, according to Gordkin, was not composed simply of corn and beans: several other ingredients were included, "fish and flesh of all sorts, either new-taken or dried, venison, bear's-flesh, beaver, moose, otter, or raccoon, cut into small pieces, Jerusalem artichokes, ground-nuts, acorns, pumpkins, and squashes."

How Indians cooked corn.

While corn was the chief product raised by the Indian, he cultivated or collected several other fruits and vegetables. Among their corn were planted peas and beans, the vines climbing up the corn-stalks; thus economizing the use of pea-brush and bean-poles. Surely this was an exhibition of economy in labor and material worthy of a savage. During the month of May they also planted "pumpkins" among their corn, "and a fruit like unto a musk-melon, but less and worse, which they called 'macocks.'" The bold and unblushing sunflower was also cultivated; but instead of putting its seeds to the ignoble use of hen-fodder, as the moderns do, they were made into bread. In some parts of the country wild rice was gathered and kept for winter use; and Barlowe, who visited North Carolina in 1584, affirms that he saw there "both wheat and oats." Tobacco was everywhere cultivated. Huge grape-vines intwined many a forest-tree, and the woods abounded with other wild fruits and berries. Gourds were raised, of all sizes, from the huge "cal-a-bash-es," holding two or three gallons apiece, to the "tiny receptacles of pigments used in painting for war." Cherries and plums also abounded, large quantities of which were dried for winter use. Concerning the cultivation of the apple, something will be said in another place.

Other fruits raised.

Although the Indians knew nothing about sugar-cane, they were not without sugar; for they extracted it from the maple, just as we do now. Mixed with freshly-pounded "sup-paun," and seasoned with dried whortleberries, a dainty dish was baked for high festivals; and, for an accompanying beverage, the dried meats of oil-nuts were pounded, and boiled in the juice of sassafras. For lights on such occasions, candles were made from the green wax of the bayberry, with rush wicks, which burned brightly, and yielded a pleasant odor.

Dainty dishes and beverages.

Their provisions were stored in boxes made of birch-bark; and their cutting instruments and sharp weapons were pointed with flint-stone, shells, or bones. A few earthen vessels were used; but the superiority of our civilization, in its material characteristics, over the aboriginal, presents no more striking contrast than in the variety and improvement of means for cultivating the soil. It may also be added, that the Indian possessed no domestic animals except a few small dogs, and no poultry.

Instruments and domestic animals.

Such is a brief picture of the agricultural life of the Indian. Long ago the cheerless wigwam was supplanted by the pleasant home, the crabbed orchard by large and more luscious fruit, and the ill-tilled, scanty corn-patch by more careful tillage and abundant crops. Although cattle-shows and agricultural anniversaries were unknown, the Indians celebrated their "green-corn dance" and the feast of the "harvest-moon." But,

Fate of Indian agriculture.

"Alas for them! their day is o'er;
Their fires are out from hill to shore.
No more for them the red deer bounds;
The plough is in their hunting-grounds;
The pale man's axe rings through their woods,
The pale man's sail skims o'er their floods;
Their pleasant springs are dry."

COLONIAL AGRICULTURE IN THE SOUTHERN COLONIES.

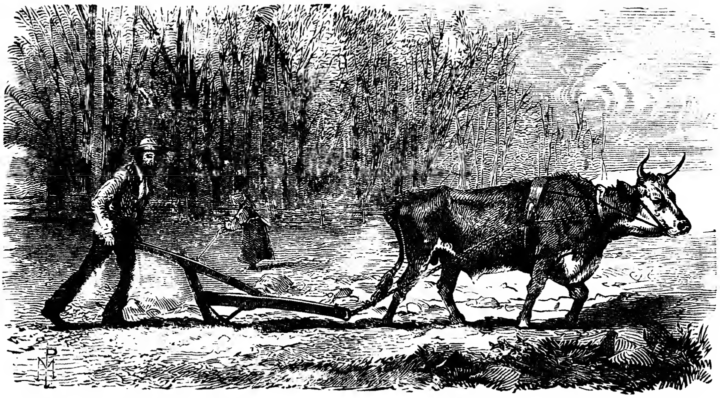
The system of agriculture which swept away the aboriginal system, though vastly superior to it, was, nevertheless, very imperfect compared with the system of modern days. Two very different systems flourished in the colonies, each of which requires a separate description. To the Southern colonies first came an aristocratic people, with their servants and slaves. They were followed by Scotch merchants and mechanics, who were succeeded by French Huguenots of high spirit and attainments; while at a later period flocked large numbers of Scotch Jacobins, on account of the unsuccessful rebellions of the pretenders to the Scottish throne. A true glimpse of the immigration by which Virginia, the mother of the South Atlantic States, was colonized, may be obtained from the response of the governor, Sir William Berkeley, to one of the interrogatories propounded to him by the British lords-commissioners of foreign affairs. In response to the inquiry, "What number of English, Scotch, and Irish have, for these seven years last past, come yearly to plant and inhabit with your government?" and also, "What blacks or slaves have been brought within the same?" he replied, "Yearly there come in of servants about fifteen hundred. Most are English, few Scotch, and fewer Irish, and not above two or three ships of negroes in seven years." Nothing is said of the free immigrants, though included in the interrogatory; and their number was, doubtless, too inconsiderable for notice. In the same examination Sir William says, "But I thank God there are no free schools or printing; for learning has brought disobedience and heresy and sects into the world, and printing has divulged them and libels against the best government. God keep us from both!"

Who settled Virginia.

The feudal system also, which was weakening in England, was adopted, though in an earlier form, as the following extract from one of the royal grants will show. It gave the patentee the right "to divide the said tract or territory of land into counties, hundreds, parishes, tithings, townships, hamlets, and boroughs, and to erect and build cities, towns, parishes, churches, colleges, chapels, free schools, almshouses, and houses of correction, and to endow the same at their free will and pleasure; and did appoint them full and perpetual patrons of all such churches so to be built and endowed; with power, also, to divide any part or parcel of said tract or territory, or portion of land, into manors, and to call the same after their own or any of their names, or by other name or names whatsoever; and within the same to hold a court in the nature of a court-baron, and to hold pleas of all actions, trespasses, covenants, accounts, contracts, detinues, debts, and demands whatsoever, when the debt or thing demanded exceed not the value of forty shillings sterling money of England; and to receive and take all amercements, fruits, commodities, advantages, perquisites, and emoluments whatsoever, to such respective court-barons belonging or in any wise appertaining;

Feudal system adopted.

and, further, to hold within the same manors a court-leet and view of frank-pledge of all the tenants, residents, and inhabitants of the hundred within such respective manors."



NEW RIVER PLOUGH-TEAM, VIRGINIA.

Farms and mansions.

The farms in Virginia and Maryland were extensive, fronting on the Chesapeake Bay or its tributaries, and running a long way into the interior. Not far from the shore of river or bay was located the planter's mansion, to which came ships from England, bringing merchandise in exchange for tobacco; or other craft laden with the products of New-England fisheries, or of West-India plantations, to barter for tobacco, wheat, or corn. The intervening space between the mansion-house and water-side was usually laid out as a garden, in the prim, stiff style of those days, with terraces, arbors, and wide walks bordered with box. Most of the houses were built of English brick, the iron-work, and also much of the interior, being imported. Entering the hall, we are told by a Virginia antiquarian, walls were seen covered with deer's antlers, fishing-rods, and guns; portraits of cavaliers and dames and children; even carefully-painted pictures of race-horses, on whose speed and bottom many thousands of pounds had been staked, and lost and won, in their day and generation. On one side of the hall a broad staircase, with oaken balustrade, led to the numerous apartments above; and on the opposite side a door gave entrance into the great dining-hall. The dining-room was decorated with great elegance; the carved oak wainscot extending above the mantlepiece in an unbroken expanse of fruits and flowers, hideous laughing faces, and armorial devices, to the cornice. The furniture was in the Louis Quatorze style, with carved backs to the low-seated chairs. There were Chelsea figures, and a sideboard full of plate, and a Japan cabinet, and a Kidderminster carpet; while in the great fire-place a few twigs crackled on huge and highly-polished brass andirons. On the walls hung pictures of gay gallants, brave warriors, and fair dames whose eyes outshone their diamonds; and more than one ancestor looked grimly down clad in cuirass and armlets, and holding in his mailed hand the sword which had done bloody service in its time. The lady portraits, as an invariable rule, were decorated with sunset clouds of yellow lace; the bright locks were powdered; and many little black patches set off the dazzling fairness of the rounded chins.

Near the mansion were tenements for the manager and the overseers, and the slave cabins. The first philanthropist to improve the condition of his slaves, according to trustworthy authority, was Col. John Taylor of the Rappahannock Valley, who was equally distinguished in the last century as a farmer, author, and statesman. "He built commodious brick dwellings for them, and accustomed them to plank floors, glass windows, and decent, civilized habits of living. He, besides, furnished them more regularly and abundantly with food and clothing than was then usual. His negroes multiplied rapidly, became more honest and industrious; and his crops increased."

Improvement of condition of slaves.

The pioneers of Virginia are described as contrasting strongly with the planters and their adherents. In most cases they were younger sons, unlucky gamesters, turbulent spirits, rejected lovers, or disbanded soldiers, who turned their backs upon civilization to live an untrammelled life in some fertile mountain-gap or rich river-bottom. Game was plentiful; and they were hunters rather than farmers, sending their peltries to market, and only cultivating enough land to supply their wants. This unrestrained life became a passion; and, as the tide of civilization advanced westward, the pioneers would leave their "settlements" with their "improvements," to seek some spot in the wilderness where as yet no white man's foot had trodden.

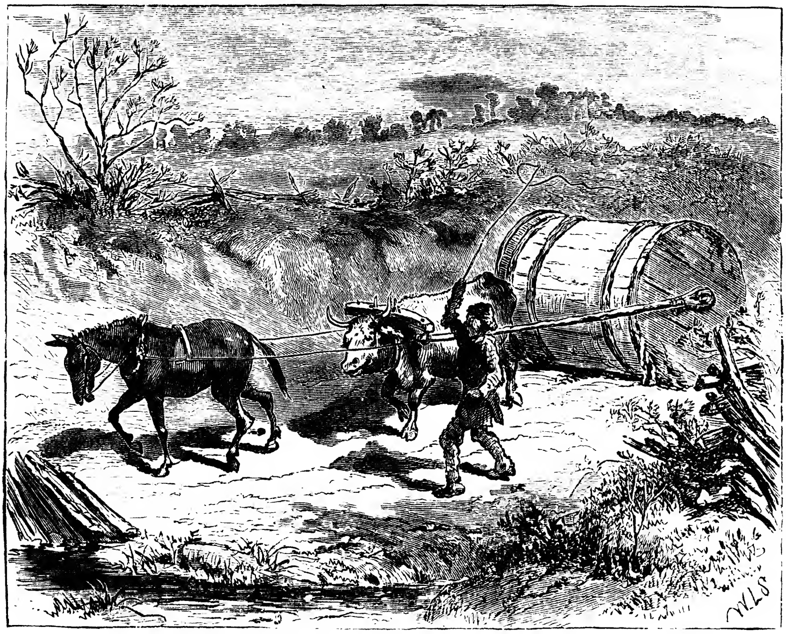
The pioneers of Virginia.

Tobacco early became the staple product of Virginia, although laws numerous and stringent were enacted to prevent its cultivation. Efforts were put forth to encourage other branches of industry; yet little attention was paid to them except for purposes of home consumption. Planters still continued the culture of the exhausting tobacco-plant, with continuous cropping, shallow ploughing, and no fertilizing, until the soil grew weak, and unfit for cultivation. Small ploughs and heavy hoes were used in cultivating it; and when the crop was gathered, cured, and packed into hogsheads, it was rolled away to the nearest wharf for inspection and transportation. In those early days good roads were unknown, and wagons were few: so a pole and whipple-trees were attached to each hogshead by an iron bolt driven into the centre of one head, thus converting the cask into a huge roller. For many years the places for deposit and inspection of tobacco were called "rolling-houses."

Cultivation of tobacco.

Though cotton was raised at an early date, it was not grown in sufficient quantities for export: indeed, the cultivation of tobacco absorbed the chief attention of the planter, especially in Virginia, until the opening of the eighteenth century. Farther south, in South Carolina, rice was cultivated. It is related, that, in 1694, a vessel from Madagascar put into Charleston in distress, the captain of which, in return for favors rendered by the governor, gave him a bag of rice. The governor, who had seen the plant growing in the hot swamps of Madagascar, conceived the idea of raising rice in his own colony: accordingly it was planted, and brought forth abundantly. The soil proved well adapted to the plant, and it was not

Cotton, rice, and other products.



MANNER OF CARRYING TOBACCO FORTY YEARS AGO.

long before the marshes of Georgia and South Carolina were covered with rice-plantations. Exports of rice to England soon after began, and in 1724 a hundred thousand barrels were sent from the latter State. Experiments in wine-making were undertaken at an early period; and in 1758 the London Society for the Encouragement of Arts, Commerce, and Manufactures, proposed premiums for its production. The same society offered premiums for hemp, opium, olives, pot and pearl ashes, barilla, logwood, scammony, myrtle-wax, sarsaparilla-root, and the gum from the persimmon-tree. It was supposed that this gum might prove a substitute for gum-arabic; but the cost of gathering and transporting it was too great, and the experiment failed. After a three-years' trial, the premium was withdrawn.

Besides the premiums offered by this society, the British Parliament granted considerable sums of money at various times to stimulate the culture of silk, indigo, and other plants. Colonial trade, however, was guarded none the less strictly; for the colonists were obliged to send all their surplus products to England, and were forbidden purchasing any foreign manufactures save in a British port.

Premiums offered by British Parliament.

COLONIAL AGRICULTURE IN THE NEW-ENGLAND COLONIES.

Let us now look toward the North, and watch the landing of the Pilgrims, and their first efforts in cultivating the soil. The colonists of Virginia, who came somewhat earlier, as we have seen, had confined their attention chiefly to the raising of tobacco; and as their climate was less rigorous, and their summers were longer, it was easier for them to obtain a living. The Pilgrims were an agricultural people, the clergy forming no exception; and for a long period they were among the foremost in New England in trying experiments, and inciting their flocks to patient and intelligent industry. One of the reasons why they came here from Holland, according to Bancroft, was, because they "had been bred to agricultural pursuits," which they could not follow in the land of their temporary adoption.

The Pilgrims an agricultural people.

That they continued to follow their original pursuit as their chief one for many years after their arrival is familiar history. But their task was a severe one. Cleared fields were small and few; and their implements were ill fitted to clear the dense woods, and subdue the stubborn soil. Some implements, doubtless, were obtained from the mother-land; but the only metal to be found here that they could work was bog-iron ore, which was very brittle, and often spoiled a day's work. The magnitude of their task, from lack of appropriate means, it is perhaps more difficult for us in this age to realize than almost any other feature of our history, because farming-implements have been brought to such a degree of perfection.

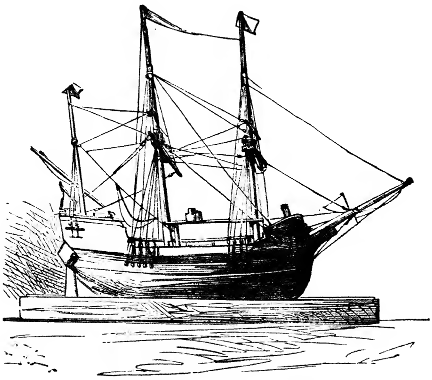
Difficulty of cultivating the soil.

Want of proper tools.

The system of agriculture best adapted to the country could only be learned by experiment. Of course the settlers brought with them the ideas and products of their mother-land; but how poor was their outfit they soon learned. Indian-corn, pumpkins, squashes, beans, potatoes, tobacco, and other vegetables and fruits, which were found growing here, it was easy to cultivate by inquiry from the Indians, and with greater success than ever attended the efforts of their teachers; but in respect to the fruits transplanted, as well as the horses, sheep, and other animals brought hither, it was only found out by numerous experiments and many losses what our climate and soil were best fitted to raise and sustain. What did the English immigrant know about the country until he came here, and how English cattle and fruits would thrive under such altered conditions? It would be an interesting chapter to trace the history of these experiments;

Success in farming could be determined only by experiment.

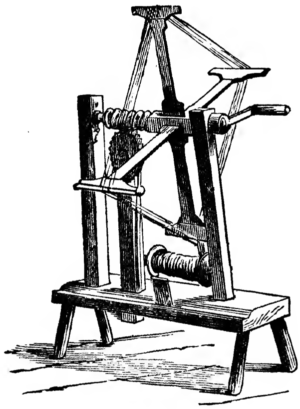
but our space is too limited, even if the necessary information could be gathered. Suffice it to say, after trial some vegetables and grasses were abandoned, while the appropriate locality of others was discovered. Hemp, indigo, rice, cotton, madder, millet, spelt, lentils, lucern, sainfoin, and many other things, were tried in New England, and failed, as did other crops in the Southern colonies. Not only the plants of Europe, but many from Asia and the East Indies, were tried, including cinnamon and various commercial plants. Some of these crops, on experiment, failed entirely; others flourished after a fashion, but proved unprofitable; others flourished with peculiar luxuriance, and with characters unchanged; and still others, under the new conditions, assumed new characters or excellences. Before the war of the Revolution, these trials had been made from Maine to Texas; and so completely had this century and a half of experiments solved the great problems of adaptation, acclimation, and often naturalization, that not a single important species of domestic animal has been profitably introduced since, nor but one plant (sorghum) of sufficient importance to be recognized in our official statistics. So writes one whose accuracy none will question.[1]



MAYFLOWER.

Picture of a New-England colony.

Let us reproduce the picture of a New-England colony during this period. It is the one flourishing at Massachusetts Bay, which was founded not long after the Plymouth Colony. Within this peaceful realm squatter-sovereignty was unknown; for no individual was permitted to establish himself without authority of the government. Each body swarmed out with a regular allotment of individual farms, based in extent upon the wealth of the settlers; a great pasture, a peat-meadow, a salt-marsh, and fishing-grounds, being held in common. These farms were so laid out, that no house was over half a mile from the meeting-house; and it was with astonishing rapidity that agricultural communities sprang up, like the fabled warriors of Cadmus, into full-armed life. Like those mythological knights, they were



KNOT-REEL.

[1] Professor Brewer of Yale College.

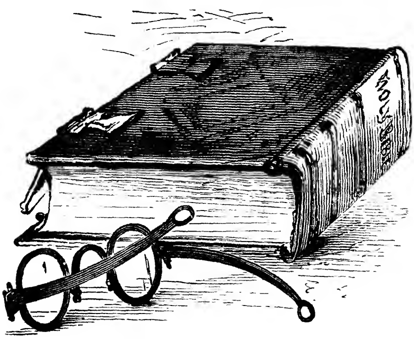
armed with weapons, not for their own destruction, but for the defence of their liberties and their homes. From these small farming-hamlets have grown up most of the towns and cities of our country, and from one of them went forth the alpha of colonization in the Great West. In the log-cabin of that agricultural era were first cultivated the true though austere religion, the domestic virtues, the sturdy habits of frugal industry, the daring spirit, and the devoted love of liberty, that have so advanced the prosperity and the glory of this Western continent. The acorns planted by our fathers have become stately trees, under whose umbrageous foliage thousands of their descendants, and others whom the grateful shade has invited from less-favored lands, find protection, shelter, and repose.

The same writer has given a felicitous sketch of the houses of the early settlers, drawn from a careful perusal of the materials collected by the tireless antiquarian. Imagine yourself as belonging to a "committee on farms," and then let us visit one of these yeomen. Riding along a "trail," indicated by marked trees, we find his horse and cattle-shed standing near an old Indian clearing, encircled by a high palisade, which includes the spring, that water may be brought without danger from the "bloody savages." The house, which is over a small deep cellar, is built of logs, notched where they meet at the corners, with a thatched roof, and a large chimney at one end, built of stones cemented with clay. The small windows are covered with oiled paper, with protecting shutters; and the massive door is thick enough to be bullet-proof. Pulling the "latch-string," we enter, and find that the floor, and the floor of the loft which forms the ceiling, are made of "rifted" or split pine, roughly smoothed with the adze; while the immense hearth, occupying nearly an entire side of the house, is of large flat stones. There are no partition-walls; but thick serge curtains are so hung, that at night they divide off the flock-beds, upon which

Houses of the early settlers.

HOUSE OF AN EARLY SETTLER.

there are piles of rugs, coverlets, and flannel sheets. A high-backed chair or two, a massive table, a large chest with a carved front, and some Indian birch-bark boxes, are ranged around the walls; while on a large "dressoir" we see wooden bowls and trenchers, earthen platters, horn drinking-cups, and a pewter tankard. The corselet, matchlock, and bandoliers are ready for defence, with a halberd, if the senior occupant of the house holds a commission in "ye trainband;" and from a "lean-to" shed comes the great wheel or the clang of the loom, as the busy "helmates" hasten to finish their "stents." High on the mantle-shelf, with a "cresset-lamp" on one side, and the time-marking hour-glass on the other, is the well-thumbed Bible, which was not left for show. "Our especial desire is," say the company's instructions, "that you take especial care, in settling these families, that the chief in the family be grounded in religion, whereby morning and evening family duties may be duly performed, and a watchful eye held over all in each family by one or more in each family appointed thereto, so that disorders may be prevented, and ill weeds nipt before they take too great a head."



BIBLE AND SPECS.

While a greater variety of crops was cultivated in New England than in the Southern colonies, yet nowhere was seen any thing like scientific farming. As new lands could be easily obtained, old ones were not thoroughly tilled. When the soil became exhausted from much bearing, and no enrichment, and grew too poor to raise wheat, corn was planted; when this would no longer thrive, barley or rye was sown: thus the quality of the crop decreased with the starving soil, until beans alone were raised; and, when these ceased to grow, the field was abandoned.

Farming unscientific.

A dearth of interest in cultivating the soil continued until the close of the Revolution. Previous to that time, no spirit of inquiry in this great industry was abroad to give a charm to daily toil. Hard work was the order of the day, into which neither poetry nor science ever entered. The farmer remained fast to his farm; and it was almost as true of him as it was of the Sybarites, who dwelt on the eastern side of Italy, and who prided themselves on growing gray between the bridges of their Lagoon City, — he never went beyond his narrow boundaries, and hardly knew of a world outside of himself.

Little interest taken in agriculture.

There were gatherings, it is true, besides those for religious worship, where neighbors met and conversed with each other. Upon election-days people mingled, and also at "raisings," when flip and cider flowed plentifully. The "husking," too, was a social as well as industrial gathering, where the same favorite drinks went round, followed by a rich feast upon pumpkin-pies, which formed one of the most thoroughly-enjoyed dishes of the early settlers. Longfellow has immortalized the "husking" in the song of Hiawatha, and we are sure our readers will delight in recalling the scene. The maize-field having grown and ripened,

Gatherings of the early farmers.

"Till it stood in all the splendor
Of its garments green and yellow,
Of its tassels and its plumage,
And the maize-ears full and shining
Gleamed from bursting sheets of verdure;
Then Nokomis, the old woman,"

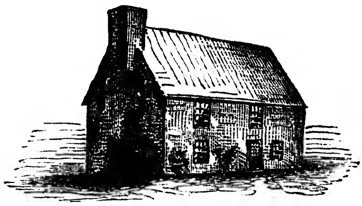
spoke to Minnehaha, the merry Laughing-Water;

"And they called the women round them,
Called the young men and the maidens,
To the harvest of the cornfields,
To the husking of the maize-ear.
On the border of the forest,
Underneath the fragrant pine-trees,
Sat the old men and the warriors,
Smoking in the pleasant shadow.
In uninterrupted silence
Looked they at the gamesome labor
Of the young men and the women;
Listened to their noisy talking,
To their laughter and their singing;
Heard them chattering like the magpies,
Heard them laughing like the bluejays,
Heard them singing like the robins.
And, whene'er some lucky maiden
Found a red ear in the husking,
Found a maizé-ear red as blood is,
'Nershka!' cried they all together,
'Nershka! you shall have a sweetheart,
You shall have a handsome husband!'
'Ugh!' the old men all responded
From their seats beneath the pine-trees."

The obstinacy with which old ideas were cherished quenched the spirit of agricultural improvement. It is not to the credit of our ancestors, that, in many a town, the possession of superior intelligence, except by the minister and doctor, was not honored, but ridiculed. If a choicer spirit arose, who ventured to try experiments, he was neither cheered nor encouraged, but, on the other hand, was laughed at for his folly. One who has studied the history of these times well says, that if such a one "did not plant just as many acres of corn as

Causes which checked agricultural improvement.

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 in 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."



WHITEFIELD'S HOUSE, LOOKING WEST.

WHITEFIELD'S HOUSE, LOOKING SOUTH.

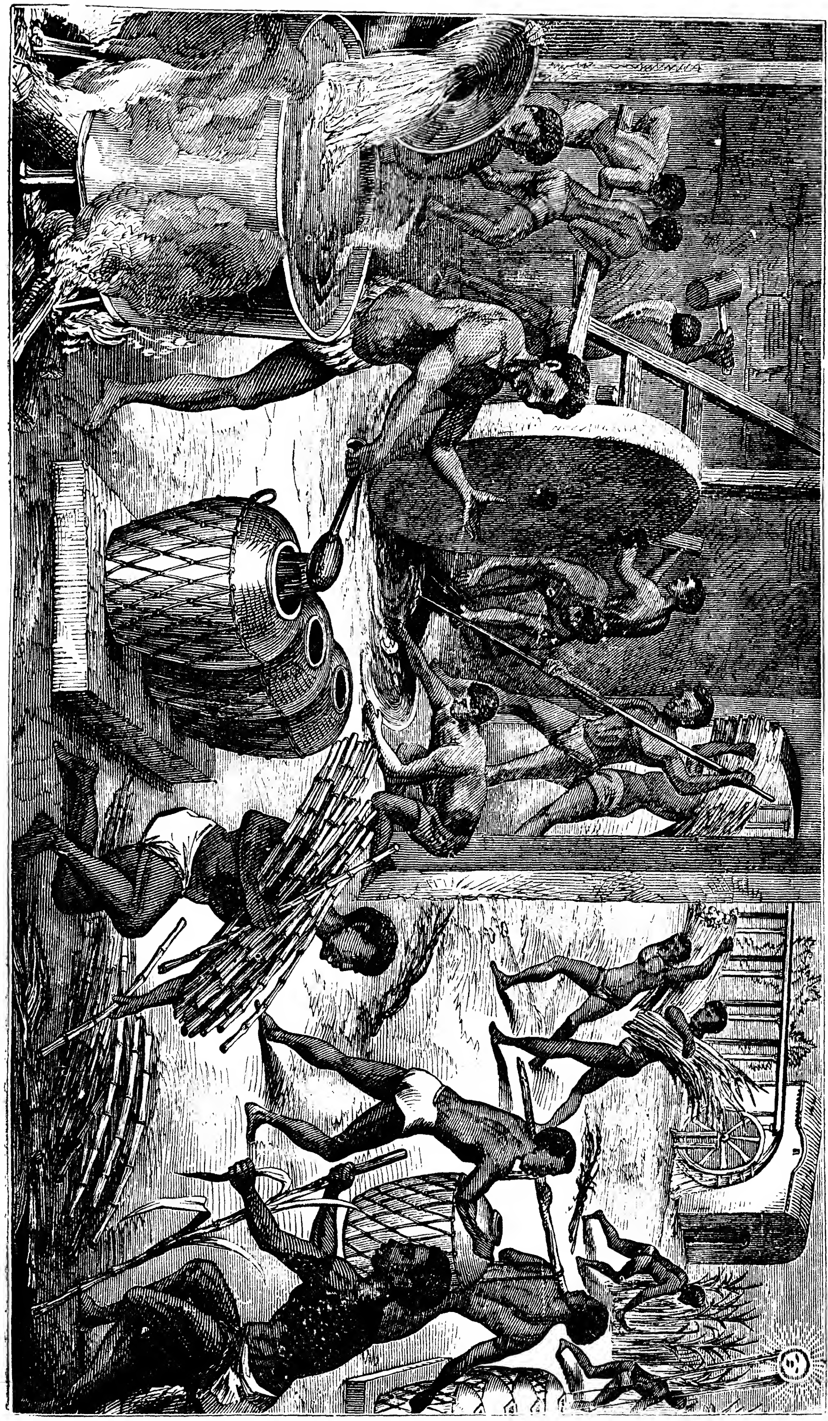
Rotation of crops unknown.

The rotation of crops was a thing unknown in those times. No one ever thought of fertilizing the soil. It has been said, that, even within the memory of men now living, barns were sometimes removed to get them out of the way of heaps of manure by which they were surrounded, rather than incur the expense and trouble of putting these accumulations upon the fields. Swine were generally allowed to run at large, and cattle were rarely housed during night or winter. It was thought necessary to leave them out of doors, and expose them to the summer's sun and dew and to the winter's storm, in order "to toughen" them. A writer says, "It was the common opinion in the Virginia Colony, that housing and milking cows in winter would kill them." Brief as this sketch is, who cannot fail to see how great and numerous have been the improvements in farming since the Pilgrims, to use their own words, "left their pleasant and beautiful homes in England to plant their poor cottages in the wilderness"? For a century and a half the colonists throughout the country remained in a stationary state in respect to their leading pursuit. Their implements, few and imperfect, were never improved; the hoe, plough, spade, fork, and occasionally a harrow, comprising pretty nearly the whole inventory. With this coarse and slender outfit their heavy task was continued for many a long and weary year.

Management of cattle.

FRENCH COLONIAL AGRICULTURE.

A word may be said concerning the French colonists, before closing the history of this period. While the English, Dutch, and Swedes were taking possession of the soil from the Penobscot to the Altamaha, the French entered the Gulf of St. Lawrence, ascended the river bearing that name, crossed the lakes, found the head waters of the Mississippi, and were borne



SUGAR-MAKING IN LOUISIANA IN 1751.

on its broad current to the Gulf of Mexico. The discoveries of the French, the journey of La Salle among the Indians and down the mighty stream, are full of romantic interest; but we can only stop to note what was done when the French landed in Louisiana, and began the permanent conquest of the soil. A variety of crops was planted; but none flourished like the sugar-cane, which had been transported into Spain from India by the Saracens, again to Madeira, and thence to the West-India Islands, from which the French planters obtained their plants. For several years its cultivation proved unsuccessful. Not until 1764 did the experiment succeed, upon the eastern bank of the Mississippi, under the intelligent and careful culture of Chevalier de Mazan. The following year, Destrehan, the royal treasurer in the colony, and other planters, erected works on the opposite bank below New Orleans; but the results were disappointing. Indeed, the planters lost so much heart, that, in 1769, they abandoned the business, and turned their attention to the cultivation of indigo, cotton, tobacco, rice, corn, and other crops. A few small gardeners continued to plant sugar-cane in the neighborhood of the city, which they retailed in the market for the use of children; or expressed the juice, making sirup, which they sold in bottles. More than twenty-five years elapsed before further efforts were made to cultivate the sugar-plant.

Cultivation of the sugar-cane.

The engraving here inserted represents the early process of manufacturing sugar, and will not be without interest to our readers. The cane was stripped of its leaves, and ground, or rather crushed, by a heavy stone made to revolve by manual force. The expressed juice, after boiling in a caldron, was ladled into large stone jars, which were exposed to the rays of the sun until the sugar crystallized. Later on we shall learn what success attended renewed efforts in the way of cultivating the sugar-plant.

Early mode of making sugar.

EFFECTS OF AMERICAN REVOLUTION.

The American Revolution wrought a profound change in the agriculture of the country; not, indeed, in the way of stimulating interest in the cultivation of the soil, but in giving greater freedom in the exchange of commodities. Thriftless as was the mode of farming prior to that event, during the Revolution it was well-nigh paralyzed; nor did it speedily recover. So dull were the people to the vast capacities of the country and to the great fortunes which lay before them, that the same spirit which animated the ante-Revolutionary farmer was found to live within the breast of his immediate descendants. But the policy of England, which was to make the colonies as profitable as possible to the mother-country without thought of an adequate return, came to an end. Restrictions against manufacturing were removed. The colonists were free to buy where they pleased: no longer could England compel them to buy of her. On the

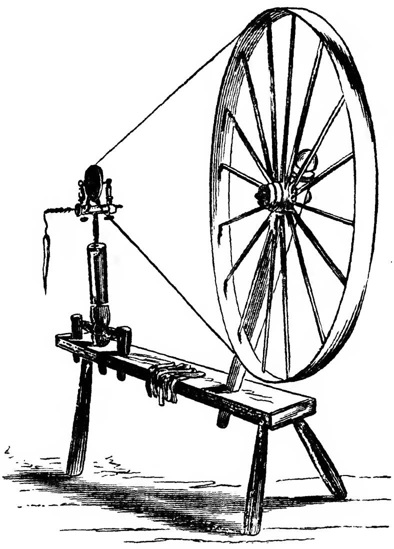
Revolution gave freedom in purchase and sale of commodities.

other hand, they were at liberty to sell their surplus in any market in the world. Thus their horizon was immensely broadened. The transition from a colony to a state was complete.

CAUSES OF PROGRESS IN AGRICULTURE.

Causes of prosperity in agriculture.

Until the present century was fairly inaugurated, American agriculture cannot be said to have made any notable progress: it had simply made a commencement. Since then a number of causes have combined to give it marked development and stimulus. Among the first of these is national peace. In time of war, the agricultural classes are drawn on most heavily for soldiery. The extent to which foreign nations, especially those of Europe, were engaged in war prior to 1815, was a great hinderance to their agricultural prosperity. The United States have enjoyed a remarkable advantage in this regard. A second influence which we have felt was the foreign demand for our productions. This is touched upon repeatedly in the ensuing chapters of this work. It will suffice to note here the fact that densely-populated countries like those of Europe, especially where the people are largely engaged in manufacturing pursuits, look to the regions of the earth which are sparsely settled for agricultural products, food, and textile fabrics. Even in our colonial days we had shown great possibilities of production, though but little reality; and as soon as our independence was achieved, and we took a place among the nations of the earth, we were looked to eagerly as a supplier of agricultural produce to the world. This foreign demand has been felt more particularly by cotton and tobacco planters, grain-growers, and stock-raisers; but an immense variety of other produce has gone to make up our enormous export trade. Still another great stimulus has been afforded to the agricultural interests of this country by the invention of improved implements for use by the husbandman. This marked advance in agriculture is treated by itself in another chapter of this work.



SPINNING-WHEEL.

Five other influences that have operated to forward and develop this industry are, — the occupation of the West under the encouragement of government legislation and land and railroad companies; co-operative effort, the mutual exchange of experience, and the patronage of organized agricultural societies; the foundation of a special department of government for the collation and dissemination of information among the agricultural classes, and otherwise aiding them in their pursuits; the development of a class of literature devoted to these subjects; and the special scientific education afforded by agricultural colleges.

Other causes specified.

HOMESTEAD LAWS.

The vast expanse of our arable territory, and the steps we have taken to encourage its occupation and settlement, have been elements of prime importance in the development of our agricultural interests. Prior to the Revolution, the American settlements were confined chiefly to the Atlantic coast. After the war, adventurers began to explore and locate in the Ohio Valley. The Louisiana purchase in 1803, the large annexation of territory from Mexico in 1847, and the definition of our British-American boundary, enlarged our domain wonderfully, and added greatly to the area susceptible to tillage east of the Mississippi.

Extension of farming area.

At one time the unsettled "public" domain of the United States embraced 1,446,716,072 acres, exclusive of the Alaska purchase. It is out of this that the States and Territories not included within the present limit of the original thirteen were erected. Of this vast area, large grants have been made to soldiers for military service, to railroads, to agricultural colleges and other purposes, and reservations made for Indians and government use. A very considerable proportion is mountainous or sterile sand; yet the extent of territory suited to agricultural purposes exceeds the like territory of any country in Europe.

Unsettled public domain.

But the United States not only had the land, but promoted its purchase and settlement by munificent offers. In 1841 Congress passed a law providing for the sale of these public lands for the remarkably low price of a dollar and twenty-five cents an acre, in lots of a hundred and sixty acres or less each, to those who would really go to live thereon, and cultivate them. This pre-emption law was followed up in 1862 by another piece of legislation, known as the "Homestead Act," which provided that the settler might have the land for nothing, under proper conditions. Prior to and during the operation of these laws, the new Western States and the railroad companies therein put forth special efforts to draw agriculturists thither.

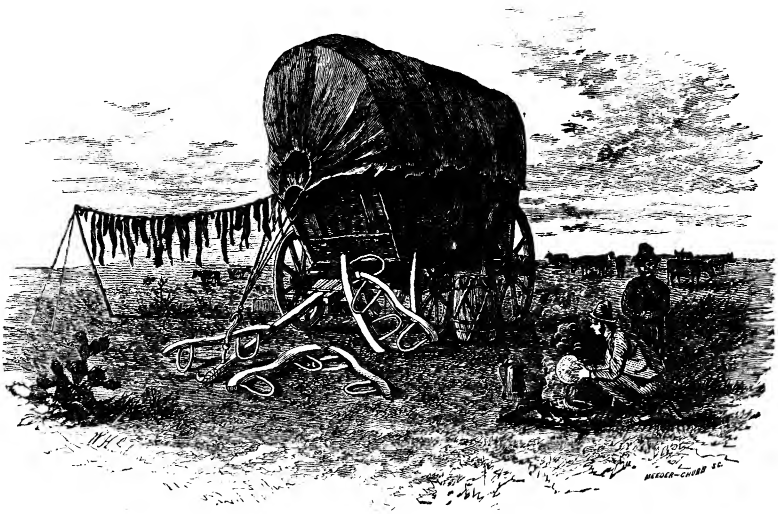
Sale of public lands.

The consequence of these inducements was to draw people in large numbers from the Eastern States, and even from Europe. Doubtless the Irish famine between 1845 and 1847, and the poor success of the German revolution of 1848, did much to accelerate foreign emigration, — a movement which the Know-nothing movement in politics a decade later slightly checked. But as large numbers of unopposed Swedes also came

Emigration.

over, and as the greater proportion of the new-comers went West to live on farms, it is apparent that our pre-emption and homestead laws were a great attraction. The perfectly surprising growth of the States of the Ohio and Mississippi Valleys can hardly be attributed solely to the fertility of the soil in that section, remarkable as that feature of it was.

Those who have looked into the subject say that agriculture thrives nowhere with such life and success as where the men who do the work own the soil.



EMIGRANT TRAIN.

Under the European feudal system, and the tenantry system which has succeeded it, the rustic populace are either hired by, or lease their land from, exacting owners, and never know such a thing as proprietorship. But here the agriculturist is made to feel the dignity of labor and a larger stimulus of self-interest by the consciousness that he may own the broad acres which he tills. No other country in the world has felt the influence of this incentive as has the United States.

Conditions of agricultural prosperity.

AGRICULTURAL SOCIETIES.

The first steps toward organization for encouraging and forwarding tillage and the arts related thereto in this country were taken by the Philadelphia Society for the Promotion of Agriculture in 1784. Similar ones were formed in New York in 1791 (incorporated two years later), in Massachusetts in 1792, and in South Carolina. At this time the conception of such societies was almost entirely new. Their formation had only just begun in England. But few men understood

Formation of agricultural societies.

how the institution was to operate; and the membership being slim, and not over-practical, little good was at first effected. There was much talk, at first, of taking these boards under governmental management, and assisting them with governmental appropriations. Washington was interested greatly in the subject. He was, while yet President of the United States, an honorary member of the Philadelphia organization to which we have alluded. He, as well as Adams and Jefferson, was a practical farmer on a large scale. He caught part of his inspiration from correspondence with Arthur Young and Sir John Sinclair of England, who were active in the spheres of agricultural organization and information. These gentlemen suggested to him the value of a national agricultural board founded and fostered by the United-States Government; but Washington's idea was, that the formation of smaller societies was a prerequisite to the greater one. These continued to be organized throughout the States slowly, and with slight results. The Kennebec Agricultural Society was instituted at Augusta, Me., in 1800, being the second society incorporated inside of Massachusetts, the separation between the two States not having been effected until a later period. A voluntary association of Middlesex-county husbandmen existed in Massachusetts as early as 1794; but it was not incorporated until 1803.

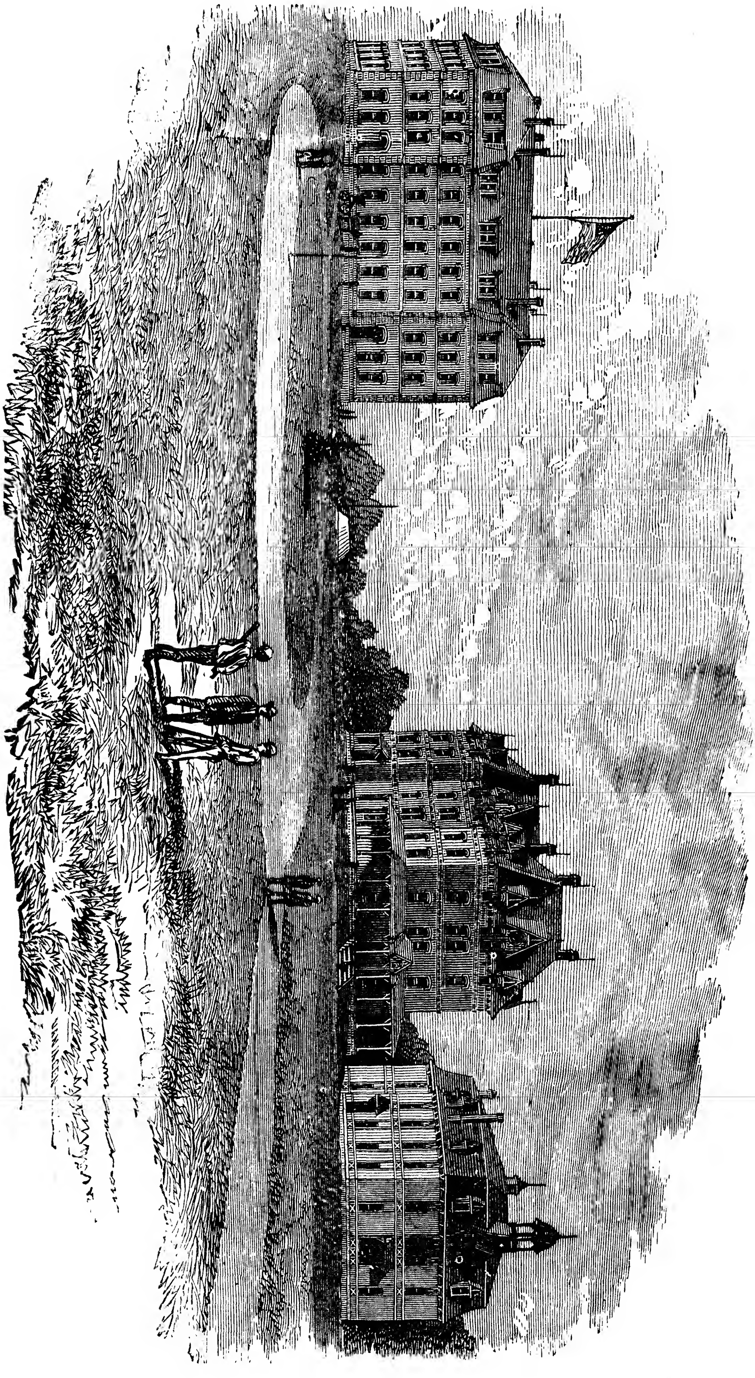
The first agricultural fair.

The first agricultural fair in this country was held at Washington, then a "city in the woods," in 1804, at the suggestion of the commissioner of patents, and under the auspices of the municipal authorities, who voted to hold them semi-annually. The first one, held in October of that year, showed the advantage, educationally, of exhibiting choice produce and stock; and at the spring exhibition the next year over one hundred dollars in premiums were offered, which proved a stimulus to the farmers' efforts. The next provision for a fair was that made by the Columbian Agricultural Society for the Promotion of Rural and Domestic Economy, at Georgetown, D.C. The organization was effected in the fall of 1809, and its first fair was held the following May. Large premiums were offered on that occasion for sheep-raising. In 1816 the Massachusetts society held a fair at Brighton, at which premiums were offered for a variety of articles; and a ploughing-match was had to show off the training of cattle.

Advantage of fairs.

These fairs brought the farmers together for an interchange of thought and experience, far more valuable than the old husking-bees and sheep-shearings that formed the earlier neighborhood rural gatherings. They excited rivalry as well as afforded new hints. Furthermore, they advertised the stock of some enterprising breeder to his neighbors; and the consequent sales enabled him to reap a rich harvest from his venturesome investments of time, trouble, and money. The agricultural societies also collected and printed such information as they could procure, individual members contributing papers on topics with which they were familiar, and these transactions being published either for circulation or reference.

Dissemination of knowledge by fairs.



MASSACHUSETTS AGRICULTURAL COLLEGE.

Increase of agricultural societies.

For the first forty years of the present century the organization of county and state societies was slow and infrequent. But between 1840 and 1850 state and county societies were numerously formed all over the country; and, since that time, scarcely an agricultural region within our national limits has been without one or both.

In 1841 an effort was made in Washington to organize a national agricultural society with the fund bequeathed for the purpose by Hugh Smithson. But the establishment of the Smithsonian Institute made the endowment available for the other purpose; and the project was abandoned until 1852, when a convention of a hundred and fifty-two delegates, representing twelve state agricultural associations and eleven other States and Territories, met, and organized a national society, which was a realization of George Washington's long-cherished idea. It was not incorporated until 1860; but before that time it had undertaken a special publication of its own, and had held serviceable national fairs. The interruptions of the war, and the assumption of some of its functions by the general department of agriculture in 1863, resulted in its disintegration and virtual abandonment.

Rise and progress of special societies.

Special societies, too, have been organized in the interest of special branches of agriculture. Horticultural societies (of which the first was formed in 1829), pomological societies, Southern planters' societies, dairymen's societies (state and national), sheep-raisers' and wool-growers', cattle and horse breeding societies, poultry and bee keepers' associations, and the like, have grown up within the past quarter of a century very numerously; and these, like the more comprehensive "agricultural" societies, have done much, by the interchange of observations, experiment, and exhibition, to awaken and heighten individual interest, improve the standards of stock, enlighten the cultivator or breeder as to the best methods of operation, and to dignify the agricultural industry before the world.

In 1867 the records of the department of agriculture showed that 1,367 organizations of this general character were in nominal existence throughout the country. Some few had been discontinued; but most of them were revived, or supplanted by new ones. And, besides these, many other such societies have since been formed.

GRANGER MOVEMENT.

Granger movement.

In this connection it may be well to mention a system of organization for the promotion of agricultural interests which is still more recent, and somewhat different from the societies we have thus far mentioned. We refer to the Patrons of Husbandry, whose association and influence constitute what is known as "the Granger movement" in this country.

At the close of the civil war the agriculturists of the West found themselves, for one reason or another, badly situated. Their farms were mortgaged, they obtained poor remuneration for their produce, and their prospects were gloomy indeed. Letters of complaint about these and other kindred evils poured into the department at Washington in great numbers. Finally it occurred to Mr. William Saunders — a Scotchman of education and culture connected with the agricultural bureau, and in charge of the gardens and conservatories of that establishment — that many of these evils could be overcome were the farmers to organize after the manner of the Masons and Odd Fellows. He did not belong to either fraternity himself; but in 1867 he broached the idea to Mr. O. H. Kelley (a clerk in the post-office department), Mr. J. R. Thompson, and William M. Ireland, all of whom were Masons; to the Rev. A. B. Grosh, who held a high rank among the Odd Fellows; and to the Rev. John Trimble, jun. On the 3d of August, 1867, these gentlemen met, and devised a scheme for a society, as yet nameless, which contemplated the objects Mr. Saunders had in view. Soon afterward he had occasion to visit Western New-York State, and there he interested a number of his agricultural friends in the enterprise. In the autumn a second, third, and fourth degree was perfected, and the name "Patrons of Husbandry" was adopted. The National Grange was organized in December, with the following officers: William Saunders, master; J. R. Thompson, lecturer; Anson Bartlett, overseer; William Miner, steward; A. S. Moss, assistant steward; the Rev. A. B. Grosh, chaplain; William M. Ireland, treasurer; O. H. Kelley, secretary; and Edward P. Faris, gate-keeper. The constitution provided for the admission of women; and four feminine offices were created, named respectively Ceres, Pomona, Flora, and Lady Assistant Stewardess. There was also an executive committee appointed. Later in the month a subordinate Grange was formed, with about sixty members. On the 1st of January, 1868, Mr. Saunders disseminated throughout the country circulars setting forth the principles of the order, and urging the organization of Granges and the foundation of Grange libraries.

Organization of the first Grange.

Progress was at first very slow. For three months the local Grange in Washington was the only subordinate one in the whole country. On the 1st of April Mr. Kelley resigned his government clerkship, and gave his whole time and energy to promoting the growth of the order; for which he was to have a salary of $2,000, provided he could organize enough Granges to secure it in fees. During April, four were formed; and, before the year was out, six more, these latter in Minnesota. In 1869 to the original eleven were added thirty-nine, and in 1870 thirty-eight. Besides these, there were the National Grange, already mentioned, and three State Granges. Mr. Kelley came to Washington again Jan. 1, 1871, as the secretary and executive officer of the organization. From that time forward progress was rapid. The additions to the order numbered 125 in 1871, 1,160 in 1872, 8,600 in 1873, 11,000 in 1874, and about the same number in 1875. At the

Growth of the order.

close of the last-named year, a few Granges having become extinct, there were about 30,000 in the country altogether, with a membership of about 2,500,000. Since then it has grown but little, the movement having about reached its climax in 1875.

Its objects.

The objects of this order, which was secret but strictly non-political, were the higher social and intellectual culture of the members, and the dispensing with the services and profits of the middlemen in both buying and selling. The former end was attained by the introduction of music and literary exercises at the meeting of the Grange; and thus thousands of rude farmers and farmers' wives were led to develop and gratify tastes, and engage in avocations, pursued by persons in more advantageous conditions of life. The latter end was secured by several means. Agencies were established for the sale of produce directly to shippers and other legitimate purchasers, thereby dispensing with the medium of speculators. Thus the farmers were enabled to get better prices for their crops. The same sort of co-operation saved to the farmers the large profits of middlemen in buying household furniture and farming-utensils. Books, sewing-machines, all kinds of implements and merchandise, were procured at a saving of from twenty-five to thirty per cent through these agencies. These advantages, and co-operation in other directions, put the farmers in a more prosperous condition than ever before, cleared off their debts, and gave them many comforts and novelties which otherwise they could not have enjoyed.

Mode of attaining them.

The Grange dissociated from politics.

It was one of the first principles of the order that it should in no way meddle with politics; and though it has been alleged repeatedly that this or that candidate for local, state, or national office, had been elected or defeated through Granger influence, positive and emphatic denials of the same have been made by the officers of the organization. The discussion of political topics in meetings of the Grange is also prohibited.

Demands made of the railroads.

A semi-political influence has, however, been exerted by the order, though to an extent, doubtless, far less than has been generally believed. One of the evils against which the Western agriculturist declaimed most bitterly was the discrimination of the railroad companies against local shippers of freight, in favor of through shippers. It was felt that these exactions were grievous, and a remedy was sought in legislation. No "Granger" tickets were put in nomination; yet, doubtless with this object in view, the Patrons of Husbandry gained sufficient strength in the Illinois and Wisconsin legislatures to secure the enactment of State laws in 1873, restricting the railroad tariffs to a basis more favorable to the farmers who were way-passengers and shippers. The railroad companies resisted this legislation at first as unconstitutional, declaring that a State had no right to modify their charters when once granted. The matter went into the State courts, and, by appeal, to the United-States courts. But in 1876 a test case, appealed to the

Supreme Court of the nation, evoked a decision to the effect that the "Potter Law" of Wisconsin, the most famous of all these "Granger" enactments, was constitutional. The moral effect of this decision was to secure greater or less concessions from the Western railroads to the agricultural interest.

AGRICULTURAL EDUCATION AND LITERATURE.

Both in England and in this country the idea of governmental encouragement was at first associated with popular organizations for promoting husbandry. It has been remarked, that, until a quarter of the present century had passed away, agriculture had become no more of a science in Europe than it had been for centuries. But Bacon's philosophy was applied to agriculture by original and enterprising British minds in the eighteenth century; and the writings of Jethro Tull, Arthur Young, Lord Kames, and Sir John Sinclair, were followed by the establishment of a British National Board of Agriculture by William Pitt in 1793. In the minds of many Americans of that day and later the idea of congressional provision for this industry was warmly cherished; but it was long in attaining realization.

Opposition to governmental encouragement to industry.

In 1837–38 the country was roused, by the necessity for importing several million dollars' worth of breadstuffs, to a consciousness, that owing to the exhaustion of the soil, and bad management in other respects, agriculture was sadly languishing. One of the two means of relief suggested by the leading minds of that day was a government appropriation, to be expended by the commissioner of patents for the "collation of agricultural statistics, investigations for promoting agriculture and rural economy, and the procurement of seeds and cuttings for gratuitous distribution among the farmers." At this time the Hon. Henry L. Ellsworth was commissioner of patents, and it was at his suggestion that Congress appropriated a thousand dollars for this purpose in 1839. A like one was made in 1842; for each of the next two years two thousand dollars were appropriated; in 1845 the amount was three thousand dollars; then a year was missed. Resuming at the same figure in 1847, the government thereafter regularly made provision, gradually increasing the sum, until, in 1862, it amounted to sixty thousand dollars. Twice and thrice that sum has since been expended in a single year. Previous to this date the department had been little more than a clerkship in the patent office; and the annual reports, beginning with one in 1854, long constituted a part of the report of the commissioner of patents. By a law of 1862 a distinct bureau of agriculture was erected, with a commissioner at its head, a chief clerk, botanist, entomologist, statistician, and other subordinates. Since that time the size and capacity and the usefulness of the department have steadily increased.

First appropriation of money for agricultural purposes.

Organization of bureau of agriculture.

This government establishment has done far more thoroughly and on a much broader scale much of the work of a local agricultural society, and a great deal besides. By the collection of facts and figures showing the extent to which stock-raising and crop-growing of various kinds were conducted in different sections of the country, the value of the property, the cost of the several branches of the business, the profits, the character of maladies, pests, bad weather and other embarrassments, the peculiarities of soil and climate which were favorable and unfavorable to certain crops, the effects of experiments with various plants and breeds of animals, the results of observation upon the use of new implements and new methods of cultivation, and so on, it was possible to draw deductions scientifically, which could not be reached in any other way, and which were of immense value to the farming-interest.

Work accomplished by bureau.

Agricultural publications and correspondence from abroad were procured, showing the general condition and special features of the industry in other parts of the world, and the useful parts of such information made accessible to the American farmer. Special essays upon various plants, modes of culture, and breeds of animals, were obtained from gentlemen of experience and knowledge all over the country; and these were made to bear more particularly upon the value and usefulness of the choicer kinds of stock, and varieties of crops, in order to excite a desire to select, raise, and breed only the best.

Collection and diffusion of information.

In addition to the collection of this information, the department procured abroad and elsewhere the choicest seeds, plants, and cuttings, and experimented with them on government grounds in order to ascertain their habits, vitality, and utility. The more perfect and valuable specimens were extensively propagated; and the seeds, cuttings, and plants were distributed all over the country among farmers and gardeners. Thus a greater degree of excellence was secured in produce. The adaptation of these to the locality whither they were sent, and the success of their introduction, was ascertained by the department for its own and the public's information.

Collection of seeds, &c., and experiments with them.

Improved varieties of our staples, such as cotton, wheat, and corn, were sought after. Great attention was given to the introduction of plants not indigenous, but valuable, and likely to be suited to our country. The silk-worm and the mulberry-tree, ramie-grass, jute or Chinese hemp, sorghum, vines for wine, raisins, olives, and tea and coffee plants, are only a few of the innumerable importations made by the department, cultivated on its own grounds, and disseminated throughout the country. The department has never gone into stock-breeding and importation, but has procured a vast amount of information upon the subject in all its ramifications.

Introduction of new plants.

The printing of all this valuable information, and its broad dissemination gratuitously throughout the land, have educated the country and advanced the science of agriculture almost beyond computation. Without doubt it has enriched the agricultural classes and the country generally a thousand-fold more than its cost; and there is reason to believe, that, before many years, the facilities and influence of the bureau will be increased by its erection into a full-grown "department" of the administration, co-equal with those which conduct our revenue, postal, military, and naval service.

Usefulness of agricultural department.

ESTABLISHMENT OF STATE BOARDS OF AGRICULTURE.

In several of the States, Boards of Agriculture have been constituted under government auspices, sometimes based upon the remains of a defunct State agricultural society, and sometimes organized independently. These State boards are maintained by appropriations, establish experiment-stations, provide for lectures in different parts of the State, promote local farmers' clubs, and publish their proceedings. Their work, in some cases, will compare very favorably with that carried on at Washington.

Education in the science of agriculture, however, is the great thing that has developed the industry. This has been done partly by the discussions of clubs and societies, by the dissemination of documents by societies and the government, by the literature produced by individual enterprise, and by special schools for the thorough training of students in the theory and practice of farming. In the olden time, and indeed until within a century, the farmer looked at agriculture as little more than gathering what Mother Earth would yield him spontaneously. He had not studied the subject of vegetation, weather, soil, chemistry, and the other elements which entered into and vitally affected his industry. He had not indulged in wide observation, nor reduced his labor to what could be termed a science. Nearly a hundred years ago, scientific methods of wide-spread observation, logical deduction, and experimental application of theory, were begun by a few enterprising agriculturists, or patrons of agriculture, in the Old World, and subsequently in America. But no provision for procuring scientific information, and making it practically useful, has equalled the establishment of special agricultural colleges. Except Germany, this country has no equal in the educational advantages she offers her people in this direction; although the establishment of these institutions is comparatively recent.

Introduction of scientific methods into agriculture.

The first three agricultural schools were started in Germany and Switzerland in 1799. They were located at Celle in Hanover, near Berne, and at Kruman, Bohemia. In 1811 a private forestry-school was established in Saxony, which in 1816 was transferred to the state, and in 1830 became an agricultural college. The great agricultural college of

Founding of agricultural schools.

Europe — that at Hohenheim, near Stuttgart — was founded in 1818, and another such institution was started in Pomerania in 1835. Ten years ago there were a hundred and forty-four stations, institutes, schools, and colleges in Germany. Great Britain has but two of any consequence, — one at Cirencester, established before 1840, and one near Dublin. French legislation in 1848 led to the organization of one college at Versailles, and several minor schools in various parts of France.

Contrast between Europe and United States.

It will be seen from these facts, and from others which we are about to state, that Europe led us but very little in agricultural education, and soon fell behind. We have already referred to the depression of agriculture in America between 1830 and 1840. Besides the suggestion then made for a government bureau of agriculture, the establishment of technical schools in this department of knowledge was strongly recommended, Judge Buel of New York being foremost in pressing the idea. No immediate action was taken, however.

Efforts of Judge Buel.

In 1844 an agricultural department was established in connection with Oberlin College, Ohio. A separate college was founded at Cleveland in 1855, to which the Oberlin endowment was transferred. In 1854 Dr. William Terrell made a bequest to the University of Georgia, amounting to $20,000, to establish a professorship of agriculture. Arrangements for a similar department in connection with Amherst College were made by Massachusetts in 1855. Subsequently a veterinary institute was established at Boston. In 1852 a charter was obtained for an independent agricultural college. The endowment was to be raised from town, county, and personal subscriptions. Little was done toward organization until 1855. It was 1860 before the school was in operation; and, the war breaking out soon after, it closed after two terms.

Increase of agricultural schools.

Michigan was the first State, after Ohio, to get an independent agricultural college in actual operation. The act of incorporation and appropriation passed Feb. 12, 1855. A farm of 676 acres, mostly wooded, at first was purchased, and buildings erected for college-purposes, students' boarding-house, and professors' residences. The institution went into practical operation in 1857; and its stock-stables, botanical gardens, and course of instruction, soon made it famous. The original grant was of $56,000: a subsequent one of $40,000 was made; and even then there was a debt of $13,000, making a total cost of $109,000. In 1860 it passed under control of the State Board. The third such independent institution was the Farmers' High School of Pennsylvania, opened in Centre County of that State in 1859. Three years later its name was changed to the Agricultural College of Pennsylvania. Iowa made a grant of $10,000 for such an institution in 1858, and got it going on a small scale in 1859. The Ovid College appears to have been the fifth of these institutions.

Formation of agricultural schools in Michigan and Pennsylvania.

In 1862 Congress passed an act granting land to each State in the Union, to the extent of 30,000 acres for each representative in Congress, the proceeds of the sales of which were to go to agricultural and mechanical colleges. Immediately steps were taken in several of the Northern States for the foundation of industrial schools of this sort. Massachusetts devoted the proceeds of one-tenth of her land-scrip to buying a farm at Amherst, which cost $40,000; and $75,000 more was appropriated for the buildings of her Agricultural College. In New York the land-scrip was given to Cornell University, which had an agricultural department. In Connecticut the Sheffield Scientific School profited in the same way. Kentucky at first established a college in connection with the State University, but subsequently separated it, and bought a farm for it, which included "Ashland," the historic estate of Henry Clay. This school was opened in 1866; in which year the colleges of Maine, Vermont, and New Jersey, were nearly or quite completed. Where some institution had already been founded, as in Iowa, Michigan, and Ohio, they were made the recipients of the Federal grants. In some States the endowment was utilized at existing universities by the opening of special departments. The Southern States followed suit soon after the war. In 1876 all the States but Nevada had availed themselves of the government provision; and there were then 41 industrial colleges in existence in this country, with 463 professors and 3,703 students in all grades. In 1875 there were 382 graduates from these colleges; a number steadily increasing since. At the present time nearly all the land-scrip has been sold, some of it having been exceedingly desirable.

Congressional grant for State agricultural colleges.

Our agricultural literature has been regarded by eminent authority as not exclusively a cause of the development of agricultural science, but as partly an outgrowth of that advance in thought and interest; for, with slight exceptions, we had very little until nearly a quarter of the present century had passed. In the middle of the last century the Rev. Jared Eliot of Connecticut prepared and published several papers on the state of husbandry in this country, which were almost as valuable to his generation as the famous "Georgics" of Virgil. But these essays were a little ahead of the time, and had but few readers. The Philadelphia, New-York, and Massachusetts societies also published their transactions, which were valuable. Those of Massachusetts, beginning in 1796, were especially helpful.

Agricultural literature.

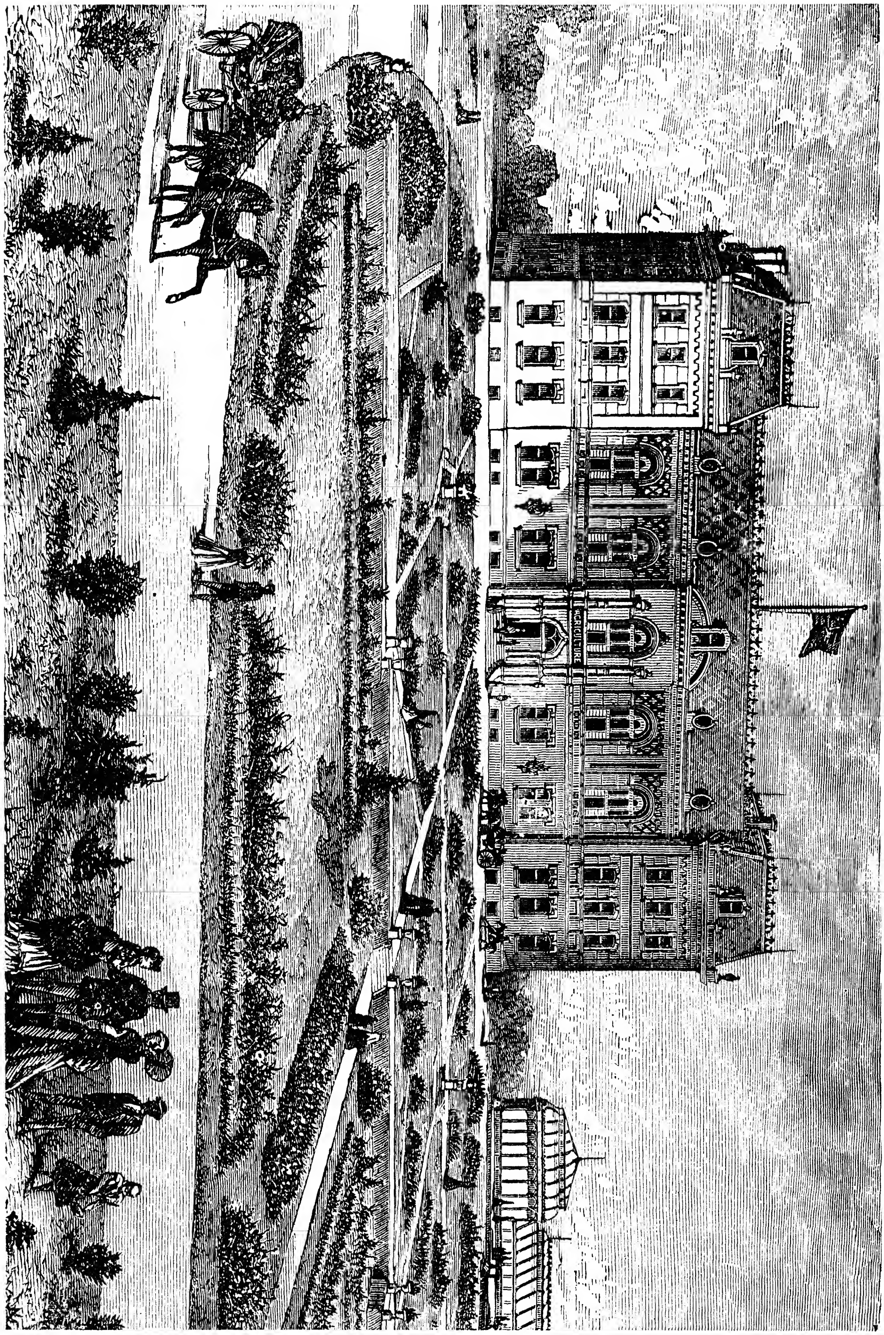
Mr. Flint thinks that "The American Farmer," published in Baltimore for the first time in 1819, was the first purely agricultural periodical in the United States. It soon attained a wide circulation, and seems to have set the farmers to reading and thinking more scientifically than before. "The Agricultural Intelligencer" was started in Boston the following year; but it lived only a few months. In 1822, however, a new venture was made with better success. Mr. T. G. Fessenden founded "The New-England Farmer," which was continued until 1846; when, upon its death,

Agricultural periodicals.

another periodical of the same name, weekly and monthly, succeeded it. Mr. Samuel Fleet started "The New-York Farmer" soon after the New-England publication made its advent, subsequently selling it out to D. K. Miner. Mr. Luther Tucker, an experienced agricultural editor, started still another paper in New-York State, near Rochester, in 1831. It was called "The Genesee Farmer," and, though it was long in becoming firmly established, eventually became a valuable and widely-circulated periodical. Judge Buel of Albany founded "The Cultivator" in 1833; and in 1839, on his death, it was consolidated with "The Genesee Farmer." "The American Agriculturist" was started in 1842. Shortly prior to this, and since, numerous other periodicals, weekly and monthly, sprang up; and their publication, and increase of circulation, rapidly developed. Among these may be mentioned "The Maine Farmer," "The Rural New-Yorker," "The Country Gentleman," "The Ohio Farmer," "The Michigan Farmer," "The Valley Farmer," "The Wisconsin Farmer," "The North-western Farmer," "The Southern Planter." There are now between fifty and sixty weekly and monthly agricultural periodicals in this country. Besides these, many other papers devote a special department to agriculture, stock-raising, dairying, poultry, and fruit.

Agricultural books.

Then, too, within the past forty years, a considerable number of books have been written on special topics in agricultural and horticultural science; Andrew Jackson Downing having been one of the earliest and most prolific writers on the subject. The reports of the United-States Government, first prepared by a clerk of the Patent Office in 1839, and then, after 1862, by the commissioner of the Agricultural Bureau, have also proved exceedingly valuable accessions to this class of American literature.



DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.

CHAPTER II.

AGRICULTURAL IMPLEMENTS.

ONE of the most interesting and important features in the history of American agriculture relates to the improvement of means for cultivating the soil. The history is a record of marked originality, perseverance, and great triumphs, with enough of tragic disappointment or pecuniary loss to spice the tale; while the vast development given to American resources and wealth by the improvement of these prerequisites to toil has given this nation its distinctive pre-eminence. Our highest rank among the peoples of the earth, in a material point of view, is as an agricultural people; and though great progress has been made in other industries, to which Americans can look with justifiable pride, improvement in means for subduing and cultivating the land is still the most marked characteristic of native inventive genius.

High character of American inventive genius.

The most important of agricultural implements is the plough: besides, it is one of the oldest; for its origin is lost in the dim twilight of antiquity. The plough is probably an improvement upon the hoe, which can lay claim to a still more ancient history. At first, it was made of the tough crotches of trees; then the forked piece was trimmed and bound to the handle to prevent the two from splitting apart. In the accompanying engraving an ancient kind of hoe is given. The plough had a similar and equally humble origin. It was not the product of great and enduring genius. The earliest ploughs known to us were rude enough in their construction. Like hoes, one limb of a tree formed the beam of the plough, and the other the share; from which simple device improvements have been slowly made, until this implement has been brought nearly to perfection.

Origin of the plough.

ANCIENT HOE AND PLOUGHS.

When the colonists first began to upturn the soil, the plough was a very rude affair. It was made wholly of wood. The beam, standard, and handles, if the plough had two, were of seasoned stuff; and the mould-board was a block of wood, and approximating to the curve required. A great deal of power was needed to draw it. Yet even this, rude as it was, far excelled the plough used in the days of Elisha, who, when summoned to assume the functions of prophet and teacher for the Hebrew children, was walking behind his plough drawn by twelve yoke of oxen. The earliest ploughs were doubtless imported, and as early as 1617 they might be seen upon a Virginia plantation. The complaint of the governor at that time was, not lack of instruments, but "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, iron for ploughs, and harness for the cattle." But ten years later, it is recorded there were only thirty ploughs in the colony at Massachusetts Bay; and, for twelve years after the landing of the Pilgrims, the farmers there had none whatever, and were compelled to prepare their lands for seed with clumsy hoes. It has been affirmed that 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.

Rudeness of early ploughs.

First importation of ploughs.

During all the centuries preceding the present one, but few improvements were made in this most important of all agricultural implements. All the earlier ones never turned a furrow, but only stirred up the ground; and hence they were difficult to draw, beside doing their work very imperfectly. In the last century the plough in use among the French settlers in Illinois was made of wood, with a small point of iron tied upon the nose with strips of raw-hide. The beam rested upon an axle and small wooden wheels; while the oxen which drew it were yoked by their horns by means of a straight yoke attached by raw leather straps, with a pole extending from the yoke back to the axle. Knight has described the English plough in use among the colonies along the coast in 1776 as being made of wood, except the wrought-iron share, and some bolts and nuts whereby the parts were fastened together. The standard rose nearly vertically, having attached to it the beam and the sole-piece. On the nose of the beam hung the clevis. The mould-board and share were attached to a frame braced between the beam and the sole. The wooden mould-board was sometimes plated with sheet-iron, or by strips made by hammering out old horseshoes. A clump of iron shaped like

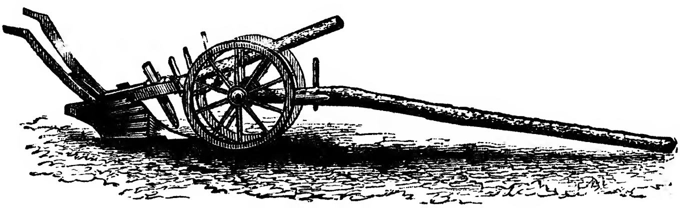
Slowness of early improvements.

Description of early ploughs used in this country.

a half spear formed the point. It was known as a "bull-plough," "bull-tongue," or "bar-share" plough. Two pins in the standard formed the handles, and it required the strength of a man to manage it. The work was slowly and poorly performed by cattle.

During the last century, the Carey plough, as it was termed, was more extensively employed than any other, and may be briefly described, although the form varied very much, according to the ideas and skill of the blacksmith who made it. It 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 strengtn of team now commonly used was required in doing the same kind of work.

Carey plough.



PLOUGH OF 1812.

The first cast-iron plough ever seen in this country was imported from Scotland soon after the Revolution, and was the invention of James Small of Berwickshire. The mould-board was cast-iron, with a wrought-iron share, the form being somewhat similar to those now in use.

Importation of the first cast-iron plough.

The first person in this country who devoted his attention seriously to this subject was Thomas Jefferson. Immersed as he was in the politics of the time, he never lost his interest in the greatest of all pursuits; and from 1788 to 1793 he studied and experimented diligently to determine the proper form of the mould-board, treating it as a "lifting-wedge and an upsetting-wedge," and endeavoring to ascertain the curve necessary to accomplish this purpose with the least friction. Probably he was stimulated to exercise his genius in this direction by receiving an improved plough from the agricultural society of the Department of the Seine in France. His son-in-law, Col. Randolph, whom Jefferson regarded as the best farmer in Virginia, soon after invented a side-hill plough adapted to the hilly regions of that State. This plough was made with two wings welded to the same bar, with their planes at right angles to each other; so that, by turning a bar adjusted to an axis, either wing could be laid flat on the ground, while the other, standing vertically, served as a mould-board.

Jefferson's interest in the subject.

Stimulated by the example of Jefferson, others entered this field of invention. Robert Smith of Pennsylvania, it is said, took out the first patent for the mould-board alone of a plough; and Newbold of Burlington, N.J., in 1797 patented a plough with a mould-board, share, and land-side all cast together. Peacock in his patent, in 1807, cast his plough in three pieces, the front of the colter entering a notch in the breast of the share. We now come to the invention of Jethro Wood of Scipio, N.Y., whose improvement was made in 1819. It was much superior to any previous invention; but he entertained a wrong idea concerning its novelty, supposing it to be the first iron plough ever invented. Its peculiar merit consisted in the mode of securing the cast-iron portions together by lugs and locking-pieces, doing away with screw-bolts, and much weight, complexity, and expense. Wood did more than any other person to drive out of use the cumbrous contrivances common throughout the country by supplanting them with a lighter, cheaper, and more effective implement. It was the first plough in which the parts most exposed to wear could be renewed in the field by the substitution of cast pieces. Wood was entitled to a great deal of credit for the genius and enterprise which he displayed; but, like many an unlucky inventor before and since his time, he spent all his fortune in developing and defending his invention.

Early inventions secured by patent.

Wood's invention.

Since his day improvements have been continuous, and every year new designs are sent to the Patent Office; nor does human skill show scarce a sign of abatement in this direction.

The application of steam to ploughing in the United States makes another phase of improvement in agricultural implements worthy of mention. The first invention of the kind in the United States was patented by E. C. Bellinger of South Carolina in 1833; but, for some reason or other, it never went into general use. Twenty-one years later, John Fowler of England improved upon Bellinger's invention so far as to manufacture and employ several of his machines. About the same time that Fowler's invention appeared, several other American improvements were made upon a very different principle. Engines were designed to travel over the field, drawing ploughs behind them. Promising as these various inventions are, many improvements are required to make them perfect; and a splendid field still lies before the genius of the inventor.

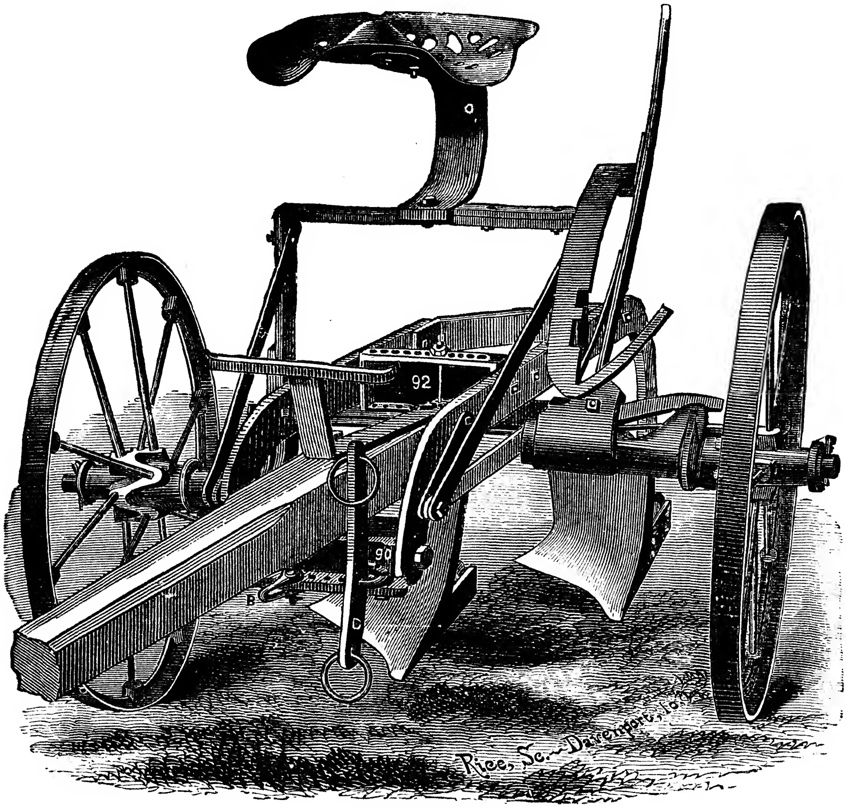
Steam-ploughs.

Great as has been the economy effected by using the improved plough, the farmer, for a long time, did not take so kindly and quickly to successive improvements in this most important of all agricultural implements as he does now. Slowly learned as were the principles upon which the true construction of the plough depended, — the turning over and pulverizing of the soil with the least friction, — farmers were slower still in adopting any improvement. Not unfrequently they asserted that cast-iron poisoned the ground, and spoiled crops; and so they adhered to their old clumsy wooden affairs. Slowly has this prejudice worn away, and

Farmers were slow to adopt improvements.

with its disappearance every real improvement has been more and more eagerly tested. The inventor has been stimulated to prosecute his efforts more critically: he has found that different kinds of ploughs will work to the best advantage on various soils; that, while one is best adapted for a damp soil, another is for dry; and that, while one works well on level ground, another turns over the soil more perfectly on the hill-side. Besides, there has been an enormous

Eagerness of modern farmers to test inventions.



STEAM-PLOUGH.

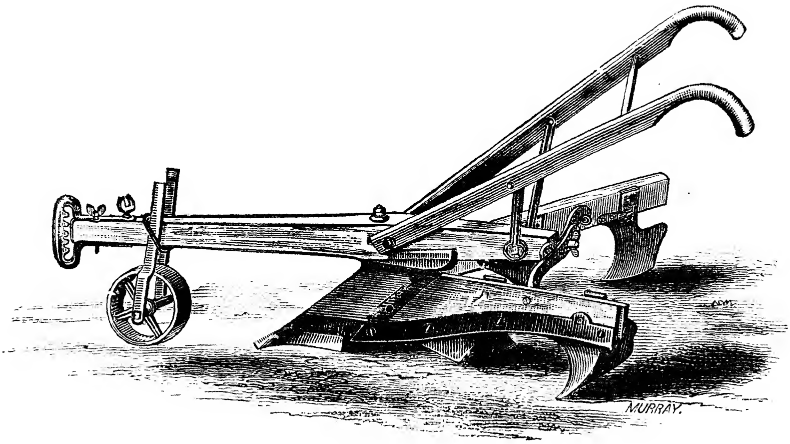
improvement in the manufacture of the plough itself. Formerly, ploughs were made by every country blacksmith; and his work, however skilful, must have been rude enough compared with that performed by the great concerns which are expressly fitted up to manufacture these instruments.

The saving which follows the employment of this one invention is enormous. We know of no method of estimating it with exactness; but he who stops a moment to consider how many days he would be in digging up ten acres with a hoe or with one of the earliest ploughs invented as a substitute, and realizes how quickly and how much more perfectly the work is done now, will be able to form an estimate for himself. Without this invention, thousands of acres would be untilled, or, if cultivated at all, only in a very imperfect manner.

Economy of modern ploughs.

There are several outgrowths of the plough, among which are the horse-hoe, invented by James Alden of New-York State, and others, and the so-called cultivator, provided with a series of diminutive plough-points to stir the soil about the roots of corn, cotton, and other crops. These implements, while of minor importance, have been of vast value; for with one of them, one horse, and a man, more work can be done than thirty men can do provided with hand-hoes.

Horse-hoe and cultivator.



HORSE-HOE.

The harrow, the next implement to be used in tillage after ploughing, is but a little different tool from what it was in the days of the ancients. Indeed, few implements have changed so immaterially in construction, and principle of operation, as this.

The harrow.

Very little data is attainable showing the progress of seed-drills for planting. Jared Eliot, writing in 1754, alludes to Mr. Tull's wheat-drill as a wonderful invention; but, owing to its cumbersome and complicated construction, he urges Mr. Clapp, President of Yale College, to apply his "mathematical learning and mechanical genius" to the invention of a simpler machine. Drills for spreading manure were soon after devised. The most marked improvement in seed-drills adapted to all kinds of crops has been made within the present century.

Planting-machines.

As regards practical value, probably no agricultural implement can compare with the mower and reaper. After the farmer has planted and raised a crop, he must harvest it: and it happens that most of his hay ripens at one time; and so with his wheat, rye, barley, oats, and buckwheat.

Mower and reaper.

If the hay be cut too soon or too late, it is of poor quality: and, if grain is allowed to get over-ripe, it rattles out of the husk, and is lost; or it sprouts in the head, and spoils. Thousands and thousands of acres of wheat in the fertile West were wasted in a single season before the reaper was perfected, owing to the inability of the owner to secure help enough to harvest it in the proper time.

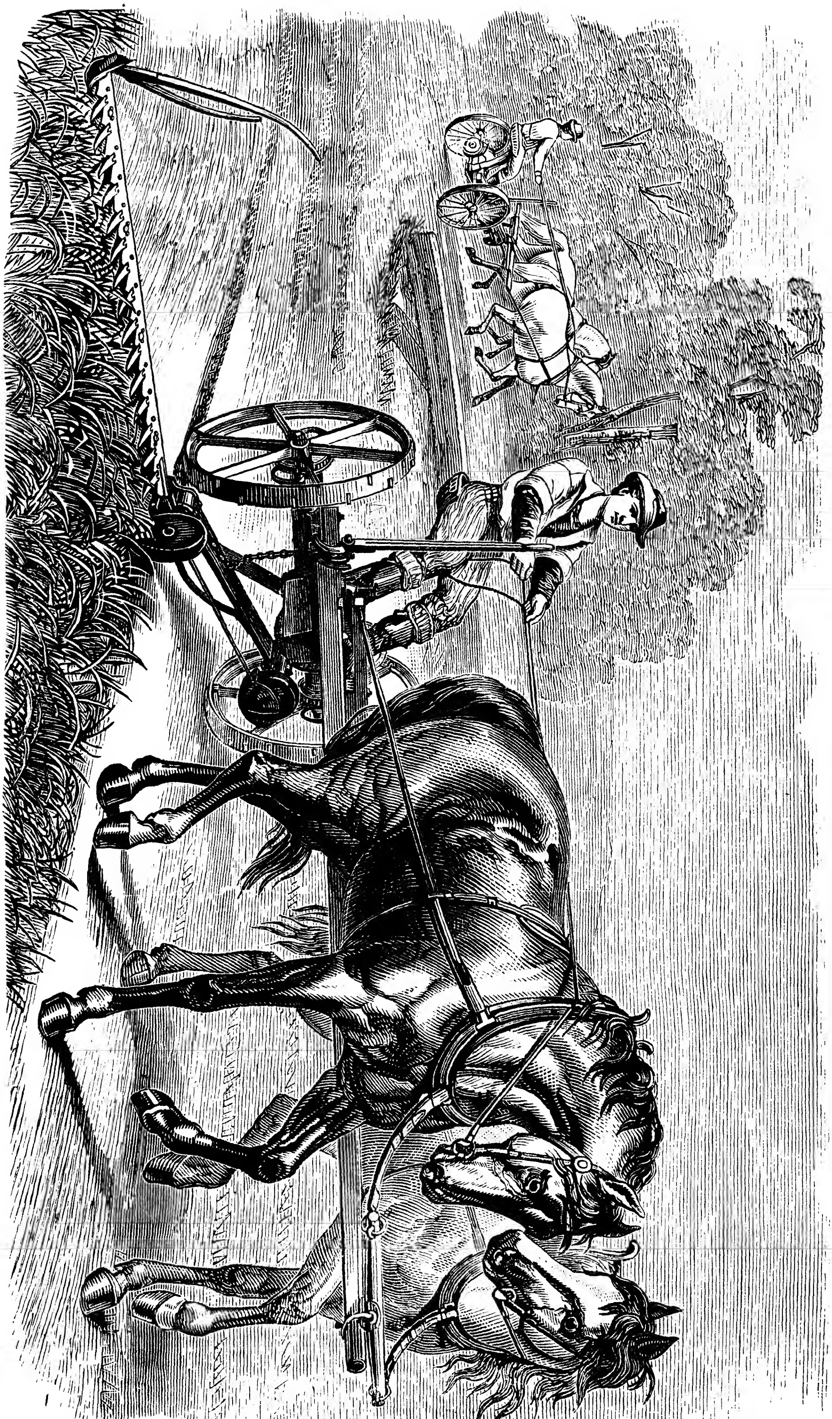
Not American inventions.

While it is true that American mowers and reapers are acknowledged to be the best in the world, and have always triumphed over all rivals in competitive trials in England, France, Germany, Russia, and South America, they are not of American origin. The mower was invented in Europe; but Yankee genius simplified and improved it greatly. Nor is the invention so very recent. The great improvement of the original dates back scarcely more than a generation; but the first reaping-machine of history is that mentioned by Pliny the elder as in use among the Gauls over eighteen centuries ago, or about the year 23 of the Christian era. At that time, and until within fifty years of the present day, most of the reaping of grain was done by the sickle. But Pliny mentions particularly a large-sized van on wheels, with teeth projecting from the forward edge, and driven through the oat and barley fields, with an ox yoked in the rear, between thills, in such a way as to push the machine ahead of him. Sometimes the sickles thus employed cut off the heads of grain at the top of the stalk, and sometimes half way down the stalk; but in either case the grain fell over into the van. Palladius, an Eastern ecclesiastical writer, A.D. 391, describing these same reapers, or an improvement thereupon, says that the driver could regulate the elevation or depression of the teeth by means of a lever. Thus it will be seen that a semi-barbaric race had invented and used a reaping-machine long before Rome's glory had departed, and even before Christ was crucified.

Description of Pliny's reaping-machine.

Early English reaping-machines.

In 1785 we read of proposals being submitted in England for the construction of a reaper; but, from the description, it does not appear to have differed substantially from that of the ancient Gallic husbandmen. And yet, as in the development of a plant or of a fine art, we now begin to see in rudimentary shape some new elements of the perfected machine. The power was applied as formerly, from behind, by either horse or ox; and the big box or van was emptied into a storeroom when full. But mention is made of a heavy drive-wheel, toothed wheels, and pulleys; which indicates that a series of knives were made to beat against the teeth in a different manner from those of old. Another reaper is described in 1799, which cut a swath two feet wide, and threw it to the ground on one side. This was another advance on the past; for the machine could now work with less frequent interruption. Agricultural writers always estimate the work of a horse as equal to five men, and judge the value of a machine accordingly. As this reaper, with a horse and a boy, could do more than six men with



MOWING-MACHINE.

sickles, it fulfilled the requirements of a labor-saving machine. Two more British machines deserve to be noticed. Mr. Gladstone devised one in 1806, which delivered the grain in gavels to be bound; and Mr. Plunckett constructed one the following year, which was drawn, instead of pushed, by the horse. In 1822 Mr. Mann brought forward a reaper, under the auspices of the Highland Society of Scotland, which would cut ten acres in ten hours. In addition to being drawn, and having a side-projecting cutter-bar, this machine made use of a sliding or reciprocating knife, had a reel to beat the grain against the knives, and had a platform on which the grain fell.

The first record of an American invention of this sort is of a mower, constructed by an ingenious mechanic of Genoa, Cayuga County, N.Y., in 1826 or 1828. The characteristic feature of it was a large wheel, which revolved horizontally near the ground, and which was provided with scythe-like knives on its periphery. A heavy drive-wheel communicated the necessary power. It was drawn by a single horse. The machine never amounted to much, and was never perfected; but it marks the first awakening of decided interest in this direction in America.

First American mower.

In 1828 Samuel Lane of Maine invented a reaper, and is said to have combined therewith a "thresher;" but we think this is a verbal error, and that "mower" is meant. A successful mower, which had some little popularity, was invented by William Manning of New Jersey in 1831; and in 1834 the Ambler patent applied Hussey's vibratory knives to the mower.

Lane's reaper.

In 1833 the first really successful and famous American reaper was invented by Hussey of Maryland. This had reciprocating knives, which operated through slatted fingers, — an entirely new principle, — and the cutter-bar was hinged so as to turn up at right angles with the ground. M'Cormick of Virginia patented a combined mower and reaper in 1834, which, with subsequent improvements, took a council medal at the World's Fair in London in 1851.

Hussey's reaper.

The period from 1830 to 1850 was one during which great attention was given to improving these machines; but even more ingenuity has been applied to their improvement since then, no less than three thousand patents having been taken out for such harvesters in this country. Among the most important attachments to the reaping-machine is the self-rake, which lays the grain off in gavels for binding; which work was formerly done by an extra man seated on the machine.

From about 1855, experiments have been made to devise and perfect a machine which shall bind grain as fast as it is cut. The man who has given the most attention thereto is Allen Sherwood of Auburn, N.Y. His apparatus consists of a series of fingers, arranged horizontally, upon which the grain is delivered by the rake in bundles; which fingers, co-operating with a slender, curved arm, are made to embrace the

Grain-binding machine.

bundle, and instantaneously girdle it with fine wire, which is cut from a reel, and its ends are twisted together for a knot. As yet, we believe that the machine has never come into practical use.

The American mowers and reapers are now awarded the palm of superiority the world over. In 1855 a competitive trial of reapers was had near Paris, France, in which machines from England, America, and Algiers, participated. The result was, that the American machine cut an acre of oats in twenty-two minutes; the English, in sixty-six minutes; and the Algerian, in seventy-two; and the same triumph has been repeatedly achieved in other similar contests. Our machines are exported to all parts of the civilized world, in preference to those of every other country.

Superiority of American mowers and reapers.

The average capacity of the American reaper is fifteen acres per day; but, under favorable circumstances, it will reap twenty or twenty-five: whereas, by hand, an acre and a half to a man is a large average. But this comparison does not fully represent the great advantage of this invention to the farmer. It must be remembered that these increased harvesting facilities enable him to gather crops which otherwise would spoil and be lost altogether, so short is the season in which grain must be harvested, if at all.

Capacity and advantages of American reaper.

The manufacture of reapers and mowers amounts to between eighty thousand and a hundred thousand a year; and, though they are made at Chicago and elsewhere in large numbers, the principal centre of the industry in America is Auburn, N.Y.

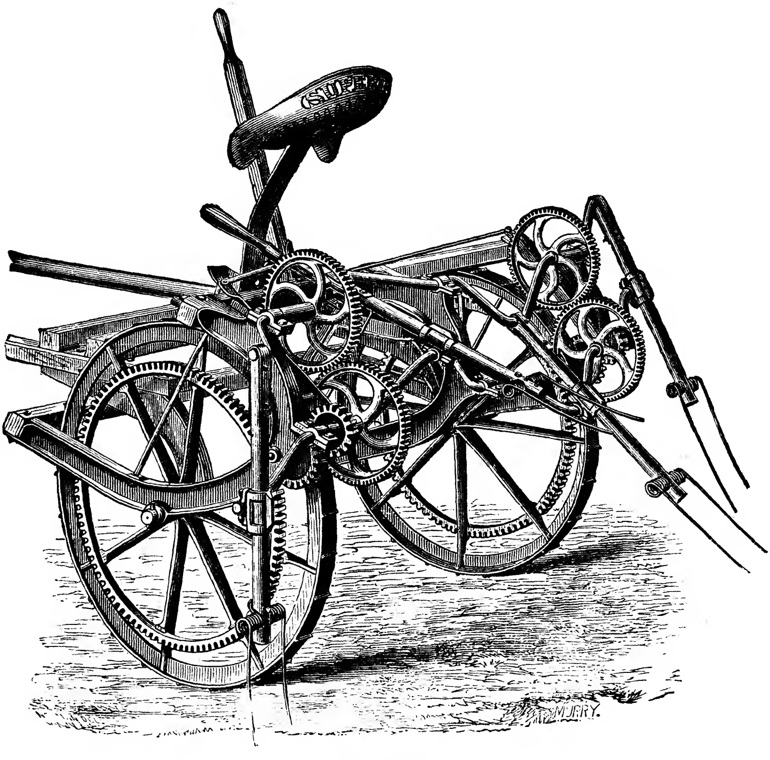
Manufacture of mowers and reapers.

Several machines have been invented within the present century, which have materially facilitated the gathering of the hay-crop. One of these is the tedder, which upturns the new-cut and half-cured grass as it lies upon the ground, and promotes its more rapid curing. Thus the risk of exposure to sudden summer storms is greatly lessened. Another very valuable implement is the horse-rake. It is found in many forms; but the two most esteemed are those with curved steel tines attached to a bar hinged to a light axletree, — first brought out in Pennsylvania, and manufactured by the Messrs. Sprout at Muncy, Lycoming County, — and those which have two sets of wooden teeth, lie close to the ground, and revolve at the will of the driver. These latter were invented by H. N. Tracy of Essex Junction, Vt. These rakes are used to gather pease, beans, and other crops, and enable the farmer to handle both them and his hay with far greater rapidity than of old. It is estimated that they do ten times the work of hand-rakes. The invention of the horse-fork, by means of which whole haycocks can be hoisted into the wagon, or from the wagon to the stack or mow, has also been the work of the past generation, and largely conduced to the saving of labor and time.

Tedders, rakes, and forks.

Agricultural implements may be divided into three principal classes, — those which prepare and till the soil, those which garner the crop, and those which separate the precious part of the product from its refuse. In addition to the mower and reaper and the horse-rake and tedder, there are several less important machines belonging to this second class. The most interesting is the potato-digger. Several attempts to devise a machine which shall plough up these tubers from the furrow, separate them from the loose earth, and deposit them on the surface of the ground, have been made, but none of them with perfect success. The great difficulty is in separating the potatoes from the dirt, when once exhumed.

Potato-digger.



HAY-TEDDER.

Prominent among the third class of machines above referred to is that which takes the place of the flail. For thousands of years, even back in the days of Israel's glory, grain was separated from its husk by throwing it upon large threshing-floors, beating it with flails, or causing it to be trampled by horses or oxen, and then purging the floor with a fan in the hand.

Threshing-machine.

The modern threshing-machine is less than a hundred years old, and, like the reaper, is a foreign invention, which has been greatly improved upon by American ingenuity. Attempts were made to devise such apparatus by Menzies in 1732, and Stirling in 1758, in Scotland; but both failed, because of an unsuccessful principle. In 1786 Andrew Meikle of East Lothian, also a Scot, invented a machine which proved effective. This device introduced the sheaf between rollers, and caused it to be beaten with arms on a drum. The English improved upon this arrangement by making this drum operate in a concave "breasting," which allowed of a more vigorous scutching and rubbing. The loosened grain fell mostly through bars in this concave, while the straw was carried onward to the shaker. The Americans improved on this still further by putting spikes, or teeth, both on the drum and the concave, and also by making the whole machine lighter and swifter than the cumbrous English apparatus. A famous trial of rival threshers was had in England in 1853 on the farm of Mr. Mechi, Tiptree Hall, Kelvedon; and the American machine did nearly three times the work the English machine did in the same time, and turned out the grain much cleaner. A subsequent trial was made in France, which resulted as follows: Pitt's (American) machine threshed seven hundred and forty litres of wheat in an hour; Clayton's (English), four hundred and ten; Duvoir's (French), two hundred and fifty; Pinet's (French), one hundred and fifty; and six experts with flails, sixty altogether.

A foreign invention.

Improvements in threshing-machines.

The threshing-machine is generally owned by itinerant proprietors, who go through the country working for successive farmers, as in the early colonial days did the plough-owners. At first they were operated by treadmill and rotary lever horse-powers; but now portable six or ten horse power engines are largely employed. The capacity of one good steam-power threshing-machine in a season of three months is from forty thousand to a hundred thousand bushels of grain. There is a record of a horse-power thresher cleaning eighty thousand four hundred bushels in fifty-two days, of which eleven thousand three hundred were threshed in five days and a half.

Mode of operating them.

Small winnowing-machines, for hand use, have been used from early colonial days. Special machines for threshing clover, and gathering its seed, have also been devised during the present century.

Winnowing-machines.

No effective machine for cutting corn or husking it has yet been devised, although repeated attempts in those directions have been made. A sheller exists, however, which removes the grain from the cob, and which is operated by hand, shelling one ear at a time; and a more rapid separator, worked by horse-power, has also been developed therefrom, and come into extensive use in the Western grain regions.

Machines for cutting, husking, and shelling corn.

Probably no machine has so conduced to the sudden and vast development of any agricultural industry in the whole world as the cotton-gin. The cotton-boll contains coarse, hairy seeds, which cling to the soft fibre, and which need to be removed therefrom before the latter can be marketed or manufactured. A century ago this labor was generally performed by women and children in the house, at evening; and the process was so slow and laborious, that cotton-culture was not particularly profitable. In India a bow and string were used to whip the cotton, and thus remove the seeds: this implement was first used in this country in Georgia, the marketable fibre being called "Georgia bowed cotton."

Cotton-gin.

A machine called a gin, designed to accomplish this object more expeditiously, is said to have been invented in 1742 by a French planter who lived on the present site of New Orleans, and who was named Dubreuil. The invention greatly stimulated the culture of the plant. Its mechanism is not described; but it probably was a less efficient apparatus than the roller or saw gin.

Dubreuil's invention.

Early in the Revolution, a roller-gin, composed of burnished gun-barrels fixed in wooden rollers, was devised by Kinsey Borden,—the man who brought the Sea-Island cotton to this country. Whether the idea was original with him, or imported, is not known. Mr. Bissell of Georgia simplified the roller-gin in 1788. Its product for a day was about five pounds of cleaned cotton. Shortly after the Revolution, Joseph Eve, or Eaves, of Rhode Island (who is also spoken of as the son of a Pennsylvania loyalist who had moved to the West Indies), introduced into Georgia an improvement on the roller-gin. It was furnished with a double set of rollers, and operated by ox-power instead of a hand-crank or treadle. It was not patented until 1803. In letters written at that day, there is a suggestion of the possibility, that, before Eve's machine was introduced, a foot-gin was in extensive use near Philadelphia, which was superior to that employed in Georgia. Still another roller-gin is mentioned as having been introduced from the West Indies, or invented by Mr. Crebs, who used it on his plantation on the Pascagoula River, in what was then called West Florida, but is now Alabama.

Roller-gin.

The best of all machines for this purpose, however, is that which is believed to have been the invention of Eli Whitney; namely, the saw-gin. We refer to this in connection with the history of cotton-culture in this country. This machine employed an entirely new principle; namely, teeth on a roller, for which sets of circular saws were afterwards substituted, rotating so closely to a set of parallel bars as to catch the fibrous cotton on the other side, and pull it through, leaving the seeds. Its relative superiority will be better understood when we say that it enabled the planter, with the employment of a single hand, to clean a thousand pounds of cotton a day; whereas the roller-gin would clean but twenty-five, and hand-picking but five or six. Bishop truly remarks of this invention, that, "in economical value, it ranks with those of Arkwright and Fulton." Indeed, it did more for the southern section of this country than the improvements on the plough, the sickle, and the flail, did for the North.

Whitney's invention.

Besides all these machines of which we have made mention, a host of others of less importance have been invented. Stone and stump extractors, which are of material use in clearing the soil for cultivation, have come into use within a generation. But, while they were valuable in the improvement of limited areas in the East, the most rapid extension of our agriculture has been in the West, where trees were scarce, and such apparatus was unnecessary. Hence they have really promoted our agricultural interests as a whole but little. Saws for lumber, ditching-machines, drain-tiles, land-rollers, planting-machines, improved hoes, rakes, shovels, scythes, wagons, churns, bee-hives, pruning-knives, and other apparatus and implements for farm-labor, have been invented almost without number, some of them proving highly popular and convenient.

The introduction of these new means of culture and harvesting has revolutionized the several branches of agriculture completely within the past century of our history, and has incalculably increased our capacity of production. The wide use into which these have come will be realized when it is known that the agricultural implements manufactured in the United States in 1870 amounted in value to fifty million dollars; though but part of this, it must be remembered, was for the export trade. The aggregate value of such apparatus owned throughout the country was a hundred and fifty-two million dollars in 1850: in 1870 it had increased to three hundred and thirty-seven million dollars, or more than doubled. Without doubt, it will be twice this figure by 1880.

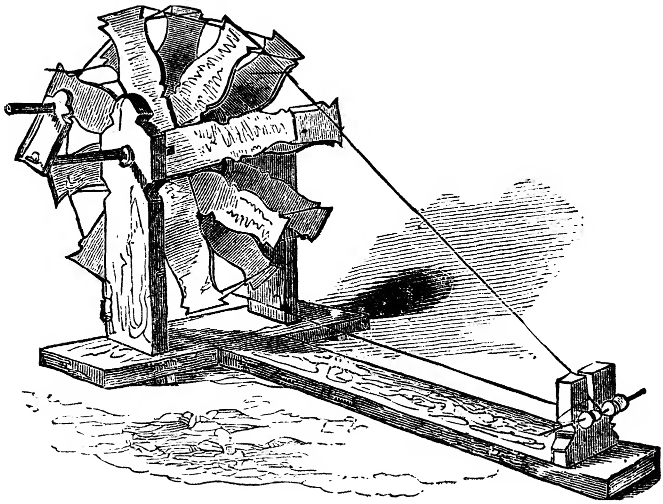
CHAPTER III.

COTTON.

NO one industry in the United States is of so great value and importance to the nation and to the world as cotton-culture. Though the annual product is not worth more than half as much as either our corn or wheat crop, we have enough left over to export, after our own consumption, to more than equal the sum total of our cereal exports. It is the one great product which we offer the other nations of the globe in exchange for what we want from them. Except petroleum, it is the leading product upon which the outside world is most dependent upon America. Yet our total product annually is worth four times our total product of rock-oil. Moreover, while we export scarcely two-thirds of our petroleum, we send abroad nearly three-fourths of our cotton. Within a century, cotton has come to succeed silk, linen, and wool, as the most useful and common textile fabric for clothing. It is a necessity of life in all civilized and semi-civilized quarters of the globe, and the United States raises seven-eighths of the world's supply. And not only do we raise the most cotton, but also the best cotton produced by any nation under heaven. It is as characteristic a product of this country as spices are of the Indies, or tea of China, but vastly more precious. It has exerted a greater political influence over this country than any other one interest. For a century it was intimately associated with negro slavery, and those who were identified with both constituted one party to the greatest civil war known on this continent. In that strife, the dependence of Great Britain on the cotton States of our Union for the basis of her greatest manufacturing industry, and source of wealth, determined the sympathies of the empire, whose friendship was of the greatest value to the contending factions. As the well-informed and thoughtful American looks forward into the industrial future of his country, he sees no agricultural interest that promises to be an equally permanent and remunerative reliance in coming years. Great Britain, it is true, is trying to become independent of the United States by raising her cotton supply in India. Thus far, however, her efforts have not been very successful. The quantity has been largely increased; but the

Importance of cotton-crop.

quality has not been much improved. So inferior is its value for manufacturing purposes, that India cotton can only be used by mixing it with some longer staple. Even the India manufacturers, who aspire to the production of only the coarsest and cheapest fabrics, are obliged to import cotton to mix with that of native growth. Nor is this defect likely to be soon remedied. The physical conditions of India are such as to render it quite impossible for cotton ever to be grown there possessing the same length, strength, and delicacy of fibre, as is found in the American product. Thus Nature has crowned our country with an advantage in raising cotton which will probably ever baffle human genius to overcome.



INDIA SPINNING-WHEEL.

Early culture of cotton.

Although the name "cotton" is of Arabic origin, and the plant is indigenous to all warm climates of the world, the fibre was first utilized in India, whence came our word "calico," and then in Persia, which gave us the first "muslin." Thence its culture and use extended into China, Arabia, Africa, and Europe. Herodotus discovered the Hindoos cultivating the plant, and weaving its delicate fleeces into cloth, 450 B.C.; and from that people the Greeks and Romans imported it before the Christian era, first for awnings, then tents, and then for clothing. Hindostan still produces considerable cotton; but her poor communications from the interior to the coast, and her inability to raise as good a quality of cotton as the United States (the American varieties not being successfully cultivated), leave her far in the background as a reliance for the world, although England still imports largely from her. Farther India and the islands of the Indian Archipelago produce cotton likewise, to some extent. China has cultivated it since the eleventh century, but has to import to supply her own manufactories. Japan raises a coarse, inferior grade of cotton. Livingstone found it growing in abundance in Central Africa. On the western coast of that grand geographical division it has been cultivated with marked success, although to no very notable extent. The late Lord Palmerston, for many years one of England's greatest statesmen, and long her prime-minister, is said to have feared that the supply from the United States would some time give out; and he urged upon his country the policy of encouraging cotton-culture on the west coast of Africa as the great resource of the future. As yet, his fears and expectations have been but poorly justified. The Moors brought the cotton-plant from Arabia into Northern Africa and Spain. In the latter country, its use by the Moslems for making turbans gave rise to a Christian prejudice against its culture. Especial efforts were made to introduce cotton into Egypt in 1821, and they have been attended by quite successful results.

Culture of cotton by various countries.

COTTON-PLANT.

Columbus discovered cotton growing on the new-found Island of Hispaniola; Magellan saw it in Brazil; and Pizarro, in Peru. Cortez gathered it in Southern Cuba to quilt into his soldiers' armor, and, on reaching Mexico, found it under high cultivation and use; the natives weaving it into the most delicate and beautiful curtains and robes, and, mingled with feathers, converting it into the most lovely and richly-colored ornaments. Other explorers found it growing as far north as the banks of the Mississippi and some of its tributaries, and some of the Indians of Texas and New Mexico even yet utilize it for blankets.

Discovery of cotton in New World.

Naturalists find many varieties of cotton in existence, and their classification thereof differs greatly. The division is made by them according to botanical distinctions, rather than such practical ones as the length and quality of the fibre. But all kinds of cotton may be narrowed down substantially to three botanical classes, — the *Gossypium herbaceum*, *arboreum*, and *hirsutum*, or herbaceous, tree, and shrub cotton. The tree and shrub cotton-plants have a life of from six to ten years, and the arborescent species sometimes grow to a height of twenty feet. In the United States, however, only the herbaceous or annual varieties are under cultivation; and these may be classified as follows: —

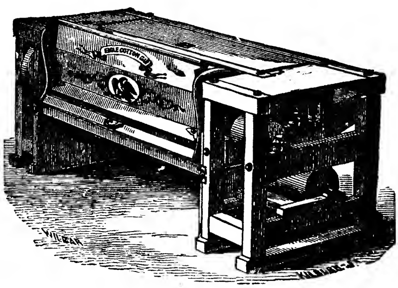
Varieties of cotton.

The upland cotton, with a short staple, a yellow blossom changing to red, and naked black seeds (this was the first kind introduced into this country); the Tennessee cotton, which partially succeeded the above-named, because of its freedom from rot, and which has seeds covered with green down; the Mexican, which has to a great extent succeeded both of the two previous-named varieties (especially in Mississippi) because of its greater vigor and productiveness, and which has seeds covered with a dingy, whitish-brown down; and the Sea-Island cotton, which has black seeds and a long staple, and is the finest cotton in the world.

Classification of cotton.

The historian Purchas says that cotton, probably the short-stapled, was planted in this country by early settlers in 1621. Historical papers in South Carolina indicate that it was under cultivation in that colony in 1666. Maryland is known to have grown it as a garden-plant in 1739; and some forty years later it was to be found in Cape-May County, New Jersey. At the breaking-out of the Revolutionary war, Gen. Delagall had no less than thirty acres of green-seed cotton under cultivation. Up to about this time the manufacture of cotton was attended with great disadvantages. The demand was slight, and scarcely any one but fanciers thought of raising it in this country. There were, nevertheless, some exports prior to the Revolution, statements to the contrary notwithstanding. In 1748 seven bags of cotton-wool were sent from Charleston, S.C., to England, valued at three pounds eleven shillings and fivepence each. Further shipments were made in 1754 and 1770. And yet in 1784, when eight bags were found aboard an American vessel by the British at sea, they were seized, on the plea that America could not produce so much, — two thousand pounds.

Cultivation of cotton by colonists.



COTTON-GIN.

To Alexander Bissell is due the credit of bringing here the Sea-Island cotton. He cultivated it first on St. Simon's Island, at the mouth of the Savannah. For a time its culture was limited to the islands off a part of South Carolina's coast and at the mouth of the Savannah River. Afterwards it was cultivated in the lowlands of the conti-

Introduction of Sea-Island cotton.

nent, in most places less than fifteen miles from the coast, but in one place in Georgia no less than a hundred and twenty-five miles inland. In Middle and Western Florida the Sea-Island cotton has since been very extensively grown. Something was done toward the cultivation of Sea-Island cotton on the Texan coast upwards of twenty years ago, with tolerable success. It deteriorates rapidly, however, when cultivated in the interior. Its excellence and the limited size of the crop give it the ascendency in the market. In 1806 it brought thirty cents a pound when the short-stapled cotton brought but twenty: in 1816 it was worth forty-seven cents to twenty-seven for the short. By careful selection of seed, and unique improvement of the plant, Mr. Kinsey Burden of St. John's, Colleton District, S.C., raised the best Sea-Island cotton about that time, and could get twenty-five cents more a pound than other raisers. The crop of 1832, amounting to eight million pounds, was the largest of this variety ever produced in this country; and a bale sent to England in 1857, from Edisto, S.C., brought the highest price on record, — one dollar and thirty-five cents a pound. It might be remarked in this connection, that the Hindoos spun the cotton fibre so finely on one occasion, that it took a hundred and fifteen miles of thread to make a pound. English spinners have stretched American Sea-Island cotton out so fine, that a pound of it would reach a thousand and twenty-six miles.

In "The Year-Book of Agriculture" we find this account of the introduction of the Mexican cotton to the United States by Walter Burling of Natchez:

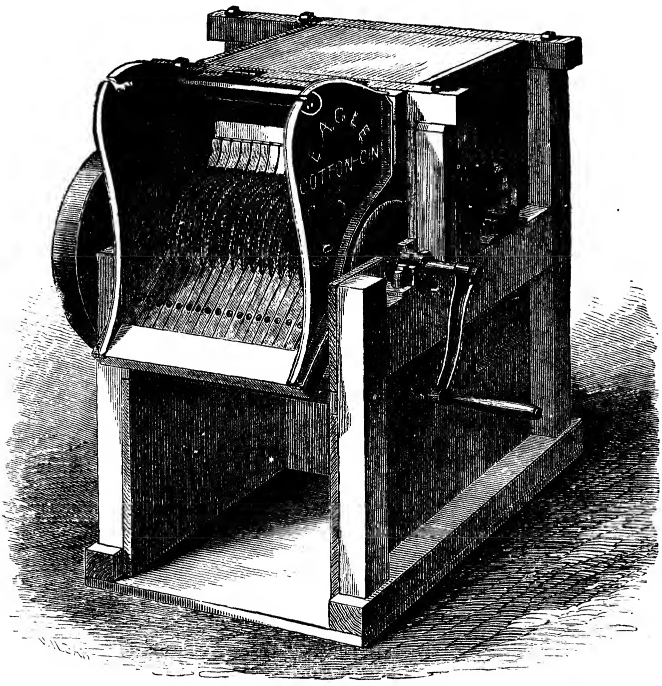
Introduction of Mexican cotton.

"In 1806 he was sent by Gen. Wilkinson to the city of Mexico, where he dined with the viceroy. In the course of the conversation at the table concerning the products of the country, he requested permission to import some of the Mexican cotton-seed, — a request that was not granted, on the ground that it was prohibited by the Spanish Government. But the viceroy, over his wine, sportively accorded his free permission to take home with him as many Mexican dolls as he might fancy, — a permission well understood, and which, in the same vein, was accepted. The stuffing of these dolls was understood to have been cotton-seed."

By the careful selection of seed, the use of seed from another section of the country, and like expedients, enterprising growers have at various times developed seemingly new varieties in many localities South, and each of these has had an ephemeral local fame. But they did not differ substantially from any of the foregoing varieties. Attempts have been made, too, to naturalize other foreign species, such as the Nankin in Georgia, but not to any notable extent. The upland varieties most popular at the present time are said to be the Dickson, Peeler, Cheatham, Boyd's Prolific, Simpson, Petit Gulf, Johnston, Hurlong, Shupeck (or Schupach), Ramases, Matagorda Silk, Java Prolific, and South-American Champion.

Five causes have operated very decidedly to develop the culture of cotton in this country. The first of these was the remarkable improvements made, a little over a century ago, in the machinery for spinning and weaving cotton, together with the gradual discovery in England that cotton alone could be used for making cloth. In 1738 Wyatt invented the spinning-jenny to succeed the distaff. Later the process of carding cotton was devised by Paul. Arkwright and Hargreaves improved on the previous spinning-machines; and then, in 1779, Crompton invented the mule, utilizing the ideas of his predecessors. Cartwright patented his power-loom in 1787; but it was not until the present century that it came into use. These remarkable improvements very naturally stimulated the production of cotton, and the application of Watt's steam-engine to the manufacture of the fibre in 1785 added still further impetus to the industry. For a time, in England, cotton was used only to adulterate linen. Some time afterwards it was found that it might be used altogether for filling a flaxen warp; and finally both warp and woof were made of cotton.

Causes which led to development of culture of cotton.



COTTON-GIN.

A still greater stimulus to cotton-culture was given by the invention of the cotton-gin. Previous to that event the difficulty of separating the seeds from the fibre of the cotton-boll was so great, that the cost of the product formed a very serious obstacle to its use; but the cotton-gin removed this, and immediately gave this material the most marked ascendency over other textiles for cheapness and utility.

Invention of cotton-gin.

The honor of this invention unquestionably belongs to Eli Whitney, who went from New Haven, Conn., to Savannah, Ga., as a tutor in the family of Mrs. Gen. Greene, in 1792. Here he learned of the difficulty experienced by the short-staple cultivators in separating the cotton from the seed. Being of an ingenious turn of mind, he applied himself to the construction of a machine which would perform the work. At first he covered a roller with hooked wire teeth like those of the cards, and revolved it close to a frame of parallel wires on which the ball cotton lay, so as to catch the fibre, and draw it through, leaving the seeds. The teeth not proving strong enough, he substituted a series of saws on his cylinder, which worked far better. Behind the saw cylinder he placed revolving brushes, which dexterously removed the fibre. When the machine was completed, he showed it to the neighboring farmers, who pronounced it a success. The next year he got his invention patented, and then, with the co-operation and capital of one Miller, went into the business of manufacturing it, and using it to gin cotton for patrons. But patent-laws were then new, almost unknown, and poorly understood. Cotton-cultivators hired ordinary mechanics to make these machines for them, in utter disregard of the patentee's rights. In 1794 Whitney's sickness and that of his employees delayed their work; and in 1795 their shop was destroyed by fire. Thus the infringers were given still greater chance to impose upon him, the immense value of the invention being almost instantly recognized. Protracted and wide-spread litigation ensued; but so ably was Whitney fought in the courts, that he could get but slight damages, or none at all, in return for his pains and his own outlay. Subsequently the State of South Carolina paid him fifty thousand dollars for his invention; but the costs of his litigation swallowed it all up. The story is one of the most pitiable in American history. The original invention was susceptible of little improvement, unlike many others for which Americans have become famous; and he deserves the honor of being one of his country's greatest material benefactors. Yet he reaped not a bit of fruit for his skill, and there stands not a monument to his memory to-day.

Whitney's invention.

Of course the invention of the gin wrought a wonderful effect. The profit of cotton-culture was thus immensely enhanced, and the business was rapidly extended; rice and tobacco, which for a time exceeded cotton in value as an export, very quickly dropping to a subordinate rank.

Effect of his invention.

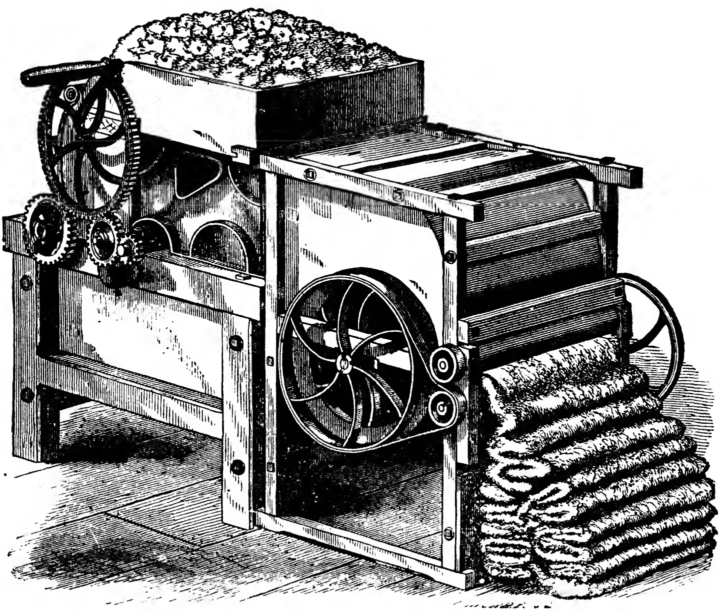
A third influence upon American cotton-culture was the introduction of negro labor; which, however, was an effect as well as a cause. The blacks seemed to be admirably adapted to perform the requisite labor in the scorching climate of the Southern States, where alone the plant could be grown: hence the rapid development of the slavery system, already ingrafted upon our body politic. Although the experience of the past twelve years shows that slavery is not essential to cotton-culture; that free negro labor is as good as slave labor, so far as the yield is concerned, if not

Negro labor.

better; and that acclimated whites can do good service on the cotton-plantation, — yet practically the work of raising our cotton was, until the late civil war, done altogether by the negroes of this country; and they have been an important means in the extension of the industry.

Fourthly, the expansion of the area of the United States in the South naturally gave further development to cotton-culture. At the close of the last century, as we have already indicated, the little cotton grown in this country was confined almost entirely to South Carolina and Georgia. From the former it extended into North Carolina, and from the latter into what soon became the State of Alabama. Kentucky and Tennessee were rapidly occupied by settlers at that period of our history, and the latter gave great attention to cotton. At the commencement of the present century the Louisiana purchase gave us the State of that

Expansion of area of cotton-culture.



COTTON-GIN.

name, Arkansas, and other territory beyond the Mississippi, which soon was occupied and developed. The State of Mississippi rose to the dignity of sisterhood in our Union. Florida was annexed in 1820, and finally Texas was added to our domain in 1845. Each of these territorial acquisitions, and the enterprise thereby stimulated, gave impetus to this particular branch of American agriculture.

And, fifthly, the great foreign demand for this product of America has conduced enormously to its culture. To be sure, much of the cotton which we exported for manufacture abroad, particularly in England, came back to us again for our own use as clothing. But, inasmuch as our manufacturing industry was not developed, we could not have utilized the staple, and would not have had any occasion to raise it if Europe had not called for it. And the demand was the greater, because it was soon discovered that our cotton was altogether the best in the world. For instance, in the year 1790 only one bale out of every thousand imported into England came from this country: in 1799 the proportion was one in every nine. This proportion steadily increased, until, in thirty or forty years, we furnished England with seven bales out of every eight that she consumed. Of late years our exportation to England has not kept pace with our production, because we are coming to manufacture a larger share of our yield ourselves, both for our own use and for export; yet our export has steadily increased, and even now amounts to nearly two-thirds of our yield, and still constitutes England's chief reliance.

Exportation.

The stimulus which the foreign demand gives to our cotton-culture will be better understood if one considers the proportion in which the various countries of the world produce the raw material, and the proportion in which they manufacture it. The foregoing figures represent the situation before our late war; since which time we have come to manufacture more of our product ourselves, and foreign countries have obtained a perceptibly smaller supply from us. As yet, however, these changes are slight. The production of the world in 1856 was as follows:—

Cotton production of the world.

	BALES.
West Indies	4,090
Brazil	5,500
Egypt	86,445
East Indies	445,637
Total outside United States	541,672
United States	3,880,580

That is, we produced seven-eighths of the world's cotton. Now for the consumption. In 1850 it was thus estimated:—

	BALES.
Great Britain	1,513,000
United States	487,800
France	369,300
Russia	125,200
Trieste and Austria	125,200
Hamburg and Bremen	70,700
Holland and Belgium	71,700
Spain	80,400
Italy, Sweden, &c.	52,100
Total	2,895,400

Thus it appears that England manufactured half or more of the world's cotton. Very naturally, then, the principal producer furnished the principal consumer most of her supply, as will appear from the following statement of our export in 1860 : —

Quantity exported by U. S.

	BALES.
To England	3,037,762
" France	709,918
" Other Countries	671,535
Total	4,419,215

This figure represents the abnormal export of the year following that of our largest crop, and is the largest aggregate shipment we ever made in any one year. We propose to give now, somewhat more in detail, a statement showing the extent of our exportation of cotton during a series of years; and, if this be compared with the statement which we shall presently give of our total production, it will be easy to see what share of the whole yield we have been accustomed to sell to other countries in exchange for what we have been obliged to buy from them.

Shipment for several years.

We have already mentioned that we sent small amounts in "sacks" to England in 1748, 1754, and 1770; and that seventy-one bags, amounting to about eight bales, were seized aboard an American vessel in 1784, because it was deemed impossible that this country could produce so much, and that such a quantity of cotton could only have been obtained by the ship illegitimately. In 1789 we shipped no less than 842 bales to England. In 1791, it is stated in the Agricultural Bureau's Report for 1862, we exported 189,316 pounds, or 4,733 bales of the modern standard.[1] In 1800, so rapid was the development of the industry, we exported 17,789,803 pounds, or 44,476 bales, — an increase of nearly ten to one in a single decade. During the next thirty years the increase was about fourteen-fold, as will be seen from the following table : —

Early shipments.

Shipments 1830–1855.

	POUNDS.
Five years ending 1830[2]	1,273,232,281
" " " 1835	1,695,970,409
" " " 1840	2,621,360,414
" " " 1845	3,443,757,674
" " " 1850	3,551,036,317
" " " 1855[3]	5,128,295,805

During the twenty-five years from the first half-decade to the last half-decade here registered the increase was a trifle over fourfold. Herewith we give the figures for the next twenty-two years, separately and in bales : —

Shipments 1856–1877.

[1] Four hundred pounds.

[2] Average per year, in bales, 636,616.

[3] Average per year, in bales, 2,564,148.

YEAR.	BALES.
1856	2,953,771
1857	2,251,496
1858	2,589,732
1859	3,020,519
1860	3,773,256
1861	3,126,867
1862	12,661
1863	28,462
1864	29,982
1865	16,517
1866	1,552,457
1867	1,552,761
1868	1,657,015
1869	1,448,020
1870	2,178,917
1871	3,166,742
1872	1,957,314
1873	2,679,986
1874	2,838,172
1875	2,680,841
1876	3,248,409
1877	3,043,084

Comments on foregoing table.

Thus it will be seen that in 1860 we attained the climax of our exportation, the amount being nearly a hundred times what it was in 1800, and almost a thousand times what it was in 1791. The war accounts for the falling-off of the next five years, and the slow recuperation from that influence for the figures of the next five. While, however, the crops have once more gotten up to ante-war figures, the development of our manufactures lessens the exportation of the raw material; and it is doubtful whether we reach the figures of 1860 again for many years. It must be remembered, however, that, prior to the war, a share of the cotton which we exported came back to us manufactured, and costing us nearly six times what we were paid for it in a raw state: hence our receipts for exported cotton were not clear gain. But now we are repurchasing only small quantities of our cotton in thread, yarn, or cloth, and are sending abroad manufactured cotton to an extent more than compensating for the falling-off in the raw material.

Production before and after civil war.

At the commencement of this century, the export to England represented pretty much our whole yield. We manufactured at home an utterly insignificant amount. As late as 1850, our export comprised over five-sixths of the crop. The following table shows the total production for the eleven years immediately before the war and the eleven immediately after, the bales averaging 440 pounds each: —

YEAR.	BALES.
1850	2,355,257
1851	3,015,029
1852	3,262,882

YEAR.	BALES.
1853	2,930,027
1854	2,847,339
1855	3,527,845
1856	2,939,519
1857	3,113,962
1858	3,851,481
1859	4,669,770
1860	3,656,006
Total	36,169,117
1865	2,193,987
1866	2,019,774
1867	2,593,993
1868	2,439,039
1869	3,154,946
1870	4,352,317
1871	2,974,351
1872	3,930,508
1873	4,170,388
1874	3,832,991
1875[1]	4,669,288
Total	36,331,582

It will be seen that the increase in our crop is quite steady. The variations noticeable are partly due to pests (of which the army-worm is the most destructive), to wet weather, and to the fluctuation of prices. Inasmuch as the increase in the demand is very slight and gradual, it is noticeable that over-production usually so depresses the price, that the cultivation next year is slightly discouraged. This will be apparent from a comparison of the yield of 1859 with 1860, and 1870 with 1871. The effect of quantity on price will be realized from the following comparison: 1869, crop of 3,154,940 bales brought 23.6 cents a pound, or $346,223,774; 1870, crop of 4,352,317 bales brought only 14.9 cents a pound, or $301,550,283.

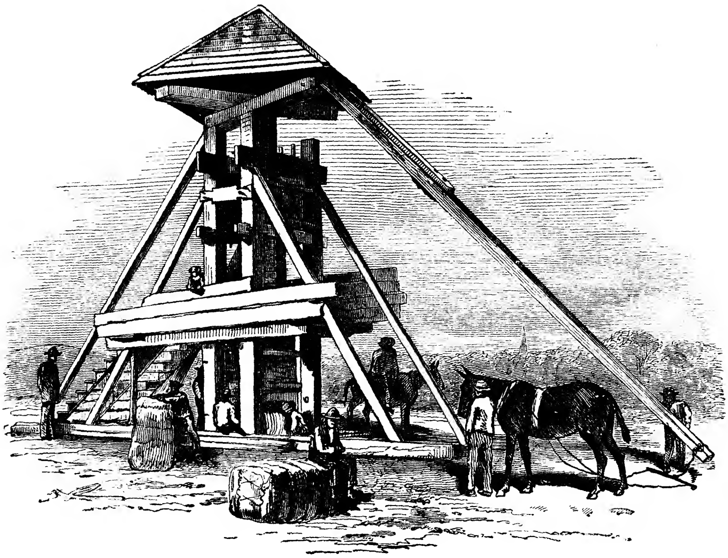
Effect of production on price.

The effect of the late civil war was to stop the production of cotton almost altogether for four years. Some of the staple produced before that interruption was hoarded; some was captured, especially in the Attakapas region of Louisiana in 1863; some was burned to keep it from falling into the hands of the Unionists; and a very little of it was taken out by blockade-runners to foreign countries. The Southern States made loans of money in England in anticipation of future production and of securing independence; which loans were necessarily left unpaid. During the war, attempts were made in the North to cultivate cotton; seed from our own country, China, Peru, and elsewhere, being widely distributed

Effect of war on production.

[1] The crop of 1876 was about 4,500,000 bales, and that of 1877 was 4,750,000, — the largest ever known in this country.

and planted. From Maine to Minnesota, and from Canada to Mason and Dixon's Line, earnest efforts to cultivate this then rare and precious fibre were put forth. But, while the plant flourished finely, the bolls would not mature; and except in limited localities, in Delaware, Maryland, Missouri, and Kansas, nothing was accomplished. Meantime India's crop and export were largely augmented, and became the chief reliance of the outside world. But, as soon as the war was over, this country quickly came to the front as the world's chief producer.



COTTON-PRESS.

Indeed, the recuperation of this industry, in view of the emancipation of the slaves, the change from compulsory to free labor, the necessary demoralization of society attendant upon the substitution, and the repeated predictions that we could never raise a crop of three million bales again, is simply marvellous. Reference to our tables of production will show, that, during the eleven years next after the war, we raised more cotton than during the corresponding period before, and that five times[1] since the war we have raised a larger crop than any year anterior to it, omitting the exceptional crop of 1859; and there is no doubt, that, were our market once assured, we could increase our annual yield to ten million bales inside of ten years.

Production since the war.

Besides the substitution of free for slave labor, some other notable changes have lately been taking place in this industry.

As with most of our other agricultural interests, there is a westward

[1] In 1870, 1873, 1875, 1876, and 1877. The last-named crop exceeds even that of 1859.

movement of the centre of cotton production. In 1849 Alabama stood in the front rank, with Georgia next, and Mississippi third. In 1859 Mississippi had the lead, with Alabama second, Louisiana third, and Georgia fourth. In 1876, as will be seen by the following table showing distribution of yield and fertility, Mississippi was first, Texas second, Louisiana third, Alabama fourth, and Arkansas and Georgia nearly equal: —

Production of the several cotton States.

	BALES.	ACRES PER BALE.	ACRES.
North Carolina	210,000	2.9	609,000
South Carolina	310,000	3.05	945,500
Georgia	505,000	3	1,515,000
Florida	50,000	3.3	165,000
Alabama	533,000	3.25	1,732,250
Mississippi	760,000	2.6	1,976,000
Louisiana	560,000	2.25	1,260,000
Texas	690,000	2.15	1,483,500
Arkansas	515,000	2.2	1,133,000
Tennessee	260,000	2.85	741,000
Indian Territory, &c.	45,000	2.6	117,000
Total	4,438,000	2.63	11,677,250

It may be remarked in passing, that, while our product is as large as before the war (larger on the average), our acreage is less, it having been upwards of thirteen million in 1860.[1] This shows an improvement in methods of cultivation.

Acreage less than before the war.

Improved cultivation is noticeable in several respects. The relative proportion of corn and other supply crops is increasing. Heretofore pork and meal have been bought from the North; but, raising them at home, the food of the laborer is made cheaper, and the profit on labor is greater. Then, too, rotation of crops is studied more closely in consequence.

Greater pains are taken to prevent waste of the soil, and also to feed and restore it. Beyond the Mississippi, along the new and rich alluvial bottom-lands of the Red River and Ouachita, no such expedients are now necessary: but, in the States east of the Mississippi, greater economy is practised with cotton-seed and lot manures; and experiments are numerous with commercial fertilizers used chiefly in combination with composts of home material.

Greater economy in cultivation of cotton.

[1] The distribution of the cotton-culture in the so-called cotton-belt is very uneven. Out of seven hundred and fifty-nine counties, no less than ninety-three produced no cotton at all in 1870, and two hundred and twenty-seven others from less than a thousand bales down to one; whereas seventy-nine produced about half of the whole crop, each yielding upwards of ten thousand bales. As an illustration on a smaller scale, it may be stated that four out of Tennessee's eighty-five counties produced four-tenths of that State's crop in 1870. Corn, the other prominent Southern crop, though of much less importance in the aggregate, is much better distributed.

The soil is being cultivated more thoroughly, and with improved implements, especially in those regions where white labor is in the largest proportion.

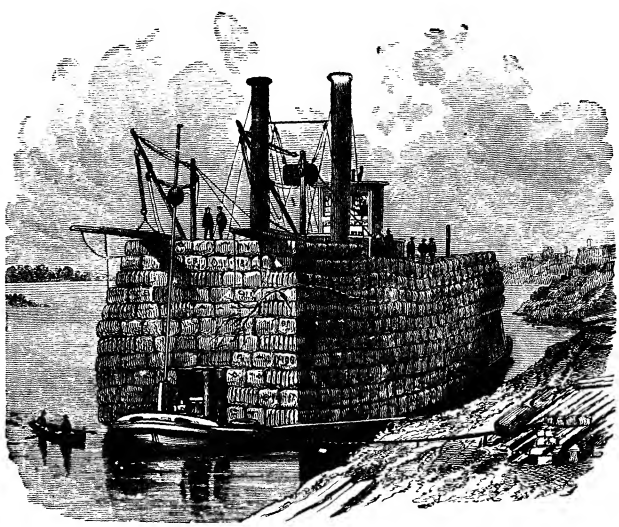
Smaller farms.

A noticeable diminution in the size of farms is going on, which conduces to higher culture. Between 1860 and 1870 the number of farms of over a hundred acres decreased in every cotton State, and those of under a hundred acres increased, the reduction being twenty-two per cent, and the increase thirty-five per cent. This movement is still progressing, the ratios being largest in South Carolina, Louisiana, and Florida.

Mode of working farms.

Rates of remuneration.

There is a tendency to depart from the method of working on shares (which came into vogue immediately after the war), and to pay cash wages instead; and, on the whole, wages are growing a trifle less. Where the share system prevails, — and it still predominates, — contracts vary somewhat in particulars. Thus bare labor gets about one-fourth of the crop on rich lands, and one-third on poor soils. If the laborers furnish their own rations, they get from four-tenths to one-half the crop, according to the productiveness of the soils. As the supply of crops becomes more plenty and larger, the tendency will be for the help to provide themselves more and more with rations, and rely less on the land-owner. The proprietor receives a third or half of the yield; if he provides implements, live-stock, and rations for the help, about two-thirds. Rations consist of about two hundred pounds of bacon and fifteen bushels of meal per man a year, which is equivalent to from forty dollars to sixty dollars. A landlord will sometimes let his land for a bale of cotton to a man, and half a bale for a woman, giving them the rest. Where cash is paid, the yearly system rather than the monthly is pursued; and the rate is from a hundred dollars to a hundred and forty-five dollars for a "full hand," and half or two-thirds that for youths and women.



COTTON-PACKET.

The freedmen are coming to take a proprietary interest in the labor, rather than to work as hirelings; which tends to greater economy, thrift, and energy. One in twenty of the freedmen are cultivating lands of their own, and in Florida the proportion is one in twelve.

Effect of cotton-culture upon other industries and movements.

Like every other great industry of the country, cotton-culture has given character and development to cities, railroads, and shipping-interests. Just as Chicago and Buffalo are built up out of the grain-business, Cincinnati out of pork-production, and Pittsburg out of iron; so cotton has done much to create Charleston, Savannah, Mobile, New Orleans, Galveston, Vicksburg, and Memphis. Railroads from the interior of the cotton States to their centres of export have been built more for this class of freight than for passenger-traffic, and it is the cotton-interest that so earnestly seconds the schemes of Northern capitalists for a Texas Pacific Railroad. Except river-boats, the South has never owned much shipping; but the heavy export-trade of cotton necessarily has given great expansion to American and foreign ship-building and navigation. So wide-spread and huge is the production, that no cotton-rings, like the coal, oil, and grain cliques, have ever existed to control the markets. But the political influence of the cotton-growers has been the most powerful that has ever been wielded by any one interest in this country; though now, the necessity for its assertion having gone by, it is no longer noticeable.

CHAPTER IV.

WHEAT.

THE culture of wheat is among the very earliest products in American agriculture, and is now, in point of aggregate cash value, one of the three most valuable. Moreover, it is a prime necessity of existence. Food to maintain life, and clothing, and houses to shelter us, are, of course, the very essentials of living. Bread is indeed the staff of life; and though, previous to its invention by the Greeks several centuries before Christ, other articles of diet formed the staple of human food, yet wheat bread is now characteristic of civilization. No people on the face of the globe have fully emerged from barbarism who do not live principally upon wheat.

Importance of wheat.

Indeed, the cultivation of that grain has had more than any other one thing to do with raising man from a nomadic and unintellectual life, as will be apparent to almost any one upon reflection. Crèvecœur, the old French traveller, illustrates this point by attributing this utterance to one of the aboriginal chiefs in this country, in a speech to his own people: "Do you not see the whites living upon seeds, while we eat flesh? that flesh requires more than thirty moons to grow up, and is then often scarce? that each of the wonderful seeds they sow in the earth returns them a hundred-fold? The flesh on which we subsist has four legs to escape from us, while we have but two to pursue and capture it. The grain remains where the white men plant it, and grows. With them winter is a period of rest, while with us it is a time of laborious hunting. For these reasons they have so many more children than we, and live longer than we do. I say, therefore, unto every one that will hear me, that before the cedar of our village shall have died down with age, and the maple-trees of the valley have ceased to give us sugar, the race of the little corn (wheat) sowers will have exterminated the race of flesh-eaters, provided their huntsmen do not become sowers."

Effect of wheat-raising upon nomadic life.

The thought might be traced still further; but it is not within our province to do so.

The earliest origin of wheat is unknown. It is generally conceded, that, unlike our fruits and domestic animals, it was not developed from a wild, inferior growth by human culture.[1] It is claimed, moreover, that it has been found growing wild in uninhabited regions of Persia, Mesopotamia, and Texas. Egypt was one of the greatest wheat-producing countries of ancient times: thither Jacob's sons went for it in the days of a famine in Canaan thirty-six centuries ago. Identically the same grain of that age, extracted from the cerements of mummies that were entombed in Joseph's time, has lately been planted; and the product is a grain substantially the same as our modern wheat, only a trifle larger and better. Thus it will be seen, that, from the earliest historical period, this grain has remained substantially unchanged; and, though upwards of three hundred varieties are said to exist, these may practically be narrowed down to three, — the hard wheat of Southern Russia, Italy, Sicily, Egypt, the Barbary States, Chili, Peru, and other warm countries; the so-called Polish wheat; and the soft wheat of Northern Russia, France, England, and North America. The hard wheats, it may be remarked, possess rather more of gluten than the other varieties; while the soft wheats abound rather in starch.

Origin of wheat.

The Egyptians were not only among the most famous of ancient agriculturists, but they also devised a method of preserving grain which has never yet been excelled; namely, placing it in stone depositories hermetically sealed. Many eminent historians have taken the mammoth Pyramids of that land for granaries; but, besides these, they are known to have had other huge receptacles in which they stored grain for years at a time.

Cultivation of wheat in Egypt.

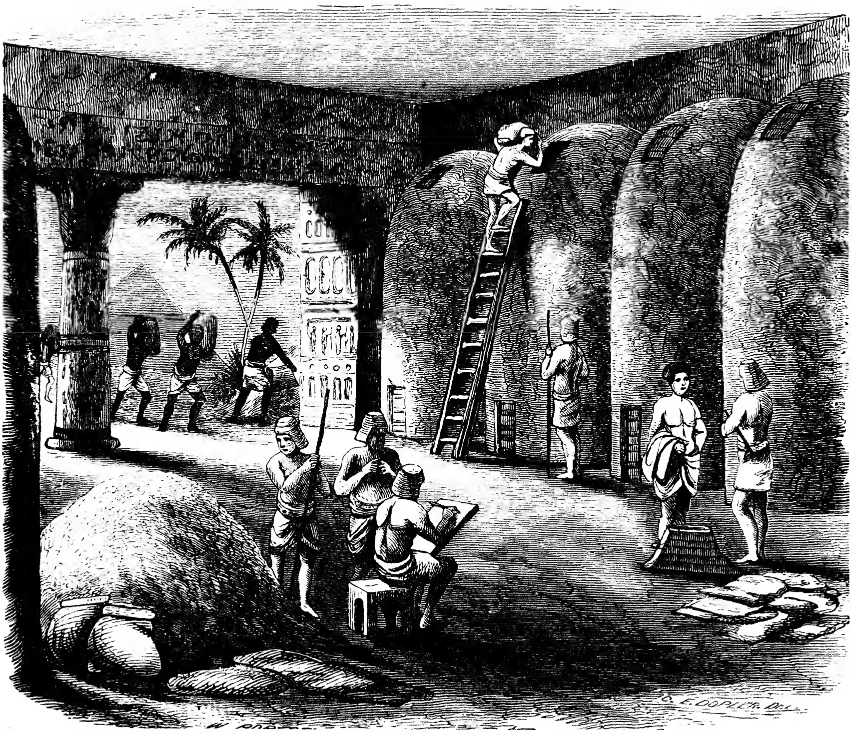
The Israelites were educated in the arts of husbandry during their bondage to the Pharaohs, and practised them extensively in later days; and the Bible contains many beautiful references to the wheatfields of Palestine.

Without dwelling further upon the ancient history of this precious grain, we proceed to consider its introduction to and culture in our own country. Cereal grasses were found under cultivation in Mexico by Cortez in 1530; but European wheat was introduced there by accident; one of the Spaniards finding a few grains mixed with his rice, which he carefully sorted out, and planted. Thus, in time, the newly-brought grain was scattered about the Spanish-American colonies, and finally spread into territory now belonging to the United States. Wheat was necessarily sown by the earliest English colonists of this country almost immediately upon their arrival: indeed, Gosnold is said to have planted it on the Elizabeth Islands, off Massachusetts, as early as 1602. For a time, Virginia gave much attention to its cultivation; and in 1648 several hundred acres in

Early cultivation of wheat in America.

[1] In The Year-Book of Agriculture for 1856 the editor mentions some curious facts which had recently been laid before the French Academy, relative to the transformation of two grasses, — *Ægilops ovata* and *Ægilops triartistrata*. A gardener named Esprit Fabre of Adge, France, by seven years experimenting found he could develop from these two grasses all or the greater number of our species of wheat. A savage plant, under cultivation, was thus made to change its entire aspect and figure, and gradually assume a new character.

that colony were sown with wheat. But the more profitable tobacco-crop soon supplanted it; and for nearly a century scarcely any was raised, even though the colonial authorities offered a premium thereon. Since the Revolution, however, this branch of agriculture has revived; and Virginia raises a good wheat-crop. In New England, wheat was grown rather assiduously until about 1662, when, for four successive years, the blast and mildew damaged the crop to such an extent as to greatly discourage those who raised it; and so the colonists fell back again on corn and potatoes, to which they have given



EGYPTIAN GRANARY.

great attention, even down to the present time. Colonial subsidies to wheat-growers in those days stimulated them but very little, the failure of their crops more than offsetting such encouragement. Wheat was grown in New England somewhat more generally in the early part of the present century; but the wearing-out of the soil, and other causes, led to its neglect. Vigorous efforts have been made to revive the industry, but without success. During the last century considerable wheat was grown in the Hudson and Mohawk River valleys of New York, and in New Jersey and Pennsylvania. In 1750 New Jersey produced more wheat than any other of our colonies;

and, long before that date, wheat and wheat-flour were exported from New York and Philadelphia. After the Revolution, Western New York gradually came to be settled; and it is now a particularly productive region, although the impoverishing of the soil makes a slight decline in the culture of the wheat there.

Writing nearly twenty years ago, when the enormous development of wheat-culture in the Western States had not been attained, Klippart said, "The States south of North Carolina, or, say, latitude thirty-three degrees, never have been and never will be wheat-growing States. Kentucky, Tennessee, and Missouri are best adapted to corn; and wheat can never be regarded as the great staple of either. Cotton is the great staple of Tennessee; hemp and tobacco, of Kentucky and Missouri. Kentucky, and Missouri too, are unsurpassed as grazing-sections and for raising stock; and there is no reason to suppose that they will change the agriculture best suited to their conditions for wheat-culture."

Klippart's opinion upon growing wheat.

The census of 1860 and of 1870 verify these predictions wonderfully; although the wheat-map given in connection with the last national census shows an area where some wheat is cultivated in North-western South Carolina, and Northern Georgia and Alabama.

Klippart's opinion verified by census.

Klippart furthermore says, in the same connection, "It is a melancholy truth, and one that reflects much on the skill and foresight of American farmers, that, while the wheat-crop of England has increased[1] at least fifty per cent in the last century, that of the United States has fallen off in nearly the same proportion. A century ago, New England, Delaware,[2] and Virginia raised an ordinary crop: now a wheatfield is a rarity in those States, and they may be regarded as no longer wheat-producing regions. Portions of New York that formerly produced thirty bushels to the acre now seldom average over eight bushels; and Ohio, new as she is (in 1860), with her virgin soil, does not yield thirteen bushels to the acre. If we go on as we have for the past century, from bad to worse, in our tillage, the lands in Ohio, in half a century from this time, will not produce wheat enough to supply our own wants. It is less than that time since Vermont was a great wheat-exporting State: now she does not export a bushel, but imports at least two-thirds of all the flour consumed in that State. Instead of increasing the productiveness of our wheat-land, as is done in England, our wheat-region is diminished more than one-half, and the productive quality of what is still used has diminished in equal proportion."

Change of wheat-producing region.

Consequence of change continues.

[1] The writer evidently does not mean increase in the aggregate yield, but increase in proportion to acreage and population. Perhaps he uses some such basis of calculation as that employed by the commissioner of the United-States census for 1870 in his crop maps. By him the number of bushels, tons, or pounds, produced in each county, is divided separately, first by the number of inhabitants, and then by the number of acres of improved land: the two quotients thus obtained are multiplied together, and the square root taken of the result.

[2] This is less true to-day of Delaware than the other sections named. It certainly is not true of Maryland and Pennsylvania.

Whether or not these lugubrious predictions will ultimately prove true, it is impossible to say. In the concluding paragraph of this chapter we show why they are not to be received with the utmost confidence. But this much is certain: within the past thirty years the star of empire in wheat-production has moved rapidly westward: and the country has rapidly increased its wheat-production, even out of proportion to the increase of population. Thus in 1850 Pennsylvania was the largest wheat-producing State in the Union, Ohio second, New York third, and Virginia fourth. For the next decade, Ohio held the lead.[1] In 1860 Illinois was first, Indiana second, Wisconsin third, Ohio fourth, Virginia fifth, Pennsylvania sixth, and New York seventh, with Iowa and Michigan a close eighth and ninth. In 1870 Pennsylvania had sunk to the seventh rank, with Virginia and New York still lower; and to-day they rate still farther down the list. In 1850 Maryland produced as much as either Michigan or Wisconsin: now each of those States yields from four to six times as much as then, while Maryland's production has scarcely changed.

Wheat-culture moving westward.

The United-States commissioner of agriculture brings out this Western movement forcibly in his report for 1876. He says, "Not only is the volume of wheat to-day more than threefold greater than twenty-eight years ago, but the *increase* of that portion of it grown west of the Mississippi River is greater than the entire crop of 1849. Five per cent only was then produced west of the Mississippi River; and in 1876, a year of comparative failure in the North-West, it was forty per cent. Dividing the country into three sections, — the first including the Atlantic-coast States, with Pennsylvania, and the Virginias to the Ohio River, and the second and third separated by the Mississippi River, — we find more than half the wheat grown in the first in 1849, the percentages in each section changing rapidly, as follows: —

Wheat grown west of the Mississippi River.

SECTION.	1849.	1859.	1869.	1876.
Atlantic Coast	51.4	30.7	20	19.6
Central Belt	43.3	54.6	49	40.8
Trans-Mississippi Belt	5.3	14.7	31	39.6

"The first section has now a little more than one-third of its former proportion; even the second, which was swept with so heavy a wave of immigration in the first decennial period, exhibits a declining percentage; while the third has eight times its former prominence, even in a year of low production of spring wheat, and promises to make the proportion nine to one in 1877. A few years more will find a preponderating

Proportions between the sections.

[1] Pennsylvania was returned as yielding 15,367,691 bushels of wheat in the census of 1850, and Ohio as only 16,487,351. This was really the crop of 1849. Ohio produced 28,769,139 bushels of wheat in 1850, — a tremendous leap to the front.

weight of wheat-production beyond the 'Father of Waters.' Comparing relative quantities, rather than proportions of the crop, we find that the Atlantic coast has held its own and little more: the central belt produces three times as much; the trans-Mississippi belt, more than twenty times as much. The figures are as follows: —

SECTION.	1849.	1859.	1869.	1876.
Atlantic Coast	51,657,020	53,294,137	57,476,371	56,489,500
Central Belt	43,522,646	94,458,609	140,877,070	118,122,000
Trans-Mississippi Belt . .	5,306,278	25,352,178	89,392,185	114,745,000
Total	100,485,944	173,104,924	287,745,626	289,356,500"

If the exact distribution of the crop of 1877, amounting to three hundred and sixty millions of bushels, could be given, we imagine the change would appear even more marked than in these figures of the commissioner.

Crop of 1877.

The population of this country, for the years 1850, 1860, 1870, and 1877, was in the almost exact ratio, respectively, of three, four, five, and six;[1] but the aggregate wheat-production of those years was in the ratio of four, seven, eleven and a half, and fourteen and a half.[2] As the increase from 1840 to 1850 was only fifteen per cent, — scarcely equal to the increase in population, — it is easy to see when the new impulse began to be felt.

Ratio of production to population.

We now come to consider some of the causes of the marked development of this department of American agriculture. The first of them was the rapid occupation[3] of the prairie-land in the Ohio and Upper-Mississippi Valleys by emigrants from the Eastern States, and from Germany, Scandinavia, and other countries of Europe, toward the middle of this century. Another was the remarkable adaptability of the soil and climate of that section to wheat-growing.[4] Still another was the famine in Ireland in 1847, which made an unusual foreign demand for American cereals. Still another was the development of the railroad[5] system in

Causes of development of wheat-culture.

[1] The exact figures are, 23,191,876, 31,443,321, 38,558,371, and about 45,000,000.

[2] The figures are, 100,485,941 bushels, 173,104,924, 287,745,626, and about 360,000,000.

[3] While emigration promoted wheat-culture and exportation, the wheat-interest, in turn, built up cities. For twenty years Chicago has been the greatest grain-dépôt of the world. Buffalo was likewise built up by the grain-trade.

[4] James Caird, an Englishman, having travelled through Illinois in 1858, remarked upon the fertility of its soil in his writings. He attributed it largely to the luxurious growth of grass on the prairies, which, being burned by the Indians or whites, year after year for centuries, deposited a great wealth of ashes. He took several samples of the soil to Prof. Voelcker, consulting chemist of the Royal Agricultural Society of England, who said, "I have never before analyzed soils which contained so much nitrogen; nor do I find any soils richer in nitrogen than these."

[5] The railroad companies, by advertisement and by selling lands at low figures, did much to promote emigration.

those States, and the construction of the Erie Canal, which opened up ample facilities for transportation eastward. But more than any of these other influences, perhaps, the improvement of agricultural implements (by Yankee ingenuity) gave impetus to wheat-culture. Elsewhere we have considered this matter; and of the improvement in the plough early in this century, and of the invention of the threshing-machine in place of the poetic but feebly-efficient old flail, we need not here remark. But what Mr. Charles L. Flint says of the reaper bears immediately upon the subject. He remarks, —

"The sickle, which was in almost universal use until a very recent date, is undoubtedly one of the most ancient of all our farming-implements.

WHEAT.

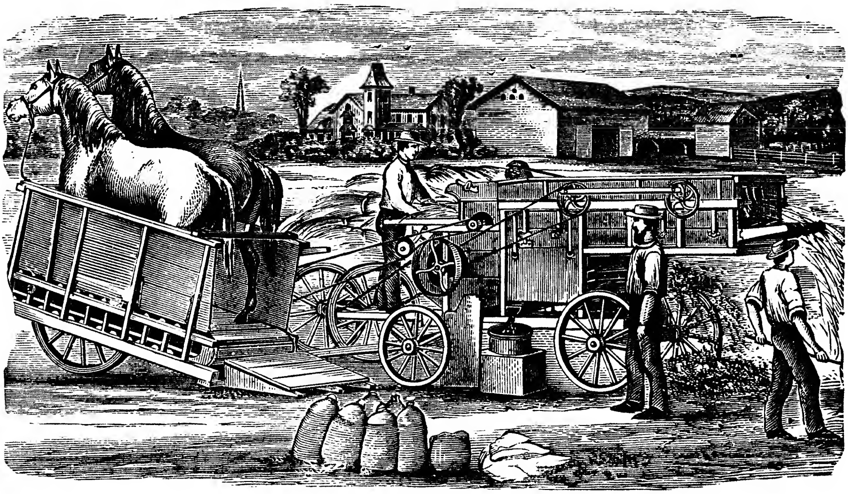
Quotation from Flint.

Reaping by the use of it was always slow and laborious: while, from the fact that many of our grains would ripen at the same time, there was a liability to loss before they could be gathered; and practically there was a much greater loss from this cause than there is at the present time. It is not, therefore, too much to say, that the successful introduction of the reaper into the grainfields of this country has added millions of dollars to the value of our annual harvests, by enabling us to secure the whole product, and to enlarge the area of our wheatfields, with a certainty of being able to gather the crop. Nothing was more surprising to the mercantile community of Europe than the fact that we could continue to export such vast quantities of wheat and other breadstuffs through the midst of the late Rebellion, with a million or two of able-bodied men in arms. . . . The number of two-horse reapers in operation throughout the country in the harvest of 1861 performed an amount of work equal to about a million of men."

Probably the number of these machines used in the summer of 1877 was more than three hundred thousand, — equivalent to at least five millions of men.

Exportation of wheat and wheat-flour.

The exportation of wheat and wheat-flour from this country was a large business prior to the Revolutionary war and for twenty-five years subsequently. In 1791 we sent abroad 619,681 barrels of flour and 1,018,339 bushels of wheat: this was equivalent to a trifle over 4,000,000 bushels. What proportion of our total product this was, we cannot say. The quantity has steadily increased in a larger proportion than the yield, just as the yield has increased in larger proportion than the population. For the five years ending 1845, the average exportation was but 7,000,000 bushels, including flour. This was a comparatively slow increase. From that point it was more rapid, partly owing to the start given by the Irish famine. For the next five years, the average was over 14,000,000; and, as the crop of 1849 [1] was 100,485,941 bushels, it will be seen that our exports amounted to about one-seventh of the yield. The Crimean war, by reducing Russia's production, stimulated our export of wheat. During our own civil war, the Southern market being cut off and our supply steadily increasing, we exported abnormally, the proportion to the whole crop being something like



THRESHING WHEAT.

one-fifth. Our average crop for the years 1870–74 was 261,015,920 bushels; and the average exportation 61,579,517, or nearly one-fourth. The export of that year was slightly abnormal, owing to the failure of foreign crops. In 1874 it aggregated 91,510,408 bushels; but in 1875 it was only 72,802,605. The crop of 1877 was, in round numbers, 360,000,000 bushels; and the estimated exports very nearly a third thereof.[2]

In his report for 1868, the United-States commissioner of agriculture says,

[1] Census of 1850.

[2] The commissioner of agriculture, in his report for 1876, says, that, in our exports of wheat and flour, the tendency is to send less flour, and more grain. Fifty years ago, flour constituted nearly the whole of our wheat export; but in 1876 it was but little over one-fourth of the whole, either in value or quantity. A special reason for this is found in the necessity for giving every possible scope to industrial production in Europe. The increasing cost of grain-production in Europe, on the one hand, and the improvement in transatlantic transportation, on the other, gave to the milling interest, especially in England and France, a margin of profit in grinding American grain, which secured to that interest an enormous development.

"The policy of growing grain for exportation, except as a pioneer expedient in opening and improving farms, is not to be commended. No material portion of our exports can ever be made up of breadstuffs, nor is it desirable that this should be." But since then our production and exportation of cereals have rapidly increased; while the exportation of cotton, with which he made comparison, has decidedly decreased. Our exports of cotton in 1868 were worth $152,820,733; of wheat and flour, $51,135,430; and of all breadstuffs, $79,046,187. In 1875 our cotton exports amounted to only about $175,000,000; while wheat and wheat-flour amounted to $83,317,-937; corn, to $25,747,470 more; and these, with other breadstuffs, to about $125,000,000. Cotton increased only about one-sixth, and cereals about one-half, in the interval. When we consider that Russia and the United States furnish those countries of the world which cannot raise wheat enough for themselves with three-quarters or more of the surplus in the producing countries; that the United States now export nearly twice what Russia does; that, notwithstanding Russia's recent introduction of improved agricultural implements, we are likely to maintain the same ascendency over her as regards production, — we see that our wheat-exportation promises to continue a leading industry for many years to come. This will further appear on the consideration of two or three other promising features of the history of wheat-culture in America.

Ascendency over other countries.

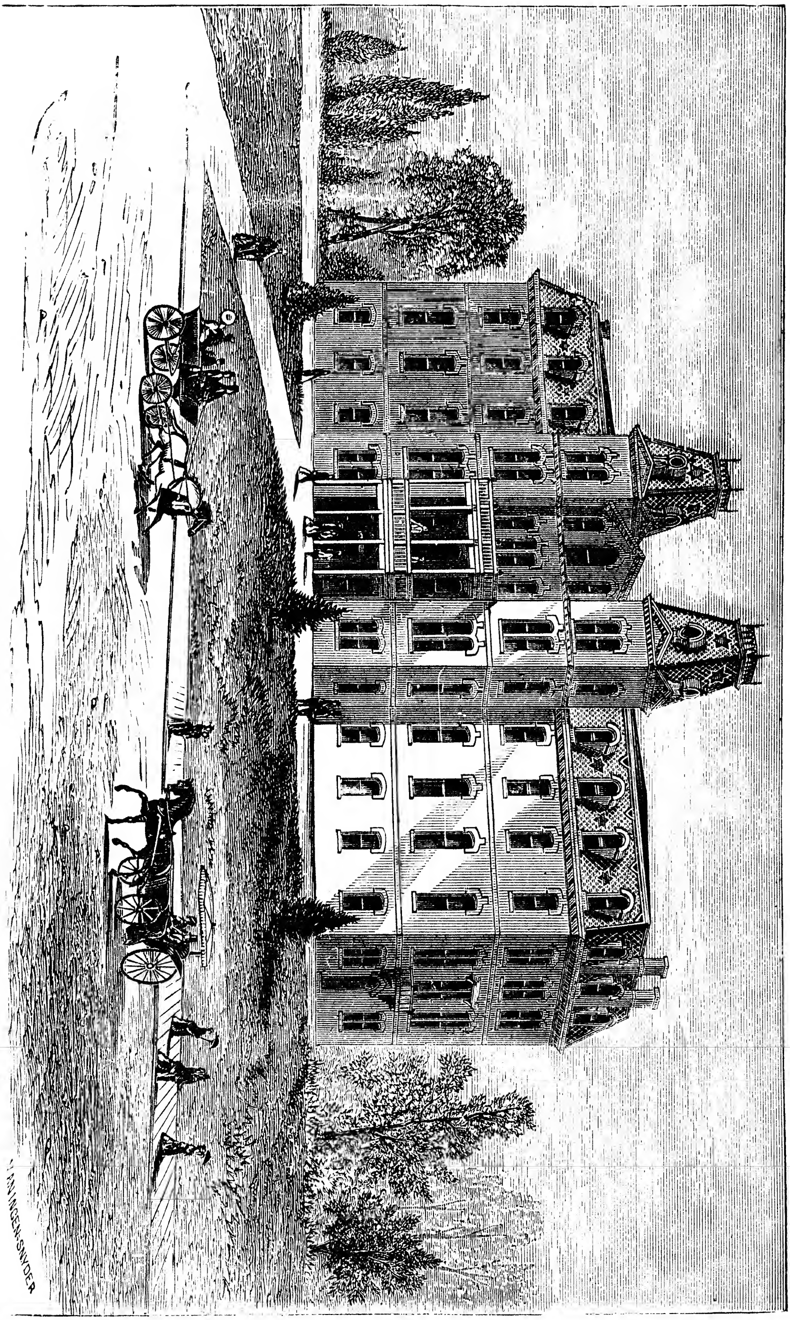
Although the wheat-crop is susceptible to many hurtful influences, — such as rust, blast, smut, the wheat-fly, weevil, chinch-bug, grasshopper, winter-killing from exposure to frost, and the blowing and lodging from heavy gales, — yet these influences have thus far proved local, and have scarcely affected the total production of the country at any time. The New-England blights of 1662–65, though discouraging, were limited. The grasshopper depredations of 1875 and 1876, in Minnesota, Nebraska, Iowa, Kansas, Missouri, Illinois, and Wisconsin, were very serious in their effects upon the farmers temporarily; and yet the effect on the total yield of the country, or the price of flour in the East, inasmuch as we had some of 1874's wheat left on hand, was to lessen but slightly our exportation. In 1877 the pest had nearly disappeared; and, by planting an extra area, we more[1] than made up the loss.

Injurious insects, grasshoppers, &c.

The wars of independence and of 1812–14 temporarily impaired our product and exportation; but the war with Mexico in 1847–48, and the late civil war, did not interfere perceptibly. Great Britain is now so dependent upon us for bread, that she can scarcely go to war with us again under any circumstances: so we are safe in that regard.

Effect of wars upon production of wheat.

[1] The crop of 1875 was not more than two per cent below the average, and that of 1876 not more than three per cent, — about eleven million bushels short. The crop of 1877 was twenty per cent above the average, and fifty million bushels more than any previous yield.



AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

Within ten or fifteen years the centre of wheat-production has moved west of the Mississippi River. Ohio, Indiana, Illinois, Wisconsin, and Michigan keep steadily increasing their yields; while Minnesota, Iowa, Nebraska, and Kansas have each a still greater development yet in store. Then, too, California is looming up tremendously as a wheat-growing State. In 1850 she raised but 17,325 bushels; ten years later, 5,928,470; twenty years later, 16,676,702; and now, upwards of 30,000,000. If not so already, she will soon be the largest producer of wheat in the Union, with a huge latent capacity for further development. Outside of the States here named, there is comparatively little new territory which we can devote to the culture of this grain; yet here is still magnificent promise, and one which even Russia cannot equal.

Future production of wheat.

We have already alluded to Klippart's gloomy prophecies as to the failure of our wheat-production through impoverishment of the soil. The experience of the Atlantic States, however, where the chemical elements of the soil are different from those of the prairie-lands and from those of California, offers no sure analogy. It must be admitted that Ohio, which in 1859 yielded over thirteen bushels to the acre, now produces but nine bushels and a half; yet, within a few pages of these same dark auguries, Klippart points out the ability of American husbandmen to restore the fertility of the soil by artificial manures, as the Englishmen do, and quotes Mr. Caird's allusions to the wheatfields of Lombardy, which have steadily yielded crops for two thousand years. In view of all these facts, we fail to see why America is likely to be worse off than her principal rival, Russia.

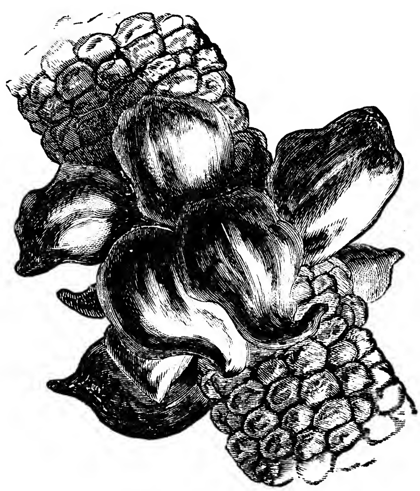
Restoring exhausted soils.

CHAPTER V.

CORN.

INDIAN-CORN, or maize, is the crop which this country produces in the largest quantity and value, and which has the widest acreage, while it ranks next to wheat among our agricultural exports. Thus in 1875 we raised 292,136,000 bushels of wheat, and 1,321,069,000 of corn. In 1877 the corn-product was the same nearly, while wheat had increased to 360,000,000 bushels. In 1875 the value of our corn-crop was $555,445,930 ; of wheat, $294,580,990 ; of hay, $342,203,445 ; and of cotton, $272,936,400. That same year we had 10,803,030 acres yielding cotton, 23,507,964 yielding hay, 26,381,512 yielding wheat, and 44,841,371 yielding corn. Such is the story which the figures tell by comparing them. Though used almost exclusively among the cereals by the mass of the Southern people as an article of diet, it is not so exclusively an article of human food in the United States as wheat. It is fed to horses largely, and to cattle, sheep, and poultry, but to swine more than to any other animal, the pork of this country being largely fattened on this grain. The stalks of this grain, too, make more nutritious fodder for live-stock than the straw of any other. There is also a perceptible consumption of corn by distillers of whiskey; and at times it has been so plentiful in some of the Western States, that it has been used for fuel. It was much cheaper, its heat considered, in many localities, in 1871, than coal at nine dollars a ton; and it was thus consumed in large quantities, although fires made of it required close attention.

Importance of corn-crop.



CORN-SMUT.

Regarding the origin of this particular grain, there has been much controversy. It has been claimed as a purely American product, all other countries getting it from the New World. While, however, there can be no doubt that it was indigenous to America, it cannot be established that it first made its appearance in this country. In 1204 the Marquis of Montferrat and his companions brought back from the Orient to Italy a grain known as "melica," or "melaga," — a name which was afterwards used interchangeably with that of the real maize, and led to the supposition that this kind of corn came first from Asia. The name "Turkish corn," which it long bore in Europe, gave rise to a supposition that it came from Turkey's Asiatic possessions. Neither of these theories has been demonstrated, however. Better evidence of the fact that the Old World had this same grain under cultivation before Columbus discovered America is found in the fact that the Chinese historian, Li-chi-tchin, speaks of a plant exactly corresponding to it in his country toward the middle of the sixteenth century. The proverbial slowness of that people in introducing new ideas and institutions, the shortness of the interval, and the inference from his remarks that the crop was long established, incline one to believe that they really had our Indian-corn in China more than four centuries ago. Indeed, Oriental travellers incline to believe that it has been cultivated in the islands of the Indian Archipelago from the earliest ages. A fact of still more decisive character is the discovery of maize in the cerements of a mummy exhumed at Thebes, Egypt, under circumstances leading to a belief that it was two or three thousand years old.

Origin of corn.

Nevertheless, it is known that it was cultivated on this continent a great many centuries ago. Longfellow embodies in his "Hiawatha" a well-known legend of the Ojibways as to the gift of maize to the red man by the Great Spirit. The Aztec nations of Mexico and Central America, who attained a high civilization, have a tradition that the Toltecs introduced the culture of maize into this country in the seventh century; but there is reason to believe that it was already common with the natives at that time, and that the Toltecs merely improved the methods of cultivation. The Mexicans had a deity corresponding to the Ceres of the Romans, who was supposed to watch over this crop, and whom they worshipped accordingly. The grain was raised plenteously from Southern Chili to the southern part of Pennsylvania when Europeans first visited America. Parched corn was the great vegetable staple of Indian diet.

Earliest cultivation of corn in America.

Corn requires less cultivation than almost any other food-crop in this country, although it is affected more by the condition of the season than some others. It prefers dry, loamy soils, and rich bottom-lands, to wet, hard clays. Though there are many varieties (some growing to the height of fifteen or sixteen feet, and others scarcely above one's knee; and some being better adapted to one section than another, there being variation.

Mode of cultivation.

also, in the shape, size, and color of the kernel), there are practically but two kinds, — the white and yellow, — each being divided into the hard and soft; and one or another is cultivated in almost every part of the United States where agriculture is practised at all. From these various causes, the first emigrants to this country raised it extensively, relying upon it as the principal article of food, and using it, also, for barter and export. Later, the crop was combined with potatoes or pumpkins, or both, on small tracts of land; and the three flourished together more prosperously than any one of them would with any other common agricultural product. Thus we find that corn-culture followed the whites into all new territory which they occupied. New England raised but comparatively little; but, long before the Revolution, New Jersey, Pennsylvania, and Delaware were exporting corn extensively, Virginia even more so, and the two Carolinas and Georgia also, having a surplus to exchange with Europe for necessary imports. The aggregate export of the colonies in 1770 was 578,349 bushels, — an amount more than once equalled by Virginia alone, before the Revolution.

Effect of Revolutionary war upon corn-culture.

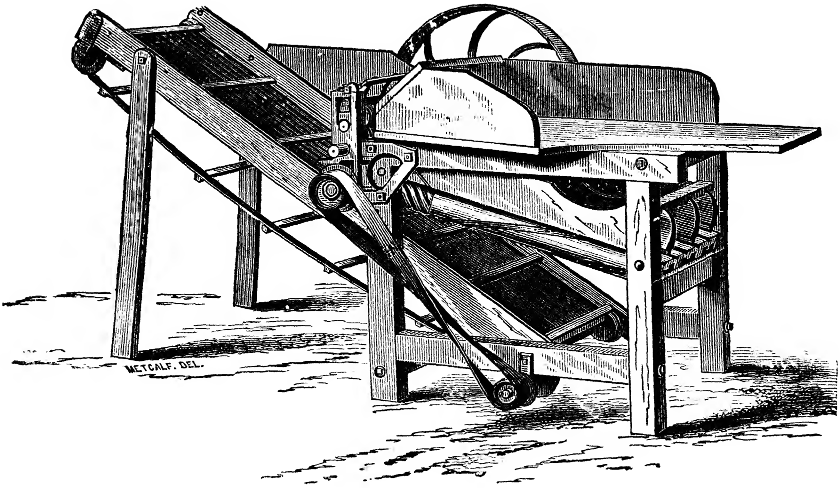
At the close of that war, for a time, agriculture in this country made little headway; and some special causes, like the sudden development of cotton-culture in the South, may have retarded the progress of other lines of agriculture. From these various causes, we find, that from 1791, when we exported corn and meal amounting to about 2,064,936 bushels of grain, there was a gradual decline for over twenty years in the export. In 1800 it amounted to 2,032,435 bushels, and in 1810 to only 140,996.

Increase during next twenty years.

In the next two decades, influences of a stimulating character began to operate on this industry, which were followed up by others during succeeding years; so that the corn-crop has for the past fifty years shown rapid increase. In 1825 the Erie Canal was opened, giving cheap transportation to Western crops. Railroads were built later, penetrating all the more productive sections of the West. Emigration rapidly increased. Farm-implements greatly improved, although these were not so essential to corn as to some other grains. The value of this cereal for fattening cattle, too, began to be realized; and its demand for this use was soon vigorous. From 1840 to 1850, the total yield increased from 377,531,875 bushels to 592,071,104, — a gain of fifty-seven per cent, while population was increasing but thirty-five per cent. The increase of wheat during this time was only fifteen per cent. By 1860 the figures had grown to 838,792,742, — an advance of but a trifle over forty-one per cent, — three-quarters of which gain was in the Northern States. During that decade the population increased thirty-five per cent as before, and wheat had increased nearly seventy-five per cent. In 1870 a falling-off was noticeable, the product being only 760,944,549 bushels. This, probably, was due to the corn-lands being converted, in some cases, to wheat-culture; which, however, is not,

Increase since.

in the long-run, quite so profitable. To continue the comparison: it may be remarked that the increase in population during that time was but a trifle over twenty-two per cent; but the wheat-yield rose over sixty per cent. In 1871 corn was unusually plenty in the West, and so cheap as to be used for fuel. In 1875 the product was 1,321,000,000, nearly 500,000,000 of which gain was effected within the last year of the five. This was a jump of nearly seventy-five per cent; while wheat was increasing but two or three per cent, and the population about eighteen.



CORN-HUSKER.

Large yield depresses the price.

It is noticeable, however, that a large crop of cereals or cotton so depresses the price, that the real gain is but slight; and a re-action usually ensues, which checks the production for a year or two. Thus, despite the increase in the corn-production from 1874 to 1875 above mentioned, the two crops were marketed respectively for $550,043,000 and $555,445,000. The yield of the two years subsequent, accordingly, fell off somewhat.

Export of corn.

The export of corn from this country to Europe is a very important item of our trade. Corn and corn-meal make up forty per cent of our cereal export. We have already remarked, that from 1791, when we sent abroad 2,064,936 bushels of corn, there was, for many years, a falling-off in the export of that commodity. For the whole five years ending 1845, the total export, including corn reduced to meal, was but 8,005,005 bushels, — an average of less than in 1791. But the Irish famine, during the next half-decade, made a tremendous demand; and during that interval the exports aggregated 53,796,953 bushels, or over 10,000,000 bushels a year. With the termination of that famine came a falling-off in our export; and these figures were not paralleled again until 1865–70, when we sent abroad 53,413,372 bushels. During the next five years we sent off 152,569,127 bushels, — an average of over 30,000,000 a year. In 1876[1] we sent 50,910,532 bushels, of which 1,416,960 was in the form of meal.[2]

Corn being cultivated in but small quantities in Europe, especially outside of France and Russia, the nations of that section of the globe are dependent chiefly upon the United States for their supply; and our shipments to Italy, Sweden, Denmark, Holland, Belgium, and France, are steadily increasing. As an article of human diet, it is inferior to wheat: nevertheless, it is finding constantly-increasing applications as such. As food for horses, its consumption in Continental cities is also rapidly augmenting, it having been discovered that the investing of money in corn is more economical than the purchase of oats. The enormous crop of 1875, and the consequent low prices, led Chicago parties to negotiate with British stock-raisers to purchase corn for fodder. From the low prices and freights then prevailing, it was estimated that this trade would prove profitable to both countries. But the movement partly defeated itself by calling out supplies of grain in excess of a normal demand, and, consequently, by cutting down prices in England below the calculated minimum. Some of the grain, from lack of care in shipment, was injured by heating in ocean transit, causing considerable losses. On the whole, however, it is estimated that the profits of this movement more than counterbalanced its losses. This was one of the causes that so greatly enlarged the export of corn during the fiscal year 1876.

Dependence of other countries upon United States.

In 1862 the commissioner of agriculture remarked that the export of corn was very undesirable, as it was worth more to this country to keep our supply at home, have low prices, and fatten our cattle more cheaply. As the possibilities of our product are comparatively unlimited, such solicitude does not seem to be fully warranted.

Opinion of commissioner of agriculture concerning export of corn.

It may be remarked, that corn exhausts our lands less rapidly than wheat; that it returns more handsome profits for increased care in cultivation than some other crops; and that careful experiments show that exhausted land may be renewed with artificial manures to such an extent as to pay immense dividends on the investment. These facts, and the steady increase of territory devoted to the production of this cereal, make the outlook for the future of the industry rather more certain and bright than that of wheat-culture.

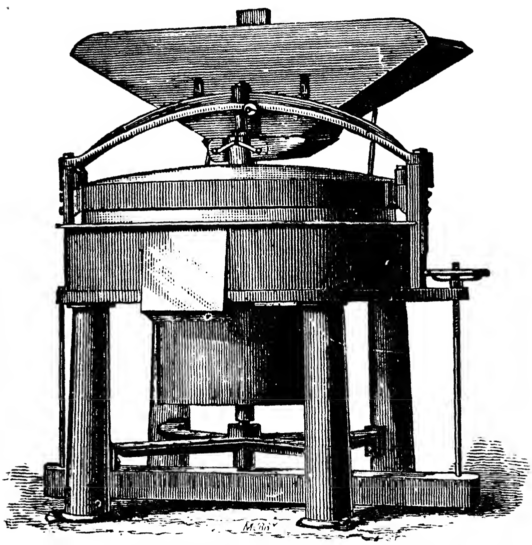
Corn a more exhaustive crop than wheat.

[1] These dates are of fiscal years, ending June 30. The export of 1876, therefore, is really based upon the crop of the calendar year 1875.

[2] As in the case of wheat, the tendency in our corn-export has been steadily to send less manufactured grain, and more unground. Thus, during the five years ending 1830, we sent abroad 3,530,710 bushels of corn unground, and 3,133,632 in the form of meal. In 1876 the corn sent abroad as meal was but two and three-fourths per cent of the whole quantity.

The distribution of corn-culture throughout the country is more even than that of any other crop. Sugar, cotton, tobacco, hay, and wheat are each more sectional than corn. However, it is more particularly confined to the Ohio and Mississippi Valleys. Illinois produces not only more than any other one State, but more than all the ten cotton States together, with Maryland and the two Virginias; while Ohio, Indiana, Illinois, Iowa, Missouri, and Kansas, together, produce two-thirds of the whole crop of the country. The culture of corn, however, is more evenly distributed than that of cotton, sugar, and tobacco in the Southern and Border States; and the policy of raising home-supplies of this cereal is coming to be more generally pursued there, that section having suffered more than once recently from insufficient food-supply. New England, engaged in manufacturing pursuits rather than in agriculture, does almost nothing in corn.

Corn more generally raised than wheat.



IMPROVED GRIST-MILL.

Production moving westward.

As in the case of wheat, so with maize, there is a westward migration of the centre of our production, as will be apparent from the following table of percentages: —

SECTION.	1849.	1859.	1869.	1875.
Atlantic-coast States	30	24	20	14
Central Belt	58	55	53	51
Trans-Mississippi Belt	12	21	27	35

The East has declined continuously and hopelessly; the centre has held a determined struggle, yielding only inch by inch; the West has trod the track of destiny with accelerated step.

As a result of the rapid growth and the geographical location of the great cornfields, there has been an immense growth of cities and railroads in that section of country between the Ohio and the Great Lakes, and just west of the Mississippi. On the rivers and lakes, especially the latter, shipping has grown immensely, to carry on the work of transportation. It would be difficult to say exactly how much of this material wealth of development is due to corn, and how much to wheat; but the division would give the former the larger share. Chicago is, of course, the great centre of the corn-interest; but many other lake and interior cities are the product of this industry. So completely dependent, too, on the grain-transportation business, are many of the Western railroads, that their stocks rise and fall on Wall Street with every fluctuation of the crops and the demands therefor. Indeed, to corn, more than to any other one agricultural product of this country, do we owe the expansion of our material prosperity.

Consequences of raising corn upon other industries and movements.

CHAPTER VI.

SUGAR AND MOLASSES.

SUGAR and molasses are among those agricultural products of the United States, which, in amount, fall far short of our necessities, rendering a heavy import (chiefly from the West Indies) requisite to supply the deficiency. The production is, moreover, limited in locality, as well as in quantity, being mostly confined to Louisiana. The cane thrives, and is the staple product, in all parts of the State south of the latitude of Baton Rouge, except in the pine uplands bordering on Texas. It must not be thought, however, that the whole of the region within these boundaries actually produces sugar. The area of cultivated land is comparatively small; swamps, lakes, rivers, and bayous occupying most of the surface of the country, and the territory available for planting being restricted to narrow strips along the water-courses. The shores of the Mississippi, for fifty miles above and below New Orleans, are lined with cane-fields, extending back for about a mile to the cypress-swamps. Along the Atchafalaya, and the La Fourche, Plaquemine, Teche, Boeuf, Courtableau, and other bayous west of the Mississippi, there is little besides sugar raised. The Teche, and the parishes bordering upon it, known under the general name of the Attakapas country, is the paradise of the sugar-planter. Perhaps the land is no better than that along the other bayous; but its conformation makes it easy of drainage, while the proximity of the Gulf gives it cool breezes in summer, and the natural beauties of the region make it the most attractive part of Louisiana. Longfellow's description in "Evangeline" fits it very well: —

Description of sugar-cane region.

> "Beautiful is the land, with its prairies, and forest of fruit-trees:
> Under the feet a garden of flowers; and the bluest of heavens
> Bending above, and resting its dome on the walls of the forest.
> They who dwell there have named it the Eden of Louisiana."

There are many little descriptive passages in the poem that are remarkably true to nature; and the wonder is that Longfellow could have got the local coloring so well without once visiting the region he pictures.

Long before the Revolutionary war the New-England colonies carried on a large commerce in sugar and molasses, which, with rum, they brought from the West Indies, and carried hence to Europe. There were refineries in various parts of Connecticut, and Massachusetts too, mostly for such sugar as was kept for home consumption. The enactment of laws by Parliament, restricting this carrying-trade to British vessels, as also the stamp-acts, which threatened to lay a tax on such sugar and molasses, seriously affected this industry.

Early commerce in sugar and molasses.

Accounts of Virginia and North Carolina, by the earliest settlers, speak of sugar-canes as indigenous to that section, but inaccurately. Sugar-canes do not appear to have been grown in any part of what is now the United States until 1751, when the Jesuits introduced them to Louisiana from San Domingo. The first sugar-mill in this section was erected by M. Dubreuil, whose plantation is now covered by the city of New Orleans. But little headway was made in the culture until 1794, when persecuted Frenchmen fled from San Domingo to Louisiana, and carried their business ideas with them. This State did not form a part of our Union, however, until 1803. In later years the culture extended into Texas to a slight extent. In 1805 an enterprising Georgia planter obtained and set out in his own State one hundred young sugar-canes. These were rapidly propagated; and the culture extended into Florida, Alabama, and elsewhere. It was soon found, though, that the soil of Louisiana was by far the most productive, and the industry never prospered very much elsewhere. In 1850 eleven-twelfths of the yield of cane sugar and molasses of this country was Louisiana's. The following table shows the distribution in 1870: —

Early cultivation in Louisiana.

Extension of culture.

STATES.	SUGAR, HOGSHEADS.	MOLASSES, GALLONS.
Louisiana	80,706	4,585,150
Texas	2,020	246,062
Tennessee	1,410	3,629
South Carolina	1,055	436,882
Florida	952	344,339
Georgia	644	553,192
Arkansas	92	72,008
Mississippi	49	152,164
Missouri	49	......
Alabama	31	166,009
North Carolina	35	33,888
Total	87,043	6,593,323

Sugar-interests gave rise to New Orleans.

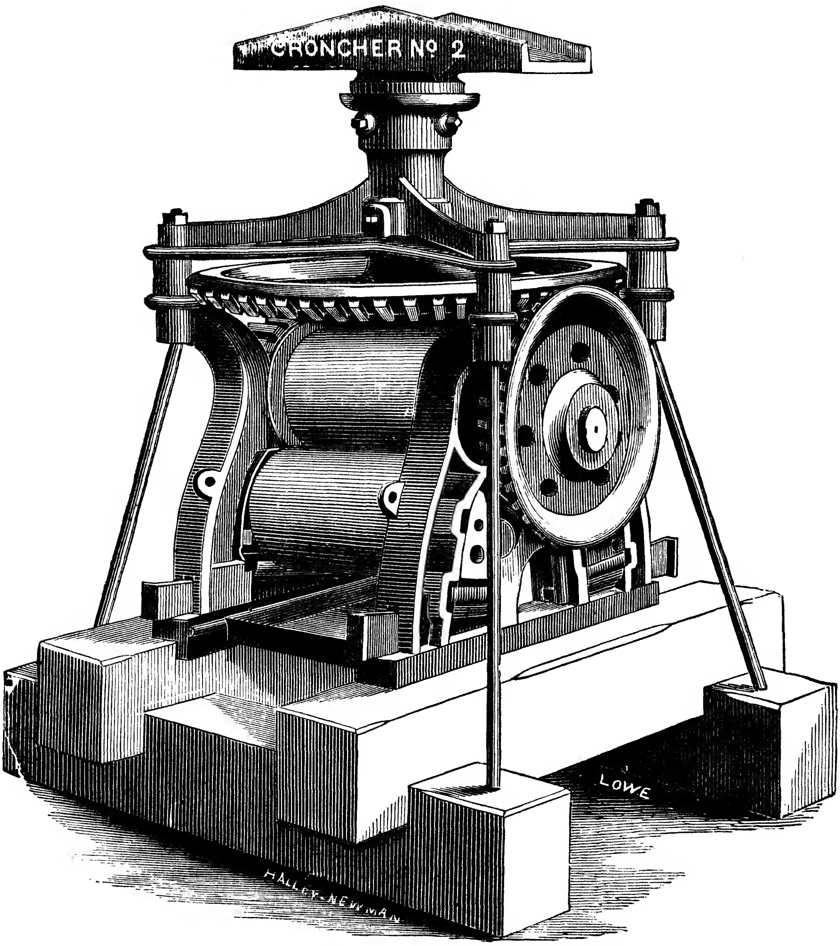
Just as the tobacco-industry built up Richmond, so the sugar-business built up New Orleans, although the cotton-interest had a share in the latter work. Very few statistics are obtainable, showing the product of cane sugar and molasses in other States; and statisticians treat that of Louisiana as about all there is in the country. Bearing this fact in mind, one can learn much of the history of the cane-sugar industry of this country, and realize how far it is from meeting our needs, by glancing at the following table, showing the total consumption in this country by tons, and what proportion thereof was imported, and how much was raised in Louisiana: —

YEARS.	IMPORTED.[1]	LOUISIANA.	TOTAL.[2]
1821	26,672	14,000	40,672
1831	44,178	35,000	79,178
1841	65,601	38,000	103,601
1842	69,474	39,200	108,674
1843	28,854	64,360	93,214
1844	83,801	44,400	128,201
1845	88,336	45,000	133,336
1846	44,974	83,028	128,002
1847	98,410	71,040	169,450
1848	104,214	107,000	211,214
1849	103,121	99,180	202,301
1850	160,210	144,600	304,810
1851	201,493	120,331	321,824
1852	196,558	118,659	315,217
1853	200,610	172,379	372,989
1854	150,854	234,444	385,298
1855	192,607	185,145	377,752
1856	255,292	123,468	378,760
1857	241,165	39,000	280,765
1858	244,758	143,734	388,492
1859	239,034	192,150	431,184
1860	296,950	118,331	415,181
1861	241,420	122,399	363,819
1862	241,411	191,000	432,411
1863	231,398	52,910	284,308
1864	192,660	28,000	220,660
1865	345,809	5,000	350,809
1866	383,178	8,500	391,698
1867	378,068	22,500	400,568
1868	446,533	23,000	469,533
1869	447,899	45,000	492,899
1870	483,892	46,800	530,692
1871	553,714	79,600	633,314
1872	567,573	69,800	637,373
1873	592,725	59,300	652,025
1874	661,869	48,500	710,369
1875	621,852	63,500	685,352
1876	561,369	77,000	638,369

[1] Omitting that which was exported again. [2] Omitting the trifle consumed on the Pacific coast.

Starting at nothing, our domestic production rapidly gained on our imports until 1843, when, spasmodically as it were, it suddenly overleaped and more than doubled them. In 1846, 1848, and 1854, our domestic product exceeded the imports, but not to so great an extent. Owing to the accumulation of a large stock in the country in 1856, the next year's home yield fell off amazingly. What abrupt and utter ruin was brought upon this industry by the war may be inferred from the fact, that, by

Increase of production.



SUGAR-MILL.

the year 1863, the cane-crop had dwindled down to 50,000 tons. In 1864 it fell to 30,000; and in 1865, the last year of the war, shrunk to the minimum of only 5,000 tons. The great trade that was thus shattered in three years, has, since the war, been slowly reviving; but still a long time will have to elapse before it again reaches the proportions to which it had attained in 1853. For the past three or four years, owing to labor-troubles and political causes which need not now be mentioned, the crop harvested in Louisiana was not so large as many supposed it would be: still, in spite of every drawback, it has increased 25,000 hogsheads each year, and during the season of 1876–77 amounted to 169,331 hogsheads, or a total of 190,672,570 pounds. It is confidently expected that the crop of the season of 1877–78 will amount to not less than 200,000 hogsheads.

Profits and prospects of this industry.

It is asserted[1] that the business of sugar-planting offers peculiar inducements to Northern people who want to find new homes in the South. The profits are immediate, and, with proper management, very large. A plantation near Franklin, with 1,100 acres in cane, received for its product of sugar and molasses $120,000; and the net profit, deducting all expenses, even to the cigars smoked by the planter and his friends, was $60,000 dollars. This is an exceptionally large plantation. About 300 acres under cultivation is an average one. The following is the condensed balance-sheet, for 1876, of a 300-acre place above Franklin: —

RECEIPTS.

400 hhds. sugar at eight cents per pound		$41,600
300 bbls. molasses at two dollars		600
Total		$42,200

EXPENSES.

Labor: twenty-five hands throughout year, and ten extra in sugar-making season	$12,000	
Rations: five pounds pork and a peck of meal a week to each hand	2,500	
Mule feed	1,500	
Hogsheads and barrels	2,500	
Purchase of mules, tools, repairs, &c.	3,000	
Commission on sale of crop	1,275	
		22,775
Profit		$19,425

The cost of a plantation like this, in good condition, with sugar-house and machinery in good repair, would range from $40,000 to $75,000. There is usually three or four times as much swamp as arable land sold with a plantation. But the swamp has a value; for it furnishes the wood required for fuel in the sugar-mill. A hogshead of sugar to the acre is a small yield, a hogshead and a half a fair yield, and two a large one. There are thirteen hundred pounds of sugar in a hogshead; and the price in New Orleans ranges from seven cents for an ordinary brown grade to ten and eleven cents for the white coffee-sugar made by vacuum pans and centrifugal machinery for sepa-

[1] New-York Tribune.

rating the molasses from the sugar. Field-hands are paid sixteen dollars a month and a ration, and have Saturday afternoons to themselves, and the use of a mule to cultivate patches of their own. The cane they raise on these patches is worked up by the planter, and they get half the product. An industrious negro will thus add a hundred dollars or more to his yearly earnings.

Thus far the land has usually been cultivated in large sections, two hundred acres being considered the minimum quantity that would sustain the expenses of a sugar-mill and of the colony of hands necessary to work both land and mill. The large planters are now encouraging the tenant-system, and a tendency to separate the business of sugar-making from cane-growing begins to show itself. On the smaller farms, where only a few hogsheads of sugar are produced, the owners are obliged to content themselves with crushing and boiling in the old-fashioned style; thus wasting much of the cane, and producing a very inferior brand of sugar. Indeed, it is stated, that, of the 1,050 sugar-houses in operation in Louisiana, upward of 250, or nearly one-fourth, still crush the cane by horse-power,— an exceedingly primitive and unsatisfactory process, by which it is impossible to extract any high percentage of juice from the cane. Great waste, and consequently great loss, is naturally the result of this practice.[1]

Large and small farms.

It is proposed to revolutionize the whole system of sugar manufacturing by abolishing all the old-fashioned and comparatively useless sugar houses and presses, and establishing in each district of the great cane-growing region an accessible and well-appointed mill of the most approved description, and containing all the latest machinery. To these mills all small farmers are to send their cane as soon as it is cut, disposing of it at a fair market-price, or having it ground into sugar, paying the mill-managers a small percentage for the work. It will be noticed that this system is similar in many respects to that which governs the manufacture of cheese in some of the great dairy districts of this State. There seems to be no reason why its establishment in Louisiana should not be the beginning of a new and more prosperous era in the history of the sugar-producing districts of the Pelican State. It ought certainly to result in the employment of large capital in the manufacture of the staple, and a great increase in the area cultivated.

New mode of making sugar.

The consumption of sugar in all parts of the world is constantly increasing, — increasing with amazing rapidity. In the United States alone, during the year 1876, the total consumption, including the product of the maple-tree and the sugar made from molasses, is estimated at not less than 745,000 tons. This is fully one hundred per cent more than the amount consumed in 1863, or than the average of the decade immediately preceding that year. From these figures it will readily be seen, that, even were every acre of the rich alluvial bluff and prairie lands of Louisiana devoted exclusively to the cultivation of sugar, there would still be no fear of over-production. Every pound that

[1] New-York Times, Sept. 11, 1877.

can be manufactured will find a ready market, and a quick sale at remunerative prices.

Most of the molasses produced in this country is in suitable condition for table-use when it leaves the Southern sugar-house. The condition of sugar usually is very different, as it is the raw brown muscovado which needs to be refined. There are refineries for this product, as well as for the raw sugars imported in many of the large cities of the country, which do an enormous business, and which have generally been very successful. The process of refining has been much improved within a few years; and the former method, which seemed to be any thing but a refining process, is rapidly going into disuse.

Refining.

What sugar is made from.

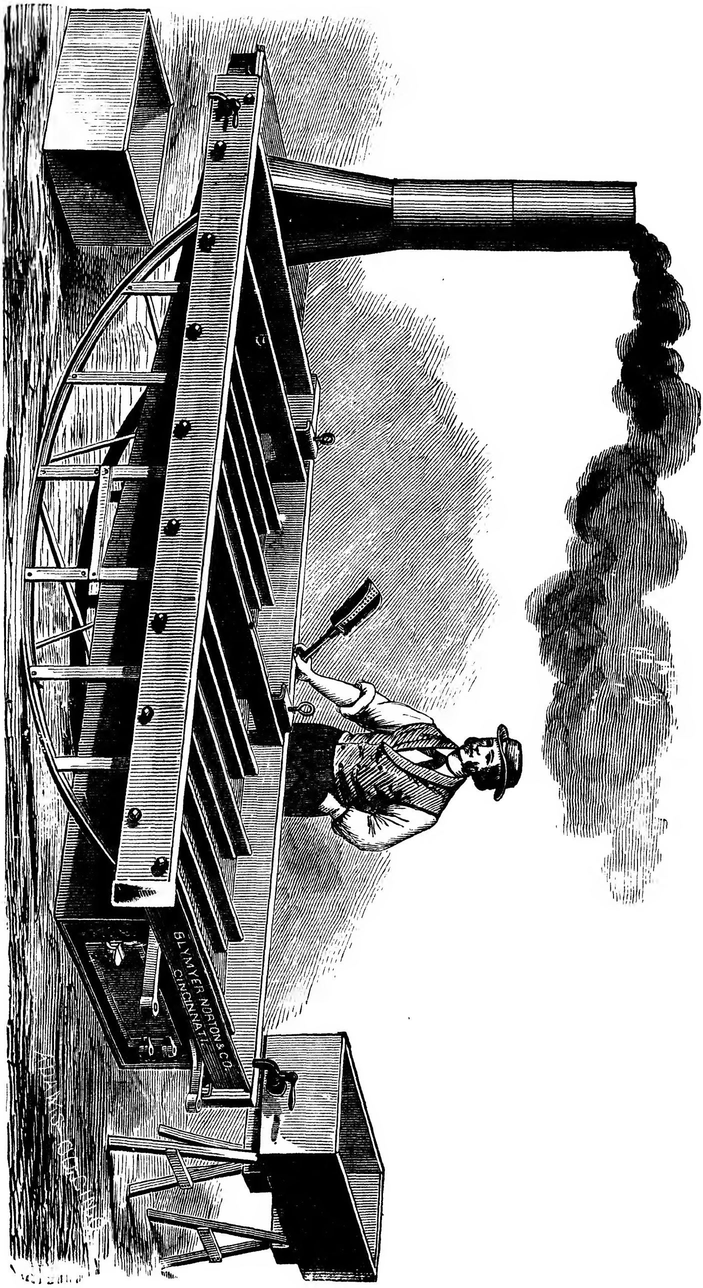
Sugar is made from three other plants besides the American or West-Indian cane; namely, the sugar-beet, the Chinese-cane or sorghum, and maple-sap.

Beet-sugar.

Forty per cent of the total sugar-product of the world is made from beets. Experiment was made in Germany, toward the latter part of the last century, by a chemist named Achard, who demonstrated that sugar could be made from beets. The first Napoleon did much to encourage this industry in France, especially in 1812, when the blockade of French ports precluded a foreign supply of cane-sugar. At one time $200,000 were placed in the hands of the minister of agriculture to encourage it. But, after Waterloo, beet-sugar production almost died out. In 1820 it revived again, and, with fluctuations, has since rapidly and extensively developed, until the product is immense. Experiments in this country began as early as 1838; David L. Child of Northampton, Mass., having produced 1,300 pounds of sugar that year. The next attempt was that of the Gennert brothers, Germans, at Chatsworth, Ill., in 1863, who bought 2,400 acres of land, and went into beet-culture for sugar very extensively. They had bad luck for several years. In 1870 they consolidated with a like establishment at Freeport, Ill., and produced that year 200,000 pounds of good sugar at moderate cost. Messrs. Bonesteel & Otto embarked in the business at Fond du Lac, Wis., in 1867; and another co-operative enterprise was started at Black Hawk, Wis., in 1870. Several ventures were made, too, in California, Mr. Wentworth of Alvarado securing the assistance of Bonesteel and Otto in 1870; and the next year they produced 1,000,000 pounds of sugar. Amherst Agricultural College, the Virginia University, and other institutions and individuals, have experimented.

Sorghum.

Sorghum, or the Chinese-cane, was introduced into this country by the Bureau of Agriculture in 1856. It can be cultivated in almost any part of the country; and, under the extensive notices given it by the commissioner's reports, it soon met with a wide acceptance. It yields a good sirup, and but little sugar. The census of 1860 showed the product of that year to be, —



SUGAR EVAPORATION.

	GALLONS.
Iowa	1,211,512
Indiana	881,049
Illinois	806,589
Missouri	796,111
Ohio	779,076
Tennessee	706,663
Other States	568,123
Total	6,749,123

Iowa was then the largest producer; but Ohio developed the industry more rapidly until 1866, since which year it has gradually declined there and in Indiana and Illinois. It extended up into Wisconsin too, somewhat, but rather more largely in Kansas, and all through the South, prominently in Georgia. It is estimated that we raise annually 12,000,000 gallons of sirup, which, at sixty-five cents a gallon, would come to $7,800,000; and 250,000 pounds of sugar, which, at six cents a pound, would make the annual yield worth over $7,815,000. When the value of the crop comes to be better understood, it is believed its culture will be vastly increased.

Production from sorghum.

The maple-sugar industry dates from the earliest colonial days, but has not been carried on extensively in any part of the country. It is mostly in the hands of individual farmers, and is chiefly confined to the Northern States, from Maine into Minnesota, though reaching into Kentucky. Statistics are imperfect and scarce; but the Department of Agriculture says, that, in 1811, Ohio produced 3,033,086 pounds, Kentucky 2,471,647, and Vermont but 1,200,000. Probably the total production throughout the country was something like 15,000,000 or 20,000,000, with sirup equivalent to as much more, a gallon of sirup counting for ten pounds of sugar. The census-returns for 1850, 1860, and 1870, show the following total product in pounds and gallons: —

Maple-sugar.

	1850.	1860.	1870.
Sugar	34,253,436	40,120,205	28,443,645
Sirup	106,782	1,597,589	921,436

In 1850 New York was the leading State, producing about thirty per cent of the whole. Vermont held the second place, with Ohio third, and Indiana fourth. In 1860 the order was, — New York, Vermont, Michigan, and Ohio. In 1870 Vermont had reached the first place, with New York second, Ohio third, Michigan fourth, and Indiana fifth. Several of the States have since improved on the figures of 1870; and it is likely that the total product now almost equals that of

Production of maple-sugar in the several States.

1860, and is worth something like $6,000,000. The utmost limit has already been reached, in all probability, however; though we are not likely to see a very marked decline for a number of years. Much of the maple sugar and sirup used in this country comes from Canada.

CHAPTER VII.

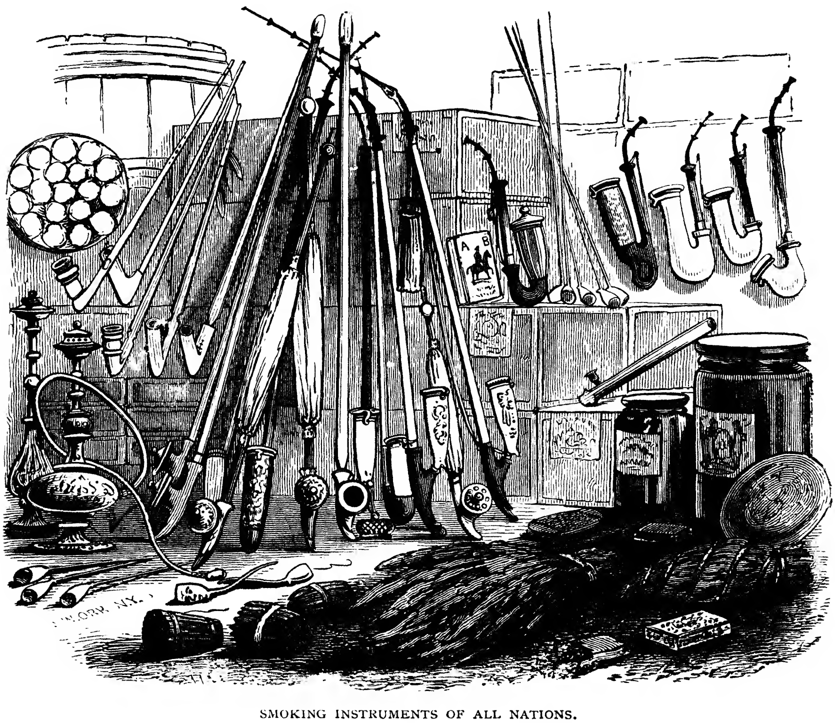
TOBACCO.

WHEN Columbus landed in Hispaniola, in 1492, he saw the natives breathing out smoke from their nostrils; and he was offered a roll of a fragrant narcotic weed, in the form of a cigar, that he might do likewise. This was the first that the civilized world ever knew of tobacco. The Spaniards and Portuguese soon made Europe acquainted with the plant and its uses. In 1560 the agent of the King of France in Portugal, named Jean Nicot, obtained from a Dutchman some seed of the plant from Florida; and thus it was introduced into France, where it was known as the Nicotian weed. Tobacco, the Indian name, appears to have been applied originally to the pipes wherein the Caribbees smoked the dried leaves. In 1586 Sir Walter Raleigh and his colleagues, who had been unsuccessful in founding a colony in America, brought back to England the custom of using tobacco; but until 1607, when the Jamestown Colony was planted, England obtained the little tobacco which it used, indirectly, through the Spaniards, from the West Indies. As the various nations of the world were using narcotics and stimulants of various sorts, this new one had to fight its way into favor against great prejudice. King James I. of England wrote a pamphlet in 1616, vigorously denouncing its use; in 1624 Pope Urban VIII. decreed excommunication to all who used snuff; in 1634 Russia affixed a penalty of cutting off the nose for smoking tobacco; and other nations restricted its importation, culture, and use, in various ways, a favorite plan being to lay very heavy taxes thereupon. Yet the use of the weed — which the American Indians smoked as a solace to care, a cheer in idleness, and a token of fidelity around the council-fire and at peace negotiations — soon became popular in Europe, and thus spread all over the Old World, — into Turkey, Egypt, Arabia, Persia, the Indies, and China. More than any other product of the soil, tobacco has an unquestioned title exclusively to American origin.

Early history of tobacco.

The culture of tobacco was undertaken almost immediately by the first settlers in Virginia; and it is recorded, that, in 1615, not only the gardens and fields, but also the streets, of Jamestown, were planted therewith. It quickly became the staple crop of the colony. The laws of the mother-country forbade any manufactures, even of necessary clothing; and tobacco was soon found to be the most valuable of agricultural products, even wheat being abandoned for its culture. By the year 1622 the product of Virginia had increased to sixty thousand pounds, and it doubled in twenty years. Its culture was begun in the Dutch colony of New Netherlands (afterwards called New York) in 1646; but it never spread very rapidly. Later, it was cultivated quite extensively in the neighborhood of Philadelphia. From Virginia the industry extended southward into the Carolinas. The French corporation known as "The Company of the West"

Cultivation of tobacco in Virginia.



SMOKING INSTRUMENTS OF ALL NATIONS.

introduced it into Louisiana in 1718. So rapidly did the production increase at first in Virginia, and so slowly was its consumption augmented abroad, that prices fell, and the colonists could not make tobacco pay for their clothing. In 1639 the Assembly ordered the product of the next two years to be burned, except a hundred and twenty thousand pounds, properly divided among the planters, in order to check production and raise prices. A tract on Virginia, printed in London in 1649, said that the price of tobacco in the colony had fallen to threepence a pound on account of the supply. In 1652 Cromwell ordered all tobacco-plants in England to be destroyed, in order to give the colonies a better chance; and the increasing popularity of the weed also stimulated the production in the colonies again, and it made rapid strides. In 1729 the product of Virginia and Maryland had increased in quantity and value, so as to be worth £375,000; and a fleet of three hundred sail was employed in its transportation. The annual export from all the colonies for the ten years prior to 1709 averaged 28,868,666 pounds; and from 1744 to 1776 the average was 40,000,000[1] pounds, or one-tenth of our present yield. Of this amount, more than three-quarters came from Virginia alone.

Increase of acreage until 1840.

Prior to the Revolutionary war the planters had discovered that their lands were deteriorating; and from 1758, when Virginia exported 75,000 hogsheads, there was a falling-off for a number of years in the amount raised on the original plantations. The acreage increased, however, extending into new States, notably Georgia and Kentucky; so that the total yield of the country kept about the same, or increased slightly. In 1790 our exports were 118,460 hogsheads, — a figure not reached again until 1840. Inasmuch as domestic consumption was increasing meantime, and the taxes were enormous which foreign countries imposed upon our tobacco when imported by them, it is probable that our product increased at least threefold during that period of fifty years, — from something like 60,000,000 to over 200,000,000 pounds.

TOBACCO-PLANT.

Production since 1840.

Between 1840 and 1850 tobacco culture remained almost at a standstill: indeed, the figures given by the Agricultural Bureau show a slight falling-off. Thus in 1840 the yield was 219,163,319 pounds, while in 1850 it was but 199,752,655. During the next decade, however, there was a very marked development of the industry. In that short time it attained double dimensions, the returns for 1860 being 434,209,461 pounds. Since that time it has been impossible to more than approximate the yield, inasmuch as the heavy internal revenue-tax on tobacco has induced producers to falsify their returns by diminishing them. Thus the

[1] Probably equivalent to 100,000 hogsheads in that day. A hogshead now contains about 1,200 pounds.

census-statement for 1870 gives 262,735,341 pounds as the total yield; but the commissioner of agriculture estimates that it was at least 360,000,000; and, as a further illustration, it may be stated, that in Ohio, in 1870, while the returns to Federal census-takers aggregated but 18,741,923 pounds, the State assessors declared the crop to be 38,953,206 pounds. The returns for 1875 were 379,347,000 pounds; and, allowing for underrating in the statements, it is safe to say that we raised something like 500,000,000 or 600,000,000, or a quarter more than in 1860. That we have made no more headway is chiefly attributed by the old planters to the emancipation of the slaves. They say that the industrial demoralization attendant upon freeing the blacks is felt far more by the tobacco-growers than by the cotton-growers. It may be remarked, however, that, while the culture of cotton was almost entirely suspended during the war, the tobacco-interest was but slightly affected, a small portion of the crop coming from Northern States, and the Border States, which yielded the most, being largely free from the depredations and paralysis of the pending conflict.

Effect of emancipating the slaves.

Though produced in all of the States, yet there were but fourteen, according to the census of 1870, which yielded as much as one million pounds apiece. Kentucky alone furnished forty per cent of the crop of 1870, and over thirty per cent of that of 1875. Kentucky and Virginia have, for twenty-five years, raised more than half of the total product. The following table shows the quantity produced in each State: —

STATES.	1850.	1860.	1870.	1875.
Kentucky	55,501,196	108,102,433	105,305,869	130,000,000
Virginia	56,803,227	123,967,757	38,086,364	59,240,000[1]
Total	112,304,423	232,070,190	143,392,233	189,240,000
North Carolina	11,984,786	32,853,250	11,150,087	14,750,000
Tennessee	20,148,932	38,931,277	21,465,452	35,000,000
Missouri	17,113,784	25,086,196	12,320,483	40,000,000
Maryland	21,407,497	38,410,965	15,785,339	22,000,000
Ohio	10,454,449	25,528,972	18,741,973	13,500,000
Total	193,413,871	392,880,850	221,855,567	314,490,000
Pennsylvania				16,000,000
Indiana				12,750,000
Connecticut				9,900,000
Massachusetts				8,500,000
Illinois				8,000,000
Other States	6,338,784[2]	41,328,611[2]	40,879,774[2]	9,707,000[3]
Grand total	199,752,655	434,209,461	262,735,341	379,347,000

[1] Includes 2,240,000 from West Virginia. [2] Includes last five States above named, with those not named at all in the table. [3] With the five States above named, makes 64,647,000.

This irregularity of distribution will more clearly appear on a more minute examination of returns. Thus one county in New Hampshire (Cheshire) yielded ninety-seven per cent of the State's crop in 1870. Three counties in Massachusetts, adjoining the Connecticut River, yielded all but 23,610 of the 7,812,885 pounds raised in that State. Connecticut grows some in each of her eight counties; and yet Hartford County produced 5,830,209 of the 8,328,798 pounds raised in the State that year. In New-York State, three counties (Onondaga, Chemung, and Steuben) yielded 1,884,048 out of 2,324,730 pounds. Pennsylvania produces seven times what New York does; and yet the great proportion of her yield is confined to Bucks, Lancaster, and York Counties; while nine-tenths of what is grown in Bucks County is produced in the immediate vicinity of the old William Penn mansion, in Falls Township. In 1869 three-fourths of Ohio's yield was inside of one county (Montgomery); although the next year the crop was so disseminated, that, according to the returns, ten counties produced only a trifle over half. In the great tobacco belt, of course, the distribution is considerably more even in proportion to the whole yield; yet the difference between the yield of the several towns in a county is oftentimes very marked.

Other features in production.

Among the more marked minor changes in the production of tobacco is the development of the yield in Indiana, Illinois, Pennsylvania, Connecticut, and Massachusetts, within the past twenty-five years. Ohio had already come to grow it largely prior to 1850. The two States next west, doubtless, were incited to the experiment more by her example than by any thing else. In New England the culture is confined mostly to the Connecticut and Housatonic Valleys; though tobacco-raising was scarcely known there even in 1850. Massachusetts yielded but 138,426 pounds that year; while in 1860 she produced 3,233,198, and now raises more than 8,000,000 pounds annually. Pennsylvania raised but 912,651 pounds in 1850; but in 1875 her crop amounted to 16,000,000 pounds. New York returned 83,189 pounds as her yield in 1850. In 1869 the figures were 8,500,000: since then they have greatly declined. This decline, as also that to be noticed in some of the other States, is probably less than is returned. Coming to the more productive regions, it is to be observed that Maryland, North Carolina, Ohio, and Tennessee have bravely held their own during the past quarter of a century, on the whole, though not doing as well now as they did formerly. Virginia, long the chief producer, has been compelled to take a second place in the line; and Kentucky has come to the head of the procession. This westward movement of the centre of production is also noticeable in the growth of Missouri's production.

Production by States.

The varieties of tobacco raised in the United States differ somewhat according to the section. Connecticut yields a light-colored, fine-fibred leaf, which makes particularly good wrappers, and which is exported largely to

Havana for the famous Havana cigars. This variety is used also for the fillers of a cheaper grade of cigars. Massachusetts, New Hampshire, New York, and Ohio mostly raise the Connecticut seed-leaf; although Westfield, Mass., has a cross between the Connecticut and Cuban; and Ohio has also the so-called "Baltimore Cuba," and some of the stronger, heavier Virginia and Kentucky varieties, which are cut or pressed for chewing, and are exported. Gadsden County, Florida, has alone succeeded in raising the Cuban tobacco in all its excellence. It has a narrow leaf, and possesses the peculiar aroma and delicious fragrance that characterize the genuine Havana cigar. The northern counties of North Carolina raise particularly fine wrappers, being both light-colored and of fine texture. In other parts of the State, coarser, ranker kinds are cultivated. In Maryland two principal varieties are noticeable, — the broad and narrow leaf. The former commands the higher price; but the latter yields the greater quantity. Only a little is used for wrappers: most of it is used for the fillers of strong cigars, snuff, and as plug and twist for chewing. It is exported largely, especially to France. When cured, it varies in color from a bright yellow to nutmeg or mahogany. The same is the case with Virginia's product and Kentucky's, which are of coarse texture and great pungency. These three States are the principal exporters of the leaf.

Varieties of tobacco grown.

FIRST PIPE.

We have already remarked, that, previous to the Revolution, tobacco was for a long time our most valuable export; and our export constituted, doubtless, nearly or quite three-fourths of our production. Our export of 1790, which was 118,460 hogsheads, was not reached again nominally until 1840, although in the interim the quantity contained in a hogshead materially increased. A hogshead of tobacco now averages between 1,200 and 1,450 pounds. Herewith we give a statement of our exports since 1840: —

Exports.

	HOGSHEADS.
1840	119,484
1841	147,828
1842	158,710
1843	94,454
1844	163,042
1845	147,168
1846	147,998
1847	378,440
1848	130,665
1849	101,521
1850	145,729
1851	95,945
1852	137,097
1853	159,853
1854	126,107
1855	150,213

	HOGSHEADS.
1856	116,962
1857	156,848
1858	127,670
1859	198,846
1860	167,274
1861	160,816
1862	107,233
1863	111,896
1864	109,905
1865	149,032

	POUNDS.
1866	190,826,248
1867	184,803,065
1868	206,020,504
1869	181,527,630
1870	185,748,881
1871	215,667,604
1872	234,936,892
1873	213,995,176
1874	318,097,804
1875	223,901,913
1876	218,310,265
1877	282,386,426

Our present export amounts to more than two-thirds of the crop-returns, but probably amounts to scarcely, if any, more than half our real production.

Where the export goes, and in what form.

The value of our tobacco export is upwards of twenty million dollars. Most of the product goes abroad in the form of leaf-tobacco: only a small proportion of it is manufactured. Some of the raw material comes back to us worked up, though but little. Most of our little import is of foreign varieties, desired for their peculiar flavors. The great bulk of our export goes to England, France, Holland, and Germany. In the large cities, there are extensive cigar-manufactories. In England, the tobacco from America is chiefly for chewing. Scotland's import is largely converted into snuff.

Foreign duty upon tobacco.

It is worth noticing, in connection with our exports of tobacco, that European countries impose a very heavy tax upon the American article; England's tariff amounting to seventy-five cents a pound, and the average duty on the bulk of American tobacco imported into all Europe being about fifty cents a pound. In some of those countries the cultivation of the plant is prohibited, in order that the government may get the full benefit of this source of revenue. In 1859 the United States made an unsuccessful attempt to secure the repeal of these taxes. Were they once removed, undoubtedly our exports, and consequently our production, would be greatly increased.

It is estimated that the world's production of tobacco to-day is 4,500,000,000 pounds. Could we get at the truth, we should doubtless find that the United States produce more than one-ninth of this. Most countries that produce it either use up their own supply, like Mexico, or call for even more, as do France and Germany. This country is, therefore, the main resource of Northern Europe.

World's production.

Already our tobacco-crop is worth forty million dollars or more to us. Were we able to secure its free admission into foreign countries, and were we to resort to improved culture, restoring the soil where impoverished, this industry might attain a development almost beyond calculation.

Value of American product.

The several ways of using tobacco are too well known to require description. It may be worth while, however, to note how the "hard times" have affected those who indulge in this luxury. In the cigar-trade there has been a large decrease in sales, and cigarettes have grown in popular favor. The sale of cigarettes, until a year and a half ago, was an unimportant item in trade, and they were kept more as a matter of convenience for fashionable people than as a profitable investment. Heretofore there were only a few brands, and the majority were of foreign manufacture: now a hundred and twenty-one different brands find a ready sale in the market, two-thirds of which have been manufactured within the past eighteen months. During the year 1877 the trade of New-York retail dealers in this line increased two hundred per cent. That the habit of smoking tobacco in this form is resorted to as a matter of economy is plainly shown by the fact that old customers who were wont to purchase cigars of a superior quality are now content with those of an inferior grade. Cigar-manufacturers, on the contrary, deny that cigarettes are taking the place of cigars, and, while admitting the great increase in the sale of cigarettes, regard it as a fashion among smokers, and not as a matter of economy. They further declare, that the greatest economy is shown by the trade in the purchase of inferior cigars. The high-priced cigars once largely sold are now manufactured in smaller quantities, owing to the hard times. This does not include the very finest quality of Havana cigars, which were heretofore obtained almost exclusively from abroad. Their manufacture is now carried on in this country, and, to a great extent, has usurped the trade formerly confined to Havana and Key West, because here they can be made and sold much cheaper. The manufacturers at those places are said to have become greatly alarmed at the increasing trade in fine cigars in this country. Domestic manufacturers affirm, in relation to the prevailing custom of cigarette-smoking, that it is injurious, because certain poisonous ingredients are used in preparing the paper of which the outer covering is made. Statistics at Washington show a very large decrease in the manufacture and importation of cigars last year in comparison with that of the previous year. According to the Bureau of

Cigars and cigarettes.

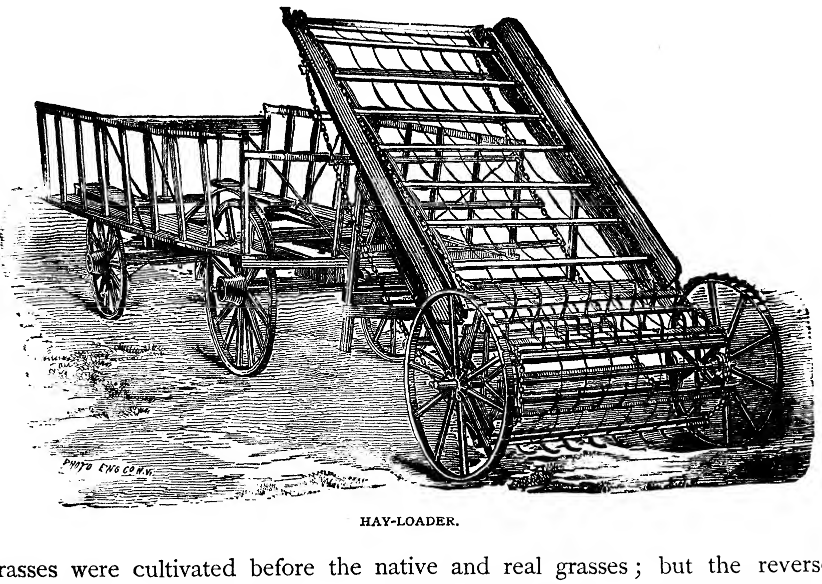
Statistics, the total number of cigars and cheroots upon which the internal-revenue tax was paid during the fiscal year ending June 30, 1876, was 1,828,807,396. This is a decrease of nearly 98,000,000 cigars from the year previous. The amount of cigars manufactured and imported in this country during the year 1875 reached nearly 2,000,000,000. The value of the imported cigars consumed in the United States during 1876 amounted to $2,289,712.89, and of snuff to $18,470.

CHAPTER VIII.

GRASS AND HAY.

THE hay-industry appears to have been forced upon the early colonists in this country immediately upon their occupation. This was especially the case in the Northern and Eastern States, where the winters were long and severe, and where there was great danger of the cattle and horses dying of starvation. In those days the implements for cutting and gathering it were the simple scythe, rake, and pitchfork. The grasses utilized were native, and grew wild, either on upland meadows or sea-marshes. In England the clover and other "artificial"

Cultivation of grasses by early settlers.



HAY-LOADER.

grasses were cultivated before the native and real grasses; but the reverse was the case in this country. It was not until about a century ago, either, that any attempt worth noting was made to sow grass-seed, and reduce its culture to a science.

Probably the most nutritious hay in this country is made from the so-called "Timothy-grass," which is named after Timothy Hanson, who carried the seed of it from New York to Virginia and Carolina about the middle of the last century. It is also known as Herd's-grass, especially in New England. Jared Eliot says that a man named Herd found it growing in a swamp near Piscataqua, N.H., early in the eighteenth century. In England it was already known and cultivated, and it is said to have been taken to Virginia by Peter Wynche in 1760. The Hungarian millet, which has been moderately cultivated within a few years past, was introduced by the Department of Agriculture. Another importation is the orchard-grass, or rough cock's-foot, common the world over, and introduced into Virginia from England in 1764, and which afterwards obtained a wide popularity farther north. It endures drought admirably, yields a luxuriant aftermath, and affords excellent pasturage. Clover, which is a forage plant of the leguminous family, and not a genuine grass, was likewise imported into this country.

Timothy.

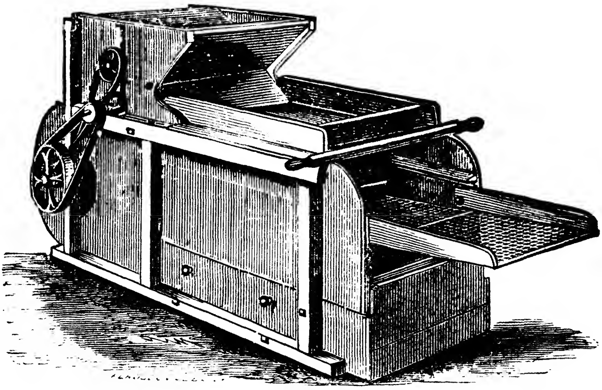
The varieties of native grass in this country are almost innumerable, though but few have any agricultural value. Among the earliest known and most esteemed is the Kentucky blue-grass, widely prevalent in the West and in New England. It thrives best on limestone soils, and is very fattening. Cattle and horses fed thereon are usually the choicest-looking stock. It is an early and vigorous plant, and makes a permanent turf. It is prized both for hay and pasturage. The red-top, sometimes called Herd's-grass, in Pennsylvania and farther south is quite a favorite, but is generally mixed with Timothy and clover. A grass called "English bent," indigenous to the Connecticut Valley, and swamp wire or fowl meadow, are two local New-England varieties. Besides these, the salt-marsh, goose or creeping sea-meadow, is frequently grown at the seaside, and, mixed with other hay, is regarded as excellent fodder. Most of the wild prairie-grasses, while affording good pasturage, are not eligible for hay. In the Far West, mostly in the Territories, the plains are covered with a short, curly, native vegetation, called "gramma," or "buffalo-grass." It is the natural and principal food of the bison, and cattle are fond of it. It is not gathered, however, as hay.

Varieties of early grasses.

The increasing demand for fodder for live-stock, and the improvement in implements for cutting and curing hay, — the mower, horse-rake, tedder, and horse-fork, — have, within the present century, given a great stimulus to the hay-business. In the Southern States little attention is given to it, because the stock can be pastured so large a part of the season; but, in the North, the severity of the season compels the farmer to devote more attention thereto. There is a large demand for hay, too, in the cities, where horses are stall-fed the year round, and where large numbers of these animals are employed for private and public conveyance and cartage. The villages and smaller cities in agricultural dis-

Causes of increase of cultivation and consumption.

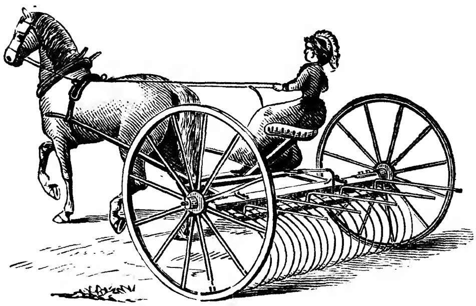
tricts are generally supplied by cartage from barns and stacks in the adjacent country. For the large cities hay is pressed into bales, and it forms a prominent article of domestic commerce. It is consumed, however, almost exclusively at home.



CLOVER-HULLER.

Our census-returns included no mention of our hay-crop prior to 1840, in which year the total product was reported at 10,248,108 tons; in 1850 it was 13,838,642; in 1860 it was 19,083,896; in 1870 it was 27,316,048, and in 1875 the scarcely larger sum of 27,873,600 tons. Of this amount New York produced nearly one-fifth (namely, 4,900,000 tons), and Pennsylvania 2,400,000, or about half that quantity. Illinois came second in rank, with 3,050,000 tons. Ohio and Iowa each raised nearly 2,000,000 tons; while Maine, Vermont, Michigan, Indiana, and Wisconsin each raised over 1,000,000 tons. The rest was distributed throughout the North and West.

Statistics of production.



HORSE-RAKE.

With the exception of wheat and corn, there are no crops in this country which equal hay in value; although in 1875 wheat threatened to step from the third to the second rank as regards value, where it was already in point of acreage, as will be seen by the following comparison: —

	1874.		1875.	
	ACREAGE.	VALUE.	ACREAGE.	VALUE.
Corn	44,841,371	$555,445,930	49,033,364	$475,491,210
Wheat	26,381,512	294,580,990	27,627,021	300,259,300
Hay	23,507,964	342,203,445	25,282,797	300,901,252

CHAPTER IX.

MINOR CROPS.

Barley among the oldest cereals.

BARLEY grows wild in Sicily, Asia, and the United States, but is among the very earliest cultivated cereals of the world. In this country there are two varieties, two-rowed and four-rowed; but in Europe a kind is grown which has six rows of kernels in a head, and is without the awn, or beard, which characterizes other barley. This is generally planted in the fall, ours in the spring. In remote times it was used largely for a coarse bread, and is now used to some extent abroad for feeding horses. Its principal use at the present time is for malt; and, as our crops are not sufficient for our needs, we are obliged to import in addition to our own yield.

Cultivation by colonists.

Barley was sown by Gosnold on Elizabeth Islands, Mass., in 1602, and by the Jamestown settlers in Virginia in 1611; but in the latter region it soon gave place to tobacco-culture. Good crops of it were raised in Massachusetts in 1630. Small samples were sent out from the Dutch colony of New Netherlands in 1626. In 1796 it was Rhode Island's principal crop. It never gained a very extensive foothold in this country, and its culture has been chiefly in those States which give the most attention to grains. In 1840 we raised 4,161,504 bushels: in 1850 the amount returned was 5,167,015. The census of 1860 stated the total yield at 15,825,898, and that of 1870 at 29,761,305 bushels. From the table of minor crops appended to this chapter, it will be seen that California is the leading producer of this grain, with New York second, and the grain States of the North-West following closely.

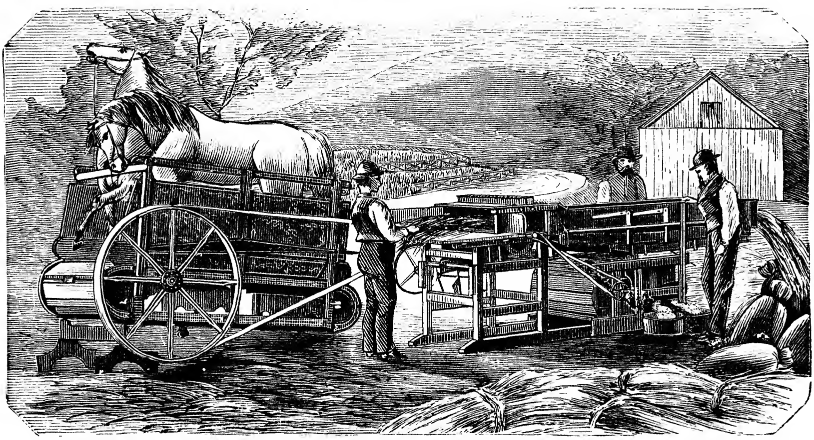
Oats.

Of all the grains, the oat most nearly resembles grass in appearance. There is but one principal variety, — the common oat, which is thought to have originated in Mesopotamia. It grows in cold climates and sterile soils, and is highly prized in Northern Europe as an article of human food, being used in the form of meal for porridge and small cakes, and as grits, or groats, for gruel. In this country, however, it is principally used as horse-feed. The straw is regarded as good fodder for milch-cows. The crop is generally regarded as an exhausting one.

A wild oat seems to be indigenous to California, where hundreds of thousands of acres are covered with it. The Indians gather it, and use it as any other seed. Early travellers used to call it pin-grass. The cultivated variety was introduced into this country by Gosnold in 1602, and it attained a much more extensive culture than either barley or rye. Of late years the Department of Agriculture has done much to disseminate choice varieties of seed for experiment, as also of barley. The census-returns of 1840 put the total product of the country at 123,071,341 bushels: in 1850 it had increased to 146,584,179, in 1860 to 172,643,185, and in 1870 to 282,107,157 bushels. Its distribution is more largely in the central and Ohio-valley sections of the Northern States. As will be seen from the table appended to this chapter, the last census showed Illinois to be the leading producer, with Pennsylvania second, New York a close third, and the Western grain States next in order. Our oat-crop is almost entirely consumed at home, and the exports are very light.

Wild oats.

Statistics of production.



THRESHER, SEPARATOR, AND CLEANER.

Rye ranks next to wheat, among the grains, as an article of human diet in this country. In ancient Britain they were planted together. It grows on sterile soils in high latitudes, and is not only the prevailing grain of Northern Europe, but is also prevalent in the colder parts of the United States. In bread-making, rye-flour is usually mixed with Indian-meal; and the product is still very popular, though old-fashioned, with the rural classes of New England. The grain is largely used, also, for the distillation of whiskey; and the straw is preferred above all others for stuffing beds. There are several varieties of it; and, like wheat, it is planted both in the fall and spring.

Rye.

It was used in this country as early as 1648, perhaps 1630; and in 1796 no less than 50,614 barrels of rye-meal, representing five times as many bushels of grain, were exported from Philadelphia alone. In 1801 the total export from the whole country was but 392,276 bushels. Its cultivation spread pretty generally over the Northern States. Being well adapted to sterile soils, and not very exhaustive, it has retained a good foothold in the East. Wheat so largely supplanted it, however, that the increase in the crop has been very gradual, no real headway having been made at all for nearly forty years.

Increase of cultivation.

Thus the total product in 1840 was 18,645,567 bushels; in 1850 it had fallen to 14,188,813; in 1860 it had risen to 21,101,380; but in 1870 it was down to 16,918,793, at which time Pennsylvania was the largest producer, New York second, and Illinois third. It still has a good show in New England, but is more largely cultivated in the Western grain States. Our total product is not consumed at home, and there is a slight export of it to Europe.

Statistics of production.

Buckwheat, like rye, is generally a secondary crop in this country. In some places it is grown simply for the honey it gives the bees. The grain is used chiefly in flour, for pancakes.

Buckwheat.

It was brought to this country by the Dutch West-India Company, and sown on Manhattan Island for horse-feed. The Swedes also cultivated it in New Jersey and Pennsylvania. It has been grown chiefly for home-consumption, and the extension of the volume of the crop has been very slow. The quantity raised in 1840 was returned at 7,291,743 bushels; in 1850 it was 8,956,912; in 1860 it was 17,571,818; but in 1870 only 9,821,721, of which New York and Pennsylvania raised fully two-thirds, the former rather more than the latter. The rest was pretty evenly distributed among the Northern States.

Early history.

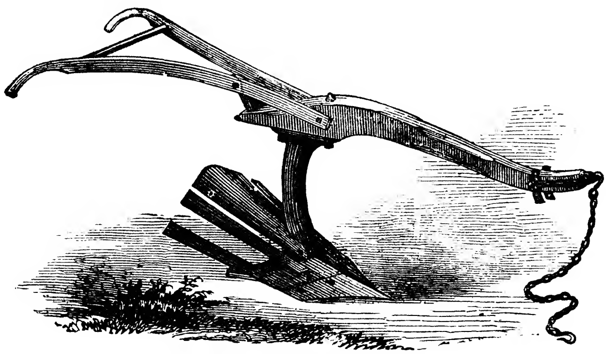
Pease and beans have been grown in moderate quantity in this country both for the table and for cattle-fodder. Gosnold planted them in 1602, and the Dutch raised them in 1644; but it is known that the natives cultivated them before the white settlers did. On the South-Atlantic coast they soon became popular, and from those colonies were exported in moderate quantities before the Revolution. Thus North Carolina exported 10,000 bushels in 1753; South Carolina, 9,162 in 1754; and Savannah, 400 in 1755. The total exports of the two for twenty years prior to 1817 averaged 90,000 bushels. In 1850 the total product of the country was 9,219,901 bushels; in 1860 it was 15,061,995; but by 1870, like several of the minor grain-crops, it fell off again, the census-returns being 5,746,027.

Pease and beans.

The two kinds of potatoes, Irish and sweet, are said to have originated in this country, although the fact is not established; and the two varieties are somewhat confused in early accounts. It is said that Raleigh took back the potato to England in 1586; and the Spaniards are said to have found the people of Quito eating a tuber, which answers the description of the sweet-potato, thirty or forty years before; and by these explorers

Potatoes.

the plant was introduced to Europe, becoming very popular in Spain, France, and Italy, and even going to Asia. The culture of the sweet-potato has been confined principally to the Southern States of this country, though it has been grown extensively in New Jersey, and even in light loamy soils near Boston. The Irish potato, however, which is by far the most abundant, is mostly confined to the Northern States, from New England westward. Neither kind attained much prominence until about the middle of the last century, when we began to make some slight exports, and have continued to do so to the present day. Among our exports of vegetable food-stuffs, the potato ranks next to wheat and corn. Owing to the effects of wet weather, dry-rot, the potato-fly, and of late years the Colorado beetle, this crop has fluctuated largely. The census of 1840 returned 108,298,060 bushels of both kinds of potatoes as the American product; in 1850 it had fallen off to 104,056,044, owing to disease. In 1860 we raised 111,148,867 bushels of Irish potatoes, and 42,095,026 of sweet. In 1870 we produced 143,337,473 of the former, and 21,709,824 of the latter. In 1874 the crop of Irish potatoes was 166,000,000 bushels; but the consequent low prices, and the depredations of the potato-bug, cut the crop of 1875 down to 125,000,000. The distribution of the crop of 1870 is shown in the table appended to this chapter.



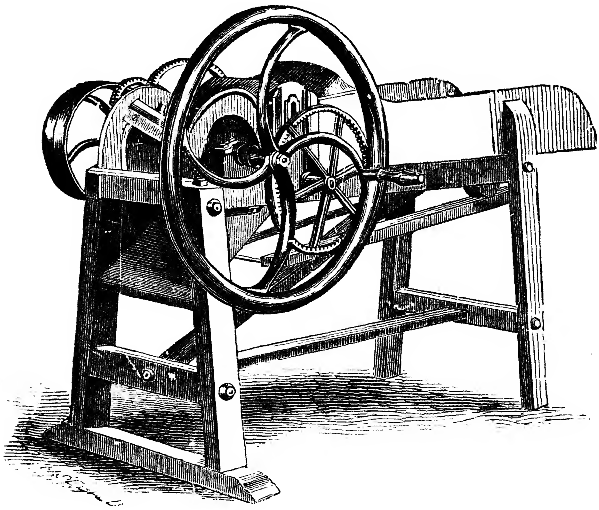
POTATO-DIGGING PLOUGH.

Statistics.

Although hops grow wild in this country in some of the Eastern States and in the Mississippi and Missouri Valleys, the first ones cultivated in America were from imported roots. They were grown for home-use in Massachusetts in 1628 or 1629, in New York in 1646, and in Virginia in 1648; their culture being encouraged by governmental bounties in the last-named colony in 1657. This branch of industry, however, grew slowly, as the careless modes of picking and packing practised in America spoiled our market. But, at the close of the last century, the present system of baling was resorted to; and subsequently something like a careful inspection and sorting was adopted. In 1806 Massachusetts created an office called Inspector-General of Hops. The development of hop-growing has been confined chiefly to the last two or three decades. In 1840 we produced 1,238,502 pounds; in 1850, 3,497,029; in 1860, 10,991,996, of which New-York State raised more than nine-tenths; and in 1870 the product had increased to

Hops.

25,456,669 pounds. A heavy export-demand between 1850 and 1860 rather stimulated the production; though the inauguration of the system of stretching wires from pole to pole, instead of using isolated poles, by Thomas D. Aylsworth of Herkimer County, New York, and other causes, seemed to confine the industry chiefly to that State. During the latter part of the next decade the crop in the East fared poorly three or four years in succession; and this gave the Wisconsin farmers a chance, which they handsomely improved. In 1870 New York produced only two-thirds of the total yield, and Wisconsin nearly one-fifth: the rest was distributed among the Northern States. Attempts have been made recently to cultivate hops in the Southern States, but with little success. In California, however, the hop-crop is beginning to assume prominence, both for quantity and quality; the price being the highest of any hops raised in America.



FODDER-CUTTER.

Export of hops.

Our exportation has been very uneven. American hops are rather stronger and ranker than those of England and Bavaria, and are not sought for, except when the crops in Europe are short. Thus in 1855 we exported a trifle over four million pounds, whereas during no previous year had we exported much more than a quarter of a million pounds. In 1856 the export was but a trifle over a million, and in 1857 a trifle under a million. During the next twenty years the crop gradually reached and passed the figures of 1855. In 1875 we exported 5,331,950, and in 1876 nearly 9,000,000 pounds.

Flax.

Flax, the fibre from which linen is made, grows wild in nearly all countries of the globe, but was probably cultivated first in Egypt. It is very largely grown in the north of Europe; Russia, Belgium, and Ireland having a wide reputation for the quantity and quality of their product. The plant has other uses too. Its seed yields a valuable oil for painting and burning, — namely, the linseed-oil; and the refuse oil-cake, as also the ground meal, are highly prized as fodder for cattle. The seed is used medicinally, and in several other exceedingly useful ways. It was first grown in the New Netherlands, or New York, in this country, in 1626, in Massachusetts in 1629, and in Virginia before 1648. The British Parliament offered bounties for its culture by the patentees of Georgia in 1733, 1743, and 1749. Pennsylvania raised a sufficient crop to export 70,000 bushels of flaxseed in 1752, and by 1771 had increased the amount to 110,412. Prior to and immediately after the Revolution, flax was prized more highly relatively than now, because cotton had not yet been utilized; and the colonists prepared, spun, and wove the fibre in almost every household.

Hemp.

Hemp, a different though similar plant, producing a coarser fibre, used chiefly for cordage, had a parallel history to that of flax in the early days of this country. Seed was brought to Plymouth Colony, and planted, as early as 1629. Bounties were offered for its culture by Virginia and Pennsylvania; but in the former tobacco was found to be more profitable, and soon supplanted hemp almost altogether. New Jersey gave great attention to hemp previous to the Revolution. Afterwards both flax and hemp were prominent in the crops of Kentucky, Ohio, Indiana, and Missouri, which, between twenty-five and fifty years ago, were the leading producers in the United States, although other Northern and the Eastern States continued to raise them both in small quantities.

Jute.

Inasmuch as our product of hemp, flax, and jute, — a coarse India fibre resembling hemp, and used for cheap bagging, — has fallen short of our needs, and our importation has always been large, amounting in the aggregate at the present time to a value of over thirty million dollars, the Department of Agriculture has given great attention to these plants, and greatly encouraged their culture. It was found some fifteen years ago that the India jute was being largely imported into this country for bagging; and inasmuch as the West needed the fibre for wool and grain shipments, and the South for cotton, those sections were urged to cultivate the new plant. This the South has come to do with marked success, though not to any very great extent. In the West it was found that four-fifths of the tow fibre left after removing the flax was wasted; yet it was far stronger for bagging than jute. Accordingly, the number of mills for utilizing it increased, and the waste was lessened.

Flax and hemp.

Since the breaking-out of the war, the fate of the flax and hemp crops has been widely different: the former has increased, while the latter has sadly declined. In 1850 our total hemp-crop amounted to 34,871 tons; by 1859[1] the yield had increased again to 74,493, of which Kentucky produced 39,409, and Missouri 19,268; but in 1870 it had fallen to 12,746 tons, of which these two States together contributed five-sixths. In 1850 the total yield of flax was 7,709,676 pounds, and 562,312 bushels of seed; in 1859[1] the returns were only 4,720,145 pounds of flax, and 566,867

[1] Census of 1860.

bushels of seed; but in 1870 the crop was 27,133,034 pounds of flax, and 1,730,444 bushels of seed.

Distribution of minor crops.

On the opposite page we give a table showing the distribution of the minor crops thus far treated for 1870.

It is not out of place to say something here concerning the production of ramie, — a grass which is now being utilized in India.[1] More than seventy years ago, attention was first directed to the properties of a fibre which to many persons has since been made familiar as the material out of which the fabric known as Chinese or Indian grass-cloth is manufactured. Experiments were soon after made, under the auspices of the British Admiralty, to test the strength of this fibre; the result of which showed, that, in whatever way the test is applied, the grass is three times stronger than the best Russian hemp, while it is also much lighter. For all the purposes for which hemp is used it was admitted to be very much superior. In consequence of difficulties that arose in the process of preparation, the matter remained a long time in abeyance. It was not until the last Russian war that the subject received fresh notice. International strife has often been the stimulus to new discoveries. When French ports were blockaded, and French commerce was destroyed, in the days of the first Napoleon, French physicians found a good substitute for ipecacuanha in the root of the violet. Our own civil war stimulated the production of cotton in Egypt, India, and the Pacific islands. The Russian war, cutting off the supply of flax from Western Europe, led to the increased cultivation of jute in India, and to its extended use and application; at the same time, it turned attention anew to the Indian-grass as another substitute; and, although it is only recently that any practical result has seemed likely, it promises now to develop into an important source of industry.

Ramie.

In addition to the great strength of the fibre, it has a remarkable power of resistance to the influence of moisture. Compared with other fibres, it may almost be said to be indestructible. It is as fine as flax, and presents a glossy lustre more nearly resembling silk. Manufacturers give it an intermediate position between animal and vegetable fibres; and those who have interested themselves about it appear to consider it as an equal if not superior substitute for flax, and very much superior in every respect to hemp. The chief reason why it has not been sooner brought into use lies in the difficulty that has hitherto been encountered in the preparation. Six years ago the Indian Government offered a premium equal to twenty-five thousand dollars for the best machine for separating the fibre from the stems. This was, however, only partially successful. Only one machine was sent in, and that only partly met the requirements. At that time it was thought that only the green stems could be operated upon; but it has since been shown that this is a mistake. The dried stems afford a fibre equal in strength and durability, and only inferior in

[1] This account of ramie is drawn from The New-York Times, Aug. 17, 1875.

STATES.	Barley.	Oats.	Rye.	Buckwheat.	Pease and Beans.	Irish Potatoes.	Sweet-Potatoes.	Hops.	Flax. Pounds.	Flaxseed. Bushels.	Hemp. Tons.
Alabama	5,174	770,866	18,977	144	156,574	162,512	1,871,360	32	37	2	. . .
Arizona	55,077	25	. . . .	. . . .	3,417	575	16	. . . .	. . . .	. . . .	. . .
Arkansas	1,921	528,777	27,645	226	47,376	422,196	890,631	25	420	104	. . .
California	8,783,400	1,757,507	26,275	21,928	380,010	2,049,227	202,035	625,064	31,740	13,294	200
Colorado	35,141	332,940	5,235	178	7,500	121,442	60	. . . .	. . . .	. . . .	. . .
Connecticut	26,458	1,114,595	289,057	148,155	13,038	2,789,894	867	1,004	300	4	. . .
Dakota	4,118	114,327	. . . .	179	456	50,177	. . . .	. . . .	. . . .	. . . .	. . .
Delaware	1,799	554,388	10,222	1,349	3,123	362,724	85,309	800	878	356	. . .
District of Columbia	. . . .	8,500	3,724	7	40	27,367	5,790	. . . .	. . . .	. . . .	. . .
Florida	12	114,204	545	. . . .	64,846	10,218	789,456	. . . .	. . . .	. . . .	. . .
Georgia	5,640	1,904,601	82,549	402	410,020	191,101	2,621,562	2	983	48	. . .
Idaho	72,613	100,119	1,756	. . . .	610	64,534	. . . .	21	. . . .	. . . .	. . .
Illinois	2,480,400	42,780,851	2,456,578	168,862	115,854	10,944,790	322,641	104,032	2,204,606	280,043	174
Indiana	356,262	8,590,409	457,468	80,231	35,526	5,399,044	150,705	63,884	37,771	401,931	22
Iowa	1,960,779	21,005,142	505,807	109,432	42,313	5,914,620	34,292	171,113	695,518	88,621	4
Kansas	98,405	4,097,925	85,257	27,826	13,109	2,342,988	49,533	396	1,040	1,553	35
Kentucky	238,486	6,620,103	1,108,933	3,443	119,926	2,391,062	802,114	947	237,268	14,657	7,777
Louisiana	1,226	17,782	984	260	26,888	67,695	1,023,706	. . . .	. . . .	. . . .	. . .
Maine	658,816	2,351,354	34,115	466,635	264,502	7,771,009	354	296,850	5,435	227	. . .
Maryland	11,315	3,221,643	307,089	77,867	57,556	1,632,205	218,706	2,800	30,760	1,541	. . .
Massachusetts	133,071	797,664	239,227	58,049	24,690	3,025,446	917	61,910	930	52	2
Michigan	834,558	8,954,466	144,508	436,755	349,365	10,318,799	3,651	828,269	240,110	5,528	. . .
Minnesota	1,032,024	10,678,261	78,088	52,438	46,601	1,943,063	1,594	222,065	122,571	18,635	. . .
Mississippi	3,973	414,586	14,852	1,619	176,417	214,189	1,743,432	. . . .	100	2	3
Missouri	269,240	16,578,313	559,532	36,252	43,986	4,238,361	241,253	19,297	16,613	10,391	2,816
Montana	85,756	149,367	1,141	988	2,414	91,477	. . . .	. . . .	. . . .	. . . .	. . .
Nebraska	216,841	1,477,562	13,532	3,471	3,332	739,984	762	100	54	404	. . .
Nevada	295,452	55,916	310	985	414	129,249	. . . .	. . . .	. . . .	. . . .	. . .
New Hampshire	105,822	1,146,451	47,420	100,034	58,375	4,515,419	160	99,469	177	6	. . .
New Jersey	8,283	4,009,830	566,775	353,983	56,221	4,705,439	1,550,784	19,033	234,061	6,095	5
New Mexico	3,876	67,660	42	10	28,856	3,102	. . . .	. . . .	. . . .	. . . .	. . .
New York	7,434,621	35,293,625	2,478,125	3,904,030	1,152,541	28,547,593	10,656	17,558,681	3,670,818	92,519	6
North Carolina	3,186	3,220,105	352,006	20,109	532,749	738,803	3,071,840	238	59,552	6,756	. . .
Ohio	1,715,221	25,347,549	846,890	180,341	45,443	11,192,814	230,295	101,236	17,880,624	631,894	25
Oregon	210,726	2,029,909	3,890	1,645	12,575	481,710	1,970	9,745	40,474	10,988	. . .
Pennsylvania	529,562	36,478,585	3,577,641	2,532,173	39,574	12,889,367	131,572	90,688	815,906	15,624	571
Rhode Island	33,559	157,010	20,214	1,444	9,920	669,408	142	249	. . . .	. . . .	. . .
South Carolina	4,752	613,593	36,165	312	460,378	83,252	1,342,165	1,507	. . . .	. . . .	. . .
Tennessee	75,068	4,513,315	223,335	77,437	194,535	1,124,337	1,205,683	565	80,930	4,612	1,033
Texas	44,351	762,663	28,521	44	42,654	208,383	2,188,041	51	25	2	5
Utah	49,117	65,650	1,312	178	9,291	323,645	163	322	10	. . . .	. . .
Vermont	117,333	3,602,430	73,346	415,096	95,242	5,157,428	96	527,927	12,899	444	. . .
Virginia	7,259	6,857,555	582,264	45,075	162,102	1,293,853	865,882	10,999	130,750	9,699	31
Washington	55,787	255,169	4,453	316	15,790	280,719	425	6,162	. . . .	. . . .	. . .
West Virginia	50,363	2,413,749	277,746	82,916	31,449	1,053,507	46,984	1,031	82,276	2,393	37
Wisconsin	1,645,019	20,180,016	1,325,294	408,897	388,425	6,646,129	2,220	4,630,155	479,398	112,019	. . .
Wyoming	. . . .	100	. . . .	. . . .	4	617	. . . .	. . . .	. . . .	. . . .	. . .
Total	29,761,305	282,107,157	16,918,793	9,821,721	5,746,027	143,337,473	21,709,824	25,456,669	27,133,034	1,730,444	12,746

gloss, and for these the existing machinery for flax and hemp is found to be well adapted; so that, while the best cloth will probably be made in India, or wherever the plant is grown, the manufacture can be made to succeed wherever the stems are imported. It is the knowledge of this fact that has given a new impulse to the discovery. The Indian Government is encouraging the cultivation on a large scale. Within the last few months a great deal of new machinery for the manufacture has been patented. Practical men are busily at work, and in a short time there is little doubt but that manufactured articles from this fibre will be placed upon the market. It is looked upon already as one of the most useful staples, and as likely to take the place, either as a substitute for or in combination with cotton, flax, hemp, jute, wool, or silk, and to be valuable, also, in the manufacture of paper and for other minor uses.

The discovery cannot, however, be regarded as of much value to our people unless the plant can be produced here. If this cannot be done, it will be more likely to benefit the British manufacturer and Indian grower, at some cost to our own. This is, therefore, an important aspect of the question. It is not quite settled whether the Indian and the Chinese fibres are produced by exactly the same plants. If they are (which is most probable), the Chinese product has a little the advantage of the other in the market. This shows that either climate or cultivation has, even there, something to do with the quality of the fibre. The plant grows very freely, however, in India; and experiments on a small scale indicate that it can be made equally successful in Australia. It also flourishes wherever it has been tried on the coast of the Mediterranean, and some very fair samples of the fibre have been grown in the south of France. With care, it has been grown in England; but it never can be produced there on any scale for commercial purposes.

It is reasonable from this to conclude that there are many parts of the United States where it could be cultivated on a large scale with advantage. Its production in the South might become a new source of wealth, second only, if not superior, to cotton. It would be necessary, in the first instance, to start upon practical information, obtained in India, in regard to the best methods of cultivation. About this there can be no difficulty; and, whether or not it be ultimately found that the soil and climate of this country are suitable, the subject is one which eminently deserves the careful consideration of persons who are interested in the maintenance of our manufacturing interests.

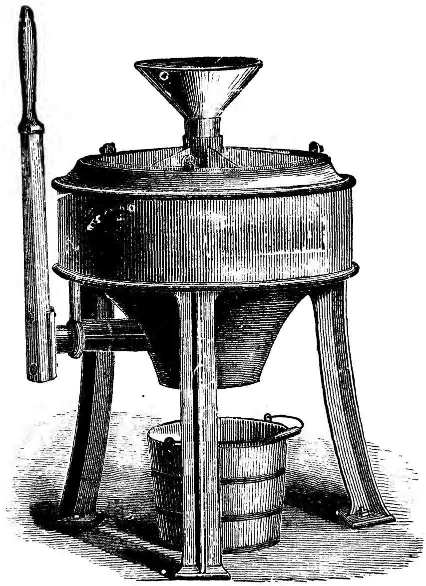
Rice.

Rice ranks next to wheat as the grain-food of human beings, taking the whole world into consideration, although it forms the staple of the diet of less civilized nations than the wheat-consumers. It is most commonly raised in India and China, although Ceylon and Java produce it in large quantities also. It is cultivated, too, in France, Hungary, and other parts of Europe, and in the United States and South America. It is rather a tropical plant, although it grows as far north as the Ohio River;

and a wild rice covers thousands of acres in the northern part of Minnesota, furnishing a very palatable food to the Indians. Though resembling wheat in the height, form, and appearance of the plant, and its harvesting and threshing, yet it usually grows in marshy lands. An upland rice is found in Maryland and Virginia, like that of Cochin; but it yields only fifteen or twenty bushels to the acre. Rice has also been grown on the sides of the Himalayas, between three thousand and four thousand feet above the level of the sea. The principal growth, however, is in the swamps, and, in this country, near the rivers and sea, where, by a carefully-adjusted system of gateways, the land can be flooded or drained as occasion requires, and where from forty to sixty bushels an acre are produced.

Early cultivation of rice.

Rice was introduced into Virginia by Sir William Berkeley in 1647, who, from half a bushel of imported seed, raised sixteen bushels of grain. South Carolina, the great rice State of this country, got its seed by accident from a sailing-vessel from Madagascar in 1694. In 1718 the Company of the West introduced it into Louisiana. Threshing-machines to separate the grain from the straw were brought hither from Scotland in 1811: they were operated by wind-power, and cleaned five hundred bushels a day. Later, Calvin Emmons of New York invented a machine with toothed beaters, which cleaned from seven hundred and fifty to eight hundred bushels a day. This process leaves the grain with a thin hull on; and in this condition it is called "paddy," or "rough rice." Our export is chiefly in that form. To complete the work of cleaning, the rice goes through another mill, between stones and under pounders like those of a quartz-mill. Formerly rice was cleaned by hand in pitch-pine mortars holding a bushel, by means of an iron-shod pestle. Nearly every large plantation has one of the new mills for cleaning.



RICE-HULLER.

Statistics of production.

The climax of our rice-culture was reached in the year 1850, when we raised 215,313,497 pounds, of which South Carolina is credited with 159,930,613 pounds, Georgia with 38,950,691, North Carolina with 5,465,868, Louisiana with 4,425,349, and the other Southern States together with less than 7,000,000. The returns of 1860, showing the crop of the previous year, gave a total of only 187,167,032 pounds, of which South Carolina produced 119,100,528, Georgia 52,507,652, North Carolina 7,593,976, Louisiana 6,331,257, and the other States together less than 2,000,000. In South Carolina all but 2,765,729 pounds were raised in Georgetown, Colleton, Charleston, and Beaufort Counties, the first-named yielding nearly half of the whole. Nine-tenths of Georgia's yield that year was confined to Chatham, Camden, McIntosh, and Glynn Counties, the first-named producing full half of the whole. In 1870 the total crop of the country was scarcely a third of what it was twenty years before. It was returned at 73,635,001 pounds, of which quantity South Carolina produced 32,304,825, — less than half, instead of three-quarters of the whole, as in 1850, — Georgia 22,277,380, Louisiana 15,854,012, North Carolina but 2,059,281, and the other States less than 1,000,000 pounds.

Effect of war upon this industry.

The effect of the war was to nearly annihilate this industry, labor being demoralized, the dams, gates, and mills getting sadly out of repair, and the rice-fields growing up with weeds. Since the war the recuperation has been slow, but sure; the negroes coming to take a proprietary interest in the culture, and Louisiana doing much to extend and develop this branch of agriculture.

Exports and imports.

Prior to the war we exported from a third to a half of our crop, the average for 1850–60 being 60,000,000 pounds a year, valued at nearly $2,000,000. During and since the war we imported to nearly the same extent, until about 1870, when the increased home-production cut down the imports very perceptibly.

Oranges.

Before concluding this chapter, a word or two is needed in respect to the cultivation of that luscious fruit, the orange. In Florida Nature produces this fruit in greatest perfection, and within a few years the cultivation of oranges there has rapidly developed. It is said that almost everybody in the St. John's River country is engaged in trying to raise the golden fruit. Very few groves are in bearing; indeed, it has been asserted, upon good authority, that between Jacksonville and Enterprise, a distance of two hundred miles, there are only about two hundred acres of producing trees: but the large profits realized from the old groves has induced the settlers to stake every thing upon the venture of rearing orchards of their own. Nine men out of ten are nursing young orchards, and waiting impatiently for them to yield some return for the money and time expended. It takes from six to ten years to bring an orange-tree to bearing. The cost of making a grove is very heavy. In the first place, the land, if on the river, is held at fancy prices. Comparatively little of it is adapted for orange-culture, and a good site commands from a hundred dollars to two hundred dollars an acre in its wild state. To clear off the heavy growth of timber, and get the stumps out, costs from fifty dollars to a hundred dollars an acre more. Then the young trees for planting are worth from thirty-five cents to a dollar apiece, and at least fifty dollars an acre must be spent before the grove is planted. Afterward it requires a yearly expenditure of about fifty cents a tree, or fifty dollars an acre, to keep the growing orchard in good condition; for the orange-tree is like a tender child, and requires constant petting, nursing, and doctoring to make it thrive. By the time the settler has paid for his land, started a grove of five acres, and built himself a house, he has spent six thousand or seven thousand dollars at least. The interest on his money, the constant expense for the care of his trees, and the support of his family, will bring his first investment up to a large figure by the time he begins to sell oranges. Still, if he has the money and the patience to remain, and the frost does not kill his trees, he will, in the end, realize a handsome competency. A grove of trees in full bearing is an independent fortune. An old tree produces from a thousand to two thousand oranges a year, when there is no failure of the crop; and the fruit sells from a cent and a half to three cents apiece at the grove. The prospect of getting twenty dollars a year from a tree is very fascinating. Counting a hundred trees to the acre, a very small amount of land can at this rate be made the source of a fortune. There are other sides to this picture not so pleasant to contemplate; yet let these not be seen while the reader longs for the sweet groves and the still more delicate and healthful fruit.

CHAPTER X.

NEAT-CATTLE.

THE history of neat-cattle raising in this country naturally divides itself into the two epochs when we bred only native cattle, and when we began the improvement of our stock by the importation of foreign breeds. In England, the country which has given more attention than any other to the improvement of this class of live-stock, comparatively little scientific breeding to develop special characteristics was practised until a hundred and fifty years ago; and none worth mentioning was undertaken in the United States until after the Revolution. The cattle which are commonly termed "native cattle" in this country are the product of an indiscriminate mixture of several varieties of foreign cattle, — two or three not very distinct British breeds, Swedish, Dutch, French, and Spanish; and so thoroughly have these original importations been crossed and intermingled, so poorly pronounced were the characteristics of the parent stock, and so modified were such characteristics, not only by cross-breeding, but also by the hardships of the climate and their owners' neglect in the early colonial days, that our native cattle have come to be a distinct breed by themselves.

Native cattle.

The first cattle in Massachusetts were the heifers and a bull brought thither in 1624 by Gov. Edward Winslow. Twelve more cows were brought to Cape Ann in 1626, thirty more in 1629, and a hundred in 1630. These last were kept at Salem, and were for the "governor and company of Massachusetts Bay." The stock bred from the importation of 1624 was divided up among the colonists three years later. The breed of these cattle is not known; but they are spoken of as black, white, and brindle. Several importations of cattle were made by Capt. John Mason into New Hampshire in 1631–33; and, as he carried on considerable trade with Denmark, his cattle were mostly Danish. They were large, well adapted for working in the yoke, and of a uniformly yellow color. Some of the breed were kept pure until 1820; and, though they were crossed more or less with other stock, they gave a prevailing cast to most early New-England cattle. Connecticut obtained her first cattle from Massachusetts, though perhaps a few from New York, and a few by direct importation.

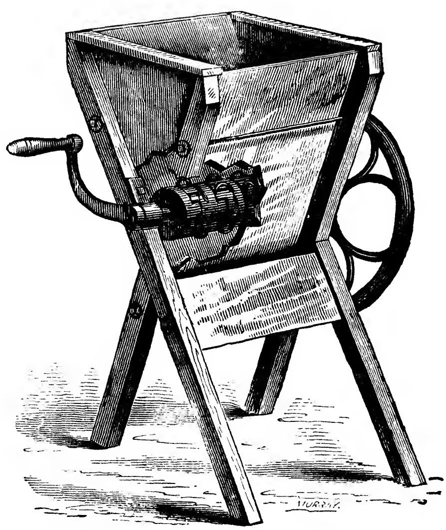
First importations to New England.

The first cattle brought to New York were imported by Pieter Evertsen Hulst, under the auspices of the Dutch West-India Company, in 1625. These came from the Island of Texel, off Holland, and were black-and-white Dutch cattle. The Swedes, settling in Delaware, brought cattle from their mother-country; and the Dutch in New Jersey got their stock from New York, where, in 1627, a milch cow was worth thirty pounds, and a pair of working-oxen forty pounds. William Penn encouraged the importation and breeding of cattle on his purchase at an early date. Virginia had cattle of her own in 1610, brought from the West Indies, where their killing was legally prohibited, by Sir Ralph Lane. The next year a hundred head were imported from Devonshire and Hertfordshire, Eng. In 1620 there were five hundred head in Virginia, and most of them were bigger than the parent stock. Maryland probably obtained most of her cattle from Virginia at first. The first importations into South Carolina were from England in 1670; but Georgia, a much younger colony, had none until 1732.

Early importations to New York, Virginia, and other colonies.

Columbus had brought cattle to the West Indies in 1493, which, with later importations, were of Spanish breeds. These were largely introduced into Mexico, and form the basis of our present Texan stock. From these, doubtless, were derived the cattle which the Indians on Red River are known to have had in 1690. The Portuguese landed cattle on the Island of Newfoundland in 1553; but no trace exists of them now. The French brought Norman cattle into Acadia in 1604, and into Canada in 1608. These were small, gentle stock; and several animals of this breed were introduced into the "American bottom" in Illinois in 1682, where they increased rapidly.

Importations by Columbus.



FODDER-CUTTER.

Cattle at first multiplied very fast in this country. Gov. Hutchinson of Massachusetts says, that, in 1632, no farmer was satisfied to do without a cow; and there was in New England not only a domestic but an export demand for the West Indies, which led to breeding for sale. But the market was soon overstocked, and the price of cattle went down from fifteen and twenty pounds to five pounds; and milk was a penny a quart. Virginia is known to have had a somewhat similar experience; for in 1639 she had 30,000 head of neat-cattle,

Rapid increase of cattle.

and only 20,000 ten years later. Maryland had so many, notwithstanding a loss of 25,000 by pestilence, in 1694 and 1695, that there was left a great plenty. Just before the Revolution, the cattle of the Carolinas and Georgia, rather small and neglected, were so plenty, that they were driven up to Pennsylvania to fatten for the butchers, and sold there for one and two guineas apiece.

Poor care taken of them in the beginning.

During the first twenty-five or fifty years of our colonial history, very little shelter or care was taken of the cattle in the winter time. The cows were not milked, there being a common belief that it would kill them at that season. No stables were built for them, especially in the Middle and South Atlantic States; and they wandered at large. No special fodder was given them, either; and they were obliged to pick up what they could on the roadsides and in the fields. Many a farmer lost twenty or thirty head from neglect every spring; and it is a matter of record that ten thousand head of cattle died in South Carolina, in the year 1731, simply from hunger and cold. From this same cause, pestilence, or the gradual decline of breeding, a scarcity was again noticeable in New Jersey and New England along toward 1700.

Hides the principal value of early stock.

The principal value attached to cattle for a long period of our colonial history was for their hides. The several assemblies enacted laws to encourage the tanning of leather, to prohibit its importation, and even regulate the shoemaking business. Farmers used to take their hides to a currier, have them tanned and returned, and then let itinerant shoemakers work them up into foot-gear for the family. Besides, there were tanners and shoemakers who did an independent business. Oxen were very extensively used, too, in hauling logs, ploughing, carting stones and farm-produce, and in other ways. Cattle were used almost exclusively for farm-labor in the colonial days, so scarce and costly were horses; and even in the present generation, in New England, working-oxen are very numerous.

Raising cattle for beef.

As the settlements grew in size, and cities began to develop, there sprang up a demand for cattle for beef. In 1651 the town of Fairfield, Conn., butchered 100 cattle. In New York, in 1678, 400 a year was the average number slaughtered; and in 1694 it was 4,000. In 1680 beef brought about twopence and a half a pound. The domestic dairy, too, was an important institution. The farmers all made a little butter and cheese for home use, and took a little to the cities to exchange for other merchandise. Butter was quoted at sixpence a pound in Connecticut in 1680. Quite a little cheese-business was built up too. There is a record of 13,000 pounds of cheese having been sold from one farm in Rhode Island in 1750; and on another farm seventy-three cows are reported to have yielded 10,000 pounds of butter in five months, or about one pound apiece per day.

Scientific breeding of cattle in England.

During the last half of the last century, and early in this, the business of breeding cattle on scientific principles developed very rapidly in England. Among the most prominent breeds that were then and have since been known there was the Durham, or short-horn. As the name implies, the horns are short; while the body looks very nearly square-cornered from the side, if one omits legs and head; and a hide colored a dark-red piebald. They run heavily to beef, for which they are chiefly prized; though special families have shown good dairy qualities. They need pretty good pasturage, however. The Devons are red, shapely, with medium-sized horns, a soft mellow hide, a tendency to fatten well, and a marked adaptation to work. The Galloways are chiefly known by their lack of horns, and are not so highly prized as some others. The Alderneys are light-red or yellow mixed with white in color, very dainty and graceful in shape, lightly built, well adapted to a thin pasturage, poor beef-producers and workers, but noted for the richness of their milk. The Jerseys, from the island of that name in the British Channel, are small, and of Norman extraction: like the Alderneys, they are greatly prized by dairymen. The Ayrshires, roan and piebald, are also highly esteemed as milk and butter producers. The French, Hungarian, Swiss, and Italian cattle have more or less of a reputation on the Continent, but, like the Andalusian fighting-bulls of Spain, are not so valuable for industrial purposes as the English stock, and have not been imported at all by American stock-raisers.

Durham.

Alderney.

Jersey.

Ayrshire.

Probably the short-horns, or Durhams, have been more extensively imported and bred with native stock than any other foreign breed; but, while numerous in the Eastern and Middle Atlantic States, they are far more common in the Ohio Valley. Almost the first pure short-horns imported were those brought to Virginia by a Mr. Miller in 1793, and to Maryland by Mr. Gough the same year. Mr. Patton took some of these cattle to Kentucky in 1797, and they were widely known in the blue-grass region as "Patton stock." In 1817 Col. Lewis Sanders of Lexington, Ky., imported three bulls and three heifers of the short-horn breed; and Capt. Smith soon had another bull and heifer of the same sort. From these pure stock was derived, and crosses made with the Patton stock; and the two were the parentage of the choicest Kentucky breeds. Very early in this century that section of the country gave great attention to stock-raising for the Eastern market, and Ohio followed Kentucky's example in improving her stock. Individuals made occasional importations prior to 1834, in which year a company was formed in the Scioto Valley for this especial purpose. The amount subscribed was $9,200, all of which was invested abroad in pure short-horns. The cattle were brought to the company's farm, and used at first for breeding, and then sold. Prices ran everywhere from $250 to $2,500; and very often the same animal would be sold again in a short time at a decided advance. The amount divided by the company three years after organization was $25,760.

Durhams most extensively imported.

Attention paid to subject in Kentucky.

This plan was imitated afterwards in Kentucky and other sections of the country. Short-horns were brought into Westchester County, New York, as early as 1792 and 1796. The breed was not kept pure long, though their descendants are recognizable to-day. Other importations were made into New York in 1815, 1816, and 1822, and still others more recently. In 1824 Mr. Powell of Philadelphia commenced importing short-horns, and continued to breed and sell them extensively for many years. In 1818 a short-horn bull, "Cœlebs," and a heifer, "Flora," were introduced into Massachusetts by Mr. Coolidge, and sold to Col. Samuel Jaques of Somerville in 1820.

Col. Jaques's experiments.

Selecting particularly fine native cows, Col. Jaques effected a cross with this bull, and developed a breed long kept pure, and called "Cream-Pots." They gave extraordinarily rich milk. Col. Jaques thus describes an experiment made with the milk of one of his cows by the foreman of his stock-farm: "After milking he took two quarts of her milk out of the pail, strained it into a pan, and allowed it to stand twenty-four hours. Having then skimmed the cream into a bowl, he churned it with a spoon; and in one minute, by the clock, he formed the butter. It was then pressed and worked in the usual way, and amounted to half a pound of pure butter. After this, the following practice was pursued for eight or ten weeks in succession: At each of four successive milkings two quarts of the strippings were strained into a pan, and then churned. The average time of churning did not exceed ten minutes: in some instances the butter was formed in five minutes. After being properly worked over it was weighed, and it never fell short of two pounds."

Stephen Williams's importations.

Stephen Williams of Northborough, Mass., imported a fine short-horn bull in 1818, which became the sire of much grade stock. Other short-horns were taken into that State in 1820. The breed like luxuriant pasturage, and have never proved very popular in New England.

Importation of short-horns since 1840.

Since 1840 short-horns have been imported in even greater numbers than ever before, and so numerously that specific mention is unnecessary.

Henry Clay's importations.

In 1817 the Hon. Henry Clay of Kentucky attempted to introduce the Hereford stock into that State. They yield less beef, but require less pasturage than short-horns, and are poorly adapted to the dairy. The enterprise never succeeded very well, and the stock was not kept pure very long. Admiral Coffin presented a Hereford bull to the Massachusetts Society for Promoting Agriculture in 1824. The animal was kept at Northampton, and left a numerous progeny. Five bulls and seventeen cows and heifers were imported by Messrs. Corning & Lotham of Albany in 1840. Other importations were added to this herd later. Animals of this breed have been introduced elsewhere; but they have never attained any marked prominence or popularity.

The Devons have been brought here and bred more numerously. The impression that the native New-England stock is of Devon extraction seems to be due to the fact that it is mostly red, and not to the possession of real Devon traits. The Massachusetts Society for Promoting Agriculture has imported some North Devons within the past thirty years; but while handsome animals, good graziers, and fine working-cattle, they have not shown the dairy qualities desired in New England. Mr. Patterson of Baltimore, before the middle of this century, had begun breeding Devons expressly for milk, and greatly improved his stock in this regard. The Devons are said to be the favorite improved stock in the South: but as the farmers of that section give little attention to beef-raising, the dairy, or even soiling, cattle-breeding has attracted less attention there than elsewhere; though the extensive breeding of native cattle in Texas forms an important exception to the general rule.

Importation of Devons.

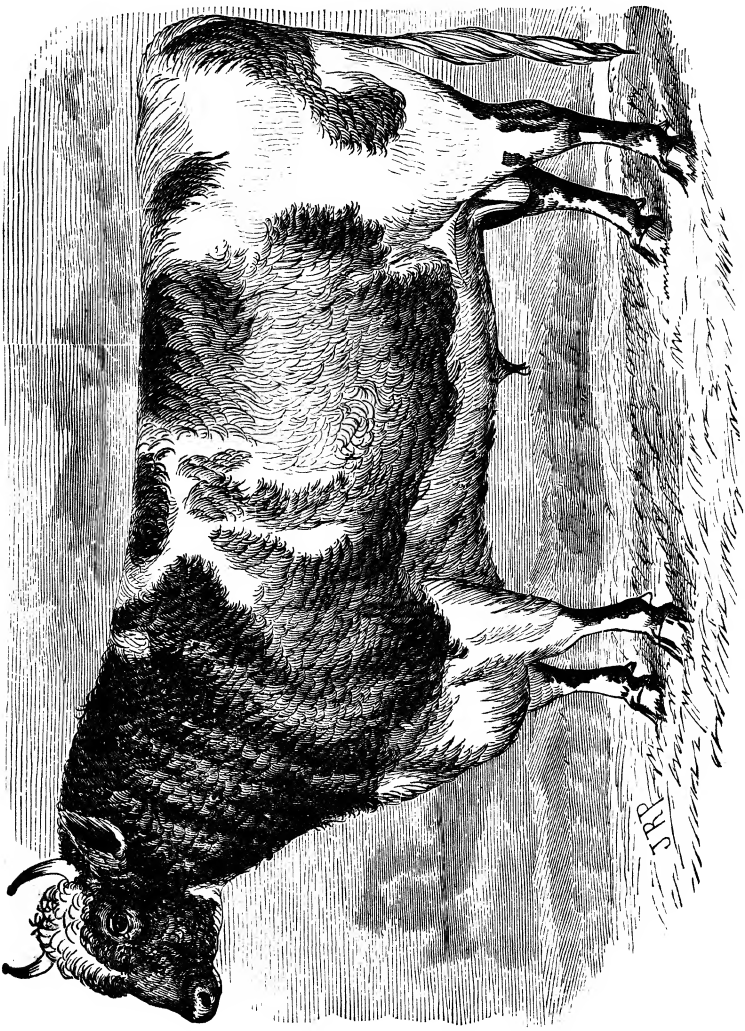
Alderneys, Ayrshires, and Jerseys have long been bred in the old country, with a view to developing their milk-producing qualities. They excel rather in richness than in quantity of milk, for which reason they are prized more by the butter-makers than by the cheese-manufacturers; although the Ayrshires are good milkers. A letter from Richard Mavis to the secretary of the Philadelphia Society for the Promotion of Agriculture, dated January, 1817, mentions a pure Alderney recently imported and owned by him, which so excelled in the richness of its milk, even upon poor feed, that he deemed it worth being published. This cow gave eight pounds of butter a week for a long period. Alderneys are great favorites with small farmers, and gentlemen living in small cities and keeping cows. Ayrshires have been introduced into New England and New York since 1830, and rather more extensively since 1850. So, too, with the Jerseys. Mr. John P. Cushing of Massachusetts imported an Ayrshire which gave 3,864 quarts of milk in a year, or an average of nearly eleven quarts a day for the whole twelve months. The Ayrshire generally makes a better return in milk for her feed than any other breed. The first Ayrshire imported by the Massachusetts Society for Promoting Agriculture yielded sixteen pounds of butter a week, on grass-feed, for several successive weeks. Grade Ayrshires are almost as valuable as the pure-blooded animals, and are consequently much sought after. Jerseys have been imported by the Massachusetts Society for Promoting Agriculture since 1850, and by individuals in New England, New York, and Maryland. In 1853 there were but seventy-five pure-bred animals in Massachusetts; but since then they have rapidly multiplied in that section, in the New-York dairy-regions, and elsewhere.

Qualities of several breeds of cows.

There have also been some slight importations of Galloways and Holsteins.

There has been rather more uniformity in the increase of the number of cattle in this country during the past century than in some other kinds of live-stock. The most marked development of interest of which we have data was between 1850 and 1860. We have no record of the number of cattle in 1840, unfortunately; and it was a little prior to that time that the great impulse in the beef-raising business began to be felt. The special start taken by the dairy-interest was not until later. In another chapter we consider the history of the cheese and butter business by itself.

Uniformity of increase in United States.



AYRSHIRE BULL.

The beef-producing industry is one of the largest and oldest-established branches of American agriculture. Beef is the great staple among fresh meats for the better class of people. As we have already remarked, the opening up of the extensive Ohio and Mississippi Valleys to emigration gave great impetus to stock-raising in those sections: so, too, did the improvements in our grasses and in the breeding of cattle; which latter influence, together with the growing custom of fattening cattle on corn, has increased the weight and value of our beeves very decidedly within the past few years.

Beef-producing industry.

It is almost impossible to estimate the value of milk consumed in the families of owners of cattle; nor is it necessary to describe the milk-peddling business of the smaller towns, with which every one is familiar. The consumption of this fluid in the larger cities necessarily creates a great demand, which must be supplied from the adjacent country. Such cities are provided with stables, where the cattle, in immense numbers, are fed on swill and distillery refuse. Of late years so great objection has been made to the milk produced, on account of its unwholesomeness, that greater pains are taken to obtain milk from the rural regions. This is now brought into town by railroad; the large cans which are placed on the morning milk-trains having been picked up along a route of fifty and a hundred miles, from all directions, in accordance with a preconcerted plan. The city agents return the cans next day to the owners; and thus a regular and extensive business is carried on.

Consumption of milk.

Before the great railroad era of the West, the cattle were brought eastward, to the more populous sections of the country, in large droves. After the quicker methods of transportation for other freights were provided, use was made of them for cattle. The railroads were put into requisition by the drovers all the way from Texas and the upper lakes to New York and Boston. The immense increase in stock in Texas was unattended with improvement in quality; but the cattle of the Ohio basin and other Western sections showed marked gain in weight and quality. In view of the vast pasturage to be found west of the Mississippi and Missouri Rivers, in the buffalo ranges, there is reason to believe that our cattle-interest is yet capable of great extension as the market therefor is opened.

Railroads and driving cattle.

Improvement of neat-cattle in Texas and other States.

Herewith we give a statement of the number of cattle in the United States for a few years past: —

	1850.	1860.	1870.	1876.
Milch cows	6,385,094	8,585,735	8,935,332	11,260,800
Oxen and other cattle . .	11,393,289	17,034,284	14,885,276	17,956,100
Total	17,778,383	25,620,019	23,820,608	30,216,900

From this it will be seen, that, between 1860 and 1870, there was a slight falling-off in the total number, although the dairy-interest held its own. The loss was chiefly in the States where the civil war raged. Meantime, in the other sections, there was a slight increase in the average weight. Since 1870 there has been a marked increase in numbers, the proportion being rather higher in milch cows than in other cattle. At the present time, New York has the largest number of cows,—1,526,200;[1] Pennsylvania comes next, with 845,300; Illinois, 724,900; Ohio, 700,000; Iowa, 665,300; and Texas just above, and Wisconsin just below, 500,000. Of other cattle, Texas has altogether the most,—3,390,500; Illinois ranks second, with 1,287,000; California, which has rather dropped the dairy-interest she took up twenty years ago, and gone to beef-raising, comes next, with 1,053,500; Iowa has 958,800; Missouri, 846,300; Ohio, 775,000; Indiana, 764,000; Pennsylvania, 701,000; and New York, 663,200. Kansas is the only other having over 500,000.

Increase in number in recent years.

As they stand, our cows are worth $27.32 apiece on the average, or $307,743,211 in all; the other neat-cattle are reckoned at $17.10 each, or $307,105,386: making a total capital, invested in this class of live-stock, of $614,848,597.[2]

Value of neat-cattle.

As will be seen from our chapter on the dairy-interest, our products in that department amount annually to $211,000,000. It is estimated that the average number of beeves killed between 1870 and 1875 in this country was at least 5,000,000 annually. Butchers estimate that beeves average 1,000 pounds live weight, and that the *five* quarters (the hide[3] and tallow count for a quarter) weigh three-fifths of that, or 600 pounds. This, at an average of seven cents for beef, hide, and tallow, makes a yield of $210,000,000. Mr. A. A. Kennard of Baltimore, of the statistical committee of the National Dairy Association, estimates the fresh-milk product of the country to be worth $250,000,000. If to these we add, at a venture, $79,000,000 for the condensed milk, fertilizers, and lampblack made from the blood and offal, the glue and bone material derived from the refuse, we shall have a total income from our neat-cattle of $740,000,000.

Value of dairy products.

A very interesting phase of our cattle-raising industry is the new export-trade begun in fresh beef. Europe, crowded with population largely engaged in manufacturing, naturally calls on us for agricultural food-products. We have sent her cereals, fruits, dairy-products, and smoked and cured meats, for many years. In 1875 the experiment of ship-

Export of beef.

[1] Figures of 1876.

[2] These are the figures of the commissioner of agriculture in his report for the year ending June 30, 1876. Mr. A. A. Kennard of Baltimore estimated the milch cows of the country to be worth $480,000,000 in March, 1878; and a like increase in the estimates for other cattle would make the total value of all neat-cattle in the United States little if any short of $1,000,000,000.

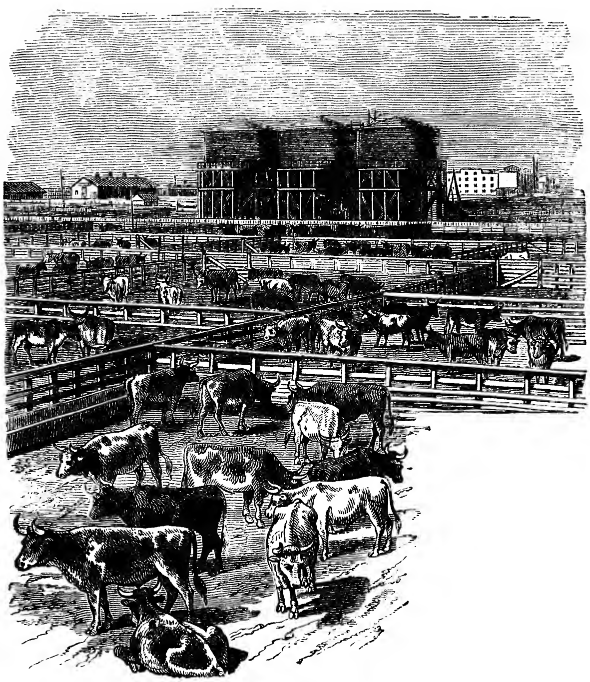
[3] The extent of our trade in hides we consider under the head of Leather, in the department of manufacturers.

ping fresh beef in refrigerators was tried; and so marked was the success attending it, that a rapid building-up of this particular branch of business has ensued.

The attempt was first made to satisfy the demands of growers and shippers for an enlarged market and higher prices for fresh beef. Yankee ingenuity and the Yankee spirit of adventure soon found a way to meet this demand.

History of the business.

On the 11th of February, 1875, John J. Bate of New York shipped twelve quarters of beef, twelve sheep, and six hogs, to Liverpool by the steamer "Baltic." The meat was kept cool and fresh by fan-blowers operated by hand. It arrived in good condition; and the attempt was renewed in June and August on a larger scale, the fans being operated by steam. Taking the business off Mr. Bate's hands, Mr. Timothy C. Eastman undertook the enterprise systematically in October of that year, when he exported forty-five cattle and fifty sheep. In December he doubled the number of beeves, and since then has steadily increased the quantity, and made weekly shipments.



CHICAGO STOCK-YARDS.

Mr. Eastman ships to Queenstown, Glasgow, and Liverpool, where arrangements have been made for sending it to his markets in Dublin, London, Manchester, Sheffield, Birmingham, Leeds, Newcastle, Dundee, and Edinburgh. He keeps the meat fresh by a process invented and patented by Mr. Bate. Special refrigerators are constructed between the decks of the steamships of the Williams and Guion, White-Star, and Anchor Lines; and a fan-blower run by steam keeps the inside air in constant circulation around the meat. The quarters are neatly wrapped in canvas, and kept in "chilling-houses," or large refrigerators, before shipment;

Mode of shipping beef.

and, when put aboard the vessels, the temperature is kept down to thirty-eight degrees, or six degrees above freezing. The cold to which the meat is subjected at first closes the pores, or sears it, so that it is not as susceptible to heat and taint as freshly-killed meat. Not a single quarter of the many Mr. Eastman has shipped has arrived tainted. It also looks as fresh and bright as newly-killed beef, nor does it lose any of its flavor.

Gillett & Sherman, another large New-York shipping-firm, prepare their beef on the New-Jersey side of the river, and use a different process. They send by the Cunard, Inman, and National Lines. Samuels & Company and Daniel Toffey & Company are also shipping from New York on a smaller scale. Philadelphia and Portland are following New York's example.

Prices realized in foreign markets.

This beef sells in foreign markets at sevenpence and eightpence a pound; which is twopence, threepence, and fourpence below the price of home-raised beef in England. Its introduction, therefore, caused a profound sensation; and the British butchers combined to stop the importation, but without success. The Queen, the Prince of Wales, the Lord-Mayor of London, the Governor of the Bank of England, and the leading press, have tried the American beef, and declare it fully equal to that raised at home.

Amount and value of shipments.

An idea of the sudden growth of this business may be derived from the fact, that in October, 1875, the shipments of fresh beef amounted to 36,000 pounds; the next October they aggregated 2,719,685 pounds; while for the month of March, 1877, they were 6,707,855 pounds. For the year ending Dec. 31, 1877, they were 55,362,793 pounds, valued at $5,244,668.[1]

Export of live-stock.

Following up their success in this line, stock-dealers have also undertaken the shipment of live cattle to Europe; and it is thought the experiment will prove a success. Prior to the winter of 1877 beef-cattle had not been shipped to foreign countries from the United States on account of the expense, the risk incurred, and the monopoly of the Eastern markets by European stock-raisers. Canada, however, has been exporting live-stock to the mother-country for some time, and with such success, that New-York and Philadelphia merchants are now trying the experiment. The shipment of live-stock across the ocean has made necessary the construction of apartments on vessels quite different from any thing heretofore in use. Portable stalls, in which the cattle are fastened, have been specially made, so arranged as to give room for eating and drinking, and to be movable, with the cattle in them, to different parts of the vessel. The stock is thus brought upon deck for several hours each day, and given the benefit of the fresh sea-air. The new arrangement is strictly an American invention, and its friends

[1] If to these figures one adds $2,847,447, the value of salted beef, $4,527,452 for butter, $13,529,978 for cheese, $122,343 for condensed milk, $1,848,555 for hides, $6,513,569 for tallow, and $19,356 for glue, he will find that our bovine product exports amount to about $35,000,000 annually.

are confident that its introduction will open Europe and every part of the globe as a market for the stock-raisers of America.

While science has thus triumphed in transporting fresh meats for a long distance, it has also won another victory in preserving them for a very long period, and in so compact a form as to be easily transported all over the world, thus economizing vastly the sources of supply; inasmuch as thousands of cattle were formerly slaughtered in South America, Australia, and Texas, for their horns, hides, and tallow, while their flesh was lost, because no way was known of preserving it. This problem of keeping meat for a long time is an old one among scientists, and Professor Liebig's "extract of beef" has been followed by numerous imitations. The chief objection to Liebig's "extract of beef" and its imitations has been, that it could be used only in liquid form. It is only recently that the preservation of solid meats has been possible. A New-York company has a unique process for this purpose. The beef, or other meat, is first dried by a patent blowing and steam-evaporating process, after the removal of all bone, and fatty or gristly substances. It is then packed in extremely thin slices, which will retain their good qualities for an unlimited period in any climate. In fact, nothing remains in the meats that can decay. A quarter of a pound of it is equal to a pound of solid meat.

Compressed meats.

The manufacture of compressed cooked meats is a new industry in this country. It began two years ago, and has now assumed almost gigantic proportions. England has received cooked meats from Australia for twenty years; but the process there differs greatly from the American method. The American meats, however, bring better prices in England to-day, and bid fair to outstrip all foreign articles. About 750,000 cans per month are produced by the two American houses, and from 3,000 to 4,000 cattle per week are slaughtered in Chicago for this purpose. For the canning of corned-beef and beef-tongues only the best materials are selected, tough and stringy parts being discarded. The Western States naturally lead the way in this industry, as they are nearer the main sources of supply and the fertile grazing-lands of the North-West. The live animals are brought to Chicago, and, after inspection, are slaughtered in the abattoirs of the company. The carcasses are cut into the required weight, and the bone, sinew, and gristle eliminated. After another inspection, the meats are ready for the curing process. The best portions of the meat are exposed to the action of steam in immense wooden vats. Metal vats would be very undesirable, on account of the liability to mineral poisoning. The beef is then packed in strong tin cans of various sizes, containing two, four, six, and fourteen pounds each. They are hermetically sealed, and the contents will keep pure and fresh in any climate for many years. They have none of that musty flavor which was formerly inseparable from canned meats, and retain their flavor a long time after being removed from their metallic envelops. The Australian method of can-

Mode of manufacture.

ning differs from the American in this, that the former cooks the meat whole in cans, while the latter cooks it in small pieces in wooden vats, as already described. The Australian cans often present a peculiar appearance after the cooling process, as the sides are sometimes contracted, and look as if they had been subjected to pressure. The extent of the American industry is also shown in the number of employees, the salaries, &c., of a Chicago firm. In one establishment 7,000 men and 150 girls are employed, and the pay-roll is $30,000 a month. The floor of the packing-house covers four acres. The refrigerator will accommodate 3,330,000 pounds. Five boilers, with a capacity of 80,000 pounds, are used for rendering tallow from marrow, and five for furnishing steam for cooking and the elevators.

Export of compressed meats.

Cooked meats by the Australian method have been known in America for twenty years; but the process is very imperfect. Owing to its inferiority, the sales of those meats have been poor. The demand for compressed cooked meats, on the contrary, has been so great, that there is a prospective business with governments in supplying them with this article. It is hoped that something may be accomplished in the way of supplying the European belligerents. Large invoices are now sent to London, Liverpool, Glasgow, Belfast, &c. Germany and France do not buy them as readily yet as Great Britain; but the promise is good of a large trade eventually in those countries. "The London Grocer" stated recently, that, during one week, 11,270 cases of packed meat were received at Liverpool from America. Each case contained twelve cans, making a total of 135,240 cans. This, however, is an average estimate, as one house in this country has frequently sent out 20,000 cases per week.

CHAPTER XI.

BUTTER AND CHEESE.

THE history of American dairying was a comparatively quiet and uneventful one until the middle of the present century, and progress was comparatively slow in its development until about that time. As we have already remarked in discussing neat-cattle, our stock was of poor quality during the last century, and its improvement not fairly inaugurated until 1825–50. The earlier efforts at improvement, too, were directed rather to the perfection of our beef than to increase the quantity and quality of the milk. The importations of foreign breeds were mostly of short-horns until 1850. A little before that time the importation of Ayrshires, Jerseys, and Alderneys, was undertaken. During the next decade the dairy-interest was confined mostly to New England and the Middle States, with a little activity in the North-West. Not until the conception of the modern cheese-factory system, and the demonstration of its marked success, did the West give much attention to the subject.

Slow progress in beginning.

Cheese is altogether the older of the two sister-products of the dairy; and its first manufacture, more or less crude, began away back in the obscure past. It was a recognized article of food with the Greeks and early Romans, to whom butter was known only as an ointment for the toilet, not as an article of diet. Even yet, in many parts of Europe, butter is sold by apothecaries as a vegetable oil for medicinal preparations, though not used exclusively for such purposes by any means. Unsalted butter, too, is used to a great extent by Europeans. The practice of salting it — doubtless intended originally for preserving it, but afterwards resorted to for the taste — seems to be more of an English and American custom. Partly from the nature of the two preparations, and partly because of the greater attention given to cheese-making, this article is found in far greater variety in Europe than is butter; and many of the delicate and peculiar varieties of foreign cheese have been unequalled by any American product for flavor, whereas no butter in the world surpasses that of our dairies.

Cheese.

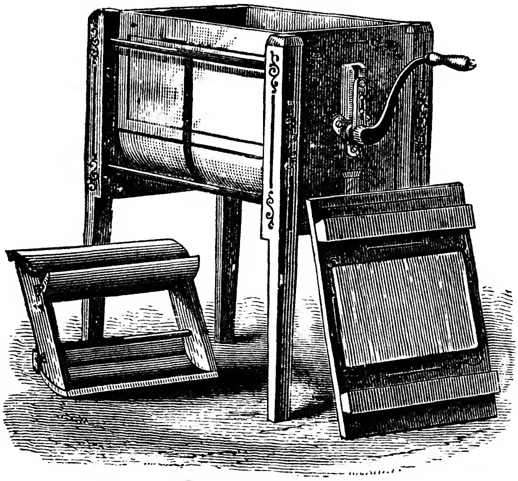
Until about 1830 cheese was made in this country by the farmers exclusively, and generally in their own farmhouses, in small quantities. The cheeses were taken to the neighboring village or town, and exchanged for groceries or dry-goods, without any thought of the trade with large cities, or the export business. If, in the course of the season, the housewife made more than a dozen cheeses of thirty or forty pounds each, she thought she was doing unusually well. However, the demand for this product continually increased among the working-classes at home and abroad; and our export trade, chiefly with England, began as early as 1790.

Early history of cheese-making.

First exportation.

Progress in cheese-making.

Along toward 1830 the profits to be realized from cheese-making, which was more remunerative than any other branch of agriculture in the Middle and Eastern States, began to be realized. In Herkimer County, New York, a change began to take place in the methods of manufacture which had been formerly in use. The herds had been milked in the open yards, the curds were worked in tubs, the cheeses squeezed in rude log-presses, and laid away to cure in a corner of the cellar or of some "spare room." But now more system was employed; and apartments, and even separate buildings, were constructed on the farm expressly for this work. A contributor to "Harpers' Magazine" says of this stage of the industry's development, —



CHURN.

"The face of the county (Herkimer) became dotted with dairy-houses as with corn-cribs. These were, for the most part, simple, unpretentious one-story structures, distinguished from the other out-buildings by closely-battened cracks and protruding stovepipe. The apparatus was simple and rude, and the system of manufacture a family's secret, imparted with wise looks and an oracular phrase. Skill was vested in intuition: it was the maiden's dower, the matron's pride. . . . It was during this period of severe application and large rewards that Herkimer County achieved that reputation for fancy cheese which is still her traditional right."

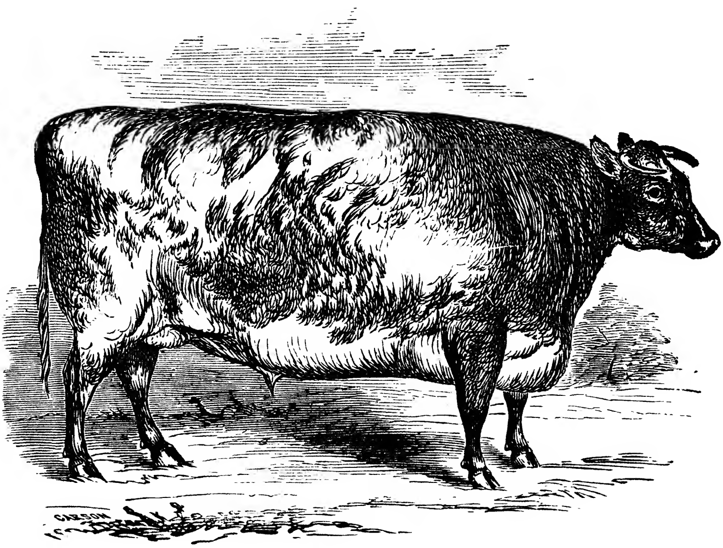
Herkimer County.

Cheese product prior to 1850.

An idea of the distribution of the cheese-production at the end of twenty years of this experience may be gathered from the following statement of the cheese production, in pounds, from the census of 1850: —

New York	49,741,413
Ohio	20,819,542
Vermont	8,720,834
Massachusetts	7,088,142
Connecticut	5,363,277
New Hampshire	3,196,563
Pennsylvania	2,505,034
Maine	2,434,454
Illinois	1,278,225
Michigan	1,011,492
Other States	3,366,917
Total	105,535,893

From this it will be seen that New York made nearly half of the country's product; and that, except Ohio, the New-England States were the only others that yielded any considerable quantity. The only other State besides the above-named which made over half a million pounds was Indiana, which is credited with 624,564 pounds.



SHORT-HORN BULL.

It was just at this time that the factory system was invented, which, being widely imitated, gave so great a stimulus to the business. It may be remarked in this connection, that not only in this country, but also in Europe, was the "American system" adopted. The cheese factory is the gift of the New-York dairymen to the world.

Factory system devised.

There lived in Oneida County, New York, near Rome, a gentleman named Jesse Williams, who had achieved a great reputation for his cheeses; and at that time reputation was money, for it brought higher prices for dairy products. In 1851 one of his sons was married, and went to live at an adjacent farm. For the sale of his son's cheese product, Mr. Williams contracted with the marketmen at the prices he obtained for his own. But the question arose, how he should insure its quality. At first he thought of going to his son's house every day to superintend the "make;" but this was impracticable. Accordingly, he proposed that the milk be brought to him. It is always the case, in enlarging a manufacturing business, that the cost of production is proportionately lessened; and, if the price of the goods be maintained, the profits are augmented. A few of Mr. Williams's neighbors brought milk to his establishment for three years, and realized these advantages; and then the value of the system began to be appreciated, and similar factories were built elsewhere. But up to 1860 there were not more than twenty of them in operation.

Jesse Williams.

The influence of the factory system was not perceptibly felt in 1860; for the total product of that year was a trifle less than that of 1850. Only a slight shifting in its distribution was discernible. New York showed the most trifling falling-off in her production: so, too, did the New-England States. While there was a corresponding increase in the Ohio basin and the North-West, Wisconsin and California showed a marked development, but one of promise rather than attainment.

First effect of factory system.

During the next decade there was a tremendous springing-up of factories. Knowledge of the system had then been well disseminated. Enterprising farmers in every dairy district organized for tbe purpose of building a factory. The economy of the plan was apparent. They would bring their milk in large cans every morning, or else put them where the factory team could pick them up on its rounds. Contracts were made for so many pounds of cheese for so much milk, and an allowance of so many cents per pound for the season's "make." A strict account of each day's milk-deliveries was kept, and suitable tests and regulations resorted to in order to prevent watering, or otherwise impairing the quality of the milk. The prosperity of one factory being noticed, often a rival establishment would be erected in the same neighborhood. By 1866 New-York State had more than 500 factories, and in 1870 they numbered 1,313 in the whole country. While the total product had increased, in round numbers, from 105,000,000 to 163,000,000 pounds, all but 53,000,000 of it was made in factories, and the rest on farms as of old. As will be seen from a comparison of the following table with the last, the increase in the aggregate was confined almost to the increase in New-York State; and the slight gains in the West were made at the expense of New England mostly, Vermont holding her own better than her sister States.

Rapid increase of factories.

Mode of operating them.

STATES.	NO. FACTORIES.	POUNDS FACTORY-MADE.	POUNDS FARM-MADE.	TOTAL PRODUCT.
New York	818	78,006,048	22,769,964	100,776,012
Ohio	195	15,984,390	8,169,486	24,153,876
Vermont	28	2,984,179	4,830,700	7,814,879
Illinois	69	4,072,301	1,661,703	5,734,004
Massachusetts	23	1,885,436	2,245,873	4,131,309
California	..	....	3,395,074	3,395,074
Wisconsin	54	1,696,783	1,591,798	3,288,581
Pennsylvania	27	1,647,467	1,145,209	2,792,676
Michigan	30	1,650,997	670,804	2,321,801
Connecticut	7	27,400	2,031,194	2,058,594
Iowa	14	256,906	1,087,741	1,344,647
Maine	..	....	1,152,590	1,152,590
New Hampshire . . .	2	23,250	849,118	872,368
Indiana	17	107,680	283,807	391,487
Other States and Territories .	129	893,272	1,557,090	2,450,362
Total	....	109,435,229	53,492,153	162,927,382

In 1877 the total cheese product of the country was estimated at 300,000,000 pounds, or nearly twice that of 1870. The increase is largely due to the further extension of the factory system, though, in a measure, to **Cheese product in 1877.** our export demand. The total value of our cheese product annually is now about $36,000,000.

Although reliable data are not accessible, it is probable that cheese was exported from this country previous to the Revolution. Since then there has been a constant though varying export trade in this commodity. **Export of cheese.** Europe continually seeks food supplies here; and, with facilities for producing more than we need at home, we are easily enabled to sell abroad. Our cheese goes almost altogether to Great Britain, whose working-men use it, with bread and beer, as one great staple of their diet.

In 1790 we exported 144,734 pounds of cheese. Five years later the amount was abnormally large, — 2,343,093; for the average from 1795 to 1805 was only about 1,400,000; and thereafter the figures did not reach **Statistics relating to exports.** 1,000,000, except in 1819, 1825, 1831, and 1833, until 1841, when the export was 1,748,471 pounds. This was at the time the Herkimer-county product was becoming so famous. During the next eight years the figures increased very rapidly; and in 1849 they were 17,433,682, — tenfold the export of 1841. A slight subsidence ensued in the trade, and for eleven years the average export was about 8,360,000 pounds. Since then they have been as follows: —

	POUNDS.
1861	32,361,428
1862	34,052,678
1863	42,045,054
1864	47,751,329
1865	53,089,468
1866	36,411,985
1867	52,352,127
1868	51,097,203
1869	39,960,367
1870	57,296,327
1871	63,698,867
1872	66,204,025
1873	80,366,540
1874	90,611,077
1875	101,010,853
1876	97,676,264
1877	112,430,384

Our principal rivals in the European market now are Canada and Australia. Yet we are able to dispose of more than a third of our product yearly at good figures, and have little occasion to worry about competition.

But little attempt has been made in this country to manufacture the more delicate and richer cheeses for which the Old World is so famous: instead, there is a great temptation to rob the cheese of part of its richness for butter. Probably there is more skim-milk cheese made here than cheese from the unskimmed. Within a few years, attempts have been made, though with slight success, to introduce into the skim-milk the clean fat from which an imitation of butter is made; namely, oleo-margarine. The object is to restore an animal oil to replace that of the cream. It is found, however, that the skim-milk does not take up the oleo-margarine readily, and very little such cheese is made or marketed.

Quality of cheese.

The history of American butter-making is rather less eventful than that of cheese-making. In quantity, we produce, perhaps, three times as much butter as cheese, although provision-dealers pretend to say that the census returns of butter-making fall short of the true yield. Butter is consumed in much larger quantities, but probably by a smaller number of people in the country, than cheese. Its use is by no means universal.

American butter-making.

Among the several reasons why this particular dairy-interest has had so equable and quiet a growth in this country, the most conspicuous are the want of any marked improvement in the apparatus for making butter, the less attention given to the foreign market, and the greater difficulties of insuring excellence in the quality than in the manufacture of cheese.

Little improvement in mode of making.

From pre-Revolutionary times until to-day the churn principally used in the United States has been the dash-churn, originally small, and operated by hand, afterwards run by dog-power treadmill, and, in regular creameries of the modern day, by steam, yet substantially the same in principle. American butter, in lots, has proved as choice as any made in any other quarter of the globe. But makers have not studied uniformity in quality, so that our exports could have a fixed standing. This variability is strongly complained of by foreign produce-buyers; and, by not remedying the evil, American dairymen have failed to make as much as they might of the foreign market. Finally, butter-making, which involves a number of fine points, has never been reduced to a science until comparatively a few years ago.

Butter-making not a science until recently.

In the first place, it was not until 1830 or 1840 that cattle were imported or bred with a special view to dairy-purposes to any great extent. Since then there has been much done in this direction. Probably it has not been fairly realized, until a later date, that the character of the fodder which cattle receive makes a difference with the flavor and richness of their milk, as does also their health. It is a matter of comparatively recent discovery that the milk of different cows varies not only in richness, but in quickness with which its butter comes in churning, and that great care should be exercised in mixing milk, lest the fullest product be not obtained. The importance of ventilation in apartments where milk is set, and of keeping the contents of the churn at just the right temperature, have not been understood until quite recently. Still, now that the factory system — originally devised for cheese-making, and employed to a far less extent for butter — has become fairly established, we may look to see a more wide-spread application of scientific principles to the industry.

Improvement in animals for making butter, and mode of keeping them.

In the earlier part of the present century butter and cheese making were principally conducted in the New-England and Middle States, although the South and West engaged in it a little. Ohio was among the earliest to attain prominence in the latter section. At first the Western breeders aimed solely at beef. Toward the middle of this century they gave more attention to dairy products, to the good quality of which the nutritious and delicious grasses of that section were peculiarly adapted. Consequently there has been a marked development in the business of making butter in the West and North-West for twenty or thirty years past; while, with the exception of New York, Pennsylvania, and Vermont, there has been no particular gain in the East. Indeed, New England has lost ground, on the whole, as have Kentucky and Tennessee. The distribution and movement of the industry will appear from the following table: —

Part played by the East and West in this industry.

STATES.	1850.	1860.	1870.
New York	79,766,094	103,097,280	107,147,526
Pennsylvania	39,878,418	58,653,511	60,834,644
Ohio	34,449,379	48,543,162	50,266,372
Illinois	12,526,543	28,052,551	36,083,405
Iowa	2,171,188	11,953,666	27,512,179
Michigan	7,065,878	15,503,482	24,400,185
Indiana	12,881,535	18,306,651	22,915,385
Wisconsin	3,633,750	13,611,328	22,473,036
Vermont	12,137,980	15,900,359	17,844,396
Missouri	7,834,359	12,704,837	14,455,825
The Virginias	11,089,359	13,464,722	12,023,744
Kentucky	9,947,523	11,716,609	11,879,978
Maine	9,243,811	11,687,781	11,636,482
Tennessee	8,139,585	10,017,787	9,571,069
Minnesota	1,100	2,957,673	9,522,010
New Jersey	9,487,210	10,714,447	8,266,023
California	705	3,095,035	7,969,744
Connecticut	6,498,119	7,620,912	6,716,007
Massachusetts	8,071,370	8,297,936	6,559,161
Other States	38,531,280	53,761,623	45,913,512
Total	313,345,306	459,681,372	514,092,683

It is believed, that, within the past few years, our annual product of butter has been raised to 900,000,000 pounds, but not by any sudden leap. It is believed, rather, that the figures of 1870 should be larger than in this table. The estimated value of the total product annually is now about $175,000,000.

Value of product.

Butter varies greatly in quality, according to the season and locality in which it is made; and, as some of the poor winter butter is often adulterated with lard, the inferior grades generally called cooking-butter are sometimes little better than soap-grease. The choicer makes of grass-butter, on the other hand, are rather rare, and much sought after. Some dairying States that produce small quantities have excelled in quality. New-England butter has always had a high rank, especially that made in Vermont. In New-York State, Orange County long held the palm; but the other large producing counties — St. Lawrence, Delaware, Jefferson, Chatauqua, Chenango, and Otsego — have also good reputations. Pennsylvania butter, especially that made near Philadelphia, has generally stood high. Even after the Western States became large producers, their product did not bring as good a price; but of late years the quality has very decidedly improved.

Quality of butter.

Export.

Our butter exports have not amounted to much until within a few years. In 1872 they amounted to but 7,746,261 pounds: in 1877 they aggregated 23,150,614, and were worth $4,527,452. This, added to the value of the cheese export, makes $18,057,430.

Within the past five years the manufacture of an imitation of butter, called *oleo-margarine,* has attained sufficient prominence to deserve mention in this connection. We have already spoken of the attempts to replace the natural oil of cream with other animal fat in making cheese from skim-milk. That practice is resorted to only to a limited extent, and in such cases the suet-fat introduced constitutes only a small proportion of the article produced. The substitution, however, is complete in the manufacture of artificial butter, inasmuch as this substance is all fat, and not caseine. Moreover, the business is carried on to a much greater extent than the production of oleo-margarine cheese.

Oleo-margarine.

The idea seems to have originated in England over thirty years ago. In 1846 one William Palmer took out a patent for "treating fat or fatty matters from beef, mutton, veal, and lamb:" but the product obtained was quite unlike butter in color and taste; it looked more like lard. The first patent taken out in this country was issued in 1871 to H. W. Bradley, and the second to one Peyrouse in the following November. These both employed beef-suet chiefly, and were intended rather for cooking than for use on the table. The next improvement was that embraced by the Paraf patent, in April, 1873.

Origin of it.

The product of this process is called oleo-margarine, from the supposition that its two elements are oleine and margarine. The so-called margarine, however, is resolvable into stearine and palmitine; and, besides these, the new product contains butyrine, one of the oils of true butter, in a small degree. The manufacture is conducted secretly, but is said to be exceedingly cleanly. Its prominent features are the extraction of clear fat from clean beef-suet, and churning it with milk. No coloring-matter is used, inasmuch as the substance is already orange-hued. It is, of course, salted like ordinary butter. In appearance it differs from real butter only in being less waxy, and in taste chiefly in the absence of flavor. Indeed, the resemblance is so strong, that only experts can distinguish between the two compounds.

Constituents of oleo-margarine.

There are two kinds of oleo-margarine. The first may be called the "original and genuine." In making it the oil is adulterated with just enough cream to allow of its being churned, the proportion of cream to oil being about one to twenty. The "original and genuine" is made in large factories operating under the Mege patent. Butter-dealers claim to be able to distinguish this article from dairy butter quite readily, lacking as it does the "texture" of the latter. The second kind is that in which the oil has been largely adulterated with cream, — perhaps with fifty or sixty per cent of cream. This kind is made by country dairymen, and, it is believed, in considerable quantities; and to detect its composition baffles the skill of any except the most experienced dealer.

Two kinds of oleo-margarine.

A Philadelphia correspondent of one of the New-York newspapers [1] describes seeing half a ton of "ole" in the Quaker City, fresh from New York, and labelled "Philad à Best Print." He says it looked exactly like the best butter coming to that market; but it was made of any thing except pure cream. It tasted a little like butter; but when one thinks of fat and stearine and suet, and a shade of tallow, what would be his thoughts when spreading it on a piece of bread?

First appearance of "ole" in Philadelphia.

It is prepared in long flat rolls of a pound each, a shape so well known by the lovers of butter made in the counties of Pennsylvania. The Produce Exchange are frightened about this new-comer, and have taken up arms against it. While they fight, an agent has been appointed, and it will be sold in spite of all opposition. What the proportions of grease exactly are the correspondent did not know: but there is at least a candle of tallow in every pound; so that, when one eats his penny-dip, he may expect a double portion of the Quaker's "light within." The New-York stockholders in the new company say they can, with their present facilities, turn out seventy thousand pounds per day. It is intended for the European market; but the first batch turned up there, perhaps for the sake of getting references. In appearance it cannot be distinguished from the very highest-priced butter; and, though this is sold for about ten cents per pound less than the best and genuine, it certainly cannot cost more than twelve cents per pound.

The success of this latest experiment has led to the manufacture of oleomargarine in New-York City on a large scale, and the institution of lesser factories under the same patent in other cities. Inasmuch as the article can be produced so much more cheaply than butter, it proves a formidable rival to the real dairy product; and the dairymen have secured the enactment of laws in New York and Connecticut, as they doubtless will in other States before long, requiring oleo-margarine to be sold as such, and not as butter. Upon the first announcement of this industry, popular prejudice rose high against it; but the new compound is already manufactured and consumed to a very great extent, — probably not short of two million pounds annually.

Success of the industry.

[1] Journal of Commerce.

CHAPTER XII.

THE HORSE.

NOWHERE in the world is the horse prized so highly as in Arabia, and nothing expresses an Arabian's admiration for the animal more clearly than the story told by an Arab concerning his origin. When Abd-el-Kader was questioned on this point by the French Government, he replied, "When God wished to create the horse, he said to the south wind, 'I wish to form a creature out of thee: be thou condensed.' Afterward came the angel Gabriel, and took a handful of that matter, and presented it to God, who formed of it a light-brown or sorrel horse, saying, 'I have called thee Horse. I have created thee an Arab, and I have given thee the color rouenenita (red mixed with black). I have bound fortune upon the mane which falls over thine eyes. Thou shalt be the lord of all other animals. Men shall follow thee whithersoever thou goest. Good for the pursuit as for flight. Thou shalt fly without wings. Riches shall repose in thy loins, and wealth shall be made by thine intercession.' "

Horse of Arabian origin.

Fossil remains prove the existence of the horse in the New as well as in the Old World before the flood. He traversed our soil as the contemporary of the mastodon. While his race here became extinct, and he was unrepresented in the Western Continent at the time of its discovery by Columbus, in the Old World he was fortunately preserved.

Geological age of horse.

When Columbus made his second journey to the New World, in 1493, he took horses along with him; but Cabeça de Vaca first introduced them into the United States in 1527. Forty-two were imported; but all perished soon after their arrival in Florida. The wild horses found on the plains of Texas and the Western prairies sprang from a Spanish ancestry, and probably descended from those brought over by De Soto, which were abandoned when that ill-starred expedition came to an end. In 1604 a French lawyer, M. Lescarbot, brought over horses to Acadia; and from these 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 in conse-

Importation of horses by Columbus.

quence of the severity of the climate and scanty forage. Though degenerated in size, they still show traces of Norman blood, from which they probably sprang.

Many improvements have occurred in the horse since his re-appearance in this country. The changes wrought, especially during the last fifty years, have been marvellous; yet may they not be regarded as indications only of other and still more important improvements, when a still higher degree of knowledge is acquired respecting the rearing and training of them? It is a striking proof of what may happen to animals under domestication; and, however great or small may be the quantity of truth contained in Darwin's famous law concerning the origin of animals, no one will deny the magnitude of the changes wrought in the horse in respect to his size, speed, strength, and other qualities, since special attention was paid to these matters, nor question the agency by which these results have been produced. Great attention has been given to this subject during the last fifty years, which we shall now proceed briefly to sketch.

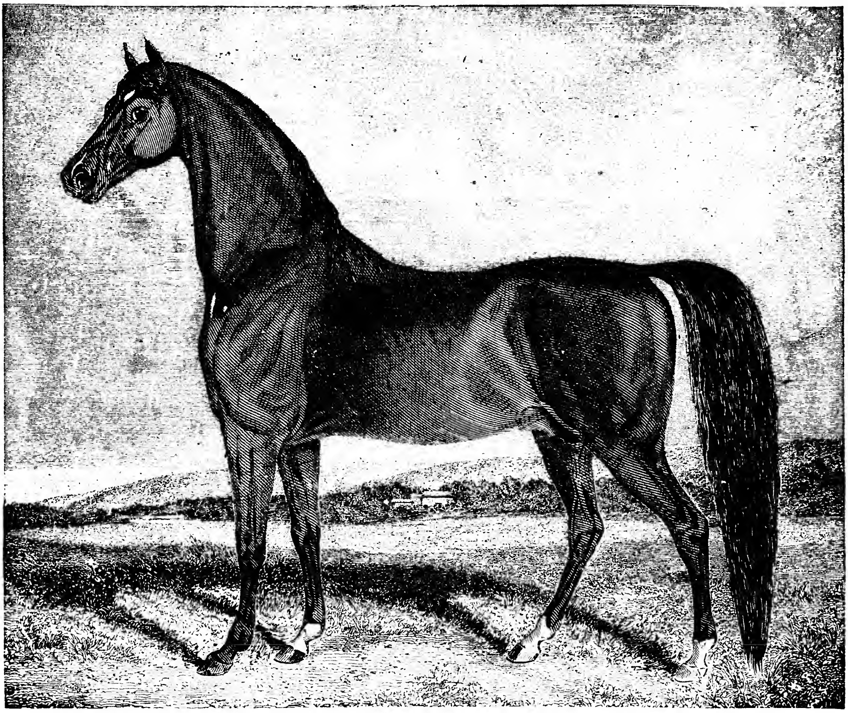
Improvements in the horse.

THE TROTTING-HORSE.

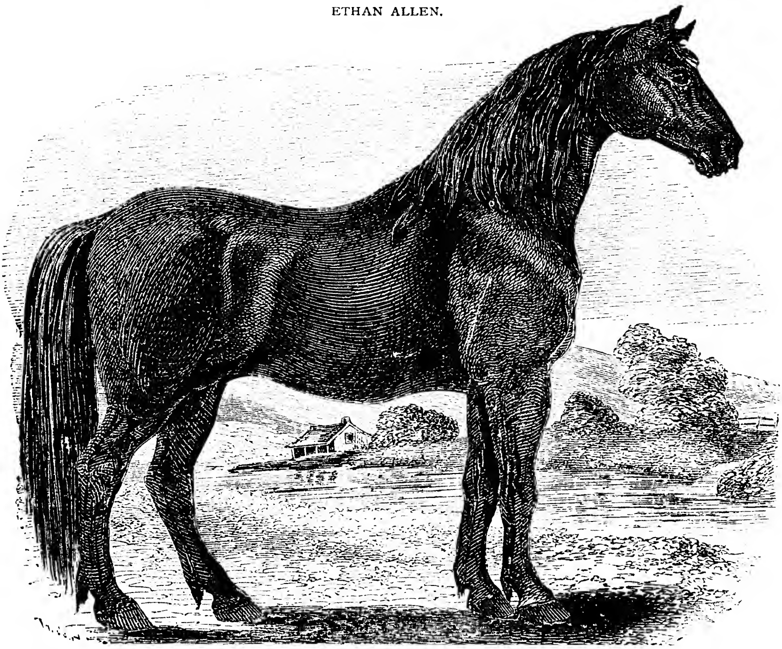
The trotting-horse is very largely the product of American thought and cultivation. Trotting, in most cases, is an acquired gait; nor has much attention been paid to it until within sixty-five years. The ancestry of the trotting-horse, however, goes farther back. Messenger, from which many of the fast horses in this country have descended, was imported into Philadelphia from England in May, 1788. Messenger was thorough-bred, and, prior to his importation, ran races on the English turf with moderate success; and without doubt it was the intention of those who brought him to this country to make him the sire of horses that should gallop rather than trot. His father, Mambrino, evinced a natural disposition to trot; and this trait was inherited by many of his progeny. Messenger was trained for the running turf in England; and in 1788 the running horse was popular in certain sections of America, and hence the inference is clear that he was imported. His color was gray, and he was fifteen hands and three inches high, and the colts which were sired by him showed fine form. In Pennsylvania, however, — into which State he was first imported, — the legislature passed a law prohibiting racing; and so the progeny of this famous stallion was trained for the road instead of the track. In the autumn of 1793 Messenger left Pennsylvania for New York, where he remained until 1808, when he died of the colic at Oyster Bay, L.I. As he had long been famous and popular, he was buried with military honors, a volley of musketry being fired over his grave.

Messenger.

As the trotting-horse was not fashionable at that period, the record is not very perfect concerning the descendants of this famous horse. "Many of the



ETHAN ALLEN.



CONESTOGA HORSE.

Early trotting-horses.

earlier horses which won distinction on the track — such as Top-Gallant, Paul Pry, and Whalebone — are known to have descended from him. Abdallah, the son of Mambrino, and the grandson of Messenger, proved to be one of the best trotting-sires that the country has produced. The horse, however, was not much appreciated in his time. His best daughter, probably, was Lady Blanche, a mare that acquired celebrity on the road and turf, and which lived to a green old age, and literally died in the harness. It is claimed, that, with proper care, she would have trotted very fast. Thirty and forty years ago the art of training and driving had not been reduced to a science as now. Abdallah's best son was the horse now so widely known as Rysdyk's Hambletonian. Through sire and dam, Hambletonian has four direct courses of Messenger blood. As he is a leading progenitor, perhaps a tabulated pedigree will interest the reader. This one pedigree will illustrate the manner in which the record of equine genealogy is kept."

- Rysdyk's Hambletonian
  - Abdallah
    - Mambrino
      - Messenger.
      - Dam
        - Sauerkraut.
        - Dam
          - Whirligig.
          - Miss Slamerkin.
    - Amazonia.
  - Charles Kent Mare
    - Mr. Bell-founder.
    - One Eye
      - Hambletonian.
      - Dam by Messenger
        - Messenger.
        - Dam by Messenger.[1]

Hambletonian.

By many it is claimed that Hambletonian owes his success as a trotting-sire from his strong infusion of Messenger blood. He was foaled May 5, 1849, on the farm of Jonas Seeley, jun., near Chester, Orange County, N.Y. When five weeks old, Mr. William Rysdyk purchased him with his dam for a hundred and twenty-five dollars. Mr. Rysdyk was a poor man then. The horse proved a mine of wealth. Of late years, the extravagant price of five hundred dollars the season has been paid for his services; and at this figure his list has always been more than full. His colts have usually commanded large prices; and by him was sired the celebrated Dexter, whose record is world-wide.

Morgan.

In New England the Morgan horse has a fine reputation, and his history is worth giving to our readers. During the last century a good many English or thorough-bred horses were brought from Virginia into Connecticut, and were kept in the vicinity of Hartford: among them were Highlander, King William, and another, called Beautiful Boy, or True Briton. He was probably thorough-bred, and was stolen, so it is said, from Gen. De Lancey at King's Bridge. For several years he was kept at Springfield, Mass., and became the sire of Justin Morgan, which was foaled in West Springfield in 1793, and which, as another writer has truthfully said, "has had a post-

[1] Harpers' Magazine, vol. xlvii. p. 605.

STELLA AND ALICE GRAY, LANTERN AND WHALEBONE. — DOUBLE-HARNESS RACE.

humous fame surpassed by that of no other animal that ever stood in New England."

When two years old, he was taken to Randolph, Vt. Like most of the stock horses of his time, especially in the more remote sections, he had to work hard in clearing up new land; and in this laborious kind of work he exhibited the most wonderful strength and willingness at a pull, and the most remarkable patience at a dead lift, — a characteristic, one would suppose, strongly in contrast with his nervous playfulness at the end of a halter or under the saddle. He would "out-draw, out-walk, out-trot, and out-run" any and every horse that was ever matched against him; and that, too, notwithstanding the fact that many of them were much larger and heavier animals. Strength and speed, as compared with the horses of his time, and endurance, were characteristics in which he especially excelled. He survived the hardships to which he was almost constantly subjected for twenty-nine years, and then received a kick from horses in the same yard which resulted in his death in the year 1821.

His history.

He impressed his fine qualities upon his offspring to an unusual degree, as they still appear unquestionably in his descendants. He is described as a small horse, only about fourteen hands high, and his weight, by estimation, about nine hundred and fifty pounds. He was a beautiful dark bay, with scarcely a white hair on his body. His legs were black. His mane and tail were black, coarse, and thick, with long, straight hair free from curls. He is described as having a good head of medium size, lean and long, with a straight face, broad and good forehead, and fine, small ears set wide apart. He had a very short back, and wide and muscular loins, but rather a long body, round, and close ribbed up. He was compact, or, as many would say, he was very snugly built; with a deep, wide chest, and projecting breast-bone; short, close-jointed legs, wide and thin, but remarkably muscular, and with some long hair about and above the fetlocks, — a peculiarity which he imparted to many of his offspring.

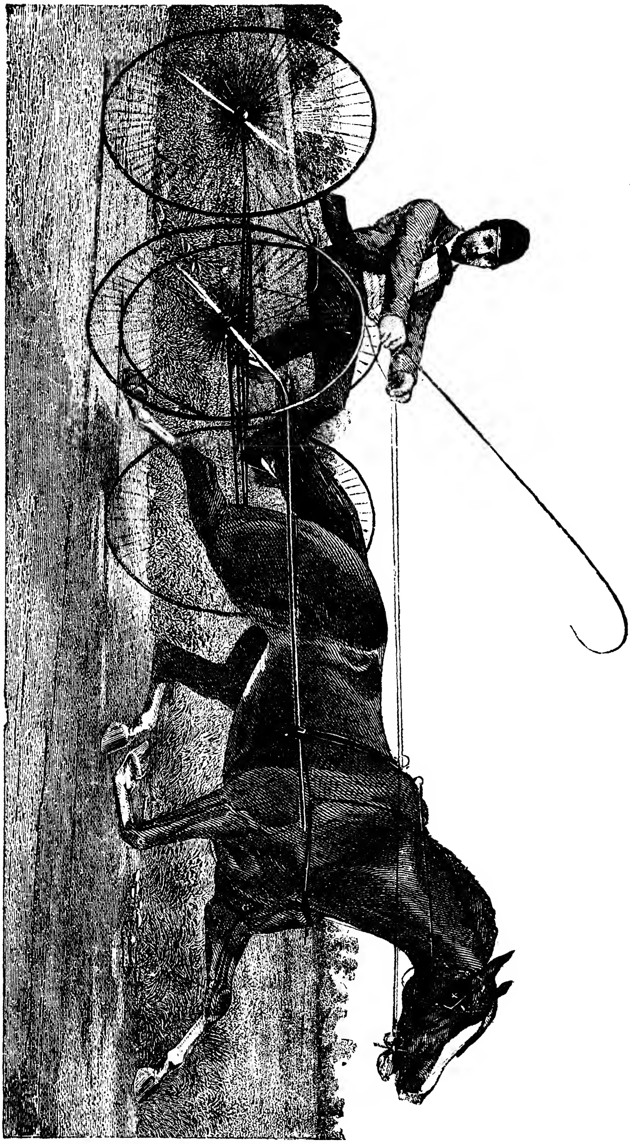
Description.

The old Justin Morgan was said to have been a very fast walker; but in trotting he had a short, nervous step, a low smooth gait, square and fine. He was not remarkably fast as a trotter, though his speed was never developed as it has been with the greatest assiduity in many of his descendants. In travelling he raised his feet but slightly, — only enough to clear the inequalities of the ground; but, notwithstanding this, he had the reputation of being very sure-footed. His style of movement was lofty, bold, and energetic, full of life and spirit; but he was managed with great ease, and it was said that a lady could drive him with perfect safety. He was much admired as a parade horse.

His speed, style, &c.

Could run well.

Though not what would now be called a very fast trotter, the old Justin Morgan could run at short distances with any other horse of his time not thorough-bred; and many an eighty rods accomplished



POCHAHONTAS.

by him won his keeper the stakes, payable at the tavern where the scratch was made in the dirt across the road as the point from which to start. Each horse had to "come up to the scratch," and, when the hat fell, to be off as fast as his legs could carry him. In all such trials, the "little horse" was always sure to win. It is from him that Bulrush Morgan and the Morrill horses have descended.

Black Hawk.

Another family of horses, too well known to be wholly omitted from this description, is the Black Hawk. The first one bearing that name was foaled near Portsmouth, N.H., 1833. At the age of four years he was sold as a roadster for the sum of $150. In 1842 he won a match of a thousand dollars, trotting five miles over the Cambridge track in sixteen minutes. In the year 1844 Mr. Hill bought and kept him as a stallion at Bridport, Vt., till the time of his death in 1856. His skeleton is preserved in the office of the secretary of the State Board of Agriculture, at the State House in Boston.

Description.

Black Hawk was not quite fifteen hands high, and weighed about a thousand pounds. He was remarkably symmetrical and muscular, graced with a beautiful head, neck, and limbs, and when in action, whether in harness or out, of a spirited, nervous, and elegant bearing, which could not fail to command universal admiration wherever he appeared. He could easily trot his mile in two minutes and forty seconds, even without much training; and he combined with great speed the perfection of form, the intelligence, courage, and endurance sufficient to make him a complete model of a roadster. He possessed the power of transmitting his characteristics to his very numerous offspring in a degree surpassed by no other horse in the country. In the carriage or under the saddle, in the quiet of a country road or on the parade-ground, under whatever circumstances the descendants of Black Hawk appear, the eye accustomed to observe the characteristics of the horse could hardly fail to detect the relationship. The Black Hawks are much sought after as light carriage and saddle horses.

Celebrity of Black Hawk's descendants.

As an evidence of their qualities, as well as the celebrity they have obtained in other parts of the country, it may be stated, that during the fair at St. Louis, in 1859, five out of six of the best stallions exhibited in the class of roadsters were Black Hawks; and the prizes, of one thousand dollars that year and of fifteen hundred dollars at the fair there in 1860, were awarded for the best stallions in this class to sons of old Black Hawk. At the various fairs held in New England — at Springfield, Boston, and elsewhere — the Black Hawks have been very largely represented, and have generally carried off a full proportion of the prizes offered. More than one hundred horses of this stock were entered at the Springfield Horse Show in 1860, and nearly half of all successful competitors were Black Hawks. Many sons of the old horse are now standing in various parts of New England as stock-getters; and, judging from the reports of State fairs in other parts of the country, it is safe to affirm that they are exerting a widely-extended influence on the stock of the United States.

We must now turn our attention to the turf. The first public race ever trotted in America was in 1818, — a match against time, for a thousand dollars. During a jockey-club dinner held in that year in New York, it was asserted that no horse could be found able to trot a mile in three minutes. Two of the members, however, — Major William Jones of Long Island, and Col. Bond of Maryland, — agreed to produce such a horse. They were as good as their word; and, when the horse had accomplished the feat, his fame was established. He went by the name of "Boston Blue."

First public race.

Within ten years after this race, trotting-courses and horse-clubs were formed in the principal cities of our country; and among the horses which competed at that early day were Top-Gallant, Screw-Driver, Betsey Baker, Whalebone, Paul Pry, Lady Washington, and Sally Miller. The first of these perhaps the most easily won distinction at the Hunting-park Course in Philadelphia. While being employed as a cart-horse his merits were recognized, and his trotting-speed was developed. Screw-Driver won as fine a reputation; for when he died, in October, 1828, a Philadelphia newspaper announced that "the emperor of horses is no more." At that time, a horse which could trot a mile in two minutes and thirty seconds was regarded as a marvel. In 1836 two remarkable animals made their appearance on the turf, — Dutchman and Awful. The former was a coarse brown horse of great endurance. At one time he was employed in tramping clay in a Pennsylvania brickyard. Awful was just the opposite of Dutchman in appearance. He was a tall, dashing, blood-looking bay, with high, sprawling action. He was a bad-tempered animal, and did not live up to his early promise. Both Dutchman and Awful figure prominently in trotting history. Dutchman's greatest performance was trotting three miles on the Beacon Course, under saddle, in seven minutes thirty-two seconds and a half. It was a match against time, and the horse was ridden by Hiram Woodruff. This was in August, 1839.

Formation of trotting courses and clubs.

Lady Suffolk comes next in the list of famous horses. Hamilton Busby thus describes her career: "She made her first public appearance in 1838, trotting three heats, and winning eleven dollars. Verily, hard work and poor pay! Lady Suffolk was a beautiful gray, with an Arab neck, and standing fifteen hands and a half. She remained on the turf nearly sixteen years, during which time she trotted in 161 races, winning 88 and $35,011, and losing 73. Her speed was shown and her powers tested in ten different States of the Union. Her best mile-heat race — 2.26½, 2.27, 2.27 — was made under saddle, July 12, 1843, on the Beacon Course, New Jersey. Her fastest mile (2.26) was done at Boston, under saddle. Lady Suffolk was withdrawn from the turf in 1853; and she died at Bridport, Vt., March 17, 1855, aged twenty-two years. Her skin was prepared and mounted by a taxi-

Lady Suffolk.

dermist, and it now does duty as an advertisement in a Broadway harness-store. Those who knew the handsome gray mare in her prime claim that her speed was never developed. Among Lady Suffolk's competitors on the turf were Washington, Confidence, Ripton, Cayuga Chief, Independence, Beppo, Oneida Chief, Lady Moscow, Americus, aud other horses dear to the memory of the sportsman whose hair is now silvered, and who loves to dwell upon the scenes of the "olden time."

Trustee.

In October, 1848, occurred the famous twenty-mile race by Trustee, the son of a thorough-bred imported horse bearing a similar name. His driver weighed a hundred and forty-five pounds, and his sulky a hundred and fifty pounds; and the twenty miles were trotted in fifty-nine minutes thirty-five seconds and a half. It was a race which thoroughly tested the endurance of the horse, and was denounced at the time as cruel; but it is affirmed that Trustee was not injured in the least by the performance.

Tacony.

Flora Temple.

In 1851 appeared a new horse (Tacony, from Maine), which won many victories, scoring twelve the second year of his public appearance; at which time Flora Temple began her wonderful career; also Ethan Allen, the worthy descendant of Morgan. The following season was rendered exciting by a series of races between Flora Temple and Tacony, in which the former beat the latter seven times at different distances. Concerning her breeding nothing is known. While young, she changed hands several times; and, when first put in the harness, she did work in a livery-stable in Eaton, N.Y. In June, 1850, she was brought with a drove of cattle to Dutchess County, where she was purchased by Mr. Velie for $175. Shortly after this she was sold to Mr. George E. Perrin of New-York City, who used her as a road-mare. In 1850 she trotted a match race; but she did not make her regular appearance on the course until two years later. She made her last turf-performance Sept. 5, 1861, on the Fashion Course, Long Island. During the eleven years in which she was prominently before the public she trotted a hundred and eleven races, ninety-three of which she won. Her winnings netted $113,000. Prominent among her competitors were Princess, Ethan Allen, George M. Patchen, Lancet, Tacony, and Highland Maid. Her best wagon-time, 2.24½, was made Sept. 2, 1856, on the Union Course, Long Island. Her fastest mile in harness, which for a long while stood at the head of the record, was done at Kalamazoo, Mich., Oct. 15, 1859. Flora Temple's turf-career was marvellous. She was a mare of obscure breeding, small in stature, being fourteen hands two inches high; and yet she rose to supremacy, and reigned for a number of years queen of the course.

Ethan Allen.

It would be impossible for us in our short space to recount the glories of all the famous trotters in the United States, or even to mention their names. Besides, as we approach nearer to the present time, there is less need of presenting such a history, as many are familiar with it.

Who has not heard of the exploits of Ethan Allen, which trotted with a running mate against Dexter, on the Fashion Course, three heats, of one mile each, in the astonishing time of 2.15, 2.16, 2.19? We must stop, however, to say a word concerning one of the most noted descendants of Ethan Allen. This is Pocahontas, whose mother also bore the same name, and whose career will be given presently. Pocahontas is the pet of Robert Bonner's stable, and cost him $35,000. She is said to be "one of the best road-mares in the world." Then there is Lady Thorne, bred in the lovely blue-grass regions of Kentucky, sired by Mambrino Chief. Her winnings, from the beginning of her career in 1859 to 1870, amounted to $61,125. Her last race was at Prospect Park, L.I., July 22, 1870, in which she trotted three heats, of one mile each, in the wonderful time of $2.19\frac{1}{2}$, $2.20\frac{1}{2}$, $2.19\frac{1}{4}$. Of Dexter and Goldsmith Maid their record is too familiar to require repetition.

Dexter.

Pocahontas.

THE PACING-HORSE.

During the latter part of the last century a class of horses became widely known in the more thickly-settled portions of New England, especially in Rhode Island, as the "Narragansett pacers." They were very popular in the earlier part of the last century, and continued to be the favorite horses for light travel under the saddle for many years. Upon good authority it may be affirmed that they probably were the easiest, fleetest, most sure-footed, and toughest saddle-horses ever known in this country, if not in this world. They could not trot. The pace was their natural gait, the only one in which they excelled; and for this they were especially esteemed.

Narragansett pacers.

The origin of this famous breed, which was kept distinct for many years, was probably a stallion imported from Andalusia, in Spain; though there are several theories, founded on tradition, in regard to him. But, from whatever source he came, there is no doubt as to his laying the foundation of a class of horses exceedingly well adapted to the wants of the times, — one that served the purposes for which it was raised more completely than any other at that time, or ever since, known in New England. Many of the Narragansett pacers could go a mile easily in less than three minutes, or carry a rider forty or fifty miles a day, and follow it up for days in succession, without apparent fatigue. It is said that their gait was far easier and more agreeable than that of the rocker or pacer of the present day, with whom the pace is an accident, or the result of training, rather than the natural gait.

Origin of them.

The Narragansett pacers became so popular, that they were largely exported to the West Indies, and the business of breeding them for that market became very profitable. At length, however, the demand there became so great, that an agent was sent to buy up all the best he could find in the locality where they were bred in the highest purity and perfection; and he

Their popularity.

was so faithful to his trust as to allow few very superior animals to escape him. This circumstance, together with the improvement of the roads, and the fact that the genuine Narragansett pacer was comparatively useless as a draught-horse, and really good only under the saddle, led to a decline in the interest in breeding this class of horses, especially during and after the war of the Revolution, when large numbers of horses were wanted for teaming and transportation. The pacer, as a breed, was wholly neglected, till, in the year 1800, it was said there was only one animal of the real Narragansett stock to be found in Rhode Island.

Pocahontas a pacer.

In 1854, however, the pacer found a splendid representative in Pocahontas, the mother of another mare bearing the same name, which we have previously described. Notwithstanding her dam was a natural trotter, she performed very striking feats as a pacer, her best time being made in 1855, when she paced one mile, to wagon, in 2.17½.

CHAPTER XIII.

SHEEP.

SHEEP are among the very oldest domestic animals known, though they are found wild in nearly every mountainous country of the world. By some authorities they are thought to be related to the goat, but are far more timid than that animal, from which they differ, also, in other respects. They are intimately associated with ancient religious rites, and were the symbol of gentleness and innocence. The great wealth of the Israelites and other pastoral nations was in sheep, which were originally raised for their milk and skins, as well as for sacrifice; but they have been prized in modern times for their wool, flesh, and fat, in which regards the improvements of breeding have been very marked for the past century and a half.

Early history of the goat.

The best breed of these animals for fine wool is the merino, which originated in Spain, and is supposed to have descended from the stock of the patriarchs. They are devoid of wool on the head and necks, and are less fleshy and symmetrical than the choice English breeds. From the Spanish merinoes are derived the famous Saxon, Silesian, and Flemish breeds. The widely-known establishment for raising sheep, owned by Louis XVI. of France, at Rambouillet, was devoted to the propagation of merinoes principally. The prevailing breed in the United States is a more or less pure merino. The Asiatic and African varieties of this animal are of little value. Probably Great Britain gives more attention to the raising of sheep for wool and mutton than any other civilized country. Her breeds are mostly producers of coarse wools, notably the Leicester or Dishley, the Cheviot, Norfolk, Suffolk, and Dorset varieties. The South-Downs have a shorter, finer fleece, and yield good mutton.

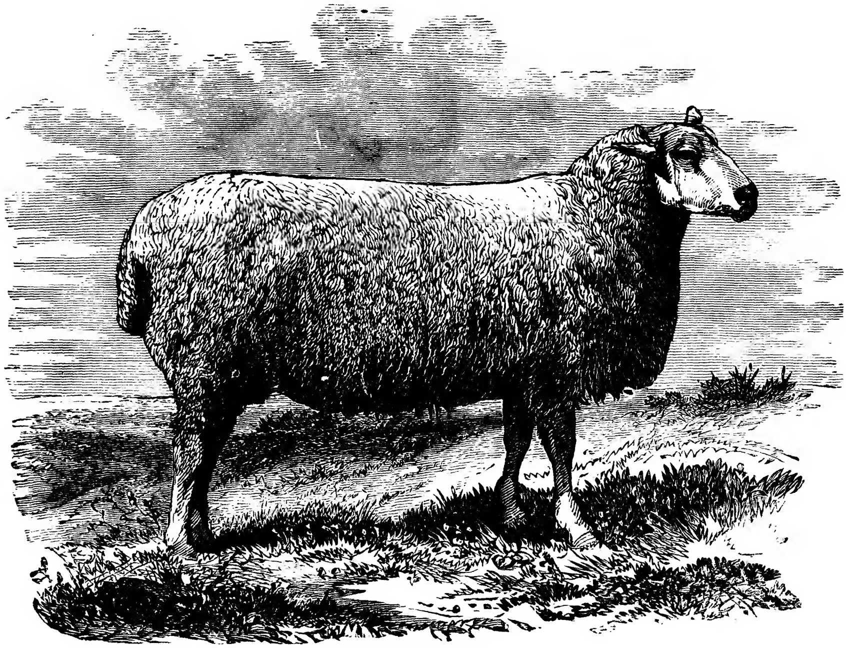
Merinoes.

Sheep-breeding in Great Britain.

Sheep were first introduced into this country at Jamestown, Va., in 1609. In forty years they had increased in numbers nearly to 3,000. The first importation to Massachusetts was in 1633; and for a time they were kept on the islands in Boston Bay, to protect them from wolves and bears. In 1652 Charlestown had as many

Introduction of sheep into the United States.

as 400 sheep; and Lynn had several flocks, which were watched and kept by a common shepherd. Sheep were introduced into the New Netherlands in 1625, and again in 1630; but such were the depredations of wild beasts, that in 1643 there were not more than sixteen in that colony. The Swedes of New Jersey were encouraged to breed sheep, and raise wool to send home, but in 1663 had no more than eighty sheep.



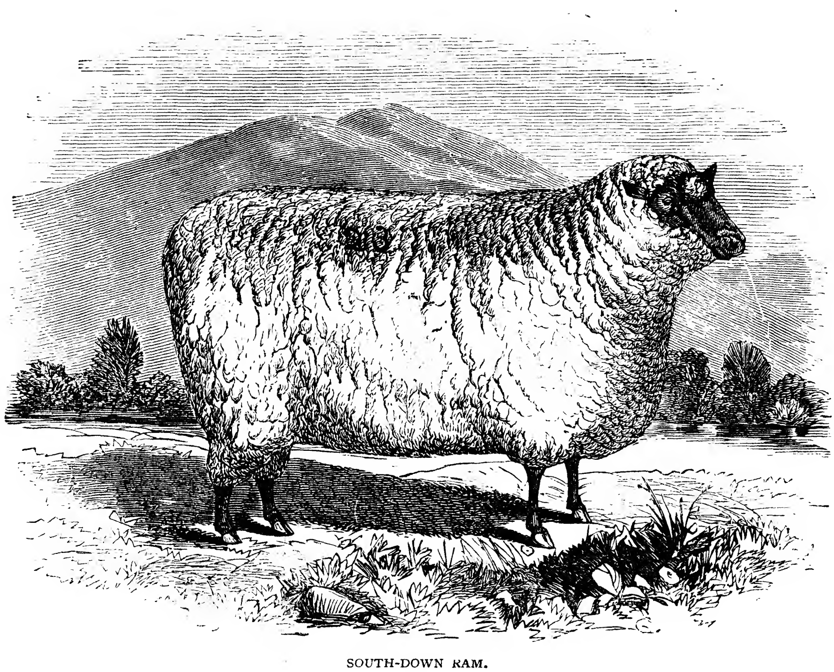
LEICESTER RAM.

The sheep in this country, in those days, were raw-boned, coarse-woolled animals; but inasmuch as the mother-country discouraged the exportation of them hither, and as the colonists felt the need of producing their own woollen clothing, the colonial governments, by addresses to the people, bounties for killing wolves, and by other measures, encouraged the importation and raising of sheep. Massachusetts, in 1645, ordered the appointment of agents in every town to ascertain who would buy sheep, and to urge the people to write their friends across the Atlantic to bring sheep with them on emigrating. In 1648 it was ordered that sheep be pastured on the common; and later the selectmen of every town were authorized to superintend the putting of rams to the flocks. In 1654 the Assembly of Massachusetts prohibited the exportation of sheep, and in 1675 of wool. Virginia enacted similar laws.

Early measures for encouraging the industry.

Gradually, but slowly, sheep multiplied in numbers. A report on American industries, made to the British House of Commons in 1731–32 by the Board of Trade, shows, that, at that time, nearly all American farmers had a few sheep, whose wool was spun at home for domestic use. There was no export, however. Great jealousy was felt by the British, lest we should compete with them in wool-production; and obstacles were put in the way of our obtaining sheep. Jared Eliot, writing in 1747, says, "A better breed of sheep is what we want. The English breed of Cotswold sheep cannot be obtained, or at least with great difficulty; for wool and live animals are contraband goods, which all strangers are prohibited from carrying out on pain of having the right hand cut off."

Jealousy of British farmers toward Americans.



SOUTH-DOWN RAM.

On the breaking-out of the Revolution, the colonists immediately recognized the importance of preserving their sheep for propagation. The Colonial Congress of 1775 voted to discourage killing, and encourage the breeding, of sheep. The Pennsylvania Assembly did likewise. The Association of Butchers voted not to kill sheep, and in 1776 it is said twenty thousand less sheep were slaughtered than in 1774. During the siege of Boston, however, in 1775–76, large supplies of live-stock, including sheep, were sent from all parts of the colonies

Measures to foster sheep-raising during American Revolution.

for the soldiers' food. There must have been more than a million of these animals in the country at that time.

Little was done in the way of importing choice breeds of sheep into this country until the close of the last century and the early part of this. Mention is made by Custis of two Leicester ewes on the estate of Washington, from which, by a Persian ram, were derived the famous Arlington long-woolled sheep. Kentucky gave preference to this and other English breeds, which were imported into and still survive in small numbers in the Middle States and those of the Ohio Valley. The merino sheep had a greater rage, and now constitute a larger proportion of our stock.

First importations.

ANGORA GOAT.

In 1793 William Foster of Boston brought home from Cadiz, Spain, where he had been staying several years, three full-blooded merino-sheep, two ewes, and a ram. He was seventy-five days on the passage; and the animals were taken sick, and nearly perished; but a French shepherd on board the vessel cured them by injections. Mr. Foster says, "Being about to leave this country for France, shortly after my arrival in Boston I presented these sheep to Andrew Cragie of Cambridge, who, not

William Foster's efforts.

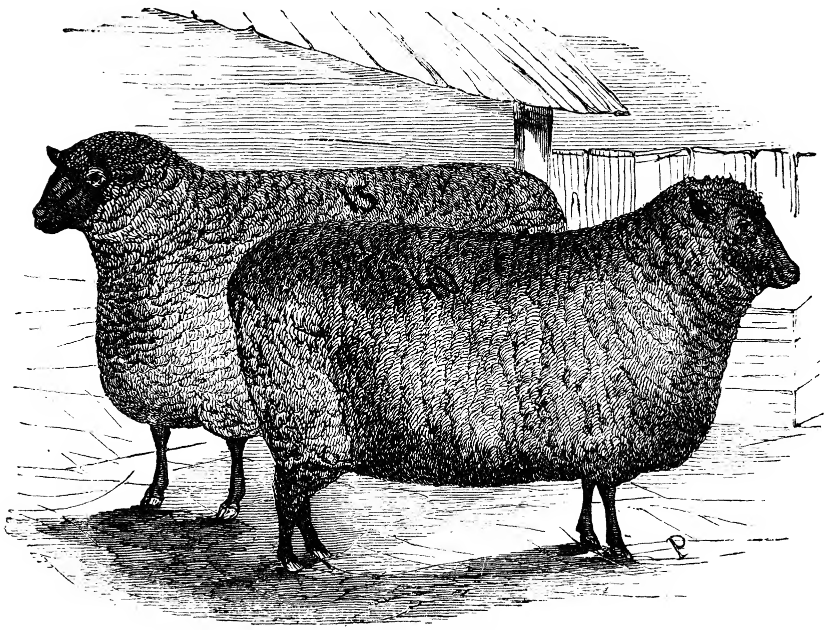
knowing their value at that time, 'simply ate them,' as he told me years after when I met him at an auction buying a merino ram for a thousand dollars."[1]

As early as 1785 the newly-organized Society for the Promotion of Agriculture, in South Carolina, offered a medal to the first person who should keep a flock of merino-sheep in that State; but there seems to be no record of the prize being taken.

Premium offered by South-Carolina Society.

Four young merino-rams were sent to this country from Paris in 1801; but not more than one survived, and that went to Rosendale Farm, Kingston, N.Y. French merinoes were also imported by William Taintor of Hartford in 1846. The Hon. David Humphreys, American minister at Madrid, brought home to his farm in Derby, Conn., ninety-one Spanish merinoes in 1802. Seth Adams of Zanesville, O., imported two Spanish ewes in 1801; and Chancellor Livingston of New York sent home two pairs from abroad the same

Importations from France and other countries.



SOUTH-DOWN EWES.

year. In 1808, and later, his sheep attained a wide reputation. William Jarvis, our consul at Lisbon, Portugal, sent a number of Spanish sheep to his home in Wethersfield, Vt., in 1809–11.

Just prior to the war of 1812–14, sheep-raising took a great start in this

[1] Choice animals have sold as high as ten thousand and fourteen thousand dollars apiece in this country.

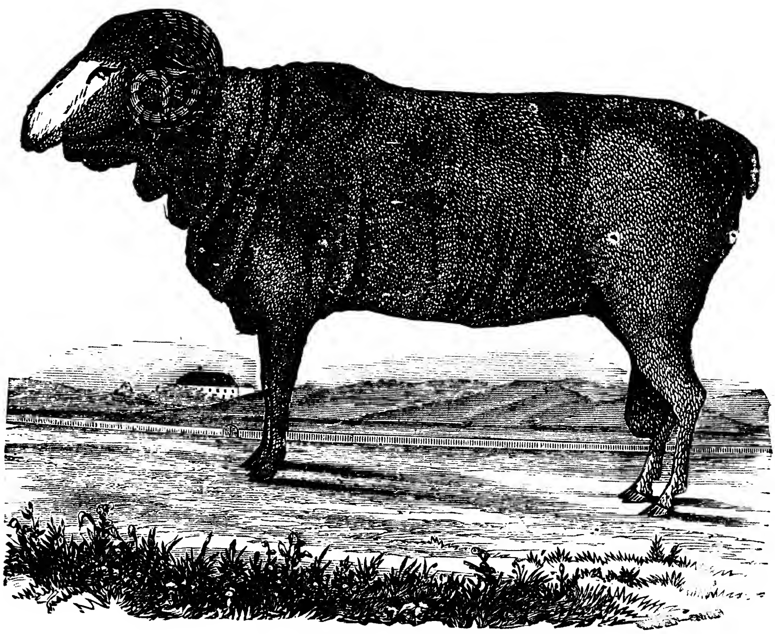
country, as did also woollen manufactures. After the war there was a brief set-back, in consequence of competition with the English markets. In 1824 a protective tariff was laid on foreign wools, and sheep-raising in America quickly revived. The importation of the Saxon, the Merino, Leicester, South-Down, Cheviot, and Cotswold breeds, soon followed, and the business rapidly developed. The Saxon sheep were highly prized for their fine wool, but proved unhardy, and yielded light fleeces; and most breeders in New England, after a thorough trial, voted them unremunerative.

Sheep-raising prior to 1812.

Effect of tariff of 1824.

Sheep are subject to many maladies, such as foot-rot, scab, sore throat, and grubs in the head; and they suffer to a great extent from the depredations of dogs. The commissioner of agriculture, in his report for 1866, says that returns from one-fourth of the counties in the country for that year showed that about a hundred and thirty thousand sheep had succumbed to this single destroying influence; and he estimated the number for the whole country to be half a million annually.

Diseases of sheep.



THAER'S ELECTORAL-ESCURIAL RAM OF 1845.

Sheep-raising increasing in the West.

Owing to these causes to a slight extent, but more particularly to the better pasturage afforded in the West, there has been for nearly forty years a westward movement in the centre of sheep-raising. Prior to 1840, when there were about eighteen million sheep in this country, the greater number were owned in the Atlantic States, from Virginia northward, and in the Ohio basin. Since then the business of raising sheep for any thing more than the butcher's demand has sensibly declined in the East; and the pastures of the Western States are our great wool-producing region. The general tendency of the movement in sheep-culture will appear from the following table, showing the distribution in the principal wool-growing States for thirty years past. It may be remarked, however, that some of the Southern States, notably Virginia, suffered from the war severely; and that the resources of California, now the great wool State of the country, were not developed until some time after the acquisition of that State from Mexico.

STATES.	1850.	1860.	1870.	1875.
California	17,328	1,088,003	2,768,187	7,290,000
Ohio	3,942,929	3,546,767	4,928,635	3,900,000
Texas	100,530	753,363	714,351	2,826,700
Michigan	746,435	1,271,743	1,985,906	2,100,000
New York	3,453,241	2,617,855	2,181,578	1,897,700
Pennsylvania	1,822,357	1,631,540	1,794,301	1,607,600
Iowa	149,960	259,941	855,493	1,680,500
Wisconsin	124,896	332,954	1,069,282	1,151,100
Illinois	894,643	769,138	1,568,286	1,258,500
Indiana	1,122,493	999,175	1,612,680	1,175,000
Virginia	1,310,004	1,043,269	922,472 [1]	1,011,500
Kentucky	1,102,091	938,990	936,765	690,400
Tennessee	811,591	773,317	826,783	345,100
Vermont	1,014,122	752,201	580,347	475,700 [2]
New Mexico	377,271	830,116	619,438	800,000 [2]
Other States	4,733,929	5,862,903	5,113,447	7,594,400
Total	21,723,220	22,471,275	28,477,951	35,804,200

The average value of American sheep in 1876 was two dollars and twenty-seven cents, and the aggregate value was estimated at $80,892,683. While some few coarse-woolled fleeces, especially in England, have been known to weigh twelve or fifteen pounds, the average fleece in this country, in 1850, weighed 2.42 pounds. Improvement in stock, or else giving greater attention to weight than to fineness of wool in sheep-raising, increased the average in 1860 to nearly three pounds, and in 1870 to nearly four. Besides the wool from our 36,000,000 live sheep, enough more from the slaughtered animals is obtained to make our annual wool product about 185,000,000 pounds. This, at thirty-five cents a pound, would amount to $64,750,000. Nearly 10,000,000 sheep are butchered annually, yielding the

Statistics.

[1] The two Virginias. [2] Estimated.

farmers a revenue of not far from $25,000,000. Our wool product does not yet meet the demand of home manufactures; and we are obliged to import over 50,000,000 pounds of raw wool annually, and, in addition to our home manufactures, import nearly $50,000,000 worth of woollen goods, although the average is gradually decreasing.

CHAPTER XIV.

SWINE.

THE hog-raising and pork-producing industry of the United States is one of the most important of our agricultural interests. At home, pork forms a larger proportion of our food than any other article of provision, breadstuffs excepted; while it is also the article of most extensive export in the line of food, except wheat. This grows out of two facts, — the hog is altogether the most prolific breeder of our domestic-food animals, matures soonest, and is the most cheaply fattened; and we have peculiar facilities for raising the food which produces altogether the best pork; namely, Indian-corn.

Importance of hog-crop.

Swine were introduced into Hispaniola by Columbus in 1493, and De Soto brought them from the West Indies to Florida in 1538. The Portuguese had left swine ashore in Nova Scotia and Newfoundland as early as 1553. At Jamestown, Va., we hear of them first in 1609; but they multiplied so fast, that the people were obliged to build palisades to keep them out of the town. Plymouth Colony imported swine in 1624, and New Netherlands (now New York) the following year. In the early days the hogs were allowed to run almost wild in the fields and woods, feeding upon beech and hickory nuts, acorns, roots, and other such vegetation. The Indians, in those days, fed extensively on hogs that had grown wild. This wandering, free life tended to make the early stock of this country, especially in the South and West, lean, large-boned, fierce, and swift-footed, — a sort of degeneration toward the wild-boar life from which swine were taken for domestication.

Introduction of swine.

Among the choicer breeds that have been known to stock-raisers for the past century are the Chinese, which are small, have slender bones, fatten easily, but are too fat themselves, and are therefore crossed with other species; the Neapolitan, descended from the best Italian breeds of two thousand years; the Berkshire, which yield much lean meat, are prized for hams and bacon, and, crossed with the Chinese, make splendid hogs; the short-bodied Essex, which have taken more prizes in England at stock exhibitions than any other porcine breed;

Chinese breed.

Berkshire.

the Middlesex, long-bodied, heavy growers, often reaching eight or nine hundred pounds in eighteen months; and the Suffolk, very symmetrical in shape, small and compact, light feeders, and with great tendency to fat. All of these varieties have been popular in this country; and our best swine are mostly from this parentage, more or less crossed.

Suffolk.

Little attention was given to swine-breeding, with a view to improving our stock in this country, until after the Revolution. Interest was first excited in the subject by the presentation to Gen. Washington of a pair of hogs by the Duke of Bedford. They were of a new breed of his own raising, and called "Woburns" after Woburn Abbey. Parkinson, the Englishman to whom they were intrusted for conveyance, was dishonest enough to sell them on his arrival in this country. They appear to have been a cross between the Chinese and the large English native stock, and were fine animals. The breed soon became common in Virginia and the neighboring States; but of late years it has quite run out. A breed known as the "Byfield," originated from Chinese and English stock by Gorham Parsons of Byfield, Mass., afterwards had a great popularity, and became great favorites in Ohio. Later the other breeds above mentioned were imported into this country, and widely disseminated. Comparatively little improvement was effected, therefore, in American stock, until about fifty years ago.

Improvements in swine-breeding.

The value of the pig for utilizing domestic table-refuse, and the facility with which he fattened on such food, and at almost no expense, led to his very general keeping by all farmers, and many towns-people and small tenants. The cheapness of bacon created a great demand for it in the old slave States likewise, and the business of furnishing wholesale supplies to that market naturally grew with the development of that section of the country. Inasmuch as the Southern planters gave themselves almost exclusively to cotton, tobacco, and sugar culture, and did not raise food for their families and help, the labor and profit of providing for them naturally fell to another section of the country; and the remarkable facilities enjoyed by the West for hog-raising gave those States almost a monopoly of the valuable Southern market, a conquest which they followed up by extensions of their trade in other directions.

Increase of hog-raising.

The one great cause to which the development of the pork-industry in the West is due is the remarkable production of corn in that quarter, and the discovery that corn-fed pork is sweeter than mast-fed or swill-fed pork. There have been times when corn was so plenty in the West that it was used for fuel, and when, for lack of transportation, it was sold for six cents a bushel, and that only twenty-five miles from the Ohio River in Illinois. The farmers soon found, that, with such abundant food, it was cheaper to pen their hogs, instead of letting them run loose, and to fatten them quickly for market. Thus hog-raising rapidly increased between fifty and twenty-five years ago in Kentucky and the three

Relation of corn product to hog-raising.

States next north of the Ohio River. Thence it spread westward across the Mississippi. The rapid and extensive construction of railroads in those States, about the middle of the present century, of course afforded an outlet for the grain; but it did likewise for the pork, live and packed; and so the business staid there. Of the seven or eight million hogs killed every year in this country, about five or six million are killed in the West, and are mostly packed: those killed in the East are mostly for immediate consumption. The pork-packing business of the West is chiefly confined to six cities, which rank in the order named; Chicago, Cincinnati, St. Louis, Indianapolis, Milwaukee, and Louisville. Inasmuch as Chicago's grain-business is her chief industry, and pork-packing is Cincinnati's leading interest, the latter city is generally reckoned the great pork-producing centre of the United States: indeed, it was so for a long time. The great bulk of the business is done in the winter-time; the season opening about Nov. 1, and closing early in March.

The following interesting description of the Cincinnati slaughter-houses, from the pen of Charles Cist, first appeared in one of the newspapers published in that city: —

Description of slaughter-house.

"The slaughter-houses are in the outskirts of the city, fifty by a 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.

Process of slaughtering.

"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 mean time a second 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 a 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 small 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 at one end, and taken out at the other, where there is a contrivance for lifting them out of the water, two at the same 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 hair and bristles. 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 head and legs; the next shave one side with sharp knives; the next shave the other; the next do the same to head and legs. To each pair of men are given twelve seconds to do their part of the work, or 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 gambrel-stick, and swing the hog off on a 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 farther, 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 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, &c., — and throws them on a 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, not counting 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 gambrel-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 are space and hooks for two thousand hogs, or a full day's work at killing. The next day they are taken off by teams to the packing-houses."

The products of pork are the hams and shoulders; sides for bacon, or packing in barrels; rumps and jowls, which go to the barrel with sides; and lard, some of which is converted into oil for lubricating and illuminating purposes, and for adulterating sperm and olive oils in the market. Stearine, from which candles are made, is a product of lard. Some of the coarser grease from the offal is used for making soap. The refuse is employed as a fertilizer. The bristles go to make brushes, the hoofs for glue, and the blood is manufactured into the chemical called "Prussian blue." Besides these industries dependent upon hog-raising, there is an immense cooperage business necessary to supply the requisite kegs and barrels.

Products of pork.

The number of hogs in the country has not materially varied for the past few years. The census of 1850 gave the number as 30,354,213; that of 1860, as 33,512,867; that of 1870, as 25,134,569. The Agricultural Bureau says, that in January, 1876, it was 25,726,800: at the same date in 1877 it was 28,077,100.

Statistics.

The report of the New-York Produce Exchange gives a table which shows the distribution of swine in the country as follows: —

Distribution of swine.

STATES.	1875.	1876.
New England	279,700	306,000
Middle States	1,643,400	1,679,300
Western (east of the Mississippi)	7,372,600	7,948,600
Western (west of the Mississippi)	5,833,000	6,649.500
Pacific	544,800	606,400
Southern	10,035,300	10,845,900
Total	25,726,800	28,035,700

Cincinnati was a great pork-packing centre as early as 1835, and long held pre-eminence in that business. During the war there was an extra demand for pork for army use; and the number of hogs slaughtered temporarily increased, but fell off again. For the twelve years immediately after, there was a steady increase again in the whole West, as will be seen from the following statement: —

1865-66	1,785,955
1866-67	2,490,791
1867-68	2,781,084
1868-69	2,499,873
1869-70	2,635,312
1870-71	3,695,251
1871-72	4,831,558
1872-73	5,410,394
1873-74	5,466,200
1874-75	5,566,226
1875-76	4,880,135
1876-77	5,072,339

In the season of 1876–77 there were slaughtered 1,618,084 hogs in Chicago, 523,576 in Cincinnati, 414,747 in St. Louis, 294,198 in Indianapolis, 225,598 in Milwaukee, 214,862 in Louisville, 1,781,274 at all other less important points South and West, and 2,336,835 in the Middle and Eastern States; in all, 7,409,174. These cost the packers, first-hand, about fifteen dollars apiece; which makes the total yield worth to the producers not far from $110,000,000, less expense of transportation. Killed, dressed, smoked, tried, or packed, one-quarter was added to the market value of the product.

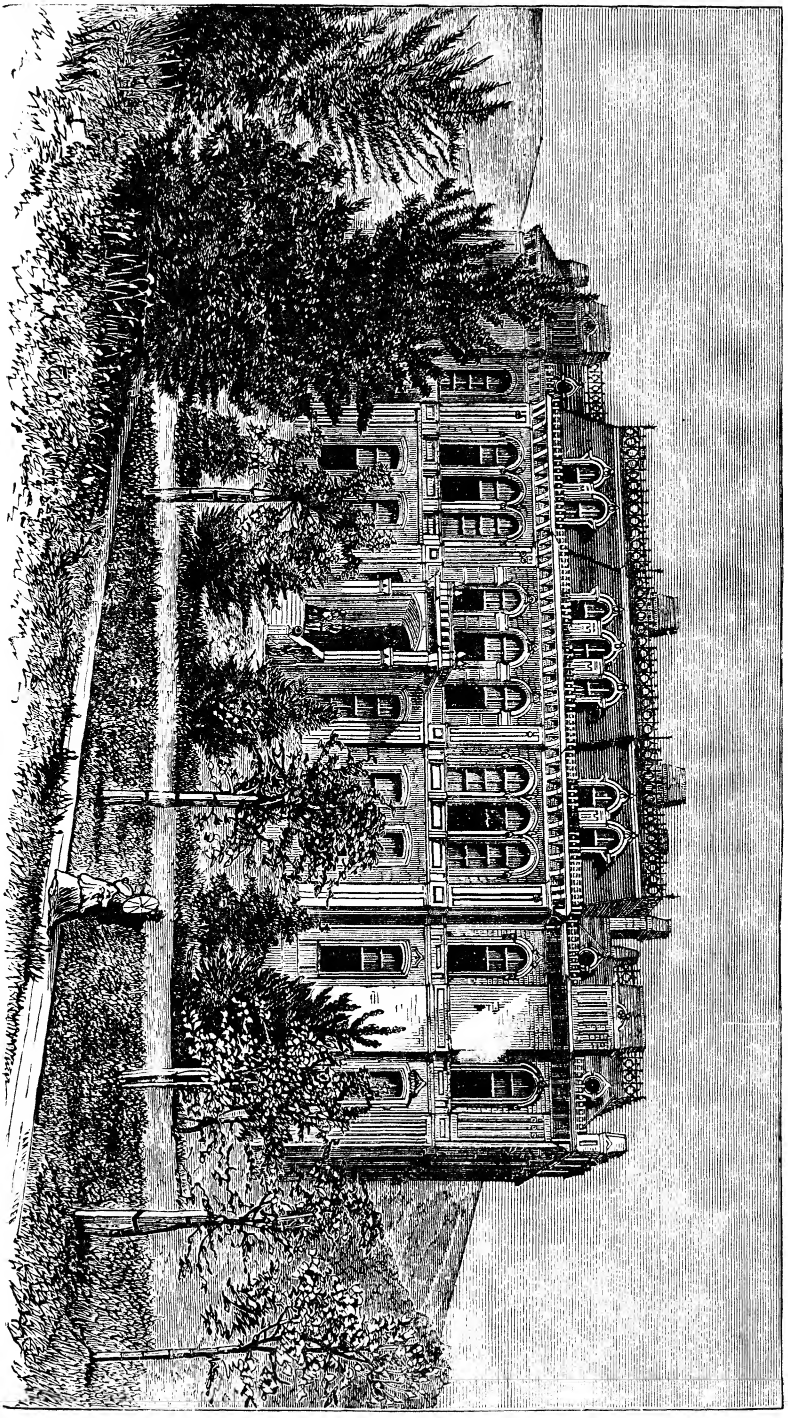
Number slaughtered.

The marked development of the Western pork raising and packing business is largely due to the steady increase of our export-trade in hog products for the past few years. During the fiscal year ending June 30, 1876, we exported, —

Export-trade.

	POUNDS.	VALUE.
Bacon and hams	327,730,172	$39,664,456
Barrelled pork	54,195,118	5,744,022
Lard	168,405,839	22,429,485
Total	550,331,129	$67,837,963

This was ten and a half per cent of our total exports; and it ranks next after cotton, petroleum, and wheat. The great bulk of the lard and bacon go to England and Ireland, which take a small proportion of the barrelled pork. Germany, France, and Belgium are our next best foreign customers.



CALIFORNIA AGRICULTURAL COLLEGE.

CHAPTER XV.

HORTICULTURE, NURSERIES, AND FRUIT-RAISING.

THAT branch of the agricultural industry which most closely approaches to fine art is horticulture; under which term we include ordinary market-gardening, landscape-gardening, flower and fruit culture. Fruits and flowers are mostly luxuries, rather than necessities, and in the early days of our history were scarcely thought of by the mass of colonists. Only a few gentlemen of social position, culture, and wealth, gave attention thereto; and fruits and flowers were introduced more for the gratification of individual taste and pride than for the general good. Like the development of the taste and pursuit of literature and painting, horticulture is one of those civilized avocations to which the human mind turns only after the necessities of life are well provided for: consequently horticulture is of comparatively recent birth and development in this country.

Horticulture a recent pursuit.

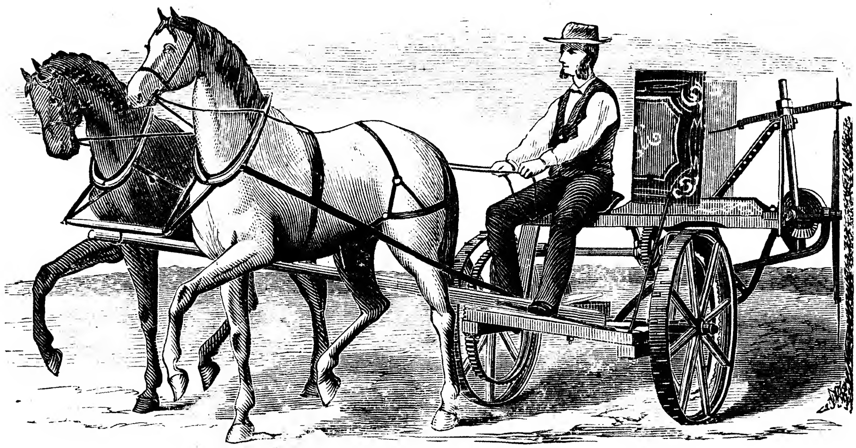
To market-gardening it is unnecessary to give especial attention here. The raising of a few kitchen vegetables for domestic use began on a limited scale in early colonial days; and, with the growth of our large cities since the Revolution, the business of purveying to the needs of the people has gradually grown up to be a respectable-sized trade all over the country, in many cases the cultivation of plants for seed being a branch of the business.

Market-gardening.

Landscape-gardening, or the improvement of lands by trees, flowers, shrubbery, paths, and architecture, has been practised to a marked degree for about a century only in England and other foreign countries. Little attention, therefore, was given to it here until after the Revolution. Taste was then manifested in the laying out of the grounds of a few prominent gentlemen in and about our large cities. Downing speaks particularly of the elegant arrangement and excellent keeping of the celebrated seats of the Hamilton family, near Philadelphia, which was famed for its beauty, in 1805; Judge Peters, near Philadelphia, a little later; Chancellor Livingston, at Clermont, on the Hudson; the Hon. Theodore L. Lyman, nine miles out of Boston; Beaverwyck, a little north of Albany, the home of William P.

Landscape-gardening.

Van Rensselaer, and the manor-house of the "patroon", of that name in the suburbs of that city; the cottage-residences of William H. Aspinwall on Staten Island, Daniel Wadsworth of Hartford, and James Hillhouse of New Haven; Col. S. G. Perkins at Brookline, near Boston; and J. P. Cushing's place, in the same vicinage.



HEDGE-TRIMMER.

Horticultural literature.

In 1824 M. André Parmentier of Enghien, Holland, came to this country, and started horticultural nurseries near Brooklyn, N.Y., and laid out his grounds with especial regard to illustrating the principles of landscape-gardening. About that time Bernard McMahon of Philadelphia wrote a book called "The American Gardener's Calendar."

Downing.

About 1840 Andrew J. Downing, a man whose writings have given a wonderful impetus to horticulture in this country, published a work on "Landscape-Gardening," which also gave to the art a great impetus.

Growth of interest in the subject.

Within the next few years much attention was given to the subject by all persons building large manor-houses, and laying out large estates all over the country, but especially in the neighborhood of large cities. The grounds adjoining colleges and public buildings began to be laid out with greater taste, those at the Smithsonian Institute in Washington having been designed by Downing. Agricultural societies began to give a little more encouragement to ornamental tree-planting and flower-culture. The nurseries springing up here and there furnished young shade-trees as well as fruit-trees. Young towns studied the art of making their streets graceful, with trees on either side, and flower-patches near their town-halls or county court-houses.[1]

Then the idea of adorning public cemeteries by the arts of tree-planting, winding and straight paths, adaptation of shrubbery, flowers, and walks to the undulations and other characteristics of the ground's surface, and so on, took possession of a few cultured minds, and spread rapidly. The first prominent city of the dead so laid out was Laurel Hill, near Philadelphia, the enterprise being successful largely through the taste and perseverance of John Jay Smith of that city. Other burial-places about that time — the middle of the present century — became famous from an application of the same idea. Almost every one has heard of Mount Auburn, near Boston; Greenwood, just out of Brooklyn, N.Y.; Spring Grove, Cincinnati; and the beautiful cemeteries near Baltimore and New Haven. Within the past twenty-five years the newly laid-out cemeteries of the country have nearly all been greatly beautified.

Public cemeteries.

Still another manifestation of the same taste and culture is the laying out of parks in and about our cities, which shall be more than the old "common" of a New-England town. Perhaps the most important work of this sort undertaken in this country is Central Park, in the upper part of New-York City. It is half a mile wide, and two miles and a half long, and includes what was originally very wild and beautiful scenery. The land was appropriated to this use by the New-York legislature in 1857, largely through the influence of Downing's writings. The next year, in pursuance of plans submitted by Frederick Law Olmstead and Calvert Vaux, the improvement of this free park was begun, and has been continued at enormous expense even until the present time. By a judicious preservation, alteration, or utilization of the characteristic features of the land, and by extensive and costly work, an arrangement of lakes, lawns, flower-beds, groves, rocks, glens, caverns, footpaths, driveways, terraces, bridges, châlets, and other architectural devices, has been perfected, which makes the place one of the most delightful public resorts in the world. Llewellyn Park, near Orange, N.J., laid out by Bauman, a famous Philadelphia botanic gardener, Fairmount Park near Philadelphia, and Prospect Park near Brooklyn,

Public parks.

SNOWBALL.

are among the more recent and more famous of such institutions in this country.

Of all departments of horticulture or gardening, the propagation and cultivation of flowers most closely approaches a fine art. Only in a limited sense is it an industry. Those who engage in it professionally are few in number: the great mass of devotees to this pursuit, mostly ladies, are incited thereto by the same æsthetic instinct which leads them to study and practise music. That delightful writer, Ruskin, has said, "Flowers seem intended for the solace of ordinary humanity. Children love them; quiet, tender, contented, ordinary people love them as they grow; luxurious and disorderly people rejoice in them gathered. They are the cottager's treasure, and in the crowded town mark, as with a little broken fragment of rainbow, the windows of the workers in whose heart rests the covenant of peace." Truly the production and care of flowers is the poetry of agriculture.

Cultivation of flowers.

It has been noticed in connection with the development of certain arts (architecture, for instance) that the tendency in their earlier stages is toward massive proportion and general effect, and afterwards to refinement of organization, and beauty of detail. Something of the same characteristics is to be found in the history of floriculture. At first, flowers were thought of and used chiefly as elements of landscape-gardening; afterwards prized for themselves, improved and cared for accordingly.

Architecture and floriculture.

Prior to and during the Revolution it may be said, that virtually no attention was given to flowers in this country. Now and then persons had a solitary rose-bush, or, to gratify some odd fancy, grew some curious plant, such as cotton was then, upon their grounds. Toward the close of the last century and the beginning of this, flowering-plants, generally shrubs, were grown as borders to paths on the beautified suburban estates of a few wealthy gentlemen; then regular flower-beds, either made in the turf or in clean soil, with box-tree borders, and separated by paths, began to appear.

No attention to subject before the Revolution.

The imitation of these means of beautifying a home came to be practised in time by persons of lesser means, and on a small scale; and it was not until a quarter of this century had passed away that the little domestic flower-bed came to be at all common.

It was not until about this period, therefore, that professional gardeners gave much attention to importing, propagating, and selling to the general public, flowering-plants, seeds, and bulbs. At first this business was conducted by persons engaged in growing vegetables and fruits for the market in the vicinity of Boston, New York, and Philadelphia; but in a short time the increased patronage warranted the starting of independent nurseries and flower-gardens. The rapid development of popular taste and interest since about 1825, and the growing demand for flowers in

Sale of plants, &c.

the larger cities for festal occasions, funerals, and sentimental remembrances, led to the extension of the professional florist's trade all over the country; so that now scarcely a city or town of fifteen thousand inhabitants is without an establishment of this sort.

Green-houses. When the gentlemen of the earlier days began to introduce the choicer and more tender plants to their estates, the greenhouse, for shelter and for forcing plants, was here and there erected, the idea being taken from the foreign forcing-houses for fruits. Of necessity, the professional florist requires a greenhouse at the very outset of his business. Between 1825 and 1850, when landscape-gardening and domestic architecture took such a stride in this country, the erection of conservatories as ornaments to a lawn, as well as permanent shelters for choice plants, came into vogue, both as independent edifices, and as additions to the proprietor's mansion.

Literature on the subject. It was during this period, too, that a literature devoted to flower-culture began to make its appearance. In 1832 Robert Buist of Philadelphia, proprietor of the Roseland Nurseries, published a book on this subject, which was among the earliest and best publications of the sort. It reached several editions. During the next decade A. J. Downing adapted to American use Mrs. Loudon's "Ladies' Companion to the Flower-Garden;" and, still later, Henry Carey Baird got out an American edition of "Fruit, Flower, and Kitchen Gardening," written by Dr. Niell, secretary of the Royal Caledonian Horticultural Society. These and other American works were widely disseminated. Agricultural and horticultural journals gave more attention to flowers, and the ordinary newspapers republished extracts bearing upon floriculture. Within a few years leading florists have got into the way of publishing descriptive catalogues of their seeds, bulbs, and plants, together with valuable hints and suggestions concerning their cultivation, for gratuitous distribution, like the almanacs of patent-medicine makers.

SPIRÆA LANCEOLATA.

Progress. During all this time there has been a quiet, steady improvement — though not very great or startling in the aggregate — in the methods of propagation and care of flowers. There has been a perceptible improvement in the character of varieties, and a multiplication of species by hybridization and other scientific processes; and, in addition to the increase in numbers and beauty brought about by the efforts of American florists, there has been an extensive importation of foreign flower plants and seeds. The tendency to greater discrimination and taste in the selection of species and varieties has been very marked within the past twenty years.

Perhaps the most recent development in this uneventful though interesting history is the popular devotion to window-gardening by people in moderate and humble circumstances, — a natural outgrowth of a maturing and refining taste, and an instinct to keep one's flowers thrifty the year round. Scarcely a home is now to be found in the country, where some attempt is not made in this direction; if not with bay-windows filled with jars, flower-stands, and costly jardinières of rustic-work, shells, or quaint and lovely tiles, combined, perhaps, with bird-cages and aquariums, at least a simple hanging-basket or undecorated window-box.

Pomology.

As will appear presently, from our consideration of the history of individual fruits, the first of these luxuries we had in this country was the product of trees or seed or vines brought here by individual enterprise and for individual use. Half a century ago, organized movements were set afoot for fruit-culture. The ideas of foreign fruit raisers and breeders began to attract attention. Nurseries were started to attempt the improvement of stock and the dissemination of choice varieties. Individual cultivators awoke enough public enthusiasm to lead to the organization of pomological societies. The first of these was formed in 1829, and in 1848 a national pomological society was organized. The Agricultural Bureau at Washington soon after began devoting attention to fruits, imparting a vast deal of information with regard to all kinds and varieties, the proper modes of culture, and the soils and climates to which each was best adapted. Downing's book on "Fruits and Fruit-Trees of America," and horticultural writings, did a great deal to disseminate information, arouse interest, and stimulate culture.

Early nurseries.

Among the first nurseries we hear of in this country was that of Gov. Endicott of Salem, Mass., who in 1640 had quite a grove of young seedling apple-trees; but until 1835 there were scarcely more than two or three institutions for supplying the public generally. Among the earliest mentioned are those of James Bloodgood on Long Island, and William Reid on Murray Hill, a part of New-York City, now covered with residences. These were well known between 1830 and 1835. Since that time nurseries have rapidly increased in numbers in the Central and Western States, but notably in Central and Western New York. Probably one-tenth of the fruit-trees sold come from Monroe County in that State, the county-seat being Rochester. The environs of Geneva and Syracuse and Long Island are also great producers of young fruit and shade trees, shrubbery, and berry-plants. There are now something over a thousand nurseries in this country, from which are sold five hundred thousand dollars' worth of trees annually.

The grape is one of the oldest known fruits of the world, though it has had comparatively little prominence in this country until within a generation. There are many varieties native that have proved valuable and popular besides the many choice imported varieties. The Isabella and Catawba both originated in North Carolina; the Muscatel, long known as the "Cape," and incorrectly imagined to be an importation from South Africa, was indigenous to Pennsylvania; the Scuppernong, at one time thought to promise well for wine-making, is a Carolina grape; the Sweetwater, which with the Catawba is widely cultivated in California for wine, and also in the Eastern States, is a native. Texas produces a grape widely known as the Mustang; and there are other varieties almost too numerous to mention.

Grape.

Long after the Revolution, grapes were raised in this country, principally to be eaten fresh, as a dessert fruit. Hardy varieties were grown principally, though a few choice foreign kinds were raised under glass. About 1840 or 1850 the growing interest in fruit-culture led to a larger cultivation of hothouse grapes by fanciers and wealthy gentlemen. Downing mentions, that, at about this time, thousands of bushels of grapes were raised near New York and Philadelphia for the market, and that large quantities of the fruit were packed in cotton for preservation during the winter.

Recent culture of grape.

But it is for wine-making purposes that the grape is to be principally regarded. The Gothic seamen who touched our shores before Columbus's day called America "Wineland the Good," because of its grapes and their dreams of its possibilities. Very early in our colonial history, high expectations were entertained by emigrants of the wine-making possibilities of this country; and numerous experiments were made in that direction. Vines were imported to Virginia in 1610, and wine thus produced was sent to England in 1612. Gov. Winthrop gave attention to the subject in Massachusetts before 1630, at which time he owned a fine vineyard; and in 1634 Governor's Island, in Boston harbor, was rented on condition that the lessee should plant a vineyard or orchard, and pay a hogshead of wine yearly, — a condition that probably was not fulfilled. Attempts were made to introduce wine-grapes into the New Netherlands in 1642; but the frost killed them. Grape-culture was especially contemplated by the grantees of the Carolinas; but it took a poor hold at first. Delaware gave some little attention to wine-making in early days, and in 1753 a wealthy citizen offered a prize of forty shillings for the best article produced. Maryland in 1715 protected her home industry by imposing a tax on imported wine. But all these movements proved virtual failures, except in North Carolina, where, in 1750, wine-making was quite a prosperous though small industry.

Wine-making.

We hear little further until 1845, when Downing mentions that the attempts of Swiss adventurers at Vevay, Ind., to raise grapes and make wine on a large scale, had failed; and that Mr. N. Longworth of Cincinnati, after experimenting for thirty years with foreign vines from the

Swiss adventurers.

cold Jura-mountain sides and warm Madeira, had decided that the native grape was our great American reliance. In 1849 300 acres of vineyards were to be found within twelve miles of Cincinnati, which yielded over 50,000 gallons of wine that year. We also hear of some small vineyards in Missouri, at this time, that yielded 250 gallons to the acre; and in 1858 an instance is mentioned, as rare, of 400 gallons being produced in Alabama from an acre.

Vineyards near Cincinnati.

Other instances are mentioned, which show, that, by about 1850, grape-culture for wine had taken a new start in this country, especially in the Central and Western States. The census shows the total product of wine for the country that year to have been 221,249 gallons, of which California yielded 58,055; Ohio, 48,207; Pennsylvania, 25,590; Indiana, 14,055; North Carolina, 11,058; Missouri, 10,563; and New York, 9,172.

Wine product.

During the next decade wine-making rapidly increased. The art seemed to have been mastered at last: American champagne, sherry, claret, and port, had achieved a new and enviable reputation. The Department of Agriculture year after year afforded valuable information concerning grape-culture, avoiding blights and pests, and methods of wine-making; and California, already known to be a perfect Eden for fruits of all kinds, multiplied her vineyards, and yielded so abundantly, that a thousand gallons an acre was frequently obtained. The vine flourished in all parts of that State: but the principal vineyards were in three counties; namely, Los Angeles, San Bernardino, and San Diego. In 1860 the wine-product of the country had increased eightfold from that of ten years before, being returned at 1,627,192 gallons, of which Ohio produced fully one-third, or 568,617 gallons; California, 246,518; Kentucky, 179,948; Indiana, 102,895; and New York, North Carolina, Illinois, and Connecticut, not far from 50,000 each.

Wine-making between 1850-60.

In the next decade California took the lead again, her wines receiving high commendation at the Paris Exposition of 1867, her fame becoming world-wide, and the development of her product being nearly eightfold. Missouri's progress, too, was startling, her yield in 1870 being twelve times what it had been in 1860. The last national census returned 3,092,330 gallons, of which California is credited with nearly two-thirds, or 1,814,656 gallons; Missouri, 326,173; Ohio, 212,912; Illinois, 111,882; Pennsylvania, 97,165; and New York, 82,607. North Carolina had scarcely advanced, while Indiana had fallen off to only a quarter of her yield in 1860.

Wine-making since 1860.

Without doubt the wine-product of this country now amounts to over five million gallons annually; and there is every likelihood that we shall not only fully supply our demands for domestic consumption before very long, but shall soon be exporting wine to foreign countries. This is now one of the most promising of American agricultural industries.

Present wine product of the country.

Passing now to the fruits grown in our country, the apple ranks first among them, because it is the most common of all in this country, and the most useful. It is not the oldest in development and culture, however: the grape, the fig, and the pomegranate flourished in Palestine long before the apple was mentioned in Scripture. And even then, as also in the Greek fables which tell of the golden apples of the gardens of Hesperides and of the apple of discord, it is probable that the word "apple" was used in a generic sense, meaning fruit rather than this particular variety. In the early days of Rome the apple was well known; and Pliny states, that, in his day, no less than twenty-nine varieties were cultivated in various parts of Italy. At the present time there are about two hundred distinct varieties of this delicious fruit recognized, of which, however, about thirty constitute the staple product of the United States.

Early history of apple.

The parent stock of all our apples is the wild crab of Europe. Doubtless the first great step taken in its culture and its utilization was the invention of grafting by the Romans. It will be remembered, that, after the establishment of the Roman empire upon the wreck of the republic by Augustus Cæsar, the poet Virgil was employed by the emperor to write a series of poetical treatises on agriculture, intended to educate the nation in the foremost of all the arts of peace. In the course of his suggestions, that never-to-be-forgotten writer says, —

> "Graft the tender shoot:
> Thy children's children shall enjoy the fruit."

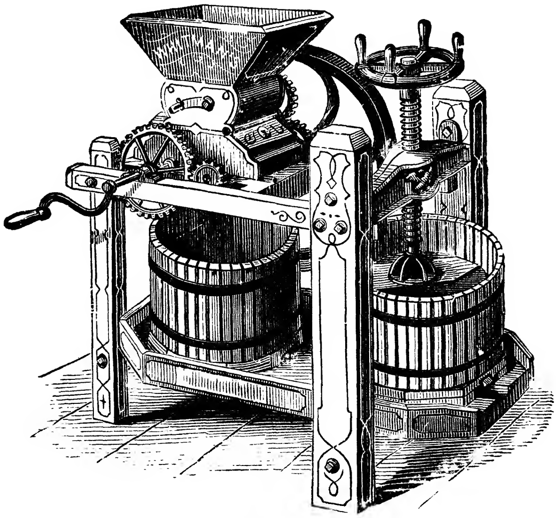
In the luxurious days of later Rome, fruit-culture was extensively indulged in by wealthy gentlemen; and nearly every person of means had a walled fruit-garden immediately connected with his dwelling-house. In the middle ages, too, the monks of Europe, from Southern Italy to the Highlands of Scotland, gave great attention to fruit-culture; the practice of pruning, setting large flat stones underneath the young trees, and some other devices, coming into more or less permanent use. Yet the fact that a generation of time, or more, must elapse before the setting out of a young orchard yielded its full reward, discouraged even those who grew apples for luxury, much more the poor rustic who lived from hand to mouth. The modern inventions of budding and dwarfing have enabled the horticulturist to get a quicker return for his labor, and they have therefore given a remarkable stimulus to apple-culture.

Progress in culture of apple.

The first record we have of the cultivated apple in England was the announcement that pippin-seed, brought from France in 1524, was planted in Sussex. A trifle later, the golden pippin was developed from this stock, and soon became famous in England. The early colonists found it almost impracticable to bring young trees or even scions to America; and, as we had no native apples, they were compelled to rely pretty much on seeds for our first stock. Naturally enough, therefore, the introduction

Early cultivation of apple in New England.

of the fruit was rare and slow. Nevertheless, it is asserted, that, so early as 1639, "ten fair pippins" were brought to Boston from trees that had been planted on Governor's Island, in the adjacent harbor. The following year Gov. Endicott had a nursery of young fruit-trees in what is now Danvers, Mass., and sold five hundred young apple-trees for two hundred and fifty acres of land.



CIDER-MILL.

For more than a century and a half, however, apples were cultivated almost exclusively for cider, the trees for fruit to be eaten being as rare for a long time as orange and other tropical plants are now in the North. Indeed, not until 1830 did the United-States Government begin to collect statistics of our orchard products. Probably the apple-trees of this country, in the first quarter of the present century, were mostly confined to New England and Long Island. New Jersey had a few, and so had Eastern and South-eastern New York. Western New York, Ohio, and Michigan had not yet felt the impetus soon to be given to this branch of horticulture.

Cultivation of apples for cider.

Several influences, however, began to stimulate apple-culture thirty and forty years ago very perceptibly. One was the attention given thereto by the Federal Government, which had established a Bureau of Agriculture in the Patent Office. The report of the commissioner for the year 1849 indicates that a wide-spread interest was being felt throughout the land, especially in New England. Horticultural societies began to be formed, and the general agricultural societies offered more premiums for choice apples. The first horticultural society in this country was founded in 1829, and the American Pomological Society was established in 1848. Nurseries came to be more numerous; Rochester, N.Y., beginning to show great prominence in this sphere, as also Onondaga County in that State. Books and periodicals devoted more attention to the subject. Andrew Jackson Downing, long the editor of the monthly "Horticulturist," and author of "Fruits and Fruit-Trees of America," undoubtedly did much to stimulate enthusiasm on the subject. Attention was given especially to winter apples

Efforts of Downing and others.

about this time, and some slight experiments in connection with trans-Atlantic steam navigation suggested to far-sighted men the possibility of our doing quite an export business in apples. Even then the American apple was beginning to assert its superiority over the English; and in the winter of 1858–59 no less than a hundred and twenty thousand barrels of apples, mostly Baldwins, were exported from Boston alone. Scientific discovery regarding the culture of the apple seemed, moreover, to take a stride about thirty or forty years ago. Growers began to recognize that varieties which thrived well on the granite-bedded soil of New England did not do so well in the soft loam of New Jersey and the Western States, and that the limestone ledges of Central and Western New York called for still different varieties. Adaptability to place and climate was more carefully studied. Moreover, it began to be understood how to improve varieties. Seeds from good fruit had almost invariably yielded poor fruit when the new trees got to bearing; and this poor return, after many years' waiting, was eminently discouraging. But growers not only found that by crossing old varieties, as the Netherlanders did, could be produced new ones even superior to the parent stock, but also that by taking seed from young seedlings, and replanting, permanent varieties could be established in four generations. These trees too, as also the dwarfed trees, could be made to yield early in life; and thus labor and money returned interest upon investment far quicker than of yore.

These various influences, with the consequent popularity of our fruit abroad and the establishment of fruit-stores and apple-stands in our cities, have of late years rapidly developed our apple-culture, and given our country pre-eminence in the whole world for the superiority of this fruit.

Varieties.

It does not come within the scope of this work to give in detail the distribution of the varieties of apples in this country. It may not be out of place, however, to say, that the Rhode-Island greening, the Roxbury russet, the Baldwin, the gillyflower, and the Hubbardston nonesuch, are the best-known winter apples, and the early harvest, sweet-bough, the Porter, and the Coggswell pearmain, among fall apples, in New England. New Jersey is noted for its sound, tart Swaar; New York for the Newtown pippin, king, greening, russet, Spitzenberg, and seek-no-farther; and Michigan for her seek-no-farthers, Northern spys, pippins, and pound sweetings. It is generally admitted, that, for flavor, the fruit of New York is the richest; but the light soils of Michigan and Ohio yield the largest specimens. Owing to the backward state of apple-culture, little had been done in the South previous to the war; although it is well established, that, were adaptation of varieties to soil and climate studied more, the Gulf States might produce apples abundantly. Since the depression of the war, little activity has been manifested in that section. California is almost the only State west of the Upper-Mississippi and Lower-Missouri Valleys that has gone much into fruit-culture as yet; and, in that unusually fertile soil and balmy climate, the apple, like all other fruits of the temperate zone, flourishes exuberantly.

According to the census of 1870 our orchard products that year amounted in value to $47,335,189, or two and a half times what they did in 1860, and six times those of 1850; and, inasmuch as our agricultural and horticultural industries have developed more than any other since then, it would be safe to reckon the same products for 1877 — though an off-year in some localities — at not far from $60,000,000. Now, as berries and grapes are not included in this estimate, and as pears, peaches, plums, cherries, and oranges are our only other leading orchard products, it would be reasonable to say that the total annual apple-crop of the country to-day is worth $40,000,000.

Quantity now raised.

The name of the quince clearly indicates that it grew naturally in the Island of Crete, though it probably did not originate there. It has been found growing wild along the Danube and in France. It was also known at an early day in England and Portugal. When first known, it was more nearly shaped like a pear than now: indeed, it is distantly related to both pear and apple. The ancients were wont to regard it as a symbol of love and happiness; and in the rabbinical writings it is referred to as the forbidden fruit. The fruit has never had a very extensive culture in this country, although highly prized for jellies and preserves; but the stock has been quite generally used for grafting dwarf trees, especially pears.

Quince.

HYDRANGEA OTASKA.

Probably no fruit has been so greatly improved by the horticulturist, nor been the subject of so much study and experiment, as the pear. Though not a native of this country, it was early cultivated here, not only for the fresh fruit, but also for its juice, which is called "perry," and was often more highly esteemed than cider. There were no less than 442 varieties of this fruit, according to the catalogue of the London Horticultural Society, in 1842; but, during the fifty or sixty years prior to that date, much had been done to improve and develop the fruit, and form new varieties. Probably more attention was given to this matter by Van Mons, the Belgian fruit-culturist, in the early part of this century, than has been given it by any

Pear.

other one man; and he did much to start new kinds of pears himself, and to stimulate others to do so, by hybridizing, and experiments with seedlings.

Thus it will be readily seen that but few pears raised in this country prior to the Revolution were particularly choice. There was one tree, however, planted in New-York City, in the dooryard of Peter Stuyvesant, when governor of the old Dutch Colony of New Netherlands, more than two centuries ago, which remained growing, or at least alive, until about 1875; when, having died, and become not only unsightly, but an obstacle to building, it was cut down, the wood being preserved as relics of an interesting historic age. The fruit was a bon-chrétien, and of good quality; and grafts were obtained for much other stock.

Stuyvesant pear-tree.

Even more valuable than the fruit of this tree was that of the famous Seckel pear-tree. The late Bishop White of Pennsylvania narrates, that, when he was a boy, — about 1760, — there was a German cattle-dealer who used to sell to Philadelphians some small but particularly delicious pears; but from what source he obtained them he would not tell. Not long after, the tract of land belonging to the Holland Land Company, on the Delaware River, just south of Philadelphia, was sold in parcels; and "Dutch Jacob," as he was called, bought a section on which stood the tree from which he had procured this fruit. Soon after, the farm was sold to a Mr. Seckel; and ultimately the property became part of Stephen Girard's estate. The tree itself lived until quite recently. From that tree have come the Seckel pears so widely known and prized. Doubtless the tree was a seedling raised by early German settlers; but, while the Seckel somewhat resembles certain known German varieties, it is distinct from them, and is a strictly American fruit.

Seckel.

A less generally known but excellent pear, the Petre so called, was a seedling raised by John Bartram, a well-known Philadelphia horticulturist, in 1735, from the seed of a butter pear obtained from Lord Petre of England.

Petre.

Another tree famous for productiveness, and size of its fruit than for the quality of it, was planted by Mrs. Ochiltree, ten miles north of Vincennes, in Illinois, somewhere about 1800. It bore no less than 184 bushels of fruit in 1834, and 140 bushels in 1840; at which latter time its trunk was ten feet in circumference, — a remarkable growth for a pear-tree.

Ochiltree pear-tree.

Among other American seedling pears, the Bloodgood, an early, high-flavored fall fruit, raised by James Bloodgood, on Long Island, about 1820 or 1830; the Dearborn, originated by the Hon. H. A. S. Dearborn of Boston in 1818; and the Buffam pear of Rhode Island, — are the most prominent.

Van Mons produced many kinds of the beurré or butter pears. The Beurré Anjou was introduced to this country about 1840 by Mr. Wilder, president of the Massachusetts Horticultural Society. The Bartlett, identical with the Williams bon-chrétien of England, was introduced to this country by Enoch Bartlett of Dorchester, Mass. This has proved one of the most popular of dessert pears in the United States. The doyenné — known as the virgaloo (or bungalow) in New York, butter pear in Pennsylvania, and St. Michel's near Boston — is an old French variety, and was brought here quite early in the century. Within the past twenty-five years the importations have been almost innumerable, the beurrés, Duchesse D'Angoulême, Flemish beauty, and Vicar of Winkfield, being most prominent.

Bartlett, and other varieties.

The culture of pears, to be successful, requires careful adaptation to soil and climate. These points, as well as the improvement of varieties, have been closely studied by the nurserymen and horticultural societies; and since 1830 or 1840 the fruit has been very widely grown. California has been particularly productive of choice pears, and at certain seasons the Eastern markets depend almost entirely on that section for their supplies.

Culture of pear.

Besides being sold from the street-stands in cities, to be eaten out of hand and for dessert, large quantities of pears are dried or canned for the market. The business is regarded as highly profitable, many trees yielding fifty or sixty dollars' worth of fruit a year, and one tree in New York having a record of an aggregate product worth $3,750.

Dried pears.

In quantity, and perhaps in value, the fruit-crop which ranks next to the apple in this country is the peach. It is also one of our oldest fruits. Peaches originated in Persia, and grow wild in Asiatic Turkey. They have been long and widely cultivated in Europe in sheltered spots, and their improvement has received considerable attention; not, however, so much as the pear, than which the peach has much fewer varieties.

Peach.

It is impossible to say when the peach was first brought to this country; but it was pretty generally known in all the Atlantic colonies before the Revolution. Northern winters, however, have been rather too much for it; and the principal peach-orchards of the country are now confined to New Jersey, Delaware, Pennsylvania, and Maryland. It is generally conceded that American peaches, on the whole, are rather better than English ones.

History of the peach.

There were several varieties known in this country previous to the Revolution, and there is a record of the yellow clingstone having been taken to New York from South Carolina before the war for independence. Most of our best-known varieties have been developed since. The large white clingstone, long popular in New England, was raised in 1805 by David Williamson of New York. The Morris red and Morris white varieties were produced by Robert Morris of Philadelphia nearly a century ago. William Crawford of New Jersey originated the yellow-pulped peach that bears his name, about 1820. Two kinds of nectarine, raised from peach-stones by H. Bloomfield of Harvard, Mass., in 1810, and by T. Lewis

Varieties before and since the Revolution.

of Boston about 1815, were cultivated and disseminated by Col. S. G. Perkins of Brookline. This gentleman sent specimens of the former to London in 1821, which attracted great attention. The peach is really the choicest dessert fruit known. In the early part of the century it was very extensively dried for pies and sauce.

Peach-culture at close of last century.

Downing says that peach-culture in this country reached a climax about the year 1800. At that period the insidious disease called the "yellows" began to destroy the trees gradually. It first manifested itself in Pennsylvania. The fruit was carried north, and widely scattered. It was then customary for seedsmen to plant the stones of peaches indiscriminately, and without regard to the quality or health of the trees from which they came. Thus by degrees the malady became constitutional in the young peach-orchards of the Northern and Eastern States. The difficulty and its cause were not understood; and the evil operated slowly for twenty or thirty years, all remedies having been tried in vain. This difficulty, and the severity of the Northern winters, had pretty much exterminated the New-England and many of the New-York peach-orchards by 1850; since which time little effort has been made to restore them.

ROSE-COLORED WIGELIA.

Marked development of peach-culture within twenty years.

In the region above referred to, now forming the chief centre of production, there has been a marked development of peach-culture within twenty years, largely due to the development of the canning industry, and the greatly improved and special facilities for transportation by rail and steamer for this class of freight. From that comparatively limited region peaches are now sent all over the country in immense quantities at a trifling cost, and in a good state of preservation; and in the height of the season the carrying trade forms a big item in the business of certain freight-lines.

Plums are a much less prominent crop in this country. The fruit is derived from the bullace, which, in turn, is the offspring of the wild sloe, and is said to have originated in the Caucasus, near the Volga River. It has spread all over Europe from Norway south, and extended even into Barbary. English catalogues enumerated no less than two hundred and seventy-four varieties a few years since.

Plum.

Plums were known and grown slightly in this country before the Revolution, though not much is heard of them until the dawn of the present century. The venerable Chancellor Livingston was the first to bring to this country the greengage, which was known in France as the Reine Claude, having been named after the wife of Francis I. From that stock a seedling was developed by Judge Buel of Albany, which was called the "Jefferson." It is one of the most beautiful, delicious, and widely-known plums in this country. Its birth was probably not far from contemporaneous with that of the Washington plum, another spontaneous American product, derived from the greengage. Concerning the Washington plum, it is recorded that the parent-tree grew on Delancey's farm, on the east side of what is now the Bowery, in New-York City. A sucker from it was bought from a market-woman by Mr. Bolmar, a Chatham-street merchant, in 1818; and from this came the new variety. The Washington plum was soon introduced into Europe, where it has never been equalled. The Lawrence favorite and Columbia plums were also seedlings of greengage extraction, raised by L. U. Lawrence of Hudson, N.Y. Other less important varieties have been developed in this country; and numerous foreign varieties, including the common blue plum, the damson, and the apricot, have been imported. We have also, in this country, several wild native varieties. Among them are the Chickasaw, peculiar to Mississippi, a wild yellow and red plum to be found along river-sides from Canada to Georgia and Texas, and a beach-plum that grows on sandy coasts from Massachusetts to New Jersey, and occasionally farther south.

History.

Cultivation limited.

Plums have never been cultivated extensively for the market in this country, but generally by farmers and city residents for domestic use, and by fruit-fanciers as a special luxury. The common varieties are often pitted and dried, and the choicer ones pickled and preserved. The fruit is also used fresh for dessert to some extent.

Cherry.

The cherry is a fruit of Asiatic origin, and was introduced into Italy from Pontus during the Mithridatic war, 70 B.C. Thence it spread all over Europe. Within the past century or two its varieties have multiplied and improved remarkably. There are now over three hundred varieties cultivated.

Blackheart.

The blackheart variety was early introduced to this country, and seedlings were raised from it without number. The Black Tartarian, one of its Russian descendants, was brought here in 1825, and has proved a great favorite. The early whiteheart was brought here from France by R. Arden, who lived on the Hudson, opposite West Point. It has been widely cultivated. The bigarreau cherry was brought to the United States by William Prince of Long Island in 1800. Chancellor Livingston introduced a white bigarreau, and about 1825 Andrew Parmentier of Brooklyn brought the Napoleon bigarreau from Holland. Daniel Bloodgood of Flushing, L.I., M. P. Wilder of Boston, A. J. Downing of Newburgh, N.Y., and Robert Manning of Salem, Mass., brought several new varieties here between 1830 and 1850. The mayduke, supposed to be the medoc of France, was among the earliest, most valuable, and most widely-diffused varieties in this country, and many new varieties have been deduced from it. The morello, or Kentish sour red cherry, used chiefly for pies, was raised chiefly in New York along the Hudson, and in New Jersey. The fruit has never been cultivated largely for the market, but chiefly for local and family consumption. Besides being eaten fresh, the cherry is canned, dried, made into pies, and macerated with brandy or rum for medicinal purposes. The wood is also highly prized by cabinet-makers.

Other varieties.

Strawberries take their name from the old custom of putting straw underneath the plants to keep the fruit from touching the ground. The Romans called them "fragraria," on account of their delicious fragrance. They grow wild almost the world over. Little attention was given to their improvement in foreign countries until this century, and not much was done by American horticulturists until about 1830. Hovey's seedling, produced by a famous Boston seedsman in 1834, was among the very first and most popular of choice American varieties. In 1837 Alexander Ross of Hudson, N.Y., developed an improved variety from the Keen (English) strawberry. Thereafter varieties and plants rapidly multiplied, and the culture of this delicious fruit rapidly increased. Within the past ten or fifteen years strawberries have been grown in small garden-plats rather less than formerly, inasmuch as the immense quantities raised by market-gardeners in the Central States, especially on Long Island and in New Jersey and Delaware, and the improved facilities for transportation, have cheapened and made very plenty this delicious early summer fruit in all parts of the country.

Strawberry.

Raspberries (which are said to have originated on Mount Ida, in the Island of Crete) and blackberries grow wild all over the northern and eastern part of this country. Most of our cultivated berries were introduced from Europe. They have not been very extensively grown in the United States, however, the market being supplied quite as much by the wild fruit as by the improved. Horticulturists have given these berries comparatively little attention.

Raspberry.

Oranges grow to a very limited extent in this country, and chiefly in Florida. The fruit is essentially a tropical one, and has been known there from time immemorial. The principal planting and conduct of orange-groves for mercantile purposes is of recent date, under

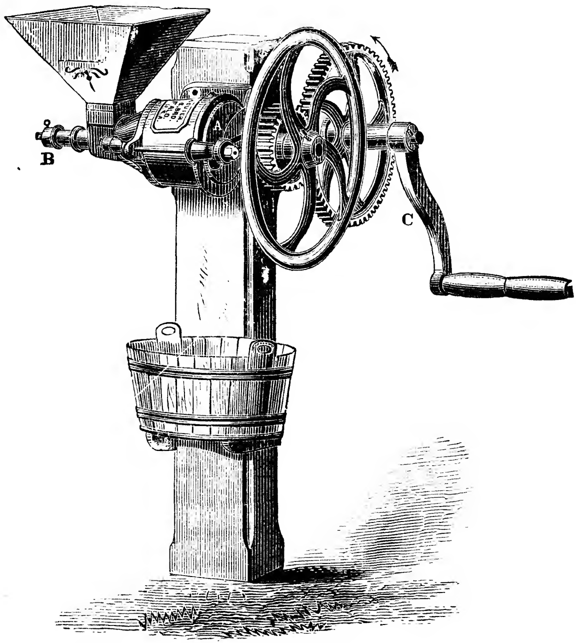
Oranges.

the auspices of Northerners who went to Florida after the war. Labor and society are as yet so demoralized, that the industry is still in its infancy, Florida oranges are large and sweet, and are highly and justly prized; and there would seem to be a deal of wealth in store for those who shall systematically supply Northern markets therewith.

Some idea of the growth of the fruit-producing business in this country within the past few years may be formed from the census returns of orchard products, which exclude grapes and wine and the various kinds of berries. In 1850 the total value was stated at $7,773,186; ten years later, $19,991,885; and ten years still later, $47,335,189. This is a more marked increase than in our sugar, tobacco, cotton, or cereals; and these simple figures contain a significant summary of horticultural history.

Figs, &c.

Besides the fruits named in this chapter, there have been attempts to domesticate others, mostly belonging to warmer climates, — such as the pomegranate, date-palm, fig, olive, lemon, mulberry, almond, and other nut-trees. But such attempts have met with but little success. The mulberry, however, be it remarked, was grown chiefly for the silk industry, which proved so signal a failure. Currants and other small fruits have too little a history to entitle them to specific mention.



COFFEE-HULLER.

Tea and coffee plants.

It may be remarked in this connection, that, besides fruit-trees, such economic plants as tea and coffee have been introduced by the horticultural branch of the Agricultural Bureau at Washington, but not with much success. The present commissioner, Gen. Leduc, is putting forth more vigorous efforts than did any of his predecessors to render tea-culture not only possible, but also a profitable industry.

BOOK II.

MANUFACTURES.

CHAPTER I.

MANUFACTURE OF IRON AND STEEL.

EARLY HISTORY.

NATURE has fitted the United States to become the centre of a great iron industry by the lavish endowment of her territory with all the materials required in the production and manufacture of that valuable metal. Iron, coal, and limestone are found in every part of our domain; and, in the region lying east of the Rocky Mountains, the country is so full of them as to present the appearance geologically of a gigantic basin filled to the rim with mineral treasures. It is said, by those who have examined the mineral resources of other countries, that, were the coal of the rest of the world deposited within the iron rim of this great basin, it would not occupy one-quarter of the area of our own coal-fields. What is true of coal is true of iron, which, by the help of coal, will be utilized still more extensively in the future of the world for the purposes of man. The deposits of the ore in this country exist in such enormous quantity as fairly to stagger the imagination. The ores are more accessible than in England, which now supplies half the iron consumed by the world; and they exist in close proximity to the coal and limestone used in extracting the metallic iron from them. Their abundance insures to the United States the ability to supply, not only its own people, but the world at large, with all the iron that could be consumed for centuries to come, if it were necessary to do so. There appears to be no other country so fortunately endowed with respect to iron and coal. England, now the resource of Europe and Asia, and once of America, supplies at present half the iron and coal of the world; but her mines are deep and difficult, and costly to work, while in the United States they lie upon the top of the ground, or near it. Sweden, with an inexhaustible supply of the richest and best ore, has no coal. Russia, Austria, Italy, Algiers, and some of the German States, have ore, but no coal. France is deficient in coal, and only maintains her iron manufacture by importing both coal and iron. Prussia has

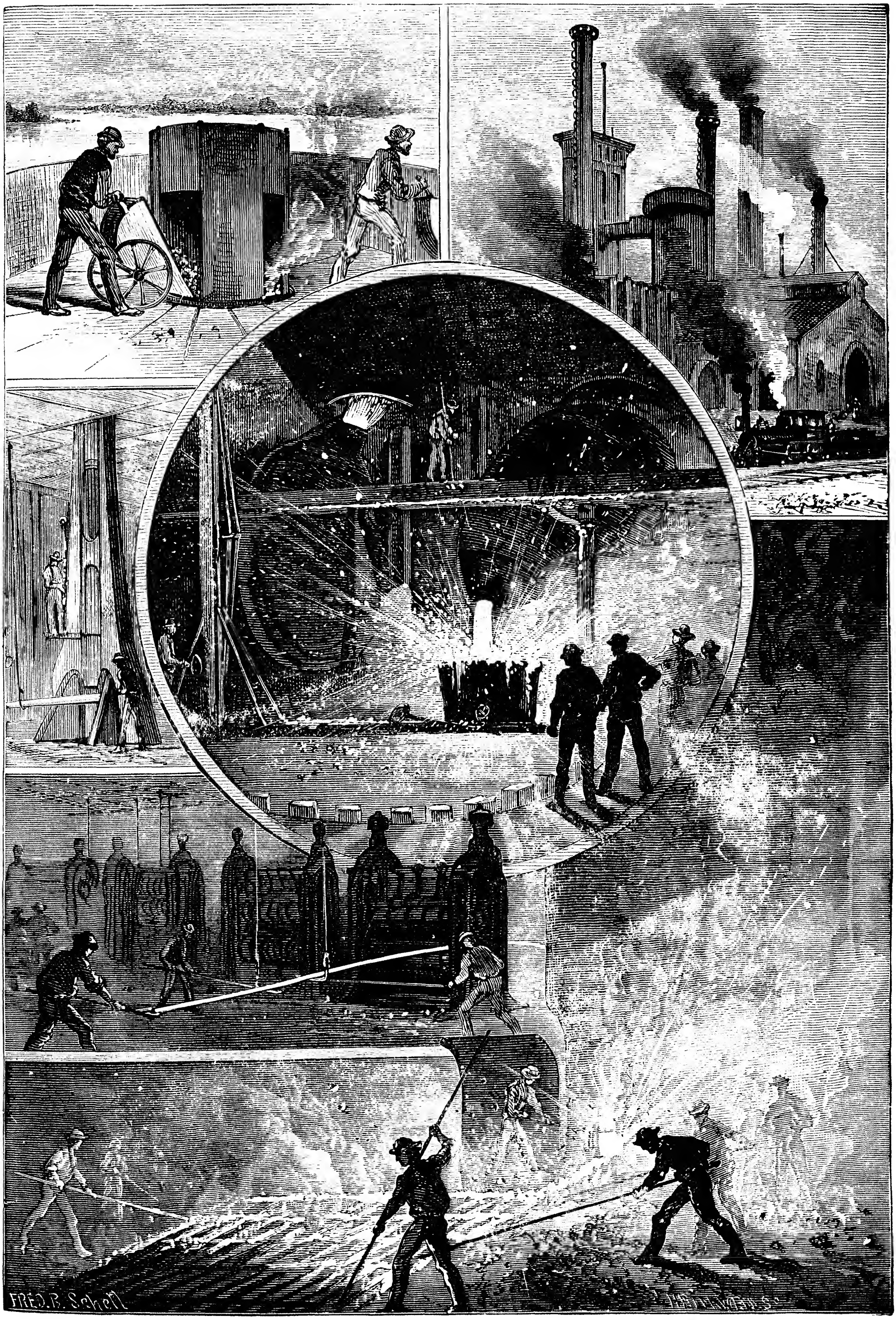
Superiority of United States over other countries in richness and variety of iron ores.

England.

a sufficient supply of both materials for her own needs, but has little surplus. Brazil has iron, but very little coal, and can only manufacture her ore by burning her forests in her furnaces, and cannot, therefore, long maintain a competition with a country whose very foundations are planted on beds of coal, if, indeed, she can ever seriously enter into one. Spain has iron and coal; but they are widely separated, and little has been done to utilize either. The United States, on the other hand, not only enjoys incalculable supplies of the best ores, and of coal and limestone, but in some States — as in Ohio, Pennsylvania, Alabama, and Kentucky — is able to point to all these materials so close together, that they exist within a radius of a mile and a half of the furnace, all lying on or near the surface of the ground. The mineral deposits of the United States will be more fully described in the book on "Mines and Mining;" and it need only be said here, that in a country filled with such exhaustless stores of coal and of iron ores of every variety, so convenient of access, nothing except the grossest apathy and ignorance on the part of the people could possibly prevent it, in time, from becoming a leading source of the world's supply of iron and iron manufactures; and that as our people are not ignorant and apathetic, but are eager, intelligent, and enterprising, the destiny of the country as the seat of a great iron manufacture is assured. Indeed, the industry has already reached magnificent proportions, and not only has now the capacity to produce enough to supply the wants of our own inhabitants, but, within the last two or three years, has begun to furnish a surplus for export. In the world at large the United States now stands second on the list of iron-producing countries, as will appear from the following table of the product of pig-metal, compiled by the American Iron and Steel Association for 1877 from the latest accessible statistics: —

Statistics.

COUNTRIES.	YEAR.	IRON, TONS.
Great Britain	1875	6,365,462
United States	1876	1,868,960
Germany	1874	1,660,208
France	1876	1,449,537
Belgium	1875	541,805
Austria	1875	455,227
Russia	1874	514,497
Sweden	1875	350,525
Luxemburg	1874	246,054
Italy	1872	26,000
Spain	1872	73,000
Norway	1870	3,975
Mexico	1876	7,500
Canada	1876	7,500
Japan	1874	5,000



IRON AND STEEL MANUFACTURE.

COUNTRIES.	YEAR.	IRON, TONS.
Switzerland	1872	7,500
Turkey	....	40,000
Australasia	....	10,000
All other countries	....	50,000
Total	....	13,682,750

The first discovery of iron in this country was in the South. Ore was found by Raleigh in Carolina; and, on his return to England, that eminent man reported that this metal formed one of the resources of the beautiful region referred to. It did not prove a special attraction to emigration at the time; for iron was not among the things in which the territory of England was deficient, and the world was not then using a hundredth part of the metal which it consumes now, and there was no great demand for it. The steam-engine had not been invented, and very little machinery was in use. Even after the practical settlement of the country by the English race had begun, in 1607, in Virginia, it was a great many years before iron was thought to be of sufficient account to expend any time on its manufacture. Tobacco was a much more profitable product, and for fifteen years was about the only product of the colony; the men sent over by the London Company to introduce industry themselves turning agriculturists, and raising that valuable plant. That minerals abounded in Virginia was, however, noted at a very early day. In 1610 "iron oare" was sent to England by the Jamestown Colony, and found to yield an excellent quality of metal. Attention was called to the matter repeatedly. Finally the London Company determined to make use of the ore; and about 1620 they sent to Virginia, as appears from "A Declaration of the State of Virginia," "out of Sussex, about forty, all famed to iron workes." These people established in Virginia a forge, or, more properly, what is now called a "bloomary." Reference is made to it by Beverly, in his "History of Virginia," as the "iron work at Falling Creek, in Jamestown River, where they made proof of good iron ore, and brought the whole work so near a perfection, that they writ word to the company in London that they did not doubt but to finish the work, and have plentiful provision of iron for them, by the next Easter;" namely, in the spring of 1621. Thus iron was actually manufactured from the ore in Virginia as early as 1620. The fuel used was charcoal. In 1621, three of the master-workmen having died, the company sent over Mr. John Berkeley, with his son Maurice and twenty experienced workmen, to carry on the works. On the 22d of May, 1622, the works were destroyed by the Indians, and the whole company massacred, with the exception of a boy and a girl, who

Discovery and early production of iron.

Manufacture of iron in Virginia.

escaped by hiding. Three hundred and forty-seven of the other settlers were killed besides. This bloody event put an end to the making of iron in Virginia for nearly a hundred years. The business was not resumed until 1712, although the rocks of this ancient and well-settled State were known to be full of valuable deposits, and the attention of capitalists in London was from time to time called to the fact.

It is one of the most remarkable coincidences in the history of the iron manufacture, that a mob in civilized England destroyed a blast-furnace, erected there by Dud Dudley for the smelting of iron by means of coal fuel, almost at the same time that the savages of the woods burned the little pioneer factory in Virginia. Experiments had been making in England for many years to utilize coal in producing iron. The forests of the kingdom were being destroyed rapidly by the insatiable demands of the forges and blast-furnaces, which then could only be worked with charcoal fuel. In 1619 Dud Dudley had succeeded in making iron with coal by means of his skill in the use of bellows and in coking coal. Iron-masters tried to obtain his secret, and working-men were incited to jealousy of him. He built five separate works, was tricked out of three, and lost one by a flood; and one was destroyed by a mob. Dudley kept his secret, and it died with him; and the manufacture of iron with the aid of hard coal was postponed for over a hundred years. It was not until about 1735 that Darby, having discovered the process, put it into use, and began making iron with coke regularly. That process and the new blowing-engines then quadrupled the product of iron in England in fifty years.

Dudley's experiments.

First use of coke.

The next attempt at making iron in the colonies was in the North. It was part of the object of colonizing Massachusetts to produce iron. In the journal of the Court of Assistants at London for the meeting on March 2, 1628, it is recorded that "also for Mr. Malbon it was propounded, he having skill in iron-works, and willing to put in twenty-five pounds in stock, it should be accounted as fifty pounds, and his charges to be borne out and home from New England; and upon his return, and report what may be done about iron-works, consideration to be had of proceeding therein accordingly, and further recompense if there be cause to entertain him." Three days after, the court made arrangements with Thomas Graves of Gravesend, Kent, "a man experienced in iron-workes," to go out to New England at the expense of the company, and serve the company for six or eight months, provision being made for his staying three years if desirable. The result of the expedition of these two men is not known. It could not have been very satisfactory; for no furnace-fires appear to have been established in consequence of it. The Court of Assistants in London got no iron from this preliminary attempt. Fifteen years later the subject of iron-making was agitated again, and in 1637 the General Court of Massachusetts

Manufacture of iron in New England.

granted to Abraham Shaw one-half the benefit of any "coles or yron stone w[ch] shall bee found in any comon ground w[ch] is in the countrye's disposing."

The first iron made in the colony, however, was not from stony ores, but was taken from the bottom of the peat-bogs and ponds near the coast. These bogs are found all along the eastern coast of the country as far south as Maryland. Water filtering through the neighboring hills brings down into the ponds large quantities of sesquioxide of iron in solution, and deposits the same at the bottom of the pond, along with vegetable mould, in soft, spongy masses which go by the name of "bog-iron ore." The ore, once taken out, is renewed again by gradual deposit. After the Falling-Creek experiment, the iron-works of the country were supplied for a long period principally with bog-ore. The large furnaces of the present day could not be supplied with it, because it does not exist in sufficient quantity; but, for the uses of the early colonists, it supplied pretty nearly every want. The iron cast from it is brittle, but very fluid when melted, taking every minute mark of the mould; and is, therefore, still made to the present day in North-west New Jersey and in Maryland for stove-castings.

Bog-iron ore.

In 1643 specimens of the bog-ores from the ponds near Lynn were sent to England for trial, and found to be so good, that a "Company of Undertakers for the Iron-Works" was immediately formed, with a thousand pounds capital, by John Winthrop, jun., and others. Winthrop came to New England in 1643, with a corps of workmen, to begin the regular manufacture of iron. The company built their furnace on the banks of the Saugus River, within the present limits of Lynn, at a spot which they called Hammersmith, after the place in England from which some of the workmen had come. The General Court of Massachusetts greatly favored this work by grants of three square miles of land wherever the company put up works, and by special privileges and charters. Subscriptions toward the stock were encouraged among the inhabitants. The work was very successful; and on Oct. 14, 1645, the General Court granted to the company a charter "on the condition that the inhabitants of this jurisdiction be furnished with barr-iron of all sorts for their use, not exceeding twenty pounds per tunne." In 1648 the furnace at Lynn was turning out eight tons of iron a week, and appears to have been kept busy for a long time casting cannon, shot, pots, and other hollow-ware, for which the bog-iron is so well adapted. The first article cast was an iron pot; and this historic and intrinsic treasure was handed down for generations in the family of the man who bought it, who happened to be Thomas Hudson, of the same family as the Dutch explorer, Thomas having been the original owner of the lands on the Saugus upon which the foundery stood.

Winthrop.

Furnace at Lynn.

The company built another forge about 1648, in the town of Braintree;

and in 1652 a forge was established at Raynham (now Taunton) by the two Leonard brothers, Henry and James, from whom have since descended so many of the well-known iron-masters of the country.

Braintree and Taunton.

John Winthrop, jun., went to New London in Connecticut in 1645, and in 1651 obtained a grant of privileges from the Assembly to enable him to make iron there. He did not, however, carry out his intention of establishing the business then; and the first iron-works in this colony were erected at New Haven, where they were established by Capt. Thomas Clarke in 1656.

First iron-works in Connecticut.

Rhode Island made iron at Pawtucket and elsewhere as early as 1675. There were several furnaces and forges in the State, all of them running with bog-ore taken from the ponds on the border of Bristol County, Massachusetts. The works at Pawtucket were started by Joseph Jenks, jun., from Lynn. The Indians interfered with their infant enterprises a great deal; and the iron industry has not, even to this day, reached any special development in the State. The energies of the people were directed at a very early period to cotton spinning and weaving, and that has since engrossed them almost entirely. Yet Rhode-Island hills contain unlimited quantities of the most important iron ores.

Rhode Island.

Iron ore had been discovered in New Jersey by the Dutch; and a company of people from Connecticut began the production of metal from it as early as 1664 in Shrewsbury, Monmouth County. Henry Leonard went to Shrewsbury about that year from Lynn, and is said to have set up one of the first furnaces of the provinces. Several bloomary-fires were started in Sussex and Morris Counties in 1685 by immigrants from England and the northern provinces of this country. The ore was brought to the forges many miles in leathern bags on pack-horses.

New Jersey.

There is some dispute as to whether the pioneer works in New England, at Lynn, were of the character of a blast-furnace or a bloomary-fire; but there is no doubt at all, that, during the first fifty years of practical iron-making in this country, the furnaces were, in general, what are called "bloomaries." The blast-furnaces were exceedingly rare. They were in use in England, but not here, except at Lynn (where Mr. Swank believes there was one as early as 1644), and at Shrewsbury, N.J., where one was set up about 1680. These bloomaries were simply an improvement upon the primitive mode of making iron direct from the ore, in use in India from the most ancient times, and still employed by the natives of Asia and Africa. The original bloomary was merely a hole in the ground, in which charcoal was burned by the aid of a bellows made from a goat-skin, iron ore being added to the fire in small quantities. It is the peculiar property of iron, and the ore quality above all others, which has made it of such extraordinary utility to man, that its particles agglu-

Blast-furnaces and bloomaries.

Early process of making iron described.

tinate at a white-heat. In those primitive fires it was found, that, the stone being burned out of the ore, and the iron heated almost to incandescence, the metal gathered together, and settled at the bottom in a glowing and more or less compact lump, or bloom, and might be got out and worked by breaking away the clay.

This method of making iron served the world for centuries. It was finally improved in Catalonia, in Spain, and made much more effective; and the works there perfected took the name of Catalan bloomaries, or forges, from the province in which they were first set up. The original form, used in the Pyrenees since 1293, was a furnace two feet high, with a hearth, or crucible, to receive the heated lump of metal, eleven inches deep. The blast was fed to the fire through two openings, called *tuyères*, about eleven inches from the bottom. In five hours a hundred and forty pounds of iron could be made. In time the furnace became enlarged, and the hearth was made twenty inches deep: one *tuyère* was discontinued, and the production was increased to three hundred pounds of metal in five hours. The process was as follows: In the fire-clay hearth a bottom of slag and charcoal was laid, and glazed over at a high heat: the hearth was then half filled with charcoal. On the side opposite to the *tuyère* coarse ore was heaped up to the top of the hearth, and the rest of the space was filled with charcoal. Then the blast was started at a low pressure of about three-quarters of a pound. In six hours the pressure was raised to a pound and a half, and the whole of the fire heaped over with fine charcoal and ore, except over the coarse ore. The gas and flame from the fire, meeting with difficulty in escaping through the fine charcoal, were forced principally to find an outlet through the interstices of the coarse ore, and they gradually reduced it. The melted slag, settling down below the *tuyère*, was tapped off every hour. At the end of the operation, or in about six hours, the bloom was pried out of the fire, and put under a fourteen-hundred-pound hammer for manufacture. The heat could be so increased as to melt the iron, and run it off to make castings. In the Catalan process, three tons of ore, and two and three-quarters or three tons of charcoal, were consumed to make a ton of iron; the process being very wasteful, but the metal extremely pure and good.

Iron-making in Spain.

Process described.

The principal trouble with the Catalan forge was, that the fire had to be re-made after each heat. This objection led to an improvement upon it, invented by the Germans in Alsace. These people went back to the old plan of throwing into the fire alternate layers of fine ore and charcoal, using larger fires, and making the blast continuous. By this means they were able either to run off the melted metal, or pry out the heated bloom, without re-making the fire. The principle and form of both bloomaries were substantially the same, and the product equally good.

Defect of Catalan forge.

This was the general style of forge which found its way into America in the infancy of the iron-manufacture, and by which the manufacture was established. Professor T. Sterry Hunt says of it in a recent paper, —

T. Sterry Hunt.

"This furnace had the great advantage, that its construction required but little skill and outlay. A small waterfall for the blast and hammer, a rude hearth with a chimney, and a supply of charcoal and ore, enabled the iron-worker to obtain, as occasion required, a few hundred pounds of iron in a day's time in a condition fitted for the use of the blacksmith; after which his primitive forge remained idle until there was a further demand. To this day such furnaces are found in the mountains of North Carolina, and furnish the bar-iron required for the wants of the rural population. . . . Still more worthy of note is it, that this primitive bloomary-furnace, discarded in Europe, has been improved by American ingenuity, — enlarged, fitted with a hot blast, water, *tuyères*, and other modern appliances, — so that, in the hands of skilled workmen in Northern New York, it affords for certain ores an economical mode of making a superior malleable iron. A large part of this product is consumed at Pittsburgh for the manufacture of cutlery-steel of excellent quality."

Pennsylvania, so marvellously stored with the materials for iron-making, did not begin the manufacture until 1717, — the year before William Penn's death. Penn came to the province which was named after him in 1682. He was familiar with the iron-business, and he accordingly soon had furnaces in New Jersey at various places in Sussex. He discovered in time that his own province was rich in minerals; but it appears that the industry was not developed there until the year before his death. The record of the event is found in a letter of Jonathan Dickinson, written in 1717, in which he says, "This last summer, one Thomas Rutter, a smith who lived not far from Germantown, hath removed farther up in the country, and of his own strength has set up on making iron. Such it proves to be as is highly set by all the smiths here, who say that the best of Swede's iron doth not exceed it; and we have heard of others that are going on with the iron-works." A beginning once made, the industry developed with great rapidity. In 1728 four furnaces were in full blast; one being at Colebrookdale on the Maxatawny Creek, and one being in the present county of Lancaster. By the time of the Revolution many others had been built in Eastern and North-eastern Pennsylvania. These were regular blast-furnaces run with charcoal fuel.

Pennsylvania.

Virginia resumed the manufacture of iron about 1715. Col. Alexander Spottswood opened some mines in Spottsylvania County, on the Rappahannock, and put up a blast-furnace there about that year. The owner told Col. Byrd in 1732 that he was the first in America who had erected a regular furnace, and that "they ran altogether upon bloomaries in New England and Pennsylvania till his example had made them attempt greater workes." This is believed, by Mr. Swank and others, to be a mistake, because there was a furnace at Lynn, and another at Shrewsbury, long

Resumption of iron-manufacture in Virginia.

before Col. Spottswood developed his large and flourishing works. The erection of the Rappahannock furnace was, however, an important event in the history of the iron-trade. It certainly led to the building of larger works in the North than had been put up previous to that time. Col. Spottswood had four furnaces in 1732; the largest being at Fredericksburg, thirteen miles from the mine. An idea of the sort of work the furnaces ran on at that day may be gathered from the journal of Col. Byrd, who says, that at the furnace at Massapony, on the Rappahannock, there were cast "backs for chimneys, andirons, fenders, plates for hearths, pots, skillets, mortars, rollers for gardeners, boxes for cart-wheels, &c., which, one with another, could be delivered at people's doors for twenty shillings a ton."

New York.

By 1735 all the large coast provinces were busily manufacturing pig and bar iron and castings, except New York. New York came lagging in the rear of the train, and did not make iron until about 1740. The beginning of the industry appears to have been due to the development of the famous brown hematite deposits in Salisbury, Conn., in 1732. No iron of any consequence had been found within the limits of the province itself; and the city of New York had been, up to that time, supplied with iron from the adjoining provinces. In 1740 Philip Livingston built the first iron-works of the province on Ancram Creek in Columbia County, obtaining his ore from Salisbury in Connecticut, twelve miles away. The works consisted only of a bloomary-forge. In 1751 a blast-furnace was built in Orange County to work up the ores of Sterling Mountain. The celebrated mines in the northern part of the State were not opened until 1800. The oldest forge in the Champlain region is said to have been built no earlier than 1801.

The iron-manufacture began in New Hampshire about 1750, where several bloomaries were built to make use of the bog-ores. A good deal of iron was made during the Revolution; but, after that, the business died out. There is to-day only one furnace in New Hamphire; namely, the one belonging to the rolling-mill at Nashua.

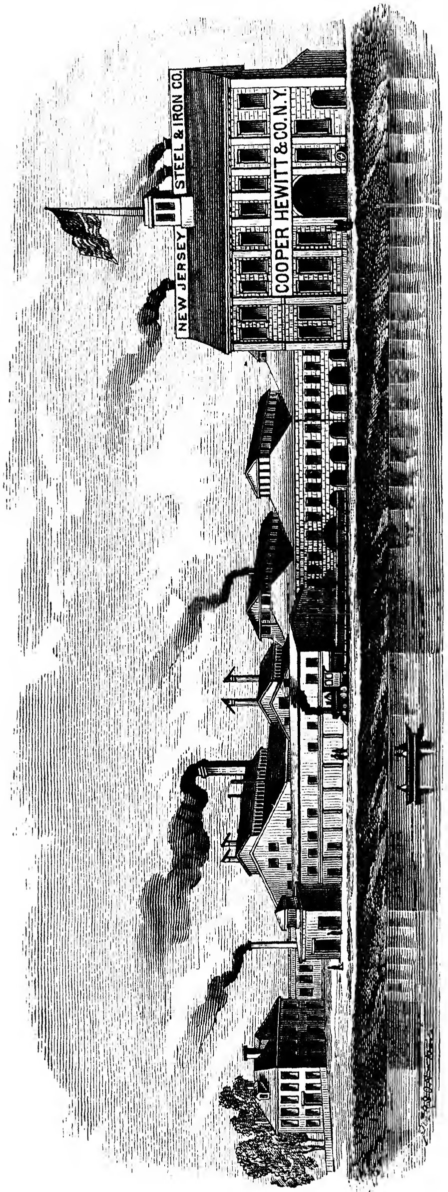
Vermont.

Vermont entered upon the industry at the same time as her sister-province, making use of the magnetic and hematite ores in the northern and western parts of the State. **Maine.** Maine had a few bloomary-forges in York County during the Revolution, the war giving an energetic development to this business in every part of the country. **North Carolina.** North Carolina exported a little iron as early as 1728, and during the Revolution had a great many bloomaries and forges in operation. **South Carolina.** In South Carolina the first forge was erected in 1773, in the north-western part of the State: it was burned by the Tories during the war. **Kentucky.** In Kentucky the first works were built in 1791 by government troops, on Slate Creek in Bath County. In Tennessee a bloomary was established at Emeryville as early as 1790; and in both that State and Kentucky a large number of works sprang up immediately after, and were operated for many years, until the cheaper iron of the North made the business unprofitable. Georgia made no iron prior to the American Revolution.

FORTY YEARS OF REPRESSION AND STRUGGLE.

Laws enacted to repress iron-industry.

Thus, by the middle of the eighteenth century, the manufacture of iron had taken a very favorable start. The furnaces and forges were small, and mainly devoted to supplying the blacksmiths of the vicinity surrounding them with bar-iron, and to casting the articles of hollow-ware, and furniture for fireplaces. They furnished a quantity of crude iron for export, however, because the skill and capital to manufacture this material into cutlery, tools, machinery, and goods of the higher types, did not at first exist in this country, and the production was somewhat in excess of the demands of the blacksmiths. Along towards the middle of the eighteenth century, steel furnaces, rolling and slitting mills, and plating forges, began to be erected in the various colonies, the industry keeping steady pace with the growing wealth and development of the several sections. The further building of the classes of factories just named was, however, stopped in 1750 by a law which directly forbade it as a common nuisance. This was one of the early steps of the intolerance of the mother-country which led to the ultimate revolt and independence of the colonies. A peculiar feeling existed in England toward the colonies. The people here were Englishmen, were proud of the fact, and were unflaggingly loyal to the government under the protection of whose banners they were trying to subdue the wilderness, and build up a group of flourishing and civilized communities. As Englishmen they were protected by the arms of England against all foreign invasions of their rights and territory, and their loyalty was rewarded by the recognition of their able men with commissions in the king's civil and military service and otherwise. But they had the misfortune to live and be born out of the realm itself, and on that account they never enjoyed the full respect and sympathy of the people of England and of the crown. All the legislation had in respect to them was inspired, therefore, with something less than a spirit of full fraternity, and often with a positive determination to make them simply subserve the purposes of the people at home, regardless of their own welfare and prosperity. The legislation in respect to the industrial development of the colonies was dictated by mercenary considerations exclusively. Growth here was retarded in every possible manner. Bounties for the export of agricultural products were given to induce the colonists to confine their attention exclusively to agriculture, and to depend entirely upon the mother-country for articles of manufacture. Parliament desired our people, living as they did under the shadow of gigantic forests, to export even their timber to England, and obtain from that country, in return, our wooden-wares, chairs, tables, carriages, and wooden bowls. The development of the local industries of England, and the promotion of the carrying-trade to the colonies so as to insure to England a great deal of shipping, were aimed at steadily. The growth of industry here was looked upon with impatience; and when it was seen that the colonists refused to be dependent forever, and that they were showing great vigor and enterprise in putting up their own factories and forges, Parliament interposed with a regulation of the sort above referred to.



NEW-JERSEY STEEL AND IRON WORKS, TRENTON, N.J.

Law of 1750.

The law of 1750 restricted the iron-making of the colonies to the production of pig and bar iron and to castings. Nails were made in a small way by the people, in their chimney-corners, evenings; and the blacksmiths still worked away at wrought-iron implements and utensils: but general growth was stopped. A large part of the iron made was exported to England, the colonists getting it back again in the cutlery, steel, and other goods they were not permitted to make themselves. The following table, which we copy from Scrivenor's "History of the Iron Trade," will show the quantity exported to England, down to the time of the Revolution, in tons: —

YEAR.	PIG-IRON.	BAR-IRON.
1718	....	3
1728–29	1,132	....
1730	1,725	....
1730–31	2,250	....
1731–32	2,332	....
1732–33	2,404	....
1733	....	½
1733–34	2,197	....
1734	....	....
1734–35	2,561	....
1735	....	55
1739	2,417	....
1740	2,275	5
1741	3,457	5
1742	2,075	....
1743	2,985	....
1744	1,861	57
1745	2,274	4
1746	1,861	196
1747	2,156	82
1748	2,155	4
1750	2,924	5
1751	3,210	5
1752	2,980	81
1753	2,737	247
1754	3,244	270
1755	3,441	389
1761	2,766	39
1762	1,766	122
1763	2,566	310
1764	2,554	1,059
1765	3,264	1,078
1766	2,887	1,257
1767	3,313	1,325
1768	2,953	1,989
1769	3,401	1,779
1770	4,232	1,716
1771	5,303	2,222
1772	3,724	965
1773	2,937	837
1774	3,451	639
1775	2,996	916
1776	316	28

In the same period, there were some slight shipments to Scotland in addition to these.

When the colonies began their daring experiment of a fight for political independence, they were poorly provided with the means for carrying on a war. Not to mention their lack of factories for clothing, of ships, of public funds, and private capital, and of a dense population from which to recruit an army, the poverty of their resources for making cannon, chains, rifles, swords, and shot, was so great as of itself alone to place them at an enormous disadvantage in the conflict with England. They had few or no works for the production of these necessaries of war, and neither sufficient ready capital to build all the country needed, nor the skill to produce at once an article of good workmanship. The casting of a ten-pounder cannon was so serious a piece of business with them at that day, that few cared to undertake it. The absolute cutting-off of the supplies from England, upon which the colonies had formerly depended, however, placed them under the necessity of enlarging their iron-manufacturing facilities at once. The people not being able to do this to the extent required both by the local wants and the demands of the government, the Continental Congress took part in the work; and the troops and the public funds were employed to establish furnaces and factories of iron and steel in various parts of the country. Works were established by Congress in the Housatonic Valley in Connecticut, in the Highlands of the Hudson, in Northern New Jersey, Kentucky, and wherever the ores were rich and the forest dense, and charcoal therefore abundant. It is said that the first trials of anthracite for manufacturing purposes were made by Congress at its armory at Carlisle, Penn., in 1775, established in consequence of the Revolutionary war. The combined resources of Congress and people were only barely sufficient at first to supply the country with the iron it needed. It took some time to train workmen, and the Tories frequently interfered with proceedings by burning the iron-works. Toward the close of the Revolution the industry gained a good start; and, had the treaty of peace in 1783 been followed up by a policy favorable to native manufactures, its rise would have been thenceforward rapid.

Condition of iron-manufacture at outbreak of Revolution.

Policy of Continental Congress.

But the Continental Congress had no power to initiate a policy of the proper sort; and a period of six years followed, during which the country was flooded with cheap manufactures from England; and a large number of the native American furnaces and factories, finding no demand for their iron, ceased to exist. By the previous repression of our industries, England had been enabled to enlarge and develop her own; and the skill of her workmen, and the large capital of the masters, made it impossible for America to compete with her, even in supplying her own needs. The few iron furnaces and founderies which managed to keep alive during the interregnum from 1783 to 1789 scarcely did more than provide for their respective neighborhoods.

1783 to 1789.

THE EFFECT OF TARIFFS.

In 1789 the first Congress met under the new Constitution, equipped by the people with power to legislate for the commonweal on a variety of important subjects, which, before that, the General Government had been unable to touch. It was a convention of the best men of the Revolutionary struggle. The first law passed was one in relation to official oaths; the second, an act for the protection of American industries and for revenue. By this law a duty was levied upon all importations of iron; a moderate one, — only five per cent on the home value of iron, and fifty cents per hundred-weight on steel, — but enough to prove a temptation to many furnace-men to kindle anew the fires in their deserted stacks, and collect their scattered workmen, and resume the industry (so valuable to the country) which the heavy importations from England had obliged them to abandon. The duty, not proving large enough, was increased by different Congresses, until in 1812 it reached thirty-two per cent and a half on iron (thirty-seven per cent if brought in foreign vessels), and two dollars per hundred-weight on steel. After the war of 1812 it was reduced somewhat. Under the protection of this tariff, iron-making was resumed in all the States in which it had previously been carried on. In States and localities where no start had yet been made it was begun. Pittsburgh, now the most important iron centre of the country, had yet had no bloomary nor foundery; and Ohio, with its rich stores of coal and ore, and busy farming-population, had seen no piece of iron laid on a village anvil except that which had been toilsomely brought by wagon from the distant East. But in 1803 the iron-industry was initiated at Pittsburgh by the building of a foundery, and in Ohio by the erection of a small charcoal-furnace in Poland Township, Mahoning County. Bloomaries, furnaces, rolling-mills, and steel-works sprang into being throughout the Union everywhere. The mines of the West and South were opened as the wave of population flowed into the regions surrounding them, and in the older communities in the rear of them branches of the manufacture which had never been attempted on this continent were successfully tried and established. Production began to keep pace with consumption, and a small quantity of crude iron was even supplied for exportation.

Early tariff laws.

Increase of manufacture.

Were it expedient to do so, the history of iron-making from 1789 down to 1878 might be divided into eras coinciding with the changes in the principle on which the tariff has been framed. There have been several important changes. The tariff was protective until 1816. In 1816 the duties were lowered in deference to the wishes of the free-traders. In 1824 the protective tariff was again enacted, and, being strengthened in 1828, lasted until 1834. Then a compromise tariff was adopted, by which the duties were gradually lowered. In 1842, again, there

Character of various legislative enactments.

was a tariff for protection; but in 1846 free-trade gained the ascendency once more, and until 1861 there was little or no protection. In 1861 the present protective tariff was adopted. These changes brought about periods of alternate depression and prosperity in the iron-industry. There has been such an abundance of land in the country, and the agricultural life, with its ownership of a bit of land, has had such fascinations in theory, if not in fact, to the mass of the people, that wages have always been necessarily high here; and the iron-masters have not been able to produce either crude or manufactured iron for American consumption in competition with Englishmen, without the protection of an efficient duty. Whenever the tariff has been lowered, therefore, the fires have gone out in scores of furnace-stacks and rolling-mills throughout the country, and working-men have been thrown out of employment. Several times, as in 1820, the business has been in a state of ruin. Whenever protection has been again extended, the smoke has again floated from the chimneys of the iron-works, and the business has become prosperous. The influence of the tariff has been so great, that mention of it cannot be omitted. It is preferable, however, to divide the history of iron-making into periods, simply with reference to the progress of invention, and not with reference to tariff changes. Still it may not be uninteresting to the reader to glance over the following table of the changes in the duties, and compare it with the succeeding table of production of iron in the United States: —

RATES OF DUTY FROM 1789 TO 1876.

	PIG-IRON.	BAR-IRON.	RAILROAD-BARS.	STEEL.
1789 .	5 per cent.	5 to 7½ per cent.	. . . . .	50 cents per cwt.
1790 .	5 per cent.	5 to 7½ per cent.	. . . . .	75 cents per cwt.
1792 .	10 per cent.	10 per cent.	. . . . .	$1 per cwt.
1794 .	15 per cent.	. . . .	. . . . .	. . . .
1804 .	17½ per cent.	1 cent a pound.	. . . . .	$1 per cwt.
1812 .	32½ per cent.	2 cents a pound.	. . . . .	$2 per cwt.
1816 .	20 per cent.	45 cts. to $2.50 per cwt.	. . . . .	$1 per cwt.
1818 .	50 cents per cwt.	75 cts. to $2.50 per cwt.	. . . . .	$1 per cwt.
1824 .	50 cents per cwt.	90 cts. to $3.36 per cwt.	. . . . .	$1 per cwt.
1828 .	62½ cents per cwt.	$1.12 to $3.92 per cwt.	$37 per ton.	$1.50 per cwt.
1830 .	62½ cents per cwt.	$1.12 to $3.92 per cwt.	25 per cent.	$1.50 per cwt.
1832 .	50 cents per cwt.	$1.12 to $3.92 per cwt.	free.	$1.50 per cwt.
1833 to 1842	gradual fall to 20 per cent.	gradual fall to 20 per cent.	free.	$1.50 per cwt.
1842 .	$9 per ton.	$17 to $56 per ton.	free.	$1.50 to $2.50 per cwt.
1843 .	$9 per ton.	$17 to $56 per ton.	$25 per ton.	$1.50 to $2.50 per cwt.

	PIG-IRON.	BAR-IRON.	RAILROAD-BARS.	STEEL.
1846 .	30 per cent.	30 per cent.	30 per cent.	30 per cent.
1857 .	24 per cent.	24 per cent.	24 per cent.	24 per cent.
1861 .	$6 per ton.	$15 to $20 per ton.	$12 per ton.	$1.50 to $2 per cwt. and upwards.
1862 .	$6 per ton.	$17 to $25 per ton.	$13.50 per ton.	under 11 cts. a lb., $1\frac{3}{4}$ to $2\frac{1}{2}$ cts.; over, 25 per cent.
1864 .	$9 per ton.	$22.40 to $39.20 per ton.	$13.44 per ton.	under 11 cts. a lb., $2\frac{1}{4}$ to 3 cts.; over, $3\frac{1}{2}$ cts. and 10 p. c. ad valorem.
1865 .	$9 per ton.	$22.40 to $39.20 per ton.	$15.68 per ton.	under 11 cts. a lb., $2\frac{1}{4}$ to 3 cts.; over, $3\frac{1}{2}$ cts. and 10 p. c. ad valorem.
1870 .	$7 per ton.	$22.40 to $39.20 per ton.	$15.68 per ton.	under 11 cts. a lb., $2\frac{1}{4}$ to 3 cts.; over, $3\frac{1}{2}$ cts. and 10 p. c. ad valorem.
1872 .	$6.30 per ton.	$20.16 to $35.28 per ton.	$14.11 per ton.	10 p. c. less than in 1864.
1875 .	$7 per ton.	$22.40 to $32.20 per ton.	$15.68 per ton.	same as in 1864.

Down to 1816 a discrimination was regularly made in favor of the American carrying-trade by levying ten per cent more of duty if the iron were brought in foreign vessels. The figures above given represent the duty on imports in American vessels.

The best statistics as to the production of iron in the United States are those compiled by the American Iron and Steel Association, of which Mr. James M. Swank is the author. They are as follows: —

PRODUCTION OF PIG-IRON IN GROSS TONS.

1810	54,000
1820	20,000
1828	130,000
1829	142,000
1830	165,000
1831	191,000
1832	200,000
1840	315,000
1842	215,000
1846	765,000
1847	800,000

1848	800,000
1849	650,000
1850	564,755
1852	500,000
1854	736,218
1855	784,178
1856	883,137
1857	798,157
1858	705,094
1859	840,627
1860	919,770
1861	731,544
1862	787,662
1863	947,604
1864	1,135,996
1865	931,582
1866	1,350,343
1867	1,461,626
1868	1,603,000
1869	1,916,641
1870	1,865,000
1871	1,911,608
1872	2,854,558
1873	2,868,278
1874	2,689,413
1875	2,266,581
1876	2,093,236

THE ERA OF ANTHRACITE FUEL AND THE HOT BLAST.

Down to 1838 the only fuel used to any extent in the manufacture of iron from the ore was charcoal. There were a few coke furnaces in the country; but the vast majority of the iron-masters used charcoal bloomaries and furnaces. The furnaces were small (the stacks seldom over twenty feet high), and producing from two to four tons of iron a day. From a hundred to a hundred and fifty bushels of charcoal and two tons of ore were consumed to the ton of iron produced, the quantity of coal varying according to the hardness of the wood from which the coal had been made, and the skill and experience of the foreman. The profits of the business depended largely on the judgment and success of the foreman in the use of charcoal. The blast was of cold air, supplied by two pairs of large bellows worked by water-power, and blown into the furnace, sometimes through hollow green logs placed back from the *tuyère* opening, so as to be safe from burning. The quality of iron made by these old-fashioned furnaces was exceedingly good. The metal was pure, and of great tenacity and durability of wearing surface, and was of the greatest value for the purposes of steel. Even at the present time, invention has been unable to produce iron of superior quality to that made

Introduction of anthracite.

Process described.

in the charcoal bloomaries and furnaces; and the highest-priced bars at present are still those thus produced. The quantity which could be made in the old-fashioned furnace was, however, small; and, as the forests in the mining-regions were consumed, the cost of production even of that small quantity increased.

Experiments were made for the production of iron with anthracite coal. The country was richly stored with supplies of this valuable fuel; and its usefulness for the generation of steam, and for the warming of houses, had been demonstrated at a very early day. Could it be burned in the blast-furnaces, a saving of labor and expense, and an increase of production, would certainly follow. One experiment was made as early as 1815 at Harford Furnace in Maryland, the anthracite being mixed with one-half charcoal. In 1826 anthracite was tried in a furnace near Mauch Chunk without success. In 1827 similar experiments, with similar results, were made at a furnace at Kingston, Mass. The experiments were abandoned in a good deal of despair.

Early experiments.

In 1828 James B. Neilson of Scotland brought out an invention which made it possible to work with anthracite, and immediately revolutionized the iron-making of the world. This was the use of the hot-air blast in smelting iron. The previous failures with anthracite had been due to the employment of the cold blast. Mr. Neilson applied the hot blast to coke and charcoal furnaces. Its first utility was considered to be the saving of fuel effected by it. On the Clyde a ton of iron had required the combustion of eight tons and a half of coal coked. With the hot blast this was reduced to two tons and a half at once. It was an American who conceived the idea of burning anthracite direct by means of the hot blast. In 1833 Dr. Geissenheimer of New York obtained a patent for smelting iron with anthracite and the hot-air blast. His own experiments were unfortunately unsuccessful: but in 1837 some gentlemen from Reading succeeded with the new idea in an old furnace near Mauch Chunk, using eighty per cent of anthracite; doing so well, in fact, that they at once built a new furnace to carry on the business regularly. They had good luck; and so had the owner of an anthracite furnace built in 1837 at Pottsville, Penn., and blown in in 1839. This furnace was blown by steam-power, and produced forty tons a week of good foundery-iron. A premium of five thousand dollars was given to Mr. William Lyman, its owner, by Nicholas Biddle and others, as the first person who had made pig-iron with anthracite continuously for a hundred days in the United States.

Neilson's invention.

This was the beginning of the anthracite iron-business of the country. Thereafter, almost all the new works put up in the iron-regions were built expressly to burn anthracite as fuel. The furnaces which still continued to burn charcoal were principally in the North; the coal measures of that region not having been developed, and the forests sup-

Increase in production.

plying, practically, inexhaustible quantities of the old style of fuel. The history of the blast-furnace since that date has been one principally of growth in size: year by year the stacks grew larger and taller, until, from twenty feet in height and ten in diameter, they have now risen even to ninety feet in height and twenty-five in diameter. In 1855 the yearly production of anthracite pig-iron overtook that of charcoal iron, and the latter variety has been steadily falling to the rear ever since. In 1869 the production of charcoal iron was again passed by that made with bituminous coal and coke. In 1872 the product was as follows: Anthracite iron, 1,369,812 net tons; bituminous coal and coke-iron, 984,159 tons; charcoal made, 500,587 tons. The metal made by the hard-coal and hot-blast processes is inferior to that made by the old style of furnace; but it fulfils the demand of the times for cheap and abundant iron.

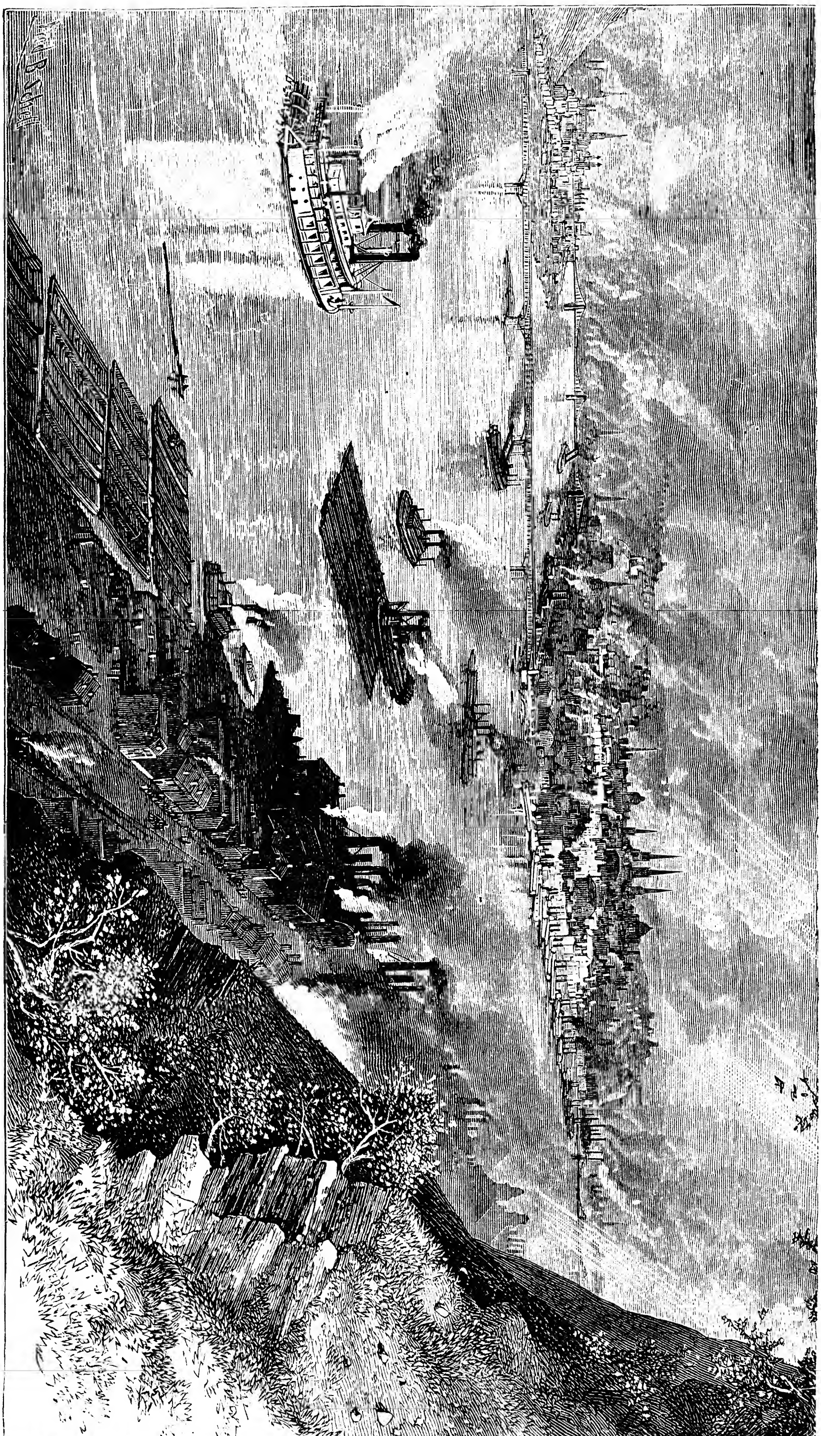
Blast-furnaces are always located in the vicinity of the supplies of fuel, either in the coal-mining regions, or along the lines of coal transportation. It is cheaper to bring the ore to the coal than the fuel to the ore, — a fact which is strikingly illustrated by the experience of Michigan, which, with incalculable treasures of ore of the finest qualities, is obliged to send away the principal part of her ore to Ohio and other States having mineral coal, to be made into pig-iron there. Indiana and Illinois, both great iron-making States, are so solely on account of their coal. Their iron ores are scanty, and of bad quality. Blast-furnaces are possible even in the cities of New York, Philadelphia, and Pittsburgh, and in other cities reached by the railroads of a great coal State.

Blast-furnaces.

The blast-furnaces of the United States have reached a size and perfection excelled nowhere in the world. There have been great intelligence, and alacrity of invention, on the part of those engaged in the iron-trade in this country; and, in respect to mechanical appliances, the American furnaces have been placed fully on a par with, if not above, the same class of works in other parts of the earth.

Description of blast-furnaces.

The blast-furnace is a structure of stone and brick work, from forty to seventy-five and even ninety feet high, enclosing a chimney-like cavity, in which the ores, fluxes, and fuel are placed to be smelted. Usually the stack is composed of a lining of fire-brick of the most refractory character, backed with a less refractory quality, and that with common red brick and stone. Most Western furnaces, and many of the new ones in the East, are, however, substantially an iron cylinder lined with fire-brick. The Philadelphia Furnace, — finished at Philadelphia in 1873, with all the latest improvements, — sixty feet high, is of sixteen-inch fire-blocks, adapted in shape to the contour of the interior, backed by a nine-inch course of ordinary fire-brick. Then a four-inch air-space, filled with loam, is backed with a nine-inch course of red brick. A three-inch air-space, filled with sand, then occurs, and a four-inch course of red brick; and the whole is cased with



PITTSBURGH.

boiler-iron a quarter of an inch thick, extending to the top of the stack. The crucible, or hearth, is composed of sixteen-inch fire-blocks. This is a good type of construction. Back of the courses above described common masonry of considerable thickness is generally built to support the stack, if an iron casing is not used. The interior cavity of the furnace is round horizontally, but perpendicularly is very much of the shape of the chimney of an ordinary kerosene lamp. At the open top, in a seventy-five foot stack, it is ten feet in diameter. It gradually grows larger going down for a distance of about forty feet, where it reaches a width of about eighteen feet: it remains of this diameter for ten feet more, and then contracts rapidly in the next seventeen feet to eight feet diameter. This sloping portion of the furnace is called the "boshes;" and it is the part of it which supports the heavy weight of the ores and fuel, filling the stack to its mouth above. At the bottom of all is the hearth, or crucible, where the melted iron and slag collect. This is from five to eight feet in diameter, and about the same in height. The extreme width of the foundation upon which this mass of masonry rests is from thirty to forty-five feet. In the most modern stacks the masonry is not solid down to this foundation; but that part of it above the hearth rests on an iron entablature, sustained by iron columns planted upon the foundation of the stack. The *tuyères* for the blast are from three to seven in number, and are cut into the hearth about four feet from the bottom. The air is blown into the furnace at a pressure of from three to four pounds, and heated to a temperature of from six hundred to nine hundred degrees. In order that the *tuyères* shall not be melted, a current of cold water is kept playing upon them constantly. Up towards the top of the stack a number of openings permit the refuse gases from the burning coal below to be drawn off by means of the draught of a tall chimney, instead of escaping through the mouth of the stack itself. These gases are made, by flues, to play around the cold-air pipes and the boiler which drives the blowing-engines; and by their combustion they heat the air for the blast, and maintain a high pressure of steam. The quantity of air blown into the furnace under pressure to produce the intense heat needed to reduce the iron ore amounts to fifteen tons or more an hour, and is always of much greater weight than the materials in the stack itself.

Formerly the furnaces were built against a hillside or a high bank, like a lime-kiln, for convenience in dumping the ores and fuel into the top of the stack. The more modern plan is to construct an elevator by the side of the furnace, with a platform on top about the throat of it, from which the materials are dumped into the stack from a barrow, or thrown in by hand.

A furnace being ready for blowing in, the fire is kindled in the hearth; and, when well under way, a quantity of ore, coal, and limestone, to dissolve the impurities of the ore, are thrown from the top. With good ores and hard coal the proportion of the different materials to the ton of iron made is about as follows: iron ore, 2,100 pounds; coal, 1,700 pounds; limestone, 400 pounds.

The blast is now turned on at two-pounds pressure. If all goes on well, in twenty-four hours the pressure is increased from four to six pounds. The workmen keep sharp watch of the *tuyères* to see that they are bright and clean, and of the gaseous products of combustion to see that the furnace is working freely and well. Every four hours, ordinarily, the hearth is tapped near the top to draw off the melted slag. There is a little hole made for the purpose, which is kept plugged with clay between times. This process produces an exceedingly brilliant display. The slag spouts from the little opening made for it with a glare which pains the eye with its intensity. It runs down a rough trough scraped out of the ground, and out through the open door of the shop into the outer air to cool. As the slag gets low in the hearth, the blast escapes with it, carrying a fiery spray from the opening like a piece of fireworks, within the reach of which no man can stand and live. At the proper moment the blast is turned off. The men run up and plug the opening with clay, and the blast is turned on again into the furnace. The melted iron in the hearth is drawn off once in eight hours from a little hole at the bottom of the hearth, which, as previously explained, is usually kept plugged with clay. The metal remains liquid in the hearth, from the fact, that, unlike water, the hottest metal sinks to the bottom, and thus it is possible to let fifteen or twenty tons of it accumulate without any danger of its chilling. The process of drawing off the iron is even more beautiful than that of taking away the slag. The metal flows out in a bright stream, throwing off dazzling scintillations, as it comes in contact with the oxygen of the air, far surpassing in vigor and beauty any thing produced by the art of man in any other way. The metal flows along the floor of the shop in channels, and runs into the rough moulds, where it hardens into the rough pigs of commerce. These are tested, when cold, by breaking with a sledge-hammer, to ascertain their quality, and are then stacked up for transportation to market.

Opportuneness of new methods of producing iron.

The introduction of the hot-air blast and the employment of anthracite as fuel, followed, five or six years afterwards, with the application of bituminous coal to smelting-purposes, was a timely event for the United States. The country was about entering upon an era of railroad and steamboat building made necessary by the diffusion of our population over the vast area of virgin territory protected by our flag. An extraordinary demand for iron was developing; and national development would have been seriously retarded if we had been obliged to depend on foreign lands for our supplies of the metal. The hot-air blast and the use of coal as fuel came along, therefore, all in good time for America. The reduction in the expense of smelting which they effected, and the demand for metal, gave an extraordinary impulse to the industry. In the period from 1848 to 1860, furnaces, rolling-mills, and iron and steel works, steadily multiplied in all parts of the country. It is an interesting fact, that, in that period, iron-making was actively prosecuted in many States in which, since railroad-building has stopped, it has in part or entirely disappeared. In Tennessee there were in 1855, during that era of activity, seventy-five bloomaries and forges, seventy-one furnaces, and four rolling-mills; but at the present time there are only eighteen charcoal and four bituminous coal furnaces, a score of bloomaries, and the four rolling-mills referred to. Arkansas made iron in 1857, but makes none now. In 1857 North Carolina had fifty bloomaries and forges, two rolling-mills, and six furnaces, in operation. There are not now in that ancient State a dozen active forges and bloomaries. There are no rolling-mills nor steel-works, and only one active furnace. South Carolina made iron extensively before the war; but her fires have all gone out, and her furnace-stacks were in 1876 all deserted.

A fresh development was given to the blast-furnace business by the war and the tariff of 1861. A new era of railroad-building set in; and such was the

Effect of war.

demand for iron, and so high were the prices, and so large the profits, that some of the most brilliant fortunes of the present age were made in the manufacture of the metal. In 1874, 735 furnaces were in operation in the United States, besides a number of bloomaries, distributed as follows: —

	ANTHRACITE FURNACES.	CHARCOAL FURNACES.	BIT. AND COKE FURNACES.	TOTAL.
Maine	...	1	..	1
New Hampshire	...	1	..	1
Vermont	...	5	..	5
Massachusetts	1	5	..	6
Connecticut	...	9	..	9
New York	45	22	..	67
New Jersey	16	..	..	16
Pennsylvania	152	44	73	269
Maryland	6	14	8	28
Virginia	1	33	..	34
West Virginia	...	3	5	8
Georgia	...	13	2	15
Alabama	...	20	..	20
North Carolina	...	10	2	12
Tennessee	...	24	3	27
Kentucky	...	23	5	28
Ohio	...	40	62	102
Indiana	...	..	7	7
Illinois	4	..	5	9
Michigan	1	30	3	34
Missouri	...	12	9	21
Wisconsin	3	11	..	14
Minnesota	...	1	..	1
Texas	...	1	..	1
Total	229	322	184	735

In 1877 the number reported was 714, of which 236 were in blast, and 478 out of blast. The productive capacity of the 714 enumerated is about 4,500,000 tons a year, or twice the present consumption of the country. The only new furnaces at present building in the country are in Ohio and some of the Southern States, notably Georgia, where iron can be made at an expense of thirteen or fifteen dollars a ton against an average of twenty dollars a ton in the Northern States, except in Ohio, where it is fifteen dollars a ton.

Statistics for 1877.

THE GROWTH OF ROLLING-MILLS.

Another department of the iron-industry rose into great prominence with the war and the tariff of 1861, accompanied as those events were by the accidental circumstances of a new and unprecedented mania for railroad-building, for supplying cities and villages with iron, water, and gas pipes, and roads and canals with iron bridges, and the use of iron in architecture. This was the rolling-mill business, which had never fairly recovered from the deadly blows of the policy of repression inaugurated by England in 1750.

Rapid development of rolling-mills.

Previous to 1860 rolled iron of all kinds had been largely imported: railroad bars had been almost exclusively so. After 1860 the mills and works necessary for the production of all this material were erected on American soil, the few old ones already in the business being enlarged to meet the demands of the times. Machinery of a magnitude and power hitherto unknown in America was built, and put into the mills for rolling and forging plates, shafts, rails, &c.; and magnificent establishments grew up in different States of the North, like the Cambria Iron-Works at Johnstown, Penn., employing seven thousand of our countrymen, and spending ten million dollars a year for wages and materials.

In the perfection of the different processes of the rolling-mill a field was afforded for the free play of the peculiar genius of the American people. Up to within a very few years, the Americans have been deficient in the patient analysis of the chemical composition and qualities of the ores and mineral treasures found embedded in their soil, compared with the rest of the world; but they have been untiring and exceedingly successful in mechanical invention. In the production of skilful machines to perform special tasks, and save a former great expenditure of human toil, they are perfectly at home; and this trait of our countrymen has been illustrated in the development of the different rolling-mills of the United States. The puddling-furnaces for converting pig and scrap iron into wrought iron, by exposing them in an open-hearth furnace to the action of a current of flame which burns out its carbon; the huge seventy-five-ton hammers and squeezers for forging the blooms from the furnace into bars for re-working and rolling; the rolls and other appliances, many of them invented abroad, — have all felt the magic touch of American inventive genius, and been greatly developed and improved;

Display of American genius.

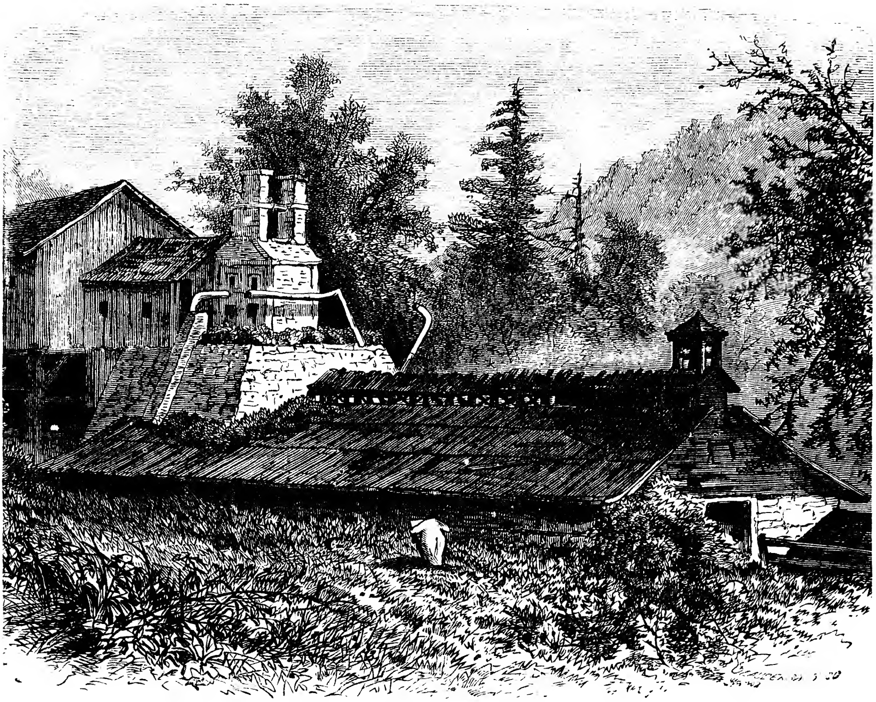
while many new appliances have been introduced of purely American origin, which have extraordinarily simplified and cheapened the processes of manufacture. It would require a volume to describe all the improvements introduced into the rolling-mills of the United States; but one of them may be mentioned as illustrating the general character of a large number of them. At the Sable Iron-Works at Pittsburgh, Penn., Mr. Zug, the senior partner of the firm, has set up a mechanism of his own invention to dispose of the puddle-bars as they leave the rolls. As the red-hot bar comes from the rolls it is discharged upon a line of rollers, over which it runs to a scale, on which it is detained long enough to be weighed. It is then pushed along the rollers to a great pair of shears, where it is cut into lengths, the pieces falling into an iron basket occupying a pit of water. This basket, suspended from a beam overhead, is raised to such a height, that it runs by its own weight to the other end, where it comes in contact with an object which unlatches the bottom of the basket; and the iron falls to the ground, ready for piling for the various furnaces. The striking of the object which opens the bottom of the iron basket reverses its direction, and sends it back on the now falling beam to the pit, with the bottom again secure for reloading. With this mechanism the puddle-iron is dragged from the rolls, weighed, cut, and laid aside by one man, who handles the product of sixteen furnaces.

Zug's improvements.

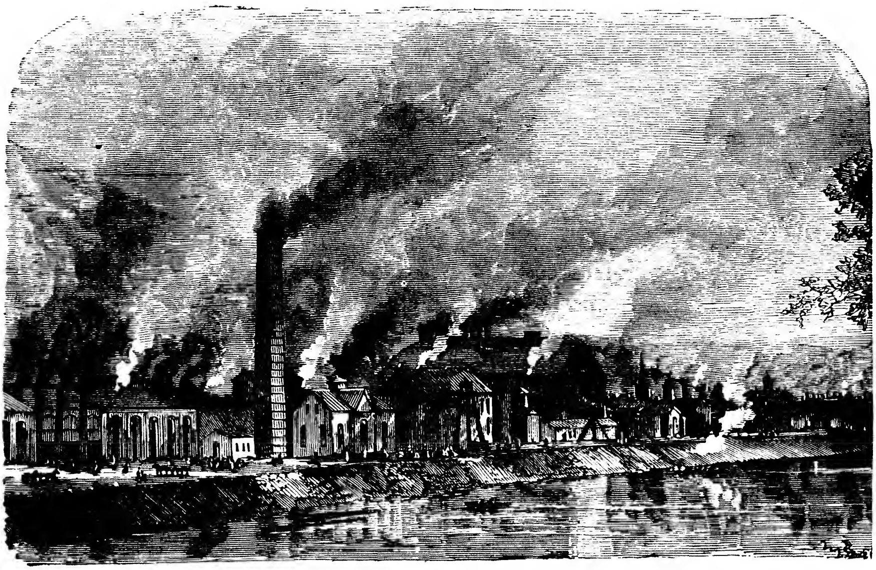
Statistics of numbers.

In 1873 the rolling-mills of the United States numbered 310, as follows: —

Maine	2
Vermont	1
Massachusetts	21
Rhode Island	4
Connecticut	5
New York	21
New Jersey	12
Pennsylvania	118
Delaware	10
Maryland	8
Virginia	3
West Virginia	7
Ohio	49
Kentucky	10
Tennessee	5
Indiana	9
Illinois	8
Michigan	4
Missouri	6
Wisconsin	1
Georgia	3
Alabama	2
California	1
Total	310



OLD IRON-FURNACE ON THE CONEMAUGH.



CAMBRIA IRON-WORKS, JOHNSTOWN, PENN.

The total of rolled iron capacity was 2,833,000 tons. In 1876 the number of mills was 338. The capacity was something over 3,000,000 tons; but the actual production was 1,921,730 net tons, worth about $190,-000,000. The product was in sheet-iron, boiler-iron, plates for iron ships, bars, rods, hoops, rails, bridge-iron, &c.

Production.

INFLUENCE OF PARIS EXPOSITION ON AMERICAN IRON-MANUFACTURE.

Before passing on to speak of the steel-works of the United States, allusion may be made to an event occurring in 1867, which had an important influence on the whole iron-industry of this country: that was the Paris Exposition. The war was over in America. The people were settling down to the developments of the arts which promote peace, and make a nation united and great. New life was felt throbbing in every department of industry. A keen interest was felt here in the Exposition of 1867; and Mr. Abram S. Hewitt was sent over there in an official capacity to study what foreigners had to teach us with reference to the iron-industry, and other experts were sent to investigate and report upon other things. What Mr. Hewitt and the iron-manufacturers who visited that great fair learned about the foreign iron-business was new and interesting, and it has since proved of incalculable value to America. It taught us many important lessons, and proved a fresh incentive to effort.

Paris Exposition.

The principal fact which arrested attention was the marked superiority of Europeans in producing difficult shapes of rolled iron without weld or joint, and their willingness to handle iron and steel for all purposes in larger masses than in America. The leading European nations present at the fair exhibited a vast variety of articles rolled from a single piece, which could not have been thus made in America then, — such as deeply-dished boiler-heads, steam-domes, tube-sheets, and culinary vessels of every form; and many other things made purely as *tours de force*, to show what could be done, — such as cocked hats, a series of square domes raised from a flat plate, &c. They displayed beams a hundred feet long, weighing fifteen hundred pounds, and others of the same length, weighing two tons and a quarter. A single plate, thirty feet long, two feet six inches broad, six inches thick, and weighing eleven tons, was shown from England. Krupp showed a single steel ingot of forty tons; when in 1851 an English ingot weighing two tons and a quarter had been deemed an astonishing achievement. Krupp also had on exhibition a fifty-ton steel cannon mounted on a fifteen-ton carriage, and a twenty-five-ton turn-table throwing a solid shot of twelve hundred and twelve pounds and a shell of ten hundred and eighty pounds. These achievements have all been surpassed since then. many of them in America; but, to the dazzled eyes of the American iron-manufacturers, they were in 1867 a revelation of marvels as interesting as a tale of Arabian enchantment.

Superiority of Europeans in rolling heavy iron.

Mr. Hewitt and others spent much time while in Europe during that exhibition in studying these products of European art, and in visiting the steel-works and rolling-mills of the great centres of the trade, and then came back to America with a volume of new ideas, which they have since utilized here to the extraordinary benefit of themselves and the country.

Investigations of A. S. Hewitt and others.

THE MANUFACTURE OF STEEL.

The most valuable property of iron, next to that of agglutination at a white-heat, and possibly exceeding that, is the quality of forming steel. Cast-iron is not pure metallic iron: it contains from three to five per cent of carbon (often five per cent and nine-tenths) chemically combined. By depriving the metal of all except about one-half per cent of its carbon, the wrought iron of commerce is obtained. By restoring to it from three-fourths to one per cent and a half of the carbon, or by reducing the carbon of cast-iron to that minimum, a new quality of iron is obtained, which we call steel, — a product of the highest value, exceeding all others in elasticity, tenacity, and hardness, acquiring a special temper by rapid cooling, white, fine-grained, and capable of taking a high polish. It is the true metal for arms.

Superiority of steel.

Anciently the Hindoos made steel in small quantities by taking their charcoal-made wrought iron, cut into small pieces, and putting about a pound of it a time into a crucible, with ten times the quantity of wood chopped fine. They put the crucible tightly plugged into a furnace, and heated it intensely for two or three hours. At the end of the operation the steel was found fused into a cake in the bottom of the crucible. From the steel thus made were fashioned the famous cimeters and blades of the East, of such exquisite edge and temper as to cut a gauze veil floating in the air without disturbing its movement.

Steel-making by the Hindoos.

It was many ages before steel was made in Western Europe. When the manufacture of it began there, a new process was invented. Steel was made by cementation. The process, in use to the present day, consisted of packing wrought-iron bars in charcoal in crucibles, and heating them from six to ten days, according to the hardness of the product required. The product thus formed was called "blistered steel," because the bars, when withdrawn, were found covered with blisters. Cast-steel was formed by breaking these bars, and fusing them; and shear-steel by tempering the cast-steel, breaking the pieces, welding them at a good heat, and then hammering them until a more uniform and tenacious texture was produced.

Blistered steel.

The business of steel-making was established in America as early as the Revolution; but it did not thrive until within the last thirty years. There was every temptation to make the metal, because it was worth in bars from two hundred and fifty to three hundred

Early steel-making in United States.

dollars a ton as against an average of from twenty to forty dollars a ton for pig-iron, and from eighty to a hundred dollars for good bar-iron. American iron, too, was exceedingly pure and tenacious, and well fitted for steel-making. But the business had been from antiquity shrouded in the deepest mystery by makers, and it was long before the American Congress gave sufficient protection to those who wished to venture in the business here to encourage them to embark their capital in it. When the business was undertaken, a great deal of money was lost in it, and many attempts were abandoned in despair. To the energy of a few men, principally at Pittsburgh, Penn., and the skill of a few native chemists, is due the fact that the business was finally mastered and established. American steel, and the saws, cutlery, tools, and machines made from it, have since become famous the world over.

Three modes of making steel.

As the art is practised in the United States, steel is made by three general processes; and the product is called respectively pot or crucible steel, Siemens-Martin steel, and Bessemer steel: in the first class, cementation is largely employed. There are also two American methods used, the invention of Professor A. K. Eaton of New York. One, discovered in 1851, consists in melting malleable iron in crucibles with a carbonaceous salt, such as ferro-cyanide of potassium, using it alone or with a little charcoal. The carbonization is rapidly effected; and the steel, when fused, is cast into moulds. The other process, discovered in 1856, consists in decarbonizing cast-iron by heating it intensely in thin plates in a bath of melted carbonate of soda. The plates are then melted and cast. The principal drawback to the former of these two processes is, that the crucibles cannot long withstand the intense heat to which they are subjected; and the principal objection to all crucible processes is, that the capacity of production is limited by the necessarily small size of the pots. A good article is produced, however; and the business is actively prosecuted at thirty cast-steel establishments in Pennsylvania, New Jersey, New York, and Connecticut, nine of them being at Pittsburgh. The product of the works is in tool, spring, machine, hammered, and ingot steel: it now amounts to 39,000 tons a year, worth $12,000,000. There are a large number of works in different parts of the country for making bars by cementation, their product in 1876 being 10,306 tons.

Methods considered at Paris Exposition.

When Mr. Hewitt was at the Paris Exposition in 1867, two methods for making steel on a large scale were beginning to attract great attention. The Bessemer process was then the sensation of the hour, and enormous provision was being made in Europe for manufacture by means of it. He studied the process carefully, and reported upon it. The other method was that which is called the Siemens-Martin. Mr. Hewitt himself introduced that system to America, upon his return, at his works at Trenton, N.J.

An Englishmen has the reputation of inventing the Bessemer process; but the first person to suggest it, and make an experiment with it, was, according to Mr. Swank, an American. As early as 1851, William Kelly, an iron-master at Eddyville, Ky., suggested the possibility of making steel on a large scale by blowing air into and through melted cast-iron, thus burning out its carbon until it was converted into steel. He made a few trials, and obtained a patent in 1851. Henry Bessemer secured his first patent for the process in England in 1855. Neither of the two men was able to attain success, however, by the methods he originally adopted; and it was not until some changes and improvements had been effected that either accomplished any thing. The process, as employed in this country, is carried on under a combination of the Bessemer and Kelly patents.

Bessemer process.

The plant required for the conversion of pig-metal into Bessemer steel is expensive; and there are now only eleven establishments for it in the United States, — five in Pennsylvania, three in Illinois, and one each in New York, Ohio, and Missouri. One of these, in Illinois, is the largest in the world. The product, however, is large, amounting now to 540,000 tons a year, worth $65,000,000.

Value of product.

The cast-iron is melted, and then drawn out, in five-ton charges, into great pear-shaped converters made of iron lined with refractory fire-clay. The converters are hung on trunnions, and are tipped down to receive the charge. The melted iron lies in the belly of the swelling side of the converter until the requisite amount is obtained; then the converter is swung into an upright position, and at the same moment a blast of air is turned on, the air finding its way into the converter through a number of small holes at the bottom, underneath the melted iron. The process now becomes one of the most spectacular in the iron-industry. The air, rushing through the liquid iron, pours out of the mouth of the converter in a tremendous flame. At first the silicon is seized upon by the oxygen of the air, the result being slag; and, while it is burning, the flame is comparatively dull. But immediately the carbon begins to burn, and the flame then increases in volume and brilliancy. The surging, splashing mass grows hotter and whiter, and appears to expand and boil. A thick, white, roaring blaze pours from the mouth of the converter, and its iron foundations tremble under the violent ebullition. There are few such exhibitions of chemical power to be seen in the industrial arts. As the decarbonization goes on, the flame grows thinner and smaller; and, when it is complete, the light dies out of it. Bessemer originally intended to stop the process at the point where just enough carbon had been left in the metal to make steel, using the spectroscope for the purpose. This was found impracticable; and the plan now is, to continue the blast until all the carbon is burned out: the right moment is indicated to the eye by the flame. The converter is then tipped over, and a small charge of melted spiegeleisen, rich in carbon, is poured in. It diffuses itself instantly through the melted mass in the converter. A flaming re-action takes place; and then the converter is

Process described.

emptied with a ladle, which is, in turn, swung over the ingot moulds. A fire-clay plug is removed by a lever, and the steel runs out pure, white, and shining. The whole operation is brief, and the men remain silent and attentive until it is completed.

The use of ferro-manganese for conversion in this process has latterly been introduced, and is increasing. Four-fifths of the Bessemer steel now made in this country is rolled into railroad iron: it is a leading industry, and has placed the steel-rail business here ahead of the iron-rail manufacture. The other fifth of the product is devoted chiefly to the purposes of machinery.

Use of ferro-manganese.

The Siemens-Martin process is not yet extensively used. It affords a valuable product; but the system last described is at present the favorite. The Siemens-Martin plan is simply that of the carbonization of wrought iron in an open hearth or reverberatory furnace, by mixing it with cast-iron and iron ore. The flame from the furnace is made to pass over a hearth on which the metal is placed, and effects the required chemical transformation. The metal is sometimes supplied with ferro-manganese in the process of conversion into steel. The product of open-hearth steel, which was only 3,000 tons in 1872, amounted in 1876 to 21,490 tons.

Siemens-Martin process.

Since the first crude experiment at iron-making in the forests of Virginia, two hundred and fifty years have flown by on the wings of time; yet it has not been until within the past five years that the United States have been able to produce iron and steel enough to supply her own wants, either in war or peace. The railroads of the country have been principally built with rails imported from the continent of Europe. Our factories and shops have been equipped with foreign-made machinery. Tools, telegraph-wire, chains, and manufactured articles in general, as well as metal in pigs and ingots, have been brought here from abroad in enormous quantities from the earliest day. In 1873 the amount imported was valued at fifty-eight million dollars. Thanks to the natural resources of our country and the enterprise of our countrymen, and the influences which have aided them, the United States have now an iron and steel producing capacity fully equal to her wants, and indeed in excess of it. The importation has been cut down to the insignificant sum of about seven million dollars for the year ending June 30, 1877; and an exportation has begun not only to the less advanced nations of the world, but also to civilized Europe. The United States are at last truly independent of the world for her iron and steel.

Wonderful extension of steel-industry.

CHAPTER II.

IRON AND STEEL MANUFACTURES.

IT was one peculiarity of the times in that age of the world when America was first settled, that gold and silver were the most highly prized of metals; and the abundance of them in any country was regarded as the test, not only of its wealth, but of its civilization. Times have changed since then; and a celebrated writer has pointed out, that, in this latter age of the world, the civilization of a race of men is more clearly indicated by the iron it employs and consumes than by any other power it possesses. Iron has always brought superiority to the race using it in the largest degree for weapons and implements; but in modern times the fact has become more conspicuous. It is marvellous to look back along the history of the conquests and wars of the past, and to compare the condition of mankind at the present day with what it was two hundred years ago, and study the important part played by iron. Eminence and progress appear to have been immediately due far more to the generous use of this valuable metal than to the intelligence of the human race and the power of numbers. Steam could never have been made the obedient vassal of man, except for this tenacious metal to confine and direct its forces. Famines were never obviated until husbandry was made successful by iron implements, and iron railways were laid to insure the free distribution of crops; and the famines of the present age occur only in those regions into which the railway and the liberal use of this noble metal have not penetrated. The people would still be living in hovels, except for iron to fashion the wood of the forests, and bind the framework of our homes. With a metal no more serviceable than copper, the world would never have risen to the heights of comfort, intelligence, and civilization, it has now attained; the brilliant conquests of the material universe which have characterized the present century could never have taken place.

Utility of iron.

The variety of uses to which iron is now put is remarkable, and there seems to be no limit yet to its employment. Machinery has been invented which will fashion it for any end, in masses of any size, from the hair-spring of a watch to those magnificent products of constructive art, the locomotive and the iron steamship. Its use is now as boundless as man's desires, and almost as wide as its own diffusion throughout nature. Iron is found in every rock: it blooms in the rose and in the maiden's cheek, and the spectroscope detects it in the light of the sun and stars. It may be said fairly to pervade nature, and now also to pervade every department of human activity. It plays some part in the simplest occupations of every-day life: it mints the coin of the people; it steers our ships; drawn out into a wire, it sounds the deepest oceans, and carries our messages from continent to continent; it fights our battles, and wins our daily bread, and carves our gravestones when we are gone; it made England mistress of the seas and of commerce; and it is one of the most efficient causes of the remarkable advance of the United States during the present century, which is the comment of the scholars and public men of the world.

Variety of uses.

In the application of iron to the uses of humanity, no people have excelled our own countrymen in ingenuity and enterprise. The purpose of this chapter is to describe the growth of some of the principal iron and steel industries which they have established.

NAILS.

Nail-making is purely an American art; for, although nails were invented before the white man first cast anchor off these shores, the process of making them which has superseded all others was the product of the Yankee's brain, and the modern system was employed here long before it found its way into Europe.

Nail-making an American art.

Iron nails were sparingly used in antiquity, but they were to some extent in the middle ages; and their use became general three or four hundred years ago, when England devloped her iron-industries. England was the great nail-making country of Europe. So large a part of her population was employed in the art, that, in later times, sixty thousand persons were employed in nail-making at Birmingham alone. All the nails were made by hand. The iron was drawn out into rods, the end was heated and formed by hammer on an anvil into a nail, when the rod was re-heated and again hammered. The business, not being so laborious as the majority of those in which men were engaged, was turned over largely to women and children; and, not being very remunerative to the workers themselves, the social condition of the nail-makers of England was one of the dark pictures of her industries. In the last century, several attempts were made to save a part of the labor expended in nail-making by the use of machinery. William Finch of Wimboorne, Staffordshire, brought out one patent for the use of tilt-hammers, which, by rapid striking, enabled several nails to be made from the rod in one heat. Thomas Clifford invented another plan in 1790, which aimed at squeezing a bar of iron

Early manufacture of nails.

into nails by feeding it in between two heavy rollers with proper moulds on their faces. The greater part of the nails used continued to be made by hand, however, until American genius released the women and children from such laborious work.

The first record we have of nail-making in this country is found in a debate in Congress in 1789, when the first tariff bill was under discussion. Mr. Madison had inserted a duty of one cent a pound on nails and spikes in the bill. Mr. Lee thought this was objectionable, as it might be a tax on the improvement of estates. Mr. Goodhue assured him that great quantities of nails were being manufactured in Massachusetts and Pennsylvania, and in a little time enough would be made to supply all North America. Fisher Ames said this on the subject: "It is a useful and accommodating manufacture, which yields a clear gain of all it sells for, except the cost of the material. The labor employed on it is such as, if not thus employed, would, in many instances, be thrown away. It has become usual for the country-people to erect small forges in their chimney-corners; and in the winter evenings, when little other work can be done, great quantities of nails are made, even by children. These people take the rod-iron of the merchant, and return him nails; and, in consequence of this easy mode of barter, the manufacture is prodigiously great. But these advantages are not exclusively in the hands of the people of Massachusetts. The business can be prosecuted in a similar manner by every State exerting similar industry."

First nail-making in America.

Fisher Ames.

FAIRVIEW NAIL-WORKS.

The duty was allowed to remain in the bill, and afterwards was increased.

But, even at the time that Fisher Ames described the chimney-corner forges, the minds of our countrymen were busy with the idea of perfecting a machine to make nails, and save all this labor by hand. Of the three hundred patents which have up to 1878 been granted for machines for nail-making, twenty-three were issued before the present century. In 1810 the secretary of the treasury reported: —

Patents for nail-machines.

"Twenty years ago, some men now unknown, then in obscurity, began by cutting slices out of old hoops, and, by a common vice griping these pieces, headed them with several strokes of the hammer. By progressive improvements slitting-mills were built, and the shears and heading-tools were perfected; yet much labor and expense were requisite to make nails. In a little time, Jacob Perkins, Jonathan Ellis, and a few others, put into execution the thought of cutting and of heading nails by water; but, being more intent upon their machinery than upon their pecuniary affairs, they were unable to prosecute the business. At different times other men have spent fortunes in improvements; and it may be said with truth, that more than a million of dollars have been expended. But at length these joint efforts are crowned with complete success; and we are now able to manufacture, at about one-third of the expense that wrought nails can be manufactured for, nails which are superior to them for at least three-fourths of the purposes to which nails are applied, and for most of those purposes they are full as good."

Jeremiah Wilkinson.

Jeremiah Wilkinson of Rhode Island is said to have been the man who headed nails in a vice.

Cut nails.

When the manufacture of cut nails was first undertaken, wrought nails cost twenty-five cents a pound, and were largely imported. This made their use for fences and houses expensive; and their cost, the abundance of timber in this country, and the desire of every man to have his own house and barn, proved powerful incentives to inventors to undertake the manufacture of them by machinery. The new machines did so well, that in 1810 one was perfected which was able to make a hundred nails a minute; and in 1828 the production was so brisk, that the price was reduced to eight cents a pound. It is now about two cents and a half a pound. In 1833 the duty on nails was five cents a pound: but the rapidity of manufacture here had brought prices down to five cents a pound, which was the same as the duty; and in 1842 the price was two cents below the duty.

Description of machine.

The American nail-machine is a somewhat complicated affair in detail, but simple in theory. The iron is rolled out into bars wide enough to make three or four strips, each one of which is as wide as the length of the nail it is intended to make. The cutting of the bar into strips is done by the slitting-mill, and is done while the bar is hot, and thus more easily cut. The strips are then taken to the nail-machines, of which there are from forty to a hundred in a factory; in the Wheeling Nail-Works there being one hundred and six, and one hundred and ten in the Belmont Works, also at Wheeling. Each machine works upon one strip or nail-rod at a time, clipping off a piece from the end presented to it, and then another, as the strip is turned over and the end again presented. The strip must be turned over each time a nail is clipped off, because the nail is cut tapering. Each bit as it is cut off is grasped by a powerful vice, which holds it, while an object called the "header" presses up the large end into a head: the nail then drops among its companions below. The process is a rapid one, and a good machine will make from half a ton to a ton and a half a day.

The variety of styles of nail made by machinery now is very large, and it may almost be said that wrought nails are so made now: for manufacturers have within twenty years begun to anneal cut nails, giving them a malleable quality; and these have driven the old style of wrought nail out of use. The styles now made are cut, wrought, horseshoe, barbed, composition, button, railroad, carpet, coffin, sheathing, galvanized, harness, leather-work, picture, siding, slating, trunk, upholstery, weather-tiling, and screw nails, spikes, brads, and tacks being included in the above. The machine for making railroad-spikes was the invention of Mr. Henry Burden of Troy (who also invented the horseshoe-machine), and has proved both profitable to the inventor and his sons, and useful to the country.

Various kinds of nails made.

The yearly product of nails and spikes in the United States now amounts to over 4,900,000 kegs of one hundred pounds each. The magnificent factories employed in their manufacture — equipped with blast-furnaces and puddling-ovens, and giving work often to several hundred men — excite the liveliest feelings of admiration when a comparison is made between them and the little chimney-corner forge of the olden times.

Production.

CUTLERY.

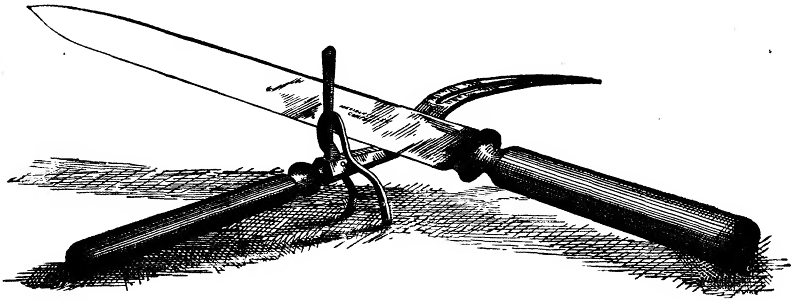
Edge-tools were made in the United States as early as the Revolutionary war; it being at that time an absolute necessity for the people to provide themselves with such implements by their own efforts. They were of a very clumsy character, however, and not very durable. How slow the progress was may be seen from the absurd daggers and swords which are preserved to us from the war of 1812, which were almost as heavy as axes, and which often resembled iron clubs with edges more than specimens of cutlery. The swords too, while frequently possessing the power of being bent double like Damascus blades, seldom possessed that of resuming their original shape upon the pressure being removed. For two hundred years after the first settlement of the country the inhabitants were really dependent upon Europe for their cutlery. Our forests were felled principally with English axes, the crops cut with English scythes and sickles, the building-arts carried on with chisels and tools from Sheffield, and even the loaf of bread upon the table sliced with an English knife. The quantity and variety of edge-tools made in the New World were extremely small.

Early manufacture of edge-tools.

About forty-five years ago the attention of New-Englanders was directed to the manufacture, both by the great success of England, — which had made herself the chief source of supply of cutlery for the world, — and by the growing demand in America. Steel was imported from Sheffield, and various mechanics began to fashion it into the articles required by the wants of our population. The greatest obstacle to the success of these pioneers of the art was the prejudice

Prejudice against American tools.

in America against the products of American shops. Our working-men were intelligent, and knew the value of a good tool, and preferred to get a good tool, even if the cost of it was high. It took many years to convince them that the Americans could make an article as true and serviceable as that which was produced at Sheffield. It was really not until the generation of men then living had passed off the stage that this prejudice was conquered. The feeling of that day is well illustrated by an incident which Mr. Greeley once related in regard to some Connecticut fish-hooks. A manufacturer of that State tried to introduce some hooks of his own make to the New-York market, and sent samples of them to the dealers there for trial. They were returned with the



KNIFE AND FORK.

discouraging statement that they were far inferior to British hooks. The manufacturer tried several times to get his hooks accepted; and finally he took some English cards, removed the hooks, put American hooks on the cards, and sent them to a merchant for comparison along with another lot of the same hooks mounted on American cards. Again word came back that the hooks on the British cards were in every way superior to those on the American cards. And the worst of it was, that, when the little device of the manufacturer was explained to the merchant, the latter was still unconvinced that the Connecticut article could at all compare with the imported. This was exactly the case with early American edge-tools. The public knew the merit of the imported ware, and distrusted the home-made.

Rapid growth of late.

American cutlery obtained a place at length, however; and of late the industry has had a rapid growth. The early prejudice, doubtless, was the cause of this, in part; for it led to the use of none except the best metal, and made manufacturers pay the utmost attention to the excellence of the form and finish of their goods. American cutlery is now finding its way all over the world; and Sheffield is fairly staggered at the appearance of American knives, shears, scythes, and planes, in the warehouses of every large English city. Sheffield is losing its trade in consequence. Canadian cutlery shares the same reputation as American.

Steel is the material used for all cutting-edges. The property of steel which gives it value for this purpose is that of being hardened and tempered. It is heated to redness, and then suddenly cooled. If the heat is high, the steel is soft, but tenacious. If the heat is low, the steel is hard, but brittle. This is taken advantage of in the making of different classes of tools. Thus 430 degrees give a pale yellow-color, suitable for lancets, which require a fine edge, and need little strength; at 450 degrees the color is a pale straw-color, good for razors, pocket-knives, and chisels; at 490 degrees a brown-yellow temper is reached, suitable for cold-chisels; at 510 degrees a brown with purple spots, fitted for axes and planes; at 550 degrees a bright blue, indicating a temper for swords and watch-springs; at 560 degrees a full blue, suitable for fine saws; at 590 degrees a dark blue, the temper for large saws; at 630 degrees the color is dark, with a tinge of green, and the metal is too soft for instruments.

Edge-tools made of steel.

Color of steel according to temper.

A weapon may be made with more than one temper in it. A sword, for instance, is best with a blue temper at the point (giving it the greatest elasticity), a violet in the middle, a yellow along the edge (for keenness), and a green near the handle (for toughness).

A tool may have more than one temper in it.

It is not usual, nor is it necessary, to fashion cutlery entirely of steel. Simple articles, like table-knives, chisels, planes, scythes, spades, &c., have been made by welding a thin strip of steel for the edge upon a back piece of iron. Blistered steel is melted into cast steel for the purpose, and hammered into bars. In shears, only the edge was formerly of steel: now the blades are of steel, and the handles of iron. In table-knives the blade is of steel, and the shank of iron. Formerly this class of articles was made entirely by hand; but American ingenuity has perfected a machine to do a great part of the work, and the best blades are formed by it entirely. The machine has been adopted in Europe. The blades of pen-knives are hammered out from the best cast steel, the smithing being well done, for the sake of condensing the metal. A temporary shank is drawn out to hold the blade while it is being ground and sharpened. A number of blades are tempered at once by being placed over a fire on a flat plate together, with their backs downward. When they have acquired a brown or purple color, they are suddenly plunged into cold water. Scythes are drawn out under a trip-hammer from a bit of iron of the requisite size, upon which a piece of steel has been welded for the edge. The workman sits on a stool by the side of his hammer, with the fire in which the metal is heating within easy reach. He takes the piece from the fire with a pair of tongs, lays it on the anvil under the hammer, and draws it out into a rough blade with marvellous speed and dexterity. It is given the right curvation while hot, and the back is folded in other machines made for the purpose. It is then tempered, and taken to the grinding-room to be finished, first on

Tools partly steel, and partly iron.

Scythes.

heavy wet grindstones, and then on emery-wheels. The American scythe has become celebrated for its superior strength and lightness. Compared with the heavy implements of native make found on the continent of Europe, it is the aristocrat of the harvest-field. It outlasts the European, and requires only half the strength to use it. Razors, bowie-knives, and hunting-knives are made from the best cast steel by hammering and careful grinding and polishing.

Edge and finish given by grinding.

Edge and finish are given to cutlery in the grinding-rooms. In scythe-factories the operation is extraordinarily noisy, the din of a dozen blades strongly pressed upon the heavy grindstones being almost intolerable. The finer work is generally done on emery-stones. The operation is an unhealthy one for the workmen, on account of the fine dust which floats in the air, and reaches the lungs of the grinders. The evil is mitigated to some extent by a flue, suitably placed to remove the metallic dust from the revolving stones, into which there is a powerful suction of air; but it does not entirely obviate it.

Effect of world's fairs.

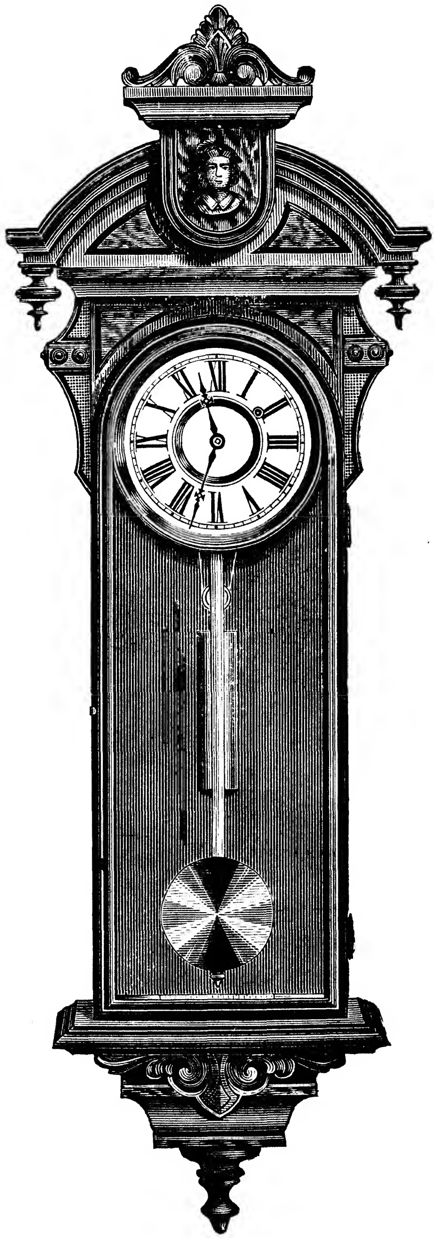
The various world's fairs have given the cutlery of the United States importance, and have, among other things, performed the great service of teaching our own countrymen its value. The manufacturers do not now hesitate to use American steel for all their work. Some of them make the steel themselves, and so are sure of its quality; as in the case of Mr. Disston of Philadelphia, — a man who began business as a mechanic by wheeling his first load of materials himself, and who now has a trade amounting to $1,500,000 yearly. Cutlery has hitherto been imported to the extent of several millions a year. In 1872 the importation was $10,500,000. So rapid has been the progress of American workshops during the last few years, that the importation has been cut down to $900,000 a year; and a promising export has begun, now amounting to $700,000 a year. European manufacturers visiting this country candidly confess that they are amazed at what they see in this industry.

Henry Disston.

CLOCKS AND WATCHES.

Early clock-making.

The word "clock" brings up a medley of recollections as diverse and as interesting as the contents of a bazaar, — the belfries of France, *les cloches*, from which the word itself is derived; the little old mathematician in a black gown in the little old shop in London, lost in abstruse calculations as to the speed of a pendulum, while his apprentices at the door of the shop are calling to the passers-by, "What d'ye lack, sirs? what d'ye lack?" the stately old Dutch time-piece, ticking solemnly in its place in the quiet old colonial farm-house; the bustling Yankee, driving from village to village with a wagon-load of wooden-wheeled time-keepers, and peddling them away for provisions and calicoes, and whatever other articles of value our great-grandfathers had a surplus of, and were willing to part with in trade; and the ancient State of Connecticut, the birthplace of the wooden clock, where nearly all in use in the United States have been made, — the land of Yankee notions, and of the original Brother Jonathan and Barnum.



REGULATOR.

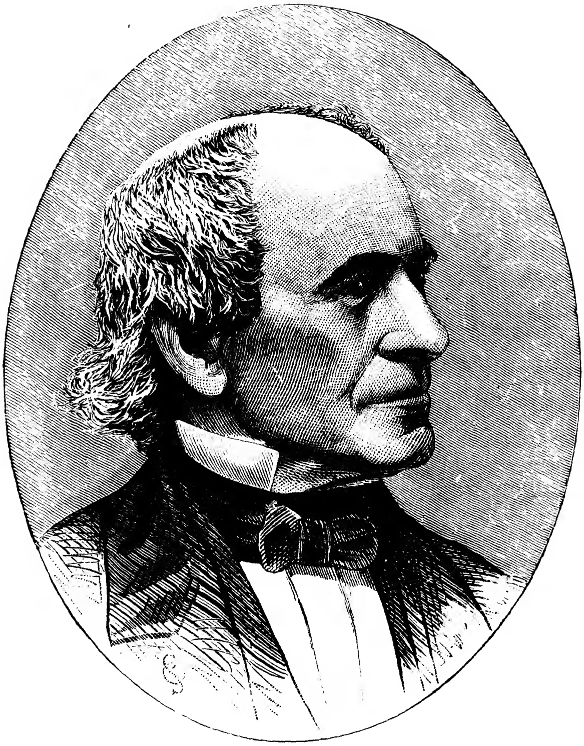
The sun was the time-piece of our forefathers, just as the sky was to them the signal-station of the Weather Bureau; and they were remarkably knowing in regard to what could be read in the sky as to the time of day and coming changes of the air. As long as the population of the world roved in the forests, and labored chiefly in the fields, time-keepers were unnecessary; and it was only when people gathered in cities, and found that in the engrossing pursuits of the shop, the laboratory, and the studio, they could not keep track of the flight of time, that instruments to record the passing hours became useful. The ancients used the sun-dial, the clepsydra, or water-glass, and the hour-glass; and Alfred the Great employed candles which would burn an hour apiece.

Necessity of time-pieces.

Finally a machine run by weights was employed; and Italy invented, and Northern Europe perfected, the tall and solemn style of clock which they put on the landings of the staircases and in the towers of the cathedrals. The pendulum was first thought of for the purposes of time-keeping at Paris in 1639, and utilized at London in 1641. These old clocks were clumsy and ill-regulated affairs. Each was made by itself, and based upon a fresh set of abstruse and interminable calculations as to the

Different kinds of clocks.

length of pendulum and speed of wheels, and required almost as many special observations of its motion by the maker, before it would go right, as is expended at the Naval Observatory at Washington upon a special star before its position in the heavens is finally and authoritatively put down upon the chart; and some of these stars are observed several hundred times. The early clocks in America were all imported from England and the Netherlands, and were costly pieces of furniture.



ALVAN CLARK, MAKER OF ASTRONOMICAL INSTRUMENTS.

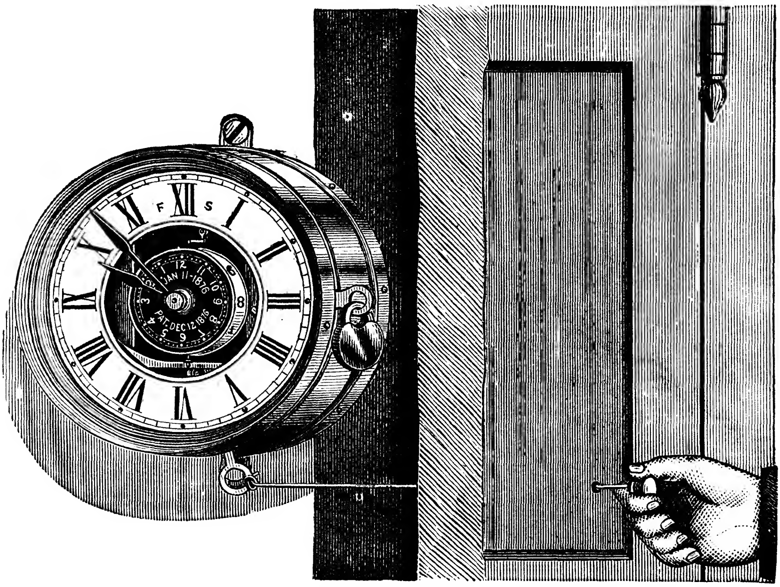
Shortly after the Revolution, clock-making was begun in this country at Plymouth, Conn., by Eli Terry, one of the old type of Yankees, who fashioned the wooden wheels of his clocks with the aid of a jack-knife, and started out with a horse twice a year to peddle them. The wheels were marked out on thin pieces of wood with square and compass, and shaped and toothed with saw and knife. Mr. Terry began in 1793, and prospered so, that in 1800 he was able to employ two young men to assist him. Twice a year he started out towards the Hudson River and the north country, whither population was tending at that period, to sell his clocks; and he disposed of them readily at twenty-five dollars apiece. In 1807 a stock company was formed at Waterbury to aid Mr. Terry; and he then went into business on a large scale, buying an old mill, introducing machinery, and laying out the works for five hundred clocks at once,—something which it is said had never before been done. In 1810 Mr. Terry sold out to Thomas & Hoodley; but he himself continued to make clocks. Others had by this time become established in clock-making; and competition was so sharp, that the price of clocks dropped from twenty-five dollars to ten dollars, and finally to

Clock-making began in Connecticut.

five dollars. The public was greatly benefited by this; but the manufacturers came to grief, and many of them failed. In 1814 Mr. Terry invented the pillar scroll top case clock, which, being of a little different and more tasty style than its predecessors, was popular for a while. It sold for fifteen dollars, and netted Mr. Terry a fortune.

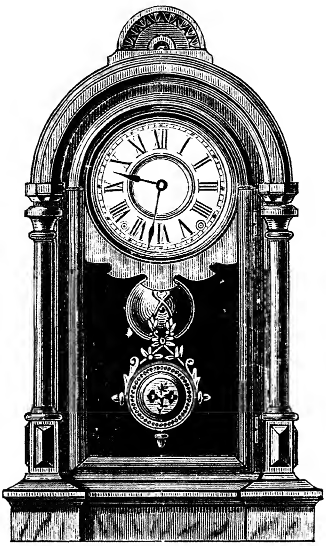
The next step in advance was taken by Chauncey Jerome, an apprentice of Mr. Terry, and a very ingenious fellow, who, with the passion for whittling characteristic of the Yankee, had begun to make wooden clocks before he left school. Mr. Jerome, when fairly established in business, employed a circular-saw in getting out his wood, and was able to produce clocks rapidly and cheaply. He had a great sale all over the United States.

Chauncey Jerome.



SHULTZ'S WATCHMAN'S CLOCK.

The clocks ran for one day, and are said to have been good time-keepers. In 1837 Mr. Jerome proved his ingenuity by bringing out the one-day clock with metal wheels, — an event which completely revolutionized the whole business. He employed brass at first, because it could be easily worked. Steel has been introduced only recently. The brass was obtained in sheets, and machines were invented to stamp from the sheets the eight or ten wheels required by each clock in a single operation. Three men could cut out the works for five hundred clocks in a single day with these machines, and the cost of the movements was soon reduced to about fifty cents apiece. As the wheels of each clock were exactly those of any other clock, the parts of one could be interchanged at will with another, or taken from store; which was found of vast utility. Wooden clocks were now promptly thrown overboard by all makers. They had been subject to disarrangement by moist weather, and could not be sent beyond seas to foreign countries with which the United States were engaged in commerce. The metal clocks defied moisture, and could be sent anywhere; and the manufacture of them received an enormous expansion. They were sent all over the world, and were found by travellers ticking away on every coast and continent, and in nearly every language under the sun. Machinery was also invented to make the frames of the clocks, and stamp out the dials and hands. Mr. Jerome's business increased from the few hundred a year of his early days to four hundred and forty-four thousand a year in 1853, and the original cost of clocks was brought down to a dollar and twenty-five cents apiece.



LOUISVILLE CLOCK.

Shipment of clocks to England.

A good story is told of a shipment of wooden clocks to England in 1841 by Mr. Jerome, which may be placed with the other story of the shipment of a cargo of warming-pans to the West Indies by an enterprising Yankee, and their sale there as sugar-scoops. The law of England permitted the customs-officers to seize upon goods imported to the kingdom if they considered them to be undervalued, paying the importer the amount of his valuation, with ten per cent added. Mr. Jerome's first cargo was entered in England at regular prices; but the officer thought the valuation so low, that he seized the clocks, and paid Mr. Jerome his price and ten per cent advance. Not particularly afflicted thereby, Mr. Jerome sent over another cargo, which he sold to the customs-officer in the same way. He then sent a third cargo; but the second one had been an eye-opener, and Mr. Jerome was permitted to import his goods himself.

History of several clock companies.

The brass clocks had a great sale, and there were in 1854 thirty establishments in Connecticut making them. Barnum owned one of them, and used to sell a large part of his clocks in the old-fashioned way. In 1855 he sold his factory to the Jerome Company; and, owing to the large debts of the former, the Jerome Company broke down. The New-Haven Clock Company was formed to succeed it. The largest concerns in Connecticut are now the New-Haven, the Ansonia, and the Waterbury Companies, and Seth Thomas & Company.

Steel clocks.

The use of steel works and of springs, and of fourteen and thirty day clocks, is now increasing, and the style of time-keeper is constantly changing and improving. Calendar clocks, to indicate the day and the month; astronomical clocks, electric, burglar-alarms, peep-of-day, watchman's detector, and tower clocks; clocks to run a hundred years without winding; illuminated clocks with phantasmagoria; clocks which consist only of a plate-glass dial and a pair of hands, the works being concealed in the hands, and working them simply by shifting a weight; and other styles, — are now made in great numbers. The latest is a nutmeg clock, which will run in any position, — standing up, or lying down, — winding up without a key, and good to travel with on the cars, which will keep good time under the most discouraging circumstances.

Calendar clocks.

Nutmeg clocks.

In watch-making America made no venture until 1850. Labor was too high and too impatient here to attempt this art in competition with the Swiss and French. Mechanical talent in this field was exclusively employed in repairing and regulating watches which were imported. In 1848, Aaron L. Dennison, a watch-repairer, and Edward Howard, a clock-maker, both of Boston, consulted about the idea of making watches by machinery. They studied the matter for two years; and Mr. Dennison, the author of the project, travelled through Switzerland, carefully informing himself in regard to the methods and weak points of the industry as practised there. Experiments were made at Roxbury, and in 1850 the two men went regularly into the business. After the first thousand watches were made, the Boston Watch Company was formed, with its factory at Roxbury. In the beginning the company made only the rough skeleton movements, cutting them out by machinery, and finishing them largely by hand, and importing the jewels, trains, &c., from Switzerland. A larger factory was built at Waltham, Mass., in 1854; but the outlay for machinery and experiments proved too heavy for the company, and it failed. Mr. Robbins bought the factory for seventy-five thousand dollars, and started the American Watch Company, with a capital of two hundred thousand dollars, which has since made the Waltham watches so famous. Mr. Howard went back to Roxbury, and resumed the manufacture of watches there. Little by little the manufacturers improved their machinery, until at length they have ceased to import any of the parts of the watch, and they make every thing under their own roof. The minute rubies, sapphires, and chrysolites, as small as grains of sand, are drilled with microscopic exactness by the diamond's point, and opened out with diamond-dust on a hair-like iron wire, the sizes of the jewels being graduated by a scale which indicates differences of a ten-thousandth part of an inch. Screws so minute that it takes two hundred thousand to weigh a pound are cut from a steel wire, threaded, and headed with surprising speed and accuracy. The wheels and pinions are cut and bored with the most minute exactness, and so completely alike, that the watch may be assembled from wheels and parts taken at random from the respective heaps.

Watch-making not begun until 1850.

Boston Watch Company.

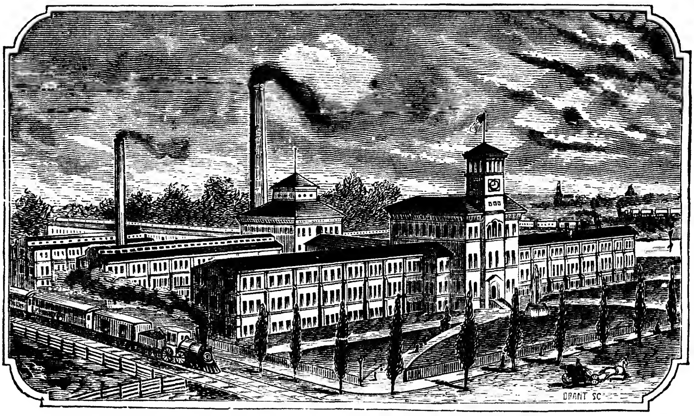
Mr. Howard.

Progress in watch-making.

The late war gave a great impetus to watch-making. The United States put a million of men under arms, and every one wanted a watch. The American Company at Waltham increased its plant in 1865, its capital being $750,000; and new companies were formed in various parts of the country. The American Company has since then doubled its capital. To-day there are eleven factories making watches, the principal ones being the American Company at Waltham, which produces about four hundred and twenty-five movements a day, and the Elgin National Watch Company at Elgin, Ill., which makes three hundred a day. The Empire City Watch Company at Jersey City, N.J., and Robbins, Clark, & Biddle of Philadelphia, are also prominent makers.

Effect of war upon this industry.

History of other companies.



ELGIN WATCH COMPANY.

American watches, though discredited at first, have, of late years, produced a decided sensation in the world of industry. From the time when all the parts of the watch began to be made by the factories here, the companies have been turning out a better ordinary time-keeper than the Swiss watch. Swiss watches held their own for a while, on account of their cheapness. In 1872 three hundred and sixty-six thousand of them were sent to the United States. In 1876 the Elgin Company announced a reduction of the prices of their watches from forty to fifty per cent. Seven movements with visible pallets were sold at four dollars. That was a terrible blow to the imported time-piece; but a still more staggering one was inflicted by the Waltham concern, which immediately announced a large reduction of prices below those of their rivals. The Swiss watch could not stand that, and the importation of them in 1876 was only seventy-five thousand. The Americans, on the other hand, are now beginning to export; and they send from twenty thousand to thirty thousand to England alone, and are menacing the Swiss make in all the markets of the world.

Swiss watch.

IRON PIPES AND TUBES.

This important industry took its rise in the United States about 1835, and was essentially the outgrowth of the business of supplying cities and villages with water and gas. Many of the companies which now manufacture pipes were founded long before 1835,—as, for instance, the Bridgewater Iron Company in Massachusetts, which was started in 1810 by Lazell & Perkins; the great Pascal Iron-Works in Philadelphia, founded in 1821 by Stephen P. Morris; and the Camden Iron-Works, in the city of that name in New Jersey, which began in 1824: but these works were originally devoted to the product of other varieties of iron-ware, stoves, &c., and took up pipe-making because of the new demand which sprang up about 1835. The number of pipe and tube establishments, which is seventy-seven, does not represent the magnitude of the industry, for some of the largest works in the United States are devoted to this specialty, and three of them claim to be the largest of their class in the world: namely, the Pascal Iron-Works at Philadelphia, covering twelve acres of ground, and employing two thousand hands; the National Pipe and Tube Works at Pittsburgh, with a production of sixty thousand tons of gas and water pipe annually; and the Reading Tube-Works at Reading, Penn., employing twenty-five hundred men. The factories are distributed as follows:—

Rise of pipe-industry.

Magnitude of the business.

Principal works.

Massachusetts, eight; New Hampshire, two; Rhode Island, two; Connecticut, one; New York, twenty-one; New Jersey, five; Pennsylvania, twenty-six; Ohio, seven; Kentucky, two; Michigan, one; Missouri, one; Wisconsin, one.

The following is the character of the product of these works: cast-iron gas and water mains, wrought-iron steam, gas, and water pipes and fittings, lap and butt welded boiler-tubes, artesian-well pipe, oil-well tubing, coil-pipe, galvanized pipe, tuyère coils, lamp-posts, vulcanized rubber-coated tube, greenhouse-pipe, drain-pipe, railway water columns, fittings, and tools. At the factory of Dennis Long & Company in Louisville—one of the largest for cast-iron pipe in the country, which is equipped with three founderies—a large number of old cannon have been converted since the war into the innocent uses of gas and water supply.

Product of works.

The making of cast-iron pipe is so simple as to need no description.

Wrought-iron pipe-making is quite a different affair. In practice the operation is rapid and simple. The iron-plate heated to redness, and partly bent by apparatus made for the purpose, is dragged from the furnace, and the end presented to a ponderous machine. It goes through the machine like a flash of lightning, emitting a series of sharp reports like a volley of musketry; and as it is projected straight and glowing from the jaws that held it, the edges perfectly welded, it

Process of making wrought-iron pipe.

strongly resembles a thunderbolt forged by Vulcan himself. The workmen have little to do except to take the plates from the furnace at the right moment, and feed them to the welding-machine. But the machine itself is not so simple, and is the product of a great deal of study and experiment. Two forms of weld are given, — the butt-weld, in which the edges of the heated plate are forced into contact under great pressure, and thus united; and the lap-weld, in which the edges of the plate are made to lap, and are then perfectly united by pressure. The former weld is suitable for gas and other pipes which are subjected to no special strain: the latter is essential for boiler and steam tubes, &c. The butt-weld is produced by first bending the plates until their edges nearly touch, and then, after heating, running them through a set of iron jaws by means of apparatus suited to the purpose. The opening in the jaws gradually contracts from a size adapted to the partially-bent plate, or "skelp," to a perfect circle the size of the finished tube; and as the plate goes through this smaller aperture, a great pressure being exerted on all sides of the tube at once, the edges come into forcible contact, and unite perfectly. The lap-welding process is similar in principle, but varies in detail. The edges of the plate are first shaved or "scarfed" by machinery, so that, when they lap, they will not form a double thickness of metal. It is requisite now in welding to apply pressure to the inside as well as the outside of the tube, in order that the edges shall not curl under: this is accomplished by means of a mandrel of slightly conical form, which is carried at the end of an iron rod somewhat smaller than the diameter of the tube to be welded. As the heated plate is forced into the jaws of the machine, the mandrel enters the tube; and thus a powerful pressure is exerted both within and without, and the weld becomes perfectly homogeneous. The mandrel is destroyed by the tremendous operation to which it has been subjected, and a new one is put on for the next tube. It is this process which creates the sound of musket-firing. The reader can imagine the interesting nature of it in a factory where eighteen or twenty furnaces are going at once.

Effect of panic of 1873.

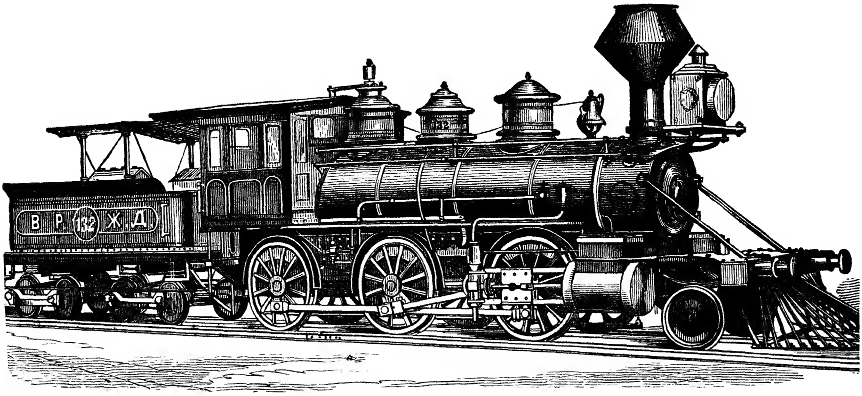
The panic of 1873 put an end temporarily to the improvement of real estate and the enlargement of cities. Most of the pipe and tube companies have accordingly shortened their production. Some of them stopped work. In an ordinary year the seventy-seven factories will consume about three hundred and fifty thousand tons of pig-iron, and manufacture a product worth over twelve million dollars. The Pascal Works, which adds the manufacture of gas-generating machinery and boilers for ranges to its other business, has a yearly product of nearly five million dollars.

LOCOMOTIVES.

It is a trait of our countrymen that they have never been able to export in large quantities their raw materials and crude fabrications (cotton alone excepted), for the reason that the smaller wages and cheaper capital of Europe have prevented Americans from entering into competition. But, when it comes to the exportation of objects requiring for their production a constructive ability and a mechanical skill of the very highest order, our countrymen have shown themselves able to compete with and surpass the world. The fact is exhibited in the history of the locomotive in America. Pig and bar iron and steel have been among the most insignificant of our exports. Manufacturers abroad have heard that the iron of the Continent rivals in quality the famous ores of Sweden. Yet what they know about it is from books and travellers: they have scarce ever seen

American locomotive.

Its superiority.



MODERN LOCOMOTIVE.

any of it; for it does not enter into foreign commerce. But that splendid creation, the American locomotive, into which this same iron is fashioned, is now known all over the globe, and is freely employed in most of the civilized countries, as being the strongest, swiftest, and most enduring of these willing servants of man. In the calendar year of 1876 less than a thousand tons of raw iron and steel were exported from the United States. But we have recently seen a single steamship loading at Philadelphia with thirty locomotives, — containing nearly a thousand tons of finished iron, and worth six hundred thousand dollars, — for transportation to Russia alone, on an order from the Imperial Government. The American locomotive is used and admired in Austria, Italy, Greece, Russia, Egypt, South America, and Australia, and even in Germany, the land where a single great master-workman — Krupp, the captain of modern industry, as Mr. Hewitt calls him — employs ten thousand men largely in the production of this class of works. The orders sent to America increase as time goes on; and the new railways of the future, especially on the southern half of this continent, will be largely operated by the engines made by the workmen of the United States, — the smartest, liveliest, most intelligent mechanics under the sun.

Export of them.

As will be related in the chapter on Railroads in another part of this book, the locomotive is an afterthought of the men who attempted to build carriages to run on the ordinary wagon-roads by steam-power. The first suggestion was made by Dr. Robison, then a student in the University at Glasgow, in 1759. Watt afterwards took up the idea, but accomplished nothing with it, because he was an opponent of the high-pressure system, and the low-pressure engines were too heavy to be successful in locomotion. Richard Trevittrick saw the trouble, and in 1802 took out a patent for a steam road-carriage on the high-pressure principle, which attracted some attention. In 1804 he built the first railway locomotive, which he worked at Merthyr-Tydvil, in South Wales, on a tram-road. In the next twenty-five years a number of patents for locomotives were taken out in England. Capitalists were slow to place confidence in the new idea, however; for they feared, that, with a heavy train of cars, the wheels of the engine would slip round on the rails, and the train would not start. Adhesion to the rails by cogs or otherwise was thought necessary. This was shown to be unnecessary in 1829 by experiments made upon the Liverpool and Manchester Railway, — the pioneer line in England, which was opened for travel that year. The directors had offered a premium of five hundred pounds for the best locomotive-engine, not to exceed six tons in weight, which should draw three times its own weight at a speed of ten miles an hour, and cost not over five hundred and fifty pounds. Five engines were entered for the competition, — "The Rocket," "Novelty," "Perseverance," "Sans Pareil," and "Cyclopède;" and "The Rocket" demonstrated its capacity to make twenty-four miles an hour, drawing a train three times its own weight. A few attempts to introduce the cogged wheel and rail were made even after that; but they attracted little attention, and amounted to nothing. An era of locomotive-building now began.

Dr. Robison. **Richard Trevittrick.** **Early difficulties.**

First engines used in United States.

The first engines used in the United States were imported from England for the Delaware and Hudson Canal Company, the Mohawk and Hudson Railway, and the Baltimore and Ohio Railway. The pioneer was an absurd little affair called "The Lion," which in 1828 was placed on the Delaware and Hudson Company's road, on the banks of the Lackawaxen, and started on its first trip by Mr. Horatio Allen. Compared with the engines of to-day, it might better have been called "The Chipmuk:" still it was rather an impressive affair then. There was some apprehension as to how the little monster would perform, and many thought that the trestle-work bridge across the creek would not sustain its weight. Mr. Allen found no one willing to make the first trip across the bridge: so he went out alone with the engine himself, in the presence of a great crowd of spectators, his own hair standing on end, however, as he rounded some of the curves, and flew over the bridge. The results of the trial were satisfactory. "The Lion" neither blew up, nor ran away, nor leaped into the creek, nor broke down the bridge. It clung to the track, made very fair time, and was entirely tractable.

Several other engines were bought abroad about this time for the purposes of experiment and study; but the purchases continued for only a few years, and were very limited in extent. The inventive genius of the United States was aroused, and a number of mechanics in different parts of the country determined to attempt the building of engines here. The Patent Office was overwhelmed with applications for a patent for this and that device, and form of construction; and in a very few years the demands of the railroads of the United States were fully met by the American shops.

Numerous American inventions.

The first locomotive made in the United States was the idea of Mr. E. L. Miller of Charleston, S.C., who came North in 1830 to arrange for the building of the machine for a railroad in which he was interested, running out of Charleston across the country, toward the city of Hamburg. Mr. Samuel Hall of the West-Point Foundery, New York, undertook to make the engine under his direction. It was completed in 1830, sent South, and operated the same year on the railroad out of Charleston, of which eight miles had been built. Mr. H. Allen had been secured as chief engineer, and the locomotive was first exhibited to the people of the South by him. It was appropriately called "The Best Friend." That particular engine did what a man's best friend never does, — promised much and performed little, and finally left the railroad entirely in the lurch by blowing up in a very short time after it was put into the service. Yet no better title was ever given to a locomotive in America; for this princely invention has been indeed to the people of the United States since that early day their "best friend."

E. L. Miller.

First locomotive made in United States.

A stimulus was given to the mechanical and inventive genius of the country in 1831 by an advertisement issued by the Baltimore and Ohio Railroad Company, which had, since May, 1830, been operating twelve miles of road west from Baltimore by horse-power. The company offered rewards of four thousand and thirty-five hundred dollars respectively for the locomotives, which, upon trial, should prove to be the first and second best in complying with the published requirements of the company. Three locomotives were built in answer to this liberal offer; and the prize was awarded to "The York," an engine built at the city of that name in Pennsylvania by Davis & Gartner, which was found to be able to draw fifteen tons at the rate of fifteen miles an hour. Being employed on the road to Ellicott Mills, a distance of twelve miles, it generally made the trip with four cars in an hour. On a straight track it attained a velocity equal to thirty miles an hour. The success of "The York" was a great encouragement to American builders; and rhapsodies of the most inflated description over the "march

Stimulus given by Baltimore and Ohio Railroad Company.

"The York."

of steam" filled the newspapers of that day, elicited by the performances of "The York." The Baltimore and Ohio Company held out every inducement to mechanics from that time forward to improve upon "The York," and build a class of engines of great adhesion to the track, and of better working-power.

"De Witt Clinton."

In 1831 "The De Witt Clinton" was built at the West-Point Foundery for the Mohawk and Hudson Road. It weighed four tons, ran on four wheels, and made forty miles an hour without a load.

Matthias W. Baldwin.

In 1832 a locomotive was made by Matthias W. Baldwin of Philadelphia for the little six-mile railroad running out from that city to Germantown, the cars of which were at that time being drawn by horses. Like all of our successful engine-builders, Mr. Baldwin rose from the shop. He began life as a jeweller, learning his trade in the store of Fletcher & Gardiner, and afterwards having a little shop of his own. The demand for his jewelry not being very satisfactory, he went into a machine-shop in partnership with David Mason. A stationary steam-engine specially adapted to the needs of the shop having become desirable, Mr. Baldwin designed one himself. He was thus interested in steam-engineering; and he found it easy to go one step farther, and attempt a locomotive, when the era of railway-building began in the United States. His primitive locomotive, built for the Germantown

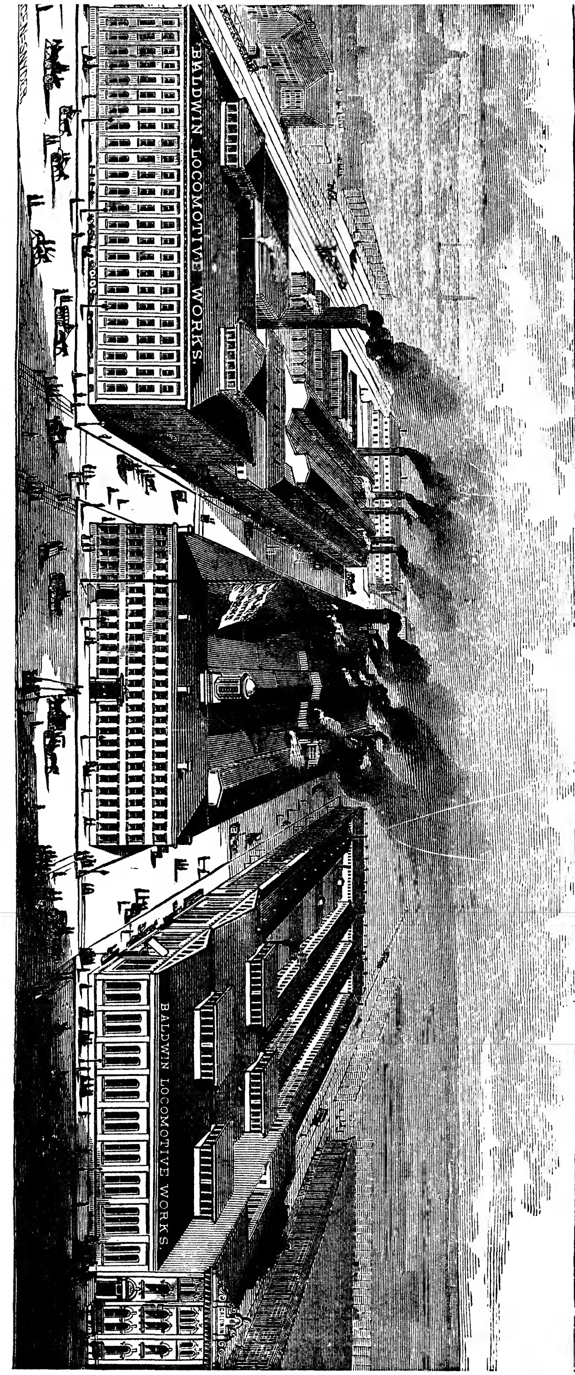
"Old Ironsides."

Road, was named "Old Ironsides," and was tried on the line in November, 1832. It weighed five tons, and ran on four wheels, the forward pair being forty-five inches in diameter and the driving-wheels fifty-four inches, and the whole four having wooden spokes. The cylinders were nine inches and a half in diameter, with eighteen inches stroke. The boiler had seventy-two copper flues. The smoke-stack was an absurdly tall affair, rising a great distance above the machine, — a fact, however, which did not prevent the sparks from burning the clothes of the engineer and the passengers. There was no cabin for the engineer; and, it being inconvenient for that functionary to carry an umbrella when it rained, the engine was housed in wet weather, and the cars drawn by horses. It cost thirty-five hundred dollars. Mr. Baldwin got five hundred dollars less for it than he expected; and, having many other discouragements with it, he vowed that he would never build another locomotive. But he did, for all that; and, his later attempts being extremely successful, the works founded by him are the foremost in the country

"E. L. Miller."

to-day. In 1834 he built a six-wheeled engine for Mr. Miller, for the South-Carolina Road, called "The E. L. Miller," with wheels of solid bell-metal, the purpose of which was to gain a better adhesion to the rails. It is hardly necessary to say that the experiment with that metal was not repeated. The wheels wore out very quickly, and had to be thrown aside. In June, 1834, Mr. Baldwin completed a successful locomotive, called "The Lancaster," for the States Road, which ran out from Philadelphia to Columbia, and connected there with the canal to the western part of the State. The engine weighed eight tons and a half, and was found to be able to haul nineteen loaded cars at twice the speed attained with horses. The State authorities were greatly pleased with its performances, and decided to convert their railroad at once from a horse line to a steam line. Mr. Baldwin gained a great deal of credit from "The Lancaster;" and, receiving several orders, he thenceforward devoted himself to the industry, and founded the works which have since attained to such magnitude of operation and world-wide reputation. Mr. Baldwin combined the best qualities of the American mechanic,—inventive genuis of a high order and unflagging perseverance, qualities not always united in the same man. He was always improving his locomotives, and many of the most important inventions of the art were his own. In 1835 he bought one device from E. L. Miller, which afterwards he threw overboard. This was a

Baldwin's improvements.



BALDWIN LOCOMOTIVE-WORKS, PHILADELPHIA.

plan for bringing part of the weight of the tender upon the rear of the engine, thus increasing the pressure upon the driving-wheels, and consequently the adhesion of the engine. Mr. Baldwin adopted this device, and paid a hundred dollars per engine for it, and in 1839 bought the patent for nine thousand dollars. He afterwards perfected plans of his own for accomplishing the same object of greater adhesion in a better way. The Baldwin engines gradually improved in size and style from year to year. Cabins were built upon them for the engineers and firemen. The old style of a single pair of drivers was changed to two pairs, and in 1855 to three pairs; ten-wheeled engines weighing twenty-seven tons being built in that year for several of the leading roads. In 1866 "The Consolidation," weighing forty-five tons, with twelve wheels, and carrying all except five tons of its weight upon the drivers, was built, being the parent of a class of engines of enormous power of that name. Head-lights, variable cut-offs, and other features of the modern locomotive, were successively introduced by Mr. Baldwin; and the works called by his name are now producing types of engines which are not surpassed at the present day.

Recent rapid growth of industry.

After the original experiments, shops for engine-building were opened in various parts of the country. In 1833 Long & Norris of Philadelphia built an engine of such unusual tractive power, that it commanded attention in England, and led to the first exportation of American locomotives. Several were ordered from the maker for employment on the line between Birmingham and Gloucester. In 1835 engines were built at Lowell, Mass. In 1837 a firm at Paterson, N.J.,—Rogers, Ketchum, & Grosvenor,—began the business, and founded the works which are now known as the Rogers Locomotive Works. Mr. Rogers was (in 1849) the first to employ the link motion in locomotive practice in this country; and he had to encounter the hearty opposition of Mr. Baldwin and others for several years before the utility of the idea was conceded. Mr. Baldwin, after a long fight against the innovation, yielded to it in 1854, and put it upon his engines. The Rogers Works are also to be credited with the full-stroke pump, and the effectual jacketing of the boiler to prevent radiation. In 1847 the Taunton Locomotive Factory was established by W. W. Fairbanks, a boiler-maker of Providence, R.I. Shops were also started about that time at Boston, Lawrence, Manchester, and elsewhere; but most of these soon ceased to do business, the shops in the Middle States possessing superior advantages for the manufacture. The Messrs. Winans at Baltimore perfected many valuable ideas in locomotive-building, and were the inventors of the camel-back engine, which has obtained some celebrity.

Locomotives built in railroad shops.

Of late years, the larger railroads of the country have begun to construct locomotives in their own shops. One effect of this has been to concentrate the production by private companies into fewer hands, and the manufacture is now principally confined to Paterson and Philadelphia.

The principal improvements of the last twenty years have been due to the necessity of fitting smoke-stacks with an apparatus to catch the sparks; to the substitution of coal for fuel in place of wood, causing many changes in construction, and the building of a larger and more powerful type of engine; and the larger use of steel for tires, boilers, and working-parts of the machinery.

Improvements of last twenty years.

The weight of the locomotive now in use on American roads varies from thirty to forty-five tons, two-thirds of the weight being on the drivers. Few of the latter class are used; but the Danforth Works at Paterson have made a few of that weight since 1873 for the Baltimore and Ohio Road. The average cost of locomotives is twelve thousand dollars: those of the largest type cost twenty thousand. On the New-York Central, the Union Pacific, and other roads where the grades are not severe, a speed of sixty miles is frequently attained in travel; but the great additional consumption required by that rate of speed, and the greater liability to accident, makes it undesirable for the ordinary traffic of the roads. The usual speed of American railway-express travel is thirty miles an hour. The average cost per mile run is nineteen cents: viz., for repairs, three cents and seven-tenths; fuel, five cents and six-tenths; stores, five-tenths of a cent; miscellaneous, two cents and five-tenths; attendance, six cents and five-tenths. If the engine is driven at greater than average speed, the cost may be nearly doubled, as the fuel consumed will vary from sixteen to sixty pounds per mile with the speed. More oil will be required, and the machines will wear faster. The maximum load of a ten-wheeled consolidation engine on a level division with which the men may expect to make time is ninety cars, although the engines of the Pennsylvania Road have frequently hauled over one hundred. An ordinary freight-train would consist of about forty cars.

Weight, speed, economy, &c.

A special class of locomotives has come into existence of late, growing out of the needs of the population of large cities for rapid transit between their homes and the scenes of their daily occupations. In New-York City, the bulk of the business of that great commercial emporium, and of the manufacturing which is done there, is transacted within a space of three miles from the lower end of the island upon which the city stands. The population, on the other hand, is scattered along for a distance of six miles beyond the business-part of the island, and indeed much farther: and a large share of the men who find employment in its stores, banks, and factories, rather than live so far away from their work, now reside across the several rivers, in New Jersey and Connecticut, and on Long and Staten Islands; because, though sometimes a greater number of miles away, they are nearer in point of time, because they have access to the city by steam-cars and steam-ferries. The inhabitants of the island have hitherto depended principally on horse-cars and stages; and it frequently takes an hour to go from one's home to his office, and *vice versâ*. The same thing is true in principle of all the

Dummy-engines.

other large cities of the country. By the natural expansion of the town, the population are compelled to reside at great distances from their places of employment.

Application of steam to city railways.

The horse-car running on a railway laid through the centre of the street subserves the purpose of expeditious transportation in cities of moderate size; but in a large trade-centre of, say, five hundred thousand souls, it does not: and the people of such a town will, in the course of the year, lose in the aggregate from five thousand to eight thousand years of time simply in getting about from home to business, and *vice versâ*, by this slow mode of locomotion; which might be saved and utilized, were travel on the street-railways effected by steam. In a larger city more time is lost. The growth of cities, therefore, has made necessary the application of steam to the purposes of local travel.

Difficulties to be overcome.

Special difficulties are encountered, however, in using steam on city railroads. Sparks from the engine are likely to endanger the safety of property. The puffing and the steam frighten the carriage and dray horses of the street. The liability of collisions and accidents is increased by the more rapid style of travelling. The problem is one which has taxed the inventive genius of the country; but it is one which inventors have not hesitated to try to solve. Newton used to say that he delighted to encounter an obstacle, as it was always a proof to him that he was on the brink of an important discovery. It has been so with reference to steam on American street-railways. The special difficulties of the case only rendered the inventors doubly zealous, and have only led to a greater triumph. The problem has at length been successfully solved, and nothing now prevents the population of every large city from travelling from home to business by steam but the lack of enterprise and public spirit among them.

Kinds of street-railway-locomotives.

The street-railway locomotives are of two sorts. The first is the dummy-engine: it can be fitted to the ordinary street-car, and is so employed with great success in the city of Philadelphia, which is the pioneer in its practical use. The engine is a small one of the vertical type, and occupies a cabin at the front-end of the car. It burns coal, and consumes its own smoke, and runs as quietly as the ordinary horse-car. Very little steam escapes from it, and that little creates no alarm among the carriage and dray horses, which the car passes at a speed of ten miles an hour on the street. There is no doubt but this style of street-motor will eventually supersede horse-power. The existing horse-railway companies resist its introduction only because they would lose so much capital by a change.

Elevated iron railway-engines.

The other sort of street-engine is applied to travel on the elevated iron railways which have been building in the city of New York during the last five years. These are genuine locomotives, drawing a car or train of cars after them as on the great railways running through the open country from city to city. They are small, weighing from five to ten tons only, consuming their own smoke, and making little noise besides that produced by rattling over the rails. They travel at great speed, and reduce the hour's travel on the plodding horse-car to fifteen minutes and less. Their special peculiarity is, that the boiler and machinery hang low between the wheels, so as to render them steadier upon the rails, and effectually to obviate the danger of being upset. Travel behind one of these beautiful engines on the elevated railways, in a car fitted up as luxuriously as those on the great railways of out-of-town travel, is as far in advance of transportation in the noisy, lumbering arks which the tired horses of the roadway lines still drag after them, as the American mechanic is in the scale of civilization beyond the Patagonian savage.

Consumption of iron a gauge of civilization.

At the beginning of this chapter allusion was made to the brilliant generalization of a recent writer, that the consumption of iron by a race of men now measures their position in the scale of civilization. The facts in regard to the locomotive throw a ray of light on the reason why. The reason is this, — that the use of iron shows the extent to which a country employs time and labor saving inventions. Machinery and ingenious tools relieve mankind from drudgery, and give the mind a chance to play; and every new invention which throws a fresh burden upon the muscles of steel and the moving-power of steam, and takes it off from the human race, gives a fresh impetus to the intelligence, the spirit, and the refinement of the people. Ought not the marvellous progress of the United States in every thing which distinguishes the age from the gloom and ignorance and poverty of the middle ages to be attributed in large part to the time and labor saved by the locomotive? and ought we not to regard the ingenious men by whose toil and energy this wonderful device has been perfected as benefactors of the race, — not second even to those who, at the cost of life and treasure, won for us the inestimable blessings of liberty and free government?

Number of establishments.

There are now eighteen locomotive-works in the United States, which have the capacity to produce twenty-six hundred locomotives a year; although the quantity annually made is less than half this number. Generally this has been a very prosperous business; and it is to be hoped, that, ere long, these various establishments will be reaping the reward to which they are entitled because of their industry and genius.

SEWING-MACHINES.

Simplicity of ancient dress.

In ancient times there was great simplicity of dress, because the process of weaving cloth was slow and difficult, and there was great economy of material in people's attire. The wealthy in that age were distinguished from others more by the magnificence of the cloth they wore than by any special elaboration in the fashion with which their garments were made. There was little sewing then, and the avocation had not yet called into being that special class of sewing-women which came upon the scene in a later age. Along in the thirteenth and fourteenth centuries commerce brought great wealth to Italy, and with it a new luxury of attire. The dress of both sexes not only became richer, but more elaborate. The Italians became the most handsomely-dressed people in the world; and the city of Milan came in time to dictate the fashions, not only to Italy, but to the north and east of Europe, and even to give its name to the new art of millinery, which thereupon took its rise, and dealt with the decoration of dress. With the new luxury of attire came a great increase in the amount of sewing; and when, two or three centuries later, the steam-engine was set to work in Europe to drive the loom, and the manufacture of cloth began to be carried on at an enormously increased scale and diminished cost, and people began to wear twice and three times as many yards of cloth as before, sewing was again doubled and tripled, and then gave employment to a special class of thousands of women and girls in all large cities. As sewing was easier work than nail-making, and was held to be (whether rightfully or not) more respectable work than household service, the ranks of the sewing-women soon became overcrowded, the pay became scanty, and the workers encountered great poverty and suffering in trying to earn their living. The lines —

Greater elaboration of dress requires more sewing.

Increase of sewing-women.

> "O Industry, how rich thy gifts!
> Health, plenty, and content
> Are blesings all by thee bestowed" —

became a bitter mockery to these struggling women; and Tom Hood wrote one of the most touching poems of modern times to commemorate their privations.

The sewing-machine, by which the condition of those who live by the needle has been materially improved, and sewing made an agreeable task, is often claimed to be a purely American invention. The United States has won laurels enough, however, in promoting the welfare of mankind, to be generous in its claims about the sewing-machine. This invention is not American in the sense that the nail-machine, the electric-telegraph, the iron-clad gunboat, and many kindred discoveries, are. The idea was originally the thought of an Englishman, Charles F. Weisenthal, who in 1755 obtained a patent for a crude device to facilitate the process of embroidering; and a great many experiments were made in the kingdom of England toward perfecting the contrivance before Americans directed their attention to the subject. To America belongs simply the honor of producing the first machines which were ever used practically in the sewing of cloth and leather.

Sewing-machine an American invention.

Weisenthal's invention, which proposed to use a needle pointed at both ends, with an eye in the middle, to go backward and forward through the cloth, was never utilized. In 1790 Thomas Saint obtained a patent for a machine "for quilting, stitching, and sewing, making shoes and other articles, by means of tools and machines." His machine was mostly of wood, with an overhanging arm, or carrier, into which was inserted a vertical reciprocating needle, and an awl to go before it and punch the holes. On the top of the arm was a spool for giving out the thread continuously. The stitch was the same as Weisenthal's, and was called the tambour or chain stitch. A loop was formed by thrusting the needle through the cloth or leather. A second thrust carried the bight of thread through this loop, making a second loop, through which, in turn, the needle was thrust to form a third, the first loop being drawn up taut during the third thrust. This variety of stitch is still in use to-day. Saint's idea appears to have been to lighten the labor of heavy sewing: he does not seem to have thought of the plan of superseding the hand needle for general work. In 1804 John Duncan invented a machine to make the tambour-stitch, hooked needles being used below the cloth to catch the loop. In 1807 James Winter patented a device for sewing leather gloves; the leather being held fast by iron jaws, so that the hands of the operator were free. About the same time a contrivance was brought out for sewing with needlefuls of thread, the cloth being crimped for the operation, and the needle thrust through the crimps horizontally.

Saint's invention.

Duncan.

These machines met with little attention, and less favor. Working-men in that age stood in dread of labor-saving inventions, and strenuously fought against their introduction with all the resources at their command.

Hostility to them.

The first American machine was the invention of the Rev. John Adams Dodge of Monkton, Vt., who took an ingenious mechanic by the name of John Knowles into his confidence, and with his help built a practical and efficient machine for sewing the back-stitch. The needle was the same as Weisenthal's, being pointed at both ends, having the eye in the middle, and going entirely through the cloth in both directions. It sewed a perfect seam straight forward; but would not allow the cloth to be turned, on account of the peculiarities of the feeding-mechanism. The machine did good work, and might have been perfected, had it not been that Mr. Knowles was overwhelmed with ministerial work (having three churches on his hands at times), and had not the journeymen tailors opposed it bitterly as a violation of their rights. It was never patented, and was soon abandoned. A machine was patented in the United States in 1826 by Mr. Lye; but its character is not now known, the records of the Patent Office bearing on the subject having been burnt. The next machine was a Frenchman's. It was brought out in France in 1830 by Barthélemy Thimonnier, and was used to a certain extent in the manufacture of army clothing. Its peculiarities were the overhanging arm, continuous thread, flat cloth-plate, and

Invention of Dodge.

Lye.

Thimonnier.

treadle and cord. The inventor had hard luck. He made eighty machines for sale; but, even in enlightened France, working-men were hostile to the new idea, and the stock of machines was destroyed by a mob. Nothing daunted, Thimonnier made another lot, this time chiefly of metal; but again they were destroyed by a mob. The inventor patented his machine in the United States in 1850, but could not recover from his reverses, and died in poverty.

Hunt.

The wits of American inventors were now fairly at work, and fresh attempts were made to solve the delicate and intricate problem of a machine which would relieve woman of the fatigue and wear of all general and continuous sewing. In 1832 Walter Hunt of New York, a skilful mechanic, made a machine which did so well, that, in the following year or two, he sold a number of them to different people. He was the first who used two threads. The upper one was carried by a curved needle, with the eye in the point; and the lower one by a shuttle. The machine made the lock-stitch, in which the threads are made to interlock as nearly as may be in the centre of the stuff. He lost an opportunity to make a fortune by neglecting to take out a patent. In 1834 G. A. Arrowsmith bought two or three of the machines, and the right to patent, but did not perfect his patent; and in 1852, when Hunt bought back the right, the Department at Washington told him that his neglect had made the invention public property, and they could do nothing for him. A patent had previously been given to J. J. Greenough, who in 1842 had perfected a machine for doing leather and other heavy work. It was like Weisenthal's and Dodge's in having a needle pointed at both ends to go through and through the fabric. Like Dodge, he never made more than one machine. In 1843 patents were issued to B. W. Bean of New-York City for a running stitch, and to George R. Corlies for a machine similar to Greenough's, with two reciprocating needles, — one to punch the holes, and the other to sew.

Howe.

While these experiments were making, Elias Howe, jun., of Cambridge, Mass., was at work independently upon the problem. After two or three years of study, he believed that he had mastered it; and in 1846 he got a patent for a machine, which, while covering very much the same ground that other men had taken possession of before him, was still so novel in its combinations and forms as to be treated at Washington as a new invention. He used a curved, eye-pointed needle; a shuttle below the cloth, driven by two vibrating mallets; a peculiar baster-plate to hold the cloth, and feed it forward, the plate being pushed back when it had reached its forward limit, the cloth again fastened to points upon it, and the plate again fed forward; and a device to give tension to the upper thread. It was the parent of our modern machines, but was not itself a great success. Howe made a few specimen machines: but they would not sell at first; and, when they did, the people who bought them could not make them work. The tension was not right; and the thread formed large loops in one part of the seam, and was too tight in another. The vertical suspension of the cloth from the baster-plate was inconvenient, and the stoppages for re-adjustment of the cloth tiresome. Howe was a mechanic of small means, and could not himself raise the capital to manufacture. He tried, therefore, to interest capitalists in the invention. But capital is timid while inventions are still in the preliminary stage of experiment; and, though Howe even went to England to look for the money which he could not raise here, he did not succeed in inspiring confidence in his machine. It is said, that, in order to get back to America, he was forced to pawn his baggage to pay for his wife's passage, and to work on the ship for his own. He was a man of remarkable perseverance, however, and did not abandon his pet idea of supplying the United States with sewing-machines.

Defects of Howe's machine.

Howe did not have the inventive genius to remedy the defects of his machines himself. The theory of it was right; but he could not embody it in the proper mechanical forms to insure its prosperous working. He was indebted to other men for the devices which made it a blessing to the country.

Bachelder.

The tension of the thread was regulated by a patent brought out by John Bradshaw of Lowell, Mass., in 1848. J. B. Johnson and Charles Morey attempted to improve the feeding-device by the invention of a circular baster-plate in 1849; but John Bachelder of Boston did better than that the same year with an automatic arrangement; and J. S. Conant of Dracut, Mass., invented still another feeding-device. Blodgett and Lerow of Boston, also in 1849, obtained a patent to make the lock-stitch by a method different from Howe's, but the same in principle, using a shuttle which described a circle, instead of moving back and forth. That was a prolific year in sewing-machine inventions. Applications for patents for improvements and new devices began to pour into the Department at Washington from all parts of New England and the East. Some of the devices were never used; but now and then one would be brought out which was of material service. In 1850 Allen B. Wilson of Pittsfield, Mass., received a patent for a "two-motion feed," which was afterwards converted into a "four-motion feed;" and also for a vibrating shuttle which was better than Howe's, because it made a stitch at every movement, which Howe's did not. This device was abandoned in 1851 for a rotating hook, which completely superseded the shuttle in his machine.

Wilson.

Singer.

Mr. Isaac M. Singer of New York came into the field in 1850. He had been interested in Blodgett and Lerow's machine; and he now offered to build one for forty dollars which would work perfectly, and sew a good seam. His offer was accepted, and he made the machine in twelve days. It had a rigid overhanging arm, vertical needle, shuttle, and double-acting treadle, and is said to have been the first machine satisfactory to manufacturers. The manufacture of this machine immediately began. It bore a close resemblance to the Howe machine, but did what Howe's had never done, — it worked well. Being the first in the market, and very popular, it took the lead in sales, and kept it until 1854.

A new style of machine was patented in 1851 by William O. Grover of Boston, in company with Mr. Baker, for making a double loop by means of the use of a circular rotary needle. It used no shuttle, worked well, and became very popular from 1854 to 1858, taking the lead in the market during that period.

Grover.

There were now three companies busily engaged in manufacturing sewing-machines for the general market, — Singer & Company, Grover & Baker, and Wheeler & Wilson. The utility of the new invention had been recognized even by journeymen tailors, and the machine was the sensation of the day. Weary women hailed its advent as a blessing, and the sewing-machine became the most charming of gifts. The three companies above named pressed their sales with great energy, and became extremely prosperous. But these companies were all infringing upon the patent of Mr. Howe. It is true that they had first made his idea useful to mankind; but the patent laws of the United States have been wisely framed to protect intellectual property, and prevent wealthy men and corporations from taking advantage of the poverty of the inventive geniuses who fill our workshops, but who do not always possess the means to secure to themselves immediately the profits of their own talents. Mr. Howe sued the several companies, and spent a great deal of money in enforcing his claims against them. Having won a test suit in the courts, the companies compromised with him, and entered into a compact, Oct. 10, 1856, which is known as the "Albany agreement." By the terms of this compact, it was stipulated that each of the three companies should pay Mr. Howe five dollars for each machine made (he had previously claimed twenty-five dollars), and that licensees might be permitted to manufacture the several machines in order to assist in supplying the country with them speedily, and that fifteen dollars should be exacted from the licensees for each machine. From this latter royalty a ten-thousand-dollar fund for the purpose of enforcing the patents in the courts should be accumulated, and the surplus receipts be divided among the four contracting parties, Mr. Howe getting the largest share. Under this agreement operations were resumed, the Wheeler and Wilson machine taking the lead in the sales from 1858 to 1868, and the Singer machine thereafter. The first agreement lasted until 1860, up to which time over 130,000 machines had been sold under it, — 55,000 by Wheeler & Wilson, 40,000 by Singer & Company, and 35,000 by Grover & Baker. The agreement was honorably executed: so Howe had no more reason for complaining of these companies. Mr. Howe securing an extension of his patent in 1860 for seven years, the Albany agreement was renewed for seven years; but it was stipulated that Mr. Howe should receive only one dollar for every machine, and that licensees should pay seven dollars. Mr. Howe's income under this arrangement was very large, amounting in one year (1866) to $155,000; but the expenses of his lawsuits consumed his estate, and he died in comparative poverty.

Utility of sewing-machine.

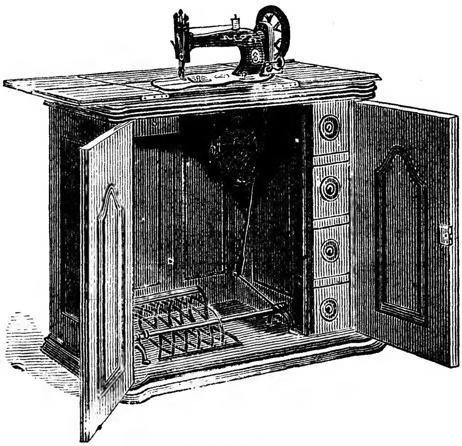
Infringement of Howe's patent.

Wheeler and Wilson.

The number of applications for patents only seemed to increase as time rolled on, and up to the present time more than twelve hundred have been filed in the Patent Office at Washington. They have averaged about fifty a year since 1857. **Number of patents.**

In 1857 the Weed machine was invented.

The same year James E. A. Gibbs of Millpoint, Va., devised an entirely new machine, whose object was to reduce the cost of these inventions by simplifying the mechanism. Mr. Gibbs had never seen a sewing-machine, but had heard of them through the newspapers. On reading about the use of two threads, it occurred to him, that, if sewing could be effected by a single thread, much of the iron-work of the machine could be dispensed with. He set his wits to work, and in the year named brought out his patent for a twisted loop-stitch, made with a single thread by means of a rotating hook underneath the cloth. It was a step in advance, and its value was promptly recognized. In 1859 James and Charles H. Willcox of Philadelphia obtained control of the patent, and began the manufacture of the Willcox and Gibbs machine. This is one of the most silent, swift, and easily run of machines, and has had a large and general sale. **Other inventors.**



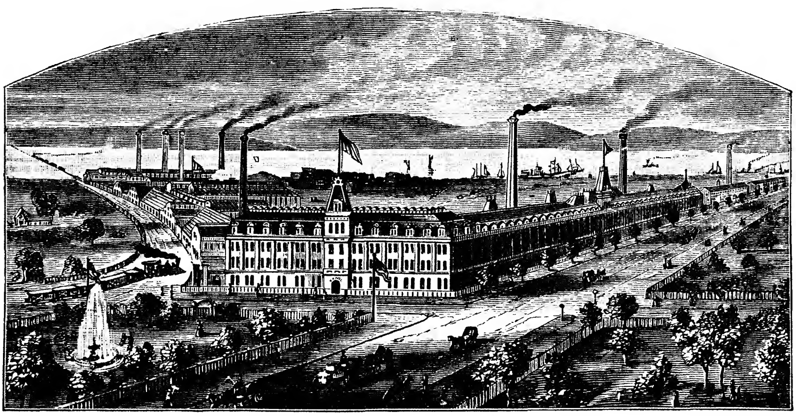
SINGER SEWING-MACHINE.

Since the date of that patent there have appeared — in 1858 the Empire, since joined with the Remington; the Slote, or Elliptic, since bought by Wheeler & Wilson; two Howe machines (Elias and Amasa B.); between 1860 and 1864 the American Button-Hole, the Ætna, and the Domestic; the Beckwith in 1865; and the Victor and the Remington, both recent machines.

A notable event occurred on the 8th of May, 1877, in the history of the sewing-machine manufacture. At noon of that day the last important patents held by the manufacturer of sewing-machines expired, leaving the market open for all who wish to compete. The leading makers immediately put down their prices from forty to fifty per cent, while others expressed the intention of speedily following suit; sixty-dollar machines being fixed at thirty dollars, and seventy-dollar machines at forty dollars. A. B. Wilson's invention, used in the four-action, rough-surface feeder, was the most important of the expiring patents; the others being the vibratory needle **Expiration of patents.**

and reciprocating shuttle, and the rotating hook. There are, perhaps, a thousand patents in force, and now held by the various manufacturers; but the above were the last of the "foundation patents," — the patents needful in making a first-class machine. The Singer, Wheeler & Wilson, Grover & Baker, and Howe companies, are said to have held the monopoly of the Wilson invention ever since 1850, pooling the enormous profits of its manufacture.

Magnitude of industry. America, if not the birthplace of the sewing-machine, is, at any rate, now the workshop of its largest manufacture. No other country in the world has so many and such large establishments devoted to this special industry. There are now twenty-five factories engaged in making sewing-machines, two of them having branches in Europe; namely, the Singer and the Howe. The Singer factory at Elizabethport, N. J., is probably the largest of its class in the world. The immense sales of the Singer machine caused the company to outgrow its very spacious quarters in New-York City; and it accordingly took its flight beyond the borders of the city,



SINGER SEWING-MACHINE COMPANY.

and erected the magnificent row of brick buildings by the side of the railroad-track running out of New York to Philadelphia, which are the wonder of every traveller who sees them. The Wheeler & Wilson and the Howe establishments at Bridgeport, Conn., are now both great concerns also. The vigor which has been manifested upon this continent in the development of this important industry is not confined to the United States alone. Canada, too, has shown true Northern fire and intelligence in taking up this business. At the Centennial Exhibition at Philadelphia, in 1876, Canada was represented there by eleven different manufacturers and some valuable machines, making a better display than any nation except the United States. The concerns exhibiting were Thomas Piper of Hamilton, Mr. Raymond of Guelph, the

Gardner Sewing-Machine Company of Hamilton, Wilkie & Osborne of Guelph, Wanzer & Company and the Canada Sewing-Machine Company of Hamilton, James Aurthors of Toronto, O. St. Amand of Quebec, J. D. Lawlor of Montreal, O. Morrill & Company of Rock Island, and the Williams Manufacturing Company of Montreal.

There is no record of the number of sewing-machines made and sold prior to the Albany agreement of 1856. Since that date the record has been preserved. The sales under the compact at Albany, from 1856 to 1869, amounted to 1,500,000 machines, divided about as follows: Wheeler & Wilson, 450,000; Singer, 350,000; Grover & Baker, 235,000; Howe, 140,000; Willcox & Gibbs, 105,000; Weed, 70,000; Florence, 60,000; all others, 100,000. From 1869 to 1878 the sales have amounted to 4,800,000, making 6,300,000 machines sold by the manufacturers of the United States, — a product worth $360,000,000 at a reasonable estimate. Since 1869 the manufacture, year by year, has been as follows: —

Number of machines manufactured.

1869	322,769
1870	464,254
1871	606,094
1872	851,236
1873	667,506
1874	528,918
1875	528,755
1876	525,000
1877	400,000 (estimated.)

Utility.

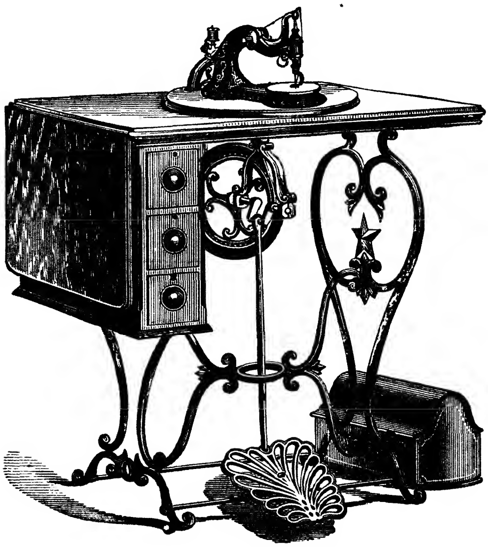
The success which has attended the introduction of the sewing-machine has been due to the thorough, rapid, and easy manner in which it has been made to perform its work. The machine has been improved in a thousand ways itself; and various attachments have been invented to be operated with it, by means of which a variety of special things, such as basting, folding the cloth for hemming, button-holing, &c., are now performed in addition to the regular work of sewing seams of every character, and degree of strength. Sewing is performed five times as fast as by hand, and the labor materially lightened. Nothing except the best metal is put into the working parts of the machines, so that they have great endurance and longevity; and the best talents of the cabinet-maker have been employed in fitting the machines with a casing of handsome woods, for the purpose of making them beautiful objects of furniture, as well as blessings to the household. Competition between the different companies has also promoted the sale of the machines greatly. It has both reduced the cost of the completed machine, and ameliorated the terms upon which the companies have been willing to deal

Variety of work done.

Economy in their use.

with their customers. The largest number of those who buy these machines are people without capital, who are not always able to pay cash for their purchases. In order to effect sales, and to accommodate their customers, the companies have adopted what is called "the instalment plan," by means of which the customer takes a machine, and pays for it in instalments from week to week, or month to month, often earning with the machine itself the money to defray the cost of its purchase.

Modes of selling them.



WARDWELL SEWING-MACHINE.

In addition to all this has been the fact of persistent advertising of the different machines. The sewing-machine companies have been the best advertisers in the country, excelling even the piano and stove makers in the unflagging zeal with which their inventions have been brought before the public eye. The newspapers, the old board fences, the directories, the flagstaffs, the rocks of the field, the trees, and every other contrivance upon which a description of the merits of a sewing-machine can be printed, pasted, or hung, have been pressed into the service, and emblazoned by the manufacturers. The county, state, and mechanical fairs in all parts of the country, and the World's Expositions here and in Europe, have been steadily frequented by the companies; and their strifes and competitive displays have now, for twenty years, formed the steady reliance of managers for one of the attractions of these bazaars of agriculture and industry. Some of the companies are able to show almost a basketful of bronze, silver, and gold medals won at the different fairs of this and other countries.

Advertising.

The world's fairs have been an important means of bringing the machines to the attention of people abroad. The fruit of the displays at those fairs is seen in the large export trade enjoyed by the companies. The number of machines sent out annually now amounts to from 40,000 to 55,000, the custom-house valuation ranging from $1,600,000 to $2,400,000 annually. They go to England, France, and Germany principally. England distributes them to all the world. Many machines now go direct to South America and Australia.

World's fairs.

FIRE-ARMS.

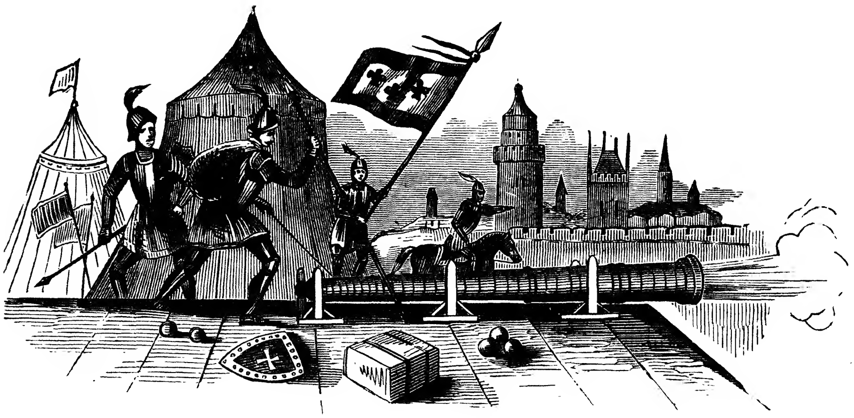
It is one of the peculiar phenomena of American life that the manufacture of weapons should reach such a remarkable proficiency in a country which abhors war and armies; which is impatient if the government keeps more than twenty thousand men under arms in times of peace; which once let the standing army run down to eighty-six men; which never believes there is going to be a war, and never prepares for one until it comes; and whose ordinary current expenditures for all military purposes do not exceed thirty-five million dollars in any one year. It would be natural to look for the highest development in this line in Europe. Several countries there spend a hundred million dollars annually for army purposes. The best mechanical talent in the army and in the private workshops is kept constantly employed devising new and destructive weapons. The rewards to the successful private inventor are great; for he is certain of recognition from the government, and a large order for arms. In America, however, the whole business of war is so foreign to the purposes of our people and the genius of our institutions, that little national encouragement is given to inventors. Congress begrudges the smallest appropriation for military experiments; and inventors must look to Europe and Asia, and the world at large generally, for the markets for the sales of the arms they make, if they bring out any worthy of particular notice. In spite of this lack of home-encouragement to the manufacturers of fire-arms, American weapons for the infantry service are the best that are made to-day. The needle-gun of Prussia won a world-wide fame at Sadowa; but the American Remington is as much its superior as a Colt's revolver to a muzzle-loading horse-pistol. The chassepôt of France has proved a weapon of deadly efficiency in recent European wars; but the American Spencer rifle, with its magazine of cartridges in the stock, firing fifty balls a minute, would enable two companies of American marksmen to annihilate a regiment armed with the chassepôt in less than three minutes' fire at easy range. American small-arms have long been celebrated; and there has not been an important war in Europe, from the Crimea to the last bloody struggle between Russia and Turkey, in which they have not played a considerable part. And then, in the line of heavy ordnance, the Americans have not been a whit behind the rest of the world in a thorough comprehension of the principles which should govern the manufacture and use of ordnance. We have not needed, and consequently have not made, such tremendous guns as Germany and England have produced; but American inventors and artillerists have given to the world some of the most valuable ideas in ordnance, which have been utilized by military nations.

Progress in fire-arms.

The first use of fire-arms was at the battle of Crécy in 1346, where the French were routed in tremendous confusion by means of the astonishment created by the English cannon. The cannon did little

First use of fire-arms.

of any consequence, except to roar; but it brought a new element into the din of battle, and struck consternation into the ranks of the gallant knights of France. These early guns were made of wooden staves, bound with wire and iron hoops, and using a stone or a leaden bullet. Pictures of them may be seen in Froissart's "Chronicles of the Middle Ages," in which are preserved some rare old woodcuts of the olden time, representing battles in which wooden cannon bore a part. It is one of the thousand illustrations which every art supplies of the fact that progress moves in every age with slow and measured pace from the old to the new, passing only from the crude to the better by fine shades of variation, that the first iron cannon was made upon identically the same principles as the wooden ones. They were composed of iron bars laid together like the staves of a barrel, and bound about with iron wire and hoops. They were afterwards welded together; and then, the gun being composed of a solid piece of iron, the idea seems to have occurred to military men for the first time to cast their cannon complete in one operation.



CANNON. 1390.

It was the explosion of one of these early wrought-iron cannon which caused the death of James II. of Scotland in 1460. The fact is interesting, because it has a parallel in the history of the United States. The idea of making wrought-iron guns was never abandoned; and in 1845 Commodore Stockton of the United-States navy caused a gun of that material to be made under his supervision, hoping to produce one which would excel any cannon which had yet been made. The piece weighed seven tons, and carried a ball weighing two hundred and fifty pounds. It was a great gun for those days. It was called "The Peacemaker." After it had been fired three times, a brilliant company of people in official life at Washington were invited down to the war-ship "Princeton," lying in the Potomac River, to witness the firing of the gun. Secretary Upshur, who feared the effects of the discharge of such a tremendous piece, got behind the mast for safety. The gun blew up at the first discharge, killing Mr. Upshur, Secretary Gilmer, Commodore Kennan, Mr. Maxey, and Mr. Gardner, and injuring Col. Benton and several others. In spite of this untoward event, military men are still experimenting with wrought-iron guns; and the comparative merits of cast and wrought iron may still be said to be an unsettled question.

First use of small-arms.

The first use of small-arms was at Arras in 1414, when the Burgundians defended their town, in part, with the aid of heavy guns, which they pointed over the walls. The guns were provided with hooks near the muzzles, to catch on the wall, and prevent recoil; and were therefore called arquebuses, or hook-guns. These weapons were used in the field somewhat after that, but not with great success at first, because they were too heavy. It took three men to serve them, and they could only be fired by resting them on tripods. Furthermore, they could not be fired rapidly, and were at the mercy of the archers. An English archer of that day would discharge twelve arrows a minute, piercing two inches of oak at a distance of two hundred and forty yards, and allowing only one arrow to miss the mark. It has taken four hundred years for mankind to perfect a fire-arm which would allow of equal practical rapidity and accuracy of fire with that, and it was not until the United States produced the Spencer rifle that a more rapid effective discharge of missiles on the field of battle was attained. Fire-arms did not come into general use in war until after the battle of Pavia, in 1525. On that occasion Charles V. employed a large number of muskets (so called from the name of the person who first attached the ramrod and barrel to the wooden stock). His bullets pierced the best armor of the knights of France, which the arquebuse had not done; and Francis I. sent off his famous message, "All lost, save honor." That battle revolutionized the art of war. The use of the lance, the bow and arrow, and of heavy armor, was discontinued after that in Europe by successive decrees; and in a hundred years the ancient trappings of chivalry had passed off the stage forever.

Flint-lock musket.

The flint-lock musket was invented in France in 1671: it was called the fusil, from the steel which struck down sparks into the priming-pan. The English adopted this weapon in 1686. It weighed nine pounds and a half, and was fired from the shoulder. The bullet, which weighed three ounces in the arquebuse, was diminished now to an ounce.

Rifle.

In the days of the early settlement of the United States the weapon in use in this country was the rifle. It had been invented for a long period, having made its appearance in the target-matches at Leipsic as early as 1498; but it had never been used in the armies, owing to the length of time it took to load it. The rifle was the sportsmen's arm, and was their familiar weapon for three hundred years. America first brought the rifle into military use. The early colonists were all armed with the rifle.

They were dependent, to a certain extent, upon their fire-arms for their subsistence. Before the land was brought under cultivation, their tables were supplied chiefly from the woods, which swarmed with game of all descriptions; and, after the soil had been subdued and tilled, they still continued to hunt both for pleasure and the benefit of their tables, and also from the absolute necessity of diminishing the number of squirrels, deer, raccoons, and bears, which depredated upon their corn and wheat and other crops. Organized hunting-expeditions, called "drives," to kill off all the game in some special tract of country, and to meet the armies of squirrels which migrated from place to place, were of constant occurrence. Now, powder and shot were costly articles in those days, and the colonists could not afford to throw them away: they consequently preferred the best and most accurate weapon, on this account alone, if on no other; and the rifle, accordingly, was their familiar and favorite fire-arm. They became as accustomed to it as to the axe. When independence was declared, the colonists were illy provided with military weapons; but they had their rifles, and they used them in the battles of the Revolution with a deadly effect which has become historic. Some of the fields of that war were won by the use of the rifle alone. The slaughter inflicted upon the soldiers of King George in the Revolution was doubtless principally due to the marksmanship of the American pioneers, and not so much to the weapon; but the weapon got the credit of it chiefly; and England, in 1794, adopted it as a part of her national armament.

Colonists.

In that respect England went a step farther than the United States. The rifle was not the official arm here: the government preferred the smooth bore for the army. Napoleon scouted the rifle, because he could not obtain a rapid fire with it. The same idea prevailed here; and, while the rifle remained the weapon of the people, it was not at once adopted by the government. The objection was this, — that, in order to make the bullet fit the rifling of the gun, it had to be forced into the gun under pressure, and time and labor were consumed in ramming the ball home. In 1813 Hall proposed a new idea. He suggested that the rifle be loaded at the breech; so that the ball and powder, united in one cartridge, might be inserted without delay and trouble, and the piece loaded and fired as rapidly as the muzzle-loading smooth bore, and all the advantages of the two styles of weapons be thus secured. Hall also proposed to manufacture the locks and other pieces of the guns by machinery, so as to make the parts of the different guns interchangeable. He was employed at the government armory at Harper's Ferry to introduce the latter idea, and experiment with the former. The "interchangeable" system of manufacture promised a reduction of expenses, and that was accordingly pressed first; and it was soon introduced to all the armories of the United States. In 1827 a hundred of Hall's guns, which had been sent to Springfield in 1824, were brought back

Napoleon scouted the rifle.

Hall's invention.

to Harper's Ferry, and placed with a hundred guns of current make. The whole two hundred were taken apart, the pieces thoroughly mingled, and the guns then remounted from pieces picked up at random. The whole two hundred fitted perfectly. This method of manufacture reduced the cost one-half. It attracted attention abroad, and England afterward obtained machinery in the United States to introduce the system to her factory at Enfield. Prior to 1853, every gun made in England was manufactured by hand. America had thus already given two ideas to the world, — the value of the rifle, and a new system of manufacture. The latter was of immediate benefit. If war and armies were inevitable, and the people had to pay for them, the cost of weapons might at any rate be reduced; and Yankee invention showed one important way to do it.

Enfield.

The percussion-cap was proposed by Shaw of Bordentown in 1817.

Hall's idea of a breech-loading rifle did not attract much attention first in the United States. Ploughshares and railroads were of more importance here than machines to kill off regiments of men in the shortest possible space of time. France and Germany began to experiment with breech-loaders; but this *insouciant*, good-natured republic at that time had other things to attend to, and paid so little attention to arms, that, when it went to war with Mexico in 1847, it absolutely had to send out troops armed chiefly with ancient flint-lock smooth bores. A few rifles, and a few of Hall's breech-loading carbines, were put into the hands of the mounted men; but the army carried flint-locks, with a few percussion smooth bores of recent make only.

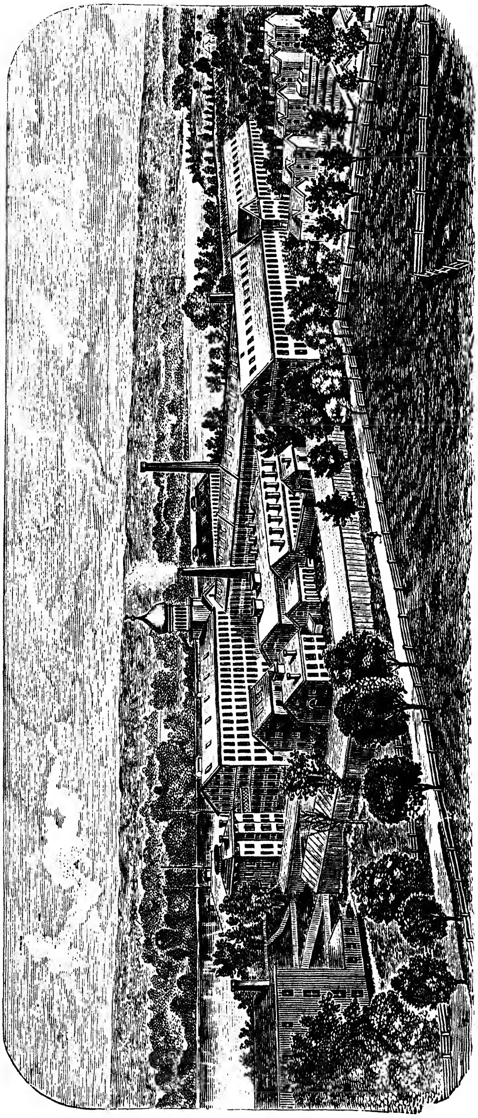
Experiments of France and Germany with breech-loaders.

The principal weapon of a new type brought out in the Mexican war was a purely American invention, which has not yet been mentioned; namely, the repeater. Samuel Colt, a seaman, while on a voyage to Calcutta in 1829, devised a six-barrelled revolver to be used with percussion-caps. In 1835 he improved upon this, and perfected a six-barrelled rotating breech, the bullets all making their exit therefrom through a single long barrel, as in the modern revolver. There is proof that the idea of a gun which should have a chambered breech, so as to admit of discharge several times without reloading, was thought of in antiquity; but such a piece was impossible until after the invention of the American percussion-cap, and the idea was never utilized until Samuel Colt made his model on board ship on the long voyage to Calcutta. Patents were issued in England, France, and the United States; and the manufacture of revolvers was carried on a short time after 1835 at Paterson, N.J. The first use of the new weapon was in 1837, when Lieut.-Col. Harney employed a number of Colt's carbines in fighting Indians, to the great astonishment of the latter, who did not understand how a soldier could fire six times without reloading. A thousand of them were used in the Mexican war. Colt's idea was a valuable one; but he secured no important sale of his weapons in this country until the discovery of gold in

Colt.

California and Australia. The rush to those regions, and the necessity of going into the new country armed, created an extraordinary demand for Colt's revolvers. Colt was overwhelmed with orders, and soon decided to build an immense factory at Hartford, Conn., to supply the demand for his weapons. He put up buildings which cost a million dollars, and in 1858 was turning out sixty thousand weapons a year. The World's Fair at London, in 1851, first introduced the revolving fire-arm to the special notice of Europe. Colt made a large display of weapons there, and no feature of the fair excited such lively interest among military men. The Duke of Wellington was constantly in the American department, examining the weapons; and Colt was invited to read a paper before the Institute of Civil Engineers on the subject of his arms. The revolvers and carbines were subjected to all sorts of tests, and endured them all successfully. The result was, that they secured a large sale in Europe. They were used in the Crimea, and by Garibaldi in Italy; and, in fact, the pistols found their way into every army in that part of the world. Colt used the interchangeable system of manufacture, and never put any thing except the best cast steel into the barrels and working-parts of his arms. His success was enormous.

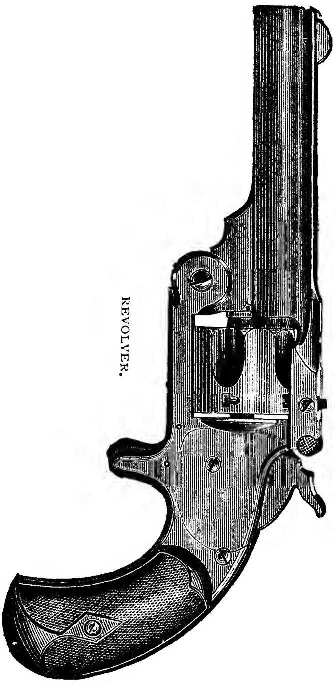
Great success of Colt's revolvers.

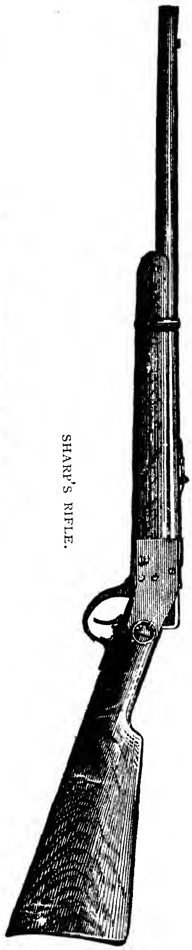


COLT'S ARMORY, HARTFORD, CONN.

The unusual demand for portable fire-arms caused by the settlement of the Territories was supplemented by large orders from the Southern States, where the revolver became a popular weapon. The large sales brought other manufacturers upon the scene; and the Allen, Derringer, Volcano, Pettinger, Whitney, Smith and Wesson, Lovell, Rupertus, and other revolvers, were introduced to the public, one after the other, and have all had a large distribution. They are made of a wide variety of patterns, from the heavy navy revolver, firing a half-ounce bullet, to the diminutive vest-pocket piece, with scarce power enough to penetrate a man's clothing. Suited to all tastes, and a convenient means of protection to travellers or to residents in large cities from the lawless classes, they are purchased in large numbers annually by people in all ranks of life. Of late a passion has been manifested among young men and boys to own one of these weapons, which, though absurd in the extreme, has exerted a material effect upon the sales of the manufacturers of arms.

Use of revolvers in Southern States.


REVOLVER.


SHARP'S RIFLE.

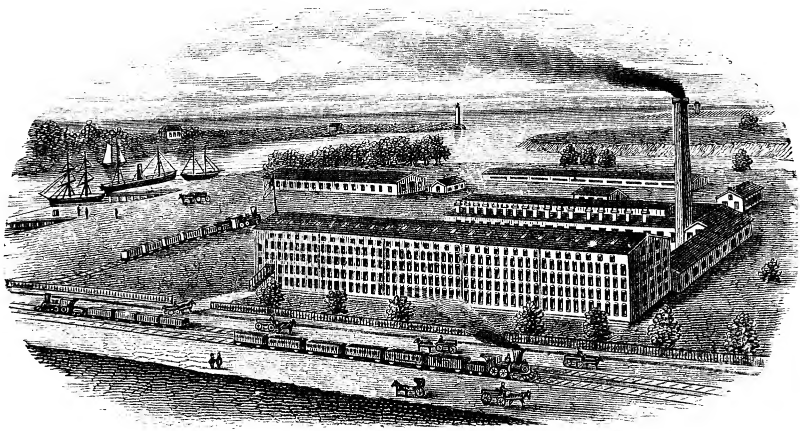
Hall's breech-loading weapons never came into general use. His idea was valuable; but he could not give it practical form. Prussia preceded the United States, therefore, in getting a breech-loader into the hands of its army. Dreyse had perfected a breech-loading gun in 1836, in which a long slug-like bullet was discharged through a rifled barrel by means of a cartridge done up in paper, and containing a fulminate at its base; the fulminate being exploded by the shock of a blunt needle entering through a small hole in the breech-plate. In 1841 Prussia put sixty thousand of these rifles with cast-steel barrels into the hands of her army, one hundred men in each battalion being equipped with them. In 1848 they were distributed to the whole army. The king called them in his decree "a special dispensation of Providence for the strengthening of our national resources," and expressed the hope "that the system may be kept secret until

Prussian inventions and experiments.

the great part which it is destined to play in history may couple it with the glory of Prussian arms and the extension of empire." The defeat of the Austrians at Sadowa in 1866 gave the needle-gun a great celebrity, and induced all the governments of the world to change their muzzle-loaders and smooth bores for a more modern style of weapon. A better gun than the Zündnadelgewehr of Prussia had, however, been invented in the United States in 1852 by Sharp of Philadelphia. The breech-pin in this weapon was pulled down below the barrel by using the trigger-guard as a lever, leaving the barrel open at the breech. The ball-cartridge being inserted, the breech-pin was thrown back to its place by closing the trigger-guard to its place. The sharp upper edge of the breech-pin cut off the paper end of the cartridge, thus leaving the powder in the now closed barrel exposed to the fire from the percussion-cap. The cap used was not the

Needle-gun.

Sharp's weapon.



SHARP'S RIFLE COMPANY, BRIDGEPORT, CONN.

ordinary thimble cap, but was the Maynard primer, in which twenty or thirty caps were arranged along a small strip of paper or leather. The strip was coiled up like a watch-spring in the lock; and, each time the piece was cocked, a cap came forward and rested upon the nipple, thus simplifying and shortening the whole operation. The Sharp's rifle was an exceedingly powerful and efficient weapon: it speedily became a favorite with sportsmen, especially upon the plains, where it frequently brought down an antelope at the distance of a mile. Mr. Sharp has had great success with his rifle. The United-States and English Governments ordered a large number for the use of their armies, and the weapon received the approval of military men in several of the leading nations. A large establishment for the manufacture was erected at Bridgeport, Conn., and is still one of the leading American factories in this department of industry. Its rifles and pistols appear regularly at

Success of it.

all the world's fairs, and occupy an important place in all competitions. The rifle has been improved of late by the use of the metallic rim fire cartridge, thus dispensing with the use of percussion-caps, and still further simplifying the weapon. The rifle is good for twelve effective shots in fifty seconds.

The muzzle-loading rifle was adopted by the United States in 1855. It was called the "Springfield musket," from the armory at which it was brought out. It was ten pounds in weight, had a caliber of .58 of an inch, and carried a ball weighing five hundred grains. It was almost as efficient a piece as the Prussian needle-gun, from the fact that the ball used was the hollow-base Minié bullet, which could be loaded at the muzzle almost as rapidly as the needle-gun at the breech; and it had a range of two thousand yards, the smooth bores doing execution at no greater distance than twelve hundred. This was the musket with which the Northern army were chiefly supplied during the war of 1861. That war, however, gave an immense impetus to the invention and improvement of fire-arms in America. A great many new ideas were brought forward in breech-loaders and repeating-rifles. The government encouraged invention by large orders to private factories, and supplied its troops as fast as it could with such of the more modern styles of guns as were approved by proper military authority. The end of the war found the muzzle-loader virtually superseded forever. Since then, nothing except breech-loaders have been issued either to the army or the militia. The part borne by different styles of weapons in the war may be seen from the following statement, prepared by the ordnance department of the army: —

Springfield musket.

Muzzle loaders gone by.

Smooth bores	463,381
Muzzle-loading rifles, United-States pattern	1,615,346
Muzzle-loading rifles, foreign	1,055,862
Rifles, breech-loading and repeating	32,048
Breech-loading carbines	398,251
Revolvers	376,751
Pistols, muzzle-loading	24,951

The total was 3,966,590, of which 1,158,907 were lost and used up in the war.

So much was invention stimulated by the war, that, at the competition of 1869, a board of army-officers examined thirty-four different varieties of breech-loading muskets, eight of carbines, and eight of pistols.

Invention stimulated by war.

The new inventions were all the product of private factories. These establishments, scattered about the country, but principally located in New England and New York, where mechanical ingenuity had received its highest development, were many of them of prior origin, and had been engaged in making sporting-rifles, shot-guns, and pistols. When the war broke out, they simply turned their attention to military weapons. Others of the number came into being with

New inventions the product of private factories.

the war. They have all continued to manufacture both military and sporting arms since the restoration of peace, and find a large sale in supplying the new armament of the militia of the several States and the armies of other parts of the world. They take part in all the rifle-competitions in Europe, and crowd every world's fair. Prior to 1861 the reputation of the United States for small-arms was sustained principally by Colt, Sharp, and Eli Whitney. At the World's Fair of 1873, where the leading American factories were all represented, nineteen concerns were represented, all of them furnishing highly creditable productions.

Spencer rifle.

The first of the new class of rifles to come into notice was the Spencer. This remarkable weapon is a strong and serviceable piece, loading at the breech, and holding a magazine of seven cartridges in the stock, which are thrown forward, one at a time, by a coiled spring, when the breech is opened to receive a new charge. The breech-pin is moved down below the barrel by the guard-lever, the empty copper shell of the cartridge last fired being thrown out by a little catch in the operation, and a new cartridge then thrown forward into place from the magazine. A fair marksman can discharge the seven shots with accuracy in twelve seconds, and then refill the magazine from his cartridge-box in about half the time it would take to ram and cap a muzzle-loading musket. The gun can be used as a single-loader by a very simple arrangement, which prevents a cartridge from coming up from the magazine. The soldier thus can load from his cartridge-box, and keep the magazine in reserve for a critical moment. The Spencer is a needle-gun, the firing-pin being in the breech-block, and being struck by a hammer, as in the ordinary rifle. Its performances at Vienna, at the competition of 1866, excited wonder The magazine principle has been

Winchester.

applied to other American guns, prominently to the Winchester, in which the magazine occupies the place of the ramrod, below the barrel, and, being a very long one, enables the marksman to fire twenty shots without reloading. The Winchester rifle is admired in Europe, and has been sold in immense quantity to the Turkish Government. It was largely used in the late war with Russia.

The Snider rifle is better known abroad than in America; but it is one of the recent American inventions, and loads at the breech upon an entirely novel principle. The breech-plate is fixed in the gun solidly; but between it and the chamber there is a space the length of the cartridge, into which a solid bolt is fitted to close the chamber, and transmit the recoil to the breech-plate. This bolt swings upward, and over to the right, upon a hinge, when the gun is being loaded, so as to leave an open space in rear of the chamber for taking out the old cartridge, and putting in the new. This style of breech-loader has been very well liked in Europe. Dahlgren gave it great praise. England applied it to her Enfield, Whitworth, Lancaster, and other rifles; and the Dutch and other governments have used large quantities of arms with the Snider breech. The Snider-Enfield has had astonishing success at the Wimbledon matches in England. England converted several hundred thousand of her Enfields to the Snider system. The peculiar principle on which this gun is made is now a favorite with American makers of breech-loading shot-guns. It is one of the two leading methods in use for that class of fire-arms; the other being the system of unhooking the rear of the barrel, and letting the barrel swing vertically on a pivot, so as to bring the chambers up to view above the breech-plate, and then, after loading, bringing the barrels to their place again, and locking them with a spring catch.

Snider-Enfields.

Various other American rifles have at different times occupied attention at the competitive trials in Europe, including the Berdan, Peabody, Hammond, Maynard, Joslyn, Sharp, and Remington, but none, perhaps, to so great an extent as the Remington. This gun is the product of a factory at Ilion, N.Y., which was founded in 1825 by Eliphalet Remington, a young mechanic who had been making gun-barrels in Herkimer County, New York, with some success for several years, and who, in 1825, moved to Ilion, and started a gun-factory. This establishment grew by successive enlargements until it represents to-day an investment of at least three million dollars in machinery, buildings, and stock. Mr. Remington took his two sons into partnership, and has devoted his factory to the manufacture both of arms and various other inventions, a sewing-machine and a mowing-machine being among them. The breech-loading rifle invented at this factory has the simplest, strongest, and best mechanism at the breech ever yet discovered. When the hammer is cocked, the breech-pin swings upon a heavy pivot down into the lock, opening the breech for the cartridge, and pulling out the old shell. The breech-plate is then swung up by the thumb to its place, and the trigger pulled. Though the breech-plate is entirely unsupported when the hammer is set free, yet the heavy shank of the hammer presents a solid shoulder to the plate in its descent; and, before the hammer reaches the firing-pin, the plate is locked firmly in its place. The shock of the recoil is transmitted to the shoulder presented by the hammer, and is sustained by the heavy pivot on which the hammer works back and forth. Nothing so simple and scientific has ever been invented. This gun is in every way the superior of the Prussian needle-gun. The latter is easily disabled by moisture and dust; whereas the Remington will work perfectly while entirely coated with rust (breech-plate and all), and covered with dust. One of the guns at Vienna in 1866, chosen at random, was tested by firing two thousand rounds. It was left out on the ground over night; water was poured into it, and it was left wet; the whole breech was covered with road-dust, and then roughly shaken out; and the gun was fired from beginning to end of the trial without cleaning. It went through the whole test perfectly, the only trouble occurring at any time being caused by sand which had got between the spring and the

Remington.

hammer, making it difficult to get the hammer at full cock. Those few grains of sand were taken out, and the gun was put to work again without further cleaning of the breech. The average speed of the gun was thirteen rounds a minute. The gun has excited the greatest admiration throughout the world since that time. It has been adopted by the United States, England, Spain, Denmark, Sweden, and other governments, and is probably the most effective single-loading arm of the present day. It is the principal style of rifle which is being put into the hands of the militia of the several States of this republic. Its accuracy is so great, that it has enabled American riflemen to win the great matches of Dollymount in 1876, and Creedmoor in 1877, against the best shots of Great Britain. Fulton prefers the muzzle-loading Remington, and with it made a score of 171 out of a possible 180 at the 800, 900, and 1,000 yard ranges at Creedmoor in 1874; which is the highest ever known.

Great success of this weapon.

The Peabody rifle, with a breech-plate dropping below the barrel, operated by the guard-lever, is also a good gun. A part of the Turkish troops were armed with it in the late war.

The barrels of American small-arms are generally made of wrought iron, chosen with reference to its toughness and tenacity; though of late years makers have begun to use steel to a greater or less extent in combination with iron. At one time bars made from old horseshoe nails were largely used, and the "stub and twist" barrels were considered the toughest and best in the market; but they have been superseded by later ideas in laminated iron and steel. For revolvers, cast-steel alone is used for the chambers and barrels. In gun-making, the bars which are to compose the barrels are heated to a white-heat, their edges first having been bevelled, and are then bent by machinery into a barrel, the edges being carefully welded either by machinery or by hand. The barrels are then straightened by machinery. Sometimes the bar is the length of the barrel which it is to make; but often it is only one-third the length, and is drawn out in welding. The locks, springs, sights, and other small metal parts of the gun, are stamped, bored, and shaped by machinery. There are often eighty different pieces in the construction of the piece, besides the stock and barrel. The production of all of these by machines specially adapted to the purpose has brought about an immense reduction in the cost of manufacture, and has added materially to the resources of the republic by insuring a speedy supply of weapons whenever wanted. This system of forging small-arms with swages and dies, and of finishing them with milling machines, was first brought to success in the government armories of the United States; but it has since found its way into all the private factories.

Cannon.

In the manufacture of cannon the United States has not occupied so distinguished a position as in reference to small-arms; but its artillery has always been of a good quality. The cannon made during the

Revolution were all of a small size, adapted for field-service and for use on ships. A number of founderies were employed in casting them in different parts of the country, but principally in New England, Pennsylvania, and Maryland, whence the guns were distributed to the different parts of the country. They ranged in size from four to thirty-two pounders, but were mostly of the smaller sizes. A few of them were cast hollow; but the majority of factories cast them solid, and bored out the caliber by machinery. The factories were prolific; and Washington had all the artillery he wanted during the Revolution, — more, at times, than he could profitably use, in fact, considering the scarcity of powder. The guns were of very simple construction, plain and unornamented, and in this respect bore a marked contrast to the splendidly-decorated pieces employed by our French allies in that war. The gun presented by Lafayette, and long owned by a well-known family of Virginia, and now in the Metropolitan Museum at New York, inscribed humorously, "Ultima Ratio Regum," and otherwise, is a striking illustration of the perfection of the arts in France at that day, and the manner in which refinement touched and glorified every thing used by the French people in war as well as in peace. One gun used in the Revolution was of wrought-iron staves bound with hoops; but it attracted little attention.

Cannon of Revolution.

In the war of 1812 the United States began to use a better style of cannon of native manufacture. The government permitted its private citizens to fit out ships to cruise against England's commerce, and there was a great demand for long and efficient guns of all calibers for use on shipboard. Some large founderies were started during this war. At Richmond three were established, capable of boring the heaviest ordnance, and of making three hundred pieces a year. One at Pittsburgh, Joseph McClurg's, made the cannon for the battles of Lake Erie and New Orleans.

No long guns for shells had been used until the war of 1812 in any country: the shell had only been discharged from the mortar and the howitzer. In 1814 Col. Bomford of the Ordnance Department invented a long gun for shells, which he called "the Columbiad." It became a favorite gun with military men at once. It was introduced to the fortifications and ships of the United States as an important resource for attack and defence; and Gen. Paixhans carried the idea to France, and brought out the gun there under his own name. The principle of a long gun for shells was adopted by all military nations.

First manufacture of guns for shells.

Paixhans.

Although the United States were at peace, and cared nothing for fortifications or a navy except to insure protection to commerce, and consequently gave slight encouragement to the invention of new implements of war, two guns had been brought out by federal officers, previous to the war of 1861, which were decided improvements on all the cannon then in use. One was the gun, invented by Capt. Dahlgren of the navy, for nine and

Dahlgren.

eleven inch shells. It was cast solid, and bored out by machinery, and in shape was very much like a champagne-bottle, having a great weight and thickness of metal around the chamber of the gun, and then rapidly tapering away forward of the trunnions, exactly after the fashion of a champagne-bottle. The eleven-inch guns of this pattern are a hundred and seven inches long in the bore. They were great favorites during the late war, and were extensively employed in the operations along the coast and on the Western rivers. Fifteen and twenty inch guns have latterly been made of Dahlgren's pattern, but are cast hollow, and cooled from the interior. The idea of casting a gun hollow, and cooling it by a current of water made to flow into and out of the bore, so as to gain density of metal on the interior, is the invention of Capt. Rodman of the Ordnance Department. The pieces of heavy American ordnance made in this manner are called "Rodman guns." The gun differs little from Dahlgren's in shape; but it is generally considered more beautiful on account of its more flowing lines. For the same size of bore it is of smaller size and weight, owing to the strength gained by the peculiar method of cooling. The largest cannon ever made in any country, prior to 1861, was a Rodman gun cast at the Fort-Pitt Foundery in Pittsburgh, and placed in the works at Fortress Monroe. It was a sixteen-inch gun, with a bore fifteen feet deep, and weighed 49,099 pounds. This style of gun has been greatly admired in Europe. A twenty-ton Rodman, fifteen-inch bore, with a shot of four hundred and fifty pounds, was tried in England shortly after our late war, and produced an unwonted sensation there. England had long been experimenting in the direction of seven and nine inch rifled cannon; but the American fifteen-inch smooth bore did what the best English guns did not, and it produced such a terrible effect on the eight-inch Wamis target, that English military men candidly confessed that the American gun could certainly hull their best ships. The twenty-ton Rodman was compared at the exhibition of 1867 at Paris with the forty-ton French smooth bore. That was the largest gun France had ever made: its bore was sixteen inches and a half, and it carried a shot of six hundred and fifty pounds. The comparison made was favorable to the Rodman gun. Making all allowances for differences in bore, &c., it was held that the Rodman gun would do the same work, with twenty thousand pounds less of metal consumed in the construction of the gun. Rodmans have been made since the war for sea-coast defence, and for ironclads of twenty-inch caliber. They weigh fifty-eight tons, and throw a shot weighing 1,060 pounds. The first twenty-inch gun was made in 1863.

Rodman.

War gave impetus to improvement of cannon.

The war gave an impetus to invention in the way of cannon as it did to the manufacture of small-arms. A vast number of guns were required for the different purposes of the war. The most extensive set of fortifications known in history was thrown up around the city of Washington, and eight hundred and seven guns and ninety-eight mortars were required for its defence. There were employed in the war, on the part of the North, fifteen hundred field-guns and twelve hundred siege-guns. The government, being without the means to produce these readily, depended largely upon private makers; and iron founders and inventors, in turn, stood ready to supply the government with a large number of new guns, which were conceived by them with the first alarm of war. Three of these new guns proved of service, and became prominent. One was the Parrott, a cast-iron rifled gun, long, and almost straight, but re-enforced at the breech by heavy coils of wrought iron wound around the piece. The first one was cast in 1861 at the West-Point Foundery. During the war they were made of all sizes, from the three-inch ten-pounder for field-service to a ten-inch gun with a three-hundred-pound shot for ship-siege and coast-service. Another of the new guns was the Wiard, made at Trenton, N.J., of cast-steel. This metal, as is well known, is the favorite with the Germans, who employ it in small-arms as well as in artillery. Mr. Wiard made guns of this material for the first time in this country, and secured large orders from the government. He fitted out the Burnside expedition with very nearly its entire armament. The third gun referred to above was the Gatling Battery, an automatic machine-gun, with six steel barrels. Cartridges are fed to the battery from a hopper, and are discharged by turning a crank. An incessant and steady fire can be kept up with this battery, and about a hundred cartridges, containing a thousand missiles, discharged per minute. Its performance is equal to that of fifty good riflemen armed with breech-loaders. A hundred batteries of this gun were ordered by the government from the Colt's Fire-Arms Company. One of them, sent to Paris in 1867, was the sensation at the World's Fair. It has a large sale abroad since that time.

Parrott.

Wiard.

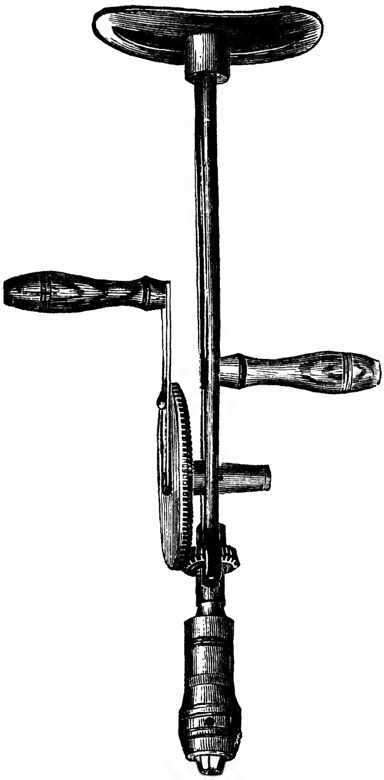
The best material for large guns is iron; though whether in the form of cast-steel, cast-iron, or wrought-iron, or a combination of these several varieties, is not yet decided. Germany prefers cast-steel for breech-loaders: all her guns are made on that metal. Krupp, the principal maker, has turned out several thousand such field-guns, and two thousand of the six, seven, eight, nine, eleven, twelve, and fourteen inch guns. The latter are fifty-ton guns, costing a hundred and ten thousand dollars each. Two only have been made. England employs cast-steel with wrought-iron re-enforcement at the breech, wrought-iron tubes with wrought-iron coils, and cast-iron; and is going back to muzzle-loaders. France uses iron tubes, with steel rings at the breech. The whole question of material may be said to be open at present, and can only be solved by years of further experiment. Possibly it may never be solved: that depends largely on the amount of war in the future of the world. For field-guns the best material is bronze: it is expensive; but it is a beautiful metal, and very tenacious.

Best material for guns.

IRON-WORKING MACHINERY.

There are those who consider the golden age of the world to lie in the future. They do not look for it in the simple times of the past, in the days of the shepherd's pipe, the stage-coach, the sun-dial, and the hand-loom; for, with all their romance, those were ill-regulated times in many respects, tyrannical, disobedient to law, and ignorant, with poverty and deprivation among the people. They believe that the better times lie in the future, — in an age when man shall have been released from the greater part of the depressing muscular toil now imposed upon him; when there is a more general diffusion of education, comfort, and content among the people; when the higher faculties and qualities come more generally into play in even the humblest occupations, and toil itself becomes a pleasure.

Golden age.



BREAST DRILL.

If ever there dawns for man a golden age of this description, (and who will deny its probability?) the change will come about, in part, through the larger employment of machinery, whereby man, instead of struggling with the forces of Nature as of old, shall turn them to his own use, and compel them to labor for him, and shall thus throw off a part of his burden of physical toil, and gain opportunity for cherishing and employing the mind. The present century is already distinguished by the extent to which it has utilized machinery in all the industrial arts. It is already called the age of machinery; and orators and writers have more than once called attention to the additional comfort, luxury, and content it has brought to the people. There seems no limit, however, to the extent to which machinery can be employed. A thousand new uses are found for it every year, and its ameliorating influences are capable of being extended almost indefinitely in all departments of labor.

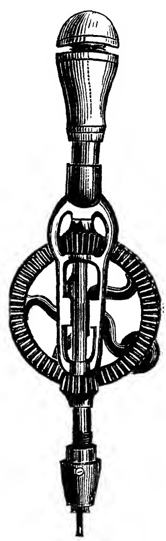
Employment of machinery.

Development has been the most remarkable in the field of machinery for the working of iron, and especially in the United States, where the progress has been the most sweeping and electrifying. The high cost of labor here, and the desirability of rendering this country independent of the Old World for its supplies of iron-manufactures, gave a powerful stimulus to American invention in this field of effort; and, from the days of the nail-making machine to the present, it has been busily employed in devising means for the fashioning of iron-manufactures by machinery, and dispensing with the old processes of doing the work by hand. The success has been wonderful. Our factories and shops are filled now with machinery, rather than with toiling human beings; and nine-tenths of all the old operations which required any particular expenditure of human toil are now performed by machinery, and better and faster performed also. The difference between an American and a foreign factory in this respect may be seen by comparing the Baldwin Locomotive Works with its three thousand men and the great locomotive works at Berlin with its ten thousand men, the latter turning out less work in the year than the former. The difference is caused by the machinery of the Baldwin Works. The same comparison could be made between an American and a British iron ship-yard.

Development of machinery for working iron.

The general application of machinery to the working of iron has called into existence a special class of establishments devoted to the making of iron-working tools and machinery, adding a re-enforcement of about fifteen hundred shops to the thousands of those devoted to the manufacture of iron and steel for the ordinary purposes of life. These fifteen hundred shops employ about a hundred thousand men. Many of them are, in part, founderies, and carry on the manufacture of general machinery; but they all make iron-working tools and machines as a regular feature of their business.

Factories for making iron-working tools.


HAND DRILL.

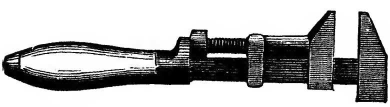
In general, iron-working machinery may be classified under the following heads, — turning-lathes, borers, drills, planes, shears, rolls, hammers, dies, punches for making holes, screw and bolt cutters, riveting and welding machines, cranes, grooving, slotting, and milling machines, and polishers. The variety of forms under each of the above heads is infinite. Obviously, the metal parts which go to make up a watch, and those which enter into a locomotive, a steam-engine, or an iron ship, must differ in extraordinary respects; and these differences in the size, purpose, and strength of the thousand objects into which iron and steel are fashioned, and the complexity of the parts which sometimes go to make up single inventions, give rise to an extraordinary variety of iron-working machines. Some of these machines attract attention from their size and power; as, for instance, the planers, which have been made large enough to plane a horizontal iron plate forty-two feet long by twenty-five wide, the plate being carried slowly backward and forward under a sharp chisel which cuts only one narrow paring at a time from its rough surface. Planers have been made to smooth vertical surfaces twelve feet long and eight feet high. Lathes are made to turn a piece of work eight feet and a half in diameter, and boring-machines to smooth the interiors of steam cylinders of the same size. Drills are made to bore a hole twenty-two inches in diameter through solid iron. At the iron ship-yards, shears are used to cut up solid iron plates two inches thick. Steam hammers are used which strike a fifty-ton blow, which could easily be increased to seventy-five tons; while the hammers are so tractable, that they can be used to crack walnuts. Cranes easily handle whole boilers and pieces of machinery weighing twenty-five tons. Rolling-mills are made of such power, that at Chester, Penn., iron plates are made six inches thick for the armor of men-of-war. Squeezers are often employed in our rolling-mills capable of taking a thousand-pound bloom from the puddling-furnace, and squeezing it into a compact pig of wrought iron in less than a minute. The power and size of this variety of machinery appear to be limited only by the demands of the country for its employment.

Planers.

Other machines are noteworthy for their special adaptation to the performance of some process and for their labor-saving qualities. Such are the small trip-hammers, striking from forty to a hundred blows a minute, for drawing out the tines of a pitchfork from the little chunk of metal two inches long from which the fork is made. Such are also the countless inventions for stamping, twisting, boring, and shaping of the wheels, springs, and pieces of metal which enter into watches, fire-arms, tools, and small machines of all kinds. Others are the grooving and mortising machines, those for turning the rims of pulleys, for cutting the teeth of wheels, for paring and bevelling the edges of boiler-plates, for planing the edges of locomotive frames, for bending carriage-springs, for cutting the threads of screws and bolts, &c. The system prevalent in the best American shops leads to the multiplication of this class of machines year by year. Invention is encouraged; and the workman is given a part of the benefit of his invention, if he will suggest a machine which will save manual labor, and facilitate the operations of the shop.

Trip-hammers.

Inventions for boring, twisting, &c.



WRENCH.

Still another class of machines is remarkable chiefly for accuracy of operation: these are the ones used in all fine machine-work. Before the general application of machinery to iron-working, inaccuracies of a hundredth part of an inch might be detected by a very experienced workman, but no smaller defects than that. Fine machine-work was almost impossible, because mechanism which was

Machinery for making minute things.

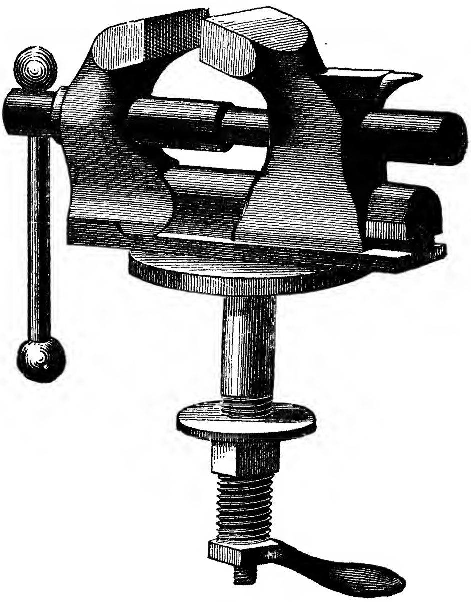
below a certain size was sure to be full of inaccuracies, and work badly. All machinery was clumsy. American ingenuity first insured absolute accuracy by the general use of machinery in the making of the small parts of complicated mechanism, and thus made fine and delicate mechanism possible by supplying the means to detect and measure differences of a ten-thousandth of an inch.

Steam riveting-machine.

The steam-riveting machine is one of the new inventions. It weighs eighteen tons, and contains one forging of five tons. It rivets the bolt with a single blow, and does its work so silently and rapidly as to obviate the fearful din of boiler-shops in general, and greatly reduce the cost of operation.

Machine for bending and tempering springs.

Another late invention, and one which carriage-spring makers have been studying for twenty years how to construct, is a machine for bending and tempering springs at one operation. It weighs less than a ton, and is a simple, straightforward device for performing a process until now always done by hand.



MILLER'S-FALLS VICE.

Machines for making parts of locomotives, iron ships, &c.

Special machines are now made for most of the operations of locomotive and iron ship and engine building, for car-shops, rolling-mills, cloth and gun shops, the sewing-machine, tool, and other factories, in large numbers. A great many of these machines are sent abroad, where they give emphatic pleasure, and receive a great deal of praise on account of the originality of idea, and high constructive ability displayed in their manufacture.

Utility of such instruments.

It has been pointed out that the construction of iron-working machinery and of machinists' tools underlies all other branches of manufacture. Take any finished product, whatever it may be, and trace backward the means by which it has been produced. We shall inevitably reach at length the hammer and the cutting-tool of the lathe, plane, or borer. Upon the efficiency and accuracy of iron-working tools and machines, therefore, depends a great deal more of human progress and comfort than one would imagine upon a superficial examination of what it is that promotes these things.

AXES AND SAWS.

The broad-axe and the cross-cut saw are the typical agencies for the working of wood. The former lays low the great tree in the backwoods: the latter cuts it up into logs which can be rafted down stream to market. All the tools which touch it after that, from the saw-mill to the last operation in the shop of the carpenter and joiner, are only modifications of the parent cutting and sawing edges.

Wood-axe and cross-cut saw.

No implement has had such universal use as the axe: it was foremost in war and in peace from the beginning of history until gunpowder was invented. Gunpowder swept the blood-stained battle-axe from the stage of civilized warfare, and the implement became then devoted only to the purposes of peace; but its use has only increased as time has rolled on. The axe is the indispensable adjunct of pioneer life in the woods: it cleared the fields and built the houses of our forefathers. Wherever population crowds the plains, and the waste timber-lands must be reclaimed to make room for man, the broad-axe is found swinging in thousands of hands for the conversion of the wilderness to a place fit for the abode of humanity. Even in the United States, where there is plenty of room in the open country and to spare, the axe is still vigorously wielded by thirty thousand lumbermen, who are sent into the woods every year to get out the timber for which shipping, building, and manufacture has created such an extraordinary demand. The axe plays a part on every farm. It lays low an oak or a big maple whenever the farmer wants money, and it gathers the winter's stock of fire-wood when the labors of the harvest are over. It enters into the economy of the household under every roof in the whole wide land.

Universal use of axe.

Until within fifty years, the axes used in America were imported. A few rude blades were forged at the blacksmith-shops by village greens; but the business was of so little account, that it was not thought worthy of protection by Congress. During the Revolution and the war of 1812, when the United States were cut off from their principal source of supply for manufactures of iron and steel, axes were largely made by the American blacksmiths; but the return of peace brought fresh importations, which checked the industry again. No tax was levied by Congress on an article of such extended use in the United States, and so indispensable to the development of the country. The first axe-shop in the country was started by Samuel W. and D. C. Collins of Hartford, Conn., in 1826. They thought that there was a field for the manufacture of axes here; and they put up a little stone trip-hammer shop, with a capacity of eight axes a day, and began drawing patterns, and forging and tempering blades. In 1828 Congress levied a duty of thirty-five per cent on axes to assist the dawning industry. The Collinses moved to Collinsville, Conn., and opened a large factory, which after some years passed into the hands of a com-

Axes imported until within fifty years.

Collins.

pany, called Collins & Company. The business has since grown to gigantic proportions and world-wide celebrity. After the Collinses' shops were opened others were started, the principal ones of which are now the Douglass Axe Company of East Douglass, Mass., and the concern at Cohoes, N.Y. A number of small factories are scattered through the country: two of them are in Newark, N.J. The Collins Factory is the largest in the world: it employs from four hundred and fifty to five hundred and fifty men, produces two thousand axes, sledge-hammers, and cast-steel tools a day, and consumes in the course of the year eighteen hundred tons of iron, three hundred and fifty of cast-steel, and seven thousand of coal.

Douglass.


WORKS OF DOUGLASS AXE COMPANY, EAST DOUGLASS, MASS.

The process of axe-making is full of interest; indeed, is exciting during some stages of the manufacture. The first operation consists in clipping from long, flat bars a half-foot of American iron, which is quickly transformed into the poll of an axe, which is merely the head and eye, and about half the blade; the balance, or cutting part of the blade, being composed of nearly a pound of the best Jessop steel, so inlaid with the iron that the tool may endure years of grinding, and still retain its fine steel edge. Other kinds in the market can boast of a greater spread of steel surface; but they are entirely innocent of that sort of "northern iron," as the Prophet Jeremiah terms it, in the centre of the tool, which will enable it to stand the hard usage in store for it. The real difference between the two metals is finely brought out in the polishing process, in which no amount of furbishing can leave that fine surface on the iron which the steel readily takes, and which forms a perfect mirror in the finished implement.

Process of axe-making.

Passing over a variety of intermediate handlings, in which the essential objects obtained are complete welding of the two metals and perfect symmetry in the several patterns made (all of which are accomplished amid the distractions of an army of large and small trip-hammers, whose din at times is well-nigh deafening to an outsider), we reach the tempering-room, where a score or so of men are occupied in bringing the steel to the proper degree of hardness, — a point requiring the utmost nicety of attention. Small furnaces are kept burning on the iron tables of the workmen (or watchmen, rather; for about all they do is to keep a keen eye on the color assumed by the iron); and, the instant the right hue is developed, the axe goes into a salt-water bath, which fixes the carbonized state of the iron forever, unless again put through the fiery torture.

The next stage in the progress of the axe toward completion brings us to the grinding and polishing departments. Some idea of the relative importance of this branch of the manufacture may be had from the fact that it costs one hundred dollars' worth of grindstones daily to bring the axe to the marketable stage, to say nothing of the immense expenditure of emery in polishing afterward. Huge stones from Nova Scotia and the West lie about the shop-yards, full seven feet in diameter many of them; and in no longer than three weeks' time they are used up. Many of the men ride on "horses" while grinding, thus enabling them to bring their whole bodily avoirdupois to aid the process of abrasion; while the fine dust flies in clouds from the stones in every direction, notwithstanding the stones are all the time completely deluged with water.

The men in this section are, from their peculiarly hazardous work, ruled out of all the life-insurance companies; since the constant inhalation of the grit and bits of steel thrown off in the process induces the "grinders' consumption," as it is rightly termed, from which a premature death is rarely averted. It is said that Americans will not work in these rooms, which are filled by French Canadians, who stop a few years, and then go home to linger a while and die.

But sometimes the peril to life is of another kind altogether, arising from the rapidity with which the stones must be made to revolve. A flaw in the stone, or possibly a loosening in the clamp holding it upon the shaft, sends the flying fragments furiously hither and thither, — perhaps through the grinder's body, or throws him through the roof. It is but justice to add, however, that such casualties happen only at rare intervals.

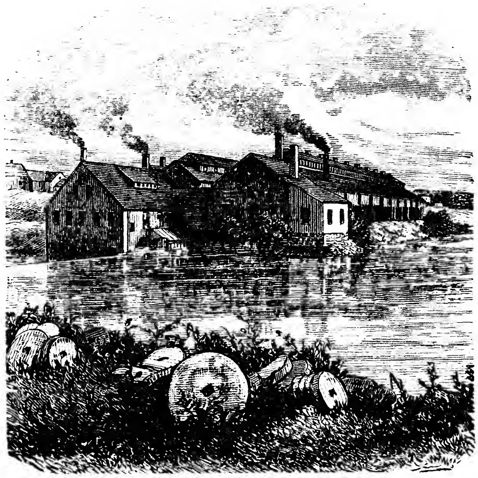
There yet remains the bevelling of the poll of the axe near the eye, which the trade insist upon in their orders, and which was formerly done by the slow process of grinding out on the stones. This is done by an iron wheel thirty inches in diameter, its periphery being an inch tire of softest iron. Revolving with great velocity, it does the bevelling almost instantly, literally melting that portion of the axe away.

American broad-axe.

The American broad-axe is a handsome blade. It has a thick, flat, broad iron head, with a cast-steel blade slightly flaring as it approaches the edge, and a crescent-shaped edge. The eye, or hole for the wooden handle, goes straight through the head. In this the axe differs from the less convenient Spanish implement, in which the handle is fitted into a loop at the back of the blade, on the principle of a plantation hoe. Nearly all the processes of manufacture are carried on by machinery. The head is cut from a bar of iron, the eye punched out, and the head flattened and pressed into shape while hot, by machines made for the purpose. The edge of the head is grooved, and a narrow piece of cast-steel welded to it at a white-heat. The steel is drawn out to form the blade in the welding-operation, the steel being thoroughly smithed to condense the metal, and render it tough. The axe is tempered very hard; and the hardness is then drawn down to what is called a blue temper, when it is ground, polished, the head painted red or black, and the axe sent to the packing-room. In old times the axe was not sharpened at the factory: every purchaser gave it an edge on his own grindstone at home.

Different kinds of axes.

Different styles of axes are made for different purposes and different tastes. Some are made for the foreign market exclusively. American heavy edge-tools have a great reputation abroad, and they form a prominent feature in the shipment of hardware to England, Germany, Australia, Cuba, and South America. Among the varieties made are hatchets, axes for turpentine-making, adzes, machetes, cleavers, broad square, and crescent blades, &c.

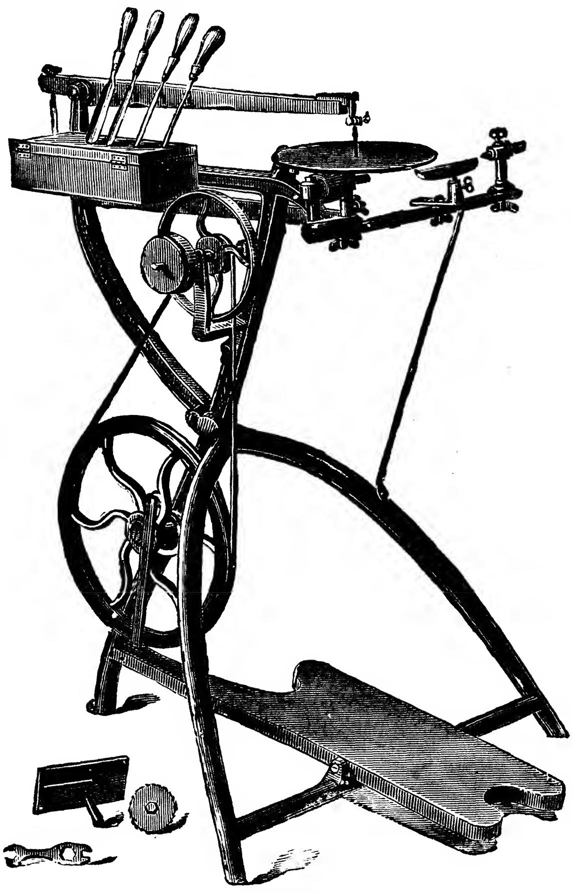


WORKS OF DOUGLASS AXE COMPANY.

Consumption of axes.

The consumption of axes is enormous. From thirty thousand to forty thousand men go out annually in the United States and Canada to cut lumber, the area cut off every season amounting to between three hundred and fifty and four hundred and fifty square miles. An axe seldom lasts a month. A handle lasts only three weeks. The axes are ground every day, and the blade soon becomes so worn that it is thrown away. The old axes are not utilized afterward. But, besides the lumbermen of America, the United States now supply, in part, the pioneers of the vast forests of South America, where the harder woods — the mahogany, rosewood, and other cabinet timber — create a still more prodigious consumption of blades. There is, besides, a constant demand for general purposes all through the population of the countries, which the American makers supply.

The style of axe preferred varies in different parts of America. The lumbermen are the true connoisseurs of blades. A Maine backwoodsman selects a long, narrow head, the blade in crescent shape, the heaviest part of the axe being in the head above the eye. New-York cutters choose a broad, crescent blade, the head rather short, the weight evenly balanced about the eye. A Western lumberman selects a long blade, the corners only rounded off, the eye holding the weight of the axe. The Canadian chopper prefers a broad, square blade, with the weight largely in the blade, the handle being short and thick. The difference in taste in regard to the shape of the axe extends also to the manner in which the cutter flings himself at a tree. An expert in the woods can tell the state or the nationality of a man by glancing at his axe, and seeing him strike one blow. The swinging, graceful cut of the Down-easter, flung at the tree from over the left shoulder, with both hands at the extreme end of the handle, is the model blow. It is claimed that a Yankee cutter will do one-fifth more work in the same length of time than either the direct-hitting Westerner, or the Canuck (who strikes more from over the head), and with less fatigue.



LESTER SAW.

The saw followed the early settlers of America into the forest almost from the start. It was the hand or cross-cut saw at first,

Saw and sawmill.

— a long, straight piece of flat steel toothed, fitted with a handle at each end, and worked back and forth by two persons, — or else a shorter, stiffer saw, designed to be used by one person by means of a handle at one end. But sawmills were in use extremely early. The first of which there is any record was put up at New York in 1633, and, in the absence of water-power, was driven by the vanes of a windmill. One was also built

Early establishment of them.

on Governor's Island in the harbor, and in 1639 was loaned for a consideration of five hundred merchantable boards yearly, half oak, half pine. Another sawmill was in operation as early as 1634, at the Falls of the Piscataqua at Berwick, Me., by English settlers.

Another was built at Scituate, Mass., in 1656, under a stipulation by the authorities that the owners should saw for the public before sawing for themselves, and should have one half the lumber for sawing the other half. Others were built on the Delaware, by the Dutch and Swedes, before Penn arrived. America was a hundred years in advance of England in the employment of the sawmill. The liberal Dutchmen employed it in Holland, and introduced it both to England and America; but there was so much opposition in England, that Parliament prohibited its use, and as late as 1760 a sawmill was destroyed by a mob. In America sawmills were a great boon, and were gladly welcomed. They soon came into general use throughout the colonies. They followed the pioneer everywhere, and formed, with the gristmill, the nucleus of every settlement and neighborhood. The saw in these mills was a straight blade until about 1790, when circular plates were invented.

First saws were imported.

The saws of early times were all imported, large and small. There was both a lack of capital and skill for making them here. The oldest instance of an attempt to make saws in the United States is the case of William Rowland of Philadelphia in 1802. Other attempts were made: they all failed. About forty years ago the manufacture was finally established by an English mechanic named Henry Disston, who had served an apprenticeship in a shop in Philadelphia, and finally became foreman of it. He was ingenious, and resolved to try to make saws. His early efforts were on a small scale. The plate steel had to be imported from England, and was expensive; and there was a prejudice against American work of this description. Disston managed to get his saws at length into the hands of merchants, and built up a considerable business. All his steel was imported, the precious scraps of it being saved, and sent back to England to be rolled into plates again. In 1861 Mr. Disston resolved to cut loose from English steel, if possible, and make his plates himself. The tariff of that year gave him protection, and he fitted up his shop for the experiment. He succeeded, and soon became an independent manufacturer. The establishment he built up is now the principal factory of its class in America. Other saw-factories have been started, however, and the industry is a large and rapidly-growing one. All sorts of saws are now made. They range in size and power, from the delicate watch-maker's and dentist's tool to the heavy circular plates for wind and steam sawmills, and the still larger ones for working the gigantic trees of the Pacific coast. Chain saws for surgeons are also made. At the factory of R. Hoe & Company, in New York, circular saws are produced eighty inches in diameter, and cross-cuts more than ten feet long. American saws are now regularly exported. Sheffield makers have lost several important markets on account of them within the last five years.

Henry Disston.

Kinds of saws.

Saws are made from ingots of steel, hammered to condense and toughen the metal, and then rolled out into plates. The sheets are slit up into the proper sizes and shapes for the different saws. The cutting edges being ground true, the teeth are punched out by a fly-press: the rough edges are then filed down, and the teeth sharpened. The blades, heated to redness, are plunged into a trough of oil, mixed with tallow, beeswax, and rosin, to harden them; and then the hardness is drawn down to the right point by wiping off only a part of the composition from the blade, and setting fire to the residue. This is called "blazing off:" it softens the blade to the right point, leaving it elastic, and the teeth hard. The saw is then well smithed on an anvil of polished steel to give uniform density to the plate; and the blade is then ground away back of the teeth upon grindstones, this thinning of the plate being one of the means resorted to to prevent the saw, in operation, from being clogged with sawdust. The teeth of the saw are generally pointed forward. In the cross-cut, which is designed to cut both ways, no pitch is given to them either way. In the circular saw a tooth has been introduced by Mr. Disston, pointing about straight forward, the under part being well cut away, its outline strongly resembling that of a fish-hook. Its advantages are facility of sharpening, and long wear, without diminishing the diameter of the saw. In all small saws a set is given to the teeth; that is, they are bent outwards to right and left alternately. This causes the teeth to make a cut wider than the blade, and so gives the latter free play.

Process of making.

STOVES.

The old-fashioned fireplace will never cease to be loved for the beautiful atmosphere it imparts to a room, and the snug and cheerful effect of an open wood-fire. When stoves were first introduced, a feeling of unutterable repugnance was felt by all classes toward adopting them; and they were used for a generation chiefly in schoolhouses, courtrooms, bar-rooms, shops, and other public and rough places. For the home, nothing except the fireplace would do. The open fire was the true centre of the home-life, and it seemed perfectly impossible to everybody to bring up a family around a stove. It was once thought that the fireplace was an insufficient means of warming a house, and the impression had its influence in securing the introduction of stoves. But it is now understood that the trouble in old times, which made it possible to see one's breath upon the air sitting by the fireplace, and find apples frozen upon the table in the centre of the room when the family were roasting in the blaze of the log-fire, was not due to the inefficiency of the fireplace, but to the bad construction of houses, which allowed the cold air to penetrate to the interior in gales. With better built houses the huge fireplace of colonial times became too large and too hot, and had to be reduced in size. The convenience of the stove for cooking had more influence on its eventual popularity than all other causes combined. Food was better cooked in the old-fashioned fireplace, but not so conveniently: in fact,

Old fashioned fireplace.

the operation was a very slow and laborious one until the cooking-stove was invented.

One of the first attempts at a stove or closed fireplace was made by Cardinal Polignac in France about 1709. The cardinal's little treatise on the subject shows by its title why Europeans could be easily interested in every new style of heating-apparatus. It was called "La Mécanique du Feu, ou l'Art d'en augmenter les Effets, et d'en diminuer la Dépense." Wood was becoming scarce in Europe, and fuel dear. Holland invented the plain box-stove, with a single door in front to introduce the fuel, a single hole in top, and a small smoke-pipe. Both the Holland and the Polignac stoves saved fuel; but the people did not take to them for the same reasons that retarded their introduction in America. Franklin paid a great deal of attention to stoves. That philosopher made some very valuable suggestions. In 1745 he invented a fireplace, capable of being closed completely, in which the current of flame and air from the fire passed through air-boxes in the sides; by which means nearly all the heat was saved, and radiated into the room. The stove had a damper, and would have been air-tight, except that castings could not be made at that time to fit close enough to be air-tight. In 1771 Franklin invented a stove for bituminous coal, with a downward draught, and consuming its own smoke. Count Rumford, an American, devised many improvements from 1785 to 1795. He invented cooking-ranges, lined with fire-brick and soapstone, with ventilating-ovens, which were used in New York in 1798, and in Boston in 1800. The stoves made in Vermont and other places at that day were mainly of the Rumford patterns. Stoves made very little headway in popular estimation, however, for a long period.

Polignac's stove.

Other European inventions.

STOVE.

Rumford.

Up to 1835 stoves were made at the bog-iron and other blast-furnaces, the plates for them being cast directly from the iron in the smelting-furnaces. The principal makers were in Salisbury and Canaan, Conn., Rutland County, Vt., Cold Spring, N.Y., and in Pennsylvania and New Jersey. The first furnace to cast stoves from pig-iron was built at New York in 1835 by Jordan L. Mott, who had been making self-feeding soft-coal stoves since 1827, and anthracite-coal stoves since 1833. In 1835 Mott bought some immense refuse-heaps in the Schuylkill coal-yards, and screened them for nut and

Early manufacture in the United States.

First cast-iron stoves.

pea coal for his stoves, and sold it in New York to the owners of his stoves. Mott's success was so great, that, before the end of 1835, other stove-factories were started in New York and in Albany; Joel Rathbone buying an old furnace in the latter place for the purpose, and thus beginning the stove-business as a regular industry in that city. The manufacture began in Providence, R.I., at nearly the same time. It was about this time that Dr. Eliphalet Nott of Union College began experimenting with stoves. The talented president of the college was a great mechanical genius; and, like Franklin, he spent years of labor, and thousands of dollars, in perfecting the base-burner and other stoves. The stove-trade is under a great weight of obligation to the old doctor, who never himself reaped the harvest of what he had so laboriously and wisely sown. Others made fortunes from his ideas.

Mott.

Nott.

The opening of the Erie, the Champlain, and other canals and routes of transportation, gave an immense impulse to the stove-business by cheapening the transportation both of the stoves and also that of coal. The patterns of stoves, too, were improving very fast, and the convenience of cooking-stoves was beginning to be understood. The manufacture of cooking-stoves especially increased with great rapidity. The early patterns in Albany were the ten-plate oval stoves, with the oven above the fire, and a single hole in the top. The saddle-bag pattern came next, the oven being in the middle, over the fire, and the stove-collar and pipe over it; while on either side were oval projections, a boiler-hole in each, level with the stove-top. The next pattern was the horse-block stove, the rear part being a step higher than the front. A rotary stove was also made, with a movable top to bring any particular vessel directly over the fire. Then came the parent of the modern cooking-stove, the Buck, for wood and coal, with the fire above the oven, which carried the flame around, behind, and below the oven, the opening into the stove-pipe being about on a level with the oven-floor. There have been several hundred modifications of this pattern of cooking-stove. In heating-stoves there have been many changes and improvements, the base-burning and self-feeding principle being applied to the greater number, but many popular heaters being the ordinary coal-burner, with the draught through the whole mass of coal. In all, there have been nearly a thousand patents issued in this country for stoves; and the manufacture has now become so skilful, and the stoves so tight, their conveniences for cooking so perfect, and the blaze of the fires of the parlor-stoves, shining out through mica windows, so cheerful, that the fireplace has been practically superseded even in country houses, and the stove is in universal use.

Cooking-stove made in Albany.

The Buck.

Number of patents issued.

Magnitude of industry.

There are now about 220 firms and companies engaged in this industry in the country. They consume from 250,000 to 340,000 tons of pig-metal yearly, and employ about 28,000 men, producing from 2,100,000 to 2,686,000 stoves a year, worth about $50,000,000. The stoves made vary in size, from the minute gas and petroleum burning affairs (with which experiment is now making), all the way through the long list of large and small cooking-stoves, — with two, four, six, and eight holes for kettles, and with fixed boilers and double ovens, — to the large ranges, capable of cooking for the thousand guests of a large hotel, and the furnaces for the basements of buildings, capable of heating structures of every size, from a dwelling to a court-house. The largest firms are in Albany, Troy, Philadelphia, Buffalo, Pittsburgh, Cleveland, Dayton, Cincinnati, Chicago, St. Louis, Milwaukee, Boston, Norwich, Providence, Portland, Manchester, and Wheeling. Perhaps no persons have displayed greater energy in pushing the manufacture and sale of their wares than the stove-makers. Of the superiority of each new invention as it appeared the public has been quickly and thoroughly informed through the medium of the press and in other ways. The production in 1876 was distributed throughout the different States as follows: —

STATE.	NO. OF FACTORIES.	NO. OF STOVES.
Maine	3	7,200
New Hampshire	5	9,600
Vermont	2	2,880
Massachusetts	12	139,200
Rhode Island	6	81,600
Connecticut	3	20,080
New York	45	765,600
New Jersey	2	14,400
Pennsylvania	29	500,640
Maryland	2	24,000
Virginia	1	14,400
West Virginia	7	67,200
Georgia	1	4,800
Michigan	2	48,000
Ohio	42	453,600
Kentucky	6	88,800
Missouri	7	182,400
Illinois	10	120,000
Indiana	7	64,800
Wisconsin	5	48,000
Iowa	1	14,400
Kansas	1	7,200
California	1	7,200
Total	200	2,686,000

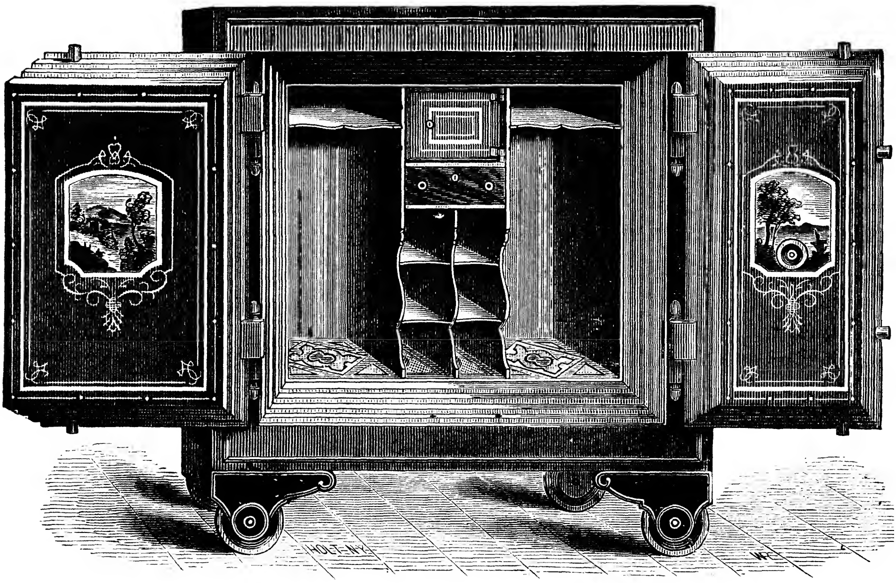
Like the sewing-machine-makers, the stove-makers are indebted for part of their popularity and large sales to the county fairs of the country, where they have had numerous and sharp competitions, which advertised them extensively.

County fairs.

SAFES.

The subject of strong-boxes to secure valuable articles and money against fire and theft attracted very little attention in this country until after the rise of the commercial cities upon the coast. The strong-box, previous to 1820, was nothing more than a heavy oaken chest. Its contents were protected from robbery merely by a stout lock and the blunderbuss of its owner. Its only security against fire was the address and the

The strong-box.



MARVIN SAFE.

strong muscles of the occupants of the building where a fire broke out. In Europe, where wealth abounded, and the industrial arts had been developed, the people were scarcely any better off for strong-boxes. A few iron coffers with complicated locks were in use; but the great majority of those who had occasion to stow away valuables at all depended upon wooden chests and their own personal vigilance for their protection. These chests were oftentimes gilded over every inch of the visible surface, and decorated with paintings, being very showy and costly articles of furniture. They were no protection against fire; and in this respect the world was no better off than in the days of King Priam of Troy, whose treasure, carried in a wooden box with a copper key, was left on the walls of Troy at the fall of the city, and was dug from the calcined ruins by Dr. Schliemann in 1873, its contents half melted and distorted by fire.

Earliest safes.

The earliest safes used in this country were imported from France about 1820 by Joseph Bouchaud, a merchant of New York engaged in very extensive commercial transactions. They were called fire-proof. They were simply boxes of hard wood plated on the outside with thick iron, and on the inside with sheet iron. Bands of iron two inches wide covered the outside of the chests, crossing each other at right angles, and being secured in place by heavy wrought-iron nails, which penetrated through band, plate, and box, and were secured on the inside by clinching. These boxes were bought by merchants and bankers in large numbers for several years. James Conner, a type-founder of New-York City, invented a better safe than this for his own use about this time, but does not appear to have realized the value of the invention. Gypsum, or plaster of Paris, had long been used in France for building fire-proof houses. Conner was familiar with the qualities of this substance, plaster of Paris having been at that day extensively used in making the moulds for casting stereotype-plates; and he applied it to the protection of an iron chest he had in his office, and which he continued to use thereafter for many years. Had Conner been visited with the calamity of a fire, he would have become aware of the properties of his safe. As it was, its value was not made known to the world: and the first manufacturer of safes of whom there is any account, Jesse Deland of New York, began making fire-proof strong-boxes, in 1826, of the Paris pattern; that is, of wood plated with iron. He patented one improvement upon this style of box, however, — the coating of the wood with a mixture of clay, lime, plumbago, and mica, to make it incombustible; and he also thought of saturating the wood with potash, lye, and alum, for the same purpose. In 1833 Charles J. Gaylor patented the idea of using a lining of asbestos between the iron plating and the wooden box. His asbestos fire-proof safes had a large sale; and one of them, preserving its contents in a fire at Thomaston, Me., was dubbed a salamander by some admiring individual; and the name has often been applied to safes since that date. Deland and Gaylor both sold large numbers of their strong-boxes; but there were only sixty of the latter in use when the great fire of 1835 took place in New-York City, and very few of them proved serviceable in the intense heat of that great conflagration. Something more efficient than that pattern was needed, and inventors and chemists began to think of the matter. John Scott invented another asbestos safe, and in 1837 Benjamin Sherwood got a patent for one with charcoal and plaster-of-Paris filling.

Bouchaud. **Deland.** **Gaylor.** **Sherwood.**

It soon became evident that substances like fire-clay, asbestos, mica, &c., which were absolutely indestructible themselves, were not, after all, the right material for fire-proof safes. In a hot fire they became heated to redness and even to a white-heat themselves, and accordingly destroyed the books, papers, bank-notes, and other contents of the safes. The need of the hour was for something which should not conduct heat. In 1843 Daniel Fitzgerald invented the safe with outer and inner boxes of iron, the space between being either vacant, or filled with plaster of Paris mixed with water, and poured in. The plaster, setting hard, and taking the water into combination, formed an excellent protecting material. When subjected to heat, it gave out its water as steam, which is itself a valuable non-conductor; and the contents of the safes were protected in a manner previously unknown. Fitzgerald had a contest over his invention with Mr. Conner, who now came forward to claim the merit of originating that style of safe. The courts confirmed the patent to Mr. Fitzgerald, however, on the ground of equity and sound public policy, Mr. Conner not having made public his idea, and thus secured the right to it. Enos Wilder becoming associated with Fitzgerald, the safes were introduced to the market as the "Wilder Patent Salamander Fire-Proof Safes." The patent was transferred to B. G. Wilder in 1844. Mr. Silas C. Herring had become interested in this patent in 1841, and had obtained the right to make them; which he still retained after 1844. Herring began in a small way in the cellar of a Water-street store in New York, but soon became the principal manufacturer of safes in the United States. The business becoming profitable, Roberts & Rich began the manufacture of chests with the plaster-of-Paris filling also. This led to lawsuits and a compromise, by which both firms were to carry on the manufacture. In 1854 Herring & Company virtually abandoned the Wilder patent for one of their own. They had advertised for a better filling than plaster, and promised a thousand dollars' reward for the discovery. Mr. Spear, a chemist of Philadelphia, found that chalk treated with sulphuric acid, washed and dried, and then rammed into a safe in a fine powder, had superior qualities to plaster of Paris. It gave up its water of combination more slowly and in less quantity, protecting the safe better, and obviating a dangerous tendency of the Wilder filling, in fires, to fill the safe with steam, and obliterate the precious writing in books and papers, and also, when in ordinary use, to rust the safe by slow evaporation from day to day. Herring & Company devoted themselves to utilizing this new idea; and B. G. Wilder, Roberts & Rich, and their successors, manufactured under the old patent. Herring took a first premium at the World's Fair in London. It is claimed by the firm, that, since their humble beginning in 1841, they have made and sold four million safes.

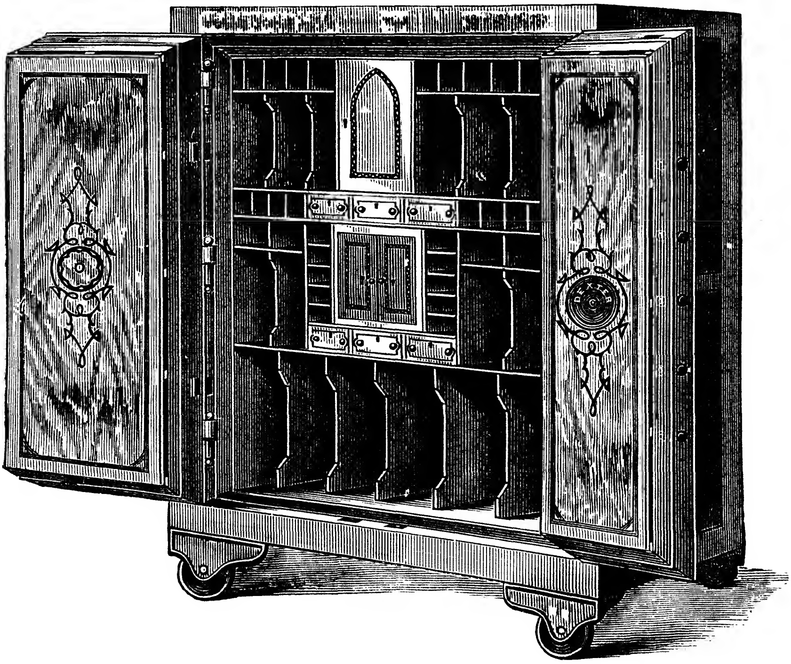
Fitzgerald.

Herring.

Wilder.

There have been a great many improvements in the salamander qualities of safes since 1860. The patents have been very numerous. Roberts & Rich, and their successors, Rich & Roff, Roff & Stearns, and Stearns & Marvin, continued to experiment with the Wilder patent; but an improvement upon the hydrated plaster which they used was at length effected, whereby the safes were filled with calcined plaster, rammed in dry, with small lumps of alum scattered through the mass. Alum contains fifty per cent of water in combination, which is given off only at a heat of 212° Fahrenheit. The tendency to rust the safe has been obviated by this arrangement, and the Marvin True-Standard safe is now made upon this principle.

Other inventors.

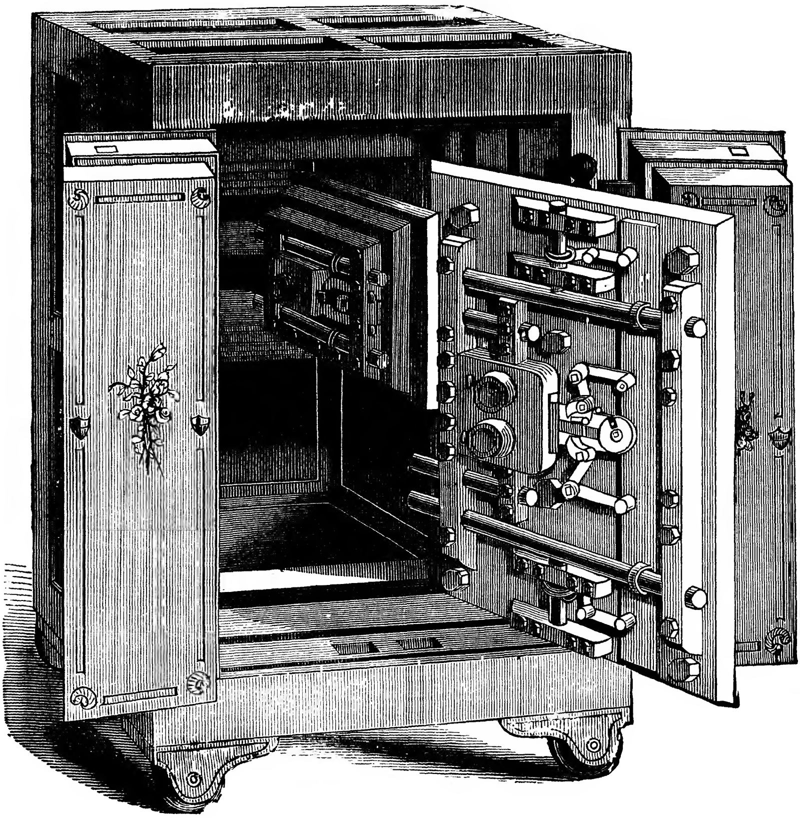


HERRING SAFE.

Among recent inventions are the following: the use of common salt for filling, a cement filling with small water-vessels stopped with glue or mucilage, clay or concrete simply as non-conductors, air-spaces containing vessels of water to give off steam during a fire, the use of non-conducting material between the plates of the door and the door-casing, and a wall made in layers, thus,—a wooden inner casing, a layer of felt, a metallic lining, a layer of cement, a water-chamber, a layer of cement, and an external metallic casing. The safes made within the last ten years have been extremely serviceable. In recent great fires in Boston, Chicago, and New York, they have repeatedly brought their contents through unscathed, though hidden in the burning ruins of buildings for two or three days. The

More recent improvements.

industry has now become very large. Factories have been started in Chicago, Philadelphia, Boston, New York, and elsewhere. Safes are manufactured at an average cost of three hundred dollars, and, having been thus popularized, are purchased in immense numbers. None have ever been imported, except the few strong-boxes brought from France about 1820: on the contrary,



HERRING BURGLAR-PROOF SAFE.

many are now being exported, especially to South America, France, and Germany.

Burglar-proof locks.

To be fire-proof is not the only quality of a good safe, nor the only thing which renders it in such universal demand. No one wants a safe now unless it is at the same time burglar-proof. The first decided step in the direction of a box which would defy the adroit thief, whose resources of drills, files, saws, gunpowder, sledge-hammers, wedges, blow-pipes for softening steel, &c., are so varied, was taken by Mr. Lillie of

Troy, N.Y., who was Herring's early competitor. Mr. Lillie employed thick slabs of chilled cast-iron, pouring cast-iron over wrought-iron ribs in their construction. Safes of this style were largely used by banks both for their large vaults and the inner strong-box, which constituted only a single feature of the furniture of its interior. Lillie's chilled iron is still largely used; but it has been penetrated with the drill, and blown up with powder. Herring & Company, within the last fifteen years, have adopted the plan of using an external casing of boiler-plate, and an inner casing of steel, filling the intermediate space with Franklinite, the hardest of all known ores. This safe has defied the drill-and-file burglars who once penetrated to bank-safes by digging under the vault in secret, and operating at leisure on the floor, or by working in from an adjoining building. They have been thrown into despair by the use of Franklinite, and are driven to operate solely on the lock and the doors of the safe and vault. The doors and locks having now been made so tight that gunpowder cannot be blown into the crevices and exploded, a safe completely burglar and fire proof seems to have been secured. Joseph L. Hall of Cincinnati, who established the business of safe-making in that city in 1848, also brought out a good safe. The company which manufactures them employs walls of alternate plates of iron, welded iron and steel, and carbonized, decarbonized, and crystal steel, the whole united by bolts from the inside. What new resources the burglars may bring to bear against the strong-box can only be learned by time; but, for the present, the race of malignants appears to be completely defeated.

Lillie's invention.

As the subject of locks will be treated elsewhere, nothing further need be said about them.

IRON BRIDGES.

The construction of this class of engineering works of iron and steel is one of the new industries of the United States. It has come into being within the last thirty years, and has attained its importance within the last fifteen. It is now one of the ten or twelve principal iron and steel consuming industries of the country. Before the stoppage of railroad-building in 1873 by the panic of that year, 150,000 tons of pig-metal were absorbed annually in the iron-bridge factories.

Iron-bridge making a new industry.

With rare exceptions, all the early long bridges of the country were of wood. The short bridges were generally of wood; but here and there, on well-traversed rural roads or city streets, bridges were occasionally built of stone, with massive arches and rising roadway. In 1810 there were eight bridges in the country built on the suspension principle, the plank roadway in each being supported by two heavy chains hung across the stream, passing over tall stone towers on the shore, and anchoring themselves in a mass of masonry back of the towers. The first of these bridges was built

Wood bridges.

in 1801 over Jacob's Creek. A patent for these was obtained by James Finlay in 1808. The chief of the eight referred to were over the Falls of the Schuylkill, with 306 feet span; over the Potomac, at Cumberland, Md., with 130 feet span; over the Brandywine, at Wilmington, with 145 feet span; and over the Potomac, near Washington. The suspension principle was first applied to bridges in the United States. The English engineers did not take up the idea until 1814. Wood, however, was the popular material for bridges. It was easily worked, did not cost much, and was sufficiently serviceable for the travel of that age. Even wooden bridges were not built where they could be avoided, because few localities were rich enough to bear the expense of them. Streams, lakes, and bays were forded or ferried, whenever possible. The inscription on a crumbling gravestone in an ancient graveyard at Watertown, Mass., "He built the famous bridge over the Charles River in this town" (a little wooden affair, only thirty feet long), shows how rare the bridge-builders were in early times, and how much of an incident it was to throw a roadway over a stream.

Toll-bridges.

The toll-bridges built along from 1810 to 1840 by the private companies chartered for the purpose by the legislatures, were, almost without exception, of wood.

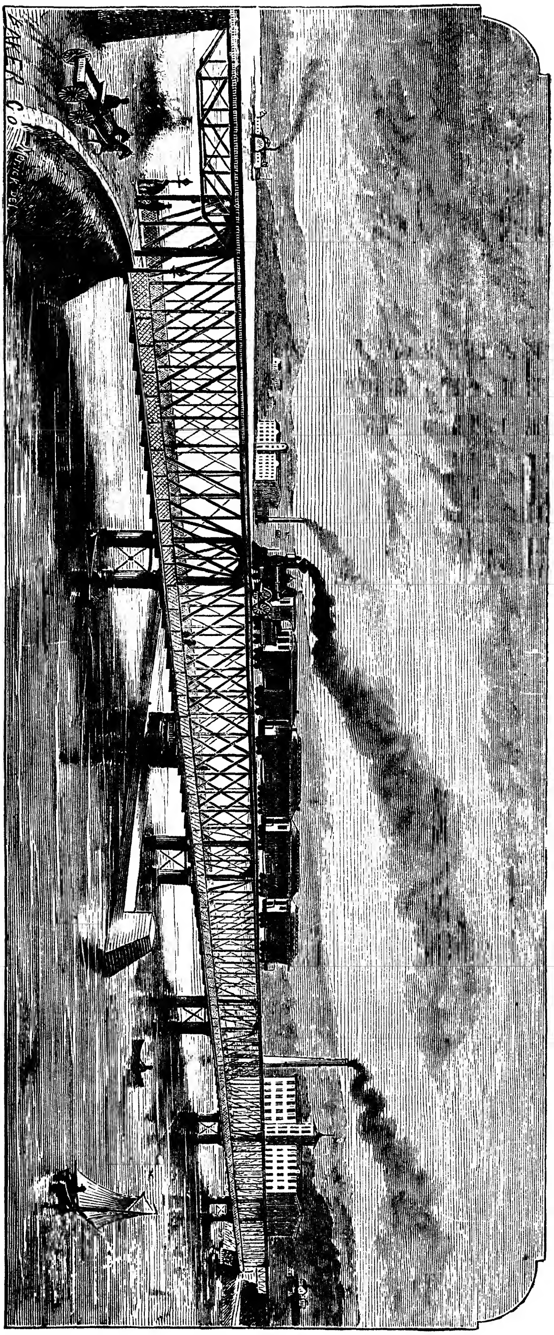
Railroads and canals gave great impetus to this industry.

With the era of railroad and canal building, bridge-building received an impetus, and became a special art. Highways had to be carried across canals, and railways across ravines; and the country became stocked with bridges. These, again, were generally of wood; and a great deal of ingenuity was expended in the invention of wooden framework which would have the requisite stiffness and strength for spanning 200 and 250 feet chasms, and at the same time consume the smallest amount of material in the structure. Howe, Burr, Long, and McCallum became known as inventors of successful trusses for the purposes of the railroads and canals, and their patterns were extensively utilized in bridges. The wooden bridges were heavy, clumsy, and unornamental, and, until the companies knew how to protect them from the weather and from fire, short-lived. It may be said, however, that they were always favorites with the railroad companies and municipal corporations, because of their comparative cheapness, and they are still, and are being largely used to-day. Notable bridges of wood have been built, even of late years, since the passion has been for a different material. The bridge at Bellows Falls, and the Susquehanna Bridge, put up by the Philadelphia, Wilmington, and Baltimore Railroad Company at a cost of $2,000,000, with 250 feet spans, are among the number.

Defects of wood bridges.

When subject first engaged attention.

About 1845 attention in this country was drawn to the value of iron for bridge-building. The American idea of chain-bridges had been adopted abroad, and the use of wire was substituted in them for that of iron chains. Wrought-iron beams were being largely used in the construction of houses and stores. Iron rods were being freely introduced into wooden trusses and into roofs. The additional lightness and strength of structure gained by the use of iron caused engineers to study the capacities of this metal as the sole material for trusses and framework. **Early experiments.** Experiments in Europe to determine the tensile strength of materials gave an impetus to the growing tendency. The consequence was, that a number of iron-makers in different parts of the country made a few short iron-truss bridges of angle and plate iron and stout bars, and put them up for railroad companies over short spans as experiments. There was considerable popular doubt as to the behavior of iron framework in the cold of winter and extreme heat of summer; and confidence, always a plant of slow growth, was not conceded to the new structures until after years of trial. About the time of the war they began to come into general use on railroads and canals.



FALL-RIVER BRIDGE.

A new era of suspension-bridges began about the same time as interest awoke in iron-truss bridges. The needs of the railway system of the Eastern States required the crossing of the chasm of the Niagara River at some point near the Falls. John A. Roebling, an American engineer, proposed a suspension-bridge of wire below the Falls. So much ability was manifested in his plans, that he obtained the contract to build the bridge against the competition of all the noted builders of England, including Sir James Fairbarn. The structure was erected about the year 1846 with 821 feet span, the material being supplied by the Phœnixville Bridge Works of Pennsylvania. Roebling afterward put up the Cincinnati and Covington Bridge, with 1,057 feet span. It was completed in 1867. Niagara River was afterwards spanned by another suspension-bridge, called the "Clifton," 1,268 feet long from tower to tower. It was a less important structure than the former, however, as it was designed only for wagon-travel. Few suspension-bridges have been put up besides these. The preference is for the other style of structure.

Suspension-bridges.

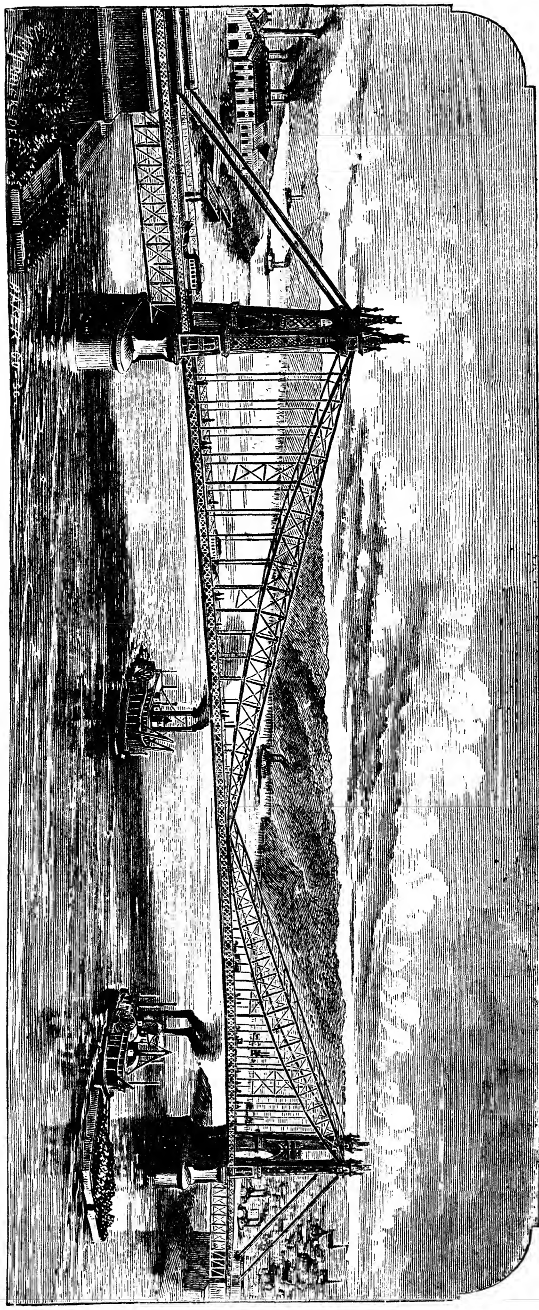
Roebling.

Up to 1862 all the iron-truss bridges built were of short span. The Schuylkill Bridge, with spans of 192 feet, and the Green River and the Monongahela, with spans of 200 feet (the latter built by Albert Fink), were the longest in the United States. In 1862 the Steubenville Bridge was designed by J. H. Linville, containing one span 320 feet long. This was the pioneer of long-span structures. The Monongahela Bridge at Pittsburgh, with spans of 260 feet, was undertaken the same year. These structures were closely studied by engineers in all the States. Each one was an experiment, requiring special tests of material, special rolling-mills to get out the angle and T iron, special patterns of plates and beams, and separate appliances for erection. They were all truss bridges, the plates and beams being fastened together by riveting, and the bars and rods being fitted to their places to brace the structure by nuts and screws. After the completion and success of these works the Baltimore and Ohio Railroad ordered two long-span bridges for their road, one of which was built at Parkersburgh, with two spans of 348 feet, four of 200 feet, and several shorter ones. The other was erected at Bellaire, at a cost of $1,000,000. It had one span of 348 feet, one of 250, four of 200 feet, and a number of 107 feet spans, the approach consisting of forty-three stone arches of twenty-eight feet four inches each. Nothing has seemed impossible since the construction of these works. A general introduction of large iron bridges has taken place accordingly in all parts of the country, but especially in the West. The wooden structures have been taken away as they have become worn out or shattered by freshets, and have been replaced with the lighter and more substantial bridges of iron. New roads have been generally built with iron viaducts only.

First long spans.

Exploits of the West in bridge-making.

The West has been the theatre of the greatest exploits in bridge-building up to the present time, because of the greater necessity for the creation of viaducts across great streams. In 1867 a frame-bridge was begun across the Ohio River at Louisville, which took three years to complete, having spans of 400 feet; and the Newport and Cincinnati Bridge was erected about the same time, with a great span of 420 feet, which remains to the present time the largest truss in the United States. A very interesting structure was built at St. Joseph, Mo., in 1872–73, across the Missouri River. The current of the river is of frightful velocity and force at this point, and the work of constructing the piers was a great engineering task. In order to prepare the river to receive the bridge it was necessary to confine the current to a specific channel, so that it might not afterward wear away the abutments. This was successfully done by Col. E. D. Mason, the engineer in charge; a sand-bar more than a mile long and half a mile wide, containing 8,000,000 cubic yards of earth, being removed in the operation. The bridge is 1,345 feet long from bank to bank, and cost



SUSPENSION BRIDGE, MOUTH OF MONONGAHELA RIVER.

\$1,000,000. Another great bridge was thrown across the Missouri at St. Charles, for the St. Louis, Kansas-City, and Northern Short-Line Railroad, by a company which leases it to the road at a perpetual rental of \$170,000 a year. The work is a mile and a quarter long, cost \$2,250,000, and is the finest structure of its class in the country. The approaches to the bridge proper are over iron trestles, of which there are forty each side of the stream; and the stream is crossed by seven trusses, two of 305 feet span, two of 306½, two of 317½, and one of 321⅔. In this structure are employed the two styles of bridge used upon railroads and highways. The central three spans are "through" spans, technically so called, because they have the track on a level with the lower chords: the others are "deck" spans, having the track on a level with the upper chords. The quantity of iron used was 7,690,000 pounds, and every bar and plate was tested up to 20,000 pounds to the square inch.

St. Louis Bridge.

The greatest bridge of all in the West crosses the greatest river of the republic at St. Louis, and is adapted both to railway and ordinary travel. It is composed of three spans,—two 502 feet in length, and one of 520 feet,—which are crossed by steel tubular arches, supporting a double roadway, one for railway and the other for wagon and foot travel. Each arch is composed of cast-steel tubes twelve feet in length, there being four sets of tubes in each arch,—two above to form the upper chord, and two below to form the lower chord, the chords being united vertically by zigzag bracing, and laterally by huge iron rods. The structure is really a double bridge, or two bridges side by side. Each span is accordingly crossed by two arches. Work was begun upon this great viaduct in August, 1867, under the supervision of Capt. James B. Eads, its originator and engineer; and the superstructure was completed in April, 1874, at a total cost of \$12,000,000. The materials used in construction were supplied under contract by the Keystone Bridge Company of Pittsburgh and Philadelphia. Every beam, tube, bar, and bolt was fitted to its place with microscopic exactitude before it left the works for the scene of the bridge. The piers of this work were built by the process employed at St. Joseph, Mo., and afterwards on the East River at New-York City. It is called the pleuro-pneumatic. It was necessary to excavate the bed of the river down to the solid rock, a distance of 119 feet below ordinary high-water line. In order to accomplish this, huge caissons of wood and iron were built, eighty-two feet long, sixty wide, and twenty-eight feet high when launched, open below like diving-bells. The masonry of the pier was built upon the caisson, so as to be constantly above the surface of the water as the caisson slowly settled down into the water to the mud, and then into the excavation made for it by the workmen in the open air-chamber below. The pressure of air in this chamber was fifty-two feet to the square inch. It was very trying to the workmen; but this plan of building a pier in deep water proved very efficient and successful. Eads's sand-pump, invented to assist in excavating the bed of the river, has since

Eads.

Construction of the bridge.

become famous. This bridge has the longest existing spans of its class in the world.

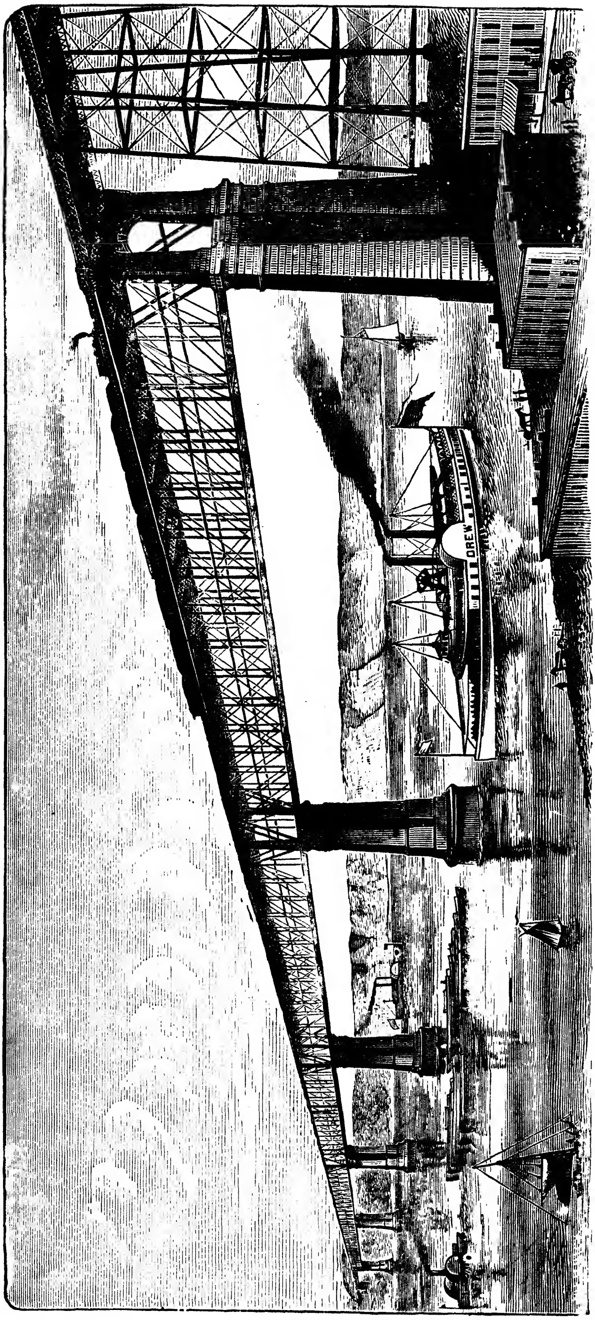
In the East there have been no great bridges, except the International at Niagara Falls, until recently. A suspension-bridge, however, is now building at New-York City, over the East River, to Brooklyn, which not only surpasses any work of its class in the country, but in the world. The great stone towers for this work are 260 feet high, and the bridge-way will be suspended in the air at a distance of 130 feet from the water,—a height sufficient to allow vessels of all sizes to pass without striking a spar, except in the case of a few of the great sailing-ships in the California and China trades, and these will seldom have occasion to pass this point. The distance from tower to tower is 1,620 feet, and to the New-York and Brooklyn anchorages from the towers 1,337 and 837 feet respectively. From end to end the bridge will be over a mile in length. It will weigh 3,600 tons, and hold 1,400 tons of freight. This great bridge was begun in 1870, and at this time half of the supporting cables are laid. It will require a year to lay the other half, the cables being strung and built up wire by wire. The total cost will be $13,000,000. The bridge was begun by John A. Roebling, its projector, and since his death is being carried on by his son, Col. W. A. Roebling.

East-river Bridge.

American constructive talent has found a problem worthy of its powers in grappling with the subject of crossing the great streams of the republic. Every venture so far has been attended with creditable success. The engineers have had a great advantage in the fact that American iron is of superior tenacity, which enables them to impart greater lightness to the cables and trusses of bridges, without loss of strength, with, in fact, a gain of strength, since the weight of the structure is diminished. Every difficulty so far has been solved by the ready invention of engineers and the intelligence and care of the workmen. It is impossible to tell what gigantic work may not yet be attempted. The Newport Bridge at Cincinnati, with its peerless truss of 420 feet, was once considered the acme of effort; but the steel arches at St. Louis have passed it; and a corner-stone has been laid for a "deck" bridge at Poughkeepsie, N.Y., designed by Linville, like the one at Newport, standing 190 feet above the water, with five spans of 525 feet each. But who shall say that American builders will stop even with 525-feet trusses? or who can safely predict that the Brooklyn Bridge is the limit of possibility in the direction of suspension-bridges?

Iron bridges of small size for general purposes are now largely manufactured as a regular industry in all parts of the country, except the South. There are no factories at present south of Mason and Dixon's Line. That there will be in a very few years there can be little doubt, owing to the needs of the Southern States, and their abundant coal, iron, and water-power. American bridges find the railways, of course, their principal consumers; but the purely agricultural

Iron-bridge building a regular industry.


HUDSON-RIVER BRIDGE. AMERICAN BRIDGE COMPANY.

regions are becoming large buyers, and many bridges are being exported to Canada and South America. The companies engaged in the manufacture are at present only twenty-three in number; the business requiring large capital, a vast amount of heavy and expensive machinery, and the best engineering talent.

PRINTING-PRESSES.

Changes in printing-press.

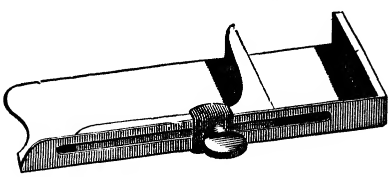
Like all other machines invented to perform some special task, which have had an ancient origin, and which have become changed and improved with the progress of time, as civilization has made larger and larger demands upon its services, the printing-press has passed through a world of vicissitudes since its origin in 1455. It would not be interesting to relate all of these. Only the leading changes of form need be noted.

Description of old press, and mode of working it.

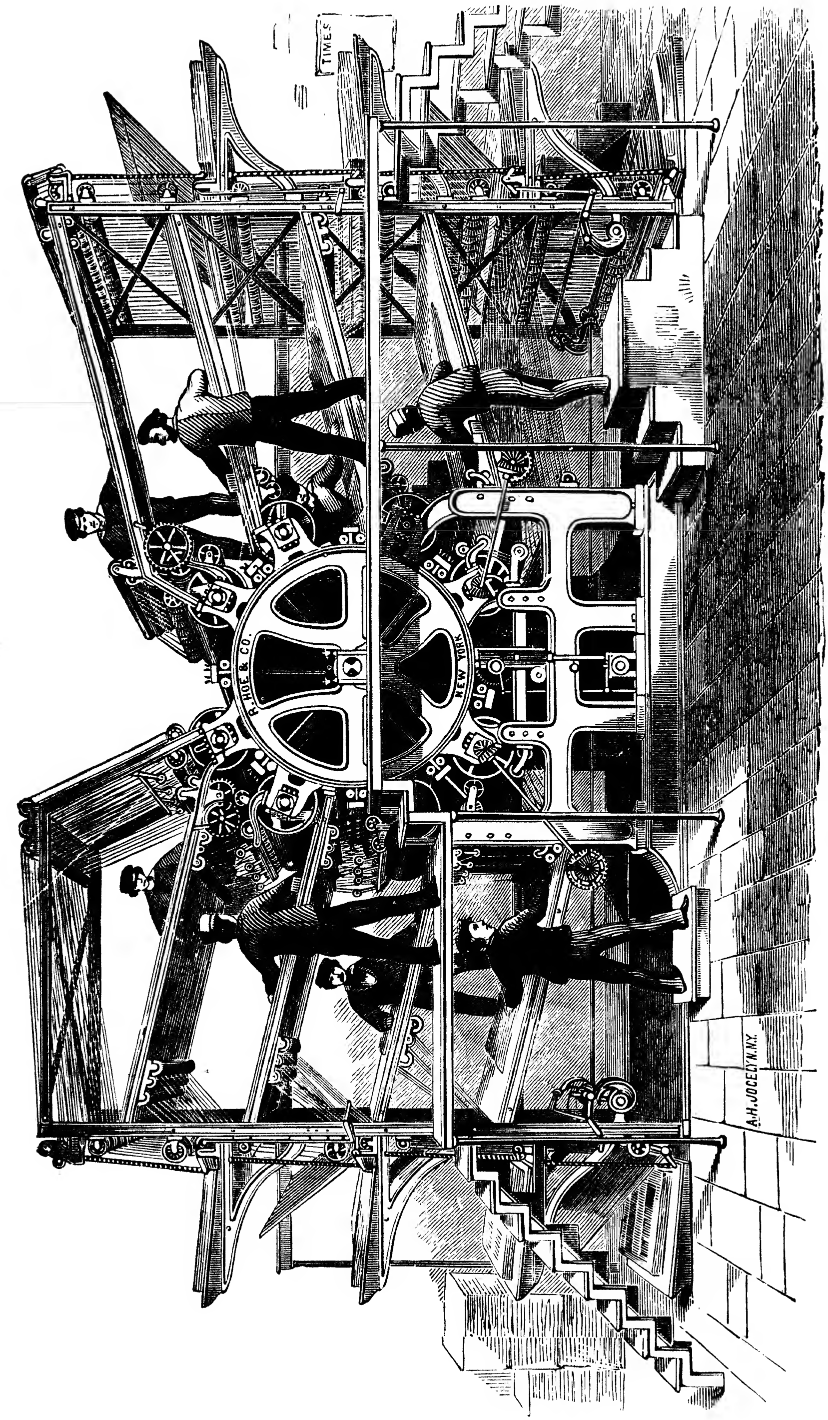
The old press used by the first printers was merely a table, upon which the type forming the page to be printed was laid, being bound together by a frame and wedges into what is called a "form." The type was inked by patting it with an inking-ball, or running an inking-roller over it. The paper was laid on by hand, and a flat plate of wood or iron was brought down on it by turning a screw, which brought the type under pressure. The Earl of Stanhope invented an improvement upon this, by which a lever was used in connection with the screw, and

GUTENBERG'S FIRST PROOF.

the plate, or platen, was brought down more quickly; and a carriage was made to run the form out from under the platen after the impression, so as to ink it again more easily. The screw was afterwards superseded by a lever and by an elbow-joint of iron, the straightening of the joint bringing down the platen. This sort of press was the one used by the early American printers. Books, newspapers, the sermons and pamphlets of which there was such a prodigious number in early days, and all fine work, were printed on presses of this general description. The pattern has not gone out of use



COMPOSING-STICK.



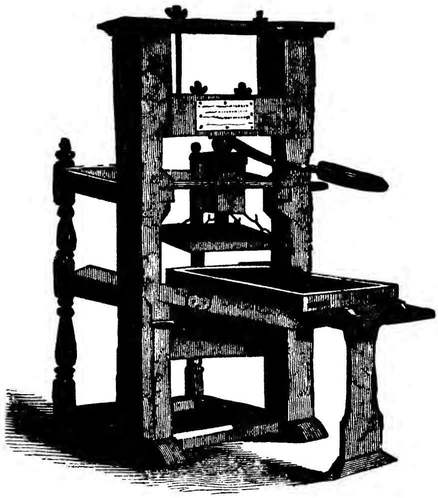
EIGHT-CYLINDER TYPE-REVOLVING PRINTING-MACHINE.

even yet. It is a convenient style of machine for printing posters, placards, &c., in small offices.

The first step in advance was in 1790, when the idea of a cylinder press was broached. The original style of machine never came into use; but the idea was a good one, and it became the theme of numerous inventors. A Saxon by the name of Frederick König built the first cylinder press to run by steam in 1814 for "The London Times." This style of press was introduced into the United States in 1830 by Robert Hoe, and Sereno Newton his partner, who built the first press in use in the country. Mr. Hoe improved this press immensely; and his son, Richard M. Hoe, has added to its capacities still more. The principle of the original cylinder press was to cause the table bearing the form to move horizontally back and forth under a large cylinder. This cylinder was supplied with paper, a sheet at a time, the paper being held to the surface of the cylinder with tapes strung taut over it. As the form went under the cylinder, the paper, moving at the same rate of speed, was brought into contact with it with pressure, and an impression taken. The form flew back under the cylinder again, when a depressed part of the surface of the latter was presented to it, to advance again for another impression. This was called technically the single-cylinder press. A number of American inventors improved the machine as well as Hoe, — Campbell, Babcock, and others among the number, — and it has been made capable of printing from two thousand to three thousand newspapers an hour.

First cylinder press.

Hoe.



FRANKLIN PRESS.

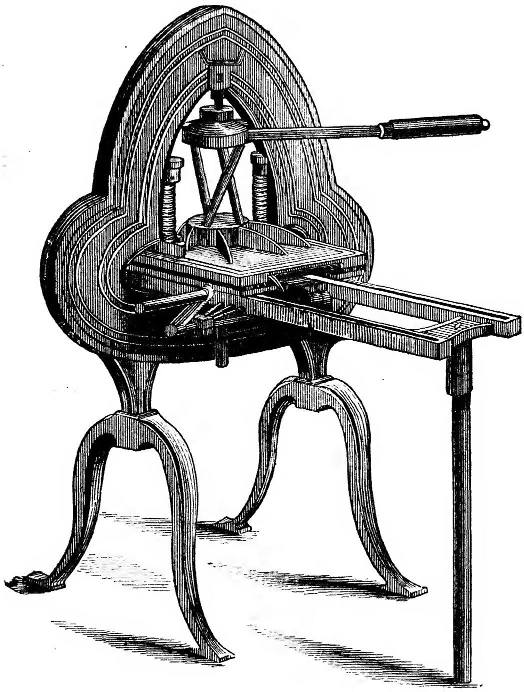
In 1830 and 1836 Isaac Adams of Boston patented the press which has always been called by his name, and which has not yet been superseded in value for book-work and fine printing. In this machine the table holding the form rises and falls vertically through the action of a powerful toggle-joint below it, making a quiet and strong impression on the paper.

Adams.

The cylinder press was improved by Richard M. Hoe in 1847 in a new and extraordinary way. The type was locked up in a form called a "turtle," from its resemblance to the back of that amphibian. The turtle was curved, and was made so that the form could be

Hoe's improvements in 1847.

fitted to the surface of a large cylinder, and made to revolve at any rate of speed without flying off, or parting with its type. Hoe enormously increased the capacity of the cylinder press by this invention. The paper was presented to the form as the latter revolved upon the big cylinder by a number of small cylinders, each attended by a separate workman. The feeding cylinders have been as high as eight, ten, and twelve in number. The monster Hoe press lately removed from the press-room of "The Tribune" office at New York, to make way for a more modern machine, was of the ten-cylinder pattern. The twelve-cylinder press would print about four hundred papers a minute, or twenty-four thousand an hour. The adoption of the Hoe press by "The London Times" showed its value.



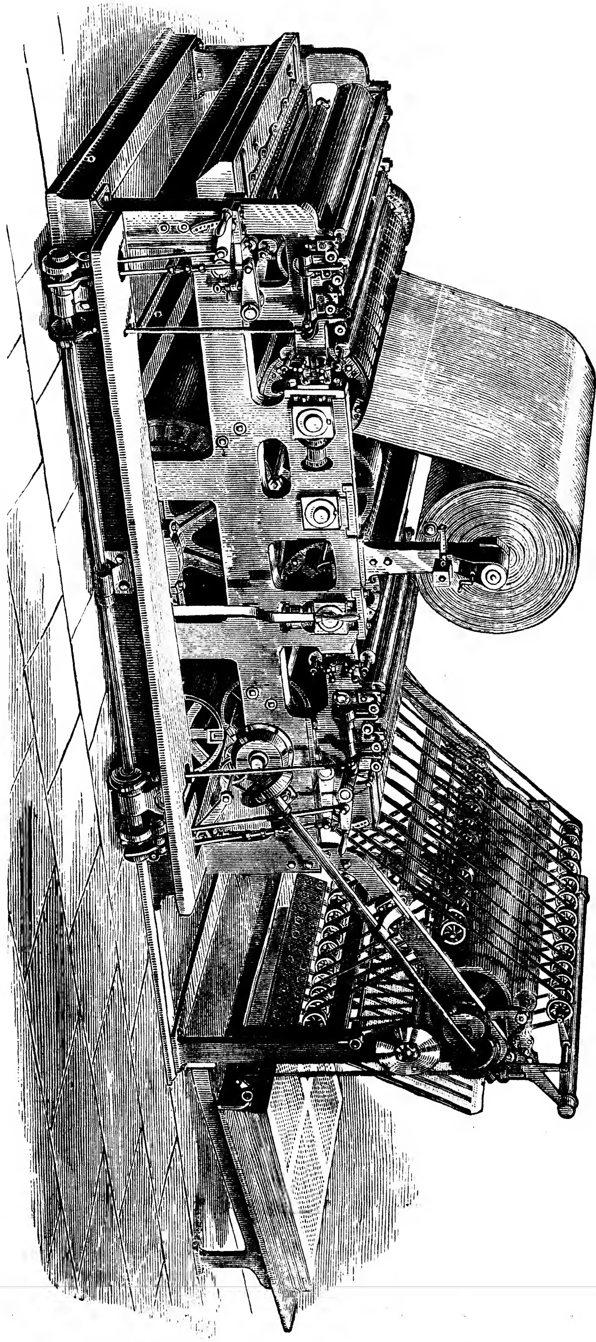
STANSBURY HAND-PRESS.

The next and last step forward has been the perfection of the web-press. This is an American invention, and is to be credited to William A. Bullock of Philadelphia, who got a patent for it in 1861, and patented it in England in 1862. The idea has been taken up abroad by Walter of "The London Times" and others; but the American inventors still retain the lead in the construction of the machine. Hoe & Company and Campbell have both perfected web-presses of their own, which are in some respects better than Bullock's. The principle upon which these presses are made is to feed the paper to the press from a huge roll, or web, upon which there is wound up from three to five miles of paper. Lightning-like shears in the press cut off the sheets from the roll, either before they are printed, as in the Bullock press, or afterwards, as in the others. The forms are stereotyped, and mounted on two large rollers; those for one side of the newspaper on one roller, and those for the other side of the sheet on the other. The paper goes to one roller, and receives the impression of one set of forms, and then goes to the other, and is printed on

Bullock.

Hoe and Bullock presses described.

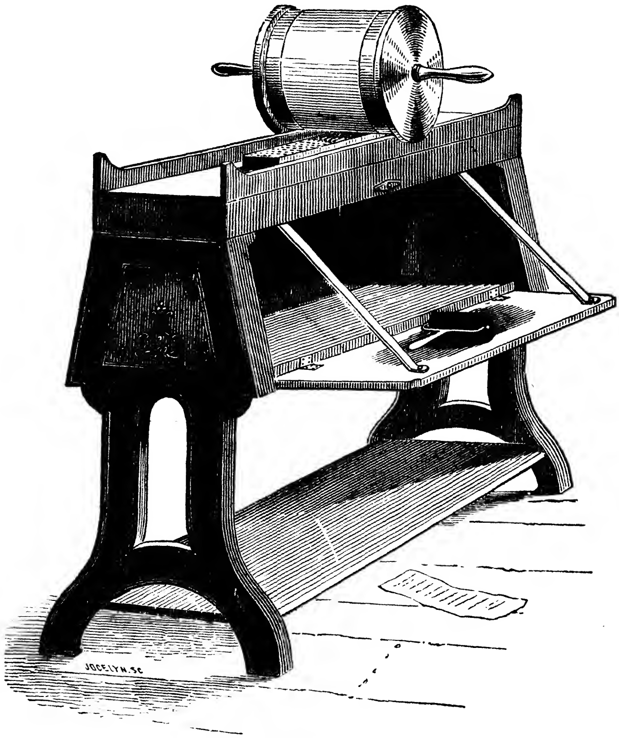
the other side, and passes on to the fly, to be delivered to the men who carry the papers to the folding-room. The Hoe presses have a capacity of 18,000 impressions with folder an hour, and 25,000 without this attachment. The Campbell press has a capacity of 35,000, but is generally operated with a folding-machine, which reduces its work to 10,000 an hour. The advantage of this style of press is not so much in the number of impressions per hour as in the saving of the original cost of the machine, and expenses of operation. A web-press is well served by two or three men, while the old style of Hoe press of the same capacity would require ten or twelve men.



WEB-PERFECTING NEWSPAPER PRINTING-MACHINE.

The United States is greatly interested in the progress of the printing-press, because the newspaper and the book have now become essentials in the life of every intelligent person, and the cheapening of the processes of making them is of vital importance to the welfare and progress of our beloved country and its inhabitants. When this cheapening can be done by the employment of machinery, instead of by the cheapening of the wages of labor, the progress made is wholesome and satisfactory.

Importance of printing-press.



NEWSPAPER PROOF-PRESS.

WIRE.

The manufacture of wire is a very ancient art; but the metal originally used was almost exclusively either gold or silver, and malleability was taken advantage of in the production of the wire rather than ductility. The metal was hammered out into thin sheets, and then cut into narrow slips, or slivers, which were afterwards rounded by hammering. The fabled net of Vulcan was made of such wire. Fabrics were also woven of it; and a golden garment weighing thirty-six pounds, made from wire of this sort, was found in the tomb of the wife of the Emperor Honorius when opened at Rome in 1544. An allusion is made in the Book of Exodus to the fact that "they did beat the gold into thin plates, and cut it into wire," for decorating the rich garments of the priests. "The beautifully-twined tassels of solid gold" of the Ægis, referred to in the "Iliad;" the zone which Juno put on to captivate Jupiter, —

Ancient wire-making.

> "All around
> A hundred tassels hung, rare works of art,
> All gold, each one a hundred oxen's price;"

and the wonderful head-dress of a profusion of gold chains found by Schliemann at Troy, — were all made of hammered wire.

It was not until some time after 1300 that wire-drawing became an art. A race of wire-drawers, who made iron wire by hand, and afterwards by water-power, then sprang up in Germany, and became famous in Europe. Nuremberg was the great centre of the industry. It was introduced thence into England about the middle of the fifteenth century. In the original machine processes the wire was stretched out from slender iron bars by pincers driven by water-power, which came forward and caught the wire and retired, and then, letting go, came forward again and took another hold, to retire again. England afterwards applied steam-power to the drawing-process, and then made use of the drawing-plate. She became in time the principal wire-making nation, from the fact that her policy was steadily directed to the breaking-down of the Dutch and German industries, and to the development of her own. In the present century she has furnished wire to all the world, and especially to the United States and the other countries of the American continent. Her manufacturers bid eagerly for contracts for supplies for telegraph companies and suspension-bridges on this continent, and have been in the past very successful in securing contracts against all competitors.

Wire-drawing in England.

This industry was introduced into the United States early in the present century. It gained very little headway until a very recent date. There was little demand for iron wire at first; and when the telegraph was invented by an American, and a new and extraordinary demand for wire was thus created, foreign competition was too powerful. Factories were, however, started in Boston, Worcester, Providence, New York, and other cities; and the industry has now become a considerable one, and successfully competes for most of the large American contracts. It is singular, however, that, while there has been immense progress in this country in every other industry, in this one very few new ideas have been evolved. Up to 1874 there had been only five patents issued concerning wire out of the 146,119 recorded up to that date. In 1874, however, twelve patents were issued.

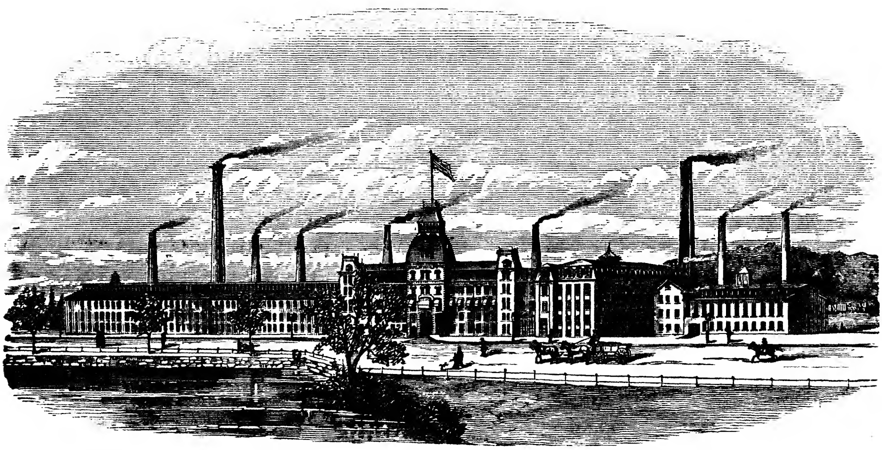
Wire-making in United States.

The uses of wire are now constantly increasing. It would seem as if there were nothing like wire for a thousand purposes for which hemp, and iron chains and bars, cobwebs, and other things, have been employed. Wire has now for forty years been twisted into cables for supporting bridges, hoisting elevators in mines and buildings, securing anchors, rigging, and guns, and threading the oceans and seas for telegraph communication. For cables and ropes it is far lighter than hempen cordage, and more easily handled. Eight-inch hawsers of steel wire have recently been made in England to take the place of the enormous twenty-five-inch hawsers used on iron-clads. The steel hawser weighs only one-third as much as the one of hemp, and is handled by twelve men; whereas the other takes forty-eight. Wire is the universal material for telegraph and telephone lines. It is drawn for all kinds of pins and needles, for the wire cards used in spinning, for the

Uses made of wire.

strings of pianos, and for fences, and is woven by machinery for a great variety of purposes. Recent deep-sea soundings have been made with piano-wire, which have been a hundred times more satisfactory than any ever before made with cords and rope. Gold and silver wire for chains, and filigree-work, and lace, are extensively used in the decorative arts; and platinum wire is drawn out as fine as a cobweb for the purposes of the crossed hairs in the telescope. The finest wire made is for the telescope. An ingot of platinum is surrounded with silver, and the compound wire drawn down to the finest point. The silver is then dissolved with nitric acid, leaving the microscopic thread of platinum behind. Wire thus made has been as fine as $\frac{1}{18000}$ of an inch.

Wire for telescopes.



WASHBURN & MOEN WIRE-WORKS, WORCESTER, MASS.

Process of wire-drawing.

The process of wire-drawing is simple. For ordinary commercial wire, iron rods of tough quality are bent into coils, and put into large tumbling boxes or rotating cylinders, with water and gravel to remove the scale. They are heated and re-rolled until they are reduced to a coarse wire of about an eighth of an inch in diameter. They are then passed cold through the draw plate. This is a piece of hardened steel pierced with a large number of tapering holes, the smallest part of each hole being on the side from which the wire emerges. The end of the wire, being carried through the largest hole, is attached to a reel, and the rod drawn through with power at the rate of from sixty to two hundred feet a minute, stretching it, and reducing its size. It is then passed through a smaller hole, and the process is repeated until the requisite size of wire is obtained. The wire is often passed through ten, fifteen, thirty, and even more holes, to get it down to the requisite fineness. The continued drawing rendering the wire brittle, it is necessary to anneal it several times during the process of reduction to make it soft. It is heated to redness in coils, and allowed to cool gradually in kilns. Twenty-four hours is the usual length of time for cooling for the smaller wires. The scale is removed after each annealing by pickling in dilute oil of vitriol.

Cast-steel wire is made from rods hammered to a quarter-inch diameter by the tilt-hammer. It makes the toughest wire known; and it will stand a strain of about 200,000 pounds to the square inch against 100,000 pounds, which is the strain the best iron wire will endure to the square inch. Spurious gold wire is made by heating copper wire to redness, and exposing it to the fumes of zinc, which converts the exterior of the wire into brass. American inventors have brought out a wire with a steel core and copper exterior, which is claimed to have advantages for telegraphy. In 1858 Henry Waterman invented a plan for tempering flat steel wire for crinolines (made by drawing, and rolling afterwards), which reduced the cost of tempering from three dollars to three cents a pound. Previously the wire had been wound into great volute coils, interlaced with iron wire, and in this form exposed to the baths, &c., of the tempering process. Waterman drew the wire through the heating-furnace directly into the hardening bath by machinery. His process is applied to all tempered-steel wire now.

Cast-steel wire.

Wire-drawing has not received the conspicuous development in the United States to which it is entitled, both because of foreign competition and of the limited uses of wire. Present indications point to an enlargement of the industry on account of the growing applications of wire, and the probability of finding a large market for the American article in South America and Australia. If China and Japan would introduce the telegraph generally, a great impetus would be given to the factories of this country.

Development of industry.

WATER-WHEELS.

The rugged ranges of mountains and hills, and the generally broken quality of the surface of the country of all the States lying along the Atlantic coast of this country, have been to our people a boon of decided value. Causes which lie so far away behind the setting of the stage upon which the incidents of history take place as to be invisible to the physical eye, and almost to the mind, often exercise the most powerful of influences upon all that occurs. A large part of the wonderful progress of the American people in industry and civilization is due to the rugged nature of the territory in which the first colonies of the republic were planted. The speculative philosopher can see in the peculiarities of that territory the germs even of American independence and the free institutions which the people set up here after independence had been secured; for, on a comparison of the different races and countries of history, it is found, that, in general, the mountains and hills have always been the seat of the greatest human liberty and progress, whereas the plains have been the basis

Wealth of water-power in United States.

of whatever indolence and slavery the world has seen. A real connection can be traced between the free and aggressive spirit of the early colonists of the North and the character of the region they inhabited. But the hills were of more immediate value in the influence they exerted upon material progress. They filled the States they permeated with an unparalleled luxuriance of water-power, which was of incalculable value in enabling the people to manufacture, and to build mills and factories and shops of all kinds, and thus make for themselves those implements and goods which are to every great nation an important source of its culture and power.

Early mills in New York and New England.

At New-York City, and along the flat seacoast of the country, windmills were employed by the early inhabitants to grind their grain, and saw their lumber; and those quaint relics of a bygone age are still in use among the people on the New-England coast and the outlying islands of that region. They have no waterfalls, because the country is too flat. In the interior there has been from the beginning, in all the arable States except Illinois, an almost inexhaustible supply of water-power; and all the heavy machinery of the interior was propelled by it for two hundred years. This water-power has been eagerly taken up, and it has given rise to a myriad of flourishing cities and villages in different parts of the country. It has been improved by the building of costly dams to regulate the flow of water so that it might not run to waste, and the construction of great storage reservoirs to hoard the accumulations of the wet seasons. A few streams like the Merrimack, the Quinebaug, the Willimantic, the Genesee, and the Owasco, have become the seat of extraordinary aggregations of capital and labor. Yet so abundant is the republic's endowment of this cheap and serviceable power, that probably not one-half of that which is available in the country is yet harnessed for the service of man. It is only in the East that it is well taken up.

Water-power in the West.

Wood wheels.

Up to within forty years, all the wheels used in the United States for utilizing the power of mill-streams were of wood. They were huge, heavy, clumsy structures, twenty, thirty, and forty feet in diameter, — picturesque enough when taken together with the red mills by the side of which they hung, and the sparkling waterfalls which they took their power from, but still liable to get out of order, to be choked with ice in the winter, and to waste almost as much power as they saved. They were of four classes, — the undershot, the overshot, the breast-wheel, and the suspended or tide wheel. The former were very little used, because they utilized only from twenty-five to thirty-three per cent of the force of the stream. They were hung near the fall; and the water, issuing from the bottom of the dam with great velocity through a floodgate, acted against the floats, or paddles, of the big wheel. They were a very crude type of motive-power. The breast-wheel was the undershot, placed in actual contact with the fall, so that about one-quarter of the circumference was acted upon directly by the water of the fall. The water acted upon this class of wheels both by gravity and momentum. About sixty-five per cent of the power of the water was saved in a wheel from sixteen to twenty-five feet in diameter. The suspended wheel is hung in the current of the stream, and is simply an undershot, intended to take advantage of the flow of the tide back and forth. The overshot was the most powerful of the four classes of wooden wheels. This type is still largely used. The wheel is supplied with buckets on the circumference instead of paddles, and receives its water through a pipe or raceway from above. It may be used with any size of fall from ten to fifty feet high; and it is said that one is in use in the Isle of Man which has the enormous diameter of seventy-two feet and a half, and a breadth of six. The disadvantage of the wheel is, that it is always heavily loaded with water, which causes it to bear heavily upon its axle. It is also a slow-moving wheel, and this makes it necessary to multiply gearing in the mill in order to impart speed to the machinery.

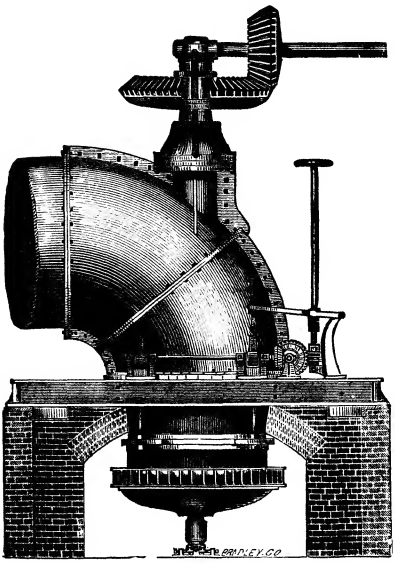
No special ingenuity was required to make these old wooden wheels. Any carpenter could build them. Very few patents were issued in regard to them.

About forty years ago there came a demand for an improved water-wheel. In densely-populated regions, where mill-streams were crowded with factories, it became important to make every gallon of water which passed over a dam do its share of work, and do as much work as possible. Attention was turned to a wheel invented in France by Benoit Fourneyron in 1834, who received six thousand francs from the Society for the Encouragement of the Arts at Paris as a reward for his valuable device. This was the original turbine-wheel, or, if not absolutely the first and the parent of its class, the first which was ever in practical use. It was a horizontal wheel placed at the bottom of the fall, and supplied with water from a perpendicular pipe. The water descended upon a solid circular plate, which was stationary; the upper surface of it being grooved from the centre to the circumference, the grooves not being straight, like the spokes of a wagon-wheel, but curved, like a sickle; so that the water, as it reached the rim of the circular plate, shot out of the grooves at a tangent in twenty or more spouts all round the wheel. The buckets or floats of the wheel were outside the circular disk, and received the spouting water with great violence, and were thus forced to revolve rapidly around the disk, the water flowing outward into the river-bed from the buckets. The floats, being attached to an annular disk, turned the perpendicular shaft, and transmitted the power to the mill above. Attention was turned to the new idea in the United States about 1843. Public discussion took place; and in 1844 Mr. U. A. Boyden of Boston invented a turbine which was an improvement upon Fourneyron's, and which, with later improvements of its own, has come into extensive use in this country. The first one in practical use was put into a cotton-mill in Lowell. It saved seventy-eight per cent of the power of the water. Boyden has made others since which have saved eighty-two per cent. From 1843 to the present,

Original turbine.

Boyden.

invention has been active, and more than a thousand patents have been issued at Washington for new forms of wheels, and new attachments to them. A variety of exceedingly effective wheels have been produced, and the iron turbine has now almost completely superseded the great wooden wheel of our forefathers. About twenty-five large and flourishing factories of them have grown up in New England, New York, Pennsylvania, Maryland, and the West.


TURBINE-WHEEL.

How the power of the turbine is determined.

The power of the turbine is derived from the weight of the column of water flowing into the wheel, and the speed of the current. If 8,000 pounds of water flow through it in a second, and the height of the fall is fifteen feet, the power expended is 120,000 pounds a second. If the wheel transmits eighty per cent of this to the machinery of the mill, it is an efficient wheel.

After a few years of experiment with the Boyden turbine, it was found that a smaller percentage of the power of the water was saved when the gate of the wheel was opened only half way, because of the eddies and commotion of the water in the wheel itself; and some Dayton (O.) manufacturers undertook to effect an improvement upon the style of wheel, by which the water should flow through solid, and should escape more readily, thus leaving less dead weight of water for the wheel to carry. They brought out the inward-flow wheel, and gave a new turn to invention. The Swain turbine, inward-flow, was afterwards brought out at Chelmsford, Mass., which, with the gate wide open, would save eighty-four per cent of the energy of the fall, eighty-three per cent with a three-quarters gate, seventy-seven per cent with a half gate, and sixty-three per cent with a quarter gate. T. H. Risdon of Mount Holly, N.J., however, has since then constructed an outward-flow wheel which saves eighty-eight per cent with a full gate, and seventy-five per cent with a half gate. Another form of wheel has been invented, called the parallel-flow, in which the water goes straight through the turbine, emerging at the bottom. It has not yet obtained the favor which has been accorded to the others. Steady progress is being made by all inventors as the science of the flow of water is better understood, and the wheels are now rapidly approaching a stage when almost the entire energy of falls will be utilized.

Dayton wheel.

Risdon.

Turbines are now made in a great variety of sizes and patterns. Since the introduction of the Holly system of water-works into cities, which distributes water to the dwellings, stores, and factories of a place, under a pressure of from sixty to two hundred pounds, small patterns of turbines have been made to be attached to the Holly water-pipes, and drive lathes and other light machinery. They are made as small as three inches in diameter. Turbines six inches in diameter, and occupying no more space in the room than an ordinary gas-meter, are made to run printing-presses for daily newspapers. From this size they are manufactured all the way up to six and seven feet in diameter. Several eighty-four-inch wheels are now in use, one of them being under a ninety-foot fall, and transmitting six-hundred-horse power to the machinery of the mill. The turbine has the great merit of economy of space, uniform and steady action, great velocity, — thus obviating the use of the old-time appliances put upon the sedate, leisurely-moving overshot wheels to increase the speed in the mill, — and absolute protection from frost, as they are always submerged under the water. Latterly the wheels have been supplied with a regulator, which opens and closes the gate automatically, so as to meet the requirements of the mill. Any one who stands in the engine-room of a great factory driven by steam-power will notice from the motion of the engine whenever any heavy piece of machinery in the mill above is put into operation, or the reverse. The engine labors under the new strain, or suddenly quickens when the strain is removed. The governor, sensitive to the slightest change of strain on the engine, opens or closes the steam-pipe instantly, and maintains a regular and uniform motion. The regulator of the turbine is the same in principle: it is the governor of the water-power.

Variety of turbines.

Their merit.

The progress of the United States and Canada in invention in this department of effort was well shown at the World's Fair of 1876, where a splendid show of turbines was made by American and Canadian makers. These wheels are now being sought for by manufacturers abroad.

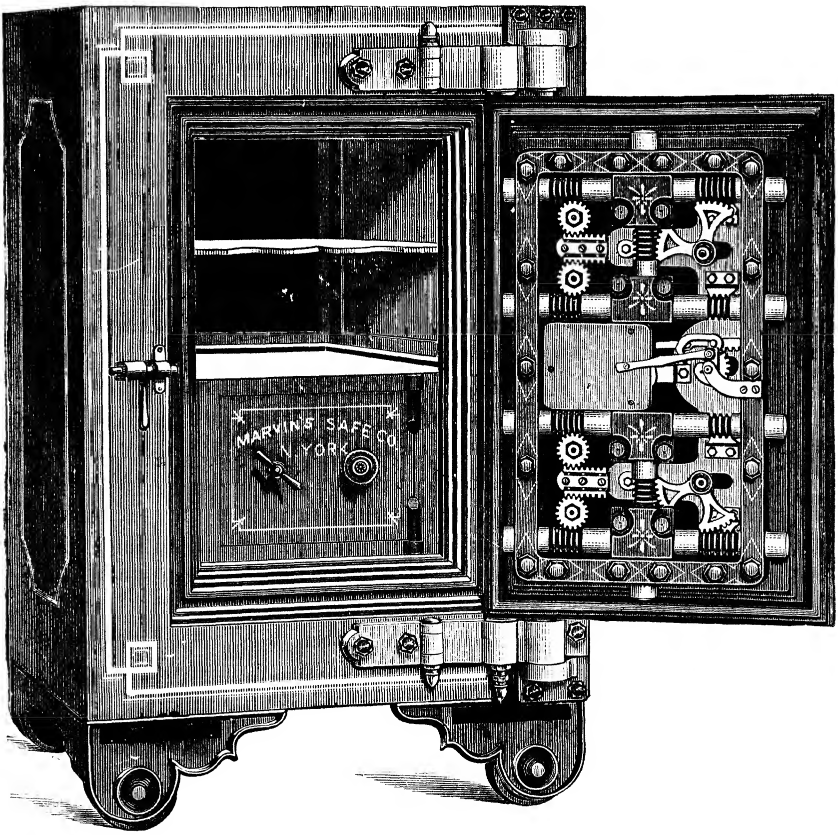
Exhibition of turbines at Centennial.

LOCKS.

In the days of the earlier simplicity of the republic the latch was an ample fastening for all the ordinary purposes of life. A grand public morality and generous good feeling between man and man prevailed at that time, which is fascinating now to look back upon, and which it is equally fascinating to find the traces of to-day in the rural and isolated communities of different parts of the country. The door was seldom barred, and then only at night. The treasures of the household were kept in unprotected drawers and closets. People rested secure in the enjoyment of the privacy of their homes and the possession of their articles of value, not so much by reason of bars and bolts as by reason of the virtue

In primitive period locks were not needed.

and self-restraint to which people were so rigidly bred in those days, and to the absence of a vicious class in the community. With immigration, the increase of wealth, and the disappearance of native Americans in the ranks of household servants, there came a different state of things; and people found themselves under the necessity of securing their houses carefully against



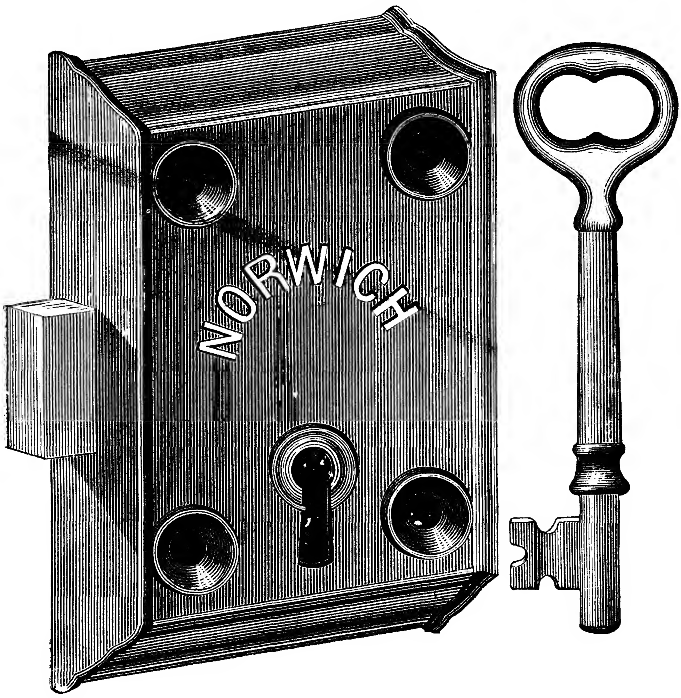
BURGLAR-PROOF LOCK.

the intrusion of unauthorized persons, and their valuables within the household against even their own domestics. The change has been very great. A hundred years ago the bolt on the outer door, and the lock upon the one box of private papers and valuables in the house or upon the strong-box at the store, were almost the only barriers erected against plunder and curiosity.

Number of locks used nowadays.

To-day, in the large cities, the whole building is placed under lock and key, even to the pantry; and, instead of the two locks of the olden time, a city residence, with its furniture, will now be fitted with from one to three hundred, and a public building with two or three thousand.

The earlier locks of the country were of the simplest form of construction. They consisted simply of a bolt operated by a spring within the lock, and by a winged key inserted through a keyhole, which, being turned, moved the bolt backward and forward. Intricacy was given to the lock simply by fashioning the wing of the key into some curious shape, and then making the lock so that only a key of that particular pattern would turn around within it. Some of the heavy locks put upon safes and strong-boxes in the early part of the present century were so made as to shoot six or eight bolts at once; but they were all of the simple plan above described, and could be easily picked with a bit of crooked wire in five minutes. They were formidable chiefly in appearance.



LOCK.

In England, where the greater accumulation of wealth compelled people to pay more attention to lock-making, an idea was brought out by Mr. Barron in 1778, which added greatly to the security of locks, and which, in fact, lies at the foundation of all our modern devices for fastening the doors of safes and treasure-magazines. Barron employed two tumblers, or latches, which fell down into the bolt and caught it, and which had to be lifted before the bolt could be moved. In 1788 Joseph Bramah of England

Barron's invention.

invented a lock with several sliders and two barrels, the inner one shooting the bolt. Bramah declared that it was not within the range of art to pick his lock, and the contrivance did defy the burglars and locksmiths for over half a century.

Bramah.

Many years after the war of 1812 attention began to be paid to lock-making in this country. The tumbler was adopted, and many minor improvements effected. How to make a lock which nobody could pick was a problem that well suited the genius of the Yankee, and applications for patents for one device and another began to pour into the city of Washington. The first real stir was created in 1841 by Dr. Andrews of Perth Amboy, N.J., who brought out a permutation-lock, in which a number of rings were attached to the key, and susceptible of an endless variety of combinations. When the bolt is turned, the lock cannot be moved except with exactly the same combinations on the key. The lock had tumblers and a detector, — a device which prevented the tumblers from freeing the bolt if lifted too high. This invention excited great admiration; but it was picked by Newall of New York, who, in turn, brought out one of his own in 1843, with two sets of tumblers, thus increasing the complication. It was thought that the acme of perfection had been reached, and Newall confidently offered five hundred dollars to any one who would pick it. His contrivance succumbed, however, to Mr. Pettitt and to William Hall of Boston, who picked it by the smoke-process, — a device of the burglars. A smoky flame was blown into the keyhole, leaving a fine deposit of lamp-black on the tumblers. The key being introduced removed the lamp-black from the parts it touched. By means of a reflector a strong light was thrown into the lock, and the key-marks revealed, and the proper shape of the false key thus indicated. Newall's lock was then improved by devices for keeping the mechanism concealed from view. H. C. Jones of Newark used concentric rings and a curtain for this purpose, and Pyes used eccentric rings and a curtain. A. C. Hobbs, an expert American locksmith, adopted the improved device, calling it the Parantoptic, and got a gold medal for it at London in 1851. The American lock-makers made a distinguished sensation at that World's Fair. Hobbs declared that he could pick all the locks in England in a few minutes, including the famous Bramah. His challenge was accepted, and he was given a Chubb lock, an old patent, and the original lock which first used a detector, to experiment upon. A convict lock-maker had once been offered his liberty and a hundred pounds to pick this lock, and had failed after three months of trial. Hobbs opened it in a few minutes. The fairness of the experiment being called in question, he renewed the attempt in a private house in the presence of a number of gentlemen, and succeeded in twenty-five minutes. He then went at the Bramah. The manufacturer of it had for years exhibited a lock, with an offer of two hundred guineas to any one who should

Dr. Andrews's improvement.

Newall.

Jones.

Pyes.

Hobbs's experiments in picking locks.

pick it. The Bramah troubled him; but, after working at it from July 24 to Aug. 23, he succeeded in unlocking it at last. Hobbs then offered the same reward to whoever should pick the Parantoptic. Several of the best of the English locksmiths accepted, and worked on the lock for thirty days, and failed. The American invention won a conceded supremacy, and the *furore* over it was immense. The Bank of England procured one, and the pattern came into general use in banks and stores in the United States.

Even the Parantoptic, however, gave way to American ingenuity in 1855. Linus Yale, jun., who had picked a very successful lock invented by his father, attacked the Parantoptic, and won a victory by the impression process. He had declared for several years, that as long as the key is of a winged form, and rubs an impression on tumblers, it can be picked; and this event proved it. To obviate this weakness of locks, he had invented in 1851 one of his own contrivance, which he called "the magic lock." It is believed that this one has never yet been picked. The key and its bits, though apparently of one piece, are separable. On the key being introduced to the lock, the bits are taken off by a pin. The key being turned puts in motion a set of wheels, which carry off the bits to a remote part of the lock, out of the reach of picking-tools, where they operate upon the tumblers; afterwards returning to the handle of the key, and joining it again.

Yale.

These brilliant devices — with others on the Hall rotary combination principle, which dispense with a key, and open the lock by turning a knob one way, and then the other, certain distances, according to a set of numbers one has in mind — have made safes and banks almost absolutely secure against robbery. The burglars are for a time at their wits' end. The larger proportion of the locks made for ordinary use are not, however, of these elaborate patterns. They are merely strong, serviceable, handsomely-made locks of the tumbler and spring patterns, for doors, trunks, chests, bureaus, &c., operated either with a flat or a winged brass key, which may be carried in the pocket. The parts of the locks are made by machinery upon the American system, except the parts which are cast; and these latter have already won a reputation for their accuracy and general superiority. The lock factories of the country are situated in New England, New York, and the Middle States, principally: they employ an extremely intelligent class of men, and form a large and important industry. The American lock in its various forms is in world-wide use. It is one of the varieties of builders' hardware for which there is just at this time, in foreign countries which have been supplied with hardware from England, a very warm admiration.

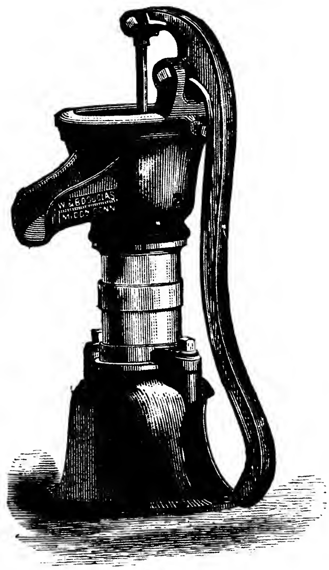
Hall's invention.

PUMPS.

The pump is a machine which has attained such importance, that a special annex was devoted to its exhibition at the World's Fair of 1876 at Philadelphia. It is a very ancient machine (dating back to the second century before Christ at least), is now made in a wide variety of forms, and is of incalculable utility. It was not in very general use among the colonists of America, because of the cost of pump logs or tubes, through which the water had to be lifted by the piston of the pump. The well was furnished with buckets, operated by means of the long well-sweep, or by a counterpoise of some other sort, which made it easy to lift the brimming bucket from the depths of the well. With machinery for boring pump-logs, and with the importation of lead pipe, pumps came into use. They were at first, and indeed until within thirty or forty years, always of wood, the valves alone being of iron and leather. About forty years ago manufacturers began to make cast-iron pumps, and these have virtually superseded all others for domestic uses. The wooden pump survives only on farms and as the town-pump on village greens. Sweet and tender memories cluster around the well-sweep and the old wooden pump, and the gradual disappearance of both before the bustling and unsentimental civilization of the present times causes a feeling of positive regret.

Importance of industry.

Wood pumps.



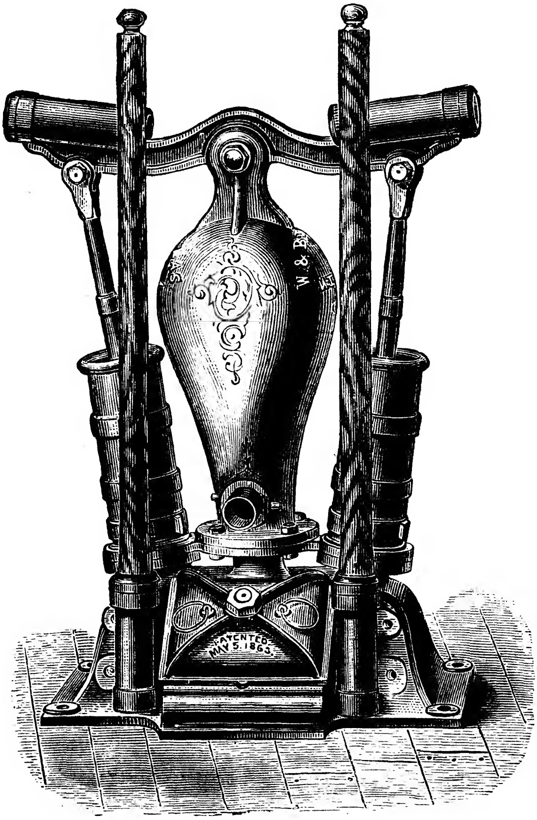
PUMP.

The highest type of pump up to the date of the introduction of the machine into the water-works systems of cities was the fire-engine. We had no great mines in this country whose treasures were deluged with floods of water as in the silver mountains of Peru, and machines of great power to keep the mines dry were unnecessary; so that for a long period the fire-engine was the peer of pumps, and a very old-fogy sort of a peer it was too. The pump was mounted upon a huge water-tight wagon-box, into which the water was poured by the bucket companies, which stood in line, and passed the buckets along from the nearest well. The pump was operated by hand-levers, from eight to twenty men being able to catch hold of the levers. The old machines were clumsy and absurd devices. After the great fire in New York in 1835 more attention was given to them, and they were then greatly improved. They were fitted with suction-pipes, which, while *en route* to and from fires, were carried in the position in which a squirrel carries his tail, and which afterwards were made to be detached, and put on at will. The brakes were lengthened, and large brass receivers

Fire-engine.

First machines: how constructed.

were put upon the pumps. Some very effective types of fire-engines were produced by this means. The best of cast-iron and cast-steel was put into the working-parts of the machine, and they were made to work smoothly, and to endure a long period of hard usage. The machine contained either two double-acting or four single-acting force-pumps. They were mostly made in the Eastern States; and the larger part of the thirty-five hundred fire-engines in use throughout the United States are still of this class of hand-power machines. They are able to throw an inch-stream of water seventy-five feet high; but it is very exhausting work for the men who operate the brakes. Simultaneously with the improvement of the hand fire-engine, attention began to be paid to the subject of steam fire-engines. One of the latter class had been made in England as early as 1829; but it was excessively clumsy; and, after a few were made, they attracted no more attention for twenty years. But in the United States the idea was taken up and utilized. Mr. Hodges built a steam fire-engine in 1841 for the insurance companies of New-York City, and employed it to good effect on several occasions of fire. It was too heavy, however, for rapid transportation from one part of the city to another in emergencies. Cincinnati was the first city to make the steam fire-engine a success. A. B. Latta built one of these engines for the city in 1853, and two more the year following. They were designed to be locomotives, and go by their own steam, but were dreadfully heavy, weighing about twelve tons each. These three engines were successfully used as part of the fire-apparatus of Cincinnati; but the attempt to propel them from one place to another with

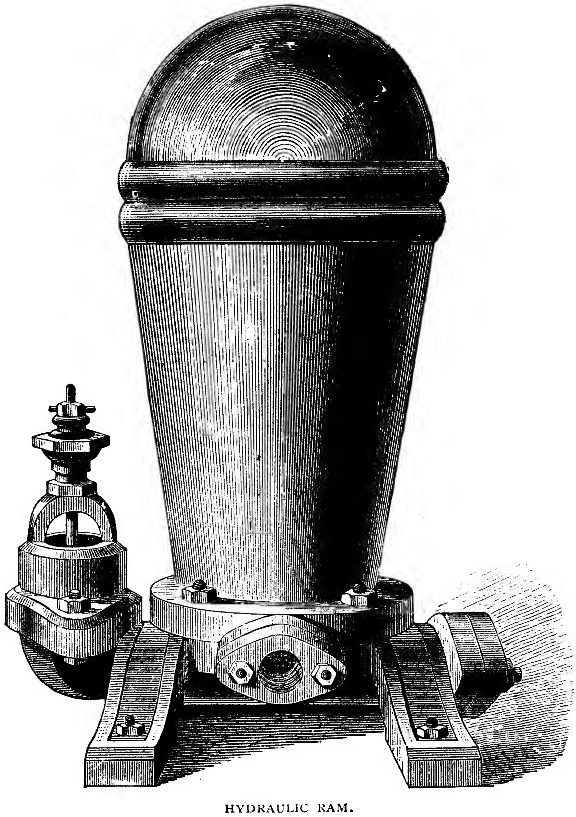


DOUBLE-ACTING PUMP, SHIP OR FIRE.

Hodges.

Extent of modern improvements.

their own power was afterwards abandoned. In 1859 a machine was built in New York, weighing only five thousand pounds, to be drawn by hand. That then came to be the standard weight of this class of engines, and a great many patterns of them have since then been invented and perfected. Boston, Philadelphia, Chicago, and other large cities, made experiments with this class of fire-apparatus ; and the result has been that all large communities have now adopted them permanently, and discarded their old hand-machines. New-York City has thirty-five of the new class. Those at present in use are

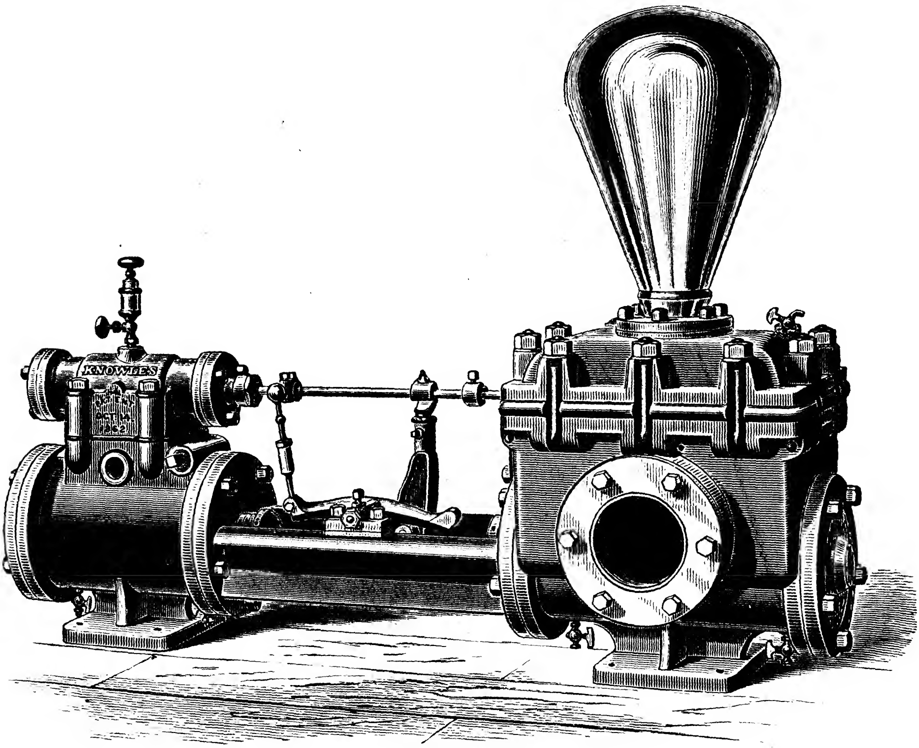


HYDRAULIC RAM.

drawn by two horses each, and will throw a five-eighths inch jet over a hundred feet high, sometimes a hundred and thirty feet. They are supplied either with piston pumps or rotary pumps ; the latter being a new idea in this class of machines, introduced about fifty years ago, and within the last twenty has become exceedingly popular. An animated controversy has raged between the rival makers of steam fire-engines as to the respective merits of the rotary and the piston principles. A continuous flow, however, is maintained with both. In the best types of engines now made steam is raised in five minutes. The principal factories are those of the Amoskeag Company, Silsby & Company of Seneca Falls, N.Y., the Paterson Company of Paterson, N.J., and E. A. Straw of Manchester, N.H; but there are half a dozen other manufacturers.

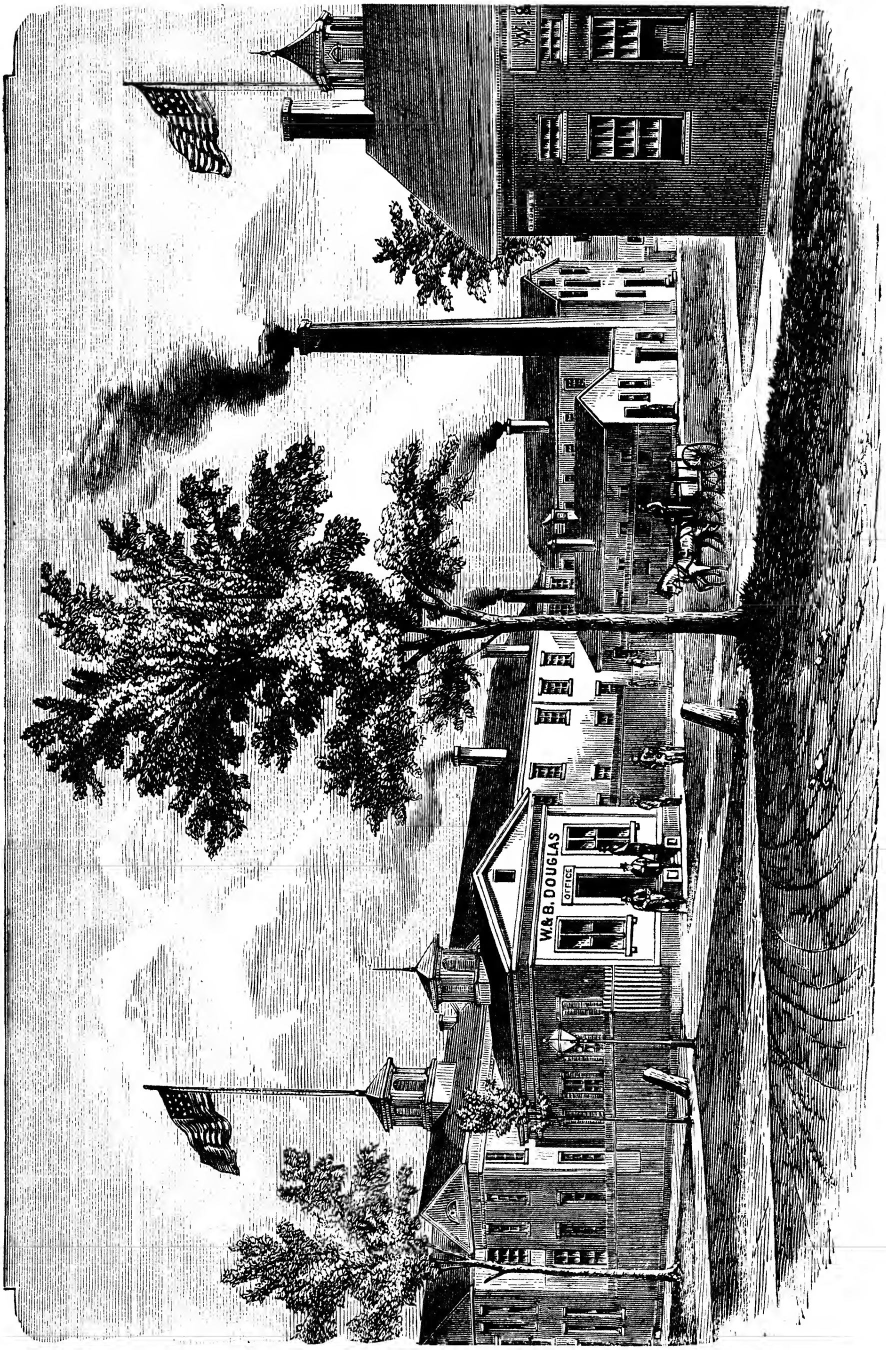
Within the last forty years a change has taken place with regard to pumps in domestic use, and the fire-engine is no longer the peer of pumps. Water-works have been extensively introduced to cities and villages; and this has led to a double result: first the almost total abolition of the common iron pump from households in those cities and villages, and the construction of a new class of massive machines of enormous power to take their place, by forcing the water through pipes and mains, under pressure, to the different houses and buildings of the community.

Pumps for supplying cities with water.



STEAM-PUMP.

A great many towns have been able to build reservoirs on the adjacent hills or high lands, at such a height above the place as to insure a heavy pressure in all the water-pipes of the place by the operation of gravity. But not all communities are so happily situated; and, in order to secure a distribution of the water, resort is had to powerful forcing-engines. These machines are built so massively that they frequently constitute the heaviest machinery in



W. AND B. DOUGLASS'S PUMP-FACTORY, MIDDLETOWN, CONN.

operation in a city, and are one of the local wonders of the place. They are either piston or rotary pumps. The rotary pumps, if driven by water-power, are direct acting; that is, the shaft of the turbine rises into the box of the rotary pump, and forms the axle of the pump, or else gears into the axle. The turbine moves naturally with such velocity, that no special gearing is required to increase the speed of the pump. If steam is used, or if a piston-pump is employed with water-power, the machine-room is generally supplied with a heavy fly-wheel, which maintains an equable motion. The piston-pumps are of cast-iron, with steel pistons and iron valves, fitted with great nicety. The workmanship upon them is of such superior order, that foreign engineers have given it hearty commendation. In some of the water-works built on the Holly principle gangs of piston-pumps are used, there being eight pumps in the set. The eight pistons rise one after the other; and a continuous flow of the water is thus obtained, and the pulsations in the pipes of the city, frequently heard, are obviated.

Heavy pumps have also of late been used to keep the gold and silver mines of the Territories free of water. There is nothing peculiar in their construction.

CHAPTER III.

MANUFACTURES OF GOLD, SILVER, AND OTHER METALS.

IN the republic of industry, iron is the president of metals; but it by no means fulfils all the purposes in the arts for which a metal is desirable. It is durable, and enormously strong; but it is corrosible even by water, and is, therefore, unfit for dishes and utensils, except for coarse uses, and then only to a limited extent. It is not a handsome metal, being utterly without rich color and decorative effect; and cannot, therefore, be used for ornament and for fine statuary. It lacks delicacy of texture, and cannot be readily and elegantly wrought; and can play no part in the manufacture of delicate ware for the gratification of luxurious tastes, even had it the beauty and value which would incline one to devote it to such purposes. It is too abundant to be precious; and cannot, therefore, be used as a medium of exchange. To supply the defects of iron for luxurious and many common uses, a bounteous Providence has stored the rocks prodigally with a variety of other metals of great beauty and value, which experience and scientific research have enabled man to abstract from their mineral surroundings, and apply to a thousand important uses. Gold, silver, and copper — all noble metals — were the first of them which were utilized by man, and, indeed, the first which were utilized at all; and so true is this last remark, that gold, silver, and copper were not only the primary metals employed in the arts by the ancient peoples of Europe and Asia, but were the first which the savages of America also took from the rocks, and worked up into tools and ornaments. The reason of this early popularity of gold, silver, and copper, is doubtless to be found in the fact that they were beautiful metals, attractive to the eye, and so soft as to be easily worked. Iron, zinc, and lead were discovered and employed next, and, after iron, platinum, last of all. Copper was the great resource of antiquity for all objects of metallic manufacture. They hardened it with zinc and tin, converting it into brass and bronze, and making of it arms, tools, armor, utensils, and many ornaments. They put it into their gold and silver to give them hardness and durability, and used a great deal of it pure. Silver and gold gradually

Iron: its unfitness for many purposes.

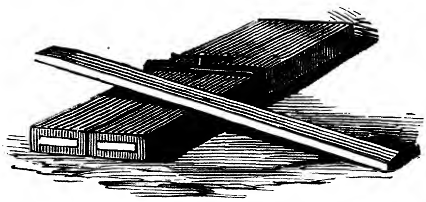
Extensive use of copper by ancient nations.

superseded it for elegant purposes, however, on account of their greater splendor and incorrosibility, and to this day are the matchless metals for table-ware, ornaments, and decorations. They are charming metals to work, and objects made of them can be covered with a profusion of luxuriant sharp-cut ornament which is absolutely unattainable in any other mineral substance. Their scarcity renders them additionally valuable, and, with their other qualities, marks them out as the true metals for a medium of exchange in trade. Copper, however, still maintains its rank next to iron for purposes of utility, and next to gold and silver for beauty. Tin, zinc, and platinum have properties of beauty and incorrosibility such as iron does not possess, and the first two were greatly valued in antiquity for their ability to make beautiful alloys with copper. They are still extensively employed for the same purposes, and also for others which modern invention has discovered that they alone are good for. A variety of other metals have been found in the earth, — lead, antimony, aluminum, iridium, mercury, nickel, manganese, &c., — each with special and valuable qualities, which have given it a distinct *rôle* to play in the arts, which iron nor any other substance can perform equally well. The culture and convenience of mankind have been promoted immensely by the discovery of this wide range of diverse metallic substances. Each one of the seven principal metals has done its distinct share in lifting man from barbarism to civilization. Collectively they have in every age supplied the principal motive for exploration, conquest, and colonization, and each one has exerted its influence on passing events; and it is not too much to say, that, had any one of them been lacking from the resources of Nature, the whole history of the world would have been totally different from what it has been. With reference to the United States, it may be said that Nature has blessed our territory with ample stores of all the principal metals except tin, and with a large supply of many of the rarer kinds. As the race which took possession of the country, and settled and developed it, was an educated one, and full of the spirit of modern enterprise and industry, it was natural to expect a development of the manufacture of the metals sooner or later in the country. The expectation has already been realized. The facts in regard to iron have already been set forth: those in regard to gold, silver, copper, and the rarer kinds, will now be related.

COINAGE.

Employment of gold and silver as money.

The most important employment of gold and silver is as a medium of exchange in trade. This was not the primary use. Gold and silver first subserved only the vanity, and love of magnificence, on the part of kings and conspicuous people, and the popular taste for the decoration of temples and statues. Articles made of the two metals were, indeed, bartered for other goods; but the notion of measuring the value of all articles by a weight of pure gold or of pure silver was invented only after trade had been carried on by barter for centuries. A common medium of value at length became necessary, and nothing answered the purpose so well as these beautiful and universally-admired metals. In the days of chivalry it was not an uncommon practice to wear heavy chains of gold or silver about the neck, and pay the score at the wayside tavern by breaking off a link or two of the precious metal. But a more accurate mode of payment was desirable, and the more popular custom of striking coins of gold and silver of given weights and purity to pass from hand to hand in trade gradually superseded all others. In the gold-mining regions of the United States, since 1848, another mode of employing gold as a medium of exchange was resorted to more or less before local facilities for coining were created, and banks were established to issue paper money. This was to carry about little bags of gold-dust, and pay all debts and scores by weighing out a proper amount of the metal. The method is still in use in remote districts to a limited extent, and is the same in principle as payment in minted coin; that is to say, by specific weight and purity of metal.



INGOTS.

Barter.

When this country was first settled, trade was carried on by the inhabitants after the primitive plan of barter. Tobacco was an almost universal medium of exchange in Virginia and other Southern colonies; and cattle, skins, wheat, and other produce, were used in the Northern colonies even to pay taxes. Gold and silver were extremely rare. What little there was in the country was brought at first from England and Holland by the colonists, or received from those two countries in exchange for the products of their labor. It was too valuable to circulate much, and its owners generally preferred to hoard it. Houses and ships were built, and real estate bought, by barter. After a few years, a supply of silver coin was obtained by trade with Cuba and the Spanish settlements in the other West Indies. This was an illegal trade, because England and Spain both required their respective colonies to deal only with the mother-country; but it was winked at by both countries on account of its obvious advantages to both the English and the Spanish colonies. The latter obtained fish, flour, and other food which they could not raise themselves; and the former secured silver coin wherewith to pay England for the manufactures they were forced to buy of her. The exports of produce from the English colonies never paid for the imports of manufactures, and the balance in trade had to be paid for with coin. The colonies, having no money of their own, were flooded with foreign coins, principally silver, but partly of gold also, the larger part of the currency being Spanish. English shillings, and sixpences, and the Spanish dollar with

First use of silver.

its fractions, were the principal money. Gold-pieces, such as guineas, doubloons, joes, pistoles, &c., were also in circulation, but were too greatly prized for conversion into jewelry to play a very important part in trade. The Spanish dollar became the accepted unit of the circulation.

The colonies always wanted a coinage of their own, and some rough pieces were struck at various times. Massachusetts established a mint for the production of silver shillings, sixpences, and threepences, which were made of twopence to the shilling less value than the English coin, so as to insure their remaining at home. The larger coin was the famous pine-tree shilling. Virginia and the Carolinas also coined pennies. These ventures were regarded with great disfavor in England as an infringement on the prerogatives of royalty, and they became short-lived experiments in consequence.

Pine-tree coinage.

Nothing more was done about a mint until 1782, when Robert Morris — the best financier of his day, and who had more than once helped Washington through a crisis by his advances of hard money to the national treasury — was asked to report a system of coinage. Mr. Morris complied, and his report formed the theme of debate for a number of years. The foundation of the currency had been for years the Spanish dollar, and contracts for hard money were always payable in that coin. In order to determine the exact value of the coin, so that no injustice might be done by replacing it with American pieces, careful assays were made by Hamilton, and $371\frac{1}{4}$ grains of pure silver were fixed upon as the standard value of the Spanish dollar. The equivalent of this in gold was fixed at twenty-seven grains. Several plans of coinage were suggested; and finally one proposed by Jefferson was adopted, and enacted April 2, 1792. It conformed to the decimal notation, and included a golden eagle of 270 grains (fineness $916\frac{2}{3}$), a half-eagle of gold, a quarter-eagle, and a dollar, a silver dollar of 416 grains (fineness $892\frac{2}{5}$), a half-dollar, quarter-dollar, dime, and half-dime, and a copper cent of 264 grains. A mint was established at Philadelphia, some very noble devices adopted for the coins, and the striking of metal money began. This first gave the Americans a money of their own, and the Spanish and other foreign pieces gradually disappeared from the purses and money-boxes of the people. They were mostly sent into the mint, and recoined. It took some time, however, to effect the change, because the facilities of rapid and safe transportation of money from one point of the country to another had not yet been created; and, the circulation of foreign coins being permitted, merchants and bankers preferred to let matters take their own course without forcing them.

Establishment of mint at Philadelphia.

Jefferson's system.

Two varieties of the coins authorized by the act of 1792 were worth too much to circulate. Owing to a rise in the value of copper, it was found that the cent had been made too heavy, and was worth more than the hundredth part of the dollar. The weight was accordingly changed, Jan. 14, 1793, to

208 grains. A year or two later it was reduced to 168 grains, and remained at that standard until discontinued in 1857. The gold dollar and its multiples were also too heavy. By an error in the calculation, twenty-seven grains were erroneously fixed upon as the equivalent of the silver dollar; and gold, though coined to a limited extent, never came into use under the law of 1792. The reason was, that the eagle, while worth more than ten dollars in silver, could only circulate as ten dollars; whereas for exportation it would bring its true value as 270 grains of bullion of a certain purity. The gold coin, accordingly, was all sent abroad to pay for foreign purchases; and the only metal currency of the United States was silver and copper until after 1834.

Difficulty with coinage of 1792.

VIRGINIA HALFPENNY.

About that time there was a gold furore in the United States, caused by the discovery of that precious metal in Georgia and in the mountains of the Carolinas. The yield of gold from the mines which were opened was never extravagantly large; but it was sufficient to cause the public men of the United States to resolve to restore gold to the circulation of the country. A careful study of the relative values of gold and silver was made, and a ratio of values agreed upon. In order, however, to make the gold dollar circulate, its weight was not only reduced to the proper point to make it worth exactly the same as the silver dollar, but it was brought just a trifle below it. The law of June 28, 1834, was then enacted, creating a gold eagle of 258 grains (899.225 fine, changed in 1837 to 900 fine) and a half and a quarter eagle of relative weight. The gold dollar of 25.8 grains was authorized March 3, 1849. The mint went actively to work coining gold; and a few years later, after the discovery of gold in California, branch establishments at San Francisco, New Orleans, and Carson City, were opened to aid it to dispose of the vast quantities of metal which were brought to it for conversion into current money. The law of 1834 produced an unexpected result. In lessening the weight of the gold coins, Congress had aimed only at preventing their exportation. But now the silver dollar, being worth more than a gold dollar as bullion or for exportation, was rapidly exported or melted up, and, in an exceedingly short time, totally disappeared from the circulation. The silver dollar was reduced to $412\frac{1}{2}$ grains (900 fine) in 1837; but that did not arrest the change which was going on. Silver began to grow extremely scarce. There was hardly small change enough to transact the business of the people. The dollars and half-dollars were at four per cent premium for export, and the stock in the country was growing beautifully less day by day. The people could not go back to barter for the purposes of trade; and, in order to supply the demand for small

Creation of gold-pieces.

Withdrawal of silver.

change, the merchants began to issue a sort of fractional paper currency, which was extensively used in large cities. In order to afford the people the needed relief, Congress enacted a law, Feb. 21, 1853, changing the weight of the half-dollar to 192 grains (900 fine), and the smaller coins relatively. That gave the people a subsidiary coinage for small business-transactions; but it finished the silver era of American money at a blow. All the old silver disappeared like a flash into melting-pots and bullion-offices; and gold became the standard money, with silver for small change.

Effect of war upon metallic currency.

All metal money, except copper, bronze, and nickel cents, two-cent and five-cent pieces (the bronze and nickel pieces authorized in 1862, 1865, and 1866), went out of circulation in the United States shortly after the outbreak of the war of 1861. The government, and banks North and South, issued so much paper money, that its value fell below that of coin, and coin disappeared. It is only in 1878 that the value of paper has approached so closely to that of coin, that coin is again in circulation.

Since the establishment of the mint in 1792, and its branches in later years, the following values of money have been struck under the laws of the United States up to June 30, 1877: —

Double-eagles	$809,598,440
Eagles	56,707,220
Half-eagles	69,412,815
Quarter-eagles	26,795,750
Three-dollar-pieces	1,300,032
Gold dollars	19,345,438
Silver dollars	8,045,838
Trade dollars	24,581,350
Half-dollars	118,869,540
Quarter-dollars	34,774,121
Twenty-cent-pieces	270,858
Dimes	16,141,786
Half-dimes	4,906,946
Three-cent-pieces	1,281,850
Nickel five-cent-pieces	5,773,090
Nickel three-cent-pieces	855,090
Bronze two-cent-pieces	912,020
Copper cents	5,304,577
Half-cents	39,926
Total gold	$983,159,695
Total silver	208,872,289
Total minor coins	12,884,703
Grand total	$1,204,916,687

While the government exercises the sole right of coining the precious metals for the purposes of a medium of exchange, and of regulating the fineness of the pieces, it does not carry on the process of minting for profit. Coining was formerly a source of enormous gain to royalty in Europe, when the people were systematically defrauded by the issue of pieces worth far less than their nominal value, in order that the king might make the difference. In the United States the mint has always been merely a factory where the people can bring their gold and silver and other metal, and, by paying a small charge for the expenses of the operation, have the metal converted into pieces of a given weight and fineness. The stamp of the government is merely the certificate of its weight and fineness. Coining has never been carried on by the people, except under the stress of a great necessity, and then only to a limited extent. During the war a vast number of copper tokens, which passed current as a cent, were coined for business-men; and, during the early days of gold-mining in the West, private firms established private mints at Denver, Col., and in San Francisco. The coins they struck were merely tokens; and, though they were largely twenty-dollar-pieces, they were always worth more than their face as bullion. The miners resorted to these mints merely as a resource for having their gold-dust converted into convenient form for shipment to the States.

Minting not carried on for making a profit.

The process of coining is very simple, and is substantially the same, whether the pieces struck are of gold, silver, copper, or nickel. Gold and silver are brought to the mint in many different forms, — in the form of gold-dust, amalgamated cakes from the retorts of the stamp-mills, laminated bars, assayed bars, plate, jewelry, and foreign coin. The metal is sent first to be assayed, where the pure gold and silver are first extracted, and then severally alloyed in the proportion of nine per cent of pure metal to one of alloy. The metal comes to the mint proper in flat bars. It is weighed, tested to ascertain its fineness, and is passed over to the manufacturing department. The bars are then annealed, and rolled at a red-heat into long, thin strips. They are again annealed, and drawn out between steel plates of the hardest steel to the proper thickness for coining. From the strips thus obtained a machine punches out round planks, or planchets of the proper size for coining. The punch cuts out a hundred and sixty a minute. The blanks are collected, and the perforated strip sent back to be melted and re-rolled. The blanks are then cleaned, and a few pieces from each lot weighed in delicate balances to ascertain if they are of the proper standard. In old times, when coins were struck by hand on an anvil, pieces differed materially in weight; and the merchant balanced each one on his finger, and estimated its value, before he took it. The use of machinery has obviated the ancient wide differences in weight; yet it is impossible to prevent a shade of variation, and the mint does not attempt to give each piece a mathematically exact value. What is called a "working tolerance" of weight is allowed. This legal deviation is as follows: —

Process of coining.

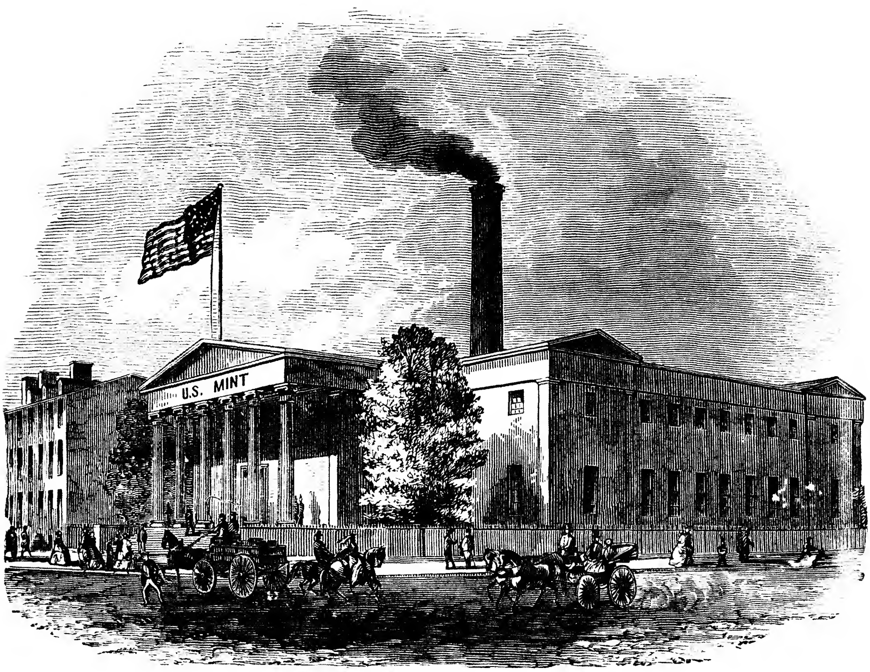
THE PIECE.	ITS WEIGHT IN GRAINS.	WORKING TOLERANCE IN GRAINS.
Double-eagle	516	½
Eagle	258	½
Half-eagle	129	¼
Quarter-eagle	64.5	¼
Three-dollar coin	77.4	¼
Dollar	25.8	¼
Silver dollar	412.5	1½
Trade dollar	420	1½
Half-dollar	192.9	1½
Quarter-dollar	96.45	1½
Twenty cents	77.16	1½
Dime	38.58	1½

Pieces which fall below the standard by more than the above variation are called "condemned lights," and are sent back for re-melting. The "heavies" are reduced to the proper point by filing. The others are called "standards." When those of the right weight are sorted out, they are milled in a machine which raises the edge so as to protect the device of the completed coin from wear. The blanks are then cleaned, polished by agitation, and sent to the coining-press. The press is a simple but very massive machine. When double-eagles are coined, it is made capable of administering to the golden blanks a grim thrust of seventy-five tons. The blanks are put into a tube, and slip down one by one upon the bed of the press. They rest upon a die containing the device of one side of the coin, while a die containing the other comes down upon them. The impression of both sides, and the fluting of the edge to save it from filing, are given all at once. Steel fingers pick up the stamped coin, and remove it. The ordinary speed of coinage is from sixty to eighty per minute. A pair of dies lasts about two weeks.

FIRST UNITED-STATES DOLLAR.

Operations of mint not solely confined to coining money.

The operations of the mint are not confined entirely to the coining of American money. A great many commemorative and other medals ordered by Congress are struck from time to time, and there has been some work for foreign governments performed. At Philadelphia 12,000,000 nickel pieces were struck in 1876 for Venezuela. The establishment at Philadelphia is the principal one in the country, and has a capacity of about 25,000 pieces an hour. The branch at New Orleans has been idle for several years, owing to the war and the falling-off in coinage during the era of paper money. It was usefully employed in previous times in converting the Mexican dollars to our own coinage. The Pacific-coast mints have run principally upon trade dollars for export to China, Japan, and India, that coin having been authorized in February, 1873, simply for export purposes. The piece is not for circulation in the United States, and was made heavy in order that it should certainly go abroad. It has been very successful in taking the place of the Spanish and Mexican dollars in Asiatic countries. The new labors imposed upon the mints by the law



PHILADELPHIA MINT.

of 1878, remonetizing silver, will tax all the establishments in the United States heavily, and compel the one at New Orleans to be re-opened, and a new one to be built.

Total coinage.

It has already been stated, on the basis of a report by Dr. Lindeman, director of the mint, that the total coinage of the United States up to June 30, 1877, was $1,204,916,987. How much of this coinage remains in existence, and how much of what remains in existence is still in the United States, available for circulation, is not certainly known. If the flow of specie into the country and out of it, for the purposes of trade, were to be alone regarded, it would appear that there was none of it scarcely left in the land of its origin. The movement of specie since 1820 has been as follows: —

	IMPORTS.	EXPORTS.
From 1820 to 1830	$69,143,780	$71,538,456
" 1830 to 1840	107,469,296	56,839,893
" 1840 to 1850	86,835,992	65,010,921
" 1850 to 1860	71,187,934	495,111,813
" 1860 to 1870	188,450,442	659,865,683
" 1870 to 1877	162,561,195	534,360,182
Total	$685,648,639	$1,882,726,948

This would seem to show that the whole coinage of the United States had been substantially exported; but fortunately a large part of the export, perhaps $500,000,000, was in bullion, and consequently the drain upon the coinage was lessened by that amount. Those who have studied the subject closely believe that about $300,000,000 of the gold and silver of the United States has escaped the melting-pot, and is still extant, and held in the country, and therefore available for circulation. The rest is believed to have been recoined in Europe, or consumed in the arts.

Extent of export of coins.

THE WASHINGTON HALF-DOLLAR.

JEWELRY.

The most ancient use of gold and silver was probably for personal adornment. The rarity and beauty of the two metals caused them to be prized for this purpose from the very beginning. At first the kings monopolized gold and silver to themselves for table-ware, jewels, and the gilding of their arms and palaces; but the rich discoveries in Africa and Spain caused them to come into more popular use, and wealthy people employed them for all the purposes named, and also for money. The Orientals were passionately fond of decoration. They loved rich colors and gold and silver ornaments in profusion; and doubtless John was in ecstasy over the sight, when, looking up from his rocky Patmos, he beheld the New Jerusalem with its jasper walls, its streets of gold, and gates of shadowy pearl. Color and ornament were becoming to those dusky-hued people; and they could wear a luxuriance of both which the cooler taste of the North would

Early use of gold and silver for ornament.

not approve, and which, in the United States of to-day, would be regarded as highly objectionable. The manufacture of jewelry was, therefore, one of the earliest arts. The Egyptians and Phœnicians became celebrated in it. The treasure of the kings consisted of gold and silver dishes and jewelry, with arms made of the baser metals; and these things constituted the most highly prized gifts. Rebekah was wooed with ear-rings and bracelets of gold; Isaac probably not having heard the line from the old poem, "Win men with thy sword-arm, and maids with thy tongue," or at any rate trusting (and successfully too) to the influence of splendid jewelry to create a favorable first impression. Juno, when she wanted to beg a favor of Jove, began by putting on a dazzling array of golden tassels and jewels. Jewelry was greatly valued even among the more *spirituelle* peoples of the north of Europe; but its use, which was ascribed chiefly to the gods and to kings, was, until modern times, more limited. In the days of early superstition it was imagined that the jewels of the gods were fashioned in the bowels of the earth by the dwarfs; and Oehlenschläger wrote a pretty poem entitled "The Dwarfs," in which he described their marvellous manufacture: —

"He crept on his belly as supple as eel
The tracks in the hard granite through,
Till he came where the dwarfs stood hammering steel
By the light of a furnace blue.

I trow 'twas a goodly sight to see, —
The dwarfs, with their aprons on,
A hammering and smelting so busily
Pure gold from the rough brown stone.

Rock-crystals from sand and hard flint they made,
Which, tinged with the rosebud's dye,
They cast into rubies and carbuncles red,
And hid them in cracks hard by.

They took them fresh violets, all dripping with dew,
Dwarf women had plucked them the morn,
And stained with their juice the clear sapphires blue
King Dan in his crown since hath worn.

Then for emeralds they searched out the brightest green
Which the young spring meadow wears,
And dropped round pearls, without flaw or stain,
From widows' and maidens' tears.

. . . .

Then they took them the skin of a large wild boar, —
The largest that they could find;
And the bellows they blew till the furnace 'gan roar,
And the fire flamed on high for the wind.

They took them pure gold from their secret store, —
  The piece 'twas but small in size;
But, ere 't had been long in the furnace roar,
  'Twas a jewel beyond all prize.

A broad red ring all of wroughten gold,
  As a snake with its tail in its head;
And a garland of gems did the rim infold,
  Together with rare art laid.

'Twas solid and heavy, and wrought with care;
  Thrice it passed through the white flame's glow:
A ring to produce, fit for Odin to wear,
  No labor they spared, I trow."

In the United States the use of jewelry was at first discouraged, partly because of the poverty of the original colonists, but, in the North, more on account of the ascendency of Puritan and ascetic ideas. Most of the colonists in New York, Virginia, and the other middle and southern provinces, brought with them a few articles of ornamental work in gold and silver; but they bought little or none when they got here until after the Revolutionary war. Only a few families thought fit to make purchases of this description. The gold beads and the few other ornaments in the family were handed down from one generation of women to another as precious heirlooms. With the rise of prosperity after the Revolution a moderate amount of luxury began to prevail, and ascetic ideas to lose their influence. A demand for jewelry sprang up. Guineas and doubloons and Spanish dollars began to be converted by the goldsmiths of the times into rings, seals, watch-chains, and pins. Public sentiment was still opposed to much ostentation. Republican simplicity of dress and manner was preferred. Still the taste for ornament rapidly grew, and somewhere about 1790 the trade in jewelry became so large as to tempt a native workman to begin the manufacture of it in this country. Epaphras Hinsdale of Newark, N.J., is believed to have been the first regular manufacturer of American jewelry. He was a mechanic of great ingenuity; and somewhere from 1790 to 1795 he devoted himself to the production of the brooches, seals, and other simple gold and silver ornaments, worn at that day. Hinsdale died about 1810; but one of his men, by the name of Taylor, followed him in the business, and put fresh vigor and capital into it. Both of these men used gold sixteen carats fine, and their work was all solid. Every piece was made by hand by hammering, filing, welding, and soldering.

Use of jewelry in United States was formerly discouraged.

Opposed to republican simplicity.

First manufacturer of jewelry.

About 1800 the manufacture of jewelry was begun in New England, the very seat of the ancient abhorrence of ornament, by two or three firms at Providence, R.I. The fact illustrates the great revolution which had taken place in the world of ideas since the days of "The Mayflower" and Miles Standish. Providence immediately became the chief centre of the industry in this country. By 1810 its firms were employing a hundred men in the business, and producing jewelry to the yearly value of a hundred thousand dollars.

Early manufacture at Providence.

In 1812 George F. Downing was making watch-seals at Newark, N.J. He carried on the business for many years. In 1821 he removed to the growing city of New York, and diversified his manufacture greatly. The only other concern in New-York City at that time is believed to have been that of La Guerre, a Frenchman who had a jewelry-shop in which he employed French workmen. La Guerre had started about 1812. The work of these two makers was of solid gold and silver, and all produced by hand.

Yankee ingenuity had devised a thoroughly different mode of manufacture, however, and New England was filling the country with a less expensive kind of jewelry. Almost from the very first the Providence makers employed machinery, and began to produce what is called filled work. The ornament was stamped by a die from a ribbon of gold or silver, the gold being about eighteen carats fine; that is to say, containing eighteen pennyweights of pure gold to six pennyweights of alloy. The softness and tenacity of the metals permitted them to be stamped into the most elaborate forms. The hollow jewel was then filled with pewter or lead, and fitted with a back of gold of inferior quality. Ornaments in a thousand patterns were thus produced, which were to all appearance of solid gold, but which could be made and sold for a small fraction of the expense of solid gold jewels. In the manufacture of this work a great deal of gold plate was used, made by putting a thin sheet of gold upon one of copper, and rolling them out in the rolling-mill, the two sheets being first united by fusing. Filled jewelry found a wide market from the very first. The universal Yankee peddler sold immense quantities of it, and the manufacture of it increased year by year. Other cities began the business; but so rapidly did the demand increase, that from 1830 to 1837 it was beyond the power of American factories to respond to it. The discovery of gold and silver in California and in the West gave a new impulse to jewelry manufacture, especially of the more solid kinds. Factories of it started up everywhere. In 1860 there were 463 establishments making jewelry in the United States, employing 5,947 workmen, and struggling to keep pace with the growth of population and luxury, — a task which they found to be one of considerable difficulty.

Filled work.

Rapid increase of business.

The war of 1861, which impoverished the South, and led to a decrease in the amount of jewelry worn in that part of the republic, gave an enormous stimulus to it in the North. Speculation was rife in every part of that section. The issues of paper money stimulated business. Everybody was making and spending money, and all classes of the people indulged in expenditures for objects of luxury and ornament to an extent never before known. The rich bought diamonds set in solid gold, solid gold and silver bracelets, rings with emeralds and other precious stones, gold pins and buttons, and all the varieties of ornaments which the jeweller's art has produced; while the poor bought pins, ear-rings, bracelets, finger-rings, and necklaces of the cheaper styles of filled work. From 1860 to 1870 the factories increased from 463 to 681 in number, and the yearly production from $10,415,000 in value to $22,104,000. In 1870, 10,091 people were employed in the business. The growth of those ten years of inflation and speculation has not been maintained, however. The panic of 1873 struck a heavy blow at jewelry-making. It was one of the first industries to suffer, and production has fallen off materially: a revival is only beginning to take place. The manufacture of solid work has suffered the least from the period of retrenchment and economy, because the rich, who are the buyers of the work, were the least affected by the times. The chief centres of the jewelry-trade now are Providence, R.I., which has about seventy-five establishments; Philadelphia, with fifty-five factories; New York, with two hundred; Bristol County, Mass., with thirty-five; and Springfield, Mass., Boston, Cincinnati, San Francisco, and Newark, N. J. The filled work is mostly made in New England and New Jersey. The principal New-York factories, such as Tiffany & Company, produce nothing except solid jewelry made by hand, each piece being unique, and seldom copied.

Increase of industry during the war of 1860-64.

Effect of panic of 1873.

A great many alloys of gold are used in the making of ornaments. Silver is used pure, being alloyed only to give it hardness. Gold is fused with copper to give it a red color, and with silver to give it a silvery lustre. It is seldom used purer than twenty-two carats, nor inferior to fourteen carats, because it would tarnish and stain below that purity. It is given either a polished, dead, or frosted surface, and is often elaborately ornamented by soldering gold wire upon it to form a pattern, or by chasing with a tool. In large factories a corps of designers is kept steadily employed in producing new patterns in pins, bracelets, rings, &c., ideas being borrowed from every source, ancient and modern. Chinese, Japanese, and antique types are now the rage. New-York-City makers are borrowing liberally from the patterns in the Cesnola collection of antiquities at the Metropolitan Museum. In the hand-labor shops it often takes two and three weeks to make a single piece of jewelry, and set it with stones: in the machine-shops thousands of pieces are completed in a single day.

Alloys of gold used in making jewelry.

Platinum is now used to some extent by the goldsmiths of the United States for the more expensive kinds of ornaments. The metal very much resembles silver, and is readily worked. It has the desirable quality of resisting chemical action, and does not tarnish as easily as silver. It is the best material, therefore, for such costly ornaments as plumes set with diamonds, to be worn in the hair.

Platinum.

Tortoise-shell and jet jewelry is also largely made. These varieties are not only cheaper than the others, but they are also very pretty, and enable thousands to gratify their love of decoration who are debarred from buying gold and silver and precious stones.

Tortoise-shell.

The diamonds and other gems which are set in the more costly articles of jewelry are nearly all imported. The rocks of the United States supply only the agate, garnet, opal, and a few of the cheaper varieties of gems.

Diamonds.

GOLD AND SILVER LEAF.

A large amount of gold, and some silver, is consumed annually, in the form of gold and silver leaf, in the decoration of the covers of books, in the gilding of picture-frames, furniture, &c., and by dentists. The quantity is almost if not quite as large as that employed either in coinage or in jewelry; and it is an actual consumption, because it does not pay to attempt to save the leaf after the articles to which it is applied are worn out, any more than it pays to collect the worn-out ends of lead-pencils, or the stumps of cigars. It must be said, however, that the use of the metal in the leaf replaces, to a certain extent, the employment of solid metal. The lavish use of gold and silver leaf took its rise in modern times in Italy and France. The passion for it in France outran all bounds, either of good taste, or prudence in expenditure. The rise of luxury in England creating a similar rage for gilding, the drain upon the world's supply of gold became very large. In the time of James I. the loss became so serious, that a special act was passed, restricting the use of gold-leaf, and permitting it to be employed only for specified objects, the decoration of military trappings being the principal one. After the discovery of gold and silver in America there was no need of further economy, — at least not on account of any supposed danger of using up the world's supply of the metals, — and gilding and silvering rapidly became universal. In this country the taste for that style of decoration has latterly outgrown the ability of people to afford it to the extent which is desired; and a number of cheap bronze and other imitation gold and silver leaves and powders have been invented for the lettering of large signs, the illumination of paper-hangings, &c., so as to put gilding and silvering within the reach of the masses for common purposes. Genuine gold and silver hold their own, however, for the better sort of decoration. Their use increases year by year. Latterly the use of silver-leaf has been almost superseded in the arts by the process of silvering called electro-plating, which is elsewhere described; but a small amount is still consumed.

Gilding.

Gold-beating is one of the most ancient of arts. The process is very simple, and differs from the practice of the olden time principally in the use of the rolling-mill for part of the work. Instead of hammering out the leaf

Gold-beating an ancient art.

directly from the ingot, the ingot is now rolled until it is reduced to the thickness of $\frac{1}{800}$ part of an inch before it goes under the hammer. An ounce of gold will make a strip ten feet long and an inch and half wide when rolled to the thickness of $\frac{1}{800}$ part of an inch. For beating, the delicate strip is cut up into pieces an inch square. Each piece is laid upon a leaf of fine vellum four inches square, and a hundred and fifty of these leaves piled up one above the other, with a few extra pieces of vellum at each end. This pile is called a "kutch." It is put into a parchment case, so that the four sides are protected; and a workman rains upon it a shower of blows from a sixteen-pound hammer, turning the pack over end for end occasionally, bending it between the hands so as to make the gold leaves spread readily, and interchanging the different parts of the pack. The hammer has a convex face. In about twenty minutes the little squares are spread to the full size of the vellum. They are then taken out, cut into quarters, and again packed and beaten. They are once again taken out, quartered, and beaten until the original inch-square pieces have been beaten out to 192 times their original size, and the thickness reduced to about $\frac{1}{150000}$ part of an inch. They are often beaten again. The ordinary commercial gold-leaf is usually beaten out to $\frac{1}{200000}$ part of an inch; but the French have reduced it to $\frac{1}{280000}$ part of an inch, spreading out an ounce of gold to cover a surface of 160 square feet. Imitation gold-leaf is made by gilding brass, and rolling and beating it out in the usual way. Silver-leaf, which is very beautiful, cannot be reduced to quite the thinness of gold, but is hammered out to $\frac{1}{100000}$ part of an inch; which is thin enough for this less costly metal.

Attempts to substitute other modes of manufacture.

Various attempts have been made to substitute a machine for hammering gold and silver leaf in place of the hand-process. New England brought out several devices for the purpose, and exhibited them at the world's fairs. They have not proved popular, and have virtually been abandoned.

How gold-leaf is put up for market.

Gold-leaf is put up for the market in little books of smooth paper, containing twenty-five leaves each, which are kept from sticking to the paper by preparing the latter with chalk or red ochre. The books are sold in packages of a dozen.

SILVER TABLE-WARE.

Colonists had but little silver-ware.

There was very little silver-ware to be seen upon the tables of the early colonists of the United States. Such a luxury was beyond the means of all except a very few, and was, besides, inappropriate to the era of log-cabins and leather garments. A few families in New York, Maryland, and Virginia, had silver plate; but they were chiefly the families of rich planters, old Dutch patroons, and royalist governors. A large part of the population were unable to afford even china, which was expensive then; and pewter plates and dishes were often the sole furniture of the table in country houses. A great deal of even the small amount of plate hoarded by old families disappeared after 1792. It was sent to the mint, and coined.

After the peace of 1815 there came an era of prosperity and speculation, during which there sprang up a demand for objects of luxury and value. Considerable importations of silver plate took place in consequence. The plate was generally solid, and always costly. Snuff-boxes and candlesticks and other objects were sometimes imported, which were made of the baser metals, and covered with gold or silver leaf by mechanical processes; but usually the ware was solid and substantial, and worth its whole weight as bullion. The expense of solid plate made its purchase by the majority of the people very limited; and, indeed, the austere ideas of the days of colonization were still sufficiently universal to make public sentiment unfavorable to the use of much silver upon the table. Martin Van Buren was defeated for re-election as President of the United States in part because he added to the use of silver table-ware the other

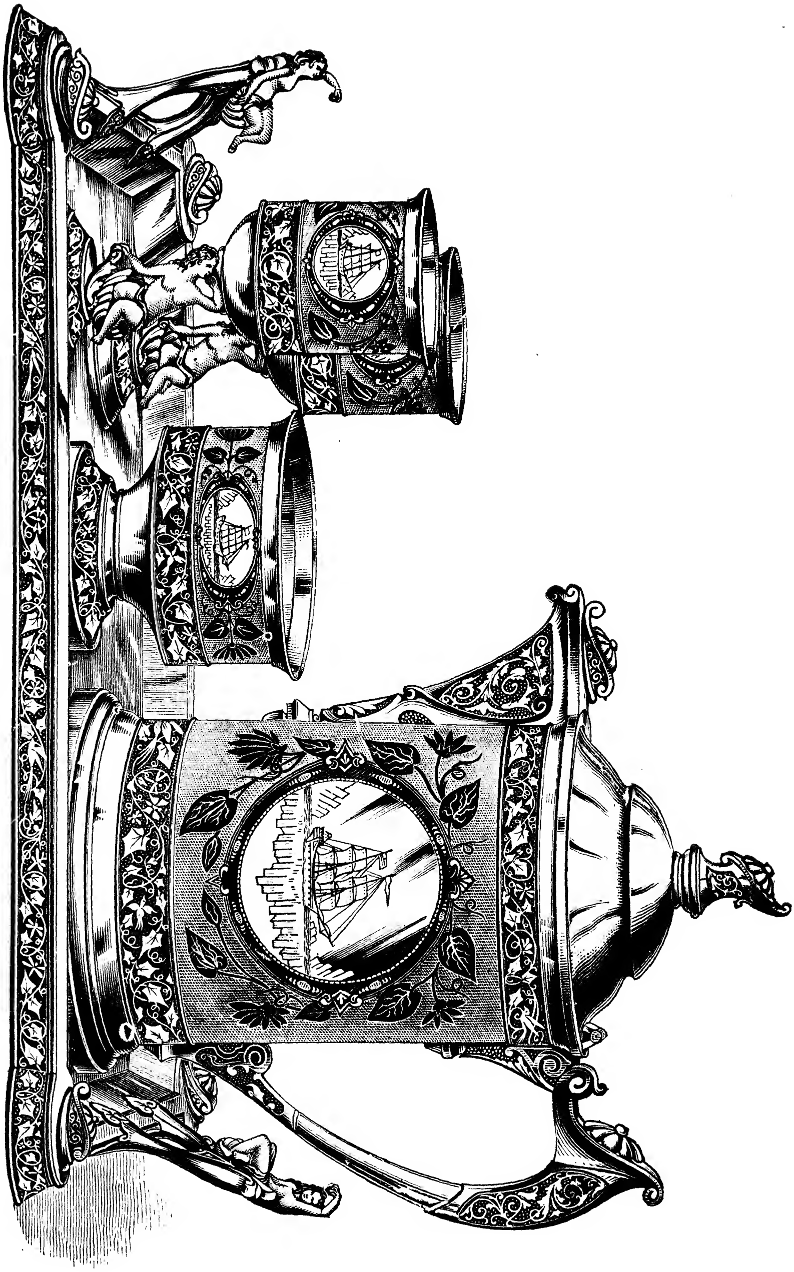
Importations after 1815.

Expensiveness of solid plate.

SPOONS, &C., IN CASE.

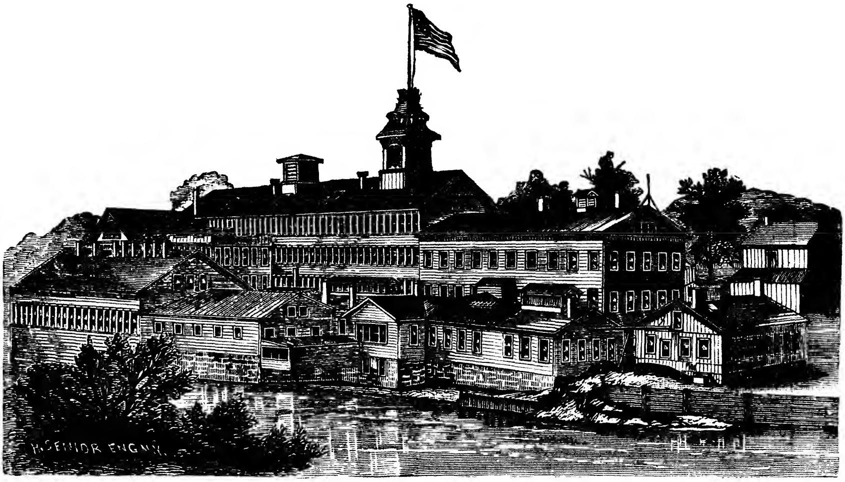
aristocratic extravagance of golden teaspoons. The spirit of the times was not partial to ostentation of that sort; and though silver was admired, yet not one family in a thousand placed an article made of it upon their tables (except, perhaps, a candlestick) from one end of the year to the other. Block-tin was used to some extent, and after 1840 britannia-ware came into favor; but the masses clung to pewter and blue crockery. Silver was so highly valued as coin, that it seemed a sinful waste of money to put it into a dish for the table. The esteem in which silver was held at that

Use of block-tin and britannia-ware.



ICE-PITCHER. SET.

day, and the economical ideas which prevailed, are illustrated by the incident of a New-England whaling-captain giving his daughter a wedding-dowry of her own weight in silver dollars, which was regarded at the time as an act of unexampled munificence; though in these days, if a prosperous father gave his daughter no more than that at her wedding, he would be regarded as a curmudgeon very much in need of the prayers of the faithful.



MERIDEN CUTLERY COMPANY, MERIDEN, CONN.

Origin of manufacture of silver-ware.

The origin of the manufacture of silver-ware in the United States is quite within the memory of old silversmiths who are still in the business: it dates from the year 1842. Prior to that year, there were no regular factories of plate in the country. The few silversmiths who had opened shops in the commercial and other cities for the repair of watches and imported plate made cups, snuff-boxes, watch-chains, and other small articles, in a desultory way; but there was no regular manufacture. The few expert workmen of those days had little capital of their own. They had only their tools and their skill; and the usual thing for them to do was to go to the jeweller and silver-merchants, and obtain from them orders to make special pieces of plate. The merchant supplied the ingot, or sheet of silver, and the workman hammered it out, and wrought it into the object desired, bringing back to the merchant the finished work and the surplus scraps of metal, both of which were carefully weighed to see that the workman had not abstracted a part of the raw material. In 1842 a number of the silversmiths of New-York City and other places got together to consult about the interests of their trade.

Tariff.

Mr. Clay was agitating at that time for a protective tariff, and the silversmiths regarded the hour as auspicious for an effort to obtain some recognition of their art from the government of the country. A delegation was accordingly sent to Washington to see Mr. Clay. Mr. Clay asked the men what the prosperity of their business required, and promised to do what he could for them. It was a very easy matter to obtain recognition in the bill which was being drawn up, silver-ware being so exclusively an article of luxury; and accordingly, when the act passed in August of that year, a duty of thirty per cent was levied by it upon all importations of gold and silver wares, whether solid or plated. This protection is said by old silversmiths to have given the industry in this country its first decided impetus. Nearly all the shops enlarged their business immediately after the law was passed.

About this time the art of electro-plating came into use; and this gave a still more remarkable impulse to the industry in the United States by cheapening the cost of silver table-ware, and vastly extending its sale. Early in the century it had been discovered that copper or gold held in solution might be made to settle upon the faces of objects suspended in the solution, and to form upon them a thick film, by passing a current of electricity through the bath to the object to be gilded or coppered. It was found that the film of metal, once formed, might be taken off, and used as a mould to produce an exact copy of the original object upon which it had been deposited. It was then found that metallic objects might be gilded by this process, and made to appear like solid gold. The invention was at first regarded as a curiosity. It was not until about 1840 that its value for the gilding and silvering of articles of common use was realized. Numerous experiments were then made with the invention both in the United States and Europe. Professor Silliman suggested that prussiate of potash would hold silver in solution without oxidizing the baser metals. This was a step in advance. Subsequently it was found that the solution of cyanide of potassium would do the work better, and silver-plating then became practicable and popular. The idea was taken up by New-England manufacturers, and several very important factories of plated ware and cutlery were started to manufacture for the American market. It was found that the most elaborate dinner and tea sets could be produced by the new process, coated with the purest silver to any thickness, for about one-fourth the expense of solid ware; and Yankee push and enterprise soon found a way to create a demand for it in every part of the country. The public taste had begun to crave elegant table-sets, and the low cost of the new class of goods secured for them a ready recognition and great favor. Iron forks and knives were virtually banished from the tables of all people of taste, and from hotels and steamboats; and plated ware and dinner and tea sets made their appearance everywhere. The industry, being protected by a liberal tariff, has grown up rapidly, and is now firmly established: 260 establishments are employed in it, giving work to 5,200 hands, and producing a yearly value of $12,000,000 worth of ware.

Electro-plating.

Regarded as a curiosity.

Number of manufacturers.

The earlier silversmiths of the United States made their dinner and tea sets, punch-bowls, goblets, &c., by hammering the various dishes from flat sheets of solid metal, shaping them upon iron forms called "stakes." The process of building up all round and oval dishes is still the same in principle, only that the hammer is no longer used, and the iron stake is thrown aside for a block of wood. Suppose the dish be a sugar-bowl. A perfectly round disk is cut from a flat sheet

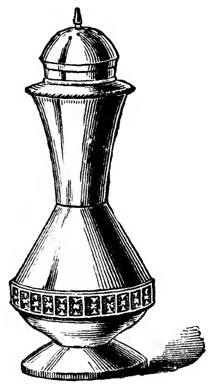
How earlier silversmiths made their wares.

CAKE-BASKET.

of solid silver, weighed, and turned over to a workman, to whom it is charged on the books. The workman has a block, made in pieces like a hat-block, so that, if a certain key be removed, it will fall apart. The block is put together and keyed, and put into a lathe touching the flat disk of silver. The block and the silver disk are then made to revolve at great speed. A smooth steel tool is pressed against the disk; and the malleable metal is made to bend down upon the block little by little, and gradually enclose it, forming the body of a perfectly symmetrical and smooth sugar-bowl, without joint or flaw. The top and bottom are properly trimmed with a sharp tool, and the bowl taken from the lathe. It would be impossible now to get

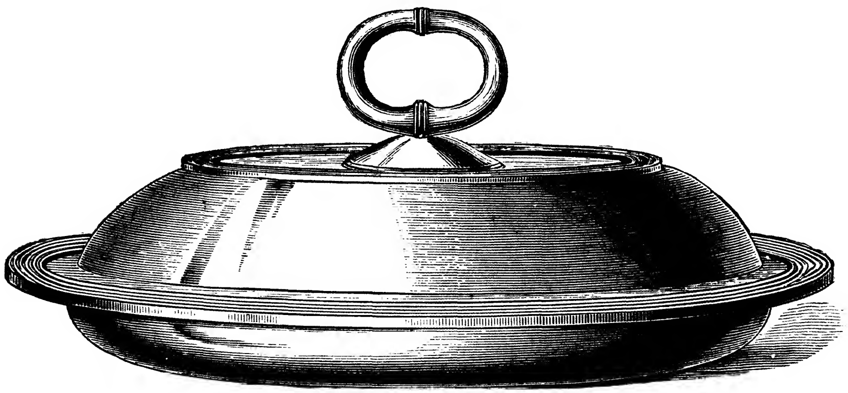
Modern process.

the wooden block out of the silver bowl, were it not that the block is made in pieces. The workman loosens the key which binds the block together, and shakes the pieces out of the narrow mouth of the sugar-bowl. The bottom of the sugar-bowl is shaped upon an appropriate block by the same process, which is called "spinning up." The handles are cast, and the different parts fastened together by soldering under a blow-pipe. This is in principle the manner in which all round and oval dishes, presentation-pieces, goblets, &c., are made from solid silver. For convenience the bodies are sometimes made in several parts, so as to permit the insertion at different places of a flat strip of decorated metal which has been rolled in a machine, and they are then subsequently assembled by the silversmiths proper, and united by soldering. The soldering is so perfectly done, that the finished article is in fact one piece of solid work, — as much so as though it had been cast. All scraps are carefully collected and weighed, and credited to the workman to whom they were previously charged. Large objects like punch-bowls, and all others of irregular shape, are hammered out by hand from flat sheets of metal, and put together by soldering. Projecting ornaments, like monograms, flowers, handles, &c., are frequently cast solid, and put upon the piece in the usual way; but by far the greater part of the decoration is done by chasing and engraving. The pattern is drawn in black and white upon sheets of paper. The workman goes all over the inside of the goblet, teapot, or other piece, whatever it may be, with a delicate hammer, and beats down the metal, so as to raise the large leaves, flowers, scrolls, &c., of the pattern, into relief on the outside of the piece. The dish is then filled with melted pitch and rosin, which is allowed to solidify and form a backing, in order that it may not lose its symmetrical shape in the subsequent processes. The workman next goes carefully over the whole of the surface outside which is to be decorated, and fashions it by indenting and beating down the metal with little chisels and a hammer, so as to leave a clear, sharp-cut pattern raised in high relief upon the beaten-down background. The pitch is then removed by melting; and the dish goes on to be smoothed, burnished, frosted, satin-finished, or gilded, as the case may be, for the store. The ornamentation of flat surfaces is sometimes done by etching. Spoons and forks are made by rolling in a machine, the pattern of the fork or spoon being engraved on the surface of the rollers. The edges of surplus metal are removed by clipping and filing, and the article receives its final shape under a die. The handles of nut-picks and knives, when hollow, are stamped in a die, in halves, and united by soldering. In the solid-silver shops great care is exercised to prevent waste of metal. The waste in polishing, clipping, filing, &c., is



PEPPER-BOX.

enormous, amounting in Tiffany's from four hundred to six hundred ounces a week in the process of polishing with leather and cotton alone. All the refuse of the shops, the grease, the dirt of the floor, the water in which the silver is washed, &c., is carefully saved, and sent to the furnace for the extraction of the metal. With all the precautions that intelligence can suggest, it is still found that five per cent of the metal weighed out to the workmen is never recovered.



VEGETABLE-DISH.

In the factories of plated ware a large part of the work is done by stamps, dies, and presses; and more of the ware is cast than in the solid-silver shops.

Stamping.

The metal forming the basis of the pieces is usually German silver (an alloy of nickel, copper, and zinc), brittania, white-metal, and aluminum. Brass and copper are sometimes used for very cheap work.

Use of brass and copper.

The original method of plating the ware with silver was to dissolve the metal in nitric acid, and precipitate it as a cyanide by cyanide of potassium. The precipitate, being washed, was dissolved in a solution of cyanide of potassium.

Process of plating.

The object to be silvered was then connected with the negative pole of a powerful battery, dipped in nitric acid, and then suspended in the solution of silver. After a few moments it was taken out and well brushed, and then replaced in the solution. The silver begins to make its appearance on the surface of the object, and in a few hours has covered every part of it with a uniform dead-white coating of pure metal. The process may be stopped when the plating has reached the thickness of tissue-paper, or it may be continued until the piece is double or triple plated. The stronger the current of electricity, the harder will be the plating. When taken from the solution, the piece is washed, and then burnished and finished in the ordinary manner. Latterly, plating is carried on by a variation of this process. The silver is not dissolved and held in suspension, but is put into the bath of cyanide of potassium in the form of a plate attached to the positive pole of the battery. The electrical current decomposes the silver, and the dish attached to the negative pole then becomes covered with the dissolved metal as before.

Electro-gilding is not extensively practised in the manufacture of table-ware, being resorted to more commonly in the production of cheap jewelry. It is astonishing how far a small quantity of gold may be made to go in hiding the cheap materials of which cheap ornaments — pencil-cases, thimbles, &c. — are made. The "magnificent" gold ear-rings and other things offered as prizes in the lotteries are frequently manufactured, at a cost of not much more than ten dollars a bushel, from copper or some such material, and gilded at an expense of about fifteen cents a piece. Heavy gold plating is, however, sometimes done upon cheap watch-cases, and also upon solid-silver ware. The inside of salt-cellars, soup-tureens, soup-ladles, spoons, &c., is frequently gilded; and, in the case of some very splendid sets of table-ware, the whole surface of the spoons is thickly coated with the precious metal. The use of solid-gold table-ware is at present limited in this country to bells and salt-cellars. Its cost bears the same relation to silver as that of silver does to pewter. But the rich color of pure gold is very much admired, and gilding is therefore demanded to a certain extent. The process is substantially the same as the original method of plating with silver.

Electro-gilding.

FRUIT-DISH.

Within the last ten years the United States have made a great advance in the beauty and originality of styles of silver-ware. Some factories make a hundred patterns of tea-sets. The Gorham Company makes nearly three hundred varieties of spoons. The New-York-City factories produce designs which are not surpassed anywhere in Europe. This result is, in part, due to the education of competent designers by the Cooper Institute and other schools of design in the country. It is also attributable, in part, to the constant purchase of books of patterns in China, Japan, and all other parts of the world where decoration is made an art, and to the diligent study of the treasures of antiquity which have been exhumed by the scholars of the Old World. The growth of wealth and taste in the United States has also proved a great stimulus.

Improvements of last ten years.

The taste for solid silver is increasing. There already begins to be visible in the centres of wealth and fashion a little of that pride in the family plate, and emulation with others, which led the Romans to vie with others in the massiveness of their silver dishes. Before the civil war, there were in Rome 150 silver dishes that weighed over 100 pounds each; and Pliny tells of one of 500 pounds, with eight plates of 250 pounds each. The Romans were gross in their tastes; and the more intellectual American does not incline in the direction of ponderous dishes which would crush the table under their weight; but he loves ornament, and the rivalry here is for the most profusely and richly decorated ware. The most splendid set ever made in the United States was that ordered by Mr. Mackey, one of the owners of the Bonanza silver-mines, in 1877, which comprised several hundred pieces of elaborately made solid-silver ware, including an enormous punch-bowl and a huge candelabrum. The set kept several hundred workmen busy for months in its manufacture. Some of the spoons and dishes were heavily gilded. The whole cost exceeded $100,000. Private dinner-parties have been given in New-York City within the last five years by princely merchants, in which $75,000 worth of silver and valuable china and crystal ware were used to spread the table, and increase the magnificence of the occasion; but the Mackey silver is the first grand set of great price ever made in the United States. Part of it goes to furnish the owner's private residence in California, and the rest of it to his houses in Paris and London.

Cultivation of taste for solid silver.

GRAVY-DISH.

CUP.

Within the last few years a special variety of silver-ware has been created to answer the demand for prizes for rifle-matches, yacht-races, trotting and ball contests, &c. The pieces are often in the form of goblets and vases, following the ancient idea of a royal gift, which was generally a valuable cup. Whether adapted for drinking or the holding of masses of flowers, or whether statuesque and purely ornamental, they are fashioned very much on the principle of a trophy. They exhibit the symbols of yachting, hunting, and athletic sports, and assemble into one piece every thing which is characteristic of the contest for which they are the victor's reward. American silversmiths display great ingenuity in this style of work.

Silver prizes.

COPPER AND BRASS UTENSILS.

Copper was the first metal wrought into arms and implements in the territory which is now the United States, if the testimony of the relics of the days of the Indian occupation, and of the records of the Catholic missionaries, does not deceive us. The red metal which underlies the State of Michigan in such priceless deposits early caught the eye of the savage warriors who threaded the forests of the North in the pursuit of game and built their camp-fires on every hill. The stone-hammers of this early race of men had been employed upon the metal; and the Jesuit fathers, who marched with the cross of their religion in advance of the soldiers who bore the lilies of France, found great quantities of it worn as ornaments and shaped into tools and weapons by the red heathen whose conversion to Christianity they sought. Had the white man, who succeeded to the occupancy of the soil, also inherited the civilization of the red man, it is probable that he, too, would have expended his art first upon the working of red copper, before attempting to utilize the less attractive and more refractory metal which now claims his more diligent attention; but the white man brought to America the science and arts of an older and higher civilization, and copper claimed his attention less at the outset than the denser metal. That has not, however, prevented copper from assuming the important rank in the arts of the country to which its qualities entitle it. Its manufacture is one of the great industries of the United States.

Early use of copper.

Copper was first worked in the United States by the white man, not under the Catholic cross of France in the North-West, but under the austerer auspices of Protestantism in New England. The first mines were opened in Connecticut; and the State employed its convicts for a period of sixty years, ending about 1830, in getting out the metal in the town of Simsbury. The ingots of metal were sold to the mint and to the smiths; but at first by far the larger part was exported to Europe to be manufactured. After 1812, when a duty of thirty-five per cent was levied upon manufactures of copper, there was less of the metal exported, and more of it made up into plate and utensils for use on this side of the water. The industry developed the fastest in the Eastern and Middle States. In

Working of copper-mines in Connecticut.

1870 there were 391 copper and brass factories in operation, employing 5,600 hands, and producing a value of $15,000,000 in finished goods annually; there being of these factories twenty-nine in Connecticut, forty-four in Massachusetts, eighty-five in New York, eighty-one in Pennsylvania, and twenty-one in New Jersey. Ansonia and Waterbury, Conn., became the principal centres of the manufacture.

Development of industry.

Pure copper is one of the softest of the metals, and is easily rolled into plates for use. It is in the form of plates principally that it is employed in the arts. Its most important use is in the sheathing of the bottom of wooden ships to protect them from accumulations of barnacles and shell-fish and the ravages of the bores. The navigators of the early centuries had great trouble with their ships on account of the fouling of the bottoms. It was finally suggested that the protection of the part of the ship below the load-line with sheet-lead would prevent incrustations, and that material was used for a while. In 1761 "The Alarm," a frigate in the royal navy, was sheeted with copper, which was found to answer the purpose very much better. After a series of years, it was found that pure copper, while protecting the ship, was itself rapidly eaten away by the chemical action of salt water, which made its renewal necessary. This was expensive, and shipping-men cast about for some improvement of the process of sheathing. A curious experiment was tried in response to a suggestion by Sir Humphry Davy. This was to place strips of iron under the sheets of copper, which would be corroded by the galvanic action rather than the copper. The invention worked beautifully: the copper was preserved, and money saved. But, quite unexpectedly, it was then found that the copper, no longer dissolving in the sea, became covered with barnacles as badly as the wooden bottoms had been before. So the ship-builders went back to pure copper. After a while, however, an alloy of copper was invented by mixing with it forty per cent of zinc, which answered the purposes of sheathing admirably. This alloy was a species of brass. It was called "yellow metal," and still retains the name, and is now universally used for the coppering of wooden vessels. The metal is very soft, and is rolled cold. It is worked down very gradually and carefully from the ingot, being annealed after each rolling, and cleared of oxide by pickling in a bath of diluted sulphuric acid. Owing to the high price of labor in this country, sheathing has been more expensively made in the United States than abroad until within a very few years. Of late the price has been so reduced, that the former large importations of it have greatly fallen off, and the sheathing used by American ship-builders is virtually all American-made. The bolts and nails by which copper sheathing is fastened to the ship are cast solid.

Importance of copper as sheathing for ships.

Process of making sheet-copper.

Sheet-copper is a very popular material for boilers and cooking-utensils in domestic use. The metal resists the action of the fire better than tin and sheet-iron: it is, therefore, applied to the construction of many forms of manufacturing apparatus which come into contact with fire; such as retorts and pipes, vacuum-pans, condensers, and boilers in distilleries, sugar-refineries, and other factories. The smaller utensils are formed from the sheet-metal by hammering, and by the process of spinning up, described under the head of "Silver Table-ware." The copper becomes very dense and brittle in the smithing process, and has to be annealed constantly as the work goes on. In boiler-making the plates are either united by lapped joints, soldering, or riveting, and sometimes by more than one of these methods.

Use of copper for cooking-utensils.

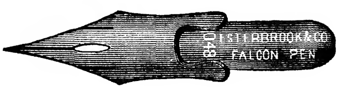
Copper is more extensively used in the form of brass than in its pure state. By admixture with a certain proportion of zinc it gains beauty and durability, and is generally preferred in that form. The best proportion of the metals is two of copper to one of zinc, which makes what is called eight-ounce brass; that is, eight ounces of zinc to sixteen of copper in the pound. Sixteen-ounce brass, the two metals being equal, is a beautiful golden alloy, called "prince's metal." Other combinations are made to produce pinchbeck, Manheim gold, and other alloys suitable for cheap jewelry, and ware for gilding and silvering. Brass is as agreeable a metal to work as pure silver. In thin plates it can be stamped and embossed in any form. It spins up beautifully in a lathe. It can be drawn out into delicate wire; and is so malleable, that it can be beaten out almost like gold-leaf itself for the purposes of cheap gilding. The metal is susceptible of a high polish. It does not rust by exposure, and has a great deal of the beauty of gold. It is the universal material of which chandeliers and gas-fixtures are made; being susceptible of rich coloring, bronzing, and silvering by chemical processes, and of shaping into the most elaborate forms by stamping and embossing. Brass was at one time the exclusive material out of which the works of clocks were made. Steel works are now beginning to be

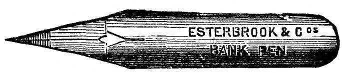
Use of copper in making brass.

Sheet-brass.

Advantages of brass.

Things made of brass.





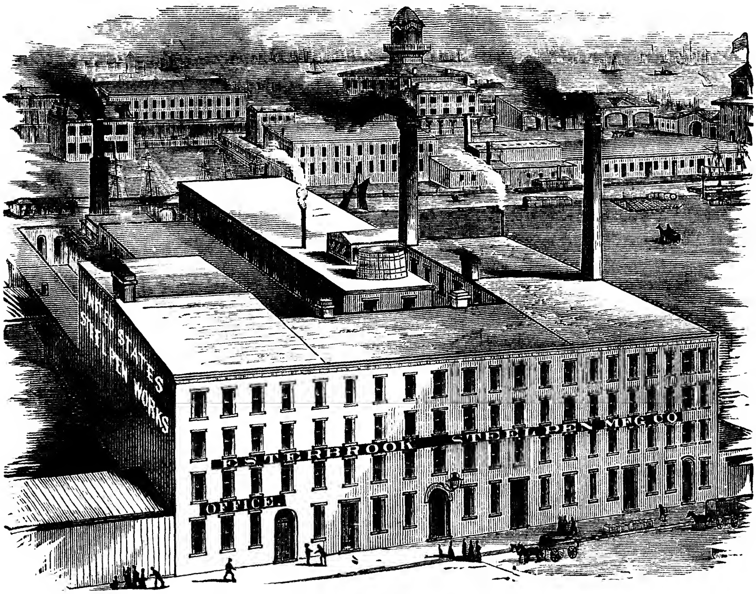
used to a very large extent; but brass holds its own for all cheap clocks, and indeed is popular in every grade of time-piece up to the great machines put in the towers of our city halls and churches. Its beauty, and freedom from rust, insure its popularity. Brass is also extensively consumed in the manufacture of pins. It is drawn out into wire. It is clipped by machinery into pieces of the right length, which are pointed, headed, and, after being tinned by agitation and boiling in a solution of tin, are stuck into papers for the market, all by machines especially invented for the purpose. The machine for putting them up in papers is an American idea,

Pins.

and saves thousands of dollars of expense annually. A great deal of brass is also consumed in the manufacture of buttons. Our forefathers were fond of brass buttons, and wore them regularly upon the ubiquitous blue dress-coat.

Brass buttons.

Brass buttons are still a regular part of the uniform of the army and navy of the United States. They are struck from sheets of flat metal, and stamped with the national coat of arms, and with proper lettering, to show that they are for government use. Backs and eyes of cheaper metal are then fastened on by soldering. The ornamental work of machinery and military equipments, the pegs upon which pictures are hung, andirons, pens, candlesticks, and a hundred objects in daily use, are made of this beautiful and serviceable alloy.



ESTERBROOK PEN-MANUFACTORY, CAMDEN, N. J.

BRONZE WARE AND STATUARY.

Bronze is the most beautiful of the alloys of copper. It has been in use from antiquity. Much of what was called brass among the ancients was in

Ancient use of bronze.

reality bronze. It was supposed that the ancients had learned the art of hardening pure copper so as to make the metal serviceable for axes and daggers: it is now believed that this hardened copper was only bronze also. The art of hardening copper is said to be lost: the fact is, chemical analysis had resurrected the art. The copper battle-axes found by Dr. Schliemann at Troy have been drilled, and the drillings analyzed.

Deducting the sand, the following was the result in the case of the three weapons tested: (1) copper 958, and tin 38; (2) copper 906, and tin 8; (3) copper 923, and tin 74. This slight addition of tin made the metal a soft bronze, which, being compacted by good smithing, produced a weapon with a hard edge. It is probable that the ancients did not clearly understand that zinc and tin were distinct metals; for they used the terms "brass" and "bronze" interchangeably. The brazen axes which slew Agamemnon, gave rise to so many glowing epics and dramas among the Grecian poets, and gave Shakspeare his suggestion for his tragedy of "Hamlet," were properly true bronze. The statue in the harbor at Rhodes, under whose legs passed for years the incoming and outgoing boats of that busy island shipping-port, was also of bronze.

Important uses of bronze.

Bronze has always been devoted to great uses. First it was the metal of war; then, when iron began to be wrought into blades and armor, bronze became the favorite material for heroic statues. It was costly, but it was beautiful, and more enduring than marble; and the sculptor found great satisfaction, when his conception had been embodied in his crumbling clay model, in seeing it reproduced immediately and easily in this noble metal, instead of being obliged to await the slow process of cutting the statue from marble, and to run all the attendant risks. After the invention of gunpowder, bronze again became a favorite metal in war. Napoleon employed it in the cannon with which he subdued the whole of Europe. Its strength was only about half that of wrought iron; but its beauty pleased the cultivated French, who loved to lavish upon every thing which belonged to them — their guns, as well as upon their dress, their buildings, and all articles of construction — their national fondness for color and for decoration, and the resources of a lively imagination. The metal resisted wear extremely well, and bronze guns were the rage. The Europeans also employed bronze for commemorative monuments, arches, and statues. The Japanese and Chinese have used bronze from very distant centuries; but their fondness for it had little to do with its use in Europe.

Composition of bronze.

The first experiments in modern times to ascertain the mingling proportions of copper and tin were in 1770 at Turin. There the proportion of twelve or fourteen parts of tin to one hundred of copper was fixed upon as the best. The French made many experiments a few years later. They decided upon eleven parts of tin as the maximum, and eight as the minimum, to one hundred parts of copper. The French learned to mix in a small percentage of lead and zinc also. At present, one to ten is the standard proportion. Manufacturers vary from this standard freely, however, to produce special effects. For a hard bronze, they mix the metals in the proportion of seven to one. For machinery bearings and medals, eight to one is the rule; for statues, four to one; for flexible tenacious bolts and nails, twenty to one; and for speculum metal, two to one. In whatever proportion the compound is made, bronze is the most durable of metals, except gold and platinum. It acquires a fine rich color by exposure, which is called "patina;" but it does not rust. Exposed to the weather, it lasts forever. It has the peculiar property of becoming malleable by tempering; and it can be given a black, red, brown, green, or silvery patina by oxidation or sulphurization.

Durability.

Up to the present decade the use of bronze in the United States has been confined to the manufacture of bells, cannon, and statuary. Within the last twenty years the country has crossed the threshold of a general manufacture of the metal. The last two decades will always be taken as the real beginning of the production of general bronze-ware in the United States. Hitherto bronze has been, as of old, the heroic metal. It has been sacred to arms and statuary, bells being the only form in which it was utilized for any domestic purposes. Now it comes more prominently into popularity in the domestic arts. It retains its rank as the unapproachable material for great statues; but it is losing ground for use in cannon, in which form it has been extremely popular in the last two wars; and it is now being made up into a thousand objects for the decoration and glorification of homes and cities. Since the war of 1861 the government has distributed to the different cities and villages of the country a large number of bronze cannon to be melted up into statues, in honor of the victories and heroes of the war, to grace public squares and parks; and factories for manufacturing bronze objects for common use have started up all over the industrial portions of the land. In the Revolutionary war the peaceful old statue of King George, in New-York City, was tumbled down, and converted to warlike uses by being melted up into good republican bullets. At the present time a change is going on which might be compared to the overthrow of the brazen arms and statue of Mars, and the melting up the warlike material into objects of beauty and peaceful luxury.

The bronze-manufacturers of the United States, previous to 1861, were few, and far between. The establishments of the Messrs. Ames at Chicopee, Mass., and of the Meneelys at Troy, N.Y., were the principal ones in the country; and there were only a few others sprinkled about here and there in the Eastern States. These factories made bells in times of peace, and cast cannon in times of war. The so-called brass guns used in the Mexican war, in the struggle of 1861–65, and in the army on the plains in fighting Indians, were made of bronze. They were cast solid, and bored, and were nearly as strong as iron. They were known as Napoleons in the army, to distinguish them from iron and steel guns. The expense of bronze limited its manufacture to these two articles and to the occasional statues which public gratitude or private liberality caused to be set up in some opulent city. The beauty of bronze caused it, however, to be prized in the arts. For many years manufacturers tried to discover a method

Increase of bronze-manufactories.

for bronzing other substances, so that the growing refinement of the public taste might be gratified by the purchase of objects which should have the appearance of bronze without its cost. Various washes, powders, and alloys were brought out one after the other. A compound of tin, regulus of antimony, and lead, was once employed as an imitation bronze. The manufacturers of fountains, vases for the decoration of grounds, doorstep-statuary, and other metal-work, gave that alloy up for zinc covered with copper by the electric process. They then discovered the solution of chloride of platinum, which will give almost any color to copper, brass, iron, or new bronze. Cheap substitutes for bronze, and powders and washes, are still largely used: they can be seen in chandeliers, cheap statuary, and coarse decorative metal-work. But there has been a decided increase in the employment of real bronze since 1861. No one wants an imitation, if he can afford the real thing.

Rapid increase in use of real bronze since 1861.

Americans, particularly, have a hatred for shams, whether it be in the professions of their public men, or in so simple a matter as the busts of Washington which adorn their mantle-pieces. Besides this, there has been a growth of the sense of color in this country. A rich dark wall-paper is wanted now where a whitewashed wall answered before. The old-time white plaster-of-Paris statuette no longer pleases; but it must be colored to resemble bronze, or must be of that opulent metal itself. The change in taste and the growth of prosperity have prepared the way for a sale of real bronze objects. The result is already seen in the factories. Concerns which formerly produced house-hardware of iron, such as locks, hinges, latches, metal ornaments, &c., have changed over to bronze. All handsome houses are now furnished, to a large extent, with bronze metal-work and fastenings, as far as the doors and windows are concerned, the light-colored bronzes being preferred for the purpose. Public buildings and stores have also adopted this style of work. The whole world is astonished and delighted with the beauty of American bronze hardware, which displays great taste, and originality of pattern. The manufacturers of clocks, inkstands,

LAST MOMENTS BEHIND THE SCENES.

cigar-holders, thermometers, and Yankee notions in general, are also now flooding the country with, and sending abroad to a certain extent, handsome wares of this popular material. For this class of objects the darker bronzes are used; many of the cheaper pieces, however, being simply of iron, but japanned to resemble bronze. Purely ornamental bronze-work, such as statues, vases, pots, trays, &c., are not yet made in America. We are behind the rest of the world in that respect. Yankee genius loves to produce the useful, giving it a beautiful form; but there is not yet a distinctive development of that independent passion for the purely beautiful which leads a people to go largely into the manufacture of exclusively ornamental objects. That will come in time; in fact, is already coming: but the progress in bronzes is not yet sufficient to be dwelt upon. Bronze busts of eminent men, and statues for parks and public places, are, however, now very commonly made. There is a genuine passion for bronze for that department of art. The richness, dignity, and strength of the alloy are asserting themselves, and the manufacturers are reaping a rich harvest therefrom.

Advantage of studying Japanese productions.

American development in bronze-work will doubtless come during the next twenty years more largely from studying the ideas of the Japanese than from analyzing those of the Europeans. The Japanese have quietly spent an immense amount of thought, experiment, and patient manual labor, upon ornamental bronze-work since the sixth century, and have attained an excellence in the art enjoyed by no other nation, although they have made the least bustle about it of any nation. Their alloys are very numerous and very rich. They call them by the color which predominates in them when they are finished. Their "green copper" is composed of copper and lead, or copper, tin, and lead. "Black copper" is produced by uniting the three metals differently. The "purple copper" is copper and lead again. One beautiful alloy is made of four parts of copper, and six of silver; and the famous and peculiar dark-blue Shakudo is made by adding to copper from two to five per cent of gold. The metal can be made of any hue and richness. American workmen are now studying Japanese designs: when they come to study the raw material, good results may be expected to follow.

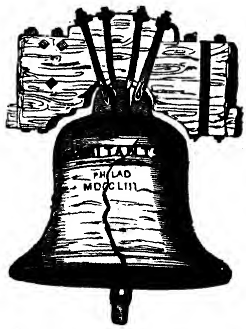
Principal bronze-manufacturers.

The principal factories of bronze statues in the United States now are that of Robert Wood & Company, Philadelphia, and that of the Ames Company at Chicopee, Mass. The statues made at these shops are either of life or heroic size. There are no colossal works by them yet. The United States have no colossal statues. One is proposed of a light-house in New-York harbor, to be presented by the French, and to be called "Liberty enlightening the World." It will be two hundred and twenty-five feet high with its pedestal, if ever erected, and will cost one million francs; but it will not be sent here until the United States build a pedestal for it to stand on, and at present nothing is being done about it.

BELLS.

Poetic history of bells.

The story of the bell should always be written by a poet: indeed, the bell has been a favorite theme with the poets of all ages and countries since its invention and introduction to the towers of castles, churches, and great buildings. No sound speaks to men with such "a various language" as the clang of a great bell. It always announces something. Once the bells of a tower were rung to scatter the storms, it being believed that the holy sound would have a subjugating effect upon the elements; but that custom has passed away, and now the bell speaks only to tell something important to the people living within the sound of its voice. It signalizes the sweetest and most tender incidents in life. It attends us to the grave. It alarms a community to meet a danger. There is always something of melancholy in the voice of a great bell, even on the most joyful occasions, and the sound is always full of sympathy. A great bell without that trace of melancholy is worthless. In Europe it has always been the custom to inscribe upon the bell a legend of some sort; and, from among the many in Latin, the following may be taken to show with how many voices the same iron tongue can speak to the people of a town: —



LIBERTY-BELL.

> "Funera plango; fulgura frango; sabbato pango;
> Excito lentos; dissipo ventos; paco cruentos."

In other words, —

> "I mourn the deaths; I break the lightnings; I mark the sabbaths;
> I arouse the slow; I scatter the winds; I appease the cruel."

And this: —

> "Laudo Deum verum; plebem voco; congrego clerum;
> Defunctos ploro; pestem fugo; festam que honoro."

That is to say, —

> "I praise the true God; I call the people; I convoke the clergy;
> I mourn the dead; I frighten the plague; I honor the feast."

Schiller, Tennyson, Edgar A. Poe, and nearly all the great national poets, have given us a song of the bell. "The Bells of Shandon" shows how universal is the love of this powerful mover of the sentiments and feelings.

Early bells imported.

The early bells of the United States were all imported from England, whence alone, for a long period, were to be obtained the supplies of tin which enter into their composition. Not many were wanted: yet the early settlers of America were a very religious people, and the white spires of their churches dotted the dark brown and green of every landscape;

and it was desired to hang a bell in as many of the spires as possible. So there was something of a demand for bells, and the ships from England brought all that were ordered. Occasionally one was hung in a state-house also. Among this class was the famous bell imported in 1752 for Independence Hall at Philadelphia; which, being cracked on trial by a too energetic stroke of the clapper, was recast under the direction of Mr. Isaac Morris of Philadelphia. The new bell was inscribed from Lev. xxv. 10, "Proclaim liberty throughout the land unto all the inhabitants thereof;" also, "By order of the Assembly of the Province of Penn. for the State House in Phil.;" and, "Pass & Stow, Phil., MDCCLII." After the tariff of 1842, which gave those who chose to take up bell-founding as a regular business the protection of a duty of thirty-five per cent, a number of small factories were started, some of which afterwards attained celebrity; among them being that of the Meneely Brothers at Troy, N.Y., the one at Boston, and that of the Bevin Brothers Manufacturing Company of East Hampton, Conn.

Bells made in United States.

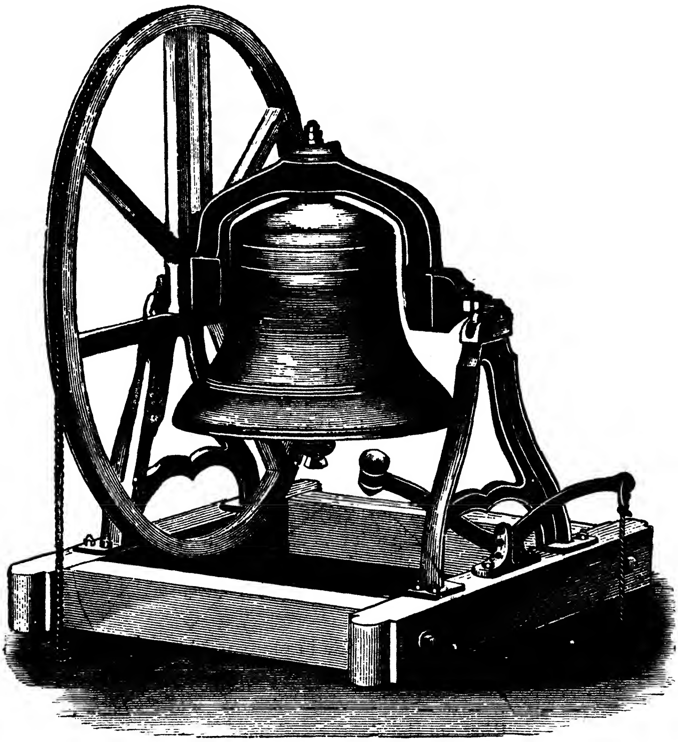
The bells which have been made in the United States have been, so far, of moderate size, with few exceptions. The conditions of society here have not been favorable to the production of monster tocsins as in some other countries. Royalty and priestcraft have resorted to colossal bells in all ages to impress the common people with the power of their rulers; and Europe is filled with monster castings of this description, the fifty-seven-ton affair at Moscow being the largest; while imperial China and Japan, with kindred aims, have hung tremendous fifteen-foot bells in nearly all the great cities of their respective empires. In the United States, where the democratic spirit prevails, where pomp and circumstance are not employed to strengthen the authority of Church and State, and all things are gauged by a common rule of beauty and utility, bells have found their use, and have only been made large enough to subserve the wants and pleasures of the people. The largest bell ever made in the country was cast at Boston for the City Hall at New York. It weighed twenty-three thousand pounds, was eight feet across at the mouth, six feet high, and six inches and a half thick where the clapper struck it. A few four and five ton bells have also been cast; but the majority of those made average a thousand pounds' weight only for churches and city halls, and four hundred pounds' weight for factories.

JAPANESE BELL.

Size of bells.

The tone of a bell is entirely within the control of the manufacturer. Its softness and sweetness can be varied by using different proportions of copper and tin, and putting in a little lead or silver. Its pitch is varied by the size and diameter. For instance, the bells ringing the first, third, fifth, and eighth of the scale are cast relative, with diameters of thirty, twenty-four, twenty, and fifteen, and weights of eighty, forty-one, twenty-four, and ten. The ease of graduating the tone has led to the adoption of chimes of bells; and churches in all the large cities of the country, and in some of the smaller ones, have within the last twenty years purchased them,

Tone of bell, how determined.



CHURCH-BELL.

and the communities have been filled with the music of "sweet chimes of magic bells." The most ancient chime in the country is that in a picturesque ruin in the southern part of California. It is a relic of the Spanish occupation. The Jesuit missionaries from Mexico built a number of massive mission-houses in that part of the country, and hung in them bells brought from Europe. One of these structures, being erected in a region occasionally shaken by earthquakes, was made with a dome ten feet thick, in order that it might resist any possible shock; and the bells were hung in the arches of a low buttressed wall, separate from the main building. In irony at the calculations of man, an earthquake crushed the massive central building, and has left the bells hanging in their arched colonnade to the present day. The most interesting chime in the country is that at Cornell University, in Ithaca, N.Y. There are ten bells, the largest weighing 4,889 pounds, and the smallest 230. They represent the notes of D, G, A, B, C, D, E, F, F sharp, and G. The largest of these bells bears various legends, as follows: "The gift of Mary, wife of Andrew D. White, First President of Cornell University, 1869;" "Glory to God in the highest, and on earth peace, good will toward men;" "To tell of Thy loving-kindness early in the morning, and of Thy truth in the night-season." Also the following, written for the purpose by James Russell Lowell: —

"I call, as fly the irrevocable hours,
  Futile as air, or strong as fate, to make
Your lives of sand or granite: awful powers,
  Even as men choose, they either give or take."

Upon the nine other bells are couplets from Tennyson's "In Memoriam," beginning with the smallest, as follows: —

"Ring out the old, ring in the new;
Ring out the false, ring in the true.

Ring out the grief that saps the mind;
Ring in redress to all mankind.

Ring out a slowly-dying cause,
  And ancient forms of party strife;
  Ring in the nobler modes of life,
With sweeter manners, purer laws.

Ring out false pride in place and blood;
Ring in the common love of good.

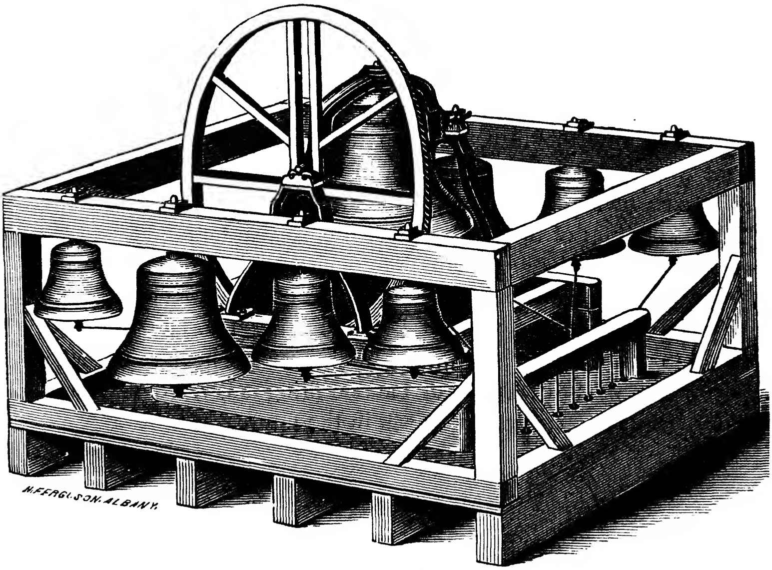
Ring out the slander and the spite;
Ring in the love of truth and right.

Ring out the narrowing lust of gold;
Ring out the thousand wars of old.

Ring out old shapes of foul disease;
Ring in the thousand years of peace.

Ring in the valiant man and free,
  The larger heart, the kindlier hand;
  Ring out the darkness of the land;
Ring in the Christ that is to be."

On this last bell is also the inscription, "This chime the gift of Miss Jennie McGraw to the Cornell University, 1868."



CHIME OF BELLS.

American manufacturers are not very confident of the value of silver in bells, and they generally prefer clear mixtures of copper and tin. The proportion is, for musical bells, six of copper to one of tin; horse-bells, copper four, tin one; and large bells, three to one. Cattle-bells are made of iron and copper. They are not intended to do any thing except make a noise. Steel bells have been experimented with some in England; but they are harsh in sound, and not popular. A few fire-alarm bells have been used in the United States, consisting of a heavy bar of steel, coiled spirally, and mounted upon a sounding-board. They have been abolished, however, by the new system of fire-alarm, which provides, not for ringing a great tocsin to agitate the town, but for ringing a gong in every engine-house by means of the telegraph, and thus giving the alarm only to those who need to know about the existence of a fire. Table-bells are now made of silver, gold, and German silver. Those in the form of a little gong, mounted upon a little slender rod, which, in turn, is supported upon a small pedestal, are the most popular. Bronze gongs are made of all sizes, from the terrific monsters shaped like a warrior's shield, which the waiters bang at the railroad eating-houses, to the tiny bell-like bronzes in alarm-clocks and office-annunciators. The casting of bells is so simple a process, that it need not be described. The gong — that

Silver in bells.

Composition of bells.

Fire-alarm bells.

Bronze gongs.

is, the gong of the Chinese sort — is made by forging under a heavy hammer.

Number of bell-manufactories. There are now about thirty-five establishments in the United States engaged in the production of bells : a portion of their product is sold abroad. The imports of bells have stopped.

It is not probable that great bells will ever form a special feature of American life. The tendency of things is not in that direction. Great bells

Future of bells in U.S. are only valuable to alarm a town and the inhabitants of the surrounding country. In the days of the hand fire-engine, it was important that every able-bodied man, in a city where there was any special

Value of great bells. accumulation of wealth, should be warned whenever any of the buildings of the place caught fire, so that he might lend his efforts to stay the conflagration. Steam fire-engines, public water-works, and the telegraph alarm-bell, have superseded the need both of a call to the population of the place and the use of great bells. During the late war, heavy bells were useful to call in the people of the rural towns to hear the news of some great victory or great defeat; but cannon-firing answered very well in the absence of bells then, and probably will in the future.

LEAD-MANUFACTURES.

Lead, though the humblest of the metals, has played its part royally in the drama of human life. When gunpowder was invented, lead was the one material of which missiles could be made. Its existence dictated the form of weapons, and changed the art of war; and not only that, but it decided the fate of all rude nations, and changed the history of the world. When chemistry brought its resources to bear upon the metal, lead became useful to man in beautifying his dwellings with color; and, when machinery was applied toward fashioning it, it was found serviceable for a variety of objects for which no other metal has been able to do equally well.

Lead was found scattered along the coast of North America, here and there, by the earlier settlers, as will be more fully described elsewhere; and its

Early use of lead was chiefly for bullets. manufacture for common purposes began long before the Revolution. It was chiefly employed for bullets. The metal was obtained at the store, and the huntsman cast his own bullets by hand. In the government armories, balls were made for the use of the army; but there was little general manufacture of lead for the market, for that or any other purpose, until after the Revolution. After the peace of 1783 the uses of lead increased. It was found that oil-paint had a tendency to preserve wooden dwellings from decay. Very few dwellings had been painted before the war. Paint was costly, it being all imported; and it was regarded as a worldly and sinful luxury in most of the colonies, especially in New England. When it was found that paint not only beautified, but was of positive utility, a perfect epidemic, of coloring houses, barns, and other wooden buildings, set in, and the home manufacture of it began. A factory to make lead-paint was started in Philadelphia before 1800: by 1820 there were several in New-York City, and still others west of the Alleghanies and elsewhere in operation. Other factories in Brooklyn, Albany, Boston, Buffalo, and the West, soon followed. Then the manufacture of small shot had been invented. In 1782 a plumber living in Bristol, by the name of Watts, dreamed that he was caught out in a rain-storm, which turned to lead as it fell. This suggested the idea of shot-making. He went up into a church and poured out some melted lead, which fell into water below, and became shot. The idea was taken up quite generally. In 1807 Paul Beck built a large shot-tower on the Schuylkill, a hundred and seventy feet high, which he thought would supply the whole United States. He could not supply the United States, however; and several other factories were built in the country in succeeding years. Four were built at New-York City, with a capacity of over three thousand tons per annum; and seven were built at St. Louis. Virginia, Baltimore, and other localities, were equipped with shot-towers also; and they have, in fact, sprung up all over the country. The census of 1870 showed seven of them in active operation, producing about five thousand tons of shot annually. Besides these uses of lead, various others were introduced at different periods; and the United States have embarked in the manufacture of lead therefor in a greater or less degree. Principal among these uses of lead is its application, either in the form of the pure metal or an alloy, to pipe-making, and the manufacture of type, emery-wheels, solder, table-ware, sheet-metal, the keys of musical instruments, Babbitt metal for the bearings of machinery, &c.

Used for paint.

Early shot-making.

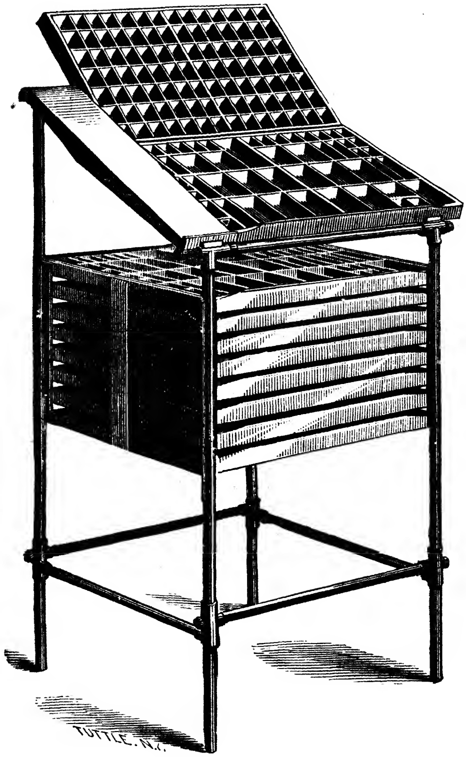
Lead derives a great part of its importance from its useful alloys. In combination with antimony it makes a metal good for type, the bearings of machinery, and ornamental metal-work, being white, hard, capable of a polish, and producing a sharper casting. The alloy melts more readily than lead, and is harder. With twenty per cent of tin, lead produces pewter. It is harder in the form of an alloy, and more fusible; a fact which is turned to use in the making of solder, by mixing equal parts of tin and lead, and in the production of a metal with which naturalists can take delicate castings. Lead melts, when pure, at 635°: but in the form of an alloy composed of lead 1, bismuth 2, tin 1, it fuses at 201°; which is considerably less than that of boiling water. When, therefore, it is desired to form a mould of some delicate tissue or substance which would be destroyed by boiling water, this useful alloy is available for the purpose.

The use of lead as an alloy.

Perhaps type-founding, next after that of bullet-making, is the most ancient industry in which the people engaged in producing useful articles from lead. Type was cast in this country as early as 1735. The pioneer in the art was Christopher Saws (or Sowes), who began printing at Germantown, Penn., and cast the type required in his

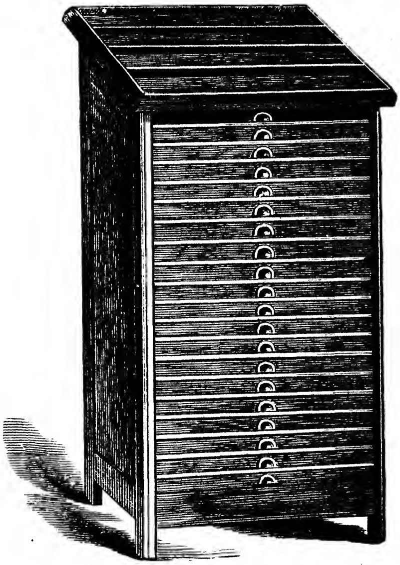
Type-making.

business, executing therewith, in 1743, the second Bible printed in America, it being in the German language. Type was cast by several printers subsequent to him, including Franklin among others. In 1796 Binney and Ronaldson of Edinburgh established type-founding as a regular business at Philadelphia, having a pretty hard time of it for a few years, but finally obtaining State aid, conquering all difficulties, and building up a business which was the origin of the present great establishment of Mackellar, Smiths, & Jordan. Before the close of the century David Bruce, also of Edinburgh, started the business at New-York City. Mr. Bruce was an ingenious man, and invented improvements in the methods of type-founding which developed the business. The original method was to cast each letter by hand, one at a time. A copper mould was made for the type, the letter being stamped into the lower end of the mould, or matrix, with a steel die, and the matrix capable of being opened to take out the letter. The matrix was put into a little wooden or iron box having a hopper to admit the melted metal. The workman, holding this in his left hand, dipped enough metal for a letter from the melting-pot with a small iron ladle. He poured it in, and gave the matrix a sharp jerk upwards as high as his head to settle the metal into the finest lines of the type and to condense it. He then pressed a spring, opened the matrix, shook out the type, closed the box, and went on as before. The average rate of casting was 400 letters an hour. Mr. David Bruce invented an improvement in 1811 by which 500 type could be cast in an hour. In 1812 a duty of thirty per cent was laid upon foreign type, in place of the previous fifteen per cent. This was a great help to American makers. Both at Philadelphia and New York the business soon became important. In 1813 David and George Bruce began the first stereotyping establishment in the United States. In 1831 Mr. David Bruce, jun., patented the only successful type-casting machine which has ever been

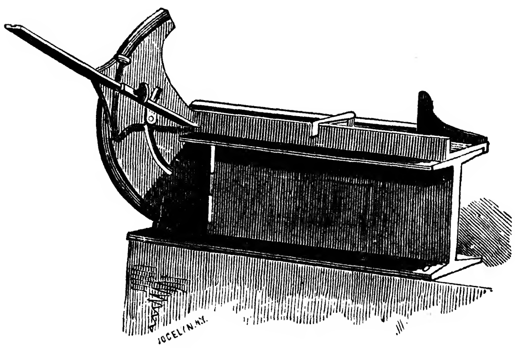


PRINTER'S STAND.

made. It was the product of years of experiment and study. It has entirely superseded the little hand-moulds, and has gone into general use in American factories and in many European. In this machine the type-metal is kept in a melted condition in a small iron reservoir by means of a gas jet. From the reservoir it is pumped, under great pressure, through a steel nipple, into the matrix of the type, which presents itself to the nipple simultaneously with the downward stroke of the piston. The quantity of metal pumped from the reservoir in each case is just enough to make one letter. A blast of cold air plays upon the mould, the metal hardens instantly, the mould recedes, the type is cast out into a hopper, the mould closes again, and moves forward to repeat the process. The speed of casting was increased about three times by this machine, and the proportion of imperfect type materially diminished. By an improvement invented by J. A. T. Overend of San Francisco, in 1875, the speed of the machine was increased to a hundred types a minute. After coming from the mould, type has to be smoothed by rubbing on a stone slab; and the jet-end must be cut off, so that all the types shall be exactly the same length. In type-founding, certain letters of the alphabet are given greater prominence than others. This is due to the frequency with which the different letters occur in the English language. The proportion in which they are cast, and in which they occur in print, is about as follows: e, 1,500; t, 900; a, 850; n, o, s, i, 800; h, 640; r, 620; d, 440; l, 400; u, 340; c, m, 300; f, 250; w, y, 200; g, p, 170; b, 160; v, 120; k, 80; q, 50; j, x, 40; z, 20; fi, 50; ff, 40; fl, 20; ffi, ffl, 15; æ, 10; œ, 5. In capital letters the differences



CABINET FOR TYPE.



MITRING-MACHINE.

are not so great; but I, T, A, and E lead in importance. The best type-metal is composed of fifty parts of lead, and about twenty-two parts of antimony for hardness, twenty-two of tin for toughness, and four of copper for tenacity. The copper is left out, however, very often. It is replaced by copper-facing, put on by the electro process invented by Dr. L. V. Newton of New-York City. A metal very much like that used for type is employed in stereotyping. It will be referred to under the head of "Stereotyping."

LEAD-CUTTER.

Manufacture of lead paint.

The manufacture of lead-paint was begun in America by John Harrison of Philadelphia, a young man who believed that a large number of chemical products which were being procured from abroad might be made by our own people. Having finished a thorough education in chemistry by a course under the celebrated Joseph Priestley of England, Harrison started a factory of sulphuric acid and white-lead in Philadelphia in 1798, and prospered from the very first. The house of John T. Lewis & Brothers, founded in 1807, afterwards went into the same business. The manufacture soon extended all over the country. It became particularly successful in Brooklyn, N.Y., owing to the growth of the communities in that immediate vicinity. At the present time there are 145 factories engaged in the production of paints, the manufacture of lead pigments being a part of their business. They employ 3,000 hands, and produce about $17,000,000 worth of goods annually in fair years. Of the total number, thirty-four are in Pennsylvania, sixteen in Massachusetts, eleven in New York, fourteen in Ohio, ten in Missouri, and four in Illinois.

The principal pigments made from lead are minium, or red-lead (which is easily produced by exposing litharge at a continued low red-heat to the action of the air), white-lead, a carbonate of the metal, chrome-red, and chrome-yellow. They are all beautiful, brilliant, and valuable pigments. Oxide of zinc now contests with white-lead the favor of builders; but the importance of the pigment is scarcely affected by the competition.

White-lead.

White-lead was originally made in Holland; and invention has thus far failed to supersede the "Dutch process" of its manufacture. Some variations in the details have been made in America; but the process is essentially the same in principle as that invented by the people who taught Northern Europe the arts of industry. To prepare the pigment, the purest metallic lead is obtained. Originally it was subjected to the chemical operation in the form of loose rolls of sheet-lead. The American method is to cast the lead into circular gratings looking very much like shoe-buckles. In whichever shape prepared, the lead is put into earthen jars, with a little vinegar at the bottom, the lead being supported by earthen ledges from coming into contact with the vinegar.

Mode of manufacturing.

Sometimes the pots have openings in the sides to permit a free circulation of the vapors set free in the process. An immense collection of the jars, tens of thousands in number, are then packed in alternate layers, with layers of some fermenting material which will give out carbonic-acid gas. Originally stable-manure was employed. At present spent tan-bark is preferred. The layers of jars and bark are carried up sometimes twenty feet high, the bark being kept out of the jars by sheets of lead and by boards. A large building being filled in this way is then closed. The fermentation sets free a large quantity of carbonic acid. Basic acetate is first formed on the surface of the lead in the pots, which is decomposed by the carbonic-acid gas, forming carbonate and free acetic acid. The latter again acts on the lead. Very little vinegar is required; and the process goes on continuously, assisted by the heat of the fermentation, until, at the end of ten or twelve weeks, fermentation stops. The process is then at an end. The stack is then taken to pieces. The lead is found in its original form, though increased in bulk and weight, and converted into a very white and soft carbonate. If the conversion has not been thoroughly done, a can of metallic or blue lead will be found in the interior of some of the pieces. The pieces of lead are now thrown into large tanks filled with water, in which they rest upon shelves of copper full of holes. They are beaten to separate and pulverize the carbonate, the water preventing the fine dust from poisoning the air and injuring the workmen. Grinding, and washing in water, then follow, until the carbonate is reduced to an impalpable powder. It is then dried in steam pans or upon tile tables, and put up for the market. The carbonate obtained in this way is superior to that obtained in any other; but a very fair commercial article is made by boiling solutions of nitrate or acetate with litharge, and precipitating the solution with carbonic acid. White-lead is not alone employed as the best white paint; but it constitutes the body of almost all other paints, it being colored by intermixture with other pigments.

Chrome-yellow.

Chrome-yellow is obtained by precipitating a solution of nitrate of lead with chromate of potash, and washing and drying the product. The red, a bright powder, is obtained from the yellow by boiling it with lime or some other alkali; also by digesting levigated litharge, by boiling with neutral yellow chromate of potash, &c. A green lead is also made.

Adulteration.

Considering how far a pound of oil-paint goes in coloring a house or a fence, the consumption of pig-lead in paint-making must be regarded as enormous. It now amounts in the United States, yearly, to about 50,000 tons. Notwithstanding the cheapness of lead-paint, it is largely adulterated for the market by small dealers with whiting. The powder is absolutely white, and does not discolor; but it does not make so brilliant a paint.

When the use of paint began to become general in this country, the favorite colors were white for houses, churches, and wooden stores,—the color conforming to the simplicity of that age, — green for window-blinds, and red for barns. Red barns are still common on the farms of the country; although drab and brown paints have come into popularity within the last twenty years, and threaten soon to supersede both red and white for wooden buildings of all kinds.

Modern process of shot-making.

Shot-making is the simplest of mechanical processes. The only place in the process where any special judgment is required is in the preparation of the pig-metal. Most manufacturers regard the presence of arsenic in the metal as absolutely necessary. Very cheap lead is used in shot-making, and the presence of one or two per cent of arsenic gives it fluidity. A pot of lead is melted. Either white arsenic or orpiment (the sulphuret) is put into the centre of the mass, and a cover put upon the pot, and sealed down. A chemical combination takes place in a few hours; and the pot is then opened, and the metal tested by pouring a little of it through a strainer at a moderate height into water. The globules of lead are round, if the mixture has been made in the right proportion; they are lens-shaped, if there is too much arsenic; and irregular in shape, if too little. If the metal is all right, it is cast into pigs for use. It is converted into shot by fusing it at a low height, and letting it drain through colanders at the top of a tower. The drops harden on the way down, and fall into water. The imperfect shot are separated from the others by letting them roll down inclined planes. The good ones go down with speed, and shoot off into proper receptacles: the irregular ones go down more slowly, and drop off upon the floor. They are sorted into sizes by being shaken in sieves. The height of a shot-tower is from 150 to 250 feet. One in Baltimore is 256 feet high, and is probably the tallest in the world. An American method, patented by David Smith of New York in 1848, aimed to dispense with these tall towers, which stand up above the other buildings, like ancient obelisks, in every city where they are erected. A shorter tower is used, and a powerful current of cold air is blown up through the falling shot by means of machinery.

Sheet-lead and lead pipe.

About the last of the great manufactures of lead to be introduced in this country was that of sheet-lead and lead pipe: it is now, however, the principal consumer of the metal. There are about twenty-five factories engaged in making lead pipe and sheet-lead, having an annual product of $15,000,000 worth of goods. They are located principally in the Middle States. Sheet-lead is easily made by rolling. It is generally cast into plates six inches thick for the purpose, and is gradually worked down between two heavy iron rollers. Lead pipe was formerly made by hand: sheet-lead was turned up into a pipe, and the edges soldered. Large pipes are still made in this way. All attempts to cast lead pipe have proved to be too cumbersome and slow. The method in use is that suggested in 1797 by Bramah, the inventor of the celebrated English lock of that name, and patented by him. The process was introduced into the United States in 1840 by Tatham

& Brothers, who patented an improvement upon it in the genuine Yankee way. It consists in pouring lead into a cylindrical cavity in a block of cast-iron, which is kept at a heat sufficient to melt lead, and then forcing the lead out again, under a pressure of two hundred or three hundred tons, with an hydraulic apparatus, through an annular space the size of the pipe required. The steel rod, or core, which forms the bore of the pipe, is fastened to the piston, and passes through the cavity containing the lead, and out through the hole in the top of the chamber. It rises slowly with the piston, which crowds the melted metal out of the chamber through the annular opening above formed by the die and the core. The pipe, as it cools, and rises slowly above the top of the machine, is coiled around a large drum above. In one process the piston rises into the chamber of melted metal: in the other the piston descends, the die being in the piston, and the core projecting upward through it from the bottom of the chamber. An old method of making lead pipe was to cast a heavy cylinder of lead with a bore of the exact size required, and then gradually to work this down under rollers, using a mandrel to keep the bore open. It is not yet entirely obsolete.

Utility of lead pipe.

Lead pipe is very convenient for domestic purposes, because it can be readily bent to any angle required. If the water within it freezes, and bursts the pipe, the latter can be easily repaired. The only drawback to lead pipes is, that the water they distribute through the houses of our cities often corrodes the lead, and becomes thus impregnated with poison. The evil is obviated by keeping the pipes always full of water, and letting the water which has stood in them any length of time flow out before drawing water for cooking or drinking.

For ornamental purposes, lead is alloyed with seventy-five per cent of antimony. It makes a hard, white alloy, capable of taking a high polish. It is the material generally used in the keys of flutes.

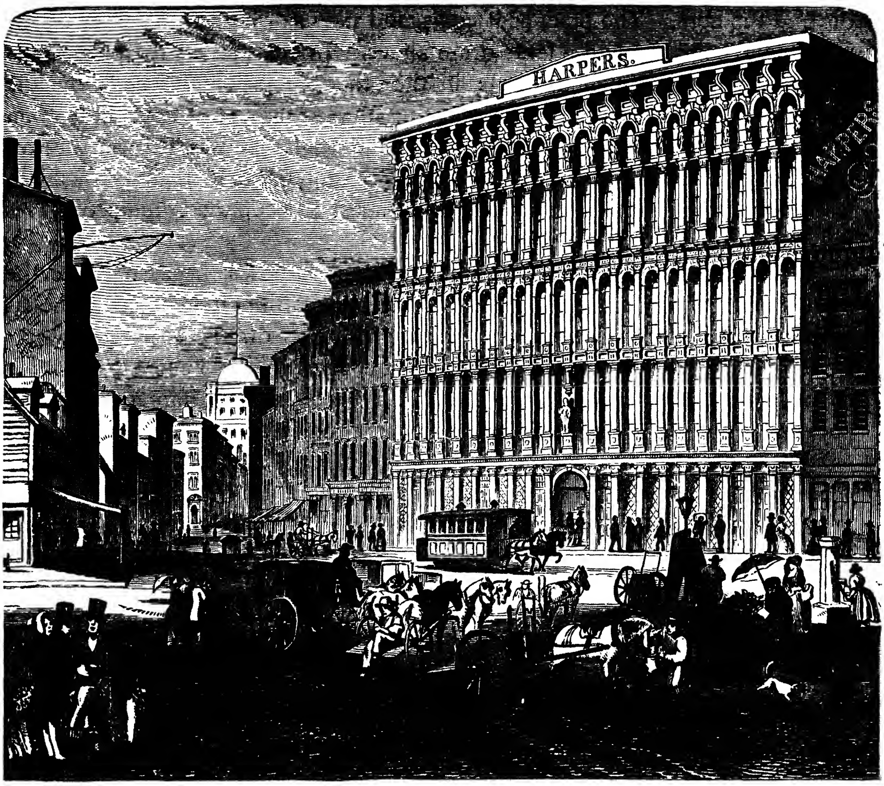
STEREOTYPING.

Economy of stereotyping.

There are serious objections to printing newspapers and books from type. A form of type is always liable to be "knocked into pie," as it is called in a printing-office. If the edition of the book or the newspaper is large, it cannot be printed expeditiously upon one press. It is necessary to set several at work upon exactly the same job. Not only would it be expensive to keep type enough on hand to "set up" some pages more than once, but it would be still more so to set them up. A better way is to cast the page of type in type-metal. By making a mould of the page, as many plates can be cast from it as may be desired, and thus several presses can be employed at once. The plates have, in addition, this advantage: they can be stored up in the lumber-room, and kept for years, if necessary; so that, if a new edition of the almanac, pamphlet, or book, is desired, it can be printed without encountering the cost of composition.

No books or papers were printed, in the early days of America, in sufficient numbers to justify a resort to the process of stereotyping. After the war of 1812 printing increased, and the need of stereotyping was felt. David and George Bruce added to their printing-business in New-York City a stereotyping establishment in 1813. It was the first in the country. Since that time, scarce any large book-printing or newspaper establishment has failed to add a stereotype-room to the resources of the business.

First stereotyping establishment.



HARPER'S PRINTING-HOUSE.

The method adopted by Mr. Bruce was to oil the surface of the page of type to be copied, and pour upon it plaster of Paris in a liquid form. This substance, when wet, hardens in a few minutes, and makes an excellent mould. The moulds, having set, were taken off, dried in a furnace, put in a casting-box, and dipped into melted stereotype-metal. The metal, having cooled, was taken from the mould. It was carefully examined for defective letters, and corrected by chiselling out the bad letters,

Bruce's method.

and inserting type. It was then planed on the back, and nailed to a wooden block for the press. This method has been practised in the United States down to the present day. It is, however, rapidly going out of use. It long ago disappeared from the large daily newspaper-offices, and has been replaced in most of the large publication-houses by another system.

How the stereotyping of newspapers is done.

In the great newspaper-offices the new method is called the "papier-maché" process. A few hours before the pages come down from the type-room the stereotypers begin to prepare heavy sheets of paper, in order to make the mould from them. A sheet of thin tissue-paper is spread out on a smooth iron table. It is brushed with some sort of sizing. Another sheet of tissue-paper is laid upon it, and brushed smoothly down. This, again, is sized, and another sheet laid on. A dozen sheets of tissue-paper are thus put together, forming a moist sheet of thick, heavy paper of extremely fine texture. When the forms come down, one of these thick sheets is laid upon the page, and hammered down with a heavy, long-handled brush, the stiff hairs of which drive the paper into the finest lines of the type. A great deal of the paper is beaten down between the type. The heavy indentations in the paper are then smoothly smeared with wet marble-dust, and another of the thick sheets laid on, and cemented to the first one by hammering with the brush. The form is then slid off upon an iron steam table, and put under a press, where it quickly dries. The sheet of paper, or papier-maché, is then taken off. It makes a perfect mould, and can be used for the casting of a dozen plates if desired; and indeed it sometimes is desired, the casting of each requiring only two or three minutes, The papier-maché matrix has another advantage. It can be put into a flat iron box for the casting of a perfectly flat plate, or into a semicircular one, or one describing any segment of a circle, for the production of a curved plate. It is this style of mould which has made possible the use of stereotype-plates upon a cylinder, and, per consequence, the invention of the perfecting web-press. It takes about twenty-five minutes to cast three plates of the page, counting from the moment the original page of type is received in the stereotype-room. By the plaster-of-Paris process it would take several hours, and the plates would be imperfect then; whereas by the other process they are absolutely correct. This system was the invention of several men, but was first made practical by Charles Crashe. It was brought out in 1861. Printers pooh-poohed at it at first, and "The New-York Herald" refused to adopt it; but Mr. Thomas N. Rooker, the old foreman of Horace Greeley in "The Tribune" office, saw its advantages, and tried it in his office. It worked well, and was instantly adopted. All the large newspapers of the country have since taken up and now employ this process, if they do any stereotyping at all.

The other new system referred to is also an American idea. It originated with Joseph A. Adams, a wood-engraver of New-York City, who reproduced an engraving by means of it about 1839, and, about 1843, employed it in producing various large borders and engravings for Harper's illustrated books. It has been greatly improved in various details by Wilcox, Filmer, Lovejoy, Gay, Knight, and others. The plan is to oil the page of type so that the mould will not adhere, or to cover it with finely-powdered graphite. A thick sheet of the best pure yellow beeswax, cast in a shallow box, is brought down upon the page under heavy hydrostatic pressure. An exact impression is thus obtained even of the finest engraving. Finely pulverized graphite is then dusted upon the wax, coating it uniformly in every line and depression, the excess being blown away. A new way of applying the graphite, invented by Silas P. Knight, is to pour a torrent of water, into which the graphite has been stirred, upon the mould. The wax matrix is then attached to the negative wire of a battery, and placed in a solution of sulphate of copper. The graphite serves as a conducting medium, and a film of copper begins to form immediately upon the face of the wax matrix. The mould is generally left in the solution over night. In the morning the copper is thick enough to be removed. A little quicker plan than this has been invented by Knight. He takes the wax mould dusted with graphite, and powders it with iron-filings. He then pours on a solution of sulphate of copper. The acid leaves the copper, and forms sulphate of iron; while the copper is deposited in a film. This is afterwards thickened by the electrotype process. The copper plate, when finally obtained, whatever the details of the process, is removed from the wax, tinned upon the back, and then laid face downwards, when stereotype-metal is bound on it, giving it the thickness of a regular stereotype-plate. It is then trimmed, planed, and fitted to the press in the usual way. Or only a thin back of stereotype-metal is given to it, and it is mounted upon a wooden block. This plan of making the plates is more leisurely than the other, is a more agreeable method for the workmen, and is adapted to the finer work of books and engravings. The number of impressions which can be taken from electrotype-plates is about three hundred thousand.

Adams's process.

If printing was the "art preservative" when in its crude infancy, what is it now, when the pages of a book can be cheaply cast in metal, and stored away, for centuries if need be, and then brought out to reproduce the thoughts of a generation of thinkers for the benefit of other ages?

TIN-WARE.

Tin is one of the most expensive of common metals, and most serviceable. While the average price of commercial iron is only twenty dollars a ton, tin costs about three hundred dollars a ton. The metal is as handsome as silver, and possesses the properties of incorrosibility, and of remarkable adhesion to iron; which makes it remarkably useful in the arts,

Utility of tin-ware.

and would alone have given it great value, even did it not ally so satisfactorily with lead and copper. Tin was once used in solid form for dishes for the table and for cooking-utensils, on account of its beauty and incorrosibility. In that form it was expensive. When it was found how readily sheet-iron could be plated with it, and thus, for all practical purposes, a sheet of metal obtained answering all the requirements of pure tin, but at one-tenth the cost, tin-ware came into general use. The restless mind of the New-England Yankee, which ever ran in the direction of improving the utensils of every-day life, seized upon the idea of producing dishes and house-ware from tin plates, and his ingenuity and enterprise have made the United States the largest consumer of tin-ware upon the face of the earth. In introducing the ware to the public, the Yankees resorted to that important agency in trade, the roving peddler, who, with a wagon loaded with plates, milk-pans, tea-kettles, dippers, cups, pails, &c., threaded every highway and lane in the country, and brought his travelling store and its tempting display of ware before the eyes of every housewife in the land. Tin-ware recommended itself not only on account of its beauty, but its lightness and general convenience. The milk-pan was, before its advent, a heavy earthen article; the milk and water pail a heavy bucket of wood, romantic enough for its association, but dreadfully tiresome to milkmaids, farmers' boys, and whoever had to carry it to and from the pasture and the well. The dipper was a heavy pewter scoop. All the ware of the household and the cans and pots of the store were clumsy and fatiguing contrivances. Tin-ware brought ease of handling, security against breakage, and beauty. To be loved, it needed only to be seen; and the untiring peddler who went through the land like the missionary of a new gospel of comfort created a veritable revolution by means of it. Forty years ago the peddler was the busiest and one of the most prosperous of our countrymen. Since he took to selling tin-ware, however, tin-shops have been opened in every community; and each city and village now depends for its supply upon its local makers. Farming-towns are still supplied to a great extent by the peddler. The growth of the manufacture of tin-ware is surprising. Formerly confined to the sterile soil of New England, it has extended all over the republic, and no corner of the remotest region is too far in the backwoods not to have been invaded by it. The number of shops where tin, copper, and sheet-iron ware are made was 6,646 in 1870; the number of hands employed was 25,283; and the value of the goods produced, $40,636,000. Over 3,400 of the shops were in the Eastern and Middle States. The tin-ware made is not entirely for culinary and pantry use, though it is principally so. A great deal of it consists of gutters for roofs, flues for the distribution of hot air from furnaces, &c.

Besides the use of tin for the plating of sheet-iron, the metal is also employed in coating a wide variety of other small iron articles to protect them from rust. Stirrups, bits, &c., are among the number.

TOYS.

Plate tin is now extensively consumed in the manufacture of toys for children. It is lighter than wood or papier-maché, is cheap, and can be easily fashioned by the use of dies and stamps. The business is of recent development. The largest house in the business is that of Leo Schlesinger & Co., New York. It is an interesting fact that playthings have become so necessary a part of American life, that the trade in them has suffered the least of all by the hard times. Playthings are a luxury; but, even if there is retrenchment in the family, the children have to be amused just as much as ever, and playthings are bought for them in scarcely diminished numbers. Besides, there is a growing demand for American toys abroad. Their ingenuity is unequalled. A great quantity of them now go to Europe and South America. In the manufacture of toys, the principal expense is the preparation of the dies. These are subjected to long and rough work, and consequently must be made of the hardest steel. They must be made with great nicety too, so that the different parts of a toy will fit. Some of the plainer toys require only one or two dies: others require four, six, and even nine. From four to ten weeks are necessary for the making of the dies for a single toy. In working up the tin into a toy, presses are used. In making a plain and unpretentious horse for every-day use, a sheet of tin is cut into the proper shape, placed in a press, and rounded out in such a manner as to form one side of the proposed animal. The two sides are next passed through a couple of cutting-machines for the purpose of trimming off the superfluous metal, and are then sent to another part of the building, fitted together in a mould, soldered, and sent to the floor above, where the completed animal assumes a coat of paint, and is turned out for use as a black, white, sorrel, or bay, at the discretion of the painter. The manufacture of a horse is a comparatively simple operation; but in making a yellow lamb standing on a smooth tin platform, with a painted bell about his neck, the animal passes through fifteen pairs of hands before appearing in a finished state. A group representing a boy leading his horse to a manger is of still more elaborate construction, and goes through at least thirty-five operations before being packed for removal. Of all toy animals the horse is the most popular, and he consequently appears in nearly every variety of shape and size. The largest and handsomest is the "Dexter," whose graceful form is made of zinc instead of tin. 180,000 "Dexters" are born and arrive at maturity in one factory in New York every year, and nearly 6,000,000 horses of a smaller breed were turned out during the past twelve months. One of the simplest playthings made is the putty-blower, well known to every school-teacher in the country. About 2,880,000 of these infernal machines were put upon the market by this one firm during the year 1876. The effects of the falling off in the number of emigrants to this country during the past few years do not seem to have

Tin toys.

reached toy-land as yet; for last winter nearly 10,000 emigrant-wagons, provided with one horse and two wheels each, were made and sold by one firm. One of the best selling tin toys manufactured is the hose-carriage, of which seventy-three different sizes and shapes are made. Fifty kinds of express-wagons, fifty-nine kinds of steam-cars, and twenty-five kinds of horse-cars, are manufactured. The newest plaything in the market is the livery-stable; and the swinging cradle immediately preceded it, with an American eagle at either end, instead of the guardian angel of tradition and song. One of the most important departments in the toy establishments is presided over by young men whose inventive minds are constantly engaged in producing new toys, and "improvising amendments" upon those already in vogue. All the paints used in toy-making are mixed by the operatives themselves before using, and in the process of painting alone all the larger toys pass through half a dozen or half a score of hands and brushes. It is estimated that the annual production of a single manufactory will often aggregate between 40,000,000 and 50,000,000 toys.

Tin plates are prepared simply by dipping the sheets of brightened iron into a bath of melted tin.

APPLICATIONS OF ZINC.

Importance of zinc.

Zinc is good for a great many things besides the making of brass. It is an important rival of lead in the manufacture of house-paint. It is a popular material for putting under stoves to prevent coals and ashes from dropping upon the carpet. It is often made into hot-air flues for furnaces in the warming of dwellings. It is also now largely used in architecture for ornamental and fire-protection purposes.

Zinc-paint.

The manufacture of white oxide of zinc for the purposes of paint is a French invention. The process of making the oxide directly from the ore, instead of from the pig-metal, is purely an American idea. It grew out of the experiments of Mr. Richard Jones of Philadelphia about 1849, and was first put into practice by the New-Jersey Zinc Company of New-York City, which was incorporated in 1849, and set about the manufacturing of oxide from the ore at Newark, N.J. The company was very successful, and has developed its business, until it has forty furnaces engaged in the production of zinc-paint. It was followed in the business, about 1853, by the Pennsylvania and Lehigh Zinc Company at Bethlehem, Penn.; and a third company was established in 1855, called the Passaic, which put up its works at Communipaw, on New-York harbor. The zinc-paint soon recommended itself, from the fact that it was not poisonous; and the manufacture of it has become enormous. The process of manufacture has one spectacular feature. The ore is ground up fine, mixed with coal-dust, and charged into a blazing furnace in

Development of industry.

Process of manufacturing.

the proportion of six hundred pounds of ore to three hundred pounds of coal. The heat sublimes the zinc. The vapors rise up through a pipe at the top of the stack. The pipe ends just above the stack, under an inverted funnel, which covers it like a hood. A strong current of air is drawn up through this funnel by flowing apparatus; and the vapors of the stack are thus carried up through the funnel, mingled with atmospheric air which enters at the open base. A very vivid combustion of the zinc takes place within the hood. The metal unites with the oxygen of the air with a pale blue flame, and rushes up into a huge pipe above in the form of oxide of zinc. The current of floating particles and gases is now carried a long distance through pipes into a tower, where it is partly cooled by dripping water, and thence into another, where the air is strained, as it were, by huge flannel bags stretched horizontally across the building. The oxide collects upon the bags, and is from time to time shaken off into cotton flues, or teats, which conduct it into receptacles below. It is put into bags and pressed to get out the air, and then ground with blanched linseed-oil for market. It is claimed that zinc-paint thus prepared has greater purity, durability, and brilliancy than lead-paint. It makes a valuable pigment, certainly; but its most valuable quality is the fact that it is not poisonous, and that, therefore, the workmen may handle it without suffering from the disease known as painter's colic.

Zinc cornices.

A recent application of zinc is to the construction of the cornices of buildings. On the business-streets of a city, where the walls of the buildings are of stone or brick, and the roofs sheeted with tin or a gravelly composition designed to protect it from fire, it has frequently been found that the buildings often take fire and burn down, when there is a fire across the street, because the cornices are inflammable. The wooden cornice is, therefore, an element of danger to a store. Within the last twenty years American builders have been experimenting with cornices made of metal, and they find zinc well adapted to the object. It can be easily stamped or beaten into any pattern desired; resists fire; and is, when painted, indestructible by the elements. It is so cheap, too, that it has brought handsome cornices within the means of all; and the invention has really been the means of improving the architectural appearance of our former exceedingly plain business-streets, as well as their security.

CHAPTER IV.

THE MANUFACTURE OF WOOL.

GENERAL HISTORY OF THE WOOLLEN-MANUFACTURE.

ONE of the very first cares of the early colonists of America was to obtain an ample supply of materials for clothing. This for many years they bought from the Dutch ships which came across the sea to trade, and from the English at home, paying for their cloth with tar, boards, tobacco, hides, and other rude products of the farm and forest. In 1660 a law was passed in England prohibiting the Dutch from trading in the colonies, and requiring the colonies to trade only with England direct. This cut off all access to a market in which goods might be bought cheaper than in England, and led the colonists to think of manufacturing their goods as far as possible for themselves.

Materials for clothing, how first obtained.

Nevertheless, the manufacture of woollen came into existence as a public industry very slowly. It was not the desire of the home government that the colonies should manufacture for themselves. It was the constant study of the men who directed the government to find ways in which the colonies might be made useful to the capitalists, traders, and factory-owners of England. Macpherson gave expression to the sentiment prevailing in England when he said, "The original intent of planting those colonies; viz., to be a benefit to their mother-country, to which they owed their being and protection." The way in which it was sought to make them a "benefit" was to compel them to sell to England all they had to sell, and buy from her all they had to buy. The first Lord Sheffield expressly said that "the only use" of the colonies was a monopoly of their trade, and the carriage of their produce. Lord Chatham declared that "the British colonists of North America had no right to manufacture even a nail or a horseshoe." A law of Virginia, passed in 1684, to encourage textile manufactures in that province, was promptly annulled by England. In 1731 the carriage of woollen goods and hats from one colony to another was forbidden by law. The exportation of woollen was also forbidden. The

Ideas of English on the subject.

England's policy.

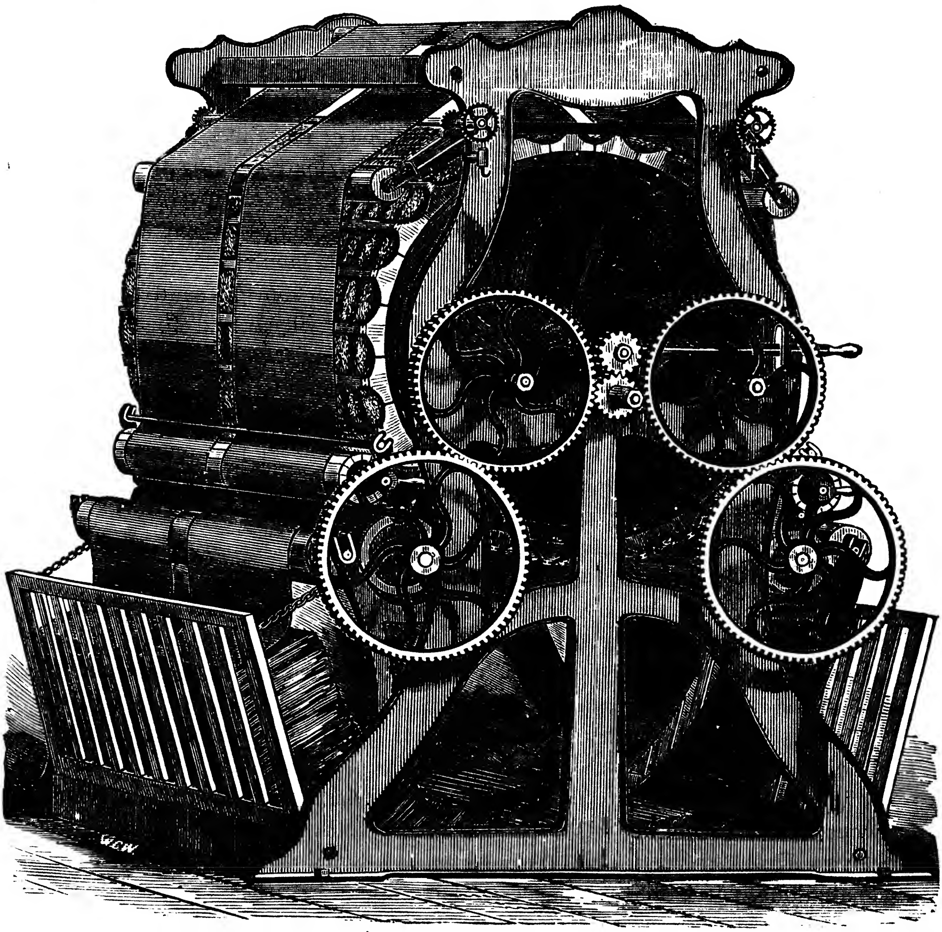
object of England's policy was to keep the Americans, a race of farmers and foresters, raising tobacco, sugar, indigo, hemp, &c., and getting tar, pitch, rosin, and timber from the forests, which they should sell to the mother-country; and to make them depend upon British factories absolutely for their clothing, tools, furniture, carriages, and all other manufactures. This policy meant mischief. It could not go on forever. No nation can produce agricultural products enough so as to have a sufficient surplus to pay for the manufactures it consumes. The colonies could not. They never exported enough to England to pay for what they bought of her; and never could have paid for what they bought at all, except that they sold large quantities of provisions to the West Indies and other countries in exchange for money, in spite of the laws which forbade it. The colonies got poorer and poorer under this policy. In 1760 they bought £2,500,000 worth of goods from England, and sold to her only £750,000 worth; and in 1771 they bought about £4,100,000 worth, and sold only £1,350,000 worth of goods. They were nearly ruined by it.

1776.

This interference with the freedom of the colonists to trade and manufacture led to two results. First they took to wearing leather garments, because they could rarely afford the imported woollens. The men wore, for a long period, waistcoats and breeches of Indian-dressed skins, —a custom which survived until the Revolution, and made its last appearance historically in the uniforms of the Continental regiments. The women wore leather jerkins and petticoats very largely; and in some of the colonies the clothing of the bed was almost entirely of leather. The sheets alone were of linen. A second result was, that industry not permitted to flourish in the open air did so in the shade. The women learned to weave and spin; and a large quantity of woollen, hemp, and linen cloth and other goods, was made in the privacy of the household throughout the whole country. Nearly every family wove a part or the whole of its own clothing and blankets; and many which had skill in the art had many pieces over and

Effect of English policy.

above their own wants to sell the merchant. The law could not reach their private factories. In 1750 a factory of woollen hats in Massachusetts was declared a nuisance, and suppressed. Parliament could club down the ripening fruit which hung in plain sight on the branches; but the million buds forming in secret under the bark, which a favoring time would eventually bring out



DOUBLE-ACTING GIG.

into bloom, were beyond its reach. In 1765 a society was formed in New York to encourage the home-manufacture of woollens. The enthusiastic members signed a pledge not to buy imported cloth, and not to eat the meat of sheep or lamb. The great want of the country was a supply of wool; and the killing of mutton was discouraged by this society and by public sentiment, in order not to diminish the sources of the supply. Homespun cloth became the rage. The Federal troops were dressed in it; and Washington, when inaugurated as President, wore a brown suit of it.

Simplicity of early manufacture.

The manufacture as carried on at that time was of the simplest description. The wool, being washed, was combed as nearly straight as possible by two cards, with leather backs and wire teeth, held in the hands of the operator. The wool was detached from the cards in a long soft roll, which was then made into yarn upon the simple spinning-wheel of those days. A large, light wheel, kept constantly in motion by the hand of the goodwife, and afterwards by her foot by means of a treadle, caused a single spindle to revolve with great velocity; and this spindle gave to the yarn its twist, the dexterous fingers of the operator regulating the supply of wool and the consequent size of the yarn. The cards were made by hand. Many people are still living who either made those old hand-cards for spinning, or who spun the yarn and wove the cloth of the whole family, year in and year out. The cloth, after being woven on the simple, slow moving hand-loom of the colonial days, was sent out to be fulled. Every village and country had its fuller and dyer, and this individual was the only one in the industry who carried on his business publicly and for a number of customers. Dyeing was not well practised then, and colors were seldom fixed so that they would not run. Bright colors were liked by gentlemen for coats in that age, — bright blue, scarlet, claret-color, &c. But, while a great deal of cloth was made of those hues, it always behooved the wearer of the coat to keep out of the rain. The Continental troops often presented a forlorn appearance from the faded aspect of their uniforms, which was forlorner even than that of the weather-beaten regiments of the war of 1861, because the Continentals made some pretence of style, while the regiments of 1861–65 did not.

Hamilton's report.

In 1791 Alexander Hamilton made his celebrated report on manufactures, in which is found one of the few records of the state of the woollen industry at that time. His references to wool are the following: —

"To all the arguments which are brought to evince the impracticability of success in manufacturing-establishments in the United States, it might have been a sufficient answer to have referred to the experience of what has been already done. It is certain that several important branches have grown up and flourished with a rapidity which surprises, affording an encouraging assurance of success in future attempts. Of these it may not be improper to enumerate the most considerable.

. . . .

"VIII. — Hats of fur and wool, and mixtures of both, women's stuff, and silk shoes.

. . . .

"Besides manufactories of these articles, which are carried on as regular trades, and have attained to a considerable degree of maturity, there is a vast scene of household manufacturing, which contributes more largely to the supply of the community than could be imagined, without having made it an object of particular inquiry. Great quantities of coarse cloths, coatings, serges and flannels, linsey-woolseys, . . . and various mixtures of wool and cotton, and of cotton and flax, are made in the household way, and in many instances to an extent not only sufficient for the supply of the families in which they are made, but for sale, and even, in some cases, for exportation.

. . . .

"In a country the climate of which partakes of so considerable a proportion of winter as that of a great part of the United States, the woollen branch cannot be regarded as inferior to any which relates to the clothing of the inhabitants. Household manufactures of this material are carried on in different parts of the United States to a very interesting extent. But there is only one branch, which, as a regular business, can be said to have acquired maturity: this is the making of hats. Hats of wool, and of wool mixed with fur, are made in large quantities in different States; and nothing seems wanting, but an adequate supply of materials, to render the manufacture commensurate with the demand. A promising essay toward the fabrication of cloths, cassimeres, and other woollen-goods, is likewise going on at Hartford in Connecticut. Specimens of the different kinds which are made, in the possession of the secretary, evince that these fabrics have attained a very considerable degree of perfection. Their quality certainly surpasses any thing that could have been looked for in so short a time and under so great disadvantages, and conspires, with the scantiness of the means which have been at the command of the directors, to form the eulogium of that public spirit, perseverance, and judgment which have been able to accomplish so much. To cherish and bring to maturity this precious embryo must engage the most ardent wishes and proportionable regret, as far as the means of doing it may appear difficult and uncertain. Measures which should tend to promote an abundant supply of wool of good quality would probably afford the most efficacious aid that present circumstances permit. To encourage the raising and improving the breed of sheep at home would certainly be the most desirable expedient for that purpose."

Farther on Mr. Hamilton alludes to the fabrication of carpets and carpeting, "toward which some beginnings have been made." He also remarks, "It is doubtful if American wool is fit for fine cloths," — a statement which sounds strangely, seeing that all our fine cloths are now made from American wools, and the coarser fabrics from those which are imported.

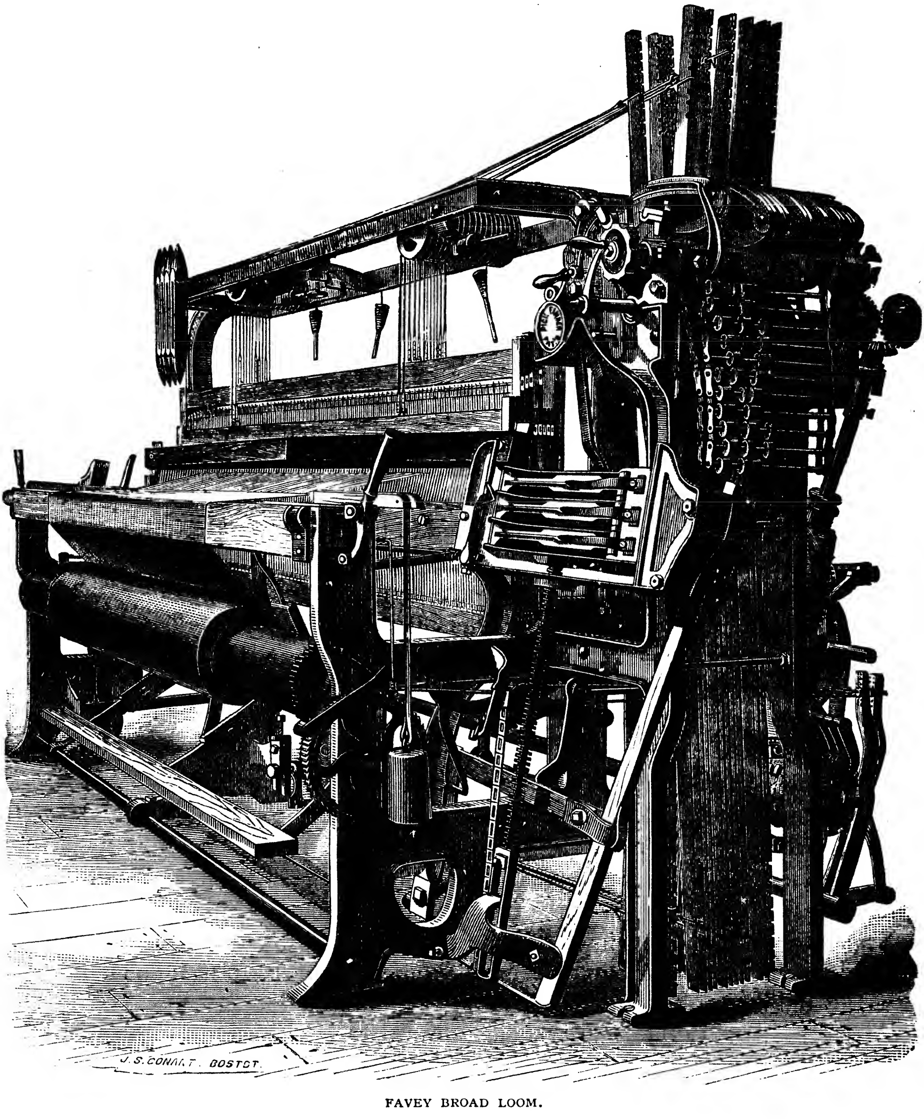
The woollen-manufacture did not change its character as a private occupation immediately after the Revolutionary war, as might have been supposed, even though emancipated from the chains imposed upon it by English policy. New ways are slowly learned, and there was a lack of capital in the country to build factories. Besides, after the treaty of peace, a flood of manufactured goods of all kinds was again poured into the country from England, against which there was no power in Congress to offer the shield of a protective tariff. When Congress was equipped with the power, it was thought best, at first, not to exercise it in respect to woollens. Wool was admitted free of duty; but no protective duty was levied on cloths until 1804, when fifteen per cent was levied. In 1812 this was increased to thirty per cent. Under these two laws the dormant buds awoke, and the manufacture bloomed into being.

Tariffs of 1804 and 1812.

There had been no factories, except fulling-mills, until 1791, when "the promising essay" was made at Hartford. In 1794 a successful factory was opened in Byfield Parish in Newbury, Mass., where the work was done by machinery. The same year the first carding-machine in the country was set up at Pittsfield, Mass., one of the early centres of the woollen-industry, where also the first broad loom in the country was afterwards set in motion. In 1801, 1804, and 1805, other carding-machines were started. Gray mixed broadcloth of good quality was made at Pittsfield as early as 1804. Madison wore a suit of black broadcloth of American make at his inauguration in 1809, — an act which well became that eminent statesman, who, though a free-trader in principle, openly advocated the policy of protection to home manufactures as essential to the strength and prosperity of the republic, and who had presented to Congress the original tariff bill which it had adopted. In 1809 a woollen-mill was put up in Northern New York, at Oriskany, in Oneida County; and others followed it within a few years in that region. In 1812 a large mill, for those days, was started at Middletown, Conn., for the making of fine cloths and cassimeres. Every day thirty or forty yards of broadcloth were made, which would sell from nine to ten dollars a yard by the piece. Small factories for coarse cloths were now getting into operation in all directions throughout the country, but especially in Massachusetts, New Hampshire, and Connecticut, which were both wool-growing and extremely enterprising States. Blankets were being made in Connecticut in considerable quantities. Superfine cloths were making at Northampton and elsewhere, which were patriotically claimed to be superior to the imported goods. The wool-supply was not yet sufficient for the needs of the country. But a merino-fever was raging: wool rose to a dollar and a half and two dollars a pound; heavy importations of sheep were taking place, and farmers giving a degree of attention to breeding, incited thereto by the high prices, which promised ere long to give the manufacturers an ample supply of excellent and cheap home-grown fleece. The war of 1812 gave a fresh impulse to manufacturing; and, during those three years in which it was in progress, it was impossible to take up a newspaper without seeing in it some notice of a new woollen-factory which had been started, or some new style of American-made woollen-goods which manufacturers were essaying to make.

Rise of factories.

The census of 1810 reported that the manufacture of wool was at that time still mostly in families. The production was roughly valued at $25,608,-



FAVEY BROAD LOOM.

788. Although the spinning-jenny, the power-loom, the nap-cutter, and various ingenious machines, were now in practical use in factories, this household manufacture appears to have been a thing the people were slow to give up. It was a valuable source of income to people of moderate means. Women could then do but few things to

Household manufactures.

make their time a source of revenue, besides spinning and weaving; and the generation of men and women of 1810 did not relinquish the household manufacture until they had passed off the scene of earthly toil and struggle. This household employment was also prized by public men, for the sake of its influences upon the character of our people. Henry Clay, speaking of the lives of farmers and mechanics, said they tended to "beget a peculiarly eager, disinterested love of truth, and exempted them in a good degree from those sudden impulses to which those who move in the more excitable walks of life are more frequently liable, and which, though sometimes leading to great actions, are oftener the prolific source of error." And it was upon people working among the pure associations of family life that these influences exerted their most powerful effect. In the fall of 1814 thirty bales of woollens were sent from Berkshire County, Massachusetts, to Albany, in one shipment; and one economist of those days, speaking through the columns of a Baltimore newspaper, said of it, —

"These cloths, it adds much to our pleasure to learn, were mostly manufactured in private families, — the plan that of all others we wish may be pursued, as it brings the *whole labor* of the people into active and healthful employment, and is without the many objections to which large establishments are liable. It is astonishing to be informed of the extent to which this industry is applied. Many of the most elegant belles that trip our streets are covered with superb shawls, and otherwise protected from the cold, by the labor of their own hands, — hands that heretofore chiefly held a romance, or touched a piano. These household manufactures are a sort of clear gain to our country, and we particularly exult at the progress they make."

Alas for the simplicity of the times of our bright-eyed, dear old grandmothers! How many of their daughters who now trip the streets are "covered with superb shawls, and otherwise protected from the cold, by the labor of their own hands"? It is to be feared that too many of them have resumed the romance and the piano.

So long did the home-manufacture retain its charm, even after factories were established, that work of the early factories simply wove the yarn that had been spun at the houses in the country round; and, when the maidens and spinsters in the household gave up the spinning-wheel and hand-loom, they simply did it to go to the factory, and resume work there.

Rapid increase of mills after 1816.

After 1816 carding-mills, fulling-mills, and woollen-factories increased rapidly in every part of the country. In 1832 the protection to woollen-manufactures, which had been lowered slightly after the war, was increased to fifty per cent, and a few years of great prosperity were enjoyed by the trade. Under the descending tariff of 1836, which brought the duties down to twenty-nine per cent in 1842, an era of depression occurred; but in 1842 protection was again decreed by a duty of forty per cent, which changed the face of things. New vigor was imparted to wool-growing and wool-manufacturing, and preparations were made for the erection of woollen-factories in great numbers, especially in New York and Pennsylvania. Every village with a mill-stream aspired to have its woollen-mill, particularly if situated in a pastoral region. Public meetings were held in all such places to raise subscriptions to the stock of the mills; corner-stones were laid with impressive public ceremonies, and odes written, beginning,

> "Hail, Enterprise! whose rising sun
> This day beams forth its light;"

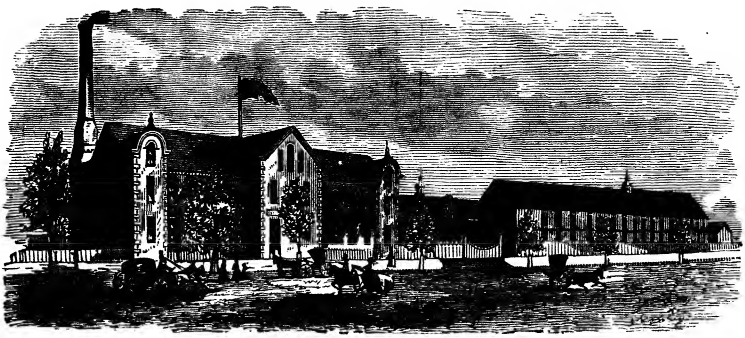
and public dinners were given in commemoration of the new era in village affairs, at which extraordinary toasts to "Liberty," "Public Spirit," "Our Own Village," "Our Guests from the Neighboring Towns," &c., were drunk enthusiastically. It was a period of great excitement, adventure, and public satisfaction. American invention took fire sympathetically during this period, and was stimulated to improve upon the looms and other apparatus then in use, and a great many valuable ideas were patented during that period. By 1850 the number of factories had increased from about twenty-five in 1810 to 1,559, employing 39,252 hands, and producing $43,207,545 worth of goods. The growth of production year by year had been as follows: —

1810	In founderies	$25,608,788
1820	In factories, the family manufactures not being reported,	4,413,068
1830	In factories	14,528,166
1840	In factories	20,696,999
1850	In factories	43,207,545

The development of 1850 was chiefly in the Middle States. One-half of the woollen-mills in the country were in the three States of Pennsylvania, New York, and Ohio. More than one-third of the whole number were 1850.
in New England. A beginning had been made in the prairie States of the West, and Virginia was employing no less than a hundred and twenty-one factories in the art. In the great mountainous and volcanic regions of the Far West, which, according to Judge Kelley, are destined to be the greatest wool-producing country of the world, there was as yet no trace of the woollen-industry. California had neither mills nor sheep. There was not a mill west of the Missouri River, and not one in the States of New Jersey, South Carolina, Florida, Alabama, Mississippi, Louisiana, Arkansas, Kansas, and Minnesota. In spite of the unequal distribution of the industry, the development was very satisfactory. It kept pace with population, and it stimulated population; for it enhanced the profits of agriculture by creating a large home-market for wool, and it brought into the country a large body of emigrants to work in the factories and settle on the public lands.

The woollen-manufacture of the United States has had the misfortune to be constantly subjected to alternate chills and fever, owing to causes entirely beyond the control of the mill-owners. It was now to encounter one of its periodic chills. The duties were lowered a trifle after 1846, and in 1857 they had been reduced about one-half what they were in 1842. This brought upon the factories again the almost undiminished force of foreign competition. Their plight was aggravated by the Massachusetts and Pennsylvania mills enlarging their capacity to a great extent, and by the erection of a hundred and thirty-eight new mills, many of them of unusual capacity, in different parts of the country; also by the panic of 1857, which brought about hard times. The total production of the country had slightly increased by 1860; but four hundred and forty-seven factories which were running in 1850, and a number of others built during the interim, had closed their doors, discharged their operatives, and ceased to do business. They were mostly small concerns, built to make local markets for the wools of their several counties; but a large amount of the earnings of the people was invested in them, and the disaster was a serious one. Many of the mills were sold out by the sheriff, to the great loss of the original owners. Of the mills which closed, sixty-five were in Connecticut, a hundred and nine in New York, a hundred and ten in Pennsylvania, and seventy-six in Virginia. It was a blue time for the woollen-industry.

Struggles of woollen-manufacturers.



CROMPTON LOOM-WORKS, WORCESTER, MASS.

The most encouraging feature of this era was the fact, that, though nearly every woollen-mill in the country was in straits, the quantity of wool actually consumed was fully maintained; and the farmers of the country, finding the market for their fleeces unfailing, were encouraged to go on and enlarge their flocks and production. This was a remarkable era of merino-breeding, particularly in the great States of Ohio, Indiana, Illinois, and Kentucky. The flocks of that region multiplied extremely fast from 1850 to 1860; and so much attention was paid to the care of the sheep, that the wool

Encouragements.

produced was of the most admirable quality. It found such a ready sale in the general market, that wool-growing in New England received a check on account of it. The flocks of New England actually decreased from 1850 to 1860. Mr. John L. Hayes, one of the high authorities on this subject, attributes the excellent quality of the wools which have resulted from the breeding of this particular era to the rural and economical habits of the American people in large part. He says, "There are certain qualities common to the varying breeds which are due to the influence of our climate and soil, but especially to the system of keeping consequent upon the thrifty habits of our people; and the most influential feature in their keeping is the fact that our sheep are uniformly and liberally fed, and hence produce a uniform, sound, and healthy fibre." The finest wool at the Exhibition of 1851 in London was from the State of Tennessee. Alexander Hamilton was "doubtful if American wool was fit for fine cloths." The quality of fleece bred in the years from 1850 to 1860 was fit for the finest cloths; and from that era to this the fine cloths of the United States have been almost exclusively made of American wools, while it is into the coarser fabrics that the imported wools have principally gone.

A new era in the woollen-industry dawned with the Morrill tariff of 1861, and the war which broke out in our territory before the end of the year. The Morrill tariff was not a war measure, although it became a law in the very midst of the excitement which preceded the war.

Morrill tariff of 1861.

It was introduced into Congress March 12, 1860; and was enacted March 2, 1861. It gave to woollen-goods a protection ranging from thirty to forty per cent; which was a great advance from the low standard of 1857. Once a law, it was powerfully supplemented in its operation by the war. The two causes combined were followed by extraordinary results.

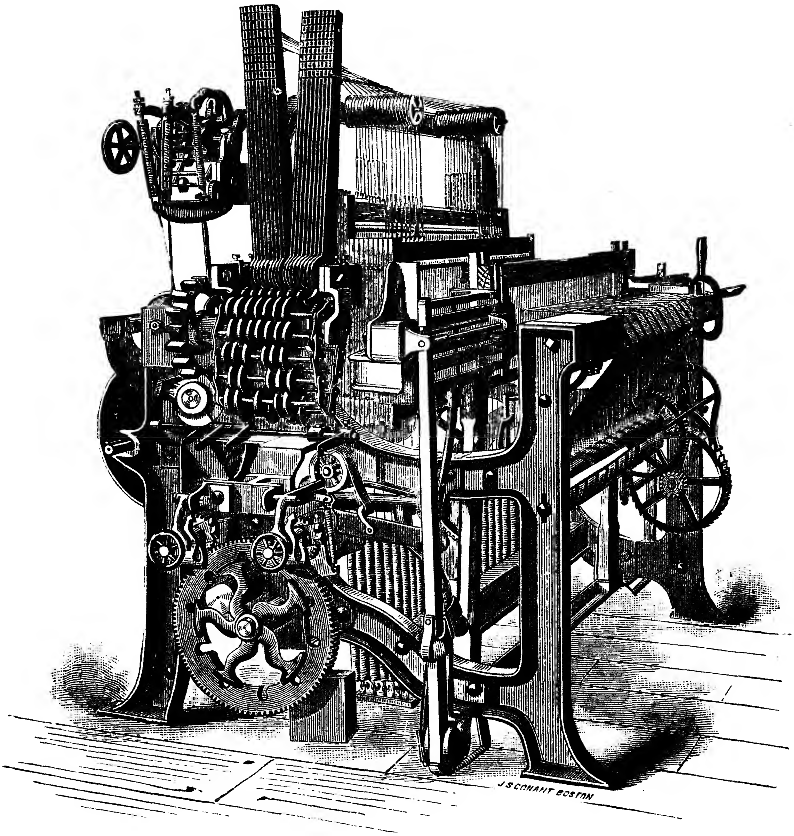
The United States have never yet gone into a war with factories enough to supply regiments in the field with clothing and the people at home too. The country has been obliged either to resort to leather, as in the Revolution, or buy cloth abroad, as in 1812, 1845, and 1861–65. It has even been the fact, that all the flags of the United States have had to be purchased outside of our own country. In an address delivered at Philadelphia in 1865 it was stated that "all our flags are grown, spun, woven, and dyed in England; and on the last Fourth of July the proud American ensigns which floated over every national ship, post, and fort, and every patriotic home, flaunted forth upon the breeze the industrial dependence of America upon England." When the hostilities of 1861 broke out, therefore, and it became necessary to clothe several hundred thousand men for the field and a larger number for the local defence of the several States, the woollen-cloth for the purpose could not be found in the United States. Not only was the country absolutely short of a supply of common woollen-cloth North and South too, but there was another fact in the situation. It had not yet entered upon the manufacture of the more elegant classes of goods. Before 1861 the factories had "attempted scarcely any thing beyond common goods of the coarser kinds." During the gloomy days of the war, an association of patriotic ladies at Washington pledged themselves to wear nothing except of American fabrication; and they found, much to their chagrin, that the variety of worsted dress-goods manufactured here was of an extremely limited character, and the goods were of a common class at that. This scarcity of cloth and of elegant goods, the increased consumption, and the protection of a timely tariff, made an immediate and lively market for American woollens. The manufacturers were not slow to take advantage of it.

Woollen-manufactures during the civil war.

During one period of the war, a large number of the cotton-mills of the country were obliged to suspend operations for the want of the raw material. There was so little cotton to be had, that the material rose from eighty-eight dollars a bale to nine hundred and a thousand dollars. No one could manufacture cotton at that price. Mill-owners closed their doors. At one time it is said that there was not a single cotton-spindle in operation in the whole of Lowell. The woollen-manufacturers, on the contrary, found themselves stimulated into wonderful activity. The government was calling continually for enormous quantities of goods. A fresh demand for American goods sprang up among the people, and the several States came into the market to buy uniforms for their re-organized regiments of militia. The mills which were in operation at the beginning of the war soon found themselves overwhelmed with orders for their goods, and a large number of them were engaged to run exclusively upon goods for the armies in the field. Under the influence of this new state of things, a great many of the woollen-factories which had been shut up during the previous hard times were re-opened and set at work. Hundreds of new factories were built in the great wool-growing region of the West: new mills were erected in nearly every one of the Southern States for the production of warm fabrics for army and people. In addition to all this, another thing took place. The cotton-mill owners of the North, seeing such a demand for woollens from both the government and the people generally, and not caring to keep their own machinery idle, resolved to turn a portion of their establishments to the manufacture of woollens. They bought expensive machinery, and put it into operation. Operatives were plenty, in consequence of the closing of the cotton-mills; and there was no difficulty in manning every spinning-jack and loom with competent hands. Every machine was run so as to produce the greatest amount of goods, and in many cases the mills were run night and day. It was an era of great prosperity. The woollen-machinery of the country was more than doubled during the war.

After the war there was a falling-off in the woollen-machinery of the country, owing to the restoration of the cotton-supply and the conversion of mills from the woollen to the cotton manufacture. But the South, being bare of goods, became a large buyer from the North at this time; and this served to stimulate toward the building of more new mills, and to prevent a decline in the manufacturing capacity of the country. As the abnormal consumption of woollen-goods by the government ceased as suddenly almost as the demand for them from this quarter arose, the wants of the South prevented the tide from turning against the manufacturers; and so they continued to reap a golden harvest. The state of things in

Woollen-manufacturing since the war.



CHAIN TAPPET-LOOM.

1870 as compared with 1850 and 1860 will show the extraordinary influence of the tariff and the war, and the subsequent demand from the South, in putting this important industry once more upon its feet. The figures are taken from the census reports: they refer only to the manufacture of woollen-cloths, and cloths of mixed wool, cotton, and silk, the carpet and worsted factories not being included.

	1850.	1860.	1870.
Alabama	....	6	14
Arkansas	....	....	13
California	....	1	5
Connecticut	149	84	108
Delaware	9	4	11
District of Columbia	1	....	....
Florida	....	....	1
Georgia	3	11	46
Illinois	16	21	109
Indiana	33	79	175
Iowa	1	12	85
Kansas	....	....	9
Kentucky	25	37	125
Louisiana	....	1	2
Maine	36	26	107
Maryland	38	27	31
Massachusetts	119	134	185
Michigan	15	16	54
Minnesota	....	....	10
Mississippi	....	4	11
Missouri	1	11	156
New Hampshire	61	51	77
New Jersey	41	35	29
New Mexico	....	....	1
New York	249	140	252
North Carolina	1	7	52
Ohio	130	115	223
Oregon	....	1	9
Pennsylvania	380	270	457
Rhode Island	45	57	65
South Carolina	....	1	15
Tennessee	4	1	148
Texas	1	2	20
Utah	....	....	15
Vermont	72	46	65
Virginia	121	45	68
West Virginia	....	....	74
Wisconsin	9	15	64
Total	1,559	1,260	2,891

The following table shows the production in all the States at three different periods. This includes a space of thirty years, during which time a remarkable change occurred in the ratio of production in several of the States. Massachusetts had the lead in the beginning, and has kept it ever since; but the production of Pennsylvania, which was $5,321,860 in 1850, had increased to $27,580,586 twenty years later, thus placing her second in the list, the rank which for many years was occupied by New York.

	1850.	1860.	1870.
Alabama	....	$191,474	$89,998
Arkansas	....	....	78,690
California	....	150,000	1,102,754
Connecticut	$6,465,216	6,840,220	17,371,048
Delaware	251,000	153,035	576,067
District of Columbia	2,400	....	....
Florida	....	....	500
Georgia	88,750	464,420	471,523
Illinois	206,572	187,613	2,849,249
Indiana	205,582	649,771	4,329,711
Iowa	13,000	127,640	1,647,606
Kansas	....	....	153,150
Kentucky	318,819	845,226	1,312,458
Louisiana	....	45,200	30,795
Maine	753,300	1,717,007	6,398,881
Maryland	295,140	605,992	427,596
Massachusetts	12,770,565	19,655,787	39,502,542
Michigan	90,242	139,246	1,204,868
Minnesota	....	....	219,862
Mississippi	....	158,507	147,323
Missouri	56,000	143,025	1,256,213
New Hampshire	2,127,745	2,601,653	8,766,104
New Jersey	1,164,446	1,085,104	1,903,825
New Mexico	....	....	21,000
New York	7,030,604	5,870,117	14,394,786
North Carolina	23,750	291,000	298,368
Ohio	1,111,027	825,000	3,287,699
Oregon	....	85,000	505,857
Pennsylvania	5,321,860	8,191,675	27,580,586
Rhode Island	2,381,825	6,915,205	12,558,117
South Carolina	....	80,000	34,559
Tennessee	6,310	8,100	696,844
Texas	15,000	38,796	152,968
Utah	....	....	199,600
Vermont	1,579,161	2,938,626	3,619,459
Virginia	841,013	717,827	488,352
West Virginia	....	....	475,763
Wisconsin	87,992	172,720	1,250,467
Total	$43,207,545	$61,894,986	$155,405,358

In 1860 the number of worsted-establishments in the country was three: in 1870 it was 102. The carpet-factories had not changed: there were 213 in 1860, and 215 in 1870. These figures show amazing progress. **Wonderful progress.** The States of the South (excluding Virginia), which had only thirty-two factories of woollen goods in 1850, and eighty-one in 1860, contained

720 factories in 1870, mostly small concerns, to be sure, and producing a coarse class of fabrics, but still busy factories, and affording a large local market for the fleeces from the plantations and farms. There were 497 woollen-factories in the West as compared with 258 in 1860. In Ohio, New York, and Pennsylvania, 932 woollen-factories had been put into operation as against 525 in 1860; while twenty-nine had been built west of the Rocky Mountains. In 1860 Massachusetts had two worsted-factories, and Rhode Island had one. There were no others in the United States. In 1870 there were 102, eighty-seven of them being in Massachusetts, Rhode Island, and Pennsylvania.

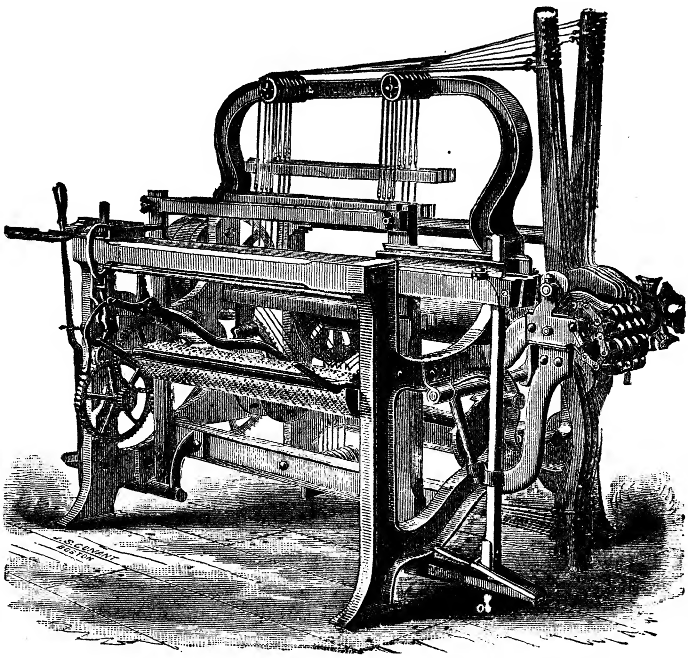
There had been equally interesting progress in the fabrics produced. Before 1860, the cloths, carpets, and woollen-goods of the country generally were of the coarse or common makes. Scarcely any thing had been attempted in the line of fine goods. After 1860 the factories began to make fine goods of every description. Particularly was this the case after 1864, in which year a more favorable adjustment of the tariff was made. It was, in fact, under the act of 1864 that the distinctively fine goods were chiefly undertaken. New machinery was bought, and old machinery was adapted to new uses. Coarse articles were still made; but the mills now began to produce fine shawls, worsted dress-goods, fine cassimeres, broadcloth, hosiery, alpaca fabrics, mohair-poplins, mohair-lustres, chinchilla cloakings, astrachans, embroidered table-covers, druggets, Axminster carpets, and almost every other variety of elegant wool-fabric. Entire success was attained with every class of goods; unless, perhaps, the finest broadcloth be alone excepted. If the manufacturers lacked a machine proper for the new purposes to which they were adapting their mills, they invented it. They frequented the world's fairs, and studied styles and processes. They acted on the old principle, which is expressed in a homely but forcible way in the motto at the head of the cards of a bill-poster at Atlanta, Ga., for 1878: —

> "It is not birth, nor rank, nor state,
> It's get up and get, that makes man great."

The manufacturers, during this period of ten years, displayed unexampled energy, and for the first time in the history of their trade they were able to furnish almost the whole of the immense supply both of coarse and fine goods required by this market. This market too, be it known, had increased threefold in power to consume from 1860 to 1870. The new styles of goods were distinguished by greater softness and strength, owing to the qualities of American wool. The staple goods, such as cassimeres, ingrain carpets, &c., displayed better style, improved finish, and softer and more agreeable colors. The delaines became so perfect, that a celebrated importer at New York, who, when called as a witness in a trial at court, had asserted his infallibility in detecting the differences in fabrics, was astounded to discover that he had sworn to the identity of foreign woven and American printed delaines.

Since 1870 depression has again chilled the hearts of the owners of the woollen-mills. This is, in part, owing to the panic of 1873, and the hard times, and retrenchment of personal expenses, which have reigned ever since. It has been, in part, due to the immense quantity of woollens which the government had on hand in 1866, when it disbanded its volunteer army of a million of men, and sent them to their homes. The government had more cloth than could be consumed by the regular army in several generations. As these goods were liable to be eaten by moths, the authorities resolved to sell them. The auctions each year depressed the price of coarse cloths, and curtailed the sales of the mills. For

Woollen-manufactures since 1870.



SATINET-LOOM.

several years, the horse-car drivers, truckmen, teamsters, and farmers wore the sky-blue uniform overcoats, or clothing made of that blue cloth dyed black, bought from the government. In consequence of the panic and the depression, the woollen-mills have lost a great deal of money. Many of them have passed into other hands at a loss. It is a fact which may be mentioned here, that nearly every woollen-mill of any consequence in the United States has, by reason of these regularly-recurring periods of depression, passed out of the ownership of the original projectors at a price considerably lower than its original cost. Owing to the hard times, the production of the mills has been lessened, so as to lighten the burden resting upon them as much as possible. Under the influences of decreased production and a lower rate of wages, the interest is now already reviving. Importations have been cut down from $50,-000,000 in 1872 to $26,000,000 in 1877. Foreign fabrics are being steadily driven out; and this great market, wherein 45,000,000 of people buy cloths, provisions, and all the necessaries and comforts of life, with its wonderful power of recuperation, is fast bringing back hope and energy to the hearts of the native manufacturers. The industry has a great future before it, and cannot long remain under the clouds that now surround it.

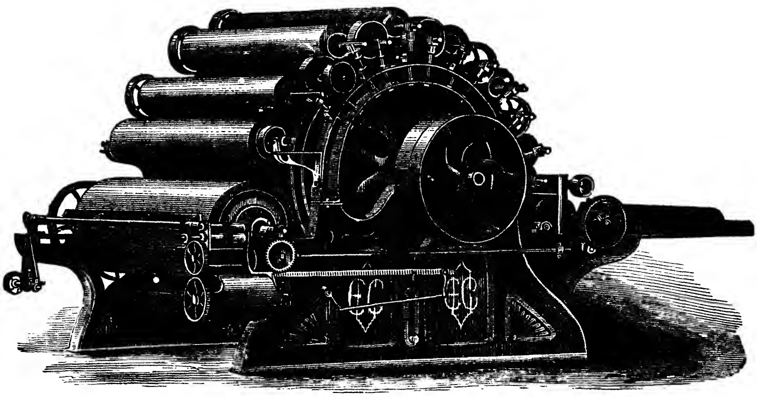
SPINNING AND WEAVING.

Evans's improved machinery.

The wire-toothed cards for combing out the wool were made by hand in the days of our forefathers, and were worked by hand. Oliver Evans of Maryland, one of the active-minded inventors of the Revolutionary era, invented a machine to prick the leather, cut, bend, and set the teeth in cards, but did not have the good fortune to see it go into practical operation. Subsequently, machinery for cutting the teeth, which were to be set in the leather sheets by hand, was employed at Worcester and elsewhere in New England. The teeth, put up in bags, were given out to families living in the country round about. The setting of the teeth was a fireside occupation; and the business employed large numbers of the gentle girls of that day, who afterwards became the mothers of rich and influential families of to-day. In 1796 Amos Whittemore took out a patent for a machine to make the cards; and this invention was soon followed by a machine to do the carding, and the two new processes soon superseded the old ones.

Carding.

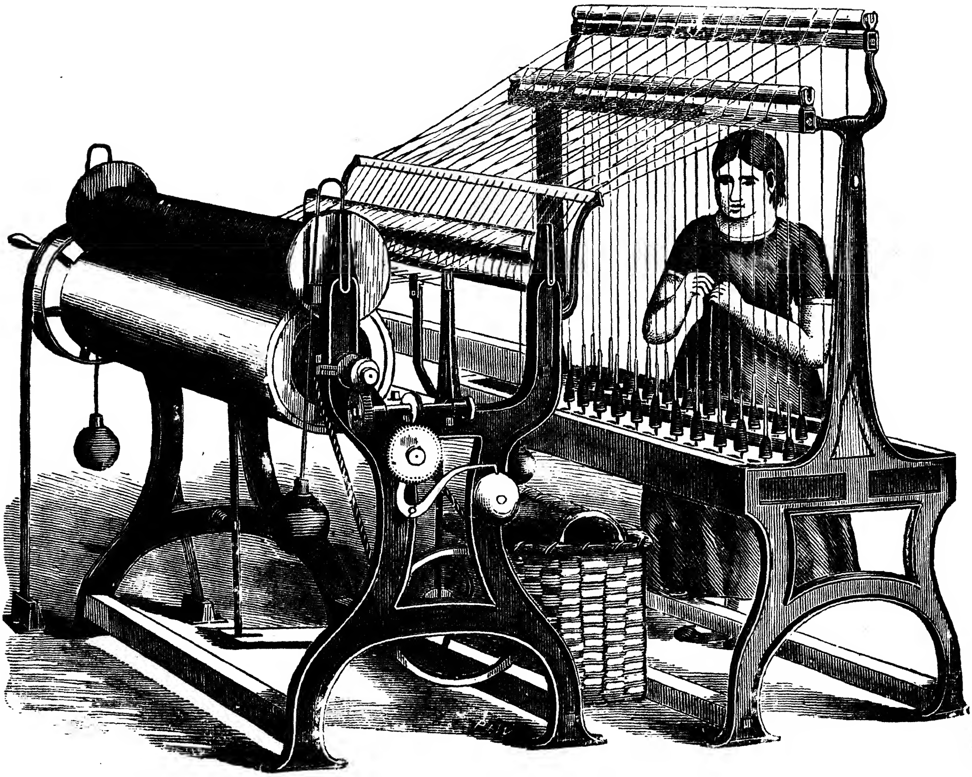
Carding is the first process of spinning. The wool is laid upon a feed-apron, and is drawn down therefrom to a large, slowly-revolving drum, whose whole surface is covered with wire card. The wool is taken up by the teeth of the card, and combed out between the large drum and two smaller ones revolving in contact with it, but in the opposite direction. The wool is then detached from the main drum by the action of the doffer, — a sort of comb moving with a quick, hoe-like motion; and it flows from the carding-machine in a broad, thin, gauzy fleece, through a smooth steel funnel, in which it contracts into a ribbon, or sliver, into a large tin can. Long wools which are used for worsted-goods are made into a sliver on the same principle, although the combing-machine varies from the one described in a few details. The slivers are now carried to the breaking-machine. Two or three (or more) cans are placed by the machine; and the ends of the slivers they contain are laid together, and passed through between two rollers, which seize and draw them forward, and pass them on to another set of rollers, which move three times as fast as the first. As a consequence of this process, the united slivers flow from the machine, and are coiled in another large tin can, in a fresh sliver of three times the length of the original slivers. Three of the new cans are carried to another frame, and the slivers passed through fresh sets of rollers; and this process is repeated sometimes until one of the slivers from the carding-machine is drawn out to fifteen hundred times its original length, although, by reason of having been incorporated with so many of its companions, it has been reduced in bulk only to about one-fourth its original size. This frequent drawing straightens the fibres of the wool, and lays them parallel to one another. The idea is the invention of Richard Arkwright of England, who made a fortune from it, and added as much to the productive power of England as though the country had doubled its population. After the drawing is completed, two slivers are united, and passed through the roving-frame, where they are drawn out so fine that they have to be twisted in the frame slightly to hold together. The roving is now wound upon bobbins, and carried to the spinning-machinery.



CARDING-MACHINE. CLEVELAND MACHINE-WORKS.

Spinning.

The original spinning-jenny of Hargreaves of England, invented in 1767, had eight spindles only: the spinning-jack of to-day has often as many as from two hundred and forty to three hundred. They are mounted upon a long frame, bearing the same relation to the machine as the front board of a bureau-drawer to the bureau, which, like the drawer of a gigantic bureau, can be pulled out a distance of ten or more feet from the machine in the spinning process. It runs out on wheels which support its weight. The bobbins containing the rovings are placed in a long row in the spinning-frame, and the ends of the soft yarn are carried through three sets of rollers to the spindles on the frame. The second set of rollers moves twice as fast as the first; and the third, five or six times as fast as the second. By this means it is still further attenuated. The twist is given to it by the spindles, which revolve with great velocity as the long frame is slowly pulled out from the machine as far as it will go. As the frame is run back again to its place, the twisted yarn is wound up on the spindles automatically, and the machine started again, and the process repeated. The twist given to yarn is from five to ten turns in an inch. The yarn is now wound off on reels in hanks five

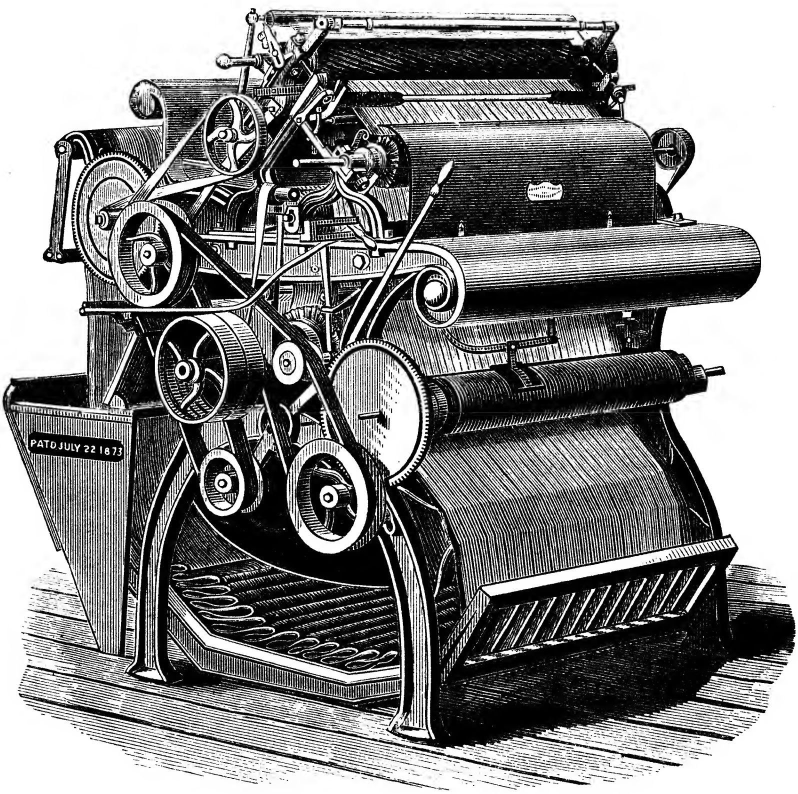


YARN SPOOLER AND STAND.

hundred and sixty yards long. The number of hanks to a pound indicate the size of the yarn; as No. 1, No. 2, and so on.

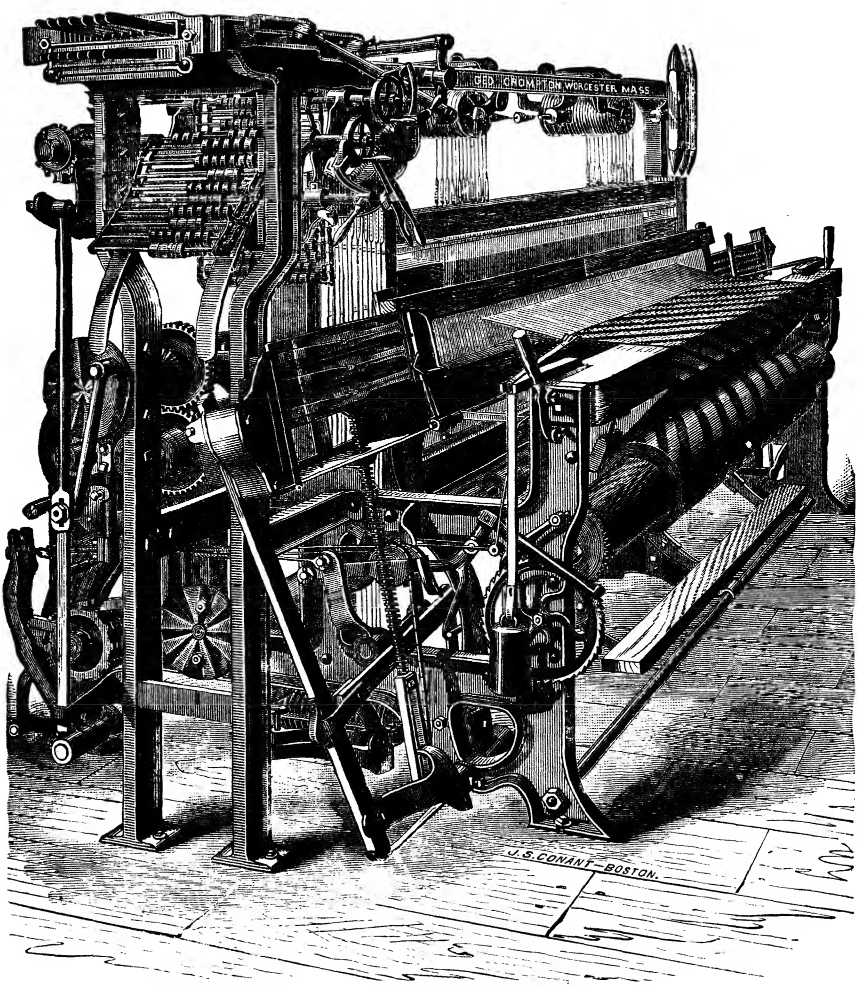
Weaving.

For weaving, the yarns which are to compose the warp of the cloth or carpet are wound off from the reels upon a long roller in a broad band of parallel threads the width of the intended piece of stuff. The rollers are placed in the loom. A forest of wires, or stout threads, crosses the loom from one side to the other, each one carrying an eye about the middle of its length. The yarns of the warp are passed through the eyes of the harness, as it is called, and thence on to the roller at the front of the loom. The office of the harness is to raise one set of the threads of the warp, and depress another set, so as to leave an opening through which the shuttle can be thrown, carrying the thread of the woof, and, when the shuttle has passed through, to depress the upper set and raise the lower set, thus locking the woof in its place, and opening the warp anew for another throw of the



SHEARING-MACHINE.

shuttle. This is the principle upon which all looms are made; but great ingenuity has been displayed in the management of the principle, so as to produce not only plain goods by means of the loom, but goods of all sorts of colored patterns, and varieties of surface. Threads of different colors are introduced for different parts of the warp; and a large variety of colors, sometimes eight or ten, are introduced by multiplying the number of shuttles and the apparatus for throwing them. The figures in weaving are produced by the fancy loom, so called, the invention of Mr. William Crompton, a native of England, but living, at the time the loom was projected, in this country. His patent was taken out in 1837. The looms were first used, it is believed, in the Middlesex Mills of Lawrence, Mass., in 1840. It is upon this loom that the fancy cassimeres and other figured cloth-fabrics are now woven.



SHAWL-LOOM.

Fulling.

After weaving, the cloth is fulled by washing and pounding in a tank, where it is subjected to the action of heavy iron mallets. It is reduced greatly from its original dimensions, both in length and width, by this process. It is then dried upon the tenter-frame upon which it is stretched. Fulling and dyeing complete the cloth, and it then needs only to be finished to be ready for the market. Made to pass over rollers, it is first scratched by a revolving drum upon which are mounted the heads of the teasel-plant, or by wire teasels; and it is then shorn by a cutting-machine with spiral blades on a cylinder acting against a straight steel blade, which cuts the nap perfectly to an even length. This helicoidal shearing-machine is an American invention, dating back to 1812.

In the mechanical department of the industry the American mind has been extremely prolific. There is not a machine in the whole factory, from the picker and the card to nap-cutter, which has not been altered, improved, and made to do better and faster work than the machines employed upon other continents. Some of the machines are purely of American invention. The wonderful Bigelow automatic loom, by which figures of any description can be woven into carpets, is the conception of Erastus B. Bigelow of Massachusetts, who took out his patent in 1845, and achieved what Europe had given up as hopeless. English machinery was largely imported at one time, especially during the war: but the Kilbourn self-operated jack, a home-invention, has superseded many of the very best English mules; and the Sawyer spindle, the outgrowth of a drought at Lowell, which made it necessary to lighten the machinery, has brought about a revolution in worsted spinning, being lighter, more efficient, and running with ease up to eight thousand revolutions, being at twenty-five per cent higher speed, with thirty-three per cent less power, than the common spindle.

Improvements of American inventors.

The machinery for a ten-set woollen-mill, all of American make, will cost about $70,000. It will require a hundred-horse-power to drive it, and 155 hands to tend it. In staple fancy cassimeres its production will be from 1,150 to 1,200 yards a day.

Cost of factory.

HATS.

One of the most interesting uses of wool arises from a peculiarity of its structure. The fibres of wool are not smooth like silk and flax, but they are roughly barbed with minute imbrications like the blades of some grasses, or the branches of a feather, which can be felt by pulling a lock of wool through the fingers. Some wools are less roughly barbed than others, and some fleeces which go by the name of wool — as, for instance, that of the Angora goat — do not possess the quality in any appreciable degree. But real wool has a serrated fibre. This peculiarity renders the shortest kinds of wool available for spinning, because, no matter what the length of the fibre may be, the barbs of the wool interlock when the fibre is twisted, and they convert the fibre into a practical yarn. This peculiarity has also given rise to a class of fabrics which are not spun at all. By rubbing a

Use of wool in making hats.

lot of wool together in hot water, the interlocking of the fibres takes place in a marked manner; and the result is the felting of the wool, or a shrinking into a close, compact, thick fabric, which is serviceable for a wide variety of purposes. The most popular use of fabric thus made is for the manufacture of hats. The idea, however, is applied to the making of piano-covers, druggets, beaver-cloths, and other heavy coatings; the wool when made into these goods being delivered from the carding-machine in a broad, thin web, which is doubled and crossed, and otherwise thickened, and then subjected to steaming and gentle hammering. Some felt seamless clothing has also been made.

Hat-making one of the earliest colonial industries.

Hat-making was one of the very earliest of colonial industries. The wintry storms and general cool climate of North America required that the covering of the head should be warm; and so, while the Spaniards of the West Indies were buying and weaving for themselves broad-brimmed hats of straw, the Americans went into the making of head-wear of thick wool. The industry began in New England: it afterwards extended to the other colonies. In Virginia, in 1662, the colonial authorities offered a premium of ten pounds of tobacco (the currency of those days) for every good hat of wool and fur made in the province. Hats were made in almost all the colonies; and in 1731 a special committee of Parliament reported that the enterprising Yankees were making 10,000 hats yearly, and were actually exporting them, with other things, to the continent of Europe and to the West Indies, — a piece of unparalleled impudence on the part of that underbred people, and quite in defiance of the welfare of the people of England and the navigation laws. So Parliament, in 1732, forbade the Americans to export hats or felts. The manufacture continued, however, and, indeed, the export too; and in 1791 Alexander Hamilton reported the business to be in a thrifty condition. It has been in that condition ever since. It has had a steady development, and has increased in value of total product from $4,323,000 in 1810, until it has reached the large aggregate of about $30,000,000 at the present time. The number of establishments making hats is now about 490, employing 16,500 hands.

Style of early hats.

The hats of the Colonial and Revolutionary era were broad-brimmed affairs, originally with high crowns, but afterward with low crowns barely rising above the top of the head. In the Revolution it was the fashion to catch up the brim on one side of the head with a cockade and feather, also to catch it up in two or three places, producing the regular military cocked hat and the hat of private gentlemen. The cocked hat went out of fashion after the Revolution, and gave place to the soft felt of various forms, and the tall, stiff stove-pipe which still remains the dress-hat of gentlemen. The white, bell-crowned, shaggy hat of the days succeeding the Revolution has gone into history as the symbolic hat of Brother

Jonathan. When Kossuth visited the country in 1851 and 1852, the style of hat he wore — a large, soft felt — became the rage for a while, and was worn for a few years with a feather. At present all sorts of soft and stiff felt hats are worn, varying in their outlines, size, and width of brim, from year to year, in response to the American taste for something new every successive season.

In hat-making, the fur of raccoons, beavers, and rabbits, is often mixed with the wool in small proportions. The right mixture being obtained, it was first felted by a process called "bowing." The bunch of fleece was gathered in front of the operator, and then violently agitated, and tossed into the air, by twanging the string of a stiff bow, and applying the string to the wool. The flying fibres would fall upon the table in a thin, even web. This was pressed under a cloth, and another layer put on, until the fabric was thick enough for use. It was then put between two cloths, immersed in hot water, and worked into a cone, which was shaped upon a hat-block, and allowed to dry in proper form, when it was napped and finished for the store. This was the original process. One man could make from four to six hat-bodies in a day. This process was quite sufficient for the leisurely days of the eighteenth century; but, in the more bustling times which succeeded them, it became necessary to increase the speed of manufacture, and machines were introduced to form the bodies. The wool was carded in the usual manner, and passed in a thin web from the machine to two revolving cones, placed base to base, over which the web wound in a zigzag manner. When the web was thick enough upon the cone, it was cut off, the two cones cut apart, and the woolly caps removed; when the process went on again as before, the removal of the cones being effected with great rapidity. The cones thus formed were treated in the usual manner. Another machine was also made to produce felted hats both of wool and of fur. The fibres were made to fly into the air; and the draught of air passing through a perforated cone of copper or one of wire caused them to settle down upon the cone evenly, in thickness sufficient for a body. These machines cheapened the cost of hats materially, and enabled the manufacturers to make them as light as one ounce if they chose; whereas, before, a perfect hat-body could not have been made to weigh less than three or four ounces. The stiff, tall silk hat, which weighs about six ounces, is still made chiefly by hand. Its texture is silk plush. It was once made of beaver-fur, and was called a beaver in consequence. The stiff hat made of brown or light-gray wool is called a cassimere.

Process of hat-making.

For summer wear, hats are now made largely of woven straw. Large, broad-brimmed affairs of cork are made for seaside and country wear, being light and airy, and protecting the head from heat, and the face from the fierce rays of the sun.

CARPETS.

The progress of a hundred years in carpets was well shown at the Exhibition in Philadelphia in 1876. No objects in the fair attracted more attention than the brilliant display of rich, soft American carpets; the opulent Axminster, laid down in the Old World only for the feet of emperors and noblemen, showing its radiant face from the midst of the throng, along with the more humble but still agreeable ingrains, three-plies, Brussels, and tapestry carpets. In 1776 the only carpet made in the United States was the unpretentious rag-carpet, woven with a stout yarn warp, and a woof composed of strips cut from the cast-off clothing of the people. From the hand-made rag-carpet of the farmhouse, to the aristocratic Axminster, woven in intricate and showy patterns upon a powerful automatic loom, one of the highest products of civilized art, is a hundred years.

Improvement in carpets.

The first regular carpet used in this country is said to have been imported by Kidd the pirate. A few carpets were imported, just before the Revolution, from Great Britain; but they were too expensive for most people. In 1791 the first carpet-factory was built in the city of Philadelphia by William Peter Sprague. It was followed not long after by others in the same city; and Philadelphia soon became the principal seat of the carpet-industry of the United States. It has always remained so, and to-day manufactures about one-half of all the carpets produced in the United States. Its factories are very numerous, and of enormous size. The city has a very extensive hand-loom house-carpet industry also. Up to 1845 carpets were woven, entirely by hand. In that year Mr. E. B. Bigelow patented a power-loom which would make figures that would match, and would weave so rapidly as to increase the production from eight yards a day (the average of hand-labor) to twenty-seven yards a day for two-ply carpet. The same machine was found applicable to the weaving of the heavy Brussels carpet also. It was employed on that class of goods, increasing the production from four to twenty yards a day. This invention diffused new life into the carpet-business of the country. The cost of carpets was so reduced by it as to bring the goods within the reach of all. The heavy purchases which were made by the people had the legitimate effect of leading to the construction of a large number of new factories and the enlargement of old ones. America is a country of homes. In spite of the emigration of population from one State to another, the American, wherever found, makes his house a home, and brings into it the charms and gentleness and grace of family-life. In the comfort of a home the carpet plays an exceedingly important part. It is absolutely essential to the quiet and happiness of the home. As soon as its value was discovered, it found its way into every dwelling, from farmhouse to brown-stone front; and the demand for carpets has therefore been regular,

Who imported the first carpet.

Carpet industry in Philadelphia.

Bigelow's invention.

large, and unfailing. The value of the carpet is so great, both on account of its beauty and its capacity for deadening the sound of the footfall, that it has within the last twenty years also invaded schoolhouses, churches, counting-rooms, railroad-cars, court-houses, and public buildings of the people. Its use is now universal.

Indications of growth.

The growth of the manufacture after 1850 is indicated by the following statement of the value of products: —

1850	$3,401,234
1860	7,857,636
1870	21,761,573
1876	36,000,000

The mills were distributed in 1870 as follows: —

Connecticut	3
District of Columbia	1
Maryland	1
Massachusetts	6
New Hampshire	3
New Jersey	2
New York	13
Pennsylvania	184
Wisconsin	2
Total	215

Manufacture of Axminster carpets in Philadelphia.

The Axminster carpets, which are laid down only in the most luxurious houses, and cost eight dollars a yard, were first manufactured at Philadelphia in 1868. They had been imported into the city of New York from France under the name of "moquette." They were all hand-made. The Philadelphians undertook their manufacture with power-looms, and succeeded so well, that the thick, velvety product, when placed side by side with the French, could only be distinguished from it by its own superior texture and cheaper price. The French makers were obliged to lower their prices one dollar and two dollars a yard to maintain themselves.

Importations nearly over.

Carpets are now imported only to a limited extent. We can now make all the ingrain, two-ply, three-ply, jute, and hemp carpets that are used in this country. We have the capacity to produce nearly all the Brussels, tapestry, and Axminster carpets also. The importation is therefore limited to Turkish and Persian rugs, and a few of the more elegant and costly styles of velvety and fashionable French and English carpets, which fashion desires because they are foreign-made, and because it despises that which the multitude can have, no matter how beautiful and comfortable the fabric.

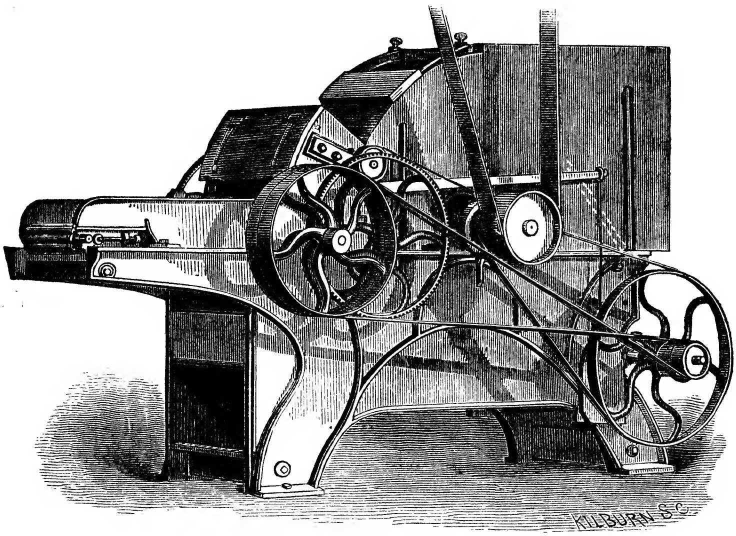
SHODDY.

One of the curiosities of the woollen-manufacture is described by the name above given, of which the country has heard so much since the outbreak of the war of 1861, and which has come into common use to designate a class of vulgar people who became suddenly rich by the war, and went about the world aping the manners of the aristocracy, without possessing the refinement, breeding, and true gentleness which distinguish aristocrats from the rest of mankind more than their money. There is no need to tell any man who shouldered a musket for the Union in any of the earlier volunteer regiments of New-York State as to what shoddy is: he knows already. Four or five of those early regiments, composed of the best young men of the best families of the State, marched to the front clad in rough, shaggy uniforms of gray, which disintegrated by the mere motion of the body, filling the underclothes and shoes full of short, gritty wool, and which in two weeks' time were in rags, breaking the hearts of the men by the shabby spectacle they presented among the splendidly-dressed regiments of the other Middle States and of New England. Those uniforms were made of shoddy. They were a disgrace to the contractors who put them upon the men, and an insult to the men. Uniforms were too often made of this sort of cloth.

Although the term "shoddy" has become one of opprobrium from this incident of the war, the thing itself subserves a useful purpose at times in the manufacture of woollen-goods. It has already been noted that the wool-supply of the United States has never been equal to the demand. Carpet and other coarse wools have to be imported, because the country does not raise all the wool it consumes, even at this late day. The scarcity of home-grown wool, and its high price, have led manufacturers to study the question of introducing other materials into their woollen-cloths, for the purpose of cheapening them, and of obtaining an abundant supply of raw material. The manufacturers have tried cotton, silk, and flax, and still use them in their goods. Whenever one of these three materials rises in price they resort to the others, using always the cheaper in the greatest quantity. They obtained another idea on the subject of raw materials, however, from England. It is well known that worn-out clothing of cotton and linen possesses a certain market-value for paper-making. Peddlers and small dealers take the clothing which goes technically by the name of "rags" for a few cents a pound, and sell it to the paper-makers. But what is worn-out woollen-clothing good for? It has never been utilized for paper-making. It is good for rag-carpets; but the superannuated woollens of forty-five millions of people, such as we have in the United States, would stock the market with more rag-carpets in a year than would be consumed in ten or twenty years. In England they studied the subject of picking the old woollen-clothing to pieces again, and spinning the fibre afresh. A machine was finally invented to pull the cloths to

Importance of shoddy.

pieces, and reduce them to the condition of unspun wool. The fibre suffered in the process, and the wool resulting from it was of an exceedingly short staple: but, by reason of the peculiarly serrated and barbed nature of woollen-fibre, even this very short staple could be spun into a yarn, especially if it were mixed with a certain proportion of long staple; which yarn was available for cloths.



SHODDY-PICKER.

The English went into the shoddy-business to an enormous extent. Yorkshire became the warehouse of the cast-off garments and hosiery of all Europe. These garments were carefully assorted there, selling for from fifty dollars to a hundred and fifty dollars a ton, and were converted into shoddy wool by the machinery set up for the purpose, and sold to the English woollen-manufacturers. The putting of shoddy into genuine wool was a clear adulteration of the latter. The completed cloth could be called "all-wool goods," and sold for the market-value of such goods; yet it was not "all wool" in the right sense of the term, as the defrauded buyer quickly found out after putting on a suit of clothes in which shoddy was present in any considerable proportion. The shoddy would shake and rub out into his underclothing, and irritate his person; while every pocket and lining would gather balls of loose, gritty wool, which would interfere with his enjoyment of the clothing. This was the shoddy working out, as it invariably will work out whenever shoddy goods are worn. But the English did not care, because the larger part of their woollens were sent abroad; and they suffered no pangs of conscience as long

Enormous use of shoddy by English.

as it was somebody else's skin which was scratched by the shoddy, and not their own.

Since 1861 (and possibly from a little earlier date) shoddy has been made in the United States. There are only about a dozen mills in the business: these are chiefly in the East. Shoddy is not much used in this country; but it is somewhat. Respectable manufacturers are very careful about putting it into their cloths, because, if they gained a reputation for using shoddy, it would injure their goods. Whenever the price of wool goes up, however, shoddy comes into demand. The material is employed also openly in the manufacture of certain classes of goods. In druggets, table-covers, heavy over-coatings, and various felted goods, it is regularly present, its utilization being justified on the ground that it saves expense to the human race, and is a means of turning to use what would otherwise be utterly valueless. The buyer must, however, always judge for himself whether the fine coatings he is looking over in the shop have not shoddy in them also; for some manufacturers think a certain percentage of it in their cassimeres does no harm, but too often they outstep the bounds of safety in the proportion used. Shoddy costs usually about ten cents a pound, and wool fifty. The temptation to use the former is, therefore, strong.

Use of shoddy in the United States.

Woollen-rags are reduced to shoddy by a cylinder three feet in diameter, the surface of which is studded, like the club of a giant of fable, with steel teeth an inch long, and half an inch apart. The cylinder makes about five hundred revolutions a minute. The rags fed down upon it are torn apart by the speed of the teeth; all rags which are not reduced to fibre falling back by their own weight, to be caught and buffeted again.

During the war, and up to 1868, shoddy was imported at the rate of from five million to eight million pounds a year. The importation is now a few hundred thousand pounds only. The consumption in the United States has been as high as twenty-five million pounds a year.

CLOTHING.

The manufacture of clothing grew up from the very humble beginning of shops in the cities strung along the Atlantic seaboard for providing sailors with their outfit for voyages. They were called "slop-shops." They were part of a very bad system for plundering the tar of the earnings of his voyage while he was on shore, still practised to a very great extent in commercial cities by the sailor boarding-house keepers. The idea was and is to lay hold of Jack the moment he comes ashore, board him, lead him into extravagances, supply him with an outfit for the new voyage, get from the ship-master an advance of a month's wages, and, if the tar is not enough in the landlord's debt to consume all the money, then to get him drunk, and put him aboard the ship, with enough "slops," or

"Slop-shops."

ready-made clothing, charged for at enormous rates, to wipe off the balance. Of course, ready-made clothing had to be kept on hand in order to carry out the system. From this humble origin has sprung a trade in ready-made clothing which has led to the erection of such palaces of industry and fashion as may be seen now in every large city in the country, inland and commercial, for supplying the masses of the people with the woollen clothing they wear during the varying seasons and upon all the different sorts of social occasions.

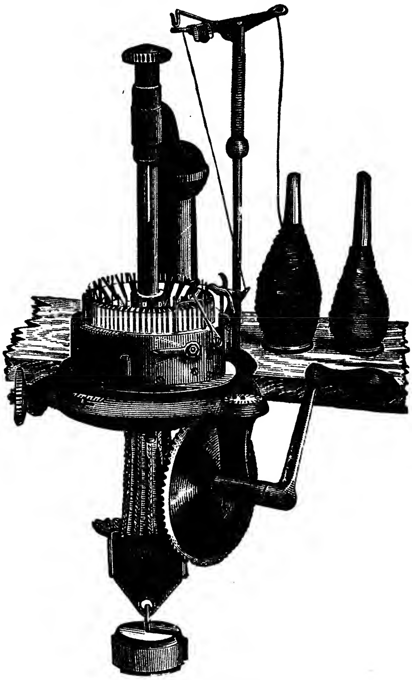
Clothes-cleansing by Jews.

The second step in the clothing-business was taken by the Jews of New-York City. These industrious people, who possess in a remarkable degree the instinct and faculty of trade, congregated on that queer, crooked, ancient street which runs down hill northward from City-hall Park, and then up hill again to the Bowery, which is known the country over as Chatham Street and the resort of old clothes-dealers and pawn-shop keepers. These people bought clothing partly worn, and cleaned and renovated it, and sold it as new; and afterwards added to their business that of fabricating new clothing from half-spoiled goods, such as those rescued in a wet and heated condition from burning buildings, &c. The customers of the Chatham-street stores were poor people. The well-to-do had their clothes made either at home by their own families or by employed seamstresses, or had them cut and made to order at tailor-shops established solely to secure the patronage of prosperous people. Farmers generally had their clothing made at home, often from the strong though rough goods spun and woven by the girls and women of the family. In the cities, large and small, cutting and making were generally done at the tailor-shops. Coats were made of blue or black goods, waistcoats of flaming red, of buff, and of white or black, and trousers of black generally, though grays and browns were liked. In 1834 and 1835 the wholesale manufacture of ready-made clothing for well-to-do and fashionable people began in New York on a small scale; and since then the business has extended step by step, the manufacturers catering to every class of society, until now the home-manufacture of men's garments has virtually ceased, and every one, from ploughman to railroad-president, goes to the store for his goods, and can be suited, if he chooses, from the shelves of the store at once. For a long time there was a prejudice among the more fashionable buyers against ready-made goods. They did not always fit; and tailors did much to deepen the prejudice by their tricks in trying to sell to indiscriminating customers garments which did not become them, in order not to lose a bargain. How often has not the tailor drawn up before the mirror a man whose mind runs ordinarily on better themes than his clothes,—and who, therefore, is not a judge of a fit,—and shown him with one hand how beautifully a coat fitted across the chest, while with the other hand he took a large reef in the bagging back so as to produce the particular phenomenon to which he drew attention! It used to be said of an unpopular man, as a parting shot, after the vocabulary of vituperation had been exhausted, "and his clothes don't fit." For fear that his own clothes wouldn't fit, everybody clung to the habit of having his suits made to order. But either tailors have grown more honest with the civilizing influences of the age, or their assortment of goods is now made in greater variety; for every one can secure an excellent fit at any ready-made clothing-store; and the majority of mankind depend upon the shelf and the counter for their suits and overcoats, rather than upon the measuring-tape and shears. A good fit can be obtained even for dress-suits. The manufacturers have found it to their advantage to increase the resources of their establishments; and great fortunes have been made from ready-made clothing within the last twenty years in Boston, New York, Philadelphia, Chicago, St. Louis, Cincinnati, Baltimore, and elsewhere. The slop-shops still exist: Chatham Street still preserves its distinctive reputation. Every city of any size has its second-hand clothing-stores. But the business has grown so far beyond those pioneer institutions, that one wonders, with the arrogant turkey-gobbler of mature years, how it could ever have been hatched from so insignificant a shell.

Magnitude of business. The census of 1870 showed that the establishments for manufacturing the clothing of men and boys had increased to 7,858: they employed 108,128 hands, consumed $86,794,000 worth of materials, paid out $30,745,000 for wages, and created clothing worth, at market-prices, the large sum of $148,660,000. The invention of the sewing-machine about 1850, and its subsequent sale by the tens of thousands, gave a great impulse to this business by cheapening the goods and imparting rapidity to the manufacture. The clothing-establishments and their operatives have been the best customers of the sewing-machine factories. The war, also, gave an impulse to the business. The uniforms for the troops were bought from the ready-made clothiers chiefly. They, having the facilities and experience needed for the production of large quantities of clothing, obtained most of the contracts for the purpose.

HOSIERY.

Knit goods. This term includes not only stockings, but knit goods for underwear. This is one of the classes of goods consumed by the great masses of the people, — consumed, in fact, by all, — for which the country was formerly almost entirely dependent upon England, but in regard to which it is now independent of all foreign countries. Parliament forbade the exportation of knitting-frames to the colonies of America in order to secure the exportation of the manufactured goods. Nearly all the knit caps, hose, doublets, &c., which were sold in the general market in that era, were consequently imported. The ladies knit for their own families; but few could knit for the general market. The enterprising State of Virginia offered a premium of ten pounds of tobacco in 1662 for every dozen pairs of woollen or worsted stockings; but this device did little toward supplying the general market with American-made goods. Little was achieved in that particular direction until the stocking-loom was imported, which was finally accomplished in spite of the Cerberus of the British custom-house. About 1723 stockings were woven in Chester County, Pennsylvania, by John Camm, and they obtained some repute. The loom itself made little progress, however, until the Revolution, when a larger supply of hose was needed, and when direct encouragement was given, in the shape of premiums and grants, for the establishment of stocking-factories in Maryland, Virginia, and New York. Then several stocking-looms were started here and there. After the Revolution, weaving continued; but it was a hand-process, and therefore slow, and the imported goods were cheaper. The business, though fostered in Virginia, Pennsylvania, and Connecticut, where it was principally carried on, did not expand rapidly until 1831, when Timothy Bailey of Albany applied power to the hand-loom, and made it a power-loom. Then American hosiery became a factory rather than a household product, and began to hold its own in the market. Up to this time, all the knitting by machinery resulted in the production of a flat web only. The stocking was made from the web by being cut out in the right pattern and sewed together. About twenty years ago the machine to knit a circular and seamless webb was invented, by whom is not known. This gave a new impetus to American hosiery, and resulted in the entire defeat of foreign hosiery, and the stoppage of importations except for the consumption of people who have the silly idea that foreign goods are necessarily more beautiful, aristocratic, and exclusive than those made by their own more intelligent and enterprising countrymen. But the importations have become very small.

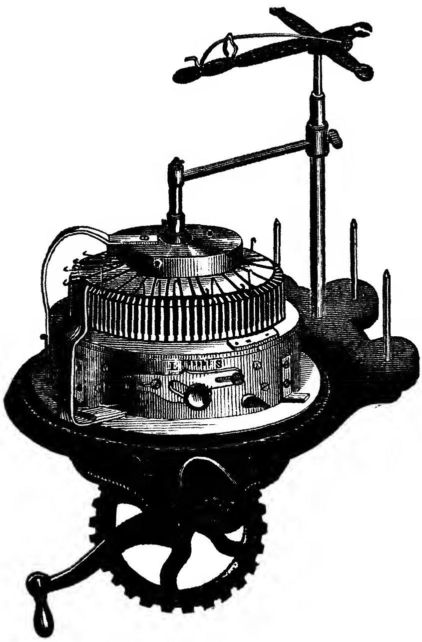


LAMB KNITTING-MACHINE.

On hosiery and knit goods there are engaged now about a hundred and fifty mills, almost wholly supplying the market. Some of the departments of manufacture are new since 1867, and a large share are since 1864. The progress made in this branch of manufacture is astonishing, as the United States now make almost all the under-goods,

Progress in business.

stockings, hosiery, scarfs, neck-comforts, opera-hoods, &c., which they consume amounting to about forty million dollars annually. Not only are the goods woven circular, but within ten or fifteen years the manufacturers have succeeded in making goods which are fitted to the form, and in making them, not by hand, but by machinery, and surpassing in quality the goods made abroad. American wool, with its long, glossy staple, is well fitted to the production of this class of fabrics; and American competition has not only succeeded in taking possession of the home-market for American products, but in cutting down prices from ten dollars to six dollars a dozen. Thus they are put within the reach of persons having only very small means; but, alas for our grandmothers! their occupation has been sadly interrupted. They ought to get consolation in thinking that their loss is the people's gain; but it is to be feared that many of them are too unreasoning to consider the subject in this comfortable light. Few, who can afford better, will prefer the unevenly stitched grandmother stocking to the precisely made fabric of the machine: so that, complain as bitterly as the grandmothers may, the day of home-made stockings is rapidly going by. The principal centres of the industry are Philadelphia, Penn., and Cohoes, N.Y.



BICKFORD KNITTING-MACHINE.

CHAPTER V.

THE MANUFACTURE OF COTTON.

IT is not known when cotton spinning and weaving began in the world; but the record of it goes back to the earliest ages of which we have any knowledge. Probably no better illustration of the antiquity of the industry can be given than the interesting legend of the voyage of Jason and the Argonauts in search of the Golden Fleece. Like all those ancient fables, the story about the voyage of Jason rests upon a basis of fact; but this fable differs from some of the others in the circumstance that we know what the basis of fact probably is. Jason's expedition was simply an attempt to reach India, by way of the Black Sea and some overland route thence, to obtain a quantity of cotton, — a beautiful fleece growing on a tree, which it was reported that India was cultivating, and which produced garments far superior in softness and beauty to those of wool then exclusively worn in the West. The Greeks of that age, with all their intelligence, were more than half pirates; and Jason's voyage was simply a search for plunder. The cotton-manufacture attained perfection in India at a very early date. The cotton was spun by hand, and woven by hand: but the people were inventive, and the mild and moist climate of the region was favorable to the production of delicate fabrics; and, when Europeans began to trade with India actively, the natives were already making textures so fairy-like, that they resembled cobwebs when spread upon the grass, and were invisible when wet with the dew.

Antiquity of cotton spinning and weaving.

From India the cotton-manufacture spread in both directions around the world. Thick cotton-cloths began to be used for tents and awnings in Southern Europe about the beginning of the Christian era. The cotton-plant spread slowly along through the countries in the south of Asia until it finally reached Egypt. The fibre was imported to Italy in the middle ages, and shipments of it reached England about 1640. The fibre was greatly admired in Europe, and all the industrial nations of that part of the world fell to manufacturing it upon as large a scale as was consistent with the small supply of the raw material. The process of

Spread of cotton-manufacture.

manufacture was greatly improved by the invention of a large number of machines. From Europe the manufacture extended west to America. The plant, however, was found growing wild here when the Europeans landed. They did not bring the plant, but only the processes of manufacture. The Indians were already working it up into rude cloths, and pieces of armor, before they came. In America the manufacture reached a perfection never before attained, as far as the production of the classes of goods consumed in large quantities by the population of the continent is concerned. In the year of our Lord 1878 we find the art, which has come down to us from at least thirty centuries ago, practised on this continent — the farthest point westward it can go — upon a scale of which the ancients of the land of its birth never dreamed in their most exalted moments. A thousand great factories are engaged in the business, many of them employing 600 operatives, and all of them performing all the processes of spinning, weaving, finishing, dyeing, and decorating, by the aid of ingenious machines which are driven by the forces of nature, and which work so fast, that, whereas there are only about 136,000 operatives employed in those thousand factories, the product of cloth and hosiery every year is equal to the product of the labor of 40,000,000 people working with the simple appliances of the birthplace of the cotton-industry. Such is the development which the manufacture has reached in its journey westward round the world; and it seems destined to reach a yet greater development.

The industry started upon the journey eastward around the world at an earlier date. It was introduced to China, by a ruler who presided over both China and India, before the Christian era. A native of India reached Japan, the utmost limit of its progress in that direction, as early as 799 A.D. The manufacture began actively in Japan as early as 1558 A.D., — at least a century earlier than it did in England. It is striking to notice the differences of its subsequent development in the two quarters of the earth, — the East and the West. In 1878 Japan has few if any native cotton-factories which employ more than thirty or forty workmen. There has been no invention of machinery, and no progress. The fibre is spun by hand, and woven by hand. It is ginned, one pod at a time, by passing it between a pair of wooden rollers an inch in diameter. It is prepared for spinning, not by carding, but by gathering it before the workman, and applying to it the twanging-string of a large bow, which causes the fibres to fly up, and arrange themselves in falling in a lap. The whole industry stands just where it did a thousand years ago; and the only symptoms of a new order of things in that ancient realm are presented by the erection of a very few American and European cotton-factories, with machinery and power, within the past few years. The older nation borrows from the younger ones the ideas which are necessary to her progress and regeneration. Could there be a more interesting illustration of how much farther the sons of Japhet have run in the race of civilization than the sons of Shem since they parted company on the plains of Asia Minor in the dawn of history?

Ancient as is the origin of the manufacture of cotton, the active development of the industry in Europe and America is of very recent date. In 1770 the consumption of raw cotton in France was only sixteen hundred tons a year: in England it was only twenty-five hundred tons a year. In that year America sent to Europe her first venture in cotton: it was only a ton. In 1784 eight bales shipped from Charleston, S.C., were seized in England by the custom-house authorities on the ground that so large a quantity of cotton could not have been produced in the United States. It is since 1770 that this industry, now of such magnificent proportions, employing so many hundreds of thousands of human beings, has attained its stature.

Active development of industry of recent date.

The cotton-plant being native to the soil of this continent, and the fleece being desirable for spinning, the plant was cultivated somewhat in the Southern States during the few years immediately preceding the Revolutionary war. It was raised as a door-yard plant at first. A great deal of attention was paid to the capabilities of cotton on account of the scarcity of wool, of which there was a very inadequate supply in this country; and the fibre was spun to a very considerable extent by the maids and matrons of the Revolutionary period North and South. In 1787 a first timid venture at a regular manufacture was made in New England at the village of Beverly, Mass., where a small concern was started to weave corduroys and bed-ticks. The machinery was of a very rude description. The factory had £9,000 capital, and it received a grant of £1,000 from the State of Massachusetts. It managed to thrive for fifteen years, when it suddenly failed, owing to the building of better mills, with which it could not compete on account of their better machinery. Another small factory was started about the same time at East Bridgewater, Mass., the State making a grant of £200 pounds to help it along. In 1788 Brown & Almy started a small factory at Providence for making homespun cloth. In 1790 a venture was made by Samuel Slater, an Englishman who had come to the United States for the sake of finding a field wherein to practise his chosen employment of spinning and weaving to better advantage than in England. Slater was an apprentice of Strutt, the partner of Arkwright, who in 1769 had invented the drawing-frame for drawing out the rolls or slivers of cotton in order to lay the fibres parallel. That quarter of a century was a time of great excitement in the cotton-trade in England, owing to the rapid succession of important inventions for spinning and weaving which were coming into use. In 1767 James Hargreaves had improved the spinning-wheel employed in his own house by making one wheel drive eight spindles instead of one. In 1769 Arkwright had invented the drawing-frame. In 1784 Crompton had invented the mule-spinner, in

First manufacture of cotton in New England.

Samuel Slater.

James Hargreaves.

which the spindles were mounted upon a movable frame, which would run out five or six feet and stretch the thread as it was twisting, and would run in again in order to permit the thread to be wound upon the spindles. The mule-spinner was able to carry a hundred and thirty spindles instead of eight; and in 1790, when water-power was applied to it, it carried four hundred spindles. Improvements were made in carding in that era also, and in 1785 the Rev. Dr. Cartwright invented the power-loom. It was just at this time that the steam-engine was being invented. England was greatly agitated by this remarkable machine, and the business of the cotton-manufacture at once assumed a vast importance in the eyes of English statesmen. The various discoveries were kept as secret as possible. None of the new machines were allowed to go out of the country, especially to America; and England tried in every way to maintain a monopoly of her discoveries. It is due to that fact that the Beverly mill, started in Massachusetts in 1787, contained none of the improved machinery in use in England. Samuel Slater was the first man that brought to America a knowledge of that machinery and its use. In partnership with Almy & Brown, Slater put up at Providence, in 1790, the whole set of new machines used and invented by Arkwright for the spinning of cotton, which he made from recollection with his own hands. This was the real beginning of the cotton-manufacture in the United States. In 1793 the three men built a new mill at Pawtucket. Neither of the two mills had more than seventy-two spindles.

Cartwright.

The beginnings of an attempt to practise so important an industry in regular factories could not fail to attract the attention of the Congress of the United States when that body organized under the Constitution. In order that Congress might be fully informed in regard to this subject, Alexander Hamilton obtained the facts of the situation as it then existed, and in December, 1791, made the following mention of the industry in his famous report to Congress on manufactures: —

"Manufactories of cotton-goods not long since established at Beverly, Mass., and at Providence in the State of Rhode Island, and conducted with a perseverance corresponding with the patriotic motives which began them, seem 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 [meaning the spinning-mule], which not only furnishes materials for that manufactory itself, but for the supply of private families for household manufacture. Other manufactories of the same material, as regular businesses, have also been begun at different places in the State of Connecticut, but all upon a smaller scale than those above 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."

Early goods produced.

In another part of the report Hamilton says,—

"There is something in the texture of this material [cotton] which adapts it in a peculiar degree to the application of machines. . . . This very important circumstance recommends the fabrics of cotton in a more particular manner to a country in which a defect of hands constitutes the greatest obstacle to success. The variety and extent of the uses to which the manufactures of this article are applicable is another powerful argument in its favor. And the faculty of the United States to produce the raw material in abundance, and of a quality, which, though alleged to be inferior to some that is produced in other quarters, is, nevertheless, capable of being used with advantage in many fabrics, and is probably susceptible of being carried, by a more experienced culture, to a much greater perfection, suggests an additional and a very cogent inducement to the vigorous pursuit of the cotton branch in its several subdivisions. How much has been already done has been stated in a preceding part of this report. In addition to this, it may be announced that a society is forming with a capital which is expected to be extended to at least half a million of dollars; on behalf of which measures are already in train for prosecuting, on a large scale, the making and printing of cotton-goods."

Hamilton's report on cotton-manufacture.

Hamilton advocated protection for the new industry. He thought the duty of three cents a pound on the raw material should be repealed, because very little cotton was being raised in this country. Hamilton believed, evidently, that very little would ever be raised here. He thought hemp-raising should be protected, but said, "Cotton has not the same pretensions with hemp to form an exception to the general rule. Not being, like hemp, a universal production of the country, it affords less assurance of an adequate internal supply; but the chief objection arises from the doubts which are entertained concerning the quality of the national cotton." Hamilton advised a bounty of one cent a pound on cloth exported, and one cent more if the cotton used was American grown. The suggestions of the secretary were not, however, carried out. The duty on raw cotton was retained, as also a duty of seven per cent and a half on manufactures, enacted in 1790. The American cotton was a great deal better than Hamilton was aware of, and there was no need of following his suggestions.

Hamilton's advocacy of protection.

It will have been observed that Slater's original enterprise was for the spinning of cotton merely. The Beverly mill wove; but Slater's did not. The weaving of that day was done with sufficient speed and economy in private families. The household was the factory of 1790. No public need really existed for setting up factories for performing what could as well be done by the family fireside; and the only thing for which there existed a positive want was the means for producing, on a large scale, a cheap and abundant supply of yarn. Slater's venture went no farther, therefore, at first, than the spinning of cotton-yarn

Character of Slater's enterprise.

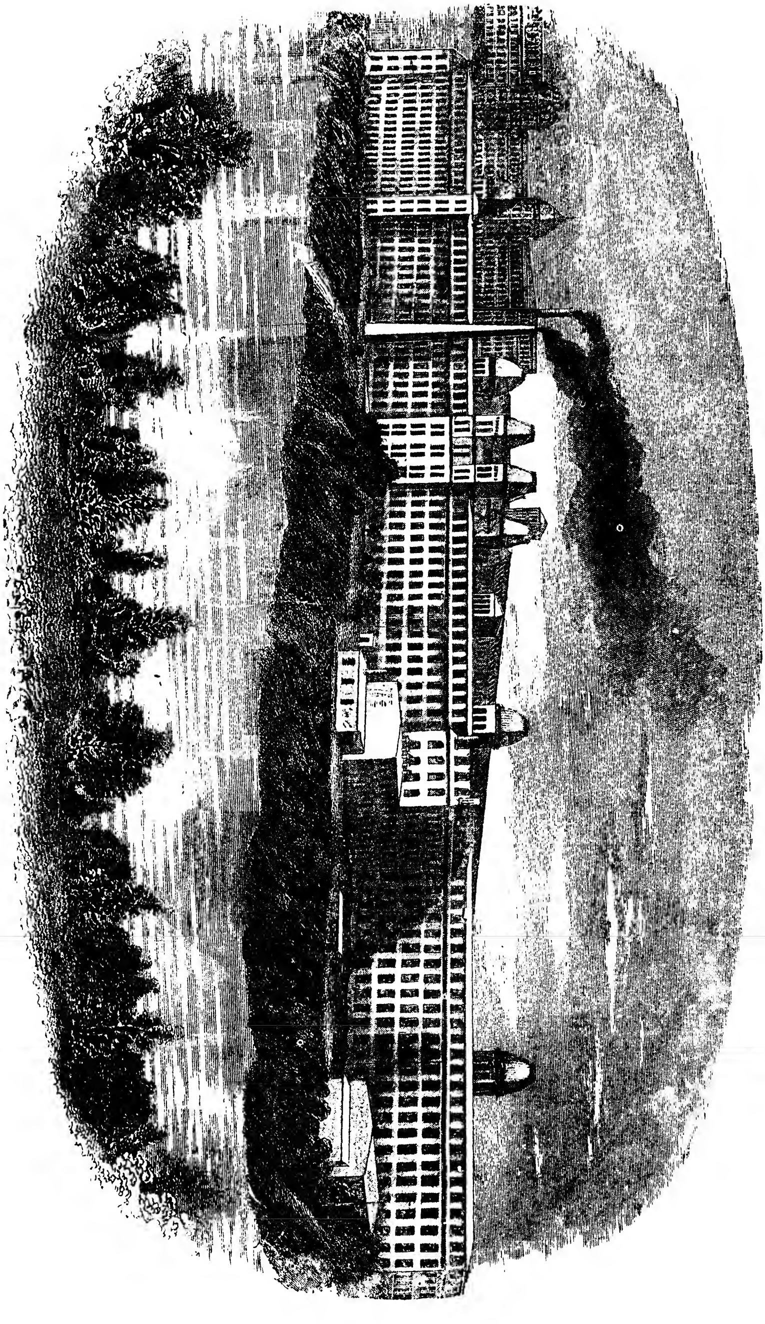
for distribution to the families of the neighborhood, to be woven by them into the cloth they needed for themselves, or which they desired to sell.

Within four years from the time of building Samuel Slater's little old wooden mill, however, the cotton-business took a tremendous start. England had done much for the business by originating machines for working up the fleece of the cotton-plant into yarn and cloth. The United States were now to do more for the cotton-manufacture than Arkwright or Crompton ever dreamed

Whitney's cotton-gin.

of, and all by one simple invention. In 1792 Eli Whitney of Massachusetts, who had gone to Georgia as a private tutor, was one day a guest in the family of Mrs. Gen. Greene. During the day mention was made of the desirableness of the creation of some machine for separating from the fleece of the cotton-plant the seed which filled it. Whitney was an inventive fellow; and, with true Yankee zeal, he undertook privately to solve the problem of ginning cotton. He obtained some cotton from Savannah, and had soon invented his famous saw-gin. The first gin was a cylinder studded with rows of stout wire teeth, which caught the cotton, and drew it through a wire grating. The lint passed through the grating; but the seeds, being too large to go through, were torn off, and separated from the fibre. Whitney soon afterwards employed circular saws instead of wire teeth, as being stronger and more serviceable. Even his first imperfect gin did good service, and satisfied the planters of Georgia, who were invited in to see it work; and his later one brought with it the assurance that cotton-planting might now become one of the most profitable branches of agriculture into which the planters of the South could go. Whitney took out his patent in 1793, and began the manufacture of gins with a partner by the name of Miller. He had bad luck, however. He was taken ill in 1794, and in 1795 his shop was destroyed by fire. Furthermore, his gin was too important to the public to permit the latter to wait for the inventor to build on a scale large enough to supply the general market; and, almost from the beginning, a large number of mechanics in New England and elsewhere made the gins in large numbers, and sold them in competition with the patentee. Whitney had great trouble in the courts with these infringers upon his rights, and about all he got for his invention was a grant of fifty thousand dollars from the State of South Carolina as a reward for his discovery. But if Whitney gained only the empty fame of his invention, without the substantial rewards to which he was entitled, the United States at any rate profited by it exceedingly. A *furore* of cotton-planting took place; and so great was the increase of production resulting from the introduction of the gin, that, whereas only 138,328 pounds of cotton were exported from the United States in 1792, the amount exported in 1795 was more than 6,000,000 pounds. A proportionate increase took place in the quantity of cotton sent to the Northern States for manufacture.

Samuel Salter's good luck, and the cheapening of cotton by the invention of the gin, led to a great extension of factory-spinning in the Northern States



HARMONY MILLS, COHOES, N.Y.

immediately. Factories were built on the large and powerful mill-streams of Eastern Connecticut, at different places in Massachusetts, and elsewhere in New England and the Middle States. They were for the spinning of cotton-yarn, and were neighborhood affairs, designed to supply the farmers and citizens of their respective counties with their material for the weaving of cloth. The girls and young men who found employment in these factories were of the best blood of New England. From a report made by Mr. Albert Gallatin, Secretary of the Treasury in 1810, it appears, that, at the close of 1809, there had been erected in the United States eighty-seven cotton-factories, sixty-two of which were in operation, and twenty-five of which would probably be completed and ready to go to work in 1810. Of the sixty-two, forty-eight were driven by the power of waterfalls, and fourteen by horse-power. They employed thirty-one thousand spindles: the whole eighty-seven would employ eighty thousand spindles.

Rapid extension of cotton-manufactures in the North.

Condition of industry in 1810.

It is an interesting fact, as we have seen, that, before the cotton-gin was invented, hemp was considered in the United States a more important plant than cotton. Hemp was absolutely necessary for the supply of the shipping with cordage; and so great was the interest felt in it, that the protection accorded to textile agriculture by Congress was extended more to hemp than to cotton. By 1790 the superior importance of cotton was realized, and Congress gave to that plant and its manufactures new and zealous attention. There was little need of recognizing raw cotton itself in the tariff, as none of the raw material was at all likely to be imported, notwithstanding Hamilton's alarm: yet Congress gave it a protection of three cents a pound, which was increased to six cents in 1812; and, in order to secure the largest-home market for it possible, the manufacture of the fleece was encouraged by a duty of twelve and a half per cent in 1794, which was increased to seventeen and a half in 1804, and to thirty-five per cent in 1812. This high duty on the manufactured cloth was needed, because England was now sending to the United States large quantities of the cotton-cloth made from our own fleeces by steam-power; and it was held, that, if cotton-cloth was to be consumed in large quantity in the United States, it would be better to encourage its manufacture here, in order that our own people might derive the profits of manufacture, and save the transportation-charges to and from Europe. If the tariff increased the selling-prices of cotton and cotton-goods in the United States, it probably did not do so to any greater extent than those prices would be enhanced under a lower tariff by transportation-charges to and from Europe; and the tariff, at any rate, secured the profits of a large portion of the manufacture to our own countrymen.

Congressional legislation.

Up to the time of the war of 1812 there had been no factories in the United States for weaving cotton-cloth, except the pioneer enterprise at

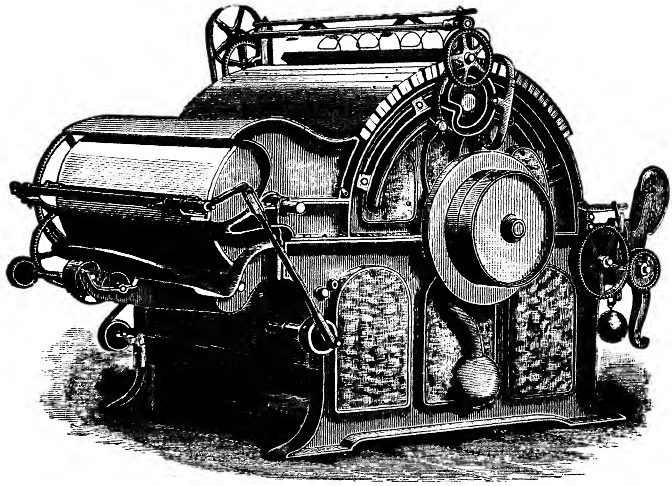
Beverly, Mass., then defunct. The factories were all for spinning yarn. Mr. Francis C. Lowell of Boston now conceived the plan of starting a factory for weaving, in which the work should not be done slowly and laboriously by hand as in the household manufacture, but by water-power. Mr. Lowell got back to the United States from a visit to Europe — which he had spent largely in inspecting the cotton-factories — just as this country was going to war with England for the protection of the freedom of our commerce and of the rights of nationality. Mr. Lowell had neither models nor machines to start his factory with, — nothing, in fact, except his recollection and Yankee wit. He formed a partnership with Patrick S. Jackson, his brother-in-law; and the two men went to work to devise a power-loom. They made a number of experiments, and finally hit upon a machine which they thought would work. Paul Moody, an expert mechanic whom they took into their employ, built a loom for them from their plans; and in 1813 the firm put up a little mill at Waltham, Mass., and began manufacturing. They had a full set of machinery for spinning and weaving. The number of spindles was 1,700. This mill is claimed and believed to have been the first cotton-factory in the world which performed all the operations of converting the cotton-lint into cloth under the same roof. Hitherto, both in England and America, spinning and weaving had been carried on in separate establishments. Mr. Lowell had a great deal of trouble at first with his looms. They were right in principle, but crude in detail; and it was several years before Moody, Jackson, and himself could devise and find out the various contrivances needed to perfect their plan of manufacturing, and make it a success. Their perseverance overcame all obstacles, however; and they prospered in their enterprise. The concern enlarged its business in 1822 by buying the whole power of the Merrimack River at the place where the city of Lowell now stands, and by building there a large mill, for which a joint-stock company was formed among the capitalists of the State. This act gave birth both to the city of Lowell and to the magnificent development of the cotton-manufacture by power to which this country has since attained. The building of cotton-factories became one of the passions of the age. There was a great deal of idle capital in the country; and the success of Slater, Lowell, and others, stimulated its investment in this industry. An immense impetus was given to the manufacture; and, in twenty years from the beginning of the war of 1812, the cotton-industry had grown to four times its previous stature.

Francis C. Lowell.

Nine-tenths of the new factories built were put up in New England, New York, and Pennsylvania. That was not the part of the United States in which the manufacture could have been carried on to the best advantage. The climate was dry and cold, entailing a large expense in warming and steaming the air of the mills. Wages were high in that part of the country. The factories were situated many hundreds of miles away from the cotton-growing regions, entailing another

Factories built in New England, New York, and Pennsylvania.

large expense for baling, pressing, hooping, and transporting the cotton to the mill, and for unpacking it, freeing it from its hoops and bagging, and picking it up loose again, after it had crossed the threshold of the mill. The distance of the factories from the cotton-fields also brought loss of interest, and waste of the cotton in transportation and handling. The better place for the factories would have been in the Southern States themselves. There the climate was mild, the wages of free labor were low, baling, hooping, and pressing would have been almost entirely avoided, and transportation would have been only a nominal charge. The water-power of the South was as abundant and cheap, too, as that of the North. In the North,



CARDING-MACHINE. MASON MACHINE-WORKS.

however, the population was denser, the climate was more invigorating, and the spirit of industry had taken possession of the people. The States of the North were under the necessity of undertaking to carry on manufactures, because agriculture was less remunerative with them than in the South, and the genius of the people was favorable to employments which called for the exercise of great ingenuity, technical skill, and executive ability. The South preferred the charms and independence of the agreeable agricultural life. Accordingly, in 1831, of the 795 cotton-mills which had then been built in the United States, and were in active and profitable operation, 508 were in New England alone, and 738 of the whole number were in New England and the Middle States. The situation in 1831 was as follows: —

	NO. OF FACTORIES.
Maine	8
New Hampshire	40
Massachusetts	250

Rhode Island	116
Connecticut	94
New York	112
Pennsylvania	67
New Jersey	51
Maryland	23
Delaware	10
Virginia	7
Other States	17
Total	795

The largest actual development of the industry since 1831 has still been in the Northern and Eastern States. The largest proportionate building of factories, however, has been in the South, whose future as a great cotton-manufacturing district is now well assured.

Development of industry since 1831.

The growth of the cotton-factories in number, after the war of 1812, would be one of the most marvellous incidents in history, were it not for the fact that their multiplication did not really represent an actual growth in cotton spinning and weaving in this country. It must not be forgotten that the cotton-manufacture was being carried on upon a considerable scale throughout the length and breadth of the land in the homes of the people when factory-weaving was introduced to the country by Mr. Lowell. It was estimated by Mr. Gallatin, that, in 1810, at least two-thirds of the clothing and of the house and table cloths consumed in the United States were still the product of family manufactures, which were then in a flourishing state. During the next twenty years the principal part of this family weaving and spinning was transferred to the factories, and this transfer was of itself sufficient to create a great factory-industry. The growth from 1810 to 1831 was chiefly due to the factory and the power-loom taking the place of the home-manufacture and the hand-loom. The growth after 1831 was the legitimate product of the increase of population in the United States in numbers and wealth, and the larger consumption of cotton-goods which followed their reduction in price. The following are the statistics of growth: —

Continuation of domestic manufactures.

	NUMBERS.	SPINDLES.	OPERATIVES.	COTTON USED, IN POUNDS.	YDS. 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	,235,727	122,028	437,905,036	1,148,252,406	98,585,269
1870	956	7,132,415	135,369	409,900,806	1,137,518,330	140,706,291

Of course it is understood, that, like all statistics which cover so vast a field as this, these figures, though compiled by the government, do not aspire to absolute accuracy. They are simply remarkably close approximations to the truth, and are to be taken as valuable indications of it. The manufacture is doubtless, in each year referred to, somewhat larger than above set forth.

Decline in price of cottons.

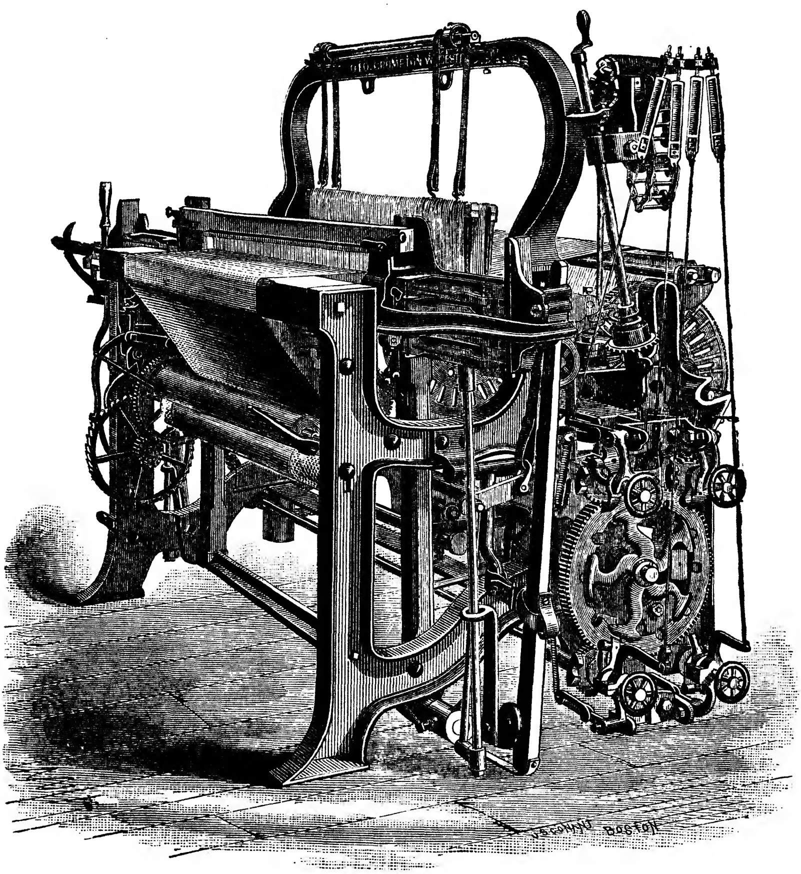
The fall in the price of cotton-cloth after factory-weaving began was something remarkable. In 1815, when cotton-cloth was still woven chiefly by hand, — the family weaver making only twenty-five throws of the shuttle per minute, and finishing only four yards of cloth a day, — the price of ordinary cloth for sheetings was forty cents a yard. In 1822 it had fallen to twenty-two cents, and in 1829 to eight cents and a half. In 1850, when the factory-manufacture had completely abolished the old-time system, when the power-loom was in full operation, — throwing the shuttle from a hundred and forty to two hundred times a minute, and one person, tending three or four looms, would weave from ninety to a hundred and sixty yards of cloth a day, — the price of cloth for sheetings was reduced to seven cents a yard as the result of machine-labor. This reduction of price was interrupted by the war and the inflation of the currency resulting from the war; but market-values have again fallen to where they were before the war, so that the reduction of price is seen to be permanent. That this change of price is due chiefly to the employment of machinery, and not so much to a fall in the price of cotton, is evident by a comparison of the prices of cotton and of cloth. The following figures will illustrate the point: —

	PRICE OF HEAVY SHEETINGS A YARD, IN CENTS.	PRICE OF PRINTED CALICOES A YARD, IN CENTS.	PRICE OF RAW COTTON A POUND, IN CENTS.
1816	30	..	30
1819	21	..	$22\frac{3}{5}$
1826	13	22	$13\frac{3}{10}$
1829	$8\frac{1}{2}$	17	$10\frac{2}{5}$
1843	$6\frac{1}{2}$	12	$7\frac{1}{2}$
1845	7	11	6
1850	7	$9\frac{1}{4}$	$12\frac{1}{2}$
1855	$7\frac{3}{4}$	..	$10\frac{3}{4}$
1860	$8\frac{3}{10}$	..	$13\frac{1}{4}$
1870	$10\frac{4}{5}$	13	$14\frac{1}{2}$
1872	$13\frac{3}{4}$	15	19
1878	$7\frac{1}{2}$	6	11

It will be observed that the prices of cloth fell faster than that of cotton, and that at the present time, while cloth is substantially as cheap as before the war, cotton commands a slightly better price. The reduction from the prices of 1816 has made the United States one of the greatest cotton-consuming countries in the world.

Production in 1860.

By 1860 the cotton-manufacture had reached an interesting and satisfactory stage of development. Nearly all the branches of manufacture were practised here, and six-sevenths of the cloth and cotton-goods bought by our people were made in our own mills. The production was $115,-000,000 worth of goods yearly. The importation was about $25,000,000. The latter consisted almost entirely of the finer classes of sheetings, calicoes,



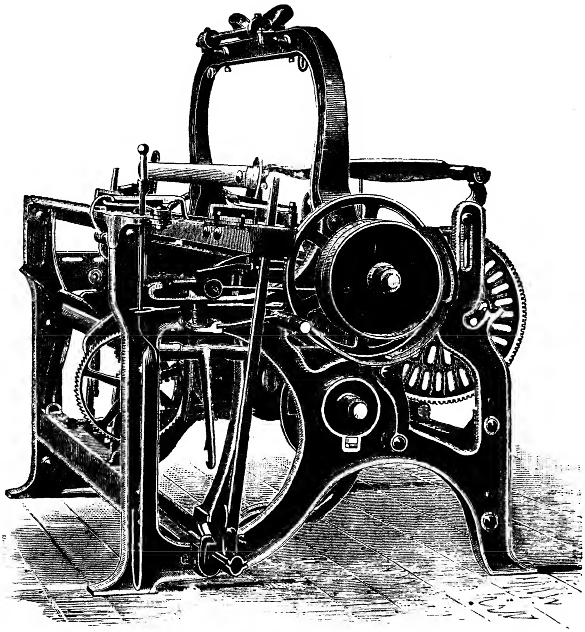
GINGHAM-LOOM.

lawns, &c. The American cloths, of such kinds as were made, excelled those produced by English mills on account of their heavier quality and their freedom from starch. They contained more honest cotton to the pound of cloth than the English goods. They were, for this reason, in great demand in China, India, and Japan; and there was an exportation of them amounting to $6,000,-000 and $7,000,000 yearly. There was every prospect that the American mills would soon be able completely to supply the home-market with our own manufactures of cotton, and in a few years more would be ready to undertake to work up for the world at large the enormous quantities of cotton which were sent abroad yearly in a raw state, amounting to five-sixths of the whole crop.

Effect of war upon industry.

The war which broke out in 1861 affected the cotton-interests of the country in an extraordinary manner. The cotton-growing region and the cotton-manufacturing region were separated from each other, and the former of the two was also substantially cut off from the world at large. The South could with difficulty dispose of its cotton: it could send little North, and scarce any abroad. The result was, that the acreage of cotton planted in the South fell off enormously. The planters began to raise food-crops instead. The cotton-manufactures of the South increased somewhat; but the factories were by no means able to stay the decline of cotton-planting. The North, on the other hand, deprived of its supply of fibre, was at its wits' ends to know what to do for raw material. A cotton-famine set in, during which the price of the raw material rose from eleven cents to a dollar and seventy-six cents a pound. A large proportion of the mills were obliged to discontinue operations: the remainder were obliged to resort to the unprecedented measure of importing raw cotton from foreign countries; and they did, for four years, import an average of 25,000,000 pounds a year from India, Egypt, and Brazil. This raw material they made to go as far as possible by mixing in with it flax and other vegetable fibres, and by producing to a larger extent than before goods whereof part of the material entering into them was wool. A great many of the factories transferred their attention entirely from cotton-goods to woollen-goods. Were it not for the fact that the South, which had been one of the largest markets in this country for imported cotton-goods, was cut off from receiving regular importations during this period, the cotton-famine in the North would have led to the importation of at least $50,000,000 worth of cotton-goods a year while the war was pending. What the importations into the South actually were cannot be stated; but into the North they were only $60,000,000 during the whole four years of the war. Besides the embarrassment and loss which the war inflicted upon the factories of the North, it brought a still greater disaster, with reference to cotton, upon the South. It not only cut off the sale of $190,000,000 of raw cotton yearly to the countries of Europe, and of $40,000,000 to the North, but it developed the cotton-growing of rival regions of the earth. India, Egypt, and Brazil reaped a rich harvest from the failure of the American cotton-crops from 1861 to 1865. At the end of the war the South found itself both with little cotton to sell, and with a powerful competition on its hands with the other cotton-countries. The cotton-interests of the South have recuperated since the war, however, in the most marvellous and unexpected manner, considering the utter prostration and ruin which had overtaken them. The crop of 1865–66 was already half a crop; and so much progress was made in replanting, that, in 1875–76, the crop was as large as it ever had been in the most favorable year before the war. The competition of Brazil, Egypt, and India, vanished like the dew before the sun; and ten years have placed the planters of the South in exactly the same position in reference to the world's supply that they occupied before the war. Part of this result was doubtless due to the ready demands of the Northern mills, which were the first to extend to the South the helping hand which lifted that section to its feet again. The North itself has also regained all it lost during the war: it has more than regained it. By 1870 its product of cotton-manufactures was larger than ever before known in history. It was manufacturing more cotton-goods than were produced in the whole country in 1860; that is to say, $160,000,000 worth as against $115,000,000 worth in the whole United States in 1860. It had again exported $6,000,000 worth of goods in a year. It was making a large variety of fine goods which had never been attempted before the war; and, while it had reduced the importations to only $18,000,000 a year, it was doing so well, that it had almost reached the point of being able to repay the favors of England by sending American cotton-goods to her. This extraordinary recuperation is one of the marvels of the age. It is an indication of the inherent vigor and vitality of the American people, which promises well for the future of our nationality.

Production in 1870.



LOOM. MASON MACHINE-WORKS.

The extent and distribution of the cotton-manufacture in 1870 are described in the following table, taken from the census-report of that year. Massachusetts was far ahead of every other State. Rhode Island came next; yet only two-fifths as many spindles were in operation in the latter State as in the former.

Extent and distribution.

	NUMBER OF FACTORIES.	SPINDLES.	OPERATIVES.	VALUE OF PRODUCTS.
Alabama	13	28,046	1,032	$1,088,767
Arkansas	2	1,125	17	22,562
Connecticut	111	597,142	12,086	14,026,334
Delaware	6	29,534	726	1,060,898
Georgia	34	85,602	2,846	3,648,973
Illinois	5	1,856	98	279,000
Indiana	4	17,360	503	778,047
Iowa	1	....	6	7,000
Kentucky	5	7,734	269	498,960
Louisiana	4	13,084	246	251,550
Maine	23	459,772	9,439	11,844,181
Maryland	22	89,112	2,860	4,852,808
Massachusetts	191	2,619,541	43,512	59,493,153
Mississippi	5	3,526	265	234,445
Missouri	3	16,715	361	798,050
New Hampshire	36	749,843	12,542	16,999,672
New Jersey	27	200,580	3,154	4,015,768
New York	81	492,573	9,144	11,178,211
North Carolina	33	39,877	1,453	1,345,052
Ohio	7	23,240	462	681,835
Pennsylvania	138	434,246	12,730	17,490,080
Rhode Island	139	1,043,242	16,745	22,049,203
South Carolina	12	34,940	1,123	1,529,937
Tennessee	28	27,923	890	941,542
Texas	4	8,878	291	374,598
Utah	3	1,020	16	16,803
Vermont	8	28,768	451	546,510
Virginia	11	77,116	1,741	1,435,800
Totals	956	7,132,415	135,369	$177,489,739

The relation of wages and materials to product, &c., in 1870, was as follows: —

Raw materials	$100,826,264	
Mill-supplies	10,910,672	
		$111,736,936
Wages		39,044,132
Product		177,489,739
Capital invested		140,706,291

Character of product of American factories.

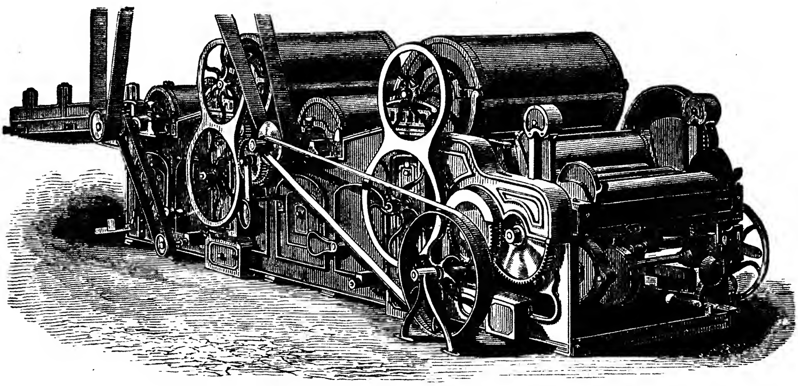
The characteristic staple products of the American mills are now heavy sheetings, fine sheetings, serviceable drillings, shirtings (especially the blue-striped kind), and domestic flannels. Jeans were among the earliest goods made. The strong drillings are said to have been introduced in 1827, and the substantial and blue-striped shirtings in 1828. The drillings have not varied a thread since they were first introduced. All these heavy cottons were soon made in superior style, and were heavily exported. One of the native cloths of the United States was invented in 1835 by Mr. James Johnson, and took the name of the domett flannel. Mr. Johnson was under the necessity of using up a lot of cotton warp which had been made for a satinet-mill which had proved unremunerative. He produced a cloth from this warp, by using a filling of wool, which met with favor; and its manufacture has since been carried on upon a very large scale. Calicoes are also a characteristic American product, and were one of the earliest attempted: they were being made in 1824 at the rate of sixty thousand yards a week. Sail-duck was also made at a very early date. Recent progress had added to the list a large number of the finer goods and fabrics, such as delaines, alpacas, the finer prints and ginghams, cambrics, &c. The weights of some of the standard fabrics are as follows: coarse shirting and sheeting, two yards and eight-tenths to the pound; fine bleached shirting and sheeting, three yards and four-tenths to six yards to the pound; standard drillings, two yards and three-fourths to the pound; fine drillings, three yards and four-tenths to six yards to the pound; print-cloths, seven yards to the pound; flannels (yard wide), four to seven yards to the pound; and ginghams (thirty-two inches wide), three to six yards to the pound. Cottonades weigh from four to twelve ounces to the yard; cassimeres, from six to fourteen ounces to the yard; and jeans, from three to six ounces. Every mill makes many different styles of its goods: sometimes the number ranges as high as two hundred and three hundred.

Kind of machinery employed.

In regard to the machinery in use in the American cotton-factories, and the processes of spinning and weaving, it may be said that the mills in the older States are organized upon the most approved principles of the art, and are supplied with the best machinery in the world. Spinning machines and looms are frequently of English pattern, and sometimes of English make. On the whole, however, the machinery is generally of American patterns and make. The manufacturers have found it desirable to buy American looms and mules, because of the fact that they were lightly built. American iron is better than the English, and tougher. The Crompton, Knowles, and other looms made in this country, are so much lighter, in consequence of the quality of the iron, that they are frequently run at a saving of fifty per cent of the power, — an important consideration, whether the power be water or steam. In the spinning-frames there have been many important American improvements. One of them, the ring-spindle, was invented by a pupil of Slater named Jenks, and has now nearly superseded all other kinds of spindles in this country. The use of it has increased the capacity of the mills, and led to the production of better yarn. The Excelsior spindle, invented by Mr. Sawyer at Lowell, is an improvement upon Jenks's. It is used with a ring; but it is lighter, saves a great deal of power, and works at a remarkable velocity. The machinery of the American mills, in fact, is considered, on the whole, to be better now than that of the English mills. All the improvements are American, showing the intelligence of our workmen, and possibly, also, the beneficial effect of our patent-law system.

Classification of cotton.

Raw cotton is divided into three classes. The long-staple (or Sea-Island) cotton is remarkable for the length and beauty of its fibre, and the delicacy of the thread which can be spun from it. This long staple is generally used for the warp of the cloth; that is, for the threads which run lengthwise of it. The medium staple, which comprises the vast bulk of the cotton raised in the United States, is shorter, but softer and silkier. It is used for the weft, or threads which run crosswise of the cloth, because it fills up the cloth better. The short staple, which generally comes from India, is harder, and is only used mixed with a proportion of the medium staple. For sewing-thread, only the long staple is used.



KITSON'S COTTON-PICKER.

Process of cotton-manufacture.

Cleaning, picking, &c.

When a bale of cotton reaches the mill, the first thing done with it is to open it, and clean and loosen the fibres. Machines are necessary for this, because the circumstance that the cotton-factories have been in the past so far from the cotton-fields has made necessary the baling and packing of the cotton under enormous pressure for convenient transportation; and it therefore comes to the mill too matted to go at once to the carding-machine. The cotton is cleaned and picked up loose in an opener and a spreader. These were formerly separate machines; but the tendency is now to have the two processes performed in one operation. The cotton is either pulled apart by toothed cylinders, or beaten with blunt knives, while a current of air blows through it, and it comes from the spreader in the form of a lap, or great, thick, fluffy sheet of fibre, cleaned, and in good condition for carding. The lap is wound upon a large roller as it comes slowly forth from the spreader, and is then carried to the carding-room.

The card, as has already been explained in the chapter on "Woollen Manufactures," is a broad cylinder, every inch of the surface of which is covered with wire teeth, and which revolves in contact with two smaller cards. The lap, being delivered to the card, is taken up by the large cylinder, and slowly combed out, between it and the small cylinders, into a gauzy film, which is then combed from the card by the action of the doffer. The cotton leaves the card in a roll, and flows on to a pair of rollers, which press and stretch the roll slightly, and let it drop into a tin can. The cotton then forms what is called a "sliver." Sometimes the cotton is carded twice. There is more or less variety in the forms of the carding-machines, according to the nature of the product of the mill. A thread-mill, for instance, has a different style of cards from the print-cloth mill. The cards are almost exclusively of American make, and are lighter built, can run faster and cheaper, and do better work, than the English cards.

Carding.

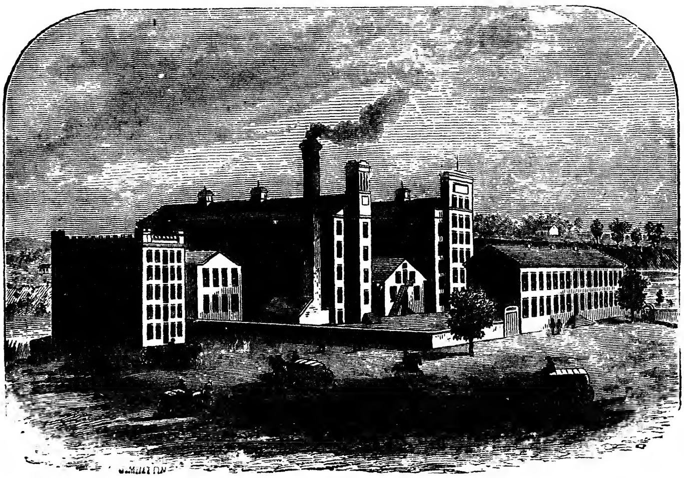
The slivers, when they come from the cards, are taken to the drawing-frames. Two or three of them are fed between a pair of rollers together, and pass thence on to a second and a third pair, and sometimes to a fourth pair, each pair revolving faster than its predecessor. The slivers are, by this process, united and stretched out into a new sliver one-third or one-fourth the size of the united three. This drawing-process arranges the fibres of the cotton, and lays them parallel with each other. The process is repeated a great number of times, the certainty of a perfect thread or yarn increasing with each doubling and drawing of the slivers. One of the original slivers, as it comes from the cards, is frequently elongated, in drawing, to thirty-two thousand times its length. The delicate sliver resulting from this continual stretching is finally taken to the roving-frame, and drawn once more, and given a slight twist. The natural interlocking of the fibres would not be sufficient now to make the loose yarn hold together without assistance; and the sliver is accordingly slightly spun, and then forms what is called a "roving." The roving, being wound upon a bobbin, is then spun into yarn for weaving, or thread for sewing.

Drawing.

In the household manufacture of our forefathers the spinning-apparatus was a wheel, which drove a single horizontal spindle mounted on a standard at about the height of the elbow. A cord, passing from around the circumference of the big fly-wheel, drove the spindle at a great velocity. The end of the roll of wool, flax, or cotton, was attached to the spindle by simply tying it around, and the big wheel was started. Simultaneously with the starting of the wheel, the spinner brought back her hand holding the roll of fibre, so as to stretch it at the same time that the spindle, on its longitudinal axis, was giving the roll the twist; then, without stopping the wheel, the spinner suddenly relaxed the strain on the yarn, and let her hand come quickly up to the end of the spindle, by which means the yarn wound itself up on the spindle instantaneously, instead of continuing to twist.

Spinning.

As soon as this process had been repeated enough times to secure a spindleful of yarn, the wheel was stopped, and the yarn reeled off upon a wooden reel into hanks, for knitting, weaving, or sewing. It was the slowness of this method of producing yarn which led the early manufacturers to think, that, if they could perform this process by machinery, they would have made for a while a great and sufficient advance. Hargreaves, who invented the spinning-jenny in 1767, used eight spindles. Invention has now gone so far, that, in the American factories, spinning is done upon frames or mules which carry three hundred and sixty spindles. The spindles themselves have undergone a change also. They are arranged vertically, instead of horizontally, in one or more rows. The yarn is no longer wound on the spindle itself, but upon a spool, or bobbin, through which the iron spindle passes, and which has a play up and down the spindle equal to its own length. Several forms of spindles are used. One style has a little steel fly at the top, through which the thread



SOUTHERN COTTON-MILL.

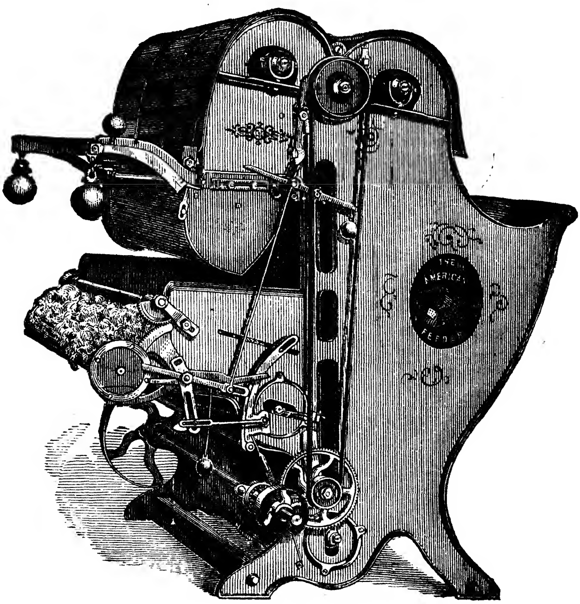
passes: another has a little steel cap. Jenks's spindle carries a little steel ring, and is called the ring-spindle in consequence. The latter is the popular spindle in American mills. Sawyer, who made it lighter, and called it the Excelsior spindle, secured for it a speed of ten thousand revolutions. A self-oiling bolster allows the spindle to run at a minimum of power. It carries the bobbin with it in spinning; and the bobbin turns independently in winding up the thread when the spindle-frame or mule is run back for the purpose. One girl will tend thirteen hundred spindles. The Sawyer spindle saves one-half of the power consumed in spinning by previous processes, or one-sixth of the power of the whole mill.

There is as yet no machine for continuous spinning; but several experiments are in progress in New England looking to the perfection of some such device.

The yarn, when spun, is reeled off from the bobbins into hanks of eight hundred and forty yards. The yarn is numbered according to the number of hanks to the pound. No. 2 is very coarse: No. 300 is very fine. No. 600 has been made, however, and No. 350 woven. The yarn for the weft of the cloth is wound upon bobbins for placing in the shuttles: the yarn for the warp requires treatment before it goes to the loom. It is taken to the proper department of the mill, and stiffened with sizing, and is then wound upon beams for the loom. The weaving is done upon American looms generally.

Weaving.

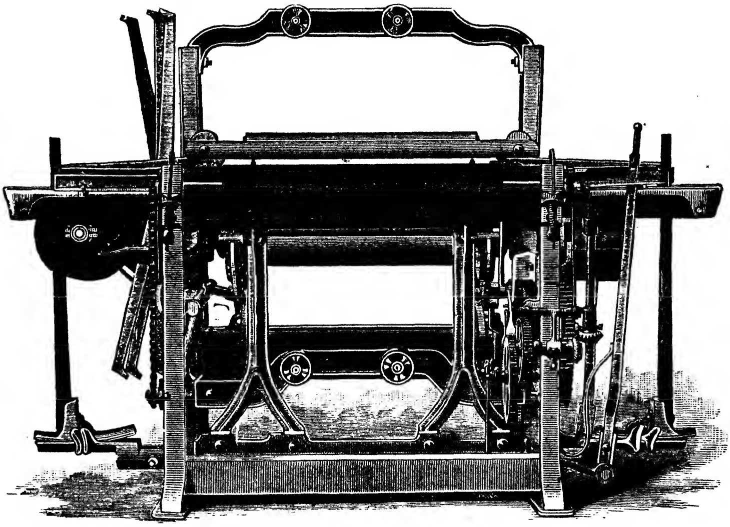
All the fancy weaving is done upon the American Crompton. The print-looms work up to a hundred and eighty and two hundred "picks," or throws of the shuttle, a minute. The fancy looms run on ginghams, shawls, &c., with the six-shuttle box, from a hundred and thirty-five to a hundred and forty-five picks a minute. The older looms make about a hundred and five picks a minute. The average of production per loom is from thirty yards to forty-five yards a day of ten hours and a half. One girl will tend three or four looms. They are perfectly automatic, and require only occasional care. In the American mills the looms are run slower than in England, and one person attends a greater number of them.



ROTARY CLOTH-PRESS.

Calico-printing.

For calico-printing the cloth is taken from the loom to the singeing-room. The cloth when it comes from the loom is covered with a fine nap, which would interfere with the perfection of the printing, and which is accordingly removed by running the cloth rapidly over a half cylinder of copper heated red-hot. The cloth is sometimes, though rarely, passed through a gas-flame. The singeing is a remarkable process, the wonder being why the cloth does not burn when in contact with the fiery cylinder. It does not burn, however: it flows past too quickly; and it comes from the ordeal to which it is subjected as white as though it had never smelled the fire. The cloth is now carefully bleached by boiling, steeping in alkali solutions, washing, squeezing, drying, &c., until it is perfectly white. Calico-printing was formerly an expensive process. Invented in India, and carried to perfection in France, it was introduced into England in 1696, and into the United States about the time of the Revolution. Printing first took place by the use of wooden blocks applied by hand or by machine. Cylinder-printing was then invented, in which the design was engraved on a copper cylinder, and the pattern impressed upon the cloth continuously. It was very costly, however, to use these cylinders. The engraving of them was laborious,



BAG-LOOM, MASON MACHINE-WORKS.

and they soon wore out. Mr. Perkins of Newburyport gave the business a vastly improved position by inventing the steel die. The pattern is engraved upon a steel roller, which is then hardened as much as possible. The pattern is then transferred to a soft steel roller by pressure, and thence to the copper roller by the same means. In this manner, a design once engraved can be multiplied upon copper rollers inexpensively to any extent. Before 1845 only a few colors were employed in printing. Four was the usual number. Machines are now in use which apply twenty colors. Each roller prints one color; and the cloth passes slowly through the big machine in which they are placed, going from one to the other until it has received the whole of the design. The printing is effected at the rate of 12,000 to 16,000 yards a day. The colors are fixed by mordants. Of the total number of cotton-factories in operation in the United States in 1870, forty-two were print-works. These factories had 240 printing-machines, employed 8,894 hands, and produced 453,809,000 yards of calicoes and 27,710,000 yards of delaines, worth $53,800,000. The works were distributed as follows: Iowa, one; Maine, one; Massachusetts, eleven; New Hampshire, three; New Jersey, five; New York, four; Pennsylvania, seven; Rhode Island, nine; West Virginia, one.

In the thread-mills, particularly in the great concern at Willimantic, Conn., the long-staple cotton finds its most cordial customers. So much are the long fibres of the long staple valued for thread-making, that they are subjected to a special combing-process in the thread-mills to free them from the shorter staple, of which there is always a certain quantity in the fleece. Cotton-thread was first spun in 1794. Previous to that date, sewing-thread was made of flax. It is said that Mrs. Samuel Slater, noticing the fineness and evenness of some yarn which she was spinning from Sea-Island cotton, suggested the idea that this staple would do for sewing-thread. The idea was taken up by Mr. Slater, and the first cotton-thread was made in his pioneer-mill at Pawtucket. In thread-making, the slivers of cotton are "drawn" to several billion times their original length.

Thread-making.

A great deal of the cotton-yarn made in the United States is now converted into hosiery by the aid of machinery. There are now in the United States about two hundred and fifty mills devoted to the fabrication of hosiery. Of the total number, sixty are in New York, seventy-five in Pennsylvania, thirty in New Hampshire, thirty-five in Massachusetts, and fifteen in Connecticut. Their product is in cotton and woollen hose (plain and striped), shirts, drawers, jackets, opera-hoods, scarfs, and shawls. There is little hand-knitting in the hosiery-business now, except in New Hampshire. The Shakers at Enfield knit the legs and feet of their hose upon circular machines, and send out the hose to have the heels and toes knit in by hand with stronger and more serviceable yarn. In consequence of the extent to which their business has grown, it is said that there is more hand-knitting in New Hampshire now than there was sixty years ago.

In the United States it is usual to build houses for the working-people of the mills in the vicinity of the several establishments, which are turned over to them for occupancy at a low rent. This circumstance has given birth to a vast number of pretty villages in New England and the North, deriving their existence solely from the mills of the place and the waterfalls which drive them. The occupants of these villages were originally people from the farms in the adjacent townships, — intelligent, cheerful, and excellent people. At the present time, the population of the factory-villages is more largely composed of people of foreign birth. During and just after the late war, when skilled operatives were so scarce as almost to be worth

Homes of the operatives.

their weight in gold, manufacturers who put up new mills were obliged to send to Canada or Europe, and bring their operatives over in cargoes or train-loads; and thus the cluster of houses erected near the mill became almost a foreign village from its origin, in every thing except location and ownership. The operatives have in most instances, however, taken kindly to American ways and American ideas, and joined heartily in the sentiments and principles of the country of their adoption. They are stimulated by freedom of opinion and equality of political condition, and in almost every instance have perceptibly brightened up mentally, and improved their condition materially, under the shadow of the new banner beneath which they have taken up their residence. The villages still wear the contented, orderly, and self-respecting appearance of yore.

CHAPTER VI.

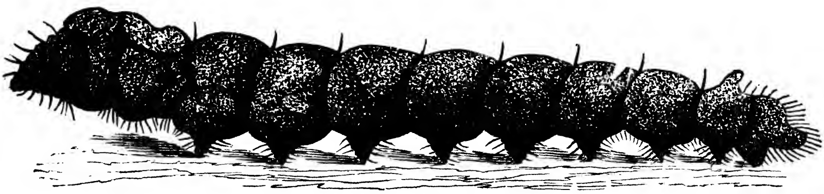
SILK-MANUFACTURE.

SILK is the softest, most beautiful, and strongest of all textile fibres. While as stout as steel, it is, by virtue of its other qualities and its costliness, the symbol and accompaniment of luxury. It was first used by the people of China and Northern India: gradually it extended into Japan and Persia, and so into Europe. Tradition carries the date of its first manufacture back twenty-five hundred years before the time of Christ; but better authenticated history lessens the distance by eight centuries, crediting Hoang-ti, contemporaneous with Joseph, the son of Jacob, with being the first silk-culturist of the Chinese Empire. As the word "silk" occurs but twice in the Bible, and in those cases is thought by some to have been translated wrongly, it is very doubtful whether the Jews knew what the substance was prior to Christ's time. Aristotle, who lived nearly four hundred years before Christ, says that those who accompanied Alexander the Great into India saw silk-worms, which he describes accurately; yet he does not seem to have understood how they produced silk, or even that they did produce it. Yet, even before Aristotle's time, there had been a heavy importation of raw and manufactured silk into Greece, by way of Persia; and this continued in the days of the Roman republic and empire. Even Pliny, the Roman historian, who lived at the commencement of the Christian era, described silk as a fine woolly substance combed from the leaves of trees. Not until A.D. 555, when two Nestorian monks who were particularly grateful to the Emperor Justinian, and who had travelled in China at the peril of their lives, brought a quantity of silk-worm eggs in the hollow of their staves to Byzantium, was it known in Europe that the highly-prized fibre was excreted, like the web of a spider, by a worm, which formed therewith a chrysalis like a caterpillar's. At the same time, the monks gave the Roman emperor a full description of the processes of silk-culture, and imparted the fact that the principal food of the worms is the leaf of the mulberry-tree; although it is known that these insects do subsist upon other kinds of foliage, but yield, in consequence, an inferior quality of silk.

Ancient culture of silk.

Gradually the culture and manufacture of silk extended through Asia Minor and Europe, although confined for many centuries to the Byzantine Empire. The products of Damascus soon became famous. The industry attained prominence in Northern Italy in about the thirteenth century of the. Christian era, the velvets of Genoa having a world-wide reputation. Silk growing, spinning, and weaving obtained a very little foothold in France until the close of the sixteenth century. It is now the greatest silk-manufacturing country of the civilized world, its products being choicer, if not more copious, than those of China, Japan, and India. The raw silk of China, however, is scarcely surpassed by any grown in Europe. From France, within the past two or three centuries, silk-culture has extended into England and Germany and other parts of Europe, and to America.

Progress of the industry.



SILK-WORM.

Colonial silk-culture.

Two of the best-known hobbies of James Stuart, the first of that Scottish royal family who sat on the English throne, were his intense detestation of tobacco, and his desire to build up the infant silk-manufactures of Great Britain. Accordingly, no sooner was the first colony established in Virginia than he employed his administration to promote the culture of silk in America, and uproot that of the Nicotian weed. He did not care to develop the manufacturing-industry on this side of the Atlantic, but merely to secure a supply of cocoons, to be soaked, reeled, spun, and woven by British industry. As early as 1608 he sent over mulberry-trees and silk-worm eggs, and required of the London Company, which managed the affairs of the colony, that it force the planters to engage in this new enterprise. A fine of a hundred pounds of tobacco was in 1623 exacted of every planter who did not cultivate at least ten mulberry-trees to every hundred acres of his estate. Under these influences some headway was made. But it was rather unprofitable business, and not to be compared with tobacco-raising; and, when Cromwell succeeded James II., the interest of Virginians in silk-culture relaxed even more. In 1656 and 1657 the industry was in a feeble condition, and the colonial authorities deemed encouragement desirable. A bounty of ten thousand pounds of tobacco was offered any one who would export two hundred pounds' worth of cocoons in a single year, five thousand pounds of tobacco to the producer of a thousand pounds of raw silk, and four thousand pounds of tobacco to any planter who would remain in the colony and devote himself exclusively to silk-growing. It does not appear that any one ever took advantage of these proffers, which were withdrawn in 1666; and though the industry still lingered along for many years, — and it is even said that silk was sent from Virginia to England, from which Charles I. or Charles II. had a robe made, — yet by degrees the business died out. Waistcoats, handkerchiefs, and even gowns, of native silk, were known in the colony until near the time of the Revolution; but they were rare, and, whatever sentiment there may have been clinging to them, of inferior quality. They were fuzzy and lustreless.

Quite a specialty was made of silk-culture in the much younger colony of Georgia. In 1732 the colonial government started a large nursery-plantation of mulberry-trees, and granted land to settlers on condition that a hundred of these should be planted to every ten acres cleared. Trees, seed, and eggs were sent over by the colonial trustees; and in other ways the industry was fostered. The British Parliament, in 1749, exempted raw silk from Georgia and Carolina from duty, and a bounty was offered for its production. An Episcopal clergyman versed in the delicate and difficult operation of reeling the silk from cocoons, and a native of Piedmont, Italy, was sent over to teach the people of this colony how to perform it; and Signor Ortolengi, an Italian gentleman, was likewise engaged in 1749 to teach the Georgians silk-culture. Subsequently the London Society for the Encouragement of Arts, Manufactures, and Commerce, offered a premium of threepence a piece on cocoons (or about three shillings a pound) for all that were taken to Ortolengi's "filature" at Savannah. As early as 1735 silk was exported; the amount not exceeding eight pounds, however. In 1759, the culminating year of the Georgia silk-industry, ten thousand pounds were exported; which is about as much as was produced in this whole country in 1850 and 1860, and more than two and a half times as much as the product of 1870. A fire in the Savannah filature destroyed eight thousand pounds in 1758. The production and exportation thereafter decreased. In 1790 the only shipment subsequent to the Revolution was made, and this amounted to only two hundred pounds. For the next forty years very little silk was grown in that State.

Nearly as much attention was given to this industry in South Carolina as in Georgia in that early day. The quantity produced was much less, but the quality excellent, — equal even to the best Italian silk. In 1755 a distinguished lady, named Mrs. Pinckney, took with her from this colony to England silk which she had manufactured into three dresses, one of which was presented to the mother of the infant King George III., and another to Lord Chesterfield: she reserved to herself the third. The Carolinian silk-business began to decline simultaneously with the Georgian; but in the settlement of New Bordeaux, on the Savannah River, seventy miles above Augusta, much sewing-silk was manufactured and sold in the neighboring counties, during the Revolution, by the French residents.

The fourth colony to engage in silk-culture, and about the only one to any notable extent in New England, was Connecticut. Mulberry-trees from Long Island were planted in 1755 at New Haven and Mansfield (the latter then in Windham County, but now of Tolland County), and silk-worm eggs were introduced in 1762. The following year, Dr. Stiles, afterwards president of Yale College, secured an act of the Assembly granting a bounty of ten shillings on every hundred mulberry-trees planted, and of threepence per ounce on raw silk. These bounties resulted in developing the culture of the trees very substantially, and the offer was withdrawn some years later. A small bounty on manufactures of home-raised raw silk was then granted. In 1763 a half-ounce of mulberry-seed was sent to every town in the colony for distribution. Dr. Stiles was a great enthusiast on the subject of silk-growing, and made many valuable experiments and observations from 1763 to 1790, which he recorded in a huge manuscript diary, bound with a silken cord, and still preserved at Yale College. The domestic culture of silk became quite general in the colony prior to the Revolution, and still existed in some sections until 1825. Small groves of white mulberry-trees, and rude cocooneries, cared for by women, are remembered by persons even now living. It is especially notable, however, that the town of Mansfield was the great centre of silk-production in this colony; and Mr. A. T. Lilly even goes so far as to say that "Mansfield seems to have been the only place where raising silk became a fixed industry." This applies more particularly, however, to the period between 1810 and 1844. Mansfield, nevertheless, deserves the credit of being the first silk-manufacturing centre of this country, — a fact to which we shall presently recur. Mr. Lilly estimates that the people of Mansfield received as much as fifty thousand dollars a year in barter for their silk from 1820 to 1830.

Cultivation of silk in Connecticut,

Dr. Aspinwall of New Haven, who was the first to import mulberry-trees and silk-worms into Connecticut, introduced them into Pennsylvania in 1767 or 1768. In 1770 Susanna Wright of Columbia, Lancaster County, made a piece of mantua sixty yards long from home-raised cocoons; and this cloth was afterwards worn as a court-dress by the Queen of Great Britain. A piece of similar goods, made by Grace Fisher, was subsequently presented by Gov. Dickinson to the celebrated Catherine Macaulay. A filature was erected in Philadelphia in 1769, and twenty-three hundred pounds of cocoons were brought there the next year to be reeled. The filature was built by subscription and at the inspiration of the American Philosophical Society, which was aroused by Benjamin Franklin, then the colony's agent in London.

Pennsylvania,

Toward the close of the last century, and in the early part of this, silk-culture was undertaken to a limited extent in New York, New Jersey, Delaware, near Baltimore, Maryland, Illinois, Massachusetts, Vermont, New Hampshire, and Maine, with but little success in the three States last named.

New York, and other States.

The Revolution nearly annihilated the production in this country by cutting off the export trade. But private domestic manufacture still created a demand; and after the war was over a slight revival and expansion were experienced in the production, Ohio, Kentucky, and Tennessee also engaging therein. However, the general decline which had been discernible before the war now continued slowly, and by 1825 silk-culture had almost entirely died out in the United States.

Effect of the Revolution upon the industry.

A famous period in this industry was the so-called *Morus multicaulis* mania. The favorite variety of the mulberry-tree among European silk-growers is the white, or *Morus alba*. American experimenters, however, among the first of whom was Gideon B. Smith, who imported a specimen in 1826, began to advocate the marvellous merits of the *Morus multicaulis*, and to instigate a revival of silk-growing. Clearly the most important preliminary step in this direction was the cultivation of mulberry-trees, which were propagated by slips. So successful were the agitators, that the agricultural classes of nearly the whole country, especially of the North, were excited on the subject; and by 1834 or 1835 a demand was created for young trees or slips, which soon rose in value from three or four dollars a hundred to twenty-five, fifty, a hundred, two hundred, and even five hundred dollars per hundred. One enthusiast bought a dozen cuttings, not more than two feet long, nor thicker than a pipe-stem, for twenty-five dollars, and said he valued them at sixty dollars. In the *furore* that ensued, nurserymen and unscrupulous agents even went so far as to sell slips of entirely different stock for mulberry, and at fabulous prices. A story is told of a Long-Island nurseryman who resorted to a bold and shrewd artifice to build up his trade. He drove to New York, and took the steamer to Newport. He drove to the first nursery there, and asked eagerly, "Have you any *multicaulis* trees?" — "A few," was the reply. "I will give you fifty cents apiece for all you have," said the Long-Islander. The nurseryman thought a minute: "If Mr. —— is willing to give that price for them, it is because he thinks they are worth more." So he answered, "I don't think I want to sell what few I have." — "Very well," was the reply: "I presume I can get them for that." Off he went, and visited every other nurseryman who was known to have mulberry-trees in Newport, Providence, Boston, Worcester, Springfield, Northampton, and elsewhere. He did not buy a single tree; but he forced the price up from twenty-five cents to over a dollar in a single week, and thus improved his own market wonderfully. So enormous were his sales, that the utmost art could not propagate trees fast enough for the trade; and in 1838–39 he sent an agent with eighty thousand dollars cash in hand to France to buy young trees for him. But, before the supply could be had, the speculative bubble burst. Excitement throughout the country became over-strained in 1839, and a sudden re-action took place.

Morus multicaulis mania.

There was no further demand for the *multicaulis;* and, when the enterprising Long-Islander's supply came from France, he was obliged to sell it for pea-brush at the rate of a dollar a hundred. Numerous other speculators were bankrupted in the same way.

COCOONS COMPLETED.

This spirit of speculation proved hurtful to those sections where silk-growing had been already carried on successfully; for it created such a demand for the trees, that raisers could not afford to feed their worms. A single tree was often worth more than the whole probable product of silk that season to the owner. Mr. Lilly mentions two trees of only a single year's growth, in North Windham, Conn., that sold at auction, in August, 1842, for a hundred and six and a hundred dollars respectively; and the rest were withdrawn from sale because the bidding was not sufficiently spirited. The *multicaulis* mania completely checked the actual silk-production for a time; and then in 1844 a general blight killed most of the trees in the country, and very effectually put an end to the business.

There were, however, prior to this time, a few gentlemen of single-hearted devotion to the country's industrial interests, who had actively engaged in and encouraged a revival of silk-culture. Among these was the Hon. Peter S. Duponceau of Philadelphia. After much agitation of the subject, and having employed a Frenchman named D'Homerque, well versed both in producing and manufacturing raw silk, he nearly obtained an appropriation from Congress of forty thousand dollars wherewith to found a normal filature, or school for teaching the delicate and difficult art of reeling silk. Failing in this, he founded such an institution at private expense, built cocooneries, went into the business to considerable extent, carried on extensive correspondence with other parts of the country on the subject, and did much to disseminate

Duponceau of Philadelphia.

valuable information. His efforts resulted in financial failure in 1837. Mr. Duponceau is on record as having expressed the very decided opinion, that we Americans should keep on trying to make silk-growing a success before trying to manufacture, even if we had to wait twenty years. But the country has not followed his advice.

Another gentleman distinguished by his earnest efforts and wide influence in this realm of industry was the late Jonathan H. Cobb of Dedham, Mass. Though not as wealthy as Mr. Duponceau, he was nearly as active. Interest having become aroused afresh in Massachusetts in 1830, the legislature authorized the governor to appoint him to prepare a manual on silk-growing for distribution among the agricultural classes. He did the work ably, and the book ran through many editions. He engaged, too, extensively in the culture himself, and in lecturing thereupon. In 1835 he engaged in an enterprise for manufacturing at Dedham, and his mill turned out two hundred pounds of sewing-silk a week. He also co-operated with Christopher Colt of Hartford, and others in the Connecticut Silk Company, whose works were in the latter city. This latter failed in 1840. His losses paralyzed his activity a while: but in 1843 he started up his old mill at Dedham, under the management of C. Colt, jun.; but a fire destroyed the establishment in 1845, and thereafter Judge Cobb had no more to do with the business with which he had been more or less identified for forty years.

Jonathan H. Cobb.

For more than quarter of a century after the bursting of the *multicaulis* bubble, little raw silk was produced in the United States. The census-returns put down the yield of 1850 at a trifle over 10,000 pounds, — equivalent to about 120,000 cocoons, and worth, perhaps, $40,000. The yield of 1860 is returned at about 11,000 pounds, and that of 1870 at less than 4,000. Within a few years, however, there has been something of a revival in the production, to a slight extent in Louisiana, but very conspicuously in Southern California.

Decline in silk-culture.

In the South there has been no ability manifested to reel the little silk produced, and no market for the cocoons. New Orleans abounds in mulberry-trees planted nearly a century ago by the French, and the trees are haunted by a wild insect whose cocoons are plentiful. From 1871 to 1874 an Italian named Roca made a business of rearing silkworms in that city, and shipping eggs and cocoons to Italy. For the last-mentioned year his invoices amounted to ten thousand dollars, and his silk was adjudged at Milan superior to any produced thereabouts. Besides, three crops of cocoons were obtained from the American market, and but two from the Italian. It is thus demonstrated, that, though the climate there is a trifle damp, Louisiana might make a great success of silk-culture.

Silk-industry in the South.

California soon developed wonderful agricultural excellence after her annexation to the United States. Louis Prévost of Normandy, France, planted mulberry-trees at San José in 1856, but could not procure silk-worm eggs until 1861. He grows three kinds of mulberries, — the *alba*, *multicaulis*, and *morelta*, but gives the white (*alba*) the preference, as do most other Californians. A. M. Müller of San José went into business with M. Prévost in 1861. Joseph Neumann, a German silk-weaver, started a similar enterprise near San Francisco in 1866; and Felix Gillet did the same soon after at Nevada City. These California pioneers raised little silk during the first decade that followed Prévost's beginnings. That little they sent to Europe as samples to make a market for their eggs. In 1869 Neumann raised a hundred and thirty pounds of silk, which he had made up into two national flags, and presented them to the governments of the State of California and the United States. For the last ten years the business has grown very rapidly. Silk-mills have been built in the State, and are supplied entirely with raw silk of domestic production; and thousands of dollars' worth of eggs are annually sent to Europe.

California.

The only other point at which silk is produced in this country to any notable extent is Silkville, Franklin County, Kan., where E. de Boissière, a French gentleman of means, has founded a small colony which is engaged in both growing and manufacturing silk. In 1870 he planted a large quantity of mulberry-seed, and in the following spring set out ten thousand young trees from France. His experiments with French eggs have not been very successful; but he is doing nicely with Japanese importations.

Kansas.

Thus far we have recounted at considerable length the history of silk-culture: we now propose to give the story of silk-manufacturing in this country.

Prior to the Revolution, nearly all the silk grown on this side of the Atlantic was exported. From 1780 to 1825 most of our product was worked up at home. Reeling, spinning, and even weaving silk, came to be a household pursuit, like hatchelling and spinning flax, or carding and spinning wool, though by no means so common. Still it was a domestic manufacture. Usually it got no farther than the form of sewing-silk; although it was sometimes woven into dress-goods, which compared with our modern machine-made silks about as the old-fashioned "homespun" would with fine broadcloth. The processes were very rude and defective: especially so was the reeling. But the spinning and weaving were generally performed on the same wheel and in the same loom used for wool, and the apparatus was poorly adapted to their use. It might be here remarked, that, during the first quarter of the present century, Eastern Connecticut was the principal centre of even this rude industry. The sewing-silk and raw silk made in Tolland, Windham, and New-London Counties, in 1810, were valued at $28,503; while the fabrics made of refuse silk mingled with wool were estimated at half as much. In some other parts of the country, however, the business was carried on, but to a much more limited extent.

Domestic manufacture of silk.

The first organized efforts at silk-manufacture in this country were those of the brothers Rodney and Horatio Hanks of Mansfield, Conn.; the latter of whom, prior to the building of their mill in 1810, had invented a double wheel-head which greatly facilitated the spinning of cotton, wool, or silk. This first mill, run by water-power, was devoted to the manufacture of sewing-silk by machinery. The edifice measured but twelve feet each way; but the enterprise was successful. In 1814 the two brothers associated with themselves Harrison Holland and John Gilbert, and built a new and larger mill at Gurleyville, near by. This venture was a virtual failure. In 1821 Rodney Hanks built still another mill at Mansfield, and associated his son George with him in the business. This mill was operated until 1828, when the improvement of machinery by others, and the ruinous competition that ensued, drove the Hankses out of the field. We shall presently recur, however, to the progress of the industry in this historic town of Mansfield.

Silk-manufacture at Mansfield, Conn.

The second pioneer in silk-manufacturing in the United States was William H. Horstmann, who came from Germany to Philadelphia in 1815. He established himself in the business of making all sorts of trimmings, into the composition of which silk partially entered. He had learned the art of silk-weaving in France, imported several machines for his use, and invented others. His products were dress-trimmings, belt and other ribbons, plaited and braided goods, fringes, sashes, epaulets, &c.; and his business steadily developed. He was the first to introduce the Jacquard loom into this country, which he did in 1824. His son, William J. Horstmann, manufactured power-looms of his own designing in 1837–38, simultaneously with their adoption in Switzerland. He succeeded his father, on the latter's death in 1852. The elder Horstmann's father-in-law, Hoeckley, was established in Philadelphia in the business of making coach lace, fringe, and tassels. The Horstmann Sons combined all these departments, and have developed the business greatly, continuing it to the present day, having taken premiums at many local and national exhibitions.

William H. Horstmann.

The high tariffs of 1824 and 1828, and other influences which stimulated manufacturing of all sorts, induced further effort with silk. In 1829 a ribbon-manufactory was started in Baltimore; but it was a short-lived affair.

The next enterprise was in Mansfield, Conn., again. This started as early as 1827–28, when a corporation was organized called "The Mansfield Silk Company." The partners were Alfred Lilly, Joseph Conant, William A. Fisk, William Atwood, Storrs Hovey, and Jesse Bingham. These names have since figured very prominently in connection with silk-manufacturing. The organization was formally incorporated by the legislature in 1829. It gave attention to the encouragement of production, but aimed especially to improve the quality of sewing-silk by improving the processes of reeling and "throwing," or doubling. Its first successful

Mansfield Silk Company.

machinery was designed by Edward Golding, a young English throwster. Their reels were greatly improved a year or two later (at the suggestion of a Mr. Brown, an English silk-manufacturer who had settled in Boston), and operated by water power instead of hand. Their business now developed, and they attained quite a reputation. American sewing-silk, though not yet perfect in color or evenness, came largely into use. The company offered to buy all the cocoons offered it: it went even farther, and undertook silk-growing itself on a large scale. Large tracts of land were leased, and planted with mulberry-trees; and the legislature was induced in 1832 to grant bounties on tree-raising and reeling. They then made another venture; namely, an attempt at weaving: but their apparatus was poorly adapted to the end. A third influence operated hurtfully upon the enterprise. Nathan Rixford of Mansfield invented improvements in winding, doubling, and spinning, which put the Mansfield Company's machinery behind the times, just as theirs had eclipsed that of the original Hankses. In 1835 Mr. Lilly withdrew from the concern; three others did in 1839; and then the company suspended, although for a time it let its mill to other parties. This factory, however, deserves the credit of being the first in this country where silk-manufacture was successfully carried on to any extent.

The early endeavors of the Hanks family, and the operations of the Horstmanns, had widely advertised the possibilities of silk-manufacture in this country. The imposition of a protective tariff, the efforts of public-spirited men to promote silk-growing, the application of Yankee ingenuity to the improvement of machinery, the marked success of these mechanical endeavors, and the practical achievements of the Mansfield Company, awakened wide interest in the fabrication of the silk fibre, and drew men and capital into such enterprises, to a great extent, from 1830 to 1839, — a period the reader will identify with that of the famous *multicaulis* mania. The critical year 1839 blasted nearly all these many young and promising enterprises, and marked a dividing-line, beyond which few of the earlier ones passed; although several of the most successful manufactures of later days were built upon the ruins of that fatal period, and by men intimately associated therewith. This will the more clearly appear from the history of three or four of the leading undertakings of that day and this.

1839.

Northampton Silk Company.

In the village of Florence, near Northampton, Mass., on the stream known as Mill River, where the historic bursting of a dam occurred in 1874, there was erected, over a hundred years ago, what was long known as the "old oil-mill." About 1830 Samuel Whitmarsh of New York, who had accumulated twenty-five thousand dollars in the tailoring-business, went to Northampton, bought the mansion now owned by Edward Lyman, erected two hothouses for raising mulberry-trees, and in 1832 caused the old oil-mill to be put in order for silk-manufacturing. Machinery was constructed after designs by Nathan Rixford, the Mansfield inventor. Mr.

Whitmarsh, by his enthusiasm and activity, not only excited the neighborhood, but secured the co-operation of several gentlemen from Middletown, Conn., in his enterprise, among them Augustus and Samuel Russell, who had founded a large American shipping-house in China. These gentlemen now organized the Northampton Silk Company, and in 1834 built a new brick mill in addition to the old oil-mill. They laid out large mulberry-plantations, and proceeded with the manufacture of watch-ribbons, vestings, and other goods. Henry Clay, Daniel Webster, and other public men, were presented with heavy black-silk vest-patterns from this establishment. But the supply of raw silk was small, and headway slight. In 1835 Mr. Whitmarsh, president of the company, went to France to obtain information on silk-culture. The result of his observations was published in a valuable book in 1839. That summer he remarked to John Ryle, then in his employ as a weaver, "I shall make this year two hundred and fifty thousand dollars before next winter." The collapse of the *multicaulis* bubble ruined the company; and, when winter came, Mr. Whitmarsh had neither cash nor credit enough to buy a barrel of flour. The company eventually paid all its debts, amounting to a hundred thousand dollars; and Mr. Whitmarsh went to Jamaica, where he made fresh ventures, that were but partially successful. Shortly before his death, in 1875, he seriously contemplated undertaking new ones in California.

When Mr. Whitmarsh left, the Northampton Company secured the services of Capt. Joseph Conant, who had been associated with several Mansfield enterprises since 1827; but, when bankruptcy ensued in 1840, the company sold out. Capt. Conant, S. L. Hill, George W. Benson, and William Adams, were the purchasers. The new corporation took the Florence property, and organized a "community" of interest and participation in work. This proved a failure; and in 1844 the property again changed hands, and Mr. Hill, who had secured the partnership of a Northampton capitalist, S. L. Hinckley, obtained control. The establishment was now denominated the "Nonotuck Steam-Mill," and has done a prosperous business in sewing-silk and twist ever since. Their "Corticelli" brand is widely famous. Conant built the Conant Mill at Conantville, Conn., in 1852; and he and his family were instrumental in founding several other enterprises. New and successful ventures have since been made at Florence, Northampton, and Holyoke, Mass. This brief narration gives one an idea of the vicissitudes that have attended the progress of the silk-industry in this country.

Conantville.

Another similar story is that of the Connecticut Silk-Manufacturing Company, incorporated at Hartford in 1835, which received a bonus of about eleven thousand dollars net from a bank charter. It was managed by Christopher Colt and J. H. Hayden. It collapsed in 1838, after sinking its entire capital. The latter gentleman then went into partnership with Mr. Haskell, who furnished the capital; and they established, under the firm-name of J. H. Hayden & Company, a silk-mill at Windsor Locks, near Hartford, which continues prosperous to this day.

One of the most successful undertakings in this department of industry is that of the Cheney Brothers of South Manchester, Conn. The family was one of bright, industrious, enterprising farmer-boys. Seth and John became artists, and left home; so did two others, who engaged in mercantile pursuits in Providence. All of them had been more less familiar with the culture of mulberry-trees during their boyhood; and in January, 1838, Ward, Rush, Frank, and Ralph started the Mount-Nebo Silk-Mills in their native town, where for four or five years past they had been raising silk-worms and producing some silk. The mills soon closed for a brief period, during which Ward, Rush, and Frank went to Burlington, N.J., to engage in the nursery and cocoonery business. They also published a magazine, called "The Silk-Grower's Manual," from July, 1838, to July, 1840. Other members of the family cultivated mulberry-trees in Florida, Georgia, and Ohio. The *multicaulis* collapse hurt them financially; and so the brothers went back to South Manchester in 1841, and re-opened the mill. Putting in new machinery, they began with the manufacture of sewing-silk, gradually extending their business to ribbons and handkerchiefs. They used imported raw silk almost exclusively, as the American silk was too poorly reeled to be serviceable, and too scanty in supply. Soon an attempt was made to manufacture broad goods, or dress-goods; their first experiments being made with pierced cocoons, floss, silk-waste, and such material as could not be reeled. This was carded and spun, and used for filling, by machinery made expressly for the purpose. The product was a substantial but lustreless goods, which found a good market. Five years of patient ingenuity and perseverance were needed to perfect this apparatus and insure success. This spun silk was woven into pongees and handkerchiefs at first, and then into foulards, ribbons, and broad goods. In 1854 a new mill was built at Hartford, and put in charge of Charles Cheney, who had come home from Ohio in 1847.

Cheney Brothers, South Manchester.

Until the breaking-out of the late civil war, and the imposition of the heavy tariff of 1861 upon foreign silk-goods, the Cheney Brothers could not compete successfully with imported articles. The acts of 1831 and 1846 had left the silk-industry in this country with too little protection. But, with the re-imposition of a stiff tariff, the business rapidly grew; and the Cheney silks have now acquired a wide and enviable reputation. The Cheneys have been public-spirited and philanthropic employers. Not only do they pay their help well, but they have beautified the village-homes of their operatives, provided commodious boarding-houses, erected and furnished a fine public hall, a reading-room, and library, and contributed largely to the erection of church, school, and armory. Meantime they have prospered in business, and acquired wide reputation and influence in their state and nation.

Tariff.

The largest silk-manufacturing centre in the country is Paterson, N.J.

Hither, in 1839, came Christopher Colt, jun., son of the Connecticut silk-manufacturing company's president, and brother of Samuel Colt, inventor and maker of the revolver which bears his name. Young Christopher had been connected more or less with the unsuccessful venture in Hartford with which his father was connected; but, foreseeing the impending ruin there, he removed to Paterson, where his brother had already built a pistol-factory. Samuel gave the use of the fourth story of his building to the younger Christopher, who there began silk-manufacturing on a small scale; but in 1840, amid the very general depression, he sold out to John Ryle.

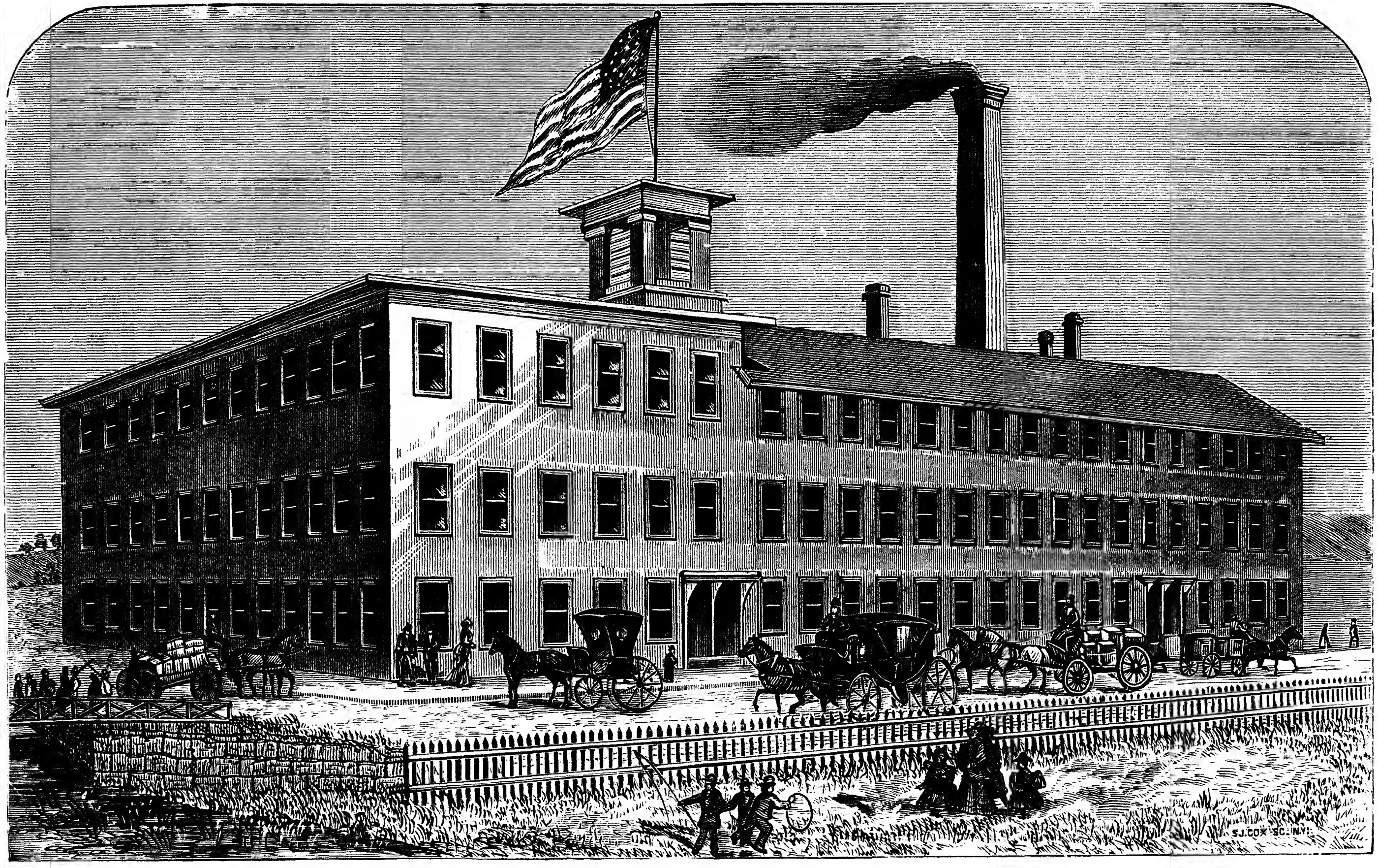
Paterson, N.J.

Ryle was a native of England, and a member of a family engaged in silk-manufacturing. He was drawn to this country by the *multicaulis* fever. For a short time he was in the employ of Mr. Whitmarsh at Northampton, and later he visited the Hartford factory. He noted the mechanical defects of these two establishments, and saw how they could be improved. He possessed not only practical ingenuity, but business shrewdness. During his visit to Northampton he had come in contact with G. W. Murray, and subsequently met that gentleman in New York. He impressed so strongly upon Murray's mind the idea, that, at the time of the great depression in 1840, one could most profitably invest, that he persuaded that capitalist to advance thirty-two hundred dollars wherewith to buy out Christopher Colt, jun. Murray put Ryle in charge, and three years later took him into partnership. In 1846 Ryle received enough assistance from his brothers in England to purchase the full ownership, and the following year he extended the business so as to include the manufacture of broad goods. In 1846 he had set a few looms at work, and made several pieces of dress-silk a thousand yards in length. In 1847 the facilities were increased, and in 1850 he went to France to visit the principal silk-factories of that country. A fair specimen of his work at this period was the large silk flag which waved over the Crystal-Palace Exhibition in New York in 1852. Since then his business has increased, prospered, and excited lively competition. In 1857–58 he was employing four hundred or five hundred operatives, and consuming two thousand pounds of raw silk a week,—an amount then unprecedented in America.

John Ryle.

This is the foundation of the Paterson silk-industry. In 1840 Paterson was but a village of seven thousand inhabitants: now it is a large, beautiful, and flourishing city. Then John Ryle was a poor mechanic, with scarcely a friend: he has since won a national reputation. In 1852 he bought a large piece of property near Passaic Falls, greatly beautified it by the arts of landscape-gardening and architecture, and presented it to the people of the town as a free public park. Shortly afterward he was elected mayor of Paterson. In 1854 he built the Murray Mill, then one of the largest and best-equipped establishments in the country.

Ryle's success.



SILK-MILLS OF HEMINWAY AND SONS, WATERTOWN, CONN.

For nearly twelve years Ryle was without local competition. In 1851–52 John Benson, formerly a cotton-manufacturer, started a small silk-mill in Paterson. Three years later, Hamil & Booth began business with twenty operatives, and gradually developed their business (their establishment, the Passaic Silk-Works, confining itself for fifteen years simply to "throwing" silk); and soon other small factories were started, some of which were the foundations of great enterprises.

Having thus sketched the foundations of the silk-industry, we pause to consider some of the causes that gave it development, and hastily to outline its fuller dimensions.

Reasons why manufacture has succeeded in this country.

One agency that stimulated manufacture from 1810 to 1840 was the culture of the raw material in this country; but since the last-named date we have been dependent chiefly upon the foreign supply. Another agency was the invention of machinery by Americans. The Hanks Brothers used rude machinery with their water-power. Nathan Rixford invented many useful devices, the most valuable of which was that for reeling silk. Before the processes of doubling, spinning, or dyeing, are performed, the fibre from half a dozen cocoons needs to be combined in a single thread. As some cocoons contain but three hundred and others thirteen hundred feet of filament, and as this is of spider-web delicacy, the work of combining parallel fibres, and attaching the successive ones smoothly and perfectly, is a very difficult one. Rixford's reels were a great advance on our old ones, and were sent to China, with samples of thread, for use and imitation by the natives who supplied our manufacturers with raw material after 1840; and, though it was hard work to secure their introduction, they finally came into wide use, and facilitated American manufacture. Mention has been made already of Horstmann's application of the power-loom to silk-weaving at Philadelphia in 1837, and to the Cheney Brothers' apparatus for carding and spinning silk for filling which could not be reeled. This latter was an important advance in the business. Rixford also invented for Ralph Cheney, in 1838, a friction-roller for use in spinning, which was of great value and extended use. Mr. M. Heminway, who began the manufacture of silk at Middletown, Conn., in 1849, was the first to substitute spool for skein silk. L. D. Brown, formerly of Gurleyville, but afterwards of Conantville and Middletown, invented valuable apparatus for spooling silk and weighing it; so that the thread was cut when the spool contained an ounce. For many years past the Danforth Locomotive and Machine Company of Paterson has been making a machine for "throwing" or spinning silk, which is more useful and valuable than is manufactured anywhere else in the world. Messrs. Atwood & Holland of Willimantic use a stretching-machine, which reduces the unevennesses in knotty Chinese silk to the smoothness of the finest Italian product.

Rixford's inventions.

The enthusiasm, far-sightedness, persevering energy, and business-tact of the pioneers in the silk-business, in the face of failure, ridicule, and many other adversities, have done every thing to establish the industry, and win others thereto. Dr. Benjamin Franklin, Dr. Stiles of New Haven, Dr. Aspinwall of that city, Mr. Duponceau of Philadelphia, Judge Cobb of Dedham, Rodney and Horatio Hanks, the Atwoods and Conants, the Lillys and others of Mansfield, Samuel Whitmarsh, Christopher Colt, J. H. Hayden, and John Ryle, are among the individuals to whom the success of silk-manufacture in America is chiefly due. Association for the exchange of information and ideas, and for co-operation in promoting the common interest, has proved helpful in this as in other industries. Paterson had a local organization of this sort in 1858, re-organized in 1872; and in the last-named year a national organization was effected, which has since had an annual meeting every spring. The protective tariffs which were enacted shortly after the war of 1812–15 did something to encourage manufacturing; but they were nearly all removed in 1831. The threats of civil war in 1859 depressed the business considerably; but the imposition of the tariff of 1861 gave fresh encouragement by checking the importation of foreign goods. Within the past three or four years the law has been so evaded, that large quantities of dress-goods have been put on the market in New York which had escaped payment of the duty; and no little embarrassment has ensued.

Progress until 1830.

By 1830 there had been only three or four short-lived ventures in Mansfield, Conn., one in Baltimore, and one successful one in Philadelphia. This latter and the Mansfield Company's were the only ones in operation in that year. During the next decade, besides the Hartford, Windsor-Locks, Northampton, Florence, and Paterson undertakings, there were perhaps a dozen others started; among them the Atlantic Silk Company of Nantucket, the Poughkeepsie Silk Company, Mr. Cobb's silk-mill at Dedham, the Morodendron Silk Company of Philadelphia, and two or three organizations at Mansfield. These and a few others failed altogether, or changed hands, about 1840. One of the successful enterprises was that of B. B. Tilt of Boston, who began making silk trimmings for dresses in 1834, and, after doing a good business many years, went to Paterson in 1862, where he organized the Phœnix Silk Manufacturing Company.

1840 to 1861.

From 1840 to 1861, besides the three or four surviving organizations and the three or four more built upon the ruins of old ones already named, there were upwards of a hundred new enterprises undertaken in Boston, the Connecticut Valley, various small villages of Eastern Connecticut, New-York City, Paterson, and Philadelphia. Many of these were small, and for the manufacture of only sewing-silk and twist. Several, especially in the cities, made dress, coach, upholsterers', and undertakers' trimmings. The Cheneys and Ryle were almost the only ones that made broad goods.

Since 1861 there have been a large number of new establishments started; but a larger number of old ones have suspended. In 1860 there were 139 returned in the census, employing 5,435 hands and $2,926,980 capital, with an aggregate production of $6,607,711. In 1870 there were but eighty-nine returned (principally in Connecticut, New York, and New Jersey), employing 6,649 hands and $6,231,130 capital, with a total production of $12,210,662. It was during this era that some of the men now most prominent in the business — the Dales, the Beldens, and others — established themselves.

1861 to 1870.

Since 1870 the industry has developed still farther. Our total production has increased to upwards of $25,000,000 a year. From 1850 to 1860 our imports of silk-goods averaged $27,000,000 a year, and in 1860 amounted to $34,330,321. During the next decade, owing to the high tariff, they averaged but $17,500,000 a year; but in 1871 they rose to $33,899,710. Since then they have steadily fallen off. In 1875 they aggregated but $23,168,118, and in 1877 about $21,000,000. Thus it will be seen that we are gradually driving the foreign product from our markets. More than that, we are now exporting nearly $100,000 worth of sewing-silk a year. Our products have taken many premiums, and received high encomiums from the juries of fairs, — local, state, national, and international, — within the past few years; and, except in the quality of a few dress-silks and velvets, they equal any thing produced in other quarters of the globe.

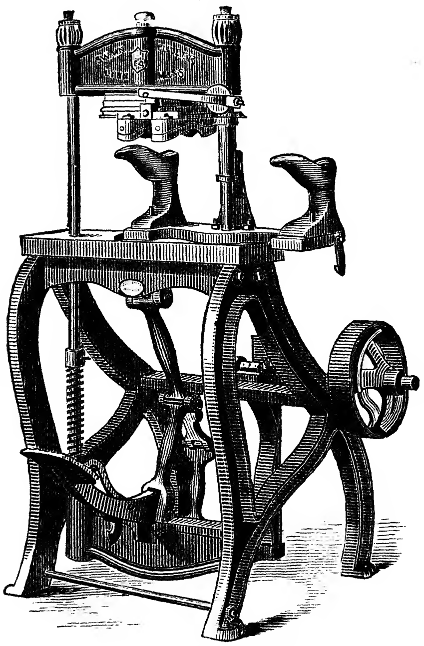
Progress since 1870.

CHAPTER VII.

SHOE AND LEATHER MANUFACTURES.

Magnitude of the industry.

WHEN one realizes that more persons are employed in the United States in preparing and manufacturing leather than are engaged in making cotton, linen, and woollen goods, and that the total value of the former products exceeds the latter, he appreciates more fully than before the importance of this class of industries. The census-returns of 1870 set down the number of persons engaged in tanning, dressing skins, and making boots and shoes, saddles and harnesses, trunks, valises, satchels, pocket-books, gloves, belting, and hose, at over 202,000. To these should be added at least 50,000 cobblers and small shoemakers, who are excluded from the above figures; and an allowance should be made also for those who use leather in book-binding, carriage-building, and making "cards" for textile fibres. The total value of the direct leather-products above enumerated was $386,000,000; and $64,000,000 would not be an extravagant estimate of the value of the leather element in the goods of which it forms but a part. The same census-returns put down the number of operatives engaged in cotton, linen, silk, and woollen manufacture, at about 250,000, and their products at $390,000,000. Since that time the leather-industry has, if any thing, gained the advantage over those with



BEATING-OUT MACHINE.

which we here make comparison. It is safe to say, that, in point of value, it constitutes over one-tenth of the whole manufacturing-industry of the country, and, in employment, surpasses the combined manufacture of textile fabrics.

Unless we except the primitive fig-leaf, the skins of wild and domestic animals may be said to have constituted the earliest clothing of mankind. The spinning and weaving of flax and wool was of later date than the first use of skins. Egyptian pictorial inscriptions of an age anterior to the Jewish captivity show the familiarity of the denizens of the Nile country with tanning and the uses of leather. The art of making "rams' skins dyed red," with which the mosaic tabernacle was covered, was doubtless learned in Egypt. It is an interesting fact, that bronze leather-slicers, similar to those of the ancient Egyptians, have been found in old Mexican sepulchres, indicating that the arts of making and using leather were understood by the founders of the early civilization of that country.

Skins the earliest kind of clothing.

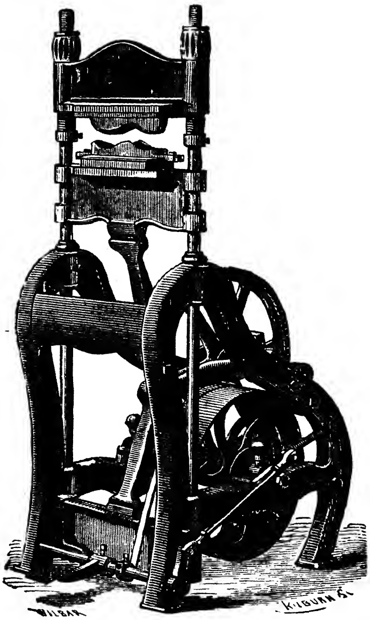
The aborigines of the United States whom the Europeans found here, doubtless of a later stock than the ancient Toltecs and Aztecs, understood the art of dressing the skins of buffalo, elk, deer, moose, and other wild animals. They employed smoke in their curing-processes, but evidently did not understand the properties of oak and hemlock bark. The moccasons, leggings, and hunting-shirts of the Indians were generally well curried, and sometimes well dyed; and these, as well as their robes, were often adorned with pictorial and symbolical designs of considerable intricacy, if not beauty.

Aboriginal mode of dressing skins.

Before the early settlers could do any thing of consequence in the way of making leather, it was necessary that their stock of imported domestic cattle should increase; which it did rapidly. Accordingly, as early as 1620, a list enumerating the kinds of tradesmen needed in the colony of Virginia contained tanners, leather-dressers, and shoemakers. We hear little of actual shoemaking, however, before 1649, when Capt. Matthews, an old settler, received legislative commendation for the various industries he had inaugurated. Among his other achievements were the erection of a tan-house, the manufacture of leather, and the employment of eight shoemakers. The production of leather and shoes was very slight, though, for many years; and, individual enterprise not being alone sufficient to develop the business, resort was had to legislative encouragement. In 1662 the Virginia Assembly required that tan-houses be erected in every county at the county charge; and provision was to be made for the employment of tanners, curriers, and shoemakers. An allowance was to be made every one for dry hides at the rate of two pounds of tobacco for every pound of hide, and shoes were to be sold for thirty and thirty-five pounds of tobacco per pair for the largest sixes. The exportation of hides was prohibited under penalty of a fine of a thousand

Condition of industry among the early settlers.

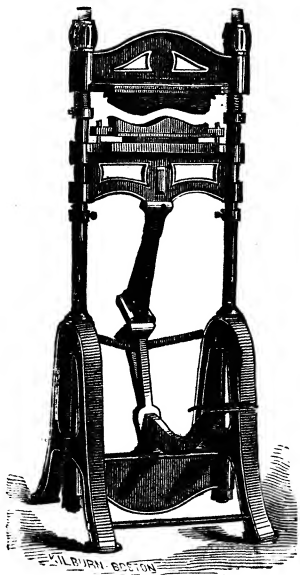
pounds of tobacco. The low price of tobacco afforded an incentive for building up new varieties of industry, and the carelessness and neglect with which cattle were treated made some steps for their protection almost necessary. Just how effectual these enactments in Virginia were does not appear; but they were followed in Maryland, in 1681, with similar ones as regards exporting hides. Beverly, writing a few years afterwards, says that a few hides were, "with much ado, tanned and made into servants' shoes, but at so careless a rate, that the planters don't care to try them if they can get others; and sometimes a better manager than ordinary will vouchsafe to make a pair of breeches of a deer-skin." Hence it would appear, that, until some time in the eighteenth century, Virginia and Maryland imported most of their shoes, of all grades, from Europe.


POWER SOLE-MOULDER.

New England, however, engaged in the shoe and leather business at that early day more extensively. Cattle were extensively bred there between 1620 and 1649 for food, and for the exportation of meat and live-stock. In the last-named year the stoppage of emigration greatly depressed the cattle-market; yet stock was always plenty, and tolerably well cared for. As early as 1630 Mr. Higginson mentions the abundance of "sumacke-trees, good for dying and tanning leather," near Salem. The first tannery in New England, however, was at the village of Swampscott, in the town of Lynn, destined from that time on to be famous for its shoe-factories. It was built by Francis Ingalls on Humphrey's Brook, Francis and his brother Edmund being among the first settlers in the town. The first shoemaker in Lynn was Philip Kertland, who came there from England in 1635; and John Herbert, another shoemaker, settled in Salem the same year. In 1629 the company's letter to the Governor of Massachusetts Colony commends to him a shoemaker named Thomas Beard, who was sent out to be maintained at the colony's expense, and work under the governor's direction. A supply of hides accompanied him on "The Mayflower," on which he was to pay freight at the rate of four pounds per ton. It was ordered that fifty acres of land be allotted him; but it does not appear where he located. Records exist of other individuals who were either tanners or shoemakers in Massachusetts prior to 1640. In that year a law was passed

Growth of industry in New England.

punishing such persons as slaughtered cattle and neglected to save the hides and send them to be tanned; from which it is probable that all the towns then organized had tanneries. Searchers and sealers of leather had already been appointed in certain towns; but in 1642 a general law was passed regulating the manufacture of leather more particularly. Butchers, curriers, and shoemakers were forbidden to tan, it being regarded desirable to make tanning a distinct occupation. No one was allowed to buy a hide but a tanner. Tanners were required to avoid hot "moors," or processes that would burn or scald their leather. They were punishable also for selling imperfectly-tanned leather. Curriers were minutely instructed what preparations they should use and should not use. Sealers were to mark good leather upon examination, and only sealed leather should be used by shoemakers. The exportation of raw hides or unwrought leather was prohibited in 1646. In 1648 the shoemakers had so increased in number, that they were incorporated as a guild by the legislature. These were more numerous at Lynn than elsewhere.



FOOT-POWER SOLE-MOULDER.

Says Bishop, "The fisheries of New England furnished abundance of oil at a cheap rate for the leather-manufacture. From the coasts of Labrador and Newfoundland were also obtained, before the Revolution, considerable quantities of seal-skins. On account of the high duty upon them in England, many which would otherwise have gone there were sent to New England, where they were tanned, and made into shoes, boots, &c., and returned to supply the fishermen on the north-east coast. Others were dressed in the hair, and were variously employed in making trunks, caps, coats, &c. The manufacture of leather in Massachusetts in early times was chiefly confined to the old maritime counties — Essex, Middlesex, and Suffolk — around Boston Bay. Since the Revolution, tanning, like shoemaking, for which Massachusetts has become famous, has developed largely in Worcester County."

Description of shoes worn.

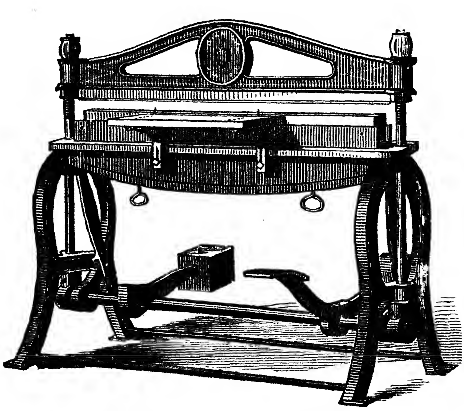
It should be remarked in this connection, that the shoes most worn by the ladies were stuff shoes: the gentlemen wore leather boots and shoes, few if any of which were made of calf-skin until after the Revolution. Cow-hide was used almost exclusively for foot-gear, although buck-skins were largely wrought up into servants' clothing. Glovers and furriers are enumerated among the artisans of 1651. We find further but unimportant legislation in Massachusetts relative to shoe and leather production subsequent to that just mentioned.

Connecticut was a decidedly agricultural colony, and cattle were extensively raised in its earliest days; and we find between 1640 and 1656 very much the same legislation there as had been enacted in Massachusetts relative to the preservation, tanning, and exportation of hides, and the separation of the tanner's from the currier's, butcher's, and shoemaker's trade. We also find the General Assembly fixing the prices of different-sized shoes, and ordering size-sticks to be made as a standard in the colony. Rhode Island, and that part of Massachusetts which was subsequently set off as Maine, had tanneries before the close of the century; but nearly a hundred years more elapsed before New Hampshire did any tanning.

Early legislation on the subject.

Cattle were imported into the Dutch colony of New Netherlands in 1625. The first tanner in the province was one of four brothers named Evertsen, who settled either at Pavonia or Manhattan in 1638. Tanners soon became numerous and prosperous in and about the city of New York, and, despite the laws, combined the shoemaker's trade with their other. A large tract of land on the west side of Broad Street, above Beaver, became conspicuous for its tanneries as early as 1653. The English governor Andros and his council were very strict in their exclusion of tanners from the city in 1676, granting a monopoly to only two. A number of wealthy and prominent English and Dutch tanners, therefore, moved outside the city walls to a region east of Broadway, and between Maiden Lane and Ann Street, where they settled. They called the place "Shoemakers' Land." Subsequently they were forced still farther up town, — to the borders of Fresh-water Pond and Beekman's Swamp; and in that locality, known as "The Swamp," many of the craft linger to the present day.

Industry in New York.



FOOT-POWER STRIPPER.

New Jersey received her first tanner in 1660, he locating at Elizabethtown; and her first shoemaker located there in 1676. Stock-raising for the New-York markets gave her plenty of hides. Tan-bark abounded in the colony; and judicious legislation so developed the produce of leather there, that New York was obliged to buy of her for a long time. West Jersey and Pennsylvania were even more tardy in developing the tanning and shoemaking industries. In the early part of the eighteenth century, however, we find tanning extensively carried on in Pennsylvania;

New Jersey.

Pennsylvania.

and leather was exported thence to Europe in 1731. In that colony, too, much was made of deer-skin for clothing; and Logan, the famous Mingo chief, was long actively engaged in dressing them for sale to the whites. Down in the Carolinas and Georgia cattle were exceedingly abundant, especially a small breed which were allowed to run wild. But little attempt was made to utilize their hides. Live cattle were shipped to the West Indies and to Pennsylvania: raw hides were likewise sent. Until very near the time of the Revolution few attempts were made to manufacture shoes, a pair of which were worth as much as an ox. A little leather was made in the coast-region; but it was exported. Indeed, from 1745 to 1760, the two Carolinas exported quite a large amount of tanned leather and dressed deer-skins. In the back country, where tan-bark was plenty and imported goods rare, the colonists made some few shoes for themselves. The greater number of the inhabitants of those colonies obtained their shoes either from those farther north and east, or from Great Britain.

Condition of industry by middle of eighteenth century.

Toward the middle of the eighteenth century, north of Virginia, every new town had its tannery almost immediately after the first settlement; and shoemakers and saddlers soon followed. In 1731, when, at the solicitations of jealous London manufacturers and merchants, Parliament ordered the British Board of Trade to inquire into the condition of manufacturers in this country, they found the Americans almost completely supplied with shoes of their own manufacture. The local shoemakers in most towns did something toward meeting the home demand. Itinerant shoemakers sometimes went from house to house, working up into shoes the family stock of leather that had been tanned by the local tanner. Itinerant cobblers also went from house to house. Massachusetts manufactured a surplus of shoes, which went to the other colonies and to the West Indies. When, in 1764, England attempted to levy duties on American imports, and the colonists resented it by refusing to buy British goods as far as possible, a special stimulus was given to shoe and leather production where before less attention had been given thereto.

Effect of Revolution.

During the Revolution the supply of hides was greatly reduced, and the amount of labor that was free to tan them and make shoes was also lessened by the demands of the military service: consequently a great scarcity of both leather and shoes characterized that period. The army suffered great privations. When the British forces landed at West Chester, N.Y., in October of 1776, the Colonial Government caused such hides as could be collected to be removed to places of concealment in the Highlands. The commissary department of the Continental army, partly from incompetence and partly from limited resources, found it impossible to obtain shoes enough for the soldiers. It was stated to Congress, in December of 1776, that one-third of the army at Ticonderoga had to perform duty without shoes. Only nine hundred pairs were sent thither on a requisition to supply over twelve thousand men. The army was then authorized to impress shoes and other supplies where they could be found. During the operations in New Jersey that winter, many of our soldiers "were without shoes, marching over frozen ground, which so gashed their naked feet, that each step was marked with blood." The following autumn it was discovered, that near Lancaster, Penn., greater quantities of leather than were ever before known there were in store. Much leather was to be had at Yorktown in exchange for green hides; but shoemakers to manufacture it were exceedingly scarce.

Effect of peace in restoring the industry.

On the restoration of peace, tanning and shoemaking rapidly revived; but the immediate influx of foreign goods soon depressed them again until a tariff could be imposed. Virginia resorted to such protection in 1788, and Congress, under the new Constitution, in 1789. The principal seats of shoe and leather manufacture, says Bishop, in the last century and beginning of this, were in Massachusetts, Connecticut, New Jersey, and Pennsylvania, though Maryland and Delaware also made a considerable amount. South Carolina had tanned some excellent leather before the Revolution; but after the war the Southern States gave little attention thereto, or to shoemaking, buying from the North. As the Western country was gradually settled, cattle-raising, tanning, and a small amount of shoemaking, kept pace with the movement; and though that section has been dependent on New England and the Middle States, to some extent, for shoes, it has not called for more unmanufactured leather than it could itself produce, inasmuch as cattle-raising has been a prominent industry of that section.

Principal seats of industry during the last century.

Manufacture of morocco.

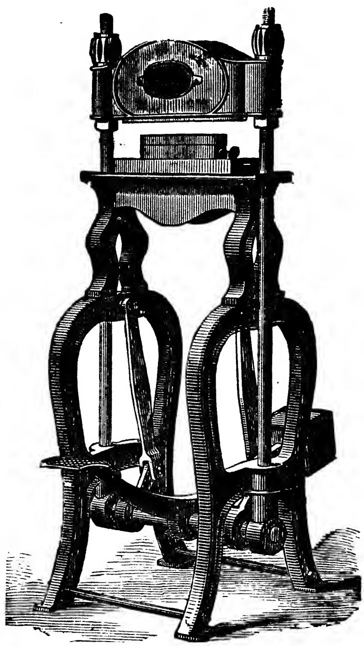
It is asserted that Morocco leather of fair quality was made in Charlestown, Mass., as early as 1770, by the subsequently famous Lord Timothy Dexter and others; and the manufacture was resumed there in 1796. The art of making Turkey and Morocco leathers from goat and sheep skins was not understood in London until about 1783, — the year of peace. The Pennsylvania Society for the Encouragement of Manufactures and Useful Arts instituted an inquiry in 1787, and found that two persons in Philadelphia had attempted the imitation with tolerable success. Sheep-skins have been rendered less valuable for the past fifty years by the introduction of merino breeds, in which improved fleeces are offset by poorer pelts. The morocco-business, however, has been a specialty of the Philadelphia leather-business to a greater extent than it has in any other part of the Union. In 1860 it employed over thirty large factories, 1,600 hands, and more than \$500,000 of capital, with sales to the amount of \$2,000,000. These figures might now be safely increased fifty per cent. Indeed, our exports alone of this class of leather exceed \$1,000,000 annually.

Calf-skins.

Within the present century, too, calf or kip skins have come into general use; whereas in Revolutionary and pre-Revolutionary days they were unknown on this side of the Atlantic.

Soon after the Revolution, our domestic supply of hides proved insufficient for our tanners' needs, and importation began chiefly from South America and the British East Indies. The immense development of cattle-breeding in this country, and the annexation of Texas, have not kept pace with our demands; and the importation of hides has steadily increased, with but slight fluctuations. In 1858 we imported $9,719,083 worth, or about 1,075,000 hides. In 1877 our importations, exceeding those of the previous year by a half, amounted to over 3,000,000 hides, valued at about $18,000,000. Thirty years ago, when the Erie Railroad was opened, most of these hides came to New-York City, and were sent out along the southern tier of counties in that State for tanning; then they came back in the form of leather, and were mostly sent to New England.

Importation of hides.



FOOT-DIE MACHINE.

The imported hides, it will be borne in mind, form only a portion of the whole leather-product. Thus, in 1839, when 3,463,611 sides or half hides were tanned as sole-leather, and 3,781,868 skins were tanned and curried for upper leather, our importation was probably less than 1,000,000 sides and skins. In 1870 there were 8,788,752 hides (17,577,404 sides) and 9,664,148 skins tanned, of which less than 3,000,000 hides and skins were imported. The following table will give some idea of the growth of the leather-producing industry in the United States of late years. It will be observed that there has been a tendency toward centralizing the business, the big establishments driving the little ones out of business as the improvements in the art increased. It should be noted, also, that certain kinds of leather are estimated twice over in the census-returns, from which the following figures are taken. The dressers of skins, the morocco-makers, and the manufacturers of patent-leather, are included in the table.

YEAR.	NO. OF ESTATES.	NO. OF HANDS EMPLOYED.	CAPITAL INVESTED.	VALUE OF PRODUCTION.
1840	8,229	.....	$15,650,929	$20,919,110
1850	6,686	25,595	22,774,795	43,457,898
1860	5,188	26,246	39,025,620	75,698,747
1870	7,569	35,243	61,124,812	157,237,597

The improvements in the manufacture of leather, says Bishop, have been very numerous, and mostly originated within the present century. They have been both mechanical and chemical, of foreign and native origin. Their adoption has been attended by a marked influence in the progressive improvement of the quality and quantity of the product, in the enlargement of the operations individually and in the aggregate, and in a proportionate increase in the profits; while the price of leather, compared with the raw material, has been reduced. The principal of these are the several mechanical appliances for softening, fulling, rolling, and splitting[1] skins and hides, and for grinding bark (some of which were very early introduced), and others for washing, glazing, and finishing leather. The application of water-power, and especially of steam, in many of the operations, and of hot water in others; the extraction and application of tannin in concentrated solutions and by hydraulic pressure; the greater subdivision of labor in large establishments, attended by more skilful manipulation in the processes of tanning, currying, and finishing leather, — have all greatly influenced the economy of leather-manufacture. Its profits have been much augmented by the "sweating" and other operations, whereby the gelatine and muscular fibre of the skin is more completely exposed to the tannic acid, and the weight of leather increased, and also by the various utilizing inventions which have appropriated all the refuse materials to some useful purpose in the arts.

Improvements in manufacture of leather.

The manufactures of articles from leather in this country, including boots and shoes, saddlery and harness, trunks, valises, and satchels, belting and hose, gloves and pocket-books, and omitting whips, carriages, cards, and book-binding, aggregated over $230,000,000; and of that amount $181,644,090 represents the boot and shoe industry, and $32,709,981 the saddlery and harness business. Thus it will be seen that more than three-fourths of the leather-manufacture is in boots and shoes.

Value of manufactured articles.

As we have already pointed out, and as the reader is aware, the knight of St. Crispin who makes boots and shoes for local custom, and who generally combines with that branch of the trade the more ignoble department of repairing, is to be found in nearly every town and village in the country. More frequently than not, his establishment is combined with a shop for the sale of shoes purchased ready made from some large manufacturer. This class of shoemakers require no further mention. Our chief interest centres in the wholesale manufacturers. The census-return of 23,428 establishments and $181,644,090 of products in 1870 includes some of the little establishments. Those making over $5,000 worth of goods apiece are set down as 3,151, and producing $146,704,000 worth of boots and shoes. It is with them that we are concerned chiefly.

Knights of St. Crispin.

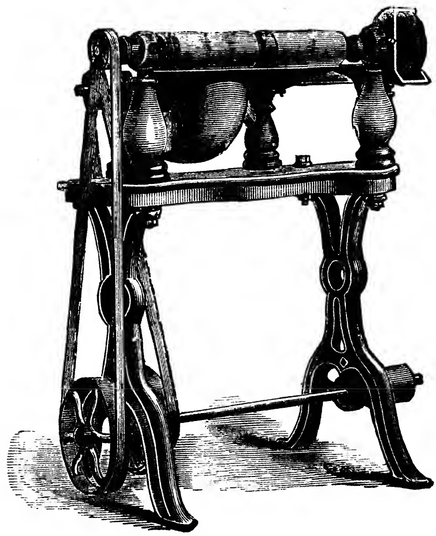
From the very first, Massachusetts has had the lead in this great industry.

[1] Thick hides are sometimes split into as many as five layers, each of which is dressed for upper leather.

The towns in the neighborhood of Boston attracted masons, carpenters, and other workmen, in the winter-season, when work was dull, to pursue shoemaking, which was always a resource. As early as 1635 Lynn had a shoemaker. Fifteen years later she made more shoes than any other town in the colony, or even in the country. She made a specialty of women's shoes, most of which were made of cloth; but, in all the kinds manufactured, the work was quite rude for a hundred years or more. Shoemakers were quite unskilled, and had little capital or general knowledge. In the early part of the eighteenth century they would send to England for well-made shoes, and take them apart to study the mechanism.

Massachusetts leads this industry.

By 1750 there was a surplus for exportation. New England was supplied chiefly from this one centre; and shoes were also sent to New York, Philadelphia, and even farther South. In the year just named, a Welsh shoemaker, named John Adam Dagyr, settled in Lynn, and by his superior skill soon became known throughout the surrounding country as the celebrated shoemaker of Essex (County). Many persons in Lynn and the neighboring towns acquired from him a better knowledge of the art, and obtained the reward of superiority in the increase of their business. A Boston correspondent of "The London Chronicle," in 1764, wrote that shoes for women were made at Lynn exceeding in strength and beauty any that were usually imported from London. During the Revolution the towns of Eastern Massachusetts provided the army with most of its shoes. Immediately after the war ended, the business rapidly developed. In 1788 Lynn alone exported 100,000 pairs of shoes; in 1795 her export was 300,000 pairs. In 1877 her product was not less than 14,000,000 pairs of boots and shoes. The wonderful facility with which shoes were turned out in those early days 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 skilfully aimed at them. There were those who asserted that boots and shoes grew there spontaneously. Thus, for over two centuries, Lynn has had the ascendency in the American shoe-manufacture.



BUFFER.

Marblehead, which makes, perhaps, four million pairs of shoes yearly, was led into the business, after the Revolution, by the decline of her fisheries.

Danvers, Haverhill, and other places in Essex, were early engaged in the manufacture of women's shoes; and there was in 1788 a considerable manufacture of men's shoes at Reading, near Lynn. Boston, Quincy, and many other towns in the vicinity, engaged in the shoe-manufacture after the Revolution, as did also Worcester and other towns of that county.

Marblehead,

Philadelphia and New-York cities have also been famous for nearly a century for the quality of their shoes, and the States of which they are the business capitals have also developed the wholesale manufacture in other towns. The following table gives the distribution of the industry, showing only establishments whose annual product exceeds five thousand dollars, and only those States being named particularly which have over a hundred such establishments: —

Philadelphia,

STATE.	NUMBER OF ESTATES.	NUMBER OF HANDS.	CAPITAL INVESTED.	VALUE OF PRODUCTION.
Massachusetts	1,123	51,167	$19,148,645	$86,565,445
New York	341	11,409	4,872,966	17,813,048
Pennsylvania	335	8,330	4,240,523	11,002,587
New Hampshire	78	2,777	919,435	4,780,020
Maine	85	2,105	677,300	3,155,221
New Jersey	67	1,990	777,900	2,830,322
Ohio	164	2,026	790,025	2,866,803
Missouri	182	960	505,200	2,363,701
Illinois	88	1,274	1,527,448	2,298,136
Other States	688	9,664	4,059,577	13,028,717
Total	3,151	91,702	$37,519,019	$146,704,000

It might be added to this, that Connecticut with only thirty-eight establishments, and Maryland with sixty-eight, each produced very nearly $2,000,000 in 1870; California produced over $1,500,000; and Wisconsin and Indiana, each a trifle over $1,000,000.

Connecticut, and other States.

Thirty years ago the sales of Massachusetts' enormous surplus to the other sections of the Union and for the foreign trade were mostly in the hands of New-York merchants, to whom the New-England producers either sold or consigned their goods. Gradually this system changed, partly owing to a change in the system of manufacture. The number of skilled workmen that came 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 work-people by the piece or the pair enables each to control his own time, working when he pleases. These sometimes club their work, and appoint an agent to sell: others, by economy, save their pay, and employ a

Mode of manufacturing and selling.

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 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 manufacture is by far the better conducted for it. The advantages of this system have made Boston, of late years, the grand centre of such operations, and have drawn thither the jobbers from New York, Philadelphia, Baltimore, Cincinnati, St. Louis, &c., until Boston has become the largest shoe-market of the world.

Improvements in style of manufacture.

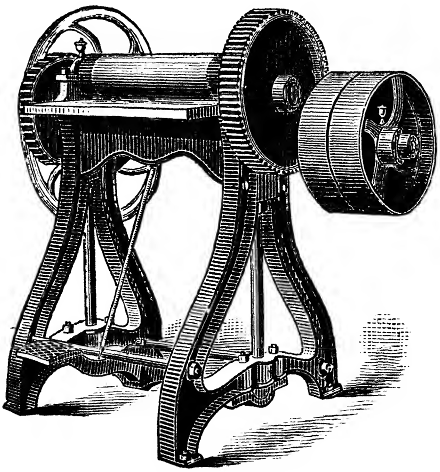
We have already spoken of the improvements in the beauty and other qualities of American shoes about the middle of the eighteenth century. They continued to be manifest from that time on, and were, in later years, due to Yankee ingenuity and taste, and not to mere imitation. A few fancy boots are even yet imported from Paris, and our exports are chiefly of the plainer grades; yet as dainty and durable a boot can be made in this country as anywhere on the globe. The improvement in the quality of our shoes is in a large measure due to the new methods of splitting and currying leather, thus affording softer and finer material for uppers.

Progress in mode of manufacture.

Fully as marked as the advance in the quality of our work is the startling progress made in the methods of manufacture. In the old days the shoes were sewed, and by hand, — a slow and laborious process. But in 1818 a Yankee, named Joseph Walker, of Hopkinton, Mass., invented the shoe-peg. This wrought quite a revolution in the business. At first the pegs were worked out by hand; but when they were found efficacious, and cheaper than sewing, machines were invented for their manufacture, and they were sold in larger or smaller quantities to shoemakers all over the country. There are now some thirty establishments whose exclusive business it is to make shoe-pegs. The tradition is current in New England, that at one time shoe-pegs became so plenty and cheap, that artful speculators tried to sell them to farmers as a new variety of large oats for seed.

Application of labor-saving machinery.

But two more important strides were to be taken in the art. Probably none of our industries has been more extensively developed than the boot and shoe business by the application of labor-saving machinery. When the sewing-machine was reduced to practice some thirty years ago, the utilization of the device for shoemaking was quickly thought of. It was several years, however, before it was properly adapted to this use. Now, however, machines made expressly for this industry (quite different in details from those used on cloth), and operated in large numbers by steam like the looms of a woollen-mill, are in use in about half the large shoe-factories of the country. In the other half the shoes are pegged by machinery. There are, however, some establishments which use both kinds of machinery; but the business is so divided up, that most manufacturers make either one kind or the other exclusively. It is almost incredible, to one who has not seen it done, that shoes can be sewed by machines; but the idea of a machine which both makes and drives pegs instantaneously, and so rapidly that a whole shoe can be pegged inside of ten seconds, is still more marvellous. The idea has been realized, nevertheless, and has been in successful operation for some fifteen or twenty years. The characteristic feature of it is a narrow ribbon of white wood, a hundred or more feet long, reeled upon the machine. This ribbon is of the thickness of a peg: its width is just the length of a peg. One edge has, by machinery, been pared sharp; and the grain of the wood runs straight across the ribbon. The operator of the pegging-machine has a basketful of shoes or boots brought him, each with the uppers and soles properly adjusted, and tacked to a last. Upon applying them, one at a time, to the machine, he causes a strong awl, kept just so far from the edge of the sole by an adjustable gauge, to pierce a series of holes in the leather: simultaneously a sharp knife splits enough wood from the end of the ribbon for a peg; the point of the peg is guided to the hole just made by the awl; and, while that instrument is making its next puncture, the new-made peg beside it is forced down into place. Both operations go on with the rapidity of a sewing-machine needle, and the shoe has only to be guided and turned while the process goes on.



POWER-ROLLER.

Machines have been invented for smoothing the rough soles after pegging, for making lasts, and for other departments of the shoe-manufacture, doing away with the necessity of any particular skill on the part of the workmen, lessening the cost of labor, but immensely magnifying the total production. That our shoe-manufactures have increased from $54,000,000 in 1850 to $92,000,000 in 1860, and $181,000,000 in 1870, is chiefly attributable to the application of new labor-saving machinery to the business. It should be remembered too, that, owing to the lessened cost of production, some kinds of shoes are now even cheaper than before the war, and that the increase in quantity since 1850 is quite proportionate to the total values above expressed.

CHAPTER VIII.

PAPER AND PAPER-HANGINGS.

Paper-making first practised by the Moors of Spain.

THE philosophers and historians of Europe have been accustomed to claim that all the progress of the modern world is due to the races which have had white skins. They take the world as they find it to-day, or as it was in the days of the Greeks, and point to the difference in greatness in war, science, industry, art, and business, between the races of Europe and those of Asia and Africa; the one quarter of the world being progressive in all things, the other passive or retrogressive. Heeren tries to account for this difference by calling attention to the fact upon which he says physiology throws no light, and which philosophy scarce dares to touch; namely, that the great races of the modern world have fair skins, and the backward nations dark skins. He intimates that herein is to be found the cause, or a part of the cause, of the difference in the development of the two great branches of the family. The assertion is flattering to Anglo-Saxons; but Heeren seems to have overlooked the Moors of Spain and the ancient Hindoos of India, to whom the modern world is indebted for nearly all of its great arts and industries. The working of iron, the spinning and weaving of cotton, silk, and wool, the practice of decoration and of graving, and many other important occupations, took their rise among those two peoples; and Spain gained all its early reputation for industry from the swarthy race which planted the arts and sciences on her soil, and left them there to flourish after it had itself been driven back to Africa. The Moors and Hindoos may have lacked the vigor in politics and affairs which the European races have ever shown; but, at any rate, they are the authors of the arts which have ameliorated society, and made the world a comfortable abiding-place for man. Paper-making is one of these arts. It took its rise among the Moors of Spain; and though it spread from Spain to Italy, and to France, Holland, England, and Germany, and, in the end, attained greater eminence in those countries than in Spain, there is no doubt about its birthplace and the people to whom the world is indebted for its invention. The Egyptians made paper from the papyrus-plant in early times; but the product was not paper in the modern sense of the term. The modern article was first made by the Moors in Spain about eight hundred years ago. Paper-mills were in operation at Toledo as early as 1085.

Introduction into France.

The manufacture of paper was introduced into France about 1314. It was begun in Italy about 1367, and in Germany in 1390. The first paper-mill in England was started in Hertfordshire in 1496.

Invention of modern paper.

The invention of modern paper antedated the printing-press by about four hundred years. It was not until 1455 that Gutenberg and Faust began printing the Bibles and Psalters which initiated the era of printing, while paper had been made from 1085. The consumption of paper was small until the printing-press was introduced, and even then books were too costly and rare to create much of a demand for the material. The real growth of the industry began about simultaneously with the planting of the English colonies in America. In 1622 the first newspaper was printed in England; and this application of the art of printing gave a spur to thought and the employment of the pen, so that paper came into demand, and the world was soon filled with a flood of newspapers, pamphlets, and books, as a consequence of it. Paper-mills started up everywhere in Europe, and the manufacture soon became very large.

Use of vegetable fibres.

Vegetable fibre was first used for the manufacture of paper by the early makers, direct from the plant; and a wide variety of fibres was used, that of flax being preferred. Along in the fourteenth century linen rags came into vogue for paper-making, as being just as good, and much cheaper. The clothing worn in Italy, Spain, Portugal, and France, was largely composed of linen, especially among the peasantry, who wore scarcely any thing else. There was in all those countries, therefore, an immense supply of cast-off clothing which might be utilized in paper-making, if engines could be made to reduce the cloth to fibre. Such engines were invented; and after 1600 Spain, Italy, France, and Holland employed rags only, and attained a great reputation for their linen papers. The first three of the countries named produced fine papers. The linen rags of Holland were coarser and darker, and the paper correspondingly coarse. In making the paper it was customary at first to pile the rags in large stone vats, and allow them to ferment and soften in water. They were then reduced to pulp by stamping, were bleached, washed, and felted into paper. In Holland the process was improved, at least in rapidity, by employing a machine which beat the rags with long steel knives, and reduced them to fibre with great celerity. The machine took the name of the Hollander, and has always retained it. When cotton-clothing came into use, cotton-rags were employed for paper. They have since nearly superseded linen-rags, just as cotton-cloth has linen.

The English colonies in America were large consumers of paper from the beginning of their career. "Oiled paper for the windows" was one of the first things the emigrants were exhorted to bring with them here by those who had preceded them to the new continent. Printing was introduced at a very early date; and newspapers, pamphlets, sermons, books, and Bibles were brought out on a large scale. Franklin's first work was a pamphlet, and for a long time the product of his presses belonged chiefly to that class of publications. Sermons were extensively printed at that day: the prominence they occupied among early American publications can easily be recognized by any one who chooses to rummage in the garret where the relics of the early days of his family are stored away. After 1704 newspapers were started in all the cities of the different colonies, and paper became one of the regular and profitable commodities in which every importer to this country traded.

Consumption of paper in colonies.

The Parliament of England did not care to see paper manufactured in the colonies: enactments were accordingly made against it. Pasteboard for the pressing of cloth was alone permitted. Nevertheless, a paper-mill was started among the Americans as early as 1693 in a little village near Philadelphia named Roxborough, where writing, printing, and wrapping papers were prosperously made, until an untimely freshet broke loose one day, and executed the will of Parliament in a summary manner by carrying away the mill, rags, vats, machinery, and all. In the next generation after the starting of this original mill three other factories were put up, — one near Boston, one upon Chester Creek in Delaware County, Penn., and the third in Elizabethtown, N.J. The newspaper printers of the colonies were very much interested in the growth of this industry. They were good customers of the mills, and an ample supply of paper at low prices was essential to their prosperity. Bradford, the famous printer at New York, owned the mill at Elizabethtown himself; and Franklin assisted to build no less than eighteen others in the course of his life. By 1769 there were forty paper-making establishments in Pennsylvania, New Jersey, and Delaware. The paper was made by these early makers from rags of cotton or linen. The pulp when obtained was taken by ladling or dipping into a hand-sieve or mould made suitable to the purpose, and by a rapid shaking motion spread evenly over the whole bottom of the sieve. The water draining through the cloth left the pulp in a sheet, which was then removed, and pressed in a pile with other sheets (a piece of felt lying between each sheet), dried, and finished. The process was slow, and the product of each mill small. After the Revolutionary war broke out, the importations of paper stopped, and the number of mills in the colonies, and the variety of their product, increased. Mr. Willcox on Chester Creek, Penn., made the paper for the Continental money issued by Congress. By 1787 there were sixty-three mills in the States, forty-eight being in Pennsylvania; and in 1791 Alexander Hamilton reported the business as being among the "considerable" manufactures of the period. The qualities made were printing, writing,

Parliament opposed to manufacture of paper in the colonies.

Growth of industry in the colonies.

Effect of Revolutionary war.

sheathing, and wrapping paper, pasteboard, fuller's or press paper, and paper for hangings. Congress did what it could for the manufacture by laying a duty of seven and a half per cent on paper in 1789, and making rags free. It has never changed this policy, except at different times, when, to give the finished product more protection, it raised the duty. The duty has at times been as high as thirty-five per cent, and is still at that rate.

The principal hinderance of the early American manufacture was the short supply of the raw material. The makers could, of course, have used raw cotton and raw flax, both of which were abundant, and would have made remarkably good papers, owing to the length of the fibres; but the excessive price of the paper would either have caused a literary famine in the land, or given the Europeans absolute control of our markets. Shortly after the panic of 1837, when prices were down and the cotton-crop large, the raw fibre of cotton was used to some extent, but not much; and manufacturers have never, as a rule, considered bale cotton one of their available resources for raw material. Their main dependence has always been upon cotton and linen rags. In 1804, in order to encourage invention to pay some attention to the subject of raw fibres suitable for paper-making, the American Company of Booksellers offered gold and silver medals for the greatest quantities and best qualities of paper made from materials other than cotton and linen rags; but at the same time the company used its best efforts to promote the saving of rags among the families of the country, as being more likely to be productive of good. The newspapers seconded the effort to induce people to save rags by frequent agitation of the subject. The Yankee peddler did more in this direction, however, than all other agencies combined, by carrying about the country in his big wagon a tempting array of bright new tinware, new brooms, &c., and offering to exchange them for good rags, which he, on the return from his expedition, sold for cash to the paper-manufacturers. In the very large cities the demand for paper material afterwards gave rise to a distinct race of people called rag-women and rag-men, who went about the streets from early dawn to sunset with iron hooks, collecting all the rags and scraps of papers they could find in the ash-barrels and gutters, and selling them to paper-makers. The ready market for rags soon led every prudent housewife to keep a rag-bag, into which all the chippings and worn-out cottons and linens might go; and the system of collecting the rags was soon well organized. Notwithstanding all this, the consumption of paper in the United States was enormously in excess of the production of rags, and always has been. The war of 1861 promoted the consumption enormously. The consequence has been, that the United States has always had to import rags. In 1845 the importation had grown to 9,000,000 pounds a year; in 1855 it was 40,000,000 pounds; in 1872 it was over 150,000,000 pounds. It is only since 1873 that the importation has begun to fall off, owing to the discovery of other raw materials; but the quantity of foreign rags consumed is still 75,000,000 pounds a year.

Lack of raw material.

Rag-saving.

The imported rags come mainly from Italy. The governments in the north of Europe do not favor the exportation of rags, especially those of linen. At various times, France, Holland, Spain, Portugal, and Belgium have absolutely prohibited it. Those from the south of Europe have been held to be the best, however, being whiter and finer.

Importation of rags.

The great scarcity and growing price of rags have led to numerous experiments during the last hundred and fifty years, with a view to utilizing other raw materials. Just before our Revolutionary war there was great anxiety in Europe in respect to the supply of rags; and nearly every grass, plant, and tree, which showed its head above the surface of the earth, was made a subject of the devouring attention of naturalists and manufacturers, with a view to ascertaining its capabilities for paper-making. In 1772 a book was printed in Germany containing leaves of paper made out of sixty different materials, among which were shavings, sawdust, thistles, cabbage-stalks, nettles, the cones of pine-trees, and the bark of several trees. About 1780 paper was made from wood in Germany. None of the vegetable fibres of Europe were, however, found to be available,—either because of their scarcity, or the lack of a proper knowledge of how to reduce them,— except the esparto-grass of Spain. This grass, so fibrous as to be available for other purposes than paper-making, produced an excellent pulp, and was easily reduced. It became a valuable addition to the resources of the industry. Its quantity being limited, experiments continued with other fibres. Straw was tried, and wood again; and at length, in 1854, Mellier invented a plan for treating straw, under a pressure of eighty degrees, with caustic alkali, which cleared the fibre of silica and gum, and brought it into the industry as an available material for the cheaper qualities of news and printing paper. A chemical process for treating wood made that material available the same year. The manufacture of paper from wood, straw, and hemp, began in the United States, in consequence of these discoveries, about the year 1861, at San Lorenzo, Cal., and in 1865 at Manayunk, Penn. The three materials are now very largely used, straw most of all. It may be mentioned as a curious circumstance, that, about fifty years ago, the idea was started of using the cotton or linen wrappers for paper-making in which the mummies of Egypt are swathed. The export of these cloths actually began for this purpose, and would have continued, except that Mehemet Ali wished to monopolize them for his own use in paper-making in Egypt.

Substitution of other materials for rags.

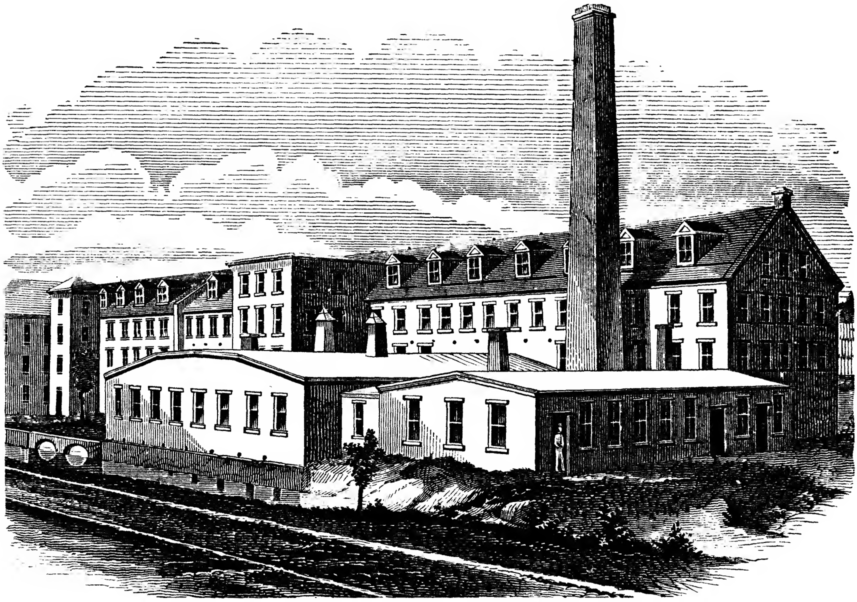
A great change has been wrought in the manufacture of paper by the employment of machinery in place of the old hand-processes. The principal machine now used in paper-making is the Fourdrinier invention. The world is indebted to Louis Robert of France for this remarkable apparatus. It was brought into use in 1799, and Robert received both a patent and a premium of eight thousand francs from the French Government. Leger Didot carried it to England in 1802,

Improvement of machinery for making paper.

and the Fourdriniers perfected it. After 1820 some of these machines were brought to the United States; and about 1830 Phelps & Spofford of Windham, Conn., began to make a rival machine, called the "Cylinder Machine," for the trade. Not long afterward, Howe & Goddard of Worcester, Mass., began to make the Fourdrinier machine. The application of power to the manufacture was a welcome idea to Americans. Labor was high here, and the cost of hand-moulded paper excessive. The idea of employing machines was taken up joyfully. The machinists perfected the cylinder and Fourdrinier inventions, and contrived a large variety of other mechanical expedients for use in the mills; and the improved processes made more rapid progress here than they did in either France or England, which originated them. While those two countries continued to use the hand-moulds on an immense scale, and still do employ them, the United States directed their whole effort to developing machinery which should make the best qualities of paper automatically as well as they were made in Europe by the other process. The greatest strides have been made since 1861. The success has been so great, that American machine-made papers are competing successfully at home and abroad with those cast in the hand-moulds.

Paper-making described.

Under the old system, a pile of a hundred and twenty sheets of paper, formed by hand, consumed two weeks in the making and finishing: now the work is all done in less than four minutes. The milky pulp, prepared by grinding, bleaching, and washing, flows from a cistern down upon one end of a long machine stretching across a large room, which is a combination of endless aprons, gangs of heavy rollers arranged perpendicularly one over the other, cog-wheels, and steam heating-pipes. The pulp falls upon a leather apron, and flows in a little cascade upon an endless wire-cloth, over which the web of paper is formed. The size of the stream is regulated according to the thickness of the paper. The wire-cloth is constantly vibrating from side to side. The motion spreads the pulp evenly over the cloth as it would be done by the shaking motion in the hand-process: it also aids the felting of the particles of fibre, and the drainage of the water through the wire-cloth. The greater part of the water having disappeared, and left a moist web on the cloth as it slowly travels away from the leather apron, the web is taken up through a pair of rollers covered with flannel, which give it a slight pressure, squeezing out some of the remaining moisture, and condensing the web. The web goes through between a second pair of wet press-rolls, and is then taken up by an endless felt apron, which carries it to a fresh set of rolls, which squeeze it more severely, and leave the paper strong and dry enough to go on without the support of the aprons. It travels along now between pressing-rolls and over the surface of steel cylinders heated by steam, and, after passing over about thirty or forty feet of heated surface, reaches the end of its journey, and is wound up tightly on a large roller,—an endless sheet of paper. The machine moves at the rate of from twenty-five to forty feet a minute. The paper is made at the rate of from three to five miles a day. From the paper-making machine the roll goes to the calendering and cutting machinery; though sometimes the cutting is done at the end of the first process by the action of a pair of shears, the paper coming from the Fourdrinier machine in sheets instead of in a web. Calendering is done by passing the paper between two rollers, one of polished copper, the other covered with paper. The pressure of the rolls is enormous, and the paper comes from between them compacted and with a beautiful surface. Letter-paper receives its power to take ink without blotting, not only by good calendering, but by sizing the paper, the latter being the more essential.



HOLYOKE PAPER COMPANY, HOLYOKE, MASS.

Decrease in importation of foreign papers.

Ever since the application of machinery, about the year 1830, the importation of foreign papers to the United States has fallen off. The importations previous to that date were heavy, and were carried to such an extent, that, for a long time previous to 1825, the United-States Senate actually used paper which was not only of foreign manufacture, but which bore the water-mark (remarkably out of place in a republic like this) of "Napoléon, Empereur et Roi, 1813." During the late war, and for a few years afterwards, the amount of the importations was from one to three million dollars' worth a year. This was an apparent increase; but it only took place because there was a demand for elegant writing-papers consequent upon the demands of fashion, and the percentage of foreign papers to the total amount consumed was really smaller than ever. The importations soon fell away again. Belgium ceased to send us her cheap news and book papers, which had been consumed in New York to a large extent. The orders for the French and English writing, ledger, fancy, and tissue papers, began to stop; and after 1871, the year of greatest importation, consumption of foreign papers dwindled rapidly away, until it reached the very insignificant figure of \$11,178.13 in the whole year of 1877, the total production of this country being about \$60,000,000 worth a year. One London house, which ten years ago sent £30,000 worth of paper to this country, had ceased to pay any attention to this trade. While this extraordinary change was taking place, an export of American papers sprang up. Before the war there had been an export to South America; but it was discontinued in 1861. It was resumed after the war. It grew so fast, that it rose from \$3,777 in 1869 to \$938,000 in 1877. American manufacturers discovered in 1869, what they had not really been consciously aware of before, that their machine-made papers were of as good a quality as the foreign hand-made, and that they could compete in foreign markets for their sale. They organized in 1877 for concerted action in pushing the export of paper. Forty-one firms united in a movement to send agents to England and to South America to see what could be done; and they succeeded, not only in selling their papers of all kinds in South America, but also in England, in competition with the local manufacturers of that kingdom. Their writing-papers were found to withstand the moist climate of England better than the English-made. American bank-note, bond, news, book, and writing papers now go to South America freely. The writing, ledger, and plate papers go to England. The thin manilas go all over the world. Wrapping-papers go to the West Indies. The range and amount of the sales is rapidly increasing, and the United States is now fairly in the field for producing a part of the world's supply of paper.

Exportation of paper.

In 1872 there were 812 paper-mills in the United States, principally in Massachusetts, New York, and Pennsylvania. They employed 22,000 people, and produced 317,637 tons of paper, or a little over 1,000 tons a day, the value of the same being \$66,500,000. Of the total product Massachusetts made one-third. Since 1872 about eighty mills have been added. It is believed that there are now no hand-made paper establishments in the country. Machinery drove them all out of existence. Two lingered along until within a very few years, — one in Massachusetts, and one in Pennsylvania, — when they, too, "folded their tents, and silently stole away."

Number of mills.

Paper-hangings were first offered for sale in America in 1737; but they were little used, except in families of wealth, before 1750. Their use was regarded as sinful luxury and ostentation. Whitewashed walls began to be regarded as something less than of the highest beauty and moral worth only about the time of the Revolution: those

Early use of paper-hangings in the colonies.

who could afford them then bought the English and French hangings, and put them in their houses. They were so costly, that they were not pasted upon the walls, but were merely hung upon them, or placed against them, attached to frames. They were frequently moved from house to house. Their manufacture was begun upon a small scale in 1763; and by 1787 there were small factories in Boston, New Jersey, and Pennsylvania. The paper for them was fabricated from the coarsest and cheapest rags, and even from woollen stuff. It was made in sheets thirty inches long, which were pasted together neatly in strips long enough to reach from floor to ceiling; and the pattern was stamped upon them with wooden blocks by hand. In 1789 John Carnes of Delaware, who had been consul at Lyons, resolved to enter upon the manufacture of paper-hangings on a larger scale than had been common in the country. He associated himself with Burrell Carnes and two French workmen by the names of Le Collay and Chardon, and they went into business at Philadelphia extensively. The hangings produced by these early makers were of a very cheap description; but they sufficed to introduce color and form into the decoration of houses, and were very extensively bought by the people. Boston was producing 24,000 pieces yearly by 1794. By 1810 four establishments in the vicinity of Philadelphia were producing 140,000 pieces yearly, worth $97,417; and Providence was making 8,000 pieces, worth $8,000, yearly.

Imported from England.

First manufactures in United States.

The best papers were, of course, imported from France and England, where the arts of design and decoration found rich patrons, and had been practised for generations. People of fashion were in the habit of putting none except French and English papers on their walls, at least in their best rooms. The American makers, for fifty years after the Revolution, aspired to do little except to supply the mass of the people with cheap hangings. The prettiest of the papers they made were in imitation of the foreign styles; but a part of their goods were in original styles, and were frequently extremely unique. The writer has a sample of a paper made at Albany in 1812 by Barnard & Steele, which was called "the battle of Lake Erie" paper. It had pictures in black and gray, on a white ground, representing in a vague and ideal sort of way three scenes in that famous naval conflict. The pictures were about two feet apart, and a wall papered with the hanging must have been a bewildering object to look at. Patriotic scenes were common, the pattern deriving its interest solely from association of ideas, and not from its material beauty. Another queer paper much in use in those early days was the "rainbow paper," invented about 1830 by the sons of John B. Howell at Philadelphia. Enormous fern-leaves covered the surface of the paper, the hues of which shaded from dark brown at one end to light yellow at the other, while the grounds shaded from light blue to dark blue. This shading of grounds and patterns soon became very common.

Importations continued.

"The battle of Lake Erie" paper.

All the printing was done by hand, with a wooden block twenty inches square and three inches thick. The color was first spread upon a blanket. The block was laid on the blanket to receive its color, and was then applied to the strip of wall-paper, metal pins at the corner marking places on the strip to guide the printer in applying future colors. Pressure was applied to the block by a treadle operated by the printer's foot. After each impression the strip of paper was pushed along, and a new impression made, until the hanging had received its printing from one end to the other. If the pattern was in more than one color, the paper was hung up to dry after receiving each color, and then taken down and subjected to the same process, each tint being put on separately and by a different block. This was a tedious process, and one man and one boy could print only a hundred rolls of one-colored paper a day. If six colors had to go on, it would take a week. The process was identical with that for printing calicoes and dress-goods. The grounds of these old papers were generally white, and in the patterns a great deal of red, yellow, and brown was used. The fashionable French papers were generally horrible combinations of yellow, gilt, brown, and white, the floral and leaf patterns being of enormous size, and the borders twelve or eighteen inches wide. Oftentimes, however, the imported papers represented scenes in a garden, classic legends, &c., the room papered with them resembling a panorama. A paper exhibited at one of the world's fairs, representing a chase in the forest, required the aid of twelve thousand blocks in the printing. In 1824 glazed grounds began to be introduced.

Mode of printing.

After 1820 the business grew very rapidly. The Fourdrinier paper-machine enabled the material for the hanging to be produced in rolls, obviating the costly old process of pasting the thirty-inch sheets together by hand, and cheapening the expense of the finished hangings immensely. Then in 1843 a machine for printing two colors was introduced into the business, and, within ten years afterwards, one which would print in six colors. This machine soon superseded all the hand-printing of ordinary papers in this country. This still further cheapened the cost, and increased the sale of hangings. Other machinery was soon invented. Formerly, whenever the ground of the hanging was colored, the stain was laid on by hand. A machine was now constructed to brush on the color automatically. Others were contrived for cutting up the long rolls of paper into strips of proper length for sale, for rolling up the strips, for brushing the paper to produce the satin finish, for embossing the paper, and for other purposes. The printing-machine was still further improved. The manufacturers did not stop with six colors, but put roller after roller into the machine until its capacity had been increased to twenty colors. Each color was laid on by a separate roller, and the long web of paper passed from one to the other until it had taken them all; and it then passed off to a frame, which caught it up in a succession of long folds, and carried it slowly across the room to dry. One

Growth of business after 1820.

roll applied varnish to the paper, and to this gilding was afterwards applied by dusting it on. By our present process one machine can turn out in one day from three thousand to five thousand rolls of hangings printed in any number of colors from one to twenty: by the old process this work would have employed a man and a boy for a year and a half. The beauty of the papers and their cheapness continually improved with this application of machinery. Colored grounds were generally introduced in place of the cold white grounds, and richer, darker, and prettier patterns. Some hand-printing of the more costly papers has still continued to be done; but American machinery is steadily encroaching on the territory of hand-work, and, for all except the papers costing from three dollars to eight dollars a roll, the work is so well done, that experienced judges cannot tell which is machine-made and which hand-made. In France and England the manufacturers cling to the hand-processes: they regard the product as clearer in print. Yet, within the last three years, American makers have taken English patterns and printed them by machine, and sent the papers back to England, where they defied discrimination from the others by the most experienced eye.

Location of factories.

The fact that the large cities of the United States are the best customers of the paper-hanging makers has led them to assemble their factories of late years near those centres of population. Formerly the factories were scattered through New England and the Middle States in the rural cities and villages, where water-power was plenty, or taxes light: now the concern of J. R. Bigelow & Company at Boston is the only one in New England; and the most prosperous and largest concerns in addition to Bigelow's are centred in New York, Brooklyn, and Philadelphia. One advantage of having large factories in a city is, that the people of the place can go to the factory, select a pattern, and have enough of the hanging made in any special color or tone to match their carpets and furniture. In 1860 there were twenty-six paper-hanging factories in the United States, making $1,037,600 worth of hangings a year. The business has increased in amount; but the number of factories has decreased. There were in 1870 only fifteen factories; but they produced $2,200,000 worth of hangings: since then the production has increased nearly $1,000,000 worth.

Style in papers.

There is in paper-hangings, as in silver and gold ware, architecture, and decoration generally, a need of distinctive American styles. American flowers and leaves are largely used in the cheaper paper; but in the costly kinds, by which the art of decorating paper-hangings must be judged, there is still the same imitation of foreign patterns which was common a hundred years ago. Manufacturers copy the French and English ideas habitually. Two manufacturers in New York are trying to introduce their own designs in expensive paper; but their inspiration is still the foreign decorations. One concern, that of Leissner & Louis, devotes itself largely to making patterns in the antique styles, producing papers in the Egyptian, Persian, Greek, Pompeiian, or any other style to order. There is great need of emancipation from the influence of the ideas of the Old World, and the contrivance of designs in a pure American spirit.

Not only are the styles of paper constantly changing, but the tastes of people also change concerning their use. Only a few years ago it was generally believed that many kinds of wall-paper were unhealthy, because of the poisonous ingredients put into the coloring-materials; while the paste used in sticking papers to the wall attracted moisture, making rooms damper than they would otherwise be. Accordingly, a period of general wall-scraping was inaugurated. Having been thoroughly cleaned of old paper and paste, walls were painted; it being everywhere admitted that the colors adopted were healthy, as well as more pleasing to the eye. But, now taste is setting once more in the opposite direction, colored walls are being re-covered with paper, the most stylish mode of putting it on being to use three shades, — the lightest shade for the middle or body of the wall, a darker shade for the top, and a still darker for the bottom. By and by we shall doubtless hear of another change, made as suddenly as this; and perhaps wall-papers may be discarded altogether.

Painted vs. paper walls.

The importation of foreign hangings has been at times very large, but never so large as since the war. In 1872 it amounted to $982,000 worth: since then it has fallen to almost nothing. A large export has sprung up in its place, especially to South America, Canada, and the West Indies.

CHAPTER IX.

GUNPOWDER AND FIREWORKS.

WHEN old Putnam stormed and fumed about the earthworks on the hills overlooking Boston, and cried, "Powder, powder! O ye gods, give us powder!" the quality of the article he then sighed for so ardently was extremely poor. This inflammable material had been in use for four hundred years; but the smoke, flame, and ashes it made were out of all proper proportion to its power. The quantity then made in the United States was not so large per annum as would be consumed in one of our modern mining-regions in a week, or in one lively battle. The government started powder-works during the Revolution to insure a supply of that necessary munition of war; but it was not until 1802 — when a Frenchman by the name of Eleuthere Irene Dupont started a factory on the Brandywine, near Wilmington, Del. — that powder of any great excellence was made upon our soil. Dupont had had a chemical education, and, noticing the poor quality of American powder, resolved to supply the rising young republic with an article which would obviate the inconveniences of an explosive which fouled the musket badly, and which would make the country more formidable in war and peace. The demands of the people of the several States for sporting-powder and for military powder with which to fight Indians, and the hostilities with England which began in 1812, gave Dupont all he could do in the way of manufacture. He repeatedly enlarged his factory; and when he died, in 1834, his establishment was the largest of the kind in the country: it has since then become the largest in the world. The war of 1812 led to the establishment of other factories of powder, especially in Pennsylvania, which has always been a large consumer of powder, and, by all odds, the largest manufacturer. The factories were generally small, and were located in places remote from other property, in order not to endanger life and capital by a possible explosion. During the war of 1861 the quantities of powder consumed in the United States were enormous. The resources of the existing factories were taxed to supply the market which was so suddenly

Powder-works during the Revolution.

Dupont.

Manufacture of powder during recent war.

and unexpectedly created. It was necessary to start new factories to meet the requirements of the times. By 1870 there were thirty-three powder-factories in full operation in the United States, fifteen of them being in Pennsylvania, five in New York, three in California, two in Connecticut, and two in Ohio. One of those in Connecticut was that of the Hazard Powder Company of Hazardville, a celebrated concern: another was the Laflin & Rand concern of New-York City.

Factories in 1870.

In a country like the United States there must always be a great demand for powerful explosives. We have few or no wars of jealousy and conquest to fight; but we have a million railroads, canals, and streets which must be laid out on direct and level routes, regardless of rocks and mountains; and they could never be laid out and built, with any regard to levels and straight lines, without the aid of powerful explosives to shatter the rocks, and remove them from the way. We have a million mines of gold, silver, copper, and iron, and quarries of stone, to work, whose treasures would be almost inaccessible, except for the agency of gunpowder and nitro-glycerine. There are reefs and rocks to be cleared out of the harbors; there are guns to be fired on occasions of public holiday; there are fireworks to be burned at festivals, and rockets and mortars to be fired by life-saving crews. Leaving aside the whole subject of the demands of the army and navy of the United States, and of the militia regiments of the several States, the legitimate demands of the engineering works, the mines, and amusements of our people, are still sufficient of themselves to create a necessity for a large manufacture of gunpowder and explosives. Not long since, a blast was fired in a limestone quarry of the Glendon Iron Company, at Easton, Penn., which contained a charge of twelve thousand pounds of mortar-powder, displacing sixty thousand tons of rock. The legitimate demands of the United States now amount to over twenty million pounds of powder annually. The manufacture is larger than that, however, because there is an export of gunpowder to Europe and South America constantly, both in the form of cartridges, and loose in kegs. The export trade is irregular, and depends largely on the progress of hostilities abroad: but, whenever there is war, there is always a demand for American powder; and, as the monarchies of Europe or the nations of Asia are in a quarrel about half of the time, there is very seldom a year in which more or less of our powder does not go abroad. About half the powder used in the Crimean war is said to have been bought in America: a great deal of that which the Turks used in the late war was certainly bought here.

Need of powder.

Gunpowder is made of three ingredients, — charcoal, nitre, and sulphur, — in proportions which vary slightly, according to the use to which the powder is to be devoted. The ingredients are combined by weight. The following are four of the more common proportions, the recipes being for a hundred pounds of powder each: —

Powder, how made.

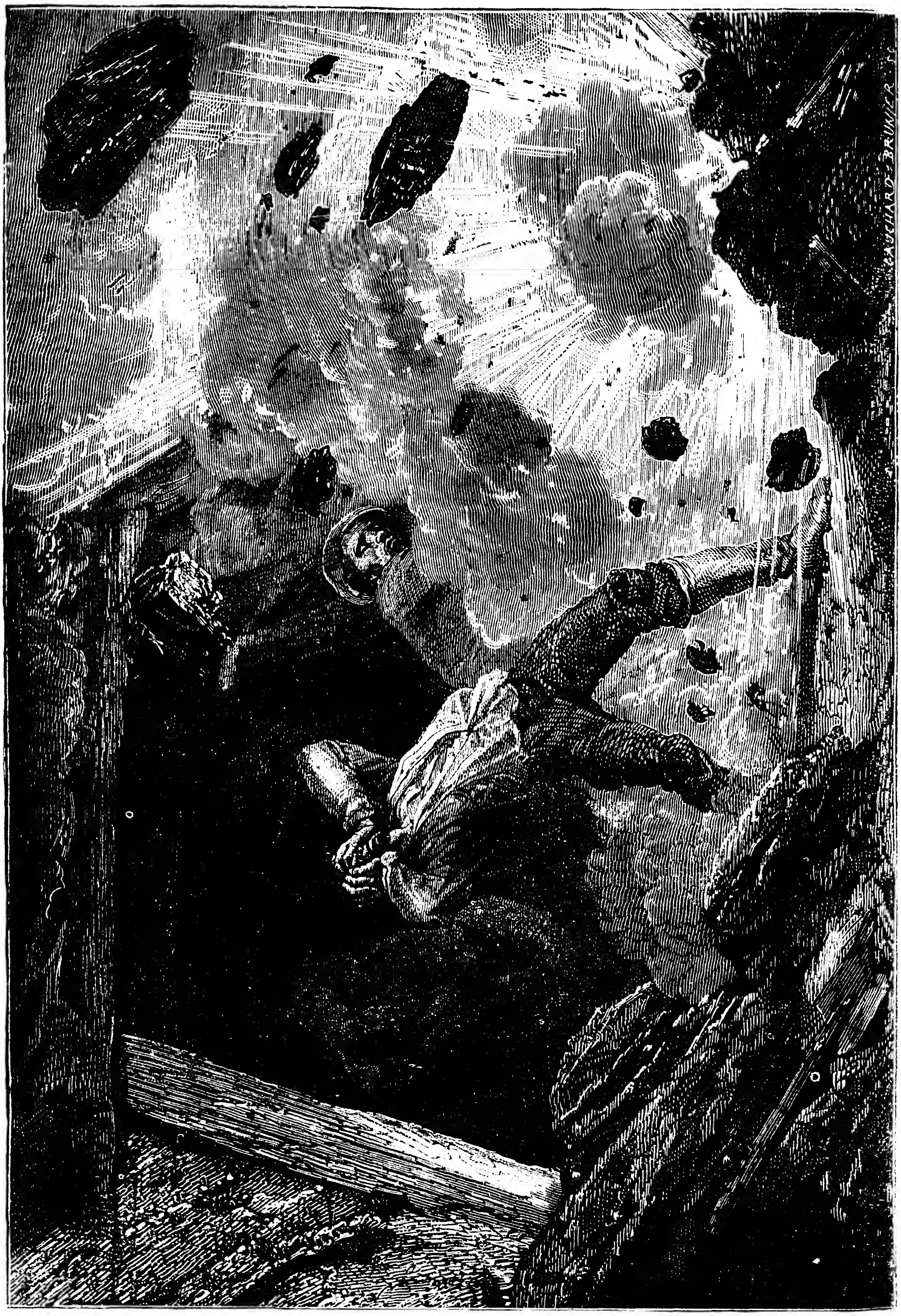
	NITRE.	CHARCOAL.	SULPHUR.
Atomic theory	74.64	13.51	11.85
United-States military	76	14	10
Sporting	78	12	10
Blasting	62	18	20

The nitre is reduced in quantity for blasting-powder in order to cheapen the cost and lessen the rapidity of combustion. For most purposes of blasting, a sustained and increasing push is better than a sudden and terrific shock. A strong and cheap blasting-powder is also made by using nitrate of soda instead of nitrate of potassa or nitre. The ingredients are mixed in the very highest state of purity. The sulphur and nitre are carefully and conscientiously refined before the mixing takes place. It is desired that the powder shall burn away completely, without residuum or ash; and it will not do this if impurities are present. The charcoal is obtained from slender willow-shoots, or from poplar, in the United States. The trees are generally cultivated by the owners of the factories. In Europe the alder is used, and in Russia the white-birch. The wood is charred in red-hot iron cylinders, and ground when cold by rolling in a barrel with zinc balls. The ingredients are all reduced to powder: they are then mixed in the proper quantities, and sent to the grinding-mill in quantities of about fifty pounds at a time. The incorporation of the ingredients is a very important matter, and the grinding, is therefore, very carefully attended to. It takes place in a circular trough of cast-iron, in which cast-iron wheels of three or four tons' weight follow each other slowly around in a circle, crushing the powder under them as they pass along. The powder is kept moistened throughout the operation. After grinding, the powder is subjected to heavy pressure between copper plates, and is thus reduced to a cake. It is then broken up into grains, either by mallets or toothed rollers, glazed by rolling in barrels so as to enable the grains the better to resist moisture, dried, sifted, and cleaned of dust.

Ignition of powder, how determined.

The relative proportion of the ingredients causes the powder to burn slowly or rapidly. This idea was taken advantage of by Gen. Rodman, U.S.A., in 1856, in order to produce a powder suited to large cannon. He conducted a series of experiments with powders, and was the first in the world to produce an explosive suited to modern artillery. His powders were made in two forms. One, called the "mammoth," was in irregular grains, from six-tenths to nine-tenths of an inch in diameter: the other, called the "perforated cake," was in hexagonal or cylindrical grains, perforated with six or ten holes. Gen. Rodman gained slow combustion by these varieties of powder, and consequently greater initial velocity at the mouth of the gun, with

Rodman.



POWDER-EXPLOSION.

less recoil. The heavy guns used in the war of 1861 were supplied with the Rodman powder. It is related, that in many cases, when light batteries or infantry regiments were deployed in front of the heavy guns, on lower ground, but close to them, the men of the latter were sometimes hit and wounded with kernels of the powder which had not been burned. Rodman's idea was adopted in Europe as soon as it became known. The English pebble and pellet powders, and the Russian prismatic, are the outgrowth of it.

Power of gunpowder.

The power of gunpowder is enormous. Water expands seventeen hundred times in becoming steam; but gunpowder expands into a greater volume of gases, and its tension is enormously promoted by the heat generated in combustion. One early experimenter in this country confined twenty-eight grains of powder in a cylindrical space which it exactly filled: when fired, it burst a piece of iron which would have resisted a strain of four hundred thousand pounds. A mortar loaded with one-twentieth of an ounce of powder, and having a twenty-four-pounder cannon laid on top of it, was burst by the explosion, and the cannon lifted. Various experimenters have arrived at different results in testing the pressure of gunpowder before being relieved by expansion, the product of force ranging from seven to 662 tons' pressure to the square inch. The average force of gunpowder is rated at forty tons to the square inch.

Other explosives.

Within the last sixty years a number of other explosives have been added to the list with gunpowder, some of which have been extremely useful in engineering. The first was discovered in 1832 in Europe by Braconnet, who found that starch dissolved in nitric acid, and precipitated with water, becomes explosive by concussion. Braconnet called his new powder xyloidine. Shortly afterward Pelouse treated paper and cotton and linen fabrics with nitric acid, and got an equally explosive product, which he called pyroxyline. The new substance was so destructive, that a peaceful old stocking treated with nitric acid became so incendiary and energetic as to be able to blow up a house. In 1846 Schönbein made gun-cotton by the use of nitric and sulphuric acid, and great attention was paid to the new product all over the world. Gun-cotton has since been made to some extent in two forms. In one, long-staple cotton is subjected to the action of one part of nitric and three of sulphuric acid, and put through a long series of washings in water and dryings, and boiling in alkaline solutions. The staple is twisted into ropes, or woven into cloth, for use. In the other, or English process, the staple is beaten into pulp, as in paper-making, after being treated with nitric and sulphuric acids, and is compressed into small white cubes or cylinders, while moist, under a pressure of four or five tons. Gun-cotton for experimental purposes has been made on a very small scale in this country. It was tried at the government engineering-works at Hell Gate, in New-York harbor, previous to the demolition of the

Pyroxyline.

Gun-cotton.

reef there; but it has always been found too violent and uncertain in its action, and too expensive, for practical use.

A whole world of explosives has grown out of the discovery of gun-cotton. Schultze-powder was soon invented; which was nothing more than wood reduced to large grains, and treated with acids. Nitro-glycerine was discovered in 1847, and first applied to engineering in 1864, in Sweden. The simplicity of manufacture and extraordinary power of this agent soon made it popular. It is prepared by introducing glycerine, drop by drop, into nitric and sulphuric acids. It is a terrible explosive, producing three and a half times as much gas, and twice as much heat, as gunpowder, and is never safe to handle except when frozen. It congeals at forty or forty-five degrees, and is then perfectly safe; but, when liquid, it explodes with slight concussion; and its power is so great, that a can which has contained it, but has been emptied, will, when thrown on the ground, explode with violence sufficient to destroy life. When not confined, it burns with difficulty on the application of a match. Since 1865 it has been extensively used in the United States for blasting in the excavation of railroad tunnels, reefs, &c. It is easily made in the vicinity of the works. Dynamite, or giant-powder, dualine, Vulcan-powder, lithofractem, and other explosives, are produced by causing nitro-glycerine to be absorbed by some inert and porous solid. The silicious infusorial earth found in Hanover, called "kieselguhr," is the best which has been found for the purpose. It is not so dangerous to handle in this form, and is yet slightly slower in combustion, and hence more serviceable. Nitro-glycerine and all of its compounds are exploded in blasting by a fulminate of mercury contained in a copper capsule, and usually ignited by an electric spark from a battery at a safe distance from the mine. One of the explosives with which the United-States engineers experimented at Hell Gate was called "vigorite." It was made of coal-tar by the action of nitric and sulphuric acids. The idea was to get a cheaper explosive than nitro-glycerine, if possible; the cost of blowing up the reef there being large, and a reduction of expense being desirable. The engineers had to fall back, however, on nitro-glycerine — that is to say, its compounds — at last, as being, all things considered, preferable to all other agents. Twenty-six tons of the material were used, distributed in cartridges in 4,462 holes in the rock. Dynamite was principally used; but some of the cartridges were of dualine and Vulcan-powder also.

Nitro-glycerine.

Dynamite.

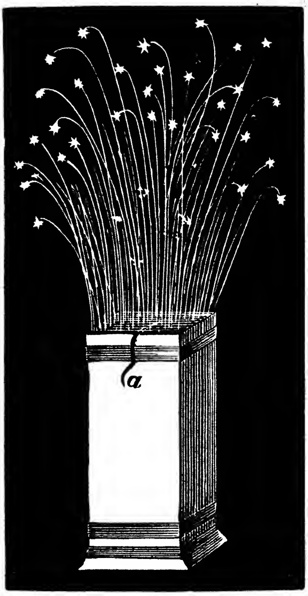
The brilliant effects produced by the burning of gunpowder at night, especially in conjunction with the metals, and other substances having a colored flame, caused the new combustible to be seized upon at once in Europe to add to the attractions of the royal *fêtes*. In Portugal, France, Spain, Italy, and England, in the ages succeeding the invention of gunpowder, public carnivals for the entertainment of the people, or royal festivities in honor of distinguished guests, were extremely common,

Fireworks and colored lights.

and were of the most extraordinary description. The travels of the kings through their own realms were also attended by public displays, and a regular feature of the night performances soon came to be the burning of fireworks and colored lights. In America, cannon-firing, bonfires, the ringing of the bells, and public parades and speeches, were, for a long time, the sole elements of a public festival, especially of those of a political character. John Adams predicted that the Fourth of July would always be celebrated with demonstrations of that character. Fireworks were not greatly used in the republic for some time after the Fourth-of-July celebrations began. Ship-masters disliked to take them on shipboard in Europe and bring them here, owing to their dangerous character; and they were too costly, and in too little demand, to be manufactured here. After 1816 they were manufactured on a small scale; and they are now made in moderate quantities every year, as Fourth of July approaches, in response to the demand for them for the festivities on that occasion. Their public use is confined entirely to that anniversary, the custom being to have the display on the night of July 3 along with the bonfires, the parades and speeches coming on the day after. Fifty years ago, when fireworks were first coming into general use, the displays were conducted by private enterprise. They were either the patriotic demonstration of private citizens, or were the speculation of some ingenious business-man, who would put up a high board fence around the garden adjoining his public-house, and exhibit his wheels and snakes and Roman candles and rockets to the admiring gaze of the people at a shilling or twenty-five cents a head. As the cities of the country have grown in size, it has been deemed fit that the celebration of so important an event as the anniversary of national independence should in all respects be carried on by the community at large. So, for twenty years or more, the annual displays of fireworks have taken place at the public expense in the various cities of the country, except here and there where demagogues and two-cent politicians in the city councils have refused to vote the necessary funds on the plea of economy for the sake of the dear people. There is an obvious propriety in having the displays take place under official supervision. Not only are they likely to be more splendid, but they are certain to be less productive of accident, and damage to property. The great accumulations of wealth in cities, in the form of buildings, have made caution and official supervision desirable.

Manufacture of fireworks.

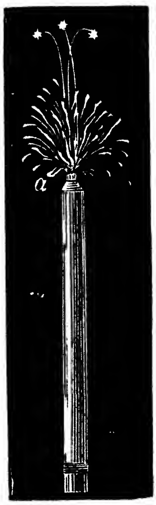
The materials used in pyrotechny are gunpowder (or various mixtures of nitre, charcoal, and sulphur), and various metals, salts, and substances for producing brilliant colors. The powder used is of a low grade of explosive power, and is intended merely to burn with brilliant sparks, instead of exploding. In rockets alone is there any explosion. In wheels, rockets, and Roman candles, the powder is so confined as to give propelling power. Rockets were originally used in war. The Congreves formed a great feature at the siege of Copenhagen in 1807, and at the battle of Leipsic. The French were routed on the latter field by a volley of Congreves. Rockets are now used on the sea as a signal of distress, and a heavy variety is employed on shore to carry a line to a stranded ship. They are good for a distance of eight hundred yards, or nearly half a mile. The rockets of the present day for festival use are often very powerful, and ascend in the air from a thousand to twelve hundred feet: at their highest point they burst, and throw out a volley of colored stars, or a cluster of snakes. Within two or three years the parachute-rocket has been invented, which throws out one, two, or three large stars, each with a parachute, which sustains them while they float off slowly on the breeze, burning red, then white, then blue, and oftentimes other colors. An immense variety of wheels is made, with showers of sparks of different forms, and flames of the different colors of the rainbow: they range from the little whizzing pin-wheel three inches in diameter, a boy's plaything, up to the huge wheel six feet across, which flings out a circle of flame and scintillations twenty feet in diameter.



ROCKETS.

Roman candles have been in use from the beginning, throwing anywhere from two to eight balls, one after the other. Within the last few years volcanoes have been introduced, shooting out a torrent of balls for several seconds; and quite recently the bomb, which, being set upon the ground, throws up a hollow ball straight into the air to the height of five hundred feet, which, exploding, also throws out a shower of balls. The fire-cracker, the delight of the boys, introduced to this country from China, forms no part of the public displays; but it does form a considerable feature in the sales of the dealers in fireworks. Its use has been regulated by law since the disastrous ten-million-dollar fire at Portland, Me., and the large number of small fires, which resulted from the careless use of this noisy plaything. Fourth of July, though, is a hollow mockery to the boys without the fire-cracker; and they still consume it enormously. A great feature of the public shows is the set pieces, in which a spread eagle, or a portrait of Washington, or "Independence," or some other motto, is depicted in lines of fire. The fancy of the makers has free play in the con-

Evil consequences of fireworks.

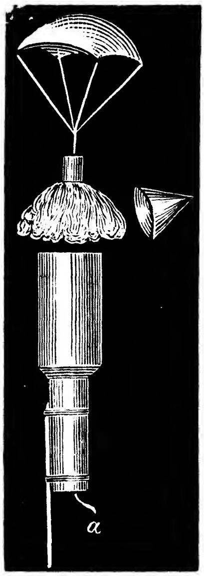


ROMAN CANDLE.

struction of these pieces, and they bear names of the most poetical description. Among those produced for the Centennial displays in 1876 were the Star of America, the Yankee Windmill, the Japanese Glory, the Fairies' Frolic, the Persian Rose, the Date-Tree of the Desert, the Scroll Quadrille, the Kaleidoscope, the Star of Independence, Washington, the Tribute to Ceres, the Polka Dance, the Shield of the Union, the Bald-headed Eagle of Liberty, the Printing-Press, and the Tribute to America. Their names sufficiently describe them.

Different colors, how produced.

In the diversification of the various fires, lampblack, or strontia nitrate or carbonate, is used to produce a very red color, such as is employed in the theatres at times, or for a simple colored fire in street-processions, as well as for fireworks. With nitre in excess, these substances produce a pink. Nitre and sulphur make a white fire. Yellow can be made by common salt, resin, or amber. A violet is produced by potassa salts, chlorate, and carbonate mixed; a blue, by potassa salts and ammonia, copper sulphate and antimony sulphide, or copper carbonate and alum; a green-blue, by zinc-filings, or copper sulphate and sal-ammoniac. A good green is obtained from barium carbonate, or verdigris with copper sulphate and sal-ammoniac. Iron-filings give bright sparks; and steel-filings and cast-iron-borings, having more carbon, afford a more brilliant scintillation with wavy radiations. Lycopodium burns with a rose-color and a magnificent flame: it is, therefore, largely used for flambeaux in street-processions, and in theatres to represent lightning, or flames in a burning building.



ROCKETS.

Improvement in fireworks.

Chemistry has thus greatly increased the resources of the pyrotechnic art. The modern fireworks are very much more brilliant than those of the middle ages; and the citizens of republican America are entertained every Fourth of July, when the cities bestir themselves, with more beautiful displays than any which ever glorified the pomps of the kings of Europe. The brilliant spectacles of the late war during the night bombardments of Sumter and of the works before Richmond and Petersburgh, which will never be forgotten by those who saw them, were the most extraordinary scenes ever witnessed upon this continent at the time they took place. They have been surpassed since the war, however, just as the royal *fêtes* of Europe in the middle ages have been, by the splendors of recent pyrotechny. The scene in the city of New York at night, for instance, from any tower which overlooks that vast community, spreading over the country for miles, — into Long Island on the one side, and New Jersey on the other, — during the discharge of anniversary fireworks, is something which surpasses the spectacular effects of the late war. The thousands of rockets ascending into the air as far as the eye can reach, the parachute-stars floating away softly on the wings of the breeze, the volleys of Roman candle-balls in every direction, the flash of colored fires, and the inevitable conflagration of a building here and there, — all these, outlined against the night, are the elements of a strange and impressive picture.

CHAPTER X.

INDIA-RUBBER MANUFACTURES.

CAOUTCHOUC appears to have been one of the valuable products of the East Indies which the ancients entirely overlooked. It was not until this substance was discovered in practical use among the savages of the continent of America that the civilized world took cognizance of it, and turned to account the magnificent rubber-trees of India. Caoutchouc was unknown to science until 1735. In that year an observing Frenchman who had just come down the Amazon, and who had noticed that the natives were making boots, bottles, and water-proof cloth, of the gum of a strange and magnificent tree, related the facts to the French Academy of Sciences. The natives of South America called the gum cahuchu; and Condamine brought the sound of the name to France, and introduced the new gum to the world as caoutchouc. In 1751 Condamine again called attention to this "elastic resin," and announced that it had been found in the trees of the French province of Cayenne. Public curiosity was then excited about the new substance. Small quantities of it were obtained from the East Indies and South America; and the chemists, who alone for a long period were interested in it, began a series of experiments to find out what it could be made useful for. Herissant and Macquer published the result of their investigations in 1763 to show that caoutchouc could be dissolved. Priestley mentioned the gum in 1770 as very meritorious for the purpose of erasing lead-pencil marks. A cube of it about half an inch on the side cost three shillings at that time, or about as much as two pounds of the crude gum costs now. A great many experiments were made with this interesting gum during the next fifty years; but not until the end of that period was it used for any thing, except to erase lead-pencil marks. In 1823 Mackintosh made the first practical application of it to industrial objects by starting a factory at Glasgow for the water-proofing of cloth with caoutchouc, the gum being dissolved for the purpose in oil of turpentine and alcohol, or coal-tar naphtha.

Discovery of caoutchouc.

From this small beginning caoutchouc has risen in fifty years to occupy a position in the arts second hardly to that of rosin and of glass. It is now so important, that it seems strange how the world could ever have got along without it. It performs a hundred offices which no other known substance could fulfil. Its elasticity, adhesiveness, and imperviousness to water, are absolutely unique. Such are its qualities, that it is now extensively woven into tapes and elastic tissues. It is applied to cloth as a waterproof varnish; and it cements any number of pieces of cloth together into thick plates, so that it can be used for valves of pumps and steam-engines, and for packing, belting, fire-hose, tubing, life-preservers, overshoes, boots, gas-bags, gloves, and scores of other kindred purposes. As a marine cement, it joins wood so tightly, that a mast or yard will break in a new place rather than where cemented. Such are its powers in this direction, that it was once proposed to dispense with iron bolts, and use this extraordinary material for fastenings instead. It is an insulator and protector of telegraph-wire; and it can be fashioned into light and serviceable objects for every-day use, such as inkstands, buttons, combs, penholders, rulers, jewelry, syringes, canes, cups, toys, bottles, pails, &c. A patent has actually been taken out for employing this substance for railroad-rails. The visitor at Philadelphia in 1876 would have discovered rails of this description on exhibition there by a live Pennsylvanian, who was expecting to make his many millions by the general adoption of his ingenious idea; the merit of it residing in the fact, that the wheels of the locomotive will not slip on a track made of rubber, and the whole power of the engine will therefore be saved, — a consideration of immediate importance to every railroad-manager in the world. The fact that so many uses could have been found for India-rubber in

Importance of discovery.

GUTTA-PERCHA TREE.

the short space of fifty years indicates great possibilities in reference to its future application. When the chemistry of the gum is better understood, it is believed that its applications can be more than doubled in number and value.

The India-rubber-tree grows only in the hottest regions under the equator. In India it is called the *Ficus elastica.* It is a colossal tree in that country. In Assam there is a forest of these trees, containing forty-three thousand in a tract thirty miles long by eight broad. The diameter of one tree has been found to be twenty-four feet, and its height a hundred feet. The tree is a sort of banyan, and grows by the rooting of the branches. In South America it is called the *Siphonia elastica,* or *Siphonia cahuchu.* It grows in the provinces of Pará and Amazonas chiefly, lying along the Amazon, and is found all the way from the seaboard to a point nineteen hundred miles in the interior. Its regular cultivation has not yet been undertaken. The natives merely hunt up the trees where they happen to grow in the forests, and tap them at the proper seasons. The extent of the area covered by these priceless trees, and the ready response the soil and vegetation of Brazil make to cultivators, are a guaranty that the supply of rubber is practically inexhaustible. Nothing except some such extraordinary demand for it as would be created by its general introduction for the tracks of railroads (should such an event ever take place) would ever severely tax the resources of Brazil for the gum. The gum is taken from the trees in the East Indies by making a number of cuts through the bark to the wood all over the trunk and branches and exposed roots. The juice is richer the higher the cut. A thick sap resembling cream flows from the wounds of the tree, and in twenty-four hours about forty pounds are obtained. The tree can safely be tapped once a fortnight. The cold season is usually chosen for these operations, because the juice is richer, and the tree less liable to be injured. In South America the natives make a perpendicular cut in the bark of the tree, and lateral cuts leading to it. The thick, white, creamy sap flows into the central cut, and at the bottom of it is conducted by a banana-leaf into a vessel placed to receive it.

India-rubber-tree.

When examined under the microscope, caoutchouc is seen to consist of a clear liquid, in which float a large number of spherical globules of from $\frac{1}{30000}$ to $\frac{1}{50000}$ of an inch in diameter. Water produces no change on the juice, and can be used to wash it without diminishing its volume. Alcohol does not change the globules, but causes groups of needle-shaped crystals to appear. The juice is dried by the natives of South America over a fire, when it becomes black with the smoke. It is dried on moulds of clay, in the shape of boots or bottles, on wooden lasts (imported for the purpose from the United States, and mounted on the end of sticks), and on paddles. The moulds, or paddles, are dippped into the juice and dried, and dipped again and again, until the

Appearance under the microscope.

Process of collecting it.

required thickness is obtained. The clay mould is broken or washed out after use. Sometimes the gum is coagulated by solar heat. A film forms over the surface, which is removed as fast as it forms, until the whole of the juice has hardened. The several sheets are then pressed together with the hands into rolls and masses. The gum is then light colored. In Nicaragua the caoutchouc is coagulated with the juice of the bejuca-vine. The mass is pressed into cakes by hand, and rolled into a sheet with a wooden roller. The sheets are called "tortillas," and are two feet wide by two inches thick. When once coagulated, the caoutchouc can never be restored to its original condition of a sap. The purest rubber of commerce comes from Pará and Amazonas. It is in bottles and thick plates. The gum from Carthagena is in large black lumps or sheets weighing a hundred pounds. The East-India gum is in light and dark reddish masses, and is mingled with bits of wood and bark, leaves, gravel, &c.

First use of India-rubber in United States.

India-rubber was first brought to the attention of the people of the United States in the form of erasers of pencil-marks (brought from England), and soon afterward in the form of clumsy water-proof shoes, which the traders imported from Pará along with the other produce of that tropical region. These shoes continued to be imported down to within thirty years ago. The substance did not fail to attract attention. A great many experiments were made to determine what could be done with it. Shortly after Mackintosh got started in Scotland, some water-proofing of cloth was done here with rubber, the solvents used being turpentine, naphtha, benzole, and caoutchoucine; the latter being produced by evaporating rubber at a heat of 600°, and condensing the vapor. Means were also found to work rubber into a thread; in which form it was spun into tissues of extraordinary elasticity with silk, cotton, wool, and flax, and became rapidly the universal material for suspenders, garters, &c. In those early years of the manufacture, however, only pure rubber was used; and in this form the material was found liable to rapid deterioration. It became rigid and inflexible in cold weather, and soft and inert in hot weather. It was very soluble. Whenever it was touched by oil or grease it would dissolve, and it could not even resist perspiration. Though useful for overshoes, it was so soft as to soon wear out. It lost its elasticity by use, had an unpleasant odor, and was so adhesive, that two surfaces of rubber applied to each other were always sure to stick. Time would fail to tell the tribulations which befell the early manufacturers of India-rubber in the United States in their efforts to cure the defects of this valuable but then intractable material. They could not master the substance. The public at length acquired a distaste for its use; and several factories which had been started in Boston, South Boston, Chelsea, Woburn, and Framingham, Mass., and on Staten Island and at Troy, N.Y., with capitals of fifty thousand dollars to five hundred thousand dollars, failed in the business. In 1840 it looked decidedly as though the applications of India-rubber were destined to be confined to water-proof cloth and erasers. The exportation of the gum from Pará at that time amounted to only 800,000 pounds a year, owing to the small demand for it; and nearly all of that went to Great Britain. It has since risen to about 15,000,000 pounds annually from Pará alone.

Just at the moment of supreme despair in the industry, two Americans hit upon separate though kindred discoveries, which completely changed the whole aspect of affairs, and made the manufacture of India-rubber one of the great pursuits of the age. In 1838 Charles Goodyear of Massachusetts became acquainted with Nathaniel Hayward, who had been the foreman of the Eagle Company at Woburn, where the latter had made use of sulphur by impregnating the solvent with it. From him Mr. Goodyear first became acquainted with the properties of sulphur as a drier of gum-elastic. Goodyear bought Hayward's claim for the use of sulphur, and made it the basis of his patent of Feb. 24, 1839, by which he hoped to make the manufacture of rubber-goods successful. He made a lot of goods with sulphur, but found, alas! that they, too, soon decomposed, just as all the manufactures of rubber had done before them. Goodyear, who had spent nearly twenty years in a diligent study of the properties of rubber, was at his wits' end to know what to do. But he did not give up the battle. While experimenting one day, the idea occurred to him to try the effect of extreme heat upon India-rubber. The stuff would melt at a low heat: what would it do at a high heat? He touched a piece of it containing sulphur to the stove. To his surprise, he found that it charred like leather. This was something new. He tried it again, with the same result; and the inference came like a flash, that, if the heat was stopped at the right point, the rubber might be divested of its adhesive qualities, and liability to rapid deterioration, and made hard and dry. He put some rubber into boiling sulphur, and found that it did not melt, as it would have done when exposed to a low heat, but that it again charred like leather. On heating another piece before the fire, he found, between the part which charred and the part unaffected by the fire, a portion which was hard, but not charred. The discovery was complete. It only remained to perfect a few details; and Goodyear soon introduced to the public his elastic, non-adhesive, vulcanized India-rubber, — a substance as different from the pure gum as gold from copper. This was the foundation of the modern industry. In his subsequent manufacture Goodyear soon learned to incorporate a variety of substances with his raw material in order to save the latter as much as possible; and, as now made, his rubber is prepared with one part of sulphur, fourteen of whiting, two and a half of white-lead, and two of litharge, to sixteen of rubber, and exposed to a temperature from 265° to 270° Fahrenheit for several hours.

Goodyear and Hayward.

The next step in the line of progress was the invention of hard rubber, or vulcanite. There is some dispute about priority in this discovery; but Professor

C. F. Chandler awards the palm to Austin G. Day of Connecticut. The discovery is claimed by Nelson Goodyear, who filed a *caveat* Dec. 31, 1849, and obtained a patent May 6, 1851, for a hard, inflexible compound composed of rubber, sulphur, magnesia, &c. The material obtained by this process was useful for certain purposes; but it was too brittle to be of great value. Day obtained his patent, Aug. 10, 1858, for a compound composed of two parts of rubber to one of sulphur, which, when heated from 275° to 300° Fahrenheit, became hard, flexible, and elastic. This product superseded the other, and is the vulcanite of commerce. It came into rapid and extensive use, and is one of the valuable materials of the modern arts. Day afterwards invented a modification of vulcanite, which he called "kesite," and applied it to the coating of telegraph-wires.

Invention of vulcanite.

These discoveries made a great change in the India-rubber manufacture of the United States. It having become apparent that there was now some hope for the industry, Congress took cognizance of it in 1842 for the first time, and gave it the protection of a thirty-per-cent duty on importations of manufactures in the comprehensive Clay tariff. A number of companies were soon formed under Goodyear's patents in Connecticut, New York, New Jersey, and elsewhere. The progress was very rapid, and in 1850 rubber-goods were made in the United States to the value of $3,024,335. In 1860 the manufacture had become centred in fewer and larger establishments, and the product was $5,642,700. In 1870 there were fifty-six factories in operation, employing 6,025 people, and making $14,566,374 worth of goods annually. Of the fifty-six factories, ten were in New York, twelve in New Jersey, thirteen in Connecticut, and sixteen in Massachusetts. Since that time there has been a large increase. The extent of it cannot be accurately stated; but it is somewhere about fifty per cent. The import of gum, mostly from South America, is now from 10,000,000 to 12,000,000 pounds a year. The ability of the United States to import and manufacture the crude article seems limited only by the capacity of the natives of the Amazon to collect and export it. The crude gum costs us at this time forty cents a pound. During the first twenty years after Goodyear's discovery the export of rubber-goods from the United States was considerable, amounting to $1,000,000 worth a year on the average. Since 1860 Europe has gone into the manufacture very largely upon Goodyear's plan, and the exportations since then have only been $200,000 or $300,000 worth a year. If the exports are ever increased again, it will only be by means of superior and cheaper processes of manufacture and new inventions.

Effect of these discoveries.

The processes of manufacture are peculiar. The gum in its crude state is extraordinarily elastic and tenacious; and it can only be worked, therefore, with the most powerful machinery. The cakes and sheets are first cleaned by being cut up in a mill into small pieces, under water, by means of knives and iron teeth. The resistance of the rubber generates heat enough to make the water boil. It is then again ground, cut, pressed, and treated in various ways, and finally compressed into a cake by being subjected to enormous pressure in cast-iron moulds under a screw. Its adhesiveness asserts itself, and unites the mass perfectly. It is left in the mould for several days. In some mills the cleaned pieces of gum are rolled by machinery into sheets, in which shape the gum is conveniently adapted for conversion into thread for weaving. The sheets are sliced into thread by means of sharp knives, which are kept constantly wet to prevent them from sticking. The machine for this purpose was invented in Europe by Ratlier in 1826. The fibres of thread, as they are reeled off, are stretched to six or eight times their original length by hand. Being moistened and cooled in the operation, they are deprived of elasticity, and can then be woven readily into webs and tissues of any degree of fineness. This stretching of the rubber-threads has been carried so far, that they have been elongated to 16.625 times their original length. A pound of caoutchouc makes from eight thousand to thirty-two thousand yards of thread. When the woven tissue is finished it is pressed with a hot iron, and the rubber immediately regains its elasticity. Threads are sometimes made from vulcanized rubber. They constitute the warp of the tissue, and are kept stretched by weights. Sometimes thread is made by reducing the gum to a paste by maceration with some solvent, and by forcing it through a line of small holes. The threads are carried off through the air six hundred or seven hundred feet by a web, during which process the solvent evaporates, and the thread becomes dry and hard. The threads are then deposited in a receiving-cup.

Process of manufacture.

The thick sheets into which the gum is rolled after the process of cleansing are usually laid away in the warehouse for several months to come. Being then brought back to the factory, the rubber is mixed with various materials which the manufacturers find they can advantageously incorporate into it. The mixing-machines are very powerful. They are great hollow revolving cylinders heated by steam. The sheets are rolled slowly between them, and, as they soften with the heat, are supplied with the white-lead, sulphur, and other materials, by means of a brush. The cylinders knead these substances together, the rubber giving out a series of pistol-shot explosions meanwhile, owing to the bursting-out of the heated air confined in the sheets. Pieces of refuse rubber or of fabrics of rubber and cloth can be kneaded into the mass during this process. The rubber comes from this machine in a thick, soft, sticky sheet. It then goes to the calendering-machine, where the process is substantially repeated, and the sheet rolled out into a thin mat. The mixture can then be incorporated into cloth or canvas by rolling, or by the aid of solvents. In the manufacture of belting, cotton-duck of double strength is impregnated with the soft, sticky rubber fresh from the mixing-rolls, and is then calendered into perfectly smooth sheets. The cloth is then taken to the belting-room, where it is laid out on tables, and cut into strips of the proper widths. If extra strength is desired, two or more strips are placed together, and united by rolling. The belting is then sent to be steamed in a chamber made for the purpose, and in eight or ten hours is thoroughly vulcanized. Belting thus made has greater strength than leather, and adheres to the drum with a tenacity which prevents slipping. In the making of hose a different process is employed. A long iron tube of the right diameter is covered with a sheet of rubber: this is then covered with webs of stout cloth woven for the purpose. When a sufficient number of folds have been applied, an outside covering of pure rubber is put on, cementing the whole fabric. The pipes, with the hose still on them, are then placed in the steam-heater, and the hose is vulcanized. Very stout hose is thus made: it is far superior to leather, and will stand a pressure from three hundred and seventy-five pounds to four hundred and thirty-five pounds to the square inch. The cloth can be preserved from the re-action of the rubber by means of carbolic acid.

Overshoes, how made.

In the making of overshoes the cloth is first prepared by mixing, rolling, and calendering, and is then cut up and fashioned into shoes of the desired patterns. The joints are united by means of rubber; and the sticky shoe, being lined with flannel, stamped, and otherwise finished, is then sent off to be vulcanized. The manufacture of shoes and boots is one of the largest branches of the business.

Application of India-rubber to valves of steam-engines.

One of the useful applications is for the valves of steam-engines and for steam-packing. Rubber preserves its elasticity when exposed to steam, and consequently follows the expansion and contraction of the cylinder and metal parts of the engine perfectly; so that the fitting is always exact. Valves of five feet in diameter are often made from rubber. Car-springs, and springs for coaches and carriages, are now made of rubber very largely indeed. The substance never loses its elasticity (thanks to Goodyear), and the springs last a long time. It answers also for door-mats, for paving, and for bed-springs.

Supremacy of rubber over bone, shell, &c.

Gutta-percha.

The hardened rubber, or vulcanite, is fast supplanting bone, shell, and ivory for its greater beauty, and the ease with which it can be moulded into any form. Its only rival is gutta-percha, a kindred product of the creamy sap of another tropical tree. This latter substance was discovered in 1842, and it is now largely imported from South America and other tropical regions for the same uses to which vulcanite is applied. It is very serviceable for speaking-tubes, fancy articles, dentists' tools, &c., and for the insulation of telegraph-wire. Gutta-percha was first applied to the purposes of insulation by Samuel J. Armstong of New York. Machinery was built to coat wires with it in 1848; and the first wire in the world thus prepared was laid across the Hudson River in 1849, at Fort Lee. The idea was carried to England, and used in the construction of the Atlantic cables. It is said that this original machinery was also carried over then. Gutta-percha and vulcanite are both prepared by the same process for use in the arts.

There has been a vast amount of litigation among the inventors and manufacturers of India-rubber and gutta-percha. An invention which clearly works for the good of mankind is eagerly seized upon by those who have capital, as likely to be the source of great fortunes to those who employ it in the manufacture. Those who have experimented in a certain direction, and invested their all in mills, machinery, and goods, are strongly tempted to the piracy of inventions when they observe a more fortunate contemporary hit upon a better way than that they have themselves followed; and the consequence of it all is, that a lucky inventor often finds himself obliged to fight long and hard to maintain his right to profit by the property created by the activity and ingenuity of his own brain. Goodyear was one of these men. The litigation in which he became involved was enormous. It is gratifying to record the fact that the inventor of this priceless product of vulcanized rubber was able to maintain his rights, and to profit by them; and that is more than can be said of all inventors.

Litigation over India-rubber inventions.

CHAPTER XI.

CHEMICAL MANUFACTURES.

Application of chemistry to manufactures.

THE mechanical department of manufacture is the one which alone catches the attention of the untechnical observer. To his eye ninety nine hundredths of all the processes of industry appear to be the mechanical manipulation of raw materials, and the application of heat and force to effect changes of form and condition. But furnaces and machinery do not cover the ground so exclusively as that. Chemistry plays a more important part in industry than appears upon the surface of things. It is, in fact, the very atmosphere of life in which industry breathes and exists: it is at least the twin-brother of machinery. Not a metal in the bowels of the earth, not a mineral (except common clay), not a textile fibre, and scarce a vegetable or animal substance, which is fabricated for any human purpose, reaches its final state of a perfected product without having been subjected to one or more chemical processes which are absolutely necessary for its manufacture. Every metal must be prepared for working up by being first refined. Cotton, wool, silk, flax, and hemp must be bleached, fermented, purified, or stained, or subjected to all four processes. Leather, rubber, soap, and various kinds of food, must be deprived of the liability to decay. Wooden buildings, ships, carriages, and cars must be protected from the corrosion of the elements. Salt and sugar must be purified. Sand and clay are required to be converted into durable and serviceable dishes. None of these things can be accomplished by mechanical means alone. Chemistry is called in to participate in the achievement of them all; and crude and barbaric indeed would the triumphs of man over the forces of nature still be, were it not for the help of this powerful art to second his efforts. It has been well said that to take away chemistry from industry would be like taking away gravitation from the universe. The result would be chaos.

The manufacture of chemicals in the United States began as early as 1793, when John Harrison started his factory of sulphuric acid and lead-paint in the city of Philadelphia. It was carried on, however, to a very limited extent indeed, for more than sixty years. The genius of our civilization was not favorable to the patient study, and quiet, persistent experiment in the laboratory, which are required of those who engage in this department of effort. The taste of Americans was for mechanical invention, and for the bustle and excitement of active pursuits. Neither science nor literature could flourish in a marked degree among a people with such propensities; and accordingly, during the last and for the first half of the present century, the chemical industry made slow progress. Lead and zinc paints, sulphuric and nitric acids, dyes and saleratus, the most ordinary and necessary of chemical materials, were made here and there in Eastern cities on a small scale; and they comprised about all the manufactures of this class which were produced. Congress endeavored at times to encourage the industry by imposing a duty on manufactured chemicals, and by providing that the raw materials — sulphur, nitrate of soda, dye-woods, crude saltpetre, argols, &c. — should be admitted free. The professors in charge of the scientific departments at Yale, Harvard, Columbia, Hamilton, and other Eastern colleges, did something towards turning attention to the matter also by their researches in regard to the minerals, alkalies, and salts of the different portions of the territory of the United States. It has only been within the last thirty years, however, that the manufacture of chemicals can be said to have attained any eminence whatever in the United States; and probably one-half, if not more, of the establishments now in existence, or at least of the branches of the industry now pursued, are the creation of the tariff of 1861.

Manufacture of sulphuric acid by John Harrison.

Progress within thirty years.

Industrial chemistry has had its largest development in France and England, where general manufacturing has also attained its largest growth; and Germany has also made marvellous strides in this field of progress. In France alone the annual production of chemicals has now reached the great value of $250,000,000. By the side of this giant development the chemical manufacture of the United States seems mere boy's play, amounting, as it did in 1870, only to $19,417,000 of chemicals, dyes, and drugs, and $5,800,000 of fertilizers. Nevertheless, the progress of the last twenty years in the United States has been striking. The manufacturers have ventured to undertake something besides the staple products of sulphuric acid, soda, vegetable dies, and medicines; and they have, within the period named, entered upon the production of a large variety of the rarer chemicals, and have evidently planted the foundations of a great industry. In 1870 there were 301 chemical factories in the United States, concentrated chiefly in the vicinity of the large Eastern cities, and 125 factories of fertilizers, these latter being largely in the Southern States.

Development of industrial chemistry in France and England.

A large part of the raw materials consumed by the American chemical factories is imported from Europe and South America, although it is a fact that they might be obtained from our own soil. There are enormous supplies of alkalies, for instance, on the plains and in the mountains of the Far West, and all the materials that a chemist could wish for the production of sulphuric acid (that most necessary and extensively made of chemicals) in the valley of the Mississippi. Salt and lime exist in the United States in unparalleled abundance; sour oranges go to waste in Florida every year by the thousands of bushels: yet the crude chemicals which are obtained from these things, and large quantities of the manufactured, as well as a great quantity of these very raw materials besides, are imported yearly from abroad. The extent to which this importation has grown may be seen by the statistics of the fiscal year ending June 30, 1877. The imports were as follows:—

Importation of raw materials.

Argols, lbs.	9,025,542
Medicinal barks, lbs.	1,976,016
Camphor (crude), lbs.	1,022,565
Chloride of lime, or bleaching-powder, lbs.	47,642,133
Cochineal, lbs.	1,324,165
Cutch and terra-japonica, lbs.	22,992,973
Dye-woods, cwt.	1,195,079
Gums, lbs.	9,873,515
Indigo, lbs.	1,504,783
Madder, lbs.	3,178,988
Sulphur (crude), tons	43,443
" (refined), cwt.	29,039
Salt, lbs.	901,209,894
Nitrate of potash (saltpetre), lbs.	13,846,670
Soda, nitrate of, lbs.	54,208,334
" bicarbonate, lbs.	4,298,906
" carbonate, lbs.	217,360,808
" caustic, lbs.	36,000,895
" other salts of, lbs.	507,381
Chemicals, dyes, drugs, and medicines, n. e. s., dols.	8,816,804

In all, our purchases amounted to about $25,000,000 worth of drugs, dyes, and chemicals; and yet $20,000,000 could have been produced from the materials which exist in unlimited abundance in our own soil. This fact points to the possibilities of the increase of the industry in the United States, when the manner of extracting the acids, alkalies, and salts of commerce, from American minerals, is better understood.

Sulphuric acid.

The most important of the products of the chemical factories is sulphuric acid. It is one of the oldest known of acids, having been in use among the proto-chemists of ancient Arabia. Professor Chandler calls it one of the pillars of science, on account of the number and the value of the uses to which it is now applied. It is used to convert common salt into soda, and hence lies at the foundation of the glass and soap industries. It is the necessary agent by means of which nitric and hydrochloric acids are obtained, the two solvents upon which the refining of gold and silver, and electro-plating and photography, depend. It is employed in the production of alum, ammonia, nearly all the vegetable acids and alkaloids, the aniline colors, ultramarine, the chrome compounds, bleaching-powder, chloroform, ether, phosphorus, and fertilizers, and is a constant resource of the laboratory; and hence is truly the pillar of a thousand great industries and occupations. This substance was anciently made by distilling iron sulphate. In 1720 Dr. Roebuck of England suggested that it could be made by burning sulphur, either in the form of pure brimstone, or as metallic pyrites. The manufacture has ever since been conducted upon the plan thus suggested. In the United States brimstone is used. The sulphur is burned in a draught of air, which carries the fumes into a large chamber completely lined with lead, where they are precipitated by a peculiar process in the form of acid. The acid enters the chamber in the form of sulphurous oxide gas: it is there mixed with steam and nitrous fumes evolved from saltpetre with sulphuric acid. The oxygen of the nitrous fumes combines with the sulphurous oxide to make sulphuric acid; while the nitrous oxide gas left in the air absorbs oxygen afresh from the atmosphere, and transmits it again to the sulphurous oxide in a process of unbroken continuity. A limited quantity of the nitrous fumes is sufficient to keep up a constant precipitation of oil of vitroil upon the leaden sides and bottom of the chamber. The acid, being diluted with water from the steam present in the air, must now be condensed. This is done by boiling in lead pans. When the acid becomes sufficiently concentrated to attack the lead, it is transferred to platinum stills, and there given a final condensation. In England the more common raw material is the pyrites of iron or copper. It seems, that, in 1838, the King of Naples gave a monopoly of the sulphur-trade to Taix & Company of Marseilles, as a result of which sulphur rose in London from twenty-five dollars to seventy dollars a ton. The Englishmen immediately patented fifteen different processes for making sulphuric acid from pyrites within a year afterward, and have ever since largely employed the material. They make over a hundred thousand tons of vitriol a year. The only drawback of the acid obtained in England from pyrites is, that it contains arsenic, and is consequently unfit for fertilizers, the making of which is one of its most extensive applications. In the United States the utilization of the mineral sulphides has made little or no headway. Professor Chandler has, however, called attention to the fact that a marked feature of the quality of the American sulphides is the absence of arsenic; and he has declared for many years, that the highly sulphurous coal-seams of the valley of the Upper Monongahela, in West Virginia, alone would supply the whole Mississippi Valley with sulphuric acid for agricultural purposes for centuries to come. Professor Sterry Hunt has also urged the utilization of the enormous beds of pyrites in the Carolinas and East Tennessee, which are useless for any other purpose. The suggestions of these eminent gentlemen will no doubt yet be heeded. The mechanical power of sulphuric acid as a solvent and re-agent is something enormous, and is the

Dr. Roebuck.

cause of its great value. It has a great appetite for water, absorbing it rapidly from the air; and an illustration of its power can be given by remarking that the acid causes the water which is poured into it to shrink in volume from 18 to 11.4. When one reflects upon the tremendous mechanical force which it would require to compress water to that extent, the power of sulphuric acid will be understood.

Nitric and muriatic acids.

Nitric and muriatic or hydrochloric acids are made with the aid of the sulphuric. The former is made by distilling saltpetre with sulphuric acid. The salt used is now, however, more generally nitrate of soda from South America, as being cheaper, and richer in nitre. This salt comes chiefly from the province of Tarapaca in Peru, where it exists in a natural state in beds which cover hundreds of square miles of ground. It is by some misnomer popularly called "Chilian saltpetre." Hydrochloric acid is made by treating common salt (chloride of sodium) with sulphuric acid. The chloride of hydrogen which passes off is conducted into water, where it is eagerly absorbed. The water takes up 460 times its own volume of the gas, and increases one-third in bulk, and seventy-five per cent in weight, in the operation. Some very large factories of these acids have been established in Philadelphia; that city being, by the way, the principal chemical centre of the country, manufacturing nearly half of the dyes, drugs, acids, salts, and medicines produced in the United States.

Salts of soda.

The different manufactures of salts of soda are very numerous, but not so extensive as the industrial development of the United States demands. Nearly all the carbonate of soda, for instance, — a material used in glass-making, in the production of caustic soda for soap-making, and for other purposes, — comes from England. It is easily made from common salt by converting the latter into a sulphate with sulphuric acid, and then treating it in a furnace with charcoal and carbonate of lime, which produces carbonate of soda mixed with sulphide of calcium, the former being then separated from the ash by leaching with hot water. All the materials exist in unlimited abundance in this country for the extensive manufacture of carbonate of soda; but the American chemists appear to have been afraid to compete with the cheap labor and large capital of England in any considerable production of it. Caustic soda is now largely made at Philadelphia and elsewhere, although the importation is still very large. It is prepared from three parts of the crystallized carbonate of soda, dissolved in water, and one part of quick-lime, slaked, and mixed with water to the consistency of cream. The caustic solution is then decanted, and boiled down rapidly, melted, cast into sticks, and preserved in bottles. The purest caustic soda is dissolved from the residue obtained by boiling down with alcohol, the latter being then driven off by heat. Soda for baking-powder is also largely made at the American factories. One concern in California has been making it since 1875, in San Francisco, from native salts obtained at the warm springs in Churchill County, Nevada. This factory is the pioneer in the attempt to use the alkaline treasures of the Far West; and it is making such progress in the production of carbonate, bicarbonate, and other salts of soda, that probably, in a few years, it will begin to supply the eastern part of the republic with its goods. Soda is now made to a limited extent in Philadelphia from cryolite, — a mineral found in Greenland, containing sodium, aluminum, and fluorine.

One of the new manufactures is that of citric acid, — a chemical used by the silk-dyers to heighten the colors of cochineal and safflower, and by the calico-printers to discharge mordants from the cloth. The industry began in Philadelphia in 1874. At present the crude material is obtained from abroad, mainly from Sicily. It consists of the juice of limes, lemons, and sour oranges. The sour oranges of Florida will, in the future, be utilized in this manufacture; but they do not yet enter into it largely. The acid is obtained by fermenting the sour juice. Chalk is added, and citrate of lime precipitated. This is treated with sulphuric acid, which forms sulphate of lime, leaving the acid in solution.

Importation of argols.

One of the large features of the imports of crude materials is called argols. This substance is not yet produced in the United States to any extent. It is the salt deposited in crystalline crusts on the sides and bottoms of wine-barrels. Being less soluble in alcohol than in water, it leaves the wine as the proportion of alcohol increases. Chemically this deposit consists of potassic bitartrate, with a small intermixture of calcic tartrate and of coloring and mucilaginous matters. Commercially it is of the highest importance. The lees of the wine are dissolved in hot water, and clarified by means of clay, and then recrystallized. The process is repeated; and the result is a white crystalline substance called cream of tartar, which is sold with bicarbonate of soda for bread-making. The high cost of the article has led dealers to practise the most shameful adulteration of cream of tartar; and half of that found in the market contains flour, gypsum, &c., exceeding two-thirds of its bulk. From argols are also made Rochelle salts, tartaric acid, and salt of tartar. The wine-producing regions of the United States promise in the future to be the means of creating a partial supply of argols at home.

Aniline colors.

Among the very recent branches of chemical manufacture in the United States is that of the aniline colors. The discovery of these intense and brilliant dyes has completely revolutionized the art of dyeing and printing textile fabrics within the short space of twenty years: it has increased the resources of the dyer immensely, and has made the processes of dyeing more complicated and elaborate. Aniline, so called from *anil*, indigo, was discovered in 1826 by a German chemist by the name of Unverdorben, who got it by distilling indigo. It crystallized readily; and he called it, accordingly, crystalline. It attracted much attention in laboratories. A great deal of study was given to it, and the range of chemical knowledge greatly increased in the course of the researches of those interested in it. No commercial importance was attached to it until 1856, when W. H. Perkin produced from it the beautiful purple dye called mauve. That set dyers and chemists in a flame, and the whole series of remarkable tints which aniline is capable of producing were soon discovered. The presence of the article itself was also soon detected in other things than indigo. Aniline, like many other chemical

Manufacture and use.

products of value, is obtained commercially from refuse or worthless substances. It is among the products of distillation of coal-tar, peat, bones, &c. It is usually made for the trade from benzole, one of the elements of coal-tar, the process being as follows: Benzole is treated with nitric acid to form nitro-benzole, and this is changed by the action of ferrous acetate (made from iron-filings and acetic acid) into a compound from which impure aniline is obtained by distillation. A second distillation, with a slight excess of lime or soda, gives crude aniline. The product is a colorless, mobile, oily, and very poisonous liquid, boiling at 182°, and possessing an aromatic, burning taste.

Rosaniline.

For the trade it is generally converted into what is called rosaniline, which is itself a dye, and from which nearly all the other dyes can be made. One part of aniline oil is treated with one and a half parts of a seventy-five-per-cent arsenic acid in a closed iron still. The product is boiled with water, and filtered. Upon adding common salt in excess, crude hydrochlorate of rosaniline is precipitated. This is dissolved in boiling water, filtered, and allowed to crystallize; and the salt thus obtained is called rosaniline. The dye is also prepared in other ways, by treatment and distillation. It varies in color from a beautiful cherry-red to a rich crimson. Rosanaline is known by the names of aniline-red, magenta, solferino, fuchsine, roseine, azaleine, &c.: it is soluble in water and alcohol. A great deal of the aniline in the general market appears there first in the form of this salt. In the United States, although coal-tar is distilled here, and benzole is one of the regular articles of export, all the crude aniline used is imported: the article comes principally from Germany, where it is most largely manufactured. Rosaniline contains three atoms of replaceable hydrogen. By treating it with iodide of methyl, ethyl, amyle, and other radicals of alcohol, and recovering the iodine by boiling in caustic potash, salts are precipitated, ranging in color from red, violet, and purple to the purest blue, according to the amount of hydrogen which has been replaced. Grays, browns, maroons, blacks, greens, and yellows, all of the rarest beauty and greatest intensity, are obtained by different processes. The manufacture of these colors is carried on principally at Philadelphia, though they are often prepared in the laboratories of the textile factories themselves. Many of them are very easily prepared.

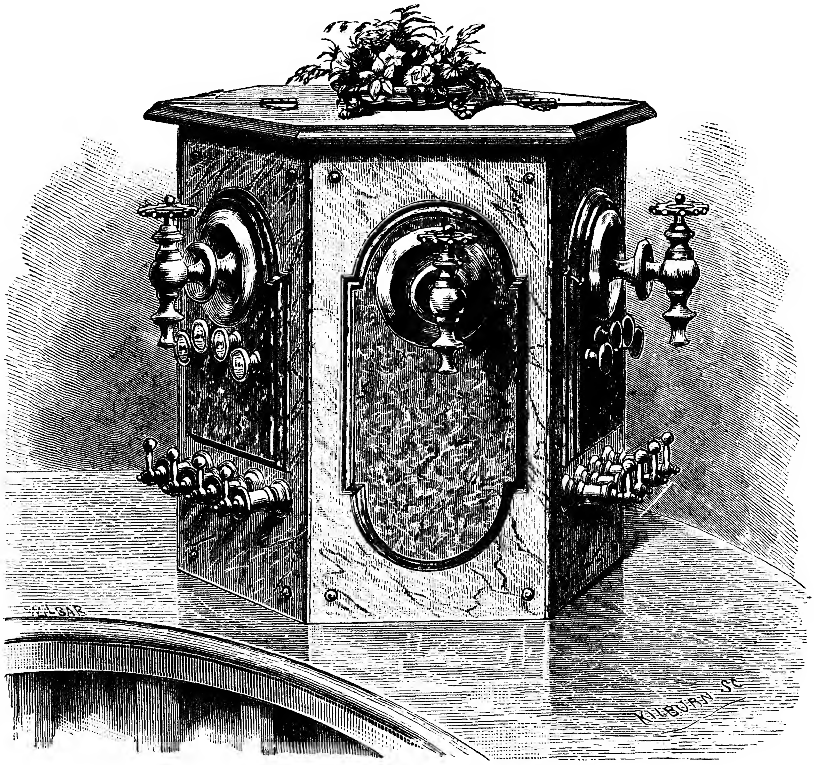
Space forbids the enumeration of all the products of the American laboratories; but a few substances may be referred to as showing what jewels

Glycerine.

modern science finds in unattractive quarters, and how the refuse of our cities is made to contribute to the welfare of the people. One of the very large products of Cincinnati and Philadelphia is glycerine.

This article is obtained from the refuse of candle-factories. Another is ammonia, extracted from the gas-liquor of the gas-works. Still another is bromide of potash, which is gathered from the refuse of salt-works. It has already been related how cream of tartar is made from the lees of wine. This invaluable substance is also largely produced from beef-bones, which a few years ago were thrown away as useless.

Chloride of lime, though in immense request in the cotton and linen factories and other textile establishments of the country, is made in the United



TUFT'S SODA-WATER FOUNTAIN.

States to a smaller extent than the magnitude of the consumption of the article would seem to require. It is easily prepared. Chlorine gas is first produced by means of the re-action of hydrochloric acid on binoxide of manganese, — a mineral abundantly supplied in all parts of the world, and always eagerly sought after. In some factories the gas is obtained by the re-action of sulphuric acid on common salt and binoxide of manganese. By whatever process it is made, it is stored away in

Chloride of lime.

slaked lime by the simple means of bringing the two substances together in a closed chamber. The lime is spread about seven inches deep on the floor, and the gas forced in. It is slowly absorbed by the lime, the process consuming about four days.

Manufacture of soda-water.

One of the most prominent chemical manufactures in this country is soda-water, so called, and its kindred beverages, — pop-beer and artificial mineral-water. The first-named is nothing more than pure water impregnated with carbonic-acid gas. When lemon, ginger, sarsaparilla, or other flavoring-extracts, are added, and it is sold in bottles, it is known as pop-beer; and when, instead of such sirups, certain mineral-salts are added to the carbonic-acid water, corresponding to the analysis of certain natural mineral-waters, they are sold for consumption by the bottle, or for distribution by the "fountain." The idea of making such preparations, especially the last-named class, originated in Germany and Sweden. Experiments began as early as the sixteenth century; but the foundation-principles were not discovered for a long time: indeed, it is only within sixty years that the art has been brought to perfection. In 1810–20 Berzelius founded in Stockholm, and Struve in Dresden, artificial spas. Faraday and Liebig pronounced the latter's imitations of mineral-waters perfect, and equally wholesome with the original. The apparatus for the manufacture consists of a large copper generator, in which the gas is evolved by a mixture of sulphuric acid and carbonate of lime, certain pipes and reservoirs for purifying it, a receptacle in which the gas is mingled with water (fresh, flavored, or impregnated with mineral-salts, as the case may be), and a device for filling bottles or larger receivers for "fountains." Valuable improvements have been made by Mr. John Matthews of New York to the process. One consists of a safety-valve to the generator to prevent explosions, and another is the practice of lining the fountains and connections with block-tin to prevent corrosion and poisoning. There are no less than ten thousand of his fountains in use in this country, and both of his devices have come into extensive use in Europe.

CHAPTER XII.

WOOD AND OTHER MANUFACTURES.

IT is now proposed to consider a variety of industries which have grown up in the United States, which are devoted to the manufacture of the vegetable products of the soil and of the minerals. Some of these, which could not be well treated with brevity, have been discussed in special chapters. In the majority of cases, these industries, though now severally employing millions of capital and supporting hundreds of thousands of people, are capable of being treated concisely; and they are, therefore, grouped as miscellaneous manufactures in the present chapter. Some of these are of very ancient date, taking their origin as far back almost as the settlement of the country: some are of very recent date, many having come into existence within the last forty years. Whether old or young, they are all profitable to the country, and form an essential part of its strength and wealth. The United States have not always manufactured a very considerable part of the raw products of her soil and fields, — not even a very large share of that portion of those products consumed in manufactured form by her own people. In the early ages of the country nearly all the raw materials — the hides, the grain, the bark, the tobacco, the cotton, and the metals — were sent abroad, and the things made out of them were brought back again from the lands to which the original products were sent. Old Beverly, in 1705, impatiently remarked of the colonists (a hundred years after the first settlement, be it noted), "Nay, they are such abominable ill husbands, that though their country be overrun with wood, yet they have all their wooden-ware from England, — their cabinets, chairs, tables, stools, chests, boxes, cart-wheels, and all other things, even so much as their bowls and birchen brooms, — to the eternal reproach of their laziness." It was not to be expected, however, that so free and active-minded a people as the Americans, living in such an invigorating climate, would long continue to send their raw products abroad to be manufactured, after they had freed themselves from that great obstacle to industry, a tyrannical government, and after they had so fairly subjugated the soil as to have an abundance of food; and accordingly we find that they

General sketch.

began to manufacture their raw products largely for themselves after their independence, and "the eternal reproach" was quickly wiped out. It has already been related what the Americans have done in manufacturing their crude metals. The history of manufacturing the more important vegetable and mineral products of the United States has been nearly completed. A few more pages, however, are needed to finish this portion of our work. While seeking to make this chapter as brief and at the same time as complete as possible, it is to be hoped that no important fact relating to the development of the industries herein considered has been omitted.

LUMBER.

The business of lumbering is one which the European settlers on this continent were obliged to begin before any other. Two necessities faced them when they landed, — the need of shelter from the weather, and cleared land whereon to cultivate food. Nearly the whole country was covered with vast and ancient forests: these yielded the material for houses and barns, but rendered the work of preparing the soil for tillage highly laborious. But there were energy, courage, and enthusiasm in the hardy Anglo-Saxon stock which occupied the country from Nova Scotia to Florida, and scarcely less in the Dutchmen and Swedes who broke the line of English settlements for a time from the Hudson to the Delaware River; so that the axe and saw were vigorously plied from the very first occupation of America. The early dwellings were of logs, imitated ever since by pioneers in new sections of the country; and the few boards and shingles used were hewn out with an admirable dexterity. Forts for defence against the hostile Indians, bridges across the streams along which the first settlements were planted, docks for the little shipping which afforded communication with the Old World, logs for corduroy roads over poor spots in the needed highways, and firewood for cooking and comfort, all called for further labor; and later — much later than should have been the case — there was some demand for material for cattle-pens and barns.

Lumbering among the colonists.

A rare and timely piece of good fortune for the American colonists was the invention of the saw-mill, which first made its appearance in this country in 1633, or shortly before, preceding the first establishment of it in the mother-country many years. Although the saw was known in Egypt in the time of Moses, yet a mill in which it was operated by machinery was scarcely known in Europe before the discovery of America. Germany had saw-mills in the fourth century; the Island of Madeira, in 1420; Norway, not till 1530; France, as early as 1555; and England, not until 1663. This last-named mill was torn down to gratify a hostile popular prejudice. Fears of like demonstration prevented the erection of another in 1700, and the populace destroyed one as late as 1767. Prior to the introduction of the

Saw-mill.

saw-mill, planks were hewed out or sawed by hand; which explains the prevalence of clay floors and the scarcity of plank floors in Europe in the olden time.

Saw-mills located on some eligible stream, and run by water-power, were erected at a very early date in the first colonies, and thereafter made their appearance in each new colony and settlement which afforded the motive-power: indeed, the location of many settlements was determined by the presence of a good mill-stream. The first saw-mill that is known to have been erected in New England was on Salmon-Falls River, near the present city of Portsmouth, N.H.; and it was built there soon after the land was granted in 1631 to Mason and Gorges, the great proprietaries of that region. It is known to have been in operation in 1635, and might have been up a year or two at that time. It is asserted that a saw-mill was in existence in Massachusetts as early as 1633; but no evidence of it exists, although one was proposed for the colony in a letter of instructions sent to Gov. Endicott in 1629. A patent for an improvement in saw-mills was granted Joseph Jenks of Lynn in 1648; but it is impossible to find any record of a saw-mill in Massachusetts before the one built in Scituate in 1656, and burned by the Indians in 1676. Another existed, near Duxbury, as early as 1664. Worcester had one in 1684; and Groton, in Middlesex, in 1686. Neither Vermont nor Rhode Island appears to have had any saw-mills before the Revolution. The younger Winthrop, afterwards governor of Connecticut, brought a millwright to New London, and put up a saw-mill in 1651. The superintendent, John Elderkin, was for thirty-five years the principal contractor for the building of meeting-houses, dwellings, bridges, &c., in Eastern Connecticut. Two more were built near Hartford in 1671 and 1680. Several more were constructed in the colony within the next few years. Saw-mills operated by wind instead of by water were erected by the Dutch on Manhattan Island as early as 1633. These were the first on this continent, but were very unprofitable, according to provincial documents. Others were soon built in the vicinity, however, and up the river, near Albany. The Catskill region, and several points on the east side of the Hudson, followed these examples. The French had saw-mills near Ticonderoga in the early part of the eighteenth century. West Jersey led the eastern side in the erection of saw-mills. The first one on the Delaware was put up in 1682. Amboy built her first ones in 1683. They rapidly multiplied in that colony, however. The Dutch and Swedes anticipated William Penn in this direction. Delaware had a saw-mill in 1658, another in 1662, and a third in 1678. Penn found saw-mills in Pennsylvania in 1683 already in operation. They were long scarce near Philadelphia, however; and not one was to be found in the adjacent county of Bucks as late as 1731. They multiplied in the interior, though, especially where the Germans settled. There is no record of Maryland's first saw-mill; but she had corn-mills run by water as early as 1639. Virginia made great

First saw-mill.

account of hewing clapboards and masts in her very earliest days. There was talk of saw-mills in 1620; but nothing was done toward their erection for full thirty years. The Carolinas and Georgia had magnificent pine-forests, which one would think would have early invited the lumberman; but, in pre-Revolutionary days, saw-mills were scarce in that region. As late as 1808 South Carolina had but sixty-five, and Georgia but one. Within the present century, though, the Carolinas and other Southern States have sent some fine lumber North. But there was a shocking waste in North Carolina after the value of the cotton-plant was realized. Splendid forests were burned down to clear the land, and the only use made of the squandered material was to manufacture a little potash out of the ashes. Turpentine and resin have, however, since been obtained in great quantities from that section, in addition to the lumber.

SAW-MILL ON THE CONEMAUGH.

From these beginnings the local lumbering-business developed all over the country. Mills were erected wherever the settlers located near good streams. New Hampshire and Maine went into the business more largely than some of the other colonies. But the saw-mill followed the pioneer wherever he went; and this remark holds true of the post-colonial as well as the colonial period of our history. As the Atlantic States filled up, and the Western States were occupied, the saw-mill was regarded the first essential of civilization. Thus we find the New-Englander who occupied Ohio building a saw-mill in 1789 on Wolf Creek, sixteen miles from Marietta. The fact that at Canton (Mass.) alone from a hundred and fifty to two hundred saw-mills were manufactured annually about 1790 is significant of the development of the lumber-business through this important instrumentality all over the country.

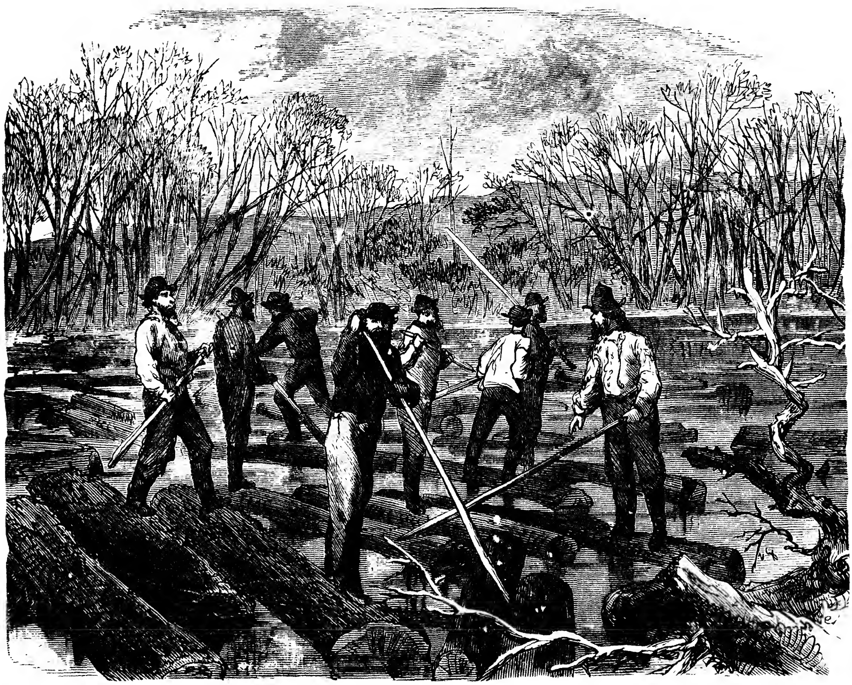
The abundance of pine-forests, the improved facilities afforded by saw-mills, and the natural hardihood and enterprise of the colonists, led many of them to embark in the lumber-trade, not simply for their own necessities, but for purposes of trade, domestic and foreign. Saw-mills were, to a great extent, run like grist-mills, the proprietor taking toll from his many patrons, and selling the stock thus accumulated, and even engaging in the cutting of trees, in order to keep his mill going, and enlarge his profits. The proprietary lumber-business thus had an early start: it began in New Hampshire and Maine, which, in the seventeenth century, both belonged to Massachusetts. Many mills were erected on the Piscataqua, Saco, Kennebec, and other rivers. Mason, Gorges, and the Pepperells, original proprietors in New Hampshire and Maine, engaged extensively in the business. There was a deal of ship-building done too, in those colonial days, at Kittery, and elsewhere along the coast; and lumber was largely consumed in this way. There was a large export of partially-manufactured lumber to the West Indies, and of masts and knees for shipping to England. New England carried on a large sugar-trade with the Indies, and was obliged to ship thither large quantities of staves and shooks for barrels. In the eighteenth century the Champlain district exported lumber extensively to Montreal and Quebec, and after the Revolution a large business sprang up in the western counties of New York. New Jersey became conspicuous for her lumber exports early in colonial days, and prohibited the carrying of any timber, planks, boards, oak-bolts, staves, heading, hoops, or even hop-poles, except in her own shipping. Huge rafts of lumber were floated down the Delaware to Philadelphia, and down the Susquehanna to Baltimore. Philadelphia exported 783,000 feet of lumber in 1765, and in 1731 a British publication mentioned the importations of £15,000 worth of lumber annually from Virginia and Maryland. The official value of the different kinds of lumber exported from all the colonies in 1770 was £154,637: this embraced boards, plank, scantling, timber for masts, spars, and buildings, staves, heading, hoops, and poles. In 1792 the exports of lumber were 65,846,024 feet, including 80,813,357 shingles, 1,080 cedar and oak ship-knees, and 191 house-frames.

Development of industry.

Within the present century, however, and especially within the past thirty years, the lumber-business has attained a development compared with which that of the pre-Revolutionary age was insignificant. The needs of the country have vastly increased, and the facilities for handling and manufacturing lumber have improved to a remarkable extent. Forty and fifty years ago we had a large ship-building industry, which has declined; and we are using iron rather more than wood in our modern bridges. But when it is remembered that our population has increased from three to forty-five millions, and that but one man in fifty has a house of brick or stone,

Lumbering during last half-century.

it can be seen, that, for building-purposes alone, our demand for lumber has multiplied exceedingly. Then, too, within forty years we have built thousands of miles of railroad and telegraph, requiring ties and poles all along the route. The timber thus employed is of an inferior sort; but the quantity is immense. Wooden pavements in our large cities also consume large quantities of this material. The invention of wood-working machinery and the development of various manufactures have necessarily increased the demand; while the application of the steam-engine to the saw, and the arrangement of saws in gangs



LOGGING.

so as to cut several planks from one log simultaneously, have enlarged the capacity of the mills wonderfully, and so increased the supply.

Centralization of industry.

If one will but compare the value of the lumber sawed and planed, and the number of establishments engaged in the business, in 1850, 1860, and 1870, he will discover that the increase in product is very remarkable, but that the increase in the number of mills is not proportionate: in other words, the business is becoming centralized. While there are a great many little local saw-mills all over the country, the main business is conducted by a few large ones, which cut fifty or a hundred times as much in one season as any mill of half a century ago. Thus in 1850 the product of

17,895 mills was $58,520,966; in 1860, that of 20,165 mills was $104,928,342, or nearly double that of ten years before; and, in 1870, that of 26,930 mills was $252,032,229, or more than double that of 1860. The increase since then has not been at quite the same rate; but it is very large.

Half a century ago the State of Maine was the great producer of surplus lumber for the rest of the country. At times the States of New York and Pennsylvania equalled her in product, and in 1860 considerably exceeded her. But while the Champlain region, the western part of New York, the Delaware, Chesapeake, Schuylkill, and Alleghany regions, were great producers, the population of those States was so large as to nearly or quite consume their home-supplies; Philadelphia even importing from the Bangor district. Maine was lightly populated, and exported to all New England, and even farther south on the Atlantic coast. By 1860 the Green-Bay region in Wisconsin, and the Saginaw district in Michigan, had assumed considerable prominence in the business; and they both eclipsed Maine during the next decade. Thus while Maine's product of sawed lumber, including laths, shingles, and staves, in that interval, only increased from $7,167,760 to $11,395,747, Wisconsin's rose from $4,616,430 to $15,130,719, and Michigan's from $7,303,404 to $31,946,396. New York's product had increased, meantime, from $10,597,595 to $21,238,228, and Pennsylvania's from $10,994,060 to $28,938,985; but except a good-sized export from New York to Canada, and a moderate one from Pennsylvania South, those two States did little more than provide for themselves. The Saginaw region continued to increase its product until 1873, when its climax appears to have been reached. The Green-Bay region has continued to increase its product. The same great belt of dense white-pine forest which starts in Maine, and runs through to the head of the Great Lakes, also crosses Minnesota; which State has, within the past eight or ten years, risen into great prominence as a lumber-producing State. The saw-mills about the Falls of St. Anthony are, perhaps, more numerous than in any other one locality in the United States. The principal lumber of Maine and the North-West is the white or soft pine, with considerable spruce and hemlock: the hard pine comes chiefly from North Carolina, Georgia, Florida, and Alabama. The Dismal Swamp in Virginia is also quite a producer of pine, spruce, and hemlock. Ohio and Michigan yield considerable black-walnut, cherry, ash, and white-oak, although these woods are also found elsewhere. Louisiana and Mississippi are also coming to be large lumber-producers. The Pacific coast and Rocky-Mountain region abounds in a sort of fir, or red-wood, which is very serviceable: this is the principal lumber of Oregon. The city of Chicago is now the greatest lumber-mart of the world, her supplies coming chiefly from the shores of Lake Michigan. It might be remarked in this connection, that Chicago and other lumber-markets now send to the pioneer, all prepared for use, much of the building-material needed by him. Indeed, to such a degree of perfection is this science

Maine.

Saginaw district.

carried, that thousands of ready-made houses are sold and shipped to their destinations every year; the timber being so cut and numbered, that a skilful carpenter, provided with the proper accompanying designs, can easily erect the proposed edifice in a very short space of time.

We have already spoken of the magnitude of the lumbering-business carried on by individuals and separate companies; yet it is not generally realized; nor is the exciting, laborious, and almost romantic experience of the lumbermen. Every fall the mill-owner or contractor arranges for a winter's campaign in the woods. If the land be his own, he provides equipments and supplies for the men himself; or, if the land be another's, he arranges with the proprietor to cut the wood for so much a thousand feet, or so much per tree. An eligible neighborhood, where there are plenty of trees, and a stream of water near by, with perhaps a more or less sloping bank, is selected; and thither a gang of able-bodied woodsmen are despatched ere snow flies. Rude log-huts called "camps" are erected, with wooden chimneys, and beds of hemlock-boughs; and here they stay for the season. The staple of their diet is salt pork and rum. At night, cards, story-telling, and general hilarity, beside a blazing fire, form a marked contrast to the hard toil of the day and the loneliness and cheerlessness of a forest-winter. Such adventures, too, as the encountering of wolves and catamounts, the occasional skating upon a frozen river, and the sharp competition through the day with neighboring gangs of workmen, lend excitement to this wild, strange life. Through the day the toil is of the hardest. The trees are cut, stripped of their branches, sawed with great cross-cut two-hand saws into logs of the desirable size, and hauled into convenient localities for drawing to the water-side. Then, by means of a chain, a skid, and an ox-team, the logs are loaded upon huge sleds, — sometimes only one end of the log being placed upon the bob, — and are hauled down to the river and emptied in, the ice-crust serving to keep them from floating off. Each owner's logs are properly marked in order to distinguish them, inasmuch as a number of different contractors are at work often on the same stream. This is the case especially in such great lumber-regions as the Kennebec, the Penobscot, Saginaw River, Green Bay, and Rum River (Minn.). The season begins in December, and generally ends in March. Every thing depends on the snow. Sometimes this is so deep, that the oxen cannot break paths; and again there is so little, that it has to be scraped up at nightfall, and made into a road to be used only at night; for even the winter sun and the mildness of day would so soften the bed, that the sleds would cut it all up and destroy it. Much of the work of hewing, sawing, loading, and hauling, is done in the stormiest and coldest of weather.

Description of industry.

From the time when operations cease in the woods, until the rivers open, there is generally a season of about two months. Few of the hands stay in the woods during this period, although a few are needed to keep watch against thefts. When spring comes, the logs are floated down stream in an immense mass called a "drive." Generally this branch of the work is carried on by a different set of men from those who cut the logs. Here, again, great skill and muscle are required, and great excitement is afforded. The logs are accumulated by millions; the streams are swollen and rapid; and the scene resembles an immense herd of furious cattle, such is the confusion, and leaping of logs upon one another. Every now and then occurs a "jam," where two or more logs in the van catch against obstructions on opposite shores, become locked, and so check the progress of the whole drive, which now piles itself up like an ice-pack. At this juncture some bold and dexterous "driver" runs out upon the floating mass, quickly finds by his practised eye where the difficulty is, and pries the obstructing logs apart with his pole; then the whole drive gives way with a tremendous rush, the foremost logs shooting away like rockets, and the heap in the rear suddenly subsiding. Only with the utmost agility is the adventurer able to reach the shore. A whole gang of men is engaged in this labor, and it takes several days to reach their destination: accordingly a cook accompanies them on a raft with their clothing and provisions, and ministers to them as in the logging-camp.

Finally the dam is reached where the mills are located. Here a "boom," or series of logs bound together with strong chains, and sometimes stayed by great piers, catches the drive, from the confusion of which the property of different owners is laboriously and tediously separated. Then, through the summer and fall, the logs are forced through the mills, and converted into lumber.

Description of mill and salt-works at Saginaw.

The following description of a mill and mill-site in the Saginaw region, where salt-boiling is carried on in connection with the sawing of lumber, as is elsewhere described, will afford an excellent idea of the magnitude of this business, not only in Michigan, but in all the other principal lumber-regions already designated, just as the description given above applies equally to all winter operations in the North. Says a writer in "The New-York Tribune," of an establishment at Bay City,—

"The mill, salt-works, and other buildings, cover a very large area. The river-front and slips, from which the lumber, lath, shingles, and salt can be placed on steam and sailing vessels, are a mile and a quarter in extent. The motive-powers of the saw-mill and other works are one engine of 760 horse power, and four smaller engines used for various purposes. There are 225 men employed in and about the mill, salt-works, and yard. There have been 265,000 feet of lumber sawed in the mill in one day of eleven and a quarter working-hours. The capacity of the mill is from 25,000,000 to 30,000,000 feet of lumber when the machinery is running on ordinary time, from May to November; but the results can be doubled in busy seasons when the men are employed night and day. In this, as in all other large mills, gang-saws are used in addition to the large circular-saws. The gang-saws are set upright in frames. There are two pairs of gang-saws in this mill: the largest of these contains fifty-four saws. The large circular-saws are used in producing timber of varying widths, the log being adjusted by machinery, so that any thickness can be obtained. The furnaces are fed with sawdust, which is carried by means of endless belts from below the saws to the mouths of the long row of furnaces. All of it, however, is not needed for this purpose; and the surplus, together with a considerable amount of other refuse, is conveyed by simple machinery to an opening, into which it is being continually discharged when the machinery of the mill is in motion. This opening leads to a large furnace, twelve or fifteen feet in diameter, into which the refuse is thrown and consumed. It was constructed for this purpose alone."

WOOD-WORKING MACHINERY.

Displacement of manual labor by machinery.

During the last fifty years mechanical labor has taken the place of manual labor, in the sawing up and shaping of wood, to an extraordinary extent. The greatest progress has been made in the United States, where machines have been absolutely necessary to supplement the limited amount of human labor which manufacturers have been able to command, and where there has been a general impression, among workmen and employers alike, that all the country needs to obviate debt, taxes, and bad weather, and to make the men handsome and the women lovelier, and give everybody a thousand dollars in the bank, is the use of plenty of machinery and a liberal issue of patent-rights. The spirit with which new machines have been received in the United States has been very different from that which formerly prevailed in Europe, and is still manifested there from time to time. The result is a larger use of mechanical inventions, and a corresponding improvement in the position of working-men, who, from manual laborers, have risen to be directors of machines, and masters of shops.

American wood-working machinery at world's fairs.

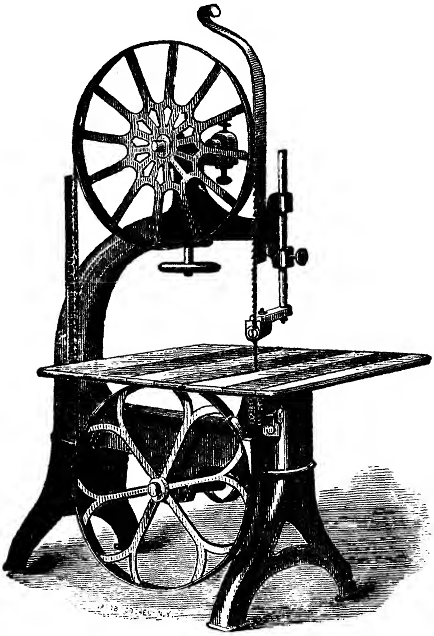
Since 1867 one of the most interesting departments in every one of the world's fairs has been that in which American wood-working machinery has been exhibited. The first show which attracted special attention was at Paris in 1867. At the exhibitions of 1851, 1855, and 1862, the English had been almost without rivals. In 1867 the United States appeared upon the scene both with wood-working and metal-working machines, and made a show which was a veritable surprise to the English makers. The American exhibit was specially commented upon in the reports made to all the governments whose people were represented in the fair. Professor Reauleaux, director of the Industrial Academy at Berlin, was especially interested in the American machines; and he reported to his government: "Upon the whole it may be said, that, in machine-industry, England has partly lost her formerly undisputed leadership, or that she is at least about to lose it. The healthy, young, trans-Atlantic industry, which continually withdraws from us energetic and intelligent heads and robust hands, makes, with the aid of her peculiar genius, the most sweeping progress; so that we shall soon have to turn our front from England westward." Describing the distinguishing traits of American machines, Professor Reauleaux said, "They are distinguished from us by more direct and rapid conception. The American aims straightways for the needed construction, using the means that appear to him the simplest and most effective, whether new or old. Our historically heaped-up material, and the cautious character of the German, are so inseparably interwoven, that, among the number of known means, we often forget to ask whether they are the simplest, or whether new ones might not be better. The American really constructs in accordance with the severest theoretical abstraction, observing on the one side a distinctly marked-out aim, weighing on the other the already available means or creating new ones, and then proceeding, regardless of precedents, as straight as possible for the object." C. B. Rogers & Company of Norwich, Conn., obtained the gold medal at this fair. At Philadelphia, in 1876, the department of machines and tools for working wood was almost exclusively occupied by the United States. Canada sent a few machines. Great Britain had one exhibiter, and the rest of the world perhaps a dozen. The United States had attained to undisputed eminence in the originality, variety, and excellence of her wood-working contrivances; and not a rival from the Old World dared really to compete with her.

The saw-mill.

The saw-mill (the pioneer wood-working machine) came into use in the very early days of this country; but not till recently has it reached any thing like a perfect state. Even yet the saw-mill is not all that it should be; for the mechanical appliances for handling the log, for holding it in place on the iron frame which carries it forward to the saw, and for adjusting the guides of the circular saw, are still somewhat crude, and make the manufacture of lumber a dangerous occupation. It is claimed that more persons are maimed and injured in the United States from the use of circular saws as now employed than from any other cause, wars and accidents not excepted. If dangerous to careless sawyers, the mill has at any rate become very efficient in cutting up the logs into planks, boards, and square beams, with great rapidity, and little waste of material. One of the devices of the saw-mill to which a good deal of attention is paid is the "dog," — a sharp iron tooth, projecting from the upright iron standard against which the log is placed, to hold it steady while it is being sawed lengthwise. The "dog" is worked by a lever, which causes it to sink down into the log with a tight grip, and draw the log tightly against the standard. A great many "dogs" are made for the trade, having various tenacity of grip; and every few years a "boss dog," or a "boss dog, jun.," or some other species of the canine, is brought out to take the place of the inventions which have preceded it, and are supposed not to do the work as well.

Saws, of course, are used all the way up, in the shaping and manufacture of wood, from forest-work to cabinet-work. Scarce a shop of any size is without its circular saw for cutting up wood rapidly into equal lengths, and the hand-saw is universal. Within the last twenty-five years ribbon-saws have come into use also for the manufacture of ornamental work, such as brackets, pieces of irregular form for furniture, ornaments for staircases, &c. The ribbon-saw is of two kinds: it is either an endless band of steel, which passes over two wheels, — one above, the other below, the table on which the piece of wood to be sawed is laid, — or it is a straight, slender blade, which works up and down with a reciprocating motion. The band-saw was the slowest in arriving at perfection. The blades were liable to break with a sudden strain. The blades for these saws are now, however, of excellent make, and the machinery upon which they are mounted is of the most solid and non-vibrating description. The saws are a valuable aid to the furniture-maker and architects. They are responsible for a great deal of the gingerbread ornament put upon the eaves, porches, balconies, and windows of our modern wooden cottages; but they have substantial and valuable uses, and are the origin of such beautiful and inexpensive brackets and wooden ornaments for interiors, that we can forgive them for what they have done for exteriors. The demand for these saws has been very large. Exhibited first at fairs as curiosities for cutting up blocks of wood into complicated Chinese puzzles, they soon came into general use in all practical work. A great many of the general machine-shops of the United States are devoted to their manufacture. The saws are worked either by steam-power or by means of a treadle. The reciprocating saw can be given a speed of two hundred and fifty cuts a minute by means of a treadle, the saw working so easily that the workman is in no respect embarrassed with the action of his foot.

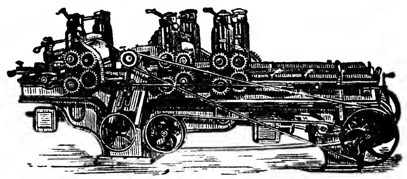
Circular and other saws.



BAND-SAW.

Some very ingenious improvements have been made in the United States upon that most universal of wood-working machines, the turning-lathe. The machine-lathe originally was devoted only to the production of straight round sticks for broom-handles, banisters, parts of chairs, &c., and other simple round objects. The chisels, which cut away the wood as the rough sticks revolved at great speed, were carried along from one end of the stick to the other by tool-posts, which were operated by long feed-screws. If it was desired to turn the banister, chair-leg, or other object, in any pattern, the chisel had to be applied by hand, and guided by the eye of the workman. About twenty-five years ago the lathe was improved, so as to perform the whole business of carving a chair-leg of any pattern. The sliding-tool carrier was supplied with two tools. One, a chisel, was fixed, and was made to rough off the work: the second, a V-shaped cutter, cut out the pattern, being guided by a template fixed to the bed of the lathe. A knife, whose edge was fashioned according to the form to be produced, was made to move vertically in a frame behind the lathe. As the tool-carrier passed along, this knife was made to descend, and smooth off the pattern. By this apparatus it became possible to turn out chair-legs with the accuracy attained by hand, and with increased speed. The lathe was also so improved as to permit the turning out of wood in elliptical and square forms. The stick was given two motions. It revolved rapidly upon its axis, and at the same time received a motion from side to side by means of eccentrics, &c., in the gearing; so that it approached and receded from the cutting-tool sufficiently to give it a square or elliptical surface. This style of machine has proved useful in turning out wood for patterns; and it has been adopted by the brass, silver, and gold smiths in the "spinning-up" of flat sheets of metal into hollow-ware, in which process a block of a certain shape and a flat disk of metal are put into the lathe, and the metal is made to lie down upon and take the shape of the block by pressing it with a smooth steel tool, both revolving rapidly during the process.

Turning-lathe.



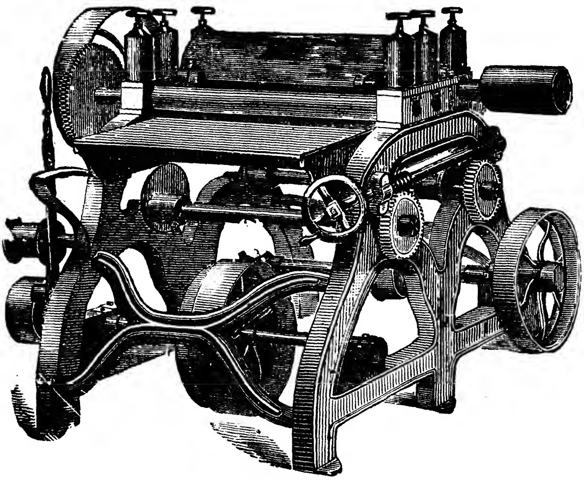
PLANER AND MATCHING-MACHINE.

Planing-machines were introduced at a very early day. They are of two kinds. In one style cutting-blades are mounted upon a cylinder, and the plank or strip of wood to be planed is passed through between the planer and a heavy roller, which are fixed the right distance apart by means of screws: in the other style the cutting-tools are chisels, mounted at right angles upon two spokes of iron, and made to revolve in a circle at enormous speed. These machines are made to plane horizontally or vertically, and to deal with wood across the grain, with knotty wood, and planks and beams of all descriptions.

Planing-machines.

The sash, blind, and door, and the hand-plane industries have given rise to a variety of machines for cutting out mortises, tenons, grooves, slots, and joints of all kinds. The work is generally done in these machines by means of chisels and saws. This class of machines has multiplied very fast since 1861, and has concentrated in factories a large amount of work which was formerly carried on by hand, and scattered far and wide among small shops. It has also greatly lessened the art of production. The machines are all very simple, though frequently very ingenious, and work with great precision. The framing, shaping, and panelling of windows, doors, and blinds, is now done entirely by machinery; and the application of mechanical labor in this industry has gone so far, that even the wire staples which fasten the rod of the window-blind to the slats are all driven by machine, and with incredible speed. If a machine were invented to brush on the green paint to the window-blind, sash, or door, there would be nothing more to do in the construction of those objects which could be done by machine. That a device of that character could be made is apparent both by the aid of the unassisted reason, and from the fact that England exhibited a painting-machine at Philadelphia in 1876. It was, in fact, her only wood-working machine shown.

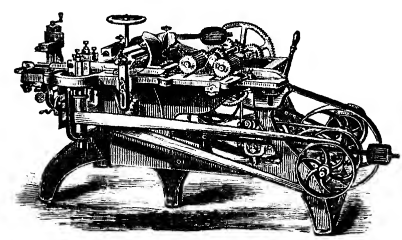
Machinery for making sashes, blinds, and doors.



TWENTY-FOUR-INCH PLANER.

One of the comparatively recent inventions is a set of machines for making the different parts of barrels. In these the staves are sawed out, bent, jointed, and prepared for the barrel, with scarcely the aid of any hand-tool whatever. The heads of the barrels and the wooden hoops are also shaped by appropriate inventions. There are also now in use machines for carving, engraving and portrait engines, lathes for cutting and boring spools, box-mortising-machines, stair-jointers, hub-boxing-machines, cork-

Barrel-making-machines.



MOULDING-MACHINE.

Carving and engraving.

cutters, shingle and lath saws, a variety of apparatus for bending wood for carriages, &c., and shoe-peggers. The latter are often made so as to drive a peg into the shoe the moment it is made from a ribbon of hard wood, coiled up like a spring in the machine, and fed forward as it is wanted. Pegs are also made by the bushel by means of it, and supplied to the trade for hand-pegging. It is said that shoe-pegs are made on such a scale in Connecticut, and so cheaply, that they are sometimes sold for oats, — a legend which will do now to be placed on the shelf with the kindred tale of the fortunes made by Connecticut peddlers in retailing wooden machine-made nutmegs. A great deal of machinery is also used in cutting out and jointing wooden toys and automatons, such as snakes, clog-dancers, dolls, furniture, mechanical playthings, wooden pipes, tenpins, boats, puzzles, blocks, &c. France formerly had almost a monopoly of the manufacture of toys, and her ingenuity in devising new ideas is still unexcelled. But her toys have been nearly all hand-made, and American machine-made wooden toys are proving a formidable rival to the product of her factories. They have become so within the last ten years.

Toy-making machinery.

Wood is one of the raw products which enter into the manufacturing industries, whose cost is generally so small, compared with the labor expended upon it, that it does not usually form any material part of the cost of the article made from it. Houses and bridges which contain a great deal of lumber are, of course, exceptions. Usually the cost of wooden-ware is attributable chiefly to the wages of the men employed in its manufacture. Nine-tenths of the selling-price of carriages, toys, ships, furniture, the minor parts of a house, brackets, picture-frames, &c., is labor. This being the case, and labor being so high in this country, the public necessity for an extensive employment of time and labor saving machinery in the manufacture of wood is apparent. Congress has given protection to the making of wooden-ware by a heavy tariff, steadily maintained; but, without the aid of machinery to cheapen production, it is doubtful whether half the manufacturers of wood in this country could hold their ground against foreign competition. With this protection, and a plenty of machinery, they are able to outstrip all rivals in supplying the American market with all wooden-ware in common use; and, to some extent, they are now able to export common goods. They have long been able to export ware fabricated from peculiar American woods, such as hickory, and peculiar inventions, like the cabinet organ; but it is only recently, and by the aid of machinery, that ware made of common woods has been made by them a feature of any interest in the export trade. Goods upon which machinery cannot be employed, and which require the expenditure of a great deal of labor, we still buy of other nations; such as lacquered ware, carved wooden clocks, carved paper-knives, elaborately-carved cabinets and inlaid tables, curious sets of chess-men, &c.

Extensive use of wood in building.

Houses and bridges.

Wooden-ware.

The number of establishments in the United States employing wood-working machinery to any extent in 1870 was about 57,000. They were the following: —

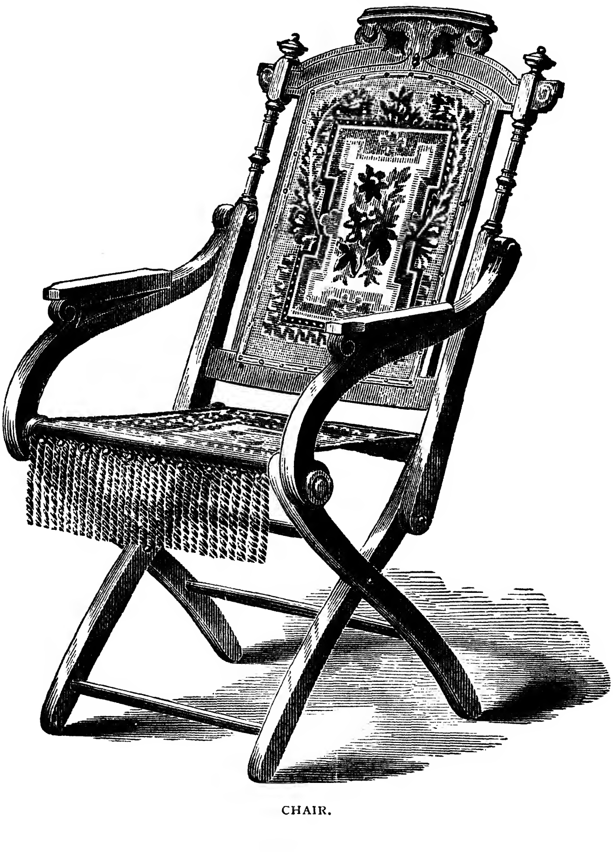
CLASS.	NO. OF FACTORIES.
Agricultural implements	2,076
Boats	174
Boxes	1,049
Brooms	635
Wagons	11,900
Cars	173
Cooperage	4,901
Cork-cutting	27
Furniture	5,960
Hubs, spokes, and fellies	302
Kindling-wood	70
Lumber (planed)	1,113
Lumber (sawed)	25,817
Lumber (staves, &c.)	15
Musical instruments	340
Oars	25
Sashes, doors, and blinds	1,605
Ship-building	762
Shoe-pegs	26
Washing-machines	64
Wheelbarrows	23
Wheelwrights	3,613
Wooden brackets	65
Wooden-ware	269
Wood (turned and carved)	733

These establishments employed steam-engines, wind-mills, and water-wheels which had a capacity of 850,000 horse power; and it is estimated, moderately, that the number of wood-working machines in operation in the factories and mills was 120,000. Ten years ago it was estimated that the total number of wood-working machines in France was only 10,000. The difference is partly explained by the circumstance that America is a great foresting country, and not only obtains from her own woodlands, and works up in her own shops, all the common timber she consumes, but a vast amount of lumber is sawed and planed for exportation; whereas France is obliged to import a large amount of timber which comes to her already prepared for consumption. Allowing for this difference in the foresting products of the two countries, the comparison in the amount of wood-working machinery employed by each is still remarkable. A comparison equally favorable to the Americans could be made with every other country in the world. To build the machinery required by the American shops devoted to wood-working, and supply that which is required to replace the worn-out and antiquated, calls for the services of several hundred machine-shops and the labor of thousands of our countrymen.

FURNITURE.

The furniture-industry had no definite beginning, as did some of the other trades of the country; though, like the mushroom which came in one night through a tar-walk, it had a definite *début* in society as a full-grown factory-industry. It grew up quietly in the carpenter-shops scattered through the land in every village and hamlet, beginning in a modest way with simple hard-wood chairs, benches, dining-tables, and bedsteads, all plainly but strongly made, and without any pretence of style. The carpenter, when out of a job of house-building, filled up the dull days with furniture-making, not as a regular trade, but as a means of saving his time. The chairs were straight-backed affairs, often with bent hickory arms. They were generally uncushioned, but they supported the form admirably; and so well did they perform their purpose, that nine-tenths of the heavily upholstered and draped chairs of the present era of fashionable art are far less comfortable and healthful to the occupant than the quaint hickory chairs which come down to us in ancient homes from a hundred years ago. The tables were simple, but heavy. They generally had hinged leaves in order to economize the space of the apartment when not in use. Sometimes they were made so that the whole top revolved on a hinge, and could be turned up perpendicularly, and the table pushed up close against the wall. Oftentimes the tables were hinged to the wall of the room, so as to turn

Rise of furniture-manufacture.



CHAIR.

up flat against it when not in use, the leg of the table hanging down against it when thus raised, but swinging down into its proper position when the table was lowered. The bedsteads were often as strongly built as a house. There was no grudging of material in them. The four posts were huge and high, and the sides and the head-boards almost as thick as the side of a ship. A framework was built over them for the curtains of the bed. Less furniture was used in that age than at present, and the wants of the colonists were amply supplied by this desultory manufacture in the carpenter-shops. Besides, for more than a hundred years, a great deal of furniture was imported from Europe. Mahogany furniture, which was then very much in fashion, was almost exclusively imported.

DENTIST'S CHAIR.

Mahogany furniture.

After the Revolutionary war, ornamental woods were freely imported from the West Indies and South America. Carpenters then began to make mahogany furniture, as well as that of the more common woods. The wood was generally worked up solid. The chairs, bedsteads, cabinets, chests, and tables into which it was fashioned, were all made by hand; and the workmen lavished upon them an amount of loving carving and decoration which showed that their hearts were in the work. Pieces of this massive old furniture are still preserved in many old families as heirlooms; and when they stray into the general market, as they occasionally do, they are eagerly snapped up by wealthy families at fabulous prices. There was not very much of it made, however, owing to its cost and the limited demand for it. It was hard to make it, also, in competition with the European makers; for France, England, and Germany had great factories employed in this class of manufactures, and furniture could be turned out at very much less cost than here.

Furniture-making in 1812.

The industry first began to differentiate itself from the general carpenter-business in 1812. Congress imposed a tax of thirty per cent upon all imported articles of furniture, and maintained a duty of about that weight, by the way, under all subsequent tariffs, free or protective, steadily. The two or three years of war following 1812 were an additional protection to the furniture-makers, and by 1815 a large number of them were regularly engaged in the business in all principal cities. From that period the rise of the industry has been rapid: it has more than kept pace with population. Soon after 1815 American ideas and vigor began to manifest themselves in the business, especially in the production of furniture for common use. The rocking-chair, a purely American idea, was largely manufactured. Straw, cane, wicker, and rattan seats and backs to chairs, were introduced. New woods were put to use, such as cherry, butternut, ash, and black-walnut. Wicker-work chairs were made. Machinery was constructed to produce the parts of chairs, beds, bureaus, &c., in wholesale lots. The art of veneering was adopted, which was to furniture what silver-plating was to table-ware. A variety of charming and serviceable forms were invented, and all furniture was made lighter, handsomer, and cheaper. The use of machinery cheapened furniture immensely, and brought within the reach of the great masses of the people that profusion of chairs, tables, bureaus, &c., which had abounded only in wealthy houses. The country was growing in wealth too rapidly. The sale of furniture grew enormously. Families bought a dozen pieces of it where they had bought one before, and furniture-making soon became one of the most diffused and most flourishing forms of native industry. By 1850 the American makers had almost entire possession of the market: indeed, they had possession of it for all except a certain percentage of the more fashionable and costly varieties. The quantity of common furniture imported was a mere leaf floating on the surface of the stream of native production.

Rapid development until 1850.

The growth of the business since 1850 will be illustrated by the following figures: —

Growth since 1850.

	FACTORIES.	OPERATIVES.	VALUE OF PRODUCT.
1850	4,242	22,010	$17,663,000
1860	3,594	27,016	25,632,000
1870	5,981	53,298	69,082,000
1870 { Including iron bedstead, refrigerator, picture-frame, and looking-glass makers . . . . }	6,312	57,091	75,539,000

Within the last twenty years the business has become subdivided greatly. Very few makers now attempt to produce all the articles needed to equip a house for occupancy. In the thickly-wooded districts many factories confine themselves simply to getting out furniture in the rough by means of machinery, sending it to the large cities to be finished for the market. There are now so many special styles of chairs made, — office, dining-room, cane-seat, wicker, camp, upholstered, bent-wood, and

Recent subdivision of business.

so on, — that large numbers of makers devote themselves to one specialty in chairs. Some factories make a specialty of sofas, some of ottomans, others of tête-à-têtes and divans. There are a large number who make special styles of tables, — dining, ironing, card, billiard, extension, library, carved, inlaid, and centre tables. Some make bedsteads alone; though the common plan is now to make bedroom-furniture in sets, the sets including a bed, bureau, commode, washstand, table, and three or four chairs. One class of makers now confine themselves to gilded or enamelled furniture; others to solid, carved, and inlaid sets. The most fashionable makers keep a corps of designers, and make sets for parlor, bedroom, dining-room, &c., to order, often taking the measure of a room, and adapting the pieces to it.

Cultivation of foreign markets.

It is only within the last ten or fifteen years that American makers have begun to pay any especial attention to a foreign trade. As furniture is a class of products into the making of which art ideas largely enter, and the artistic is the special field in which Americans have been behind the rest of the world, the furniture-dealers have been afraid to venture into the foreign markets. At the Paris Exhibition in 1867 the United States were represented by so insignificant a display of furniture, that the visitor would not have known that they were represented at all. The display consisted of a few camp-chairs, a few rocking-chairs, an inlaid table from Wisconsin, and a laurel-wood door from California. Our manufacturers have gained confidence since 1867. In 1876 they were represented at Philadelphia most creditably: they made a splendid and showy display. In all common furniture their styles were original, and their workmanship of superior description. In elegant furniture their carving, finish, gilding, &c., were all that could be desired, and were fully equal to those of foreign makers. That exhibition was a great encouragement to American makers, and they are now exporting their goods.

Lack of originality.

The one weak point in American furniture is the lack of originality of pattern in the more artistic pieces. Every thing is borrowed from the ideas of the French or the English. Whatever happens for the time to be popular abroad — whether it is the style of "Louis XIV.," the "Louis XV." patterns, the "renaissance," the "rococo," the "Queen Anne," the "Eastlake," or what not — is copied immediately and slavishly by the American designers. This fact is both a source of regret to their countrymen, and is the reason why so much costly furniture has always been imported. No admirable American style has been developed; and buyers of artistic furniture depend on Europe for their styles, and prefer, when possible, to buy the furniture really made in the workshops which set the style, rather than the imitation by the American workman. Nothing remains to be desired in the way of common furniture; but, in the line of artistic furniture, every thing is to be desired. A gleam of the dawn of a better order of things was seen at the Philadelphia Exhibition in two or three pieces, bedsteads all of them, which were carved in a truly American style, deriving its inspiration from a study of the plants of our own soil, and from a study of American ideas. One was carved with the symbolic ornaments of the lily, the poppy, and the Virginia creeper. Here was a suggestion of an American style. When the idea shall have been developed, and American pattern-makers shall fill their heads with ideas taken from the suggestions of our own beloved land and reproduce them in their furniture, they will occupy a position inferior to none among civilized nations.

STARCH.

he was cheated out of the

Uses of corn.

When Mr. Tilden, after his defeat for the Presidency in 1877, got back from his subsequent trip to Europe, he made a speech from his residence in Gramercy Park, New-York City, of which the newspapers made a great deal of fun. He alluded to the variety of products in this country which are not yet manufactured and utilized for the foreign trade to the extent of which they are capable. "Especially cereals," he said. He then went on to specify Indian-corn, which can be prepared in so "many delicious forms for human food." Acting on the suggestion that Europe needs to be civilized, and life there made joyous by imparting to its people a knowledge of the mysteries of cooking this succulent grain into pudding, corn-cake, mush, &c., Mr. Abram S. Hewitt of New York proposed in Congress that a corn-kitchen should be established at Paris at the Exhibition of 1878, in order to create a demand in Europe for Indian-corn by showing the natives how to cook it. This, in turn, made sport for the newspapers, and the sky was darkened with the clouds of lurid paragraphs and bad jokes which filled the air.

In spite of the American propensity for looking at the funny side of every thing, there was a great deal of truth in Mr. Tilden's remarks. The United States do not yet utilize their grains for export to the extent of which they are capable, and there is a vast field here open for profitable effort. The success of one single branch of the manufacture of cereals is indicative of what may yet be done in other directions.

Corn-starch an American invention.

Corn-starch is purely an American invention. Its birth dates from 1842. Previous to that year, all the starch known to commerce was made from wheat, barley, rice, and potatoes, principally from the first and last named. Potato-starch was introduced into the United States in 1802 by John Biddis of Pennsylvania; and a large number of factories were built to make the article, especially in the cotton-factory districts, the factories being their principal customers. A number of wheat-starch factories were also built. Abroad wheat was the principal material used. The consumption of starch made from it was enormous, especially in England and France, whose cotton-factories took a large part of the whole product. In 1842 Thomas Kingsford, while superintending the wheat-starch factory of W. Colgate & Company in New Jersey, made experiments with corn, and satisfied

Thomas Kingsford.

himself that corn-starch would be a better commercial article in some respects than any other. In 1848 a factory was built for him at Oswego, N.Y., by gentlemen living in the city of Auburn in the same State, the location being selected on account of the ease of obtaining large shipments of corn from the West at Oswego by an all-water route, and on account of the nearness of Oswego to the large commercial cities and manufacturing States. The factory was a prosperous concern from the outset; and it has grown so fast, that it occupies ten acres of land, and has machinery for treating 950,000 bushels of corn a year. Its product is now about 10,300 tons of starch a year. In 1858 another great concern was started at Glen Cove, L.I., by the seven Messrs. Duryea. The two establishments are now the largest starch-factories in the world. After 1860, when the two concerns had fairly developed their capabilities, they put an end, for the first time in history, to the importations of starch to the United States. They followed this up by an emphatic bid for foreign patronage. They sent their starch all over the world. They made it in three forms, — for cooking (in which form it is called "maizena"), for laundry-use, and for cotton-factory purposes; and they got gold medals for it everywhere, and enormous orders. In 1864 the export was scarce 1,000,000 pounds: in 1877 it was barely short of 10,000,000. The success of the two great concerns named has led others into the business, which is large and prospering. Corn-starch has not, however, superseded the manufacture of wheat-starch, and that branch of the business is also continued on a large scale. In 1870 the total number of starch-factories in the United States was 195, the number of operatives 2,072, and the product worth $5,995,000. The business is destined to have a great future development.

Exports of starch.

Corn-starch vs. wheat-starch.

The proportions of native starch in the different grains is as follows: Corn, from sixty to eighty-five per cent; wheat, sixty per cent; rye, sixty; oats, forty-six; barley, fifty-seven; rice, sixty-one; pease, thirty-seven; and beans, thirty-eight; and the percentage in potatoes is sixty-two. There is no reason why corn-starch — so delicious for food, and so valuable as sizing, and so cheap — should not supersede all others, and why the United States should not supply the greater part of the world with it. Its use as food is rapidly increasing. It needs only to be known to be embraced as a regular part of the bill of fare. Perhaps it is a pity that the corn-kitchen of Mr. Hewitt was not added to the Exhibition of 1878, after all, as one of the attractions of the American department.

WINE, SPIRITS, AND BEER.

One of the forms in which the grains and fruits and other raw products of the United States are utilized for commerce is in the manufacture of stimulating beverages. Mr. Tilden did not refer to this class of manufactures when he commended the idea of bringing the things which can be made out of the cereals of the land to the attention of foreign nations. There has been ample development in that direction already.

Nearly all the colonists of America, especially those living south of Connecticut, brought with them to this country a taste for wine, beer, and whiskey. The latter two beverages were popular among the middle and laboring classes in England and the Netherlands, and the former among the gentry. Wine was a luxury which almost all who came to this continent had to do without for a long period; but the population began to make beer and whiskey, and to import what they could not make, almost as soon as they landed from their ships. In every large company of artisans sent out to the colonies, a few brewers were regularly included among the rest. For a long period, however, the majority of the colonists brewed their own beer at home, just as many farmers do still, in this present age of huge breweries and cheap lager, in the country-towns in the haying and harvest season. In 1649 it is reported that Virginia had "six public brew-houses; but most brew their own beer, strong and good." Virginia gave a warmer welcome to luxuries of this description than some of the other colonies; but the condition of things was about the same in all the neighboring provinces. There were public breweries here and there; but most people made their own beverages. In New England alone was there no welcome to stimulating drinks.

Early use of stimulants by colonists.

Colonists brewed beer.

By the time of the Revolution, the distillation of whiskey from corn and other grains had begun, and was practised to a very wide extent. The stills were small; but there were a great many of them. They were scattered all through well-settled and sparsely-settled districts alike. The whiskey made was a purer article than that put upon the market at present, and could be drunk in greater quantity without danger. It was so cheap and so common, that those who made it carried it about in pails to sell to men at work on buildings and public improvements, and handed it out in a dipper. The old records of the county clerk's offices show that the owners of stills in various States acquired a great deal of property by bartering whiskey for real estate. It was often stipulated in deeds that the land should be paid for in so many barrels of whiskey down, and such or such a quantity, to be paid in the form of a pint a day, to be drunk at the still.

Distillation of whiskey.

Spirits and beer were so extensively consumed at that early day, that, when Congress took up the first tariff bill in 1789, the tax on this class of luxuries was very carefully considered, as being a thing which affected the people closely, and which would be likely to yield a large revenue. Jamaica rum was very extensively consumed among the other varieties of stimulating beverages. The bad effects of spirits on the morals and health of the people were spoken of by several congressmen, and it was universally resolved to tax them as high as there was any probability whatever of collecting a duty. Alexander Hamilton's report on the finances in 1790 stated, "The

Tariff of 1789.

consumption of ardent spirits, no doubt very much on account of their cheapness, is carried to an extreme; which is truly to be regretted, as well in regard to the health and morals as the economy of the community." Mr. Hamilton recommended a tax which would operate in favor of increasing the use of cider and malt-liquors, and decreasing that of whiskey. Congress assented to the principle, and taxed spirits heavily. It is to be feared, however, that the result was only to increase the home-manufacture of whiskey, which now became very profitable. As a moral measure, the duty had little effect, whatever result it may have had as a source of revenue.

Growth of manufacture of whiskey.

The manufacture of whiskey and beer has kept even pace with the increase of population in the United States. A strong public opinion has excluded stimulating beverages from several of the States, — particularly those of New England, — and it has limited their use among respectable people in all, except, perhaps, in regard to ordinary beer, which is a comparatively harmless drink, as it certainly is an agreeable one, and which is increasing in use constantly. But, in spite of public opinion and of active temperance agitation, there has been so far a steady growth in the manufacture. The late war, with its passionate excitements and its wearing exposures in the field, gave a great impetus to the consumption and manufacture of whiskey; and though the passion has died out, and the exposure is at an end, the tastes acquired in the field still linger, and maintain the demand for spirits. The consumption is now enormous. Considering how large a proportion of the population never touch a stimulating beverage, ladies and children particularly giving spirits a wide berth, it is an extraordinary thing to find that 61,000,000 gallons of whiskey are now annually produced in the United States, and 7,000,000 barrels of beer; and that, in addition to this, about 400 factories are busily engaged all the time in producing wines, brandies, and champagne for the American market. In 1870 the industry presented the following statistics: —

	ESTABLISHMENTS.	OPERATIVES.	VALUE OF PRODUCT.
Cider	547	1,472	$1,537,000
Spirits	719	5,131	36,191,000
Ale and beer	1,972	12,443	55,706,000
Wine and brandy	398	1,486	2,225,000

Illicit distilling.

These were the establishments officially reported. To these must be added, however, a large number of whiskey-stills conducted illicitly in the mountains of the South and in the large cities of the North, the number of which is not known. There are a very large number of these illicit stills. The revenue-officers are constantly breaking them up;

but they spring up again as thick as frogs after a shower, and they add to the total product of the country in spirits millions of gallons yearly. There was great temptation toward illicit distilling in the few years following the war, when the tariff duty on imported whiskey was two dollars and fifty cents a gallon, and the internal-revenue tax on that made within the country two dollars a gallon. Since the tax was reduced to fifty cents a gallon, the amount of secret distilling has very much decreased, owing to the removal of the temptation; but it is still considerable. Latterly, distillers in the North have added surreptitiously to the real production of the country by managing to put upon the market a large amount of whiskey which has not paid the government tax, and which, consequently, made no figure in the returns of the total amount of whiskey produced. These whiskey frauds created a great public sensation in 1876 at Chicago and St. Louis, and in 1878 at Cincinnati. Prominent and respectable houses were engaged in them. The extent of these evasions of the law has been so great, counting in both the illicit distillation and the failure to report to the government the full product of the regular distilleries, that there ought to be added to the figures above given of total annual product of spirits from 5,000,000 to 10,000,000 gallons to approximate to the real truth of the matter. The production of beer is probably correctly returned. There is less temptation to deceive the government in regard to its manufacture. Probably 7,000,000 barrels is the real annual product.

Chief whiskey-producing States.

The large whiskey-making States are New York, which has about fifty stills; Pennsylvania, a hundred and ten stills; New Jersey, fifty-seven stills; Ohio, seventy-five stills; Indiana, thirty-six stills; Illinois, fifty stills; Kentucky, a hundred and forty stills; Tennessee, forty-four stills, and Virginia, forty-nine stills.

Chief brewing States.

The large brewing States are New York, which has now about two hundred and ninety breweries; Ohio, two hundred breweries; Pennsylvania, about two hundred and fifty; Indiana, a hundred; Illinois, a hundred and fifty; Michigan, a hundred and thirty; California, ninety; Missouri, ninety; Iowa, a hundred and five; New Jersey, fifty; and Wisconsin, a hundred and eighty.

Whiskey smuggling.

During the days of the high tariff on whiskey, a great deal of smuggling of this article into the country was done from Canada. Near Toronto there are a number of distilleries of a superior quality of whiskey, the product of which many prefer to buy in the open market, paying tariff and all, rather than purchase the home article. The profit on the smuggling of Canada whiskey was so great, that, for years, the whole frontier had to be watched with unsleeping vigilance in order to head off those who were bringing in the untaxed article to the United States. It was brought over in wagons, boats, in small quantities concealed about the person, in tin babies, and in a thousand other ways.

Whiskey is made by distilling a fermented mash composed of corn, wheat, barley, rye, or oats, or a mixture of them. Bourbon whiskey — so called from Bourbon County, Kentucky — is made from fifty to sixty per cent of corn, and forty to fifty of small grain; ten per cent being malt, and the rest rye. Monongahela whiskey — named after the county in Pennsylvania of that title — is made from rye, with ten per cent of malt added. Canada whiskey is made from rye, wheat, and corn mixed, with five per cent of malt. The number of pounds of spirits containing forty-five per cent of alcohol which can be obtained from a hundred pounds of grain is as follows: Wheat, forty to forty-five; rye, thirty-six to forty-two; barley, forty; oats, thirty-six; buckwheat, forty; corn, forty. Pure whiskey contains about fifty per cent of alcohol. A large part of that sold in the market is not whiskey at all, however, but a mixture of high wines (spirits containing more than sixty per cent of alcohol) with various substances to give it color and taste. The ingredients put into spirits to make commercial whiskey are often of the most frightful and poisonous description; it has been repeatedly enough proved in New England to make a man reform from drinking simply by showing him just what the whiskey he has been drinking was composed of. There are, however, some comparatively harmless mixtures which are sold as "pure Bourbon," &c., in which the spirits are simply flavored with peach and hickory nut, pure brandy, oil of Cognac, and vinegar, ameliorated with glycerine, and colored with burnt sugar. A great deal of cheap whiskey is exported to Europe to be manufactured there into Holland gin and good Cognac brandy by flavoring and redistillation.

Process of distilling.

It is not intended here to go into the moral side of the question of this industry in the United States, except merely to say that the moral side of it, which cannot be entirely ignored, prevents the industry from being classed among those which are beneficial to our beloved country. It would be better for the land and for our countrymen were the industry to decline. Three-quarters of the spirits produced can be spared. Modern science shows that the temperate use of alcoholic beverages is not bad for certain temperaments; but it also shows that even the temperate use is bad for the majority of men, and that vice, pauperism, discontent, crude ideas, and disease follow in the train of its use invariably. It is only into families which refrain from the consumption of ardent spirits that variety of ideas, content, and the gentleness and grace of life, enter and take up their abode. Less than one-quarter of the alcohol and distilled spirits now manufactured in this country is really needed as chemical solvents in the arts.

Moral rank of industry.

The manufacture of wine is an enterprise of recent date in the United States: it is probably not over twenty years old, and has not yet reached special development. The citizen and the statesman look with greater interest on this branch of the business than on the preceding two. The first American wines were really a sort of clarified cider, which was sold in the market by the name of champagne, and

Manufacture of wine.

really was not a bad substitute for it, except that it was not what it professed to be, and was therefore a sham, no matter how pleasant a beverage it really was. Wines have been made in California and in New Mexico for a long period, but only on an extremely small scale. The grapes of those regions, and the sunny climate, led naturally to wine-making; and the produce has been so good, that the Spanish population, and lovers of good living there, have long chanted the praises of their native wines. It is only within about twenty years, however, that there has been any special manufacture of wine even in those summery portions of our national domain. The wine-making States are now Missouri, which in 1870 had a hundred and ninety establishments which are devoted to wines and brandies; California, with a hundred and thirty-nine establishments; Ohio, with thirty-eight; New York, with nine; and Illinois, with five. The total product in 1870 was worth $2,225,000. The American wines are both red and white, and comprise many of the sparkling, or champagne, variety. They are not very delicate naturally, and they are made heavy by the addition of alcohol and sugar before fermentation. Were they made of the pure juice of the grape, with a view to flavor and gentle exhilaration, rather than for strength and beautiful color, the manufacturers would do much toward removing the strong popular feeling against them, and would secure for them a larger sale both at home and abroad. American wine-makers do not now hesitate, however, to appear at world's fairs, and compete with the makers of the older countries. Twenty or thirty were at Paris in 1867: others were at Vienna in 1873. At Philadelphia, in 1876, a show was made by thirty makers. At the latter exhibition the Californians showed not only a great variety of wines, but the largest grape-vine in the world, — the famous Montecite-vine of Santa Barbara, which, after an existence of fifty or sixty years, during which it bore about six tons of grapes a year, had then only recently died. California still possesses the largest living grape-vine in the world, variously called the "Daughter Vine," or the "Young Mammoth." It grows near the place where the former thrived so long, is now eleven inches in diameter, covers an area of ten thousand square feet, and yields from eight thousand to ten thousand pounds of fruit a year.

CORDAGE AND BAGGING.

Quantity of baling and bagging stuff required.

There are now raised in the United States every year 4,600,000 bales of cotton, which have to be enclosed in coarse, stout bags in order to be in a condition for transportation to market. There are also raised 50,000,000 pounds of wool, which must also be put up in thick bags for market. There are, besides, 290,000,000 bushels of wheat, 1,300,000,000 bushels of corn, and an average of 400,000,000 bushels of other grain, besides 140,000,000 bushels of potatoes, unmeasured apples, and uncounted tons of flour, produced; the principal part of which stuff spends a portion of its time in bags of thick cloth or tenacious paper after it leaves the farm and the mill, and before it is finally consumed by man. The number of bags which have to be manufactured every year to accommodate this enormous supply of produce can only be counted by the tens of millions. It is so large as to be a matter of international importance; and foreign merchants and manufacturers are fond of studying how they can manage to furnish to the United States the largest share possible of the bags she requires every year, or of the raw material from which the bags can be made.

Cables, ropes, &c.

Another class of goods which enters into even more universal consumption in the United States comprises ropes, cables, and twine. No great sailing-vessel leaves a port of our country without going out with from one to three miles of ropes and cordage aboard of her, either strung aloft as rigging, or coiled below as cables and spare ropes. No vessel, in fact, large or small, stirs without a certain amount of cordage aboard; not even a canal-boat, which, at least, must have towing and mooring cables. As there are 23,000 large ships and steamers belonging to the people of the United States, and 3,000 canal-boats and barges, it will be seen that immense quantities of cordage are consumed every year in the furniture of the vehicles of ocean and river commerce. Besides this, every theatre in the country has a forest of rigging behind the scenes. Every new building, and work of construction, is erected by means of ropes. Every awning, flag, tower-bell, curtain, fishing-boat, and railroad-train requires the use of ropes and lines. Every package done up at the store must have a piece of twine. Cordage, in fact, is in universal demand. The Yankee schoolboy, who always carries two or three pieces of twine in his pocket, illustrates the law under which we all live in respect to cordage; for, while we do not all go about in the world with a wild mass of string and ends of rope in our pockets, we could not get through life comfortably without the instrumentality of that useful class of goods.

Materials used.

Cordage and bagging are made from the same classes of coarse vegetable-fibres, — flax, hemp, and jute. Cotton is sometimes used for small ropes, and generally for twine.

Rope-making an early pursuit.

Rope-making was one of the earliest mechanical pursuits of the colonists of America; they being impelled to exert their skill in that direction by the need of rigging for their ships, and of nets and lines for their fishing-boats. Virginia raised a great deal of hemp and flax in the early years of the province; and after 1629 New England raised hemp also. A sort of wild hemp grew in the latter district, from which the Indians made nets and lines; but this was not what the white man cultivated. Hemp-seed was obtained from England and Holland, and the domestic plant was the one cultivated. By 1641 a rope-walk had been started in Boston by John Harrison. In 1662 John Heyman was authorized to make cordage at Charlestown. This industry was, unaccountably, not opposed by Parliament; and, there being no weight upon its practice, it was taken up rapidly by Connecticut and other colonies. By 1698 there were several rope-walks in Philadelphia, some of them being owned by Joseph Wilcox. The native culture of hemp began to fall off about this time. This luxuriant plant, growing from four to twelve feet high, as fast and as strongly as Indian-corn, exhausted the soil. In Virginia it began to be abandoned for tobacco, and in the North for crops less taxing to the soil. This did not prevent the cordage-makers from getting raw material, however. An importation of hemp from Russia and other hemp-countries took place, sufficient to satisfy all demands. Parliament sought to stimulate the growth of hemp here by offering in 1703 a bounty of six pounds per ton of hemp, "bright and clean," which should be exported to England; but the effort did not avail much, and the bounty was not long maintained. Virginia and other colonies offered bounties also for hemp-raising at different times: but it did not pay to raise hemp on a very large scale when the soil was so available for tobacco and plants of that rank; and the country has never, from that day to this, raised all the hemp it could consume. For the last twenty years, from 20,000 to 40,000 tons of the material have been imported annually. The culture of hemp is now confined principally to the States of New York, Ohio, Indiana, Kentucky, Tennessee, and Missouri. Flax is now the more popular crop with farmers, because its seed is so valuable for the oil it contains, and the crop does not tax the soil so heavily. It is raised principally in the West, Ohio producing more than half of the whole crop. The production is about 15,000 tons of fibre a year, and 1,700,000 bushels of seed. Flax, however, still has to be imported at the rate of from 4,000 to 6,000 tons a year to supply the demand for it, because the farmers throw away the fibre half of the time, being content when they have gathered the seed. Flax was raised abundantly during the cotton-famine in the North resulting from the late war; but its culture fell off again after the cotton-crop of 1866 came into the market.

Culture of hemp.

Hemp is prepared for rope-making by exposure to the dew and weather in the fields, or by soaking in tanks of water; both of which processes have the same effect, — namely, of decomposing and washing out the natural glue in the bark of the plant, which unites the fibres of the bark into a tenacious peel. When the fibre readily separates, the hemp is removed from the woody heart of the plant, dried, and prepared for spinning by hackling. This process is simply combing by hand to get out the dust and tow. After the hand-treatment it is hackled finer in a machine, and then combed by another machine — the "spreader" — into a long, loose roll of fibre called a "sliver." One or two of the slivers are then passed through a "drawing-frame," in which they pass through two sets of rolls (the second set moving faster than the first), by which means the sliver is drawn out and

Process of rope-making.

attenuated. The sliver then goes to the spinning-machine, in which it is still further "drawn," and twisted into a yarn. The yarn is then reeled for twisting into a rope. John Good of Brooklyn has invented a plan by means of which the yarn is passed through a tube before reeling, and made smoother. The yarns are graded in size, according to the number that will just fill a half-inch tube, or make one strand of a three-inch rope. No. 40 is for fine rope, No. 20 for cables. The yarns, being reeled, are now tarred, if destined for rigging, by being drawn through tar heated to 220°. When they come out of the tar they pass between rollers, or through small holes, so that the superfluous tar may be pressed out. The yarns are now twisted into a rope in a long building called a rope-walk, which is generally about 1,200 feet long. (The government walk at Boston is 1,360 feet long.) A number of bobbins, containing 300 fathoms of yarn each, are put into a frame at one end of the walk, and the yarns are "hauled down" into strands. Three or more yarns pass into a tube, which compresses and moulds them into a strand; and the three strands of the rope, emerging simultaneously from as many tubes, are drawn along the rope-walk by another machine the full length of the building. Each strand is now separately and simultaneously twisted until it is hard, and then the three are allowed to come together and close up into a rope. A suitably-shaped triangular wedge is placed between the strands to prevent them from closing up too fast, and the whole process goes on slowly under the personal inspection of a workman. The process is the same, whether the rope be large or small, or tarred or white. Since 1827, when rope-factories were started in Wheeling, Cincinnati, St. Louis, and Louisville, the machinery has been propelled by steam, and a stronger twist has been given to rope, and its strength increased. The breaking-strain of hemp rope was about 9,200 pounds to the square inch when made by the old processes: the breaking-strain has risen as high as 15,000 pounds of late. Twine is spun from cotton and flax by the ordinary processes of spinning, the fibre being carded, drawn, twisted, and reeled by appropriate machinery.

Number of rope-factories in 1870.

In 1870 there were in the United States 201 factories of cordage and twine, employing 3,700 men and boys, and turning out work worth $9,000,000 annually. The factories were scattered all over the country; but the large majority were in the East. Those on the Atlantic seaboard were largely supplied with imported hemp; those in the interior, entirely with the native article.

Wire rope.

Wire rope is now beginning to supplant hemp for ships and hoisting-apparatus and many mechanical purposes. It is probable that it will soon take the place of hemp for all purposes where great strength and light weight are desired, as in heavy rigging, cables, &c.

For the finer qualities of bagging, such as for grain and flour sacks, cotton and flax are principally used; for the coarser sorts, hemp and jute are the favorite materials. Jute is a grass growing seven or eight feet high, the peculiar product of India, which was unknown to Europe until 1830, and first became known to the civilized world from the fact that it constituted the materials of which the gunny-bags were made in which Indian produce was exported. Attention being attracted to the fibre, it was exported to England; and the city of Dundee in Scotland developed a great manufacture of it into gunny-cloth. Scotland is still the principal seat of the industry; but the United States has since 1860 taken to the manufacture of jute bagging also, and now imports sixty thousand tons of jute-butts annually for the purpose. The bagging is useful for putting up the cotton and wool crops. The total value of the raw jute imported is about $2,500,000, and the bagging made from it $4,500,000. Attention has latterly been drawn to the possibility of raising jute in the United States. Experiments have been made with success in Louisiana; yet it is doubtful whether it is wise to encourage this crop. Half or more of the flax-crop of the United States is thrown away by the farmers after the seed is thrashed from it, the flax being raised only for the seed. A better bagging can be made from that refuse flax, or the flax-tow, than from jute-butts, as there can be also from hemp-tow. It would be more patriotic and prudent to encourage the utilization of hemp and flax for coarse bagging than to expend any effort on native jute. It is interesting to note that the long-decayed industry of whale-fishing has revived with the jute-manufacture, a great deal of oil being consumed in that business.

Jute.

Jute-raising in United States.

Use of refuse flax for bagging.

Since 1860 the manufacture of bags of paper has been added to the industry, and now occupies a very distinguished position. The idea of the inventors was to create something which would answer the purpose of flour-sacks, which, owing to the scarcity of cotton, were very expensive. They employed for the purpose thick manila paper, and succeeded admirably. About forty factories are now devoted to the industry; and they are producing bags of all sizes and strength, from the little package-bag in which the customer takes home a pound of candy to the huge sack holding one or two hundred-weight of flour.

Paper bags.

To flax, hemp, jute, and cotton-bagging, there are now devoted about eighty factories, producing about $15,000,000 worth of goods.

SOAP.

The French, the sunniest and most polite people in the world, love to believe that nearly every thing which ameliorates life, and renders social intercourse pleasant, was invented among themselves. They claim the origin of soap, of course. The south of France has always had an abundance of olive-oil and soda. The writers say, that, away back in the twelfth century, a fisherman's wife at Savona, who had warmed some soda lye in an earthen jar which had formerly held olive-oil, discovered

Soap, of French origin.

in the jar a new substance, which attracted attention on account of its utility, and led to the establishment of regular factories for its manufacture. From the name of the village, the new substance was called *savon*, — a word which survives in Saxon in the adjective saponaceous. It is certain that soap was made at Marseilles in the twelfth century, and that that city has ever since been the principal centre of its manufacture in the world at large. In 1860 30,000 workmen were employed there in that one industry, and the product was over 60,000 tons. The use of soap spread from Marseilles all over France, and thence all over Europe and to the rest of mankind. The manufacture has always been a prolific source of prosperity for that great maritime city, both because it added largely to the commerce of the port, and because it gave employment to so large a proportion of its own population. The soaps were perfumed, and were of exquisite delicacy and beauty.

Decline of soap-manufactures in France.

In 1877 the manufacturers of Marseilles awoke to find that the sales of their famous products were falling off in an alarming manner. North America, which formerly took so large a quantity of the goods, no longer was buying them. The South-American demand began to fall off. Europe itself was not so large a consumer. Upon investigation, it was found that the trouble was due to several causes; and one of them was the fact that the United States had ceased to be a buyer, and not only that, but that she was actually exporting from 5,000 to 10,000 tons of common and perfumed soaps every year to the countries formerly supplied by France. The matter was considered of so serious consequence, that the attention of the government of France was called to the matter. Nothing, however, has been done which could stop the American competition; and the consequence is, that the ancient city of Marseilles appears to be doomed to see a portion of her industry permanently go from her to the New World.

Importation of soap into United States.

Soaps and candles, which were always made at the same factory, were imported to the United States in considerable quantities until about 1824, when the tariff was so arranged as to give an impetus to the home-manufacture. Up to that time the only varieties made here were the common soft-soap — which was then, as now, largely a household manufacture — and the common laundry and toilet soaps. Higher grades were attempted after 1824, and made on so large a scale, that the foreign article was virtually excluded from this market. The tariff of 1864 gave another impetus to manufacture by raising the duty from about three cents to ten cents a pound. Since 1864 the American factories have been making the very highest class of perfumed and delicate soaps, as well as the more common grades; and they have, as already stated, not only been able fully to supply the home-market, but to extend their sales successfully to foreign markets.

Tariff of 1864.

Three of the American houses have attained to a great reputation within the last fifteen years; namely, those of Enoch Morgan's Sons, B. T. Babbitt &

Company, and Colgate & Company, all of New-York City. The first-named invented the article called sapolio, in which a fine white powder is incorporated, which renders the soap useful for removing dirt from the hands, and from furniture, wood-work, oil-cloth, &c., by rubbing. Colgate and Babbitt have made themselves known for specialties of their own. All three have employed indefatigably that great resource of the energetic business-man in the present age, — the system of advertising, — and in this respect have been imitated by Higgins and other Western makers. One secret of success in trade is first to have a good thing to sell, and then to let the whole world know it. The peddler travelling along every country street, and knocking at every urban door, was the mainstay of earlier merchants of small goods who wanted to diffuse their wares over the country. Since the multiplication of newspapers, and the enormous increase of travel, printed and painted advertisements have been the resource of those who have a new thing to sell, and want to impress its virtues upon the minds of the people. The soap-manufacturers have filled the newspapers of the land with their notices. They have frequented all the fairs, from the World's Expositions down along the whole line to the annual county displays of cattle and bed-quilts at them all; and have hung up big placards to catch the eye, and inform the mind. They have sent out an army of men with brushes and pots of colored paints, who have covered all the available board fences and barns and conspicuous rocks with huge inscriptions and signs proclaiming the names and virtues of their soaps. They have made it almost impossible for the American citizen to sit down in the retirement of his own home, or to go out into the open air, without seeing something that reminded him of the very excellent character of the latest brand of soap, and how happy he would be, and how rich he would probably get, if he only bought that style of soap very largely. Great ingenuity has been displayed by different makers in preparing their newspaper advertisements. Sometimes these cards are printed as paragraphs of reading-matter, and are frequently sparkling models of wit, beauty, and brevity. Higgins has used the pictorial papers largely, and filled them with imaginary pictures in which a box of his soap constitutes by turns a camp-chair for Bismarck, an iron-clad for the American navy, a coach drawn by a four-in-hand of dogs, a target for a rifle-shoot, &c. The ingenuity of those who have advertised by paragraphs is so great as to be worthy of illustration. Here are a few samples of the style of thing they have resorted to, the paragraphs being technically called at the newspaper-offices "reading advertisements." The samples have been taken at random from the actual paragraphs of these enterprising firms.

Success of American manufacturers.

Advertising.

"Shakspeare says, 'Care is no cure, but rather corrosive, for things that are not to be remedied.' We cannot associate care and corrosion, however, with ——'s Toilet-Soap; for it saves care, and is deliciously emollient. This new toilet-soap is the highest achievement of a well-known manufacturer for its perfect purity, and pleasant re-action on the skin, combined with a sweet natural odor."

"Poets and essayists have delighted in the supreme delights of country life, and its accompaniments of health, and peace of mind. But body and mind require the help of regular habits and cleanly habits. Why not, then, sing the praises of ——'s Toilet-Soap? The purest of all toilet-soaps (for none but the finest vegetable-oils enter into it), and exhaling a delicate violet-odor, it needs only to be tried to become a household necessity."

"According to Voltaire, perfection is attained only by slow degrees and the hand of time. This is peculiarly the case with inventions and discoveries. For instance, —— has been forty years in applying and perfecting his chemical science: therefore we have his new toilet-soap, — an article for the toilet and bath-room that cannot be overpraised for its excellences. As a test, it is found to be the most admirable in the world for the delicate skin of babes."

"Old Fuller, the excellent preacher, says, 'If thou wouldst please the ladies, endeavor to make them pleased with themselves.' You can help to do this by recommending them to use that superb toilet-article, ——'s soap. Nothing can equal its excellences: for the purest oils only are used, and the resources of science are artistically and scientifically lavished upon it; and a delicate fragrance is the result."

This exaggerated style of advertising is amusing in many respects: but it requires men of wit and scholarship to pen their paragraphs; and, as an investment of money, they have proved very remunerative. None of the manufacturers who have resorted to this plan of introducing their goods to the public have failed to make a fortune by it.

Soft-soap.

Soft-soap is made by boiling the scraps of fat from kitchens with a strong lye made from wood-ashes, or directly from potash. The hard bar-soap of commerce is made in the same way, except that the materials are more choice, and that twenty-five or thirty per cent of powdered rosin is added, and saponified with them. Caustic soda, prepared for the purpose, is now generally the alkali used for all soaps, in place of the lye made from wood-ashes employed by our forefathers. Marine soap is made from cocoanut-oil. It is very hard, will hold a great deal of water before dissolving, and can be used to wash with salt water. It has a heavy, disagreeable odor. Toilet-soap is made from very pure and sweet materials, such as olive-oil, sweet-almond-oil, beef's marrow, and refined sweet lard. The Marseilles soaps have gained their unequalled reputation by being made of olive-oil, from which fact it has happened that the soap has been entirely free from the heavy animal odor which generally attends common soaps. The materials for the cakes for the toilet are saponified without heat, and perfumed with vegetable-flavors. A very good toilet-soap is made, however, by cutting very pure tallow-soap into thin shavings, and melting it over a water-bath with rose and orange-flower water and common salt, in the proportion of twenty-four pounds of soap to four pints each of the perfumed waters and half a pound of salt. When cold, next day, the soap is cut into small bits, thoroughly dried in the shade, and again treated, as before, with rose and orange-flower water. It is cooled, powdered, and dried again. By this process all unpleasant odors are removed. Castile-soap is made from olive-oil and rape-seed in France, but from various mixtures of fats and oils in this country. Oxide of iron imparts the strongly-marbled appearance of this product. Soap is also made from glycerine and many other substances.

The number of factories in this country at present devoted to soap and candles is nearly 650. They produce about $25,000,000 worth of goods annually.

FLOUR.

Capacity of United States to feed the world.

The United States has become one of the great sources of the food-supply of the world. It is the aim of every free and independent nationality to make sure of its food-supply by raising it at home; but some of the countries of the Old World have utterly failed in every attempt in this direction, and some of the richest of them — especially France, Great Britain, and the Netherlands — are obliged to buy food from other nations. This is also the situation of the West Indies and South America. The United States, on the other hand, with her fertile fields and active population, has managed to raise all the food her population of forty-five million can possibly consume; and she has, besides, a surplus of grain alone every year to sell which will support thirty million people a year. Accordingly, this country not only does not import food, but it exports largely to the kingdoms of the Old World, and to those regions in the tropics which prefer to raise coffee, tea, and tropical fruits, rather than a great supply of provisions.

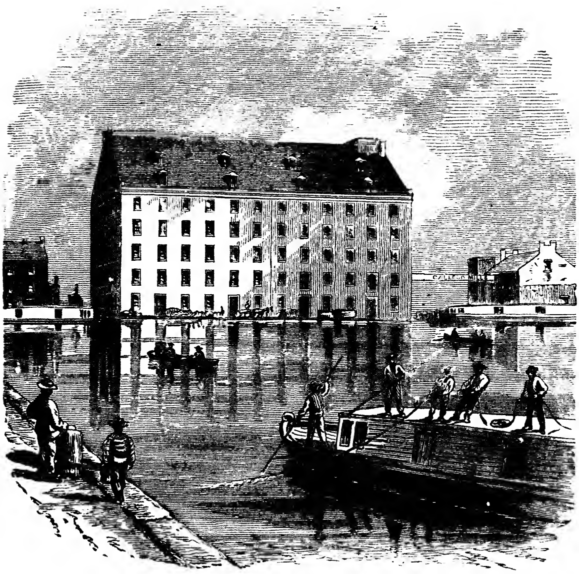
The grain-crops of the United States now amount, in an average year, to about the following figures in bushels: —

Wheat	290,000,000
Corn	1,300,000,000
Rye	20,000,000
Oats	330,000,000
Barley	40,000,000

Of this enormous yield, about 60,000,000 bushels of wheat and 70,000,000 of corn are exported to other lands. A part of what is left is consumed in replanting the earth, and in the manufacture of starch, hominy, and whiskey. There remain about 250,000,000 bushels of wheat and 1,000,000,000 bushels of corn, which are consumed in the United States as food. A part of the corn is fed to the flocks and herds of the country in the grain. A part is also used as fuel in years of excessive abundance and expensive transportation. One-half of the corn, however, and three-quarters of the wheat at least, are ground up into flour and meal for bread.

Colonial mode of making flour.

Grain was reduced to flour, in the early days of the settlement of the country, by breaking it with a hand-pestle in a mortar made from a hollow stump. This was the red man's mode of making bread. The white man improved upon it a little by rigging up an apparatus like a well-sweep, and suspending the heavy pestle from that, so that it could be operated with less expenditure of labor. The windmill was, however, soon introduced, and finally the gristmill run by water-power; and the settlers gladly allowed the grindstone to supersede the laborious pestle and mortar, which it did immediately. The flouring-mills were a great convenience to the people; and they have been an institution of such positive necessity, that they have multiplied in all parts of the country as fast as the population.



GALLEGO FLOUR-MILLS.

Former superiority of New York as a flour-making State.

Twenty years ago the largest flouring State in the country for the supply of the general market was New York. This was due to the abundance of water-power in that State, and the large number of canals and railroads available for collecting the grain and distributing the flour. The grain came largely from the farms of the State itself, but also, in part, from the West. The city of Rochester was the principal centre of manufacture, owing to the luxuriant water-power of the famous Genesee River. The cities of Baltimore and Richmond also became famous milling-centres. At the latter two places a large part of the surplus grain of the South was concentrated for conversion into flour, and distribution to market.

Baltimore and Richmond.

Since 1850 the manufacturing-centre for the general market has moved backward. The great flour-cities of the country are now in the heart of the grain-regions of the West. Louisville, St. Louis, Chicago, Minneapolis, St. Paul, Milwaukee, Toledo, &c., are now the flour-cities *par excellence;* and it is from their mills that the barrelled product comes which is distributed through the older States, and sent abroad, bearing the enthusiastic brands of "Old Glory," "Gilt Edge," "Sea-Foam," "Red Letter," "Peerless," "Monarch," "The Pride of the Border," "Hallelujah," and so on. How rapidly the milling-interest has developed since the opening of the West to free settlement may be seen from the following statement of the total number of flouring-mills in the United States: —

Names of brands.

1840	4,364
1850	11,891
1860	13,868
1870	22,573

The product was worth $136,000,000 in 1850, and $248,000,000 in 1860; but in 1870 it was worth $445,000,000, and in 1878 it must have been at least $550,000,000.

In the Eastern States the mills are run principally by water-power. Along the coast and on the islands many old windmills still stand, and grind, in their quaint, leisurely way, the corn and wheat of meal communities. Steam-mills generally supply the cities. In the South wind and water power is chiefly used; but in 1870 Texas had also fifty mills driven by horse-power, and seventeen by oxen. This sort of motive-power was also resorted to more or less in most of the other Southern States, the mills in that section being numerous, but small. An instance of the small size of the Southern mills can be given. North Carolina had about 1,450 mills in 1876 as against 1,400 in Ohio; yet North Carolina produced only about $8,000,000 worth of flour and meal, while Ohio produced more than four times as much. In the West steam-power and water-power are used. The mills of the West are very large: the bulk of the flouring for the general market is now done in that part of the country. Illinois, Indiana, Michigan, Minnesota, and Missouri are the principal milling States. New York and Pennsylvania, however, by reason of their dense population and heavy local consumption, still grind the most flour; but it is chiefly consumed by the States themselves.

Mills in the Eastern States.

Southern States.

In the West.

The ordinary operation of grinding grain is carried on by letting the grain flow slowly down between two heavy grindstones from four to six feet in diameter, weighing about 1,400 pounds apiece; the lower one stationary, the upper one revolving at a speed of 120 revolutions a minute. The grain enters between the stones through an aperture in the centre of the upper stone, and is ground to powder speedily. The flour and bran flow from between the stones into the tight box which surrounds them, and are carried off by spouts to be sifted and separated. Within

Process of making flour.

a very few years a new process has been invented, which promises to revolutionize the business of grinding. The plan is to let the grain flow into a hollow cylinder, within which a forest of iron spokes, mounted upon the axis of the cylinder, is revolving with great velocity. The grain is struck in the air, and reduced by collision rather than by grinding. Another and better known "new process" is the invention of Mr. Lacroix of Faribault, Minn., and dates from 1872. The plan is to let the stones revolve slower, so as to grind the grain more coarsely. The flour is bolted upon very large bolting-cloths with the aid of an exhaust draught of air and of brushes, which prevents the cloth from clogging. It is claimed that eight or ten per cent more flour is gained by this process.

The exports of flour are now 3,900,000 barrels yearly, and of meal 445,000 barrels. The exports of both ought to be largely increased. England grinds our grain, and derives a profitable trade by sending it as flour and meal to South America and other non-food-producing countries. We ought to grind that grain ourselves, and obtain the profit of the manufacture. We might also grind some portion of the 115,000,000 bushels of grain sent abroad every year in the kernel.

The Southern flour is the best for export, because it has the quality of standing the moist ocean-voyage better than other flours. Richmond, Baltimore, and St. Louis supply the bulk of the flour for export.

MUSICAL INSTRUMENTS.

In distant Europe the people expect very little of the United States in an art point of view. They look upon the country as half-savage yet. They think everybody carries a revolver, and drinks a great deal of whiskey straight, and can go out of town into the country any day, in any part thereof, and kill a wild Indian or a rampant buffalo within a few miles of the city. They look upon the United States somewhat as they do upon Siberia, whose only value to Europe consists in its producing savage dogs of great size and beauty; or as a barbaric country, from which it is absolutely out of the question to expect any product of genius and high artistic culture. It was therefore possible in 1875 for an English clergyman, the Rev. H. R. Haweis, to write his charming book on "Music and Morals," in which he discussed music and musical instruments in all their phases, historical and otherwise, and absolutely without referring to the existence of such a thing as an American piano, organ, or violin; and the book was reprinted in the United States too. Yet the American piano, organ, and violin are concededly the best made in the present age of the world. The European makers of pianos have been defeated at every international exhibition since 1862 by one or both of the American houses of Chickering and Steinway, in respect to touch, tone, bril-

European idea of America.

Superiority of American pianos.

liancy, durability, and all the other desirable qualities of the piano. Broadwood (whose pianos often cost $6,000 in London in 1851), Erard, Collard, and Pleyel have all failed to surpass the American makers. The American cabinet-organ is superior in all respects, and has a world-wide sale. It has been discovered of late years that New-York City possesses a violin-maker, Gemünder, whose work ranks with the best which is produced in the ancient capitals of the Old World. It is a singular comment on the lack of candor and fairness in the English mind, that the production of such remarkable instruments in America was not alluded to in any manner in the book above referred to, which professed to be standard on the subject of which it treated.

Fondness of man for music.

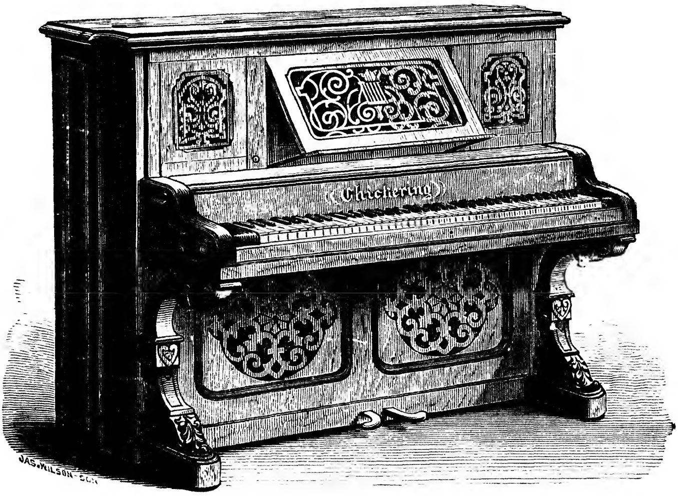
The human family is fond of music, and the variety of musical instruments in use is large. Every nation contributes its quota to the vast multitude of contrivances for producing musical sounds. Wild countries have eccentric creations of bamboo and hide, horn trumpets which can be heard three miles, and violins, ornamented with tusks and men's heads, which produce shrieks of noise that would make an American's hair stand on end. From this class of instruments, up to the melodious organs, violins, pianos, and brass horns in use in civilized regions, there is a wide interval; but it is filled with a myriad of inventions of all degrees of originality and perfection. The piano, which stands near the head of the list of perfect instruments, is comparatively a recent invention, dating back no farther than 1760. It had ancestors which resembled it somewhat, however, in the queer old psaltery and dulcimer (boxes across which strings were stretched), the clavicitherium (with a keyboard, the strings being plucked with quills), the clavicymbal, the virginal, the spinet, and the harpsichord. The harpsichord was the instrument in use by our great-grandmothers. It was the first one of the series in which the strings were struck by a hammer. Prior to 1760 the strings had been plucked with a quill. A few specimens of the harpsichord are still extant among the older families of the country. One made for Charles Carroll was exhibited in Philadelphia in 1876.

Jefferson.

The expense of the larger musical instruments prevented many people from owning them in this country until after the manufacture began here. A great many violins and accordions, which cost little, were owned by the people, and helped solace the loneliness of the farms, and the lack of popular amusements in homes in the cities. Jefferson was an accomplished musician with the first-named instrument. But harpsichords and pianos were seldom seen. A few were imported by merchants for sale in the cities; and great musicians who came over here to give concerts generally brought pianos with them, which they generally left behind when they returned to Europe: but, on the whole, the instrument was as rare as appointments to positions in the President's cabinet. It was, moreover, even as late as 1825, still a thin-toned, feeble instrument. It was made with a frame entirely of wood, and could not stand our climate.

In 1822 Jonas Chickering of Boston, a young and intelligent mechanic with a love of music, began to experiment at piano-making. His first instrument was offered for sale in April, 1823. Chickering began, almost from the very outset, with pianos which were a long stride ahead of the European instruments in purity and resonance of tone, and in the length of time they would remain in tune. He made the entire frames of his pianos of iron instead of wood, and introduced the circular scales, arch wrest-planks, and tuning-blocks. The iron frames were a great improvement. The strings of a piano pull enormously; and, unless the frame is perfectly rigid and unyielding (which the wooden frame never was), the piano will get out of tune rapidly, and soon wear out. The pull of the strings of

Jonas Chickering.



CHICKERING PIANO.

a modern grand piano is between eleven and twelve tons. The iron frame was improved by other makers, and was soon adopted generally both in America and Europe. Alpheus Babcock of Philadelphia got a patent in 1825 for an oblong frame, the shape of which caused it to resist the tension better. Conrad Meyer of Philadelphia, in 1833, made square pianos with full iron frames substantially like those now used by American makers.

Conrad Meyer.

There were other makers in the business in the early part of the century: among them were Stodart, Osborn, and Thurston; Stodart, perhaps, being the most popular. All the makers displayed great ingenuity in increasing the richness and brilliancy of tone of their pianos; and they were rewarded, in the prosperous times following 1825, by the large demand which grew up for their instruments. Competition between them

Early piano-makers.

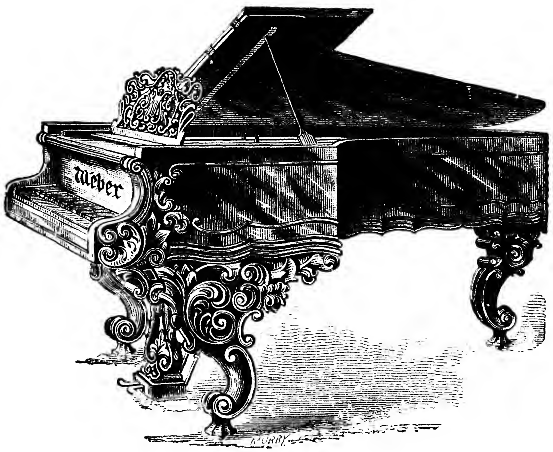
reduced prices, and the sales soon increased to several thousand a year. The sale has since been constantly extending. Chickering took the lead after a while, and in 1853, when he died, was selling eight hundred pianos a year. By 1867 the firm had sold in all thirty thousand pianos, and was ahead of all competitors. The house has since increased its sales to more than three thousand a year.

In 1855 Steinway & Sons of New-York City introduced the second of the two striking improvements which have been made in the piano by American makers: this was the "overstringing" of the bass-strings, as it is called; that is, taking them out of the horizontal plane in which the tenor-strings are placed, and stringing them over the others, and nearer the middle of the sounding-board. By this improvement, and a new arrangement of the bridges, Steinway & Sons increased the length of the bass-cords over the sounding-board from forty to sixty-four inches. This brought a wonderful access of power to the instrument. All the other makers, American and foreign, were soon compelled to adopt this excellent arrangement of the strings. They were the first to manufacture improved grand pianos in this country. Their first essay in this direction was brought out in 1859, and appeared in concert at the New-York Academy of Music.

Steinway & Sons.

In 1860 Lindeman & Sons of New York patented a cycloid piano which received universal commendation; and Decker & Brothers, J. P. Hale, Harris Brothers, and Albert Weber, of New York, Knabe & Company of Baltimore, William P. Emerson, and Hallet, Davis, & Company, of Boston, and others, in turn, brought out special styles and patents. All these makers have had a great sale of their instruments. Steinway & Sons took the lead in 1869.

Other inventors.



WEBER PIANO.

The annual production of pianos in the United States is now about forty thousand: in Europe it is only about twenty-five thousand. In 1867, at Paris, the first prizes were given to Steinway and Chickering. The United States now outstrips the Old World both in the extent of production and the quality of her pianos; and she has the three largest factories in the world. She can well sustain the neglect of Haweis in "Music and Morals" with equanimity, in view of these facts.

Joseph P. Hale.

Within the last two years, one of the New-York factories (that of Joseph P. Hale) has begun to do business on a scale which promises to put its sales ahead of that of the houses of both Chickering and Steinway. Mr. Hale, a Massachusetts man by birth, began piano-making in New York in 1860, after having first accumulated a fortune in the crockery and real-estate trades in Worcester, Mass. His purpose was to cheapen the selling-cost of the piano. He wanted "the people," as contrasted with the upper ten thousand, to have a piano which would be both good, and cheap enough for them to afford. He entered upon the manufacture on a large scale, and by 1872 had a factory in New-York City capable of building sixty pianos a week. He has recently undertaken to increase the capacity of his factory to a hundred and fifty pianos a week; which would be three times greater than that of any other factory in the world, and would supply one-fifth of the trade of the continent. Mr. Hale's operations made a great sensation in the piano-trade in 1877.

Number of factories.

In 1870 there were 156 piano-factories in the United States, employing 4,200 people, and producing 24,306 pianos worth $8,330,000. The number of factories does not increase; but the production has now nearly doubled.

Cabinet-organ.

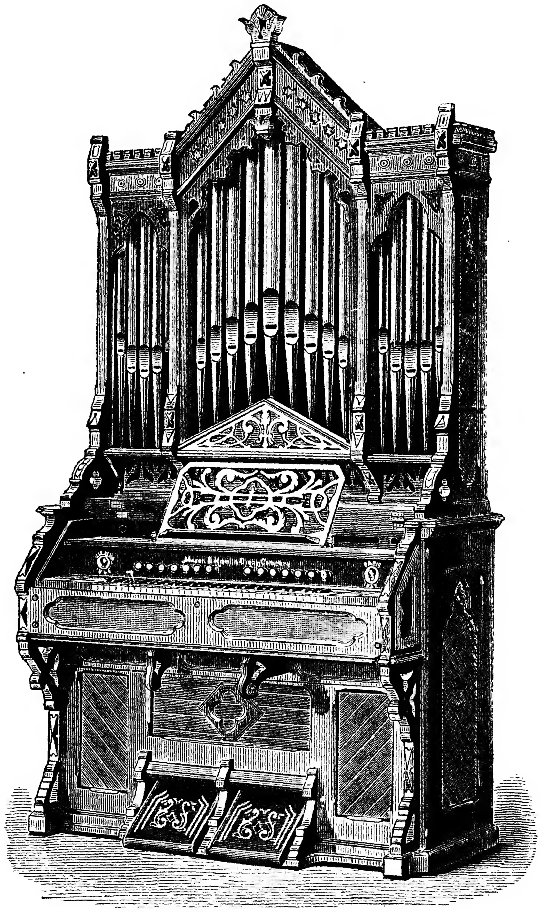
An instrument which is contesting for the palm of popular favor with the piano is the sweet-voiced cabinet-organ, whose gentle and sympathetic tones are far better adapted to the quiet and repose of the family life than the more brilliant but less gracious piano: in fact, it might have been said that the contest is ended in favor of the cabinet-organ, were it not for the fact that its larger sale is partly due to its cheaper price, and that the recent reduction in the price of pianos leaves the contest for the ultimate largest sale still an unsettled question.

An American invention.

The cabinet-organ is an American invention: it sprang from so humble an origin as the accordion. It is a reed-instrument, the tones being produced, not with the aid of pipes, but by the vibrations of a thin strip of brass from half an inch to several inches in length, fastened at one end over an aperture in a metal plate through which a current of air is forced or drawn. The original patent was issued to Aaron M. Peasley, in 1818, for what he called "an improvement in organs." At first the reed-organ was simply an accordion, or lap-melodeon; and it was in that form that manufacturers, for a long period, improved and sold it. It was enlarged by different makers, strengthened in power, and finally improved in tone by curving the reeds into an S. It became popular for accompaniments to church-music about 1840. In 1846 Jeremiah Carhart, then of Buffalo, invented the modern "melodeon" by fitting to the reed-organ a pair of exhaust-bellows and a regular key-board. It was provided that the air in this instrument should be drawn inward through the reeds, rather than blown outward. The change improved the tone, prevented the reeds from sticking, secured a prompt response whenever a key was touched, and brought with it many other advantages. Mr. Carhart, and Prince & Company, made four-octave melodeons on this plan for two or three years, and then increased their scope to five octaves. Many changes of detail were made in the arrangement of the interior apparatus from year to year, and the tone and working of the instrument were improved. The machine still lacked the perfect sweetness which it ought to have had.

Emmons Hamlin.

In 1849 Emmons Hamlin, a young man in the employ of Prince & Company of Buffalo, hit upon the happy idea of giving a slight twist to the curved reeds. The change eliminated all harshness from the tone of the reeds, and made them soft and musical. It led, also, to experiments in the direction of giving different qualities of voice to reeds by alterations in their size and form, which have since proved successful. Prince & Company immediately adopted all the new ideas in their melodeons, and presented to the public a class of instruments which instantly became a powerful rival to the piano. Said Spenser in a retired nook of an ancient palace,



CABINET-ORGAN.

> "My love doth sit,
> Playing alone, careless, on her heavenly virginals."

If the ancient virginal, with its faint, thin voice, could have filled the poet's head with dreams, what would not the divine, assuaging strains of the sweet melodeon, now brought to perfection, have done in that direction!

Progress of the manufacture.

In 1854 Mr. Hamlin formed a partnership with Mr. Henry Mason, son of Dr. Lowell Mason the composer, and began the manufacture of reed-organs upon a large scale in Boston. The firm first presented to the public their organ-harmonium, with four sets of reeds and two manuals of keys. In 1861 they brought out the school-harmonium, in 1862 the cabinet-organ. They have since constantly developed the resources, sweetness, and scope of their instruments, until they stand absolutely at the head of manufacturers of reed-organs in the world at large. They are not, however, the only American makers who excel the French, German, and English makers: many others do that, and among them the B. Shoninger Organ Company of New Haven, Conn.; the Quaker-City Organ Company, Philadelphia; Peloubet, Pelton, & Company of New York; the Benham Organ Company of Indianapolis; the Clough & Warren Organ Company of Detroit, Mich.; and the Taylor & Farley Organ Company of Worcester, Mass. It is believed that these makers all build upon the exhaust or American plan; and their instruments are certainly superior, in sweetness, variety, and rapidity of execution, to European organs, — a fact which is recognized by the large foreign sale of their organs. They receive orders from every continent in the world, and send abroad about $600,000 worth of instruments annually.

Number of establishments.

The manufacture in the United States is now being carried on in about seventy-five establishments. In 1870 the production had already reached 32,000 instruments a year, which was a good ways ahead of the manufacture of pianos. It cannot at present be less than 50,000 a year.

Pipe-organs.

In the building of pipe-organs for churches the United States have made some progress. They are able now to depend upon their own factories for all that they need in this class of musical instruments. The principal makers are Hook & Hastings of Boston, and George Jardine & Son of New York. About 700 church-organs are made every year.

Manufacture of brass instruments.

The manufacture of brass horns and trumpets, violins, banjos, guitars, drums, cymbals, xylophones, gongs, accordions, tambourines, and all other instruments, both for serious and comic use, is now conducted upon a large scale. The industry is in a very healthy state. The highest class of brass and silver pieces, and of violins, is being attempted, and reasonable success has been attained by a few makers. Gemünder of New York, especially, has done well in violins. The manufacture now amounts to about $2,500,000 worth yearly. There is a fondness for European instruments of these smaller kinds, however, which our makers have not yet conquered; and $700,000 worth of them are imported yearly. The triumph which the piano and organ makers have won has yet to fall to the lot of the makers of these smaller instruments. That the latter will yet carry their eagles all over the musical world and subdue it, as their brothers have done before them, is, however, certain. They have the talent, and it only needs time and patient study to accomplish the result.

Two-thirds of all the musical instruments in the country are made in New-York City, Boston, and Philadelphia, the cities taking rank in the order named.

MATCHES.

The means of lighting a fire were so poor in the days of our forefathers, that a fire was dispensed with whenever possible; and where a fire was absolutely necessary, as in the kitchen, it was kept alive constantly, like the flame on an ancient altar, by feeding, and by covering the coals at night with the ashes. The usual way of kindling a fire in those days was to strike a shower of sparks from a piece of flint into a few scorched cotton or linen rags, which, by a little gentle blowing, would then be made to burst into a flame. Phosphorus was not discovered until 1677, and it was not until a hundred years afterwards that it came into use at all for lighting fires. There were two ways in which it was then used. A piece of phosphorus was put into a vial, and stirred with a hot wire, so as to coat the bottle with oxide of phosphorus: the bottle was then tightly corked. When wanted for use, a splinter of wood about six inches long, the end of which had been coated with sulphur, was dipped into the vial, where it took fire from the phosphorus, and was lighted. This process of getting a light was in use almost within half a century: only the rich employed it. Another plan contemporary with it was to employ an oxymuriate match. A stick of wood about six inches long was tipped with sulphur, and then, with a paste made of chlorate of potash, gum, and sugar, colored with vermilion. Vials containing a piece of asbestos soaked in oil of vitriol were sold with them. The match, touched to the oil of vitriol, burst into a blaze.

How fires were formerly lighted.

Discovery of phosphorus.

How it was at first used.

In 1829 an English chemist discovered that chlorate of potash would ignite by friction; and this gave rise to the modern lucifer-match. The new style of match was tipped with chlorate of potash, sulphate of antimony, and starch, and was lighted by drawing between folds of sand-paper. The manufacture of this class of matches began soon afterward in the United States, in New England. They were called "locofoco" matches popularly, the jingling and unmeaning name being given them for comic effect. The Democrats in 1835 acquired the name of "Locofocos" as a political party from the use of these matches. The New-York Whigs had called a meeting; and the Democrats, in order to get possession of the hall, came in and blew out the candles. The Whigs retired; and the Democrats then relighted the candles with locofoco-

Discovery which led to the making of the lucifer-match.

"Locofoco" matches.

matches, and went on with the meeting. The matches were also called "Congreves," because they were explosive like the rockets of that name. In 1834 phosphorus was for the first time applied to the match itself. In 1836 Alonzo D. Phillips of Springfield, Mass., got a patent for phosphorous matches, which was a step in advance of the old kind; and since then the manufacture has been carried on in the United States on a large scale. The length of the match was reduced to about two inches. Machinery was invented for making the wooden splints, and performing different operations of the manufacture; and the business was so systematized, and entered upon on such an enormous scale, that matches soon became, not the luxury of the rich, but the cheapest article which entered into the retail trade of the people. In 1850 A. Beecher & Sons established a large factory of matches at Westville, Conn.; and in 1854 Swift & Courtney went into the business at Wilmington, Del. The two firms consolidated in 1870 as the Swift, Courtney, & Beecher Company, and now constitute the principal house in the business in the United States. They have branches in Philadelphia, New York, Baltimore, and Chicago. There are at present about eighty establishments in the business. The manufacture is enormous, reaching about 15,000,000,000 matches a year.

Invention of Alonzo D. Phillips.

Extension of industry.

Friction-matches were first made in combs of a dozen or two each. In this form the wood was very conveniently arranged for dipping into the melted sulphur, and afterward into the chemical preparation of phosphorus, or chlorate of potash. Each match was broken off as it was wanted for use. This style of match is still largely made for its cheapness. The more convenient and now more common form in which matches are sold is in bundles or boxes, containing anywhere from twenty-five to five hundred. The splints are formed by machinery, which will make two million in a day. They are rolled into flat bundles eighteen inches across by machinery, each splint being held apart from its neighbors; and are then dipped by hand into the chemical preparations necessary to cause them to ignite. One workman can dip a million matches in an hour. They are then dried, and put up in packages for the market.

Process of making.

The match-business is now the principal customer for phosphorus, and one of the large ones for sulphur. It is said that ninety-five per cent of all the phosphorus made is consumed in match-making. The business has been in the past an unhealthy one, owing to the poisonous character of the chemicals used. In England, where match-making used to be carried on largely at home, the poor people engaged in it were never free from the fumes. At night their very clothing was luminous: in the day-time white vapors were continually rising from them. American ingenuity, by introducing the use of machines, has made the business a very different sort of an occupation; and it is now as healthful as the majority of trades.

Quantity of phosphorus consumed in match-making.

Among the matches now made are several for special uses, — the parlor-match, for instance, which uses no sulphur, and is thus free from the choking fumes of sulphur; the smoker's match, which blazes strongly, and can be used to light a cigar in the wind or rain; and the wax match, which burns a long time, and is an elegant affair for dainty uses.

Various kinds of matches.

GLASS-WARE AND POTTERY.

The first glass-factory in the United States was started in Virginia almost immediately after the founding of the first settlement. It is said that the very first cargo sent back to England contained "trials" of glass made in Virginia. There is very little on record about that original establishment; but it appears, at any rate, that it stood in the woods, about a mile from Jamestown, and that a portion of its product was in the form of glass beads to be used in the trade with the Indians. In 1621 a fund was subscribed to establish a factory especially for glass beads. Italian workmen were sent over to get the works in operation. Whether one or more factories were in operation in 1632 is not known; but one certainly was. It was broken up, however, in that year, by the Indians, who invaded the colony, and destroyed factories, the crops, and the settlers, indiscriminately. The glass-bead business was not again resumed in Virginia for more than a hundred and fifty years.

First glass-factory in United States.

The next essay by the colonists was in Massachusetts. Glass bottles, table-ware, and window-glass were universally wanted, and the colonists were not satisfied with the slow and costly business of getting them from Europe. Factories were accordingly started at Braintree at a very early date, and at Salem in 1639: they were encouraged by the government of the colony of Massachusetts, and appear to have thrived for a long period. The one at Braintree remained in operation nearly until the time of the Revolution. Philadelphia had a glass-house in 1683. An old map of New-York City shows that there were two glass-factories at that place as early as 1732. During the Revolutionary war window-glass was made in New-Jersey; but it was a very inferior article. After the Revolution the manufacture of glass was encouraged both by the national and by several of the state governments, as being one of the backward industries of the country. Ten per cent duty was levied upon all imported glass-ware by the former. In 1788 the legislature of New York loaned three thousand pounds for eight years to the proprietors of a glass-factory near Albany, and about 1803 Massachusetts voted a bounty to a factory in Boston for every table of window-glass made. The manufacture was encouraged in Connecticut, Maryland, and Virginia; and all of these States had small factories in operation before the beginning of the present century. The business began at Pittsburgh, Penn.,

Glass-making in Massachusetts Colony.

Encouragement of industry after Revolutionary war by the states and nation.

in 1796, with the establishment of bottle and crown glass works by Gen. O'Hara. This factory met with great success; and it is in operation even at the present day, under the ownership of Thomas Wightman & Company, though, of course, so enlarged and changed as to possess only the soul, and not the body, of the original works. Pittsburgh became the principal glass-making city of the country in a very few years. Gen. O'Hara's success inspired others to go into the business, and the war of 1812 operated to provide still further inducements by raising the prices of glass-ware; and, as Pittsburgh was sufficiently remote from the coast and frontier to be safe from the operations of the war, by 1814 there were five glass-furnaces in blast in that city, making bottles, window-glass, and table-ware. One of them was the flint-glass-works of Blakewell & Company, the pioneer of its class in America. This concern imported its workmen: it made sets of table-ware for two presidents, and also produced a splendid vase which was subsequently presented to Lafayette.

Success of factory at Pittsburgh.

The United States were designated by nature as a glass-making country. The land is stored in every part with sand, limestone, and disintegrated quartz-rock of the best quality; and there has always been an abundance of cheap fuel. Only one of the materials entering into the composition of glass is not present in this country in abundance: that is soda, which constitutes twenty per cent of the weight of glass. This can be obtained, however, as cheaply as it can be in England, Belgium, and France; and the possession of the other materials is a qualification for the business such as few other countries are endowed with. There has been, therefore, a considerable growth of the business, especially in Pennsylvania, New Jersey, and New York. The statistics are as follows: —

Favorable conditions for glass-making in United States.

	FACTORIES.	WORKMEN.	VALUE OF PRODUCT.
1832	44	. . . . .	$2,500,000
1840	81	3,236	4,000,000
1850	94	5,571	4,641,000
1860	112	9,116	9,000,000
1870	201	15,800	19,233,000

Of the factories reported in 1870, fifty-two were in Pennsylvania (mostly at Pittsburgh, where there were forty-seven factories in active operation), fifty-four in New York, nineteen in New Jersey, fourteen in Massachusetts, and nine in Ohio.

Notwithstanding this progress, the glass-works of the United States by no means supply the domestic market. No doubt the production of bottles coarse and fine, of lamp-chimneys, good table-ware, and common window-glass, is sufficient for the demands of the country; but in the higher qualities of window, mirror, and plate glass, the production is entirely inadequate. Over six million dollars' worth of these classes of glass-ware is imported yearly from Belgium, France, and England, to supply the deficiency of native production. There is in this direction a large field for the extension of the business. Several places exist in the South where the manufacture could be economically and profitably carried on, Mobile being one of them. There are several good places in the North-West.

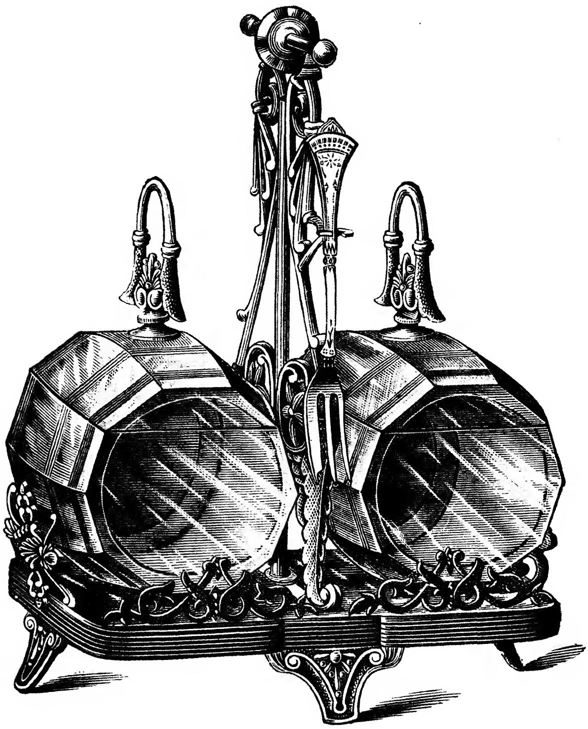
America does not supply her own market.

CASTERS.

In the manufacture of glass-ware there is not one article in ten thousand which is not fashioned at the end of a blow-pipe. Plate-glass for windows, and the lenses of optical instruments, are cast; and goblets, lamps, and some other irregularly-shaped ware, are pressed in dies: but every thing else is taken from the melting-pot in a soft lump at the end

Process of glass-making.

of a blow-pipe, and acquires its first form by the operation of the lungs and hands of the workman. Window-glass is made by blowing the lump into tables or cylinders. The sand, carbonate of soda, manganese, and arsenic, which compose the glass, are first melted down in eight or ten pots arranged in a large circular dome, in the centre of which is the fire. It takes about forty-eight hours to perfect the fusion. When the bubbles are all gone, and the dross has been skimmed off, a workman dips the end of a blow-pipe five feet long, with a diameter ranging from one-fourth inch to one inch, into the melted glass, and takes up a lump of it: he blows this into a large flat globe. A boy affixes to the globe opposite the pipe an iron rod with the aid of a little melted glass, and the blow-pipe and the nose of the globe are then separated from the globe by the application of a piece of cold iron. The globe held by the iron rod is then put into the furnace, and rapidly revolved. It softens, and finally opens out with a flap into a flat dish, which is then kept revolving until it is cold. It is next sent to the annealing-furnace, and its brittleness removed by annealing; and it is then cut up for the market with a diamond-point. The other process of making window-glass is to blow a lump of melted material out into a cylinder, which is done by holding the blow-pipe alternately over the head, and then down below the platform on which the workman stands. In the latter position it elongates into a cylinder. The cylinder being put into the oven, the heated air within bursts out the end opposite to the blow-pipe. The latter end is cut off with a hot iron as soon as the cylinder is cool. The cylinder is then slit once lengthwise, and laid in an oven, where it softens, opens, and flattens down, the workman assisting the



DECANTERS.

operation by working a block of wood over it attached to the end of a rod. The plate is then sent off to be annealed. The distortions which are produced by looking through window-glass come from the fact, that, the inner and outer surfaces of the cylinder being of different lengths, the flattening produces in the glass undulations called cockles.

Bottles and hollow-ware are blown out from a lump of melted material, and shaped in moulds of brass or iron, which open and shut on a hinge, and are worked by the foot. Plate-glass is cast upon an iron slab, at the sides of which are placed bars of iron of the intended thickness of the plate. An iron or copper roller rests upon these bars, and is then rolled over the surface of the melted glass, pressing before it the superfluous material, and giving the plate a uniform thickness. The edges of the plate are trimmed when it is cool, and the plate is then annealed. Flint-glass for table-ware is ground after pressing by means of sand and emery wheels. The sharp edges so often noticed are produced in this way. All glass has to be ground and polished by apparatus specially fitted up for the purpose. Colored glass for stained windows, lanterns, &c., is made by mixing into the melting-pot oxide of gold for red, oxide of copper for blue, oxide of manganese for amethyst, iron ore and manganese for orange, copper and iron for green, and other metals for other colors. The color may be produced in the body of the glass itself, or only on the surface: if on the surface, it is produced by dipping the lump of clear glass into a pot of colored material, when some of the latter clings to the whole surface, and remains permanent in every stage of the subsequent processes. The silvering of glass for mirrors is a simple operation. Tin-foil is spread over a stone table, and quicksilver poured thinly over it. The plate of glass is slid slowly upon the table, pushing the quicksilver before it, the object being to prevent any air getting under the glass. The superfluous metal is then drawn off, and the plate weighted down for several hours. It is then taken up, the tin-foil adhering, and exposed to the air, back uppermost, for several days, until the amalgam is perfectly hard.

Bottles and hollow-ware.

Plate-glass.

The Siemens reverberatory gas-furnace has been adopted in the glass-manufacture, as well as in the iron and steel business, — more largely abroad, however, than in America. It is now considered essential in the making of the higher qualities of glass. The ordinary furnace, with its melting-pots arranged around an open fire-box, is certain to injure the glass by bringing coal-dust, sulphur, &c., into contact with the melting-materials. This is all obviated by the Siemens furnace; and the enlargement of the plate and fine glass business in this country can only proceed with the aid of this style of furnace.

Siemens reverberating gas-furnace.

Pottery was one of the earliest manufactures of the colonists. The London companies sent over potters to all the colonies, and the Dutch did the same for their settlements at the mouth of the Hudson. The colonists could not get on without jars, jugs, mugs, and earthen dishes; and every district of the country had its own pottery. Alexander Hamilton reported in 1790 that the business was thriving. It was one of the few branches of industry which had made itself able to supply the colonial demand. The business is a very simple one, the clays, white and brown, being fashioned by hand upon a little revolving round table directly from the lump, dried in the air, baked in an oven, and then glazed. It is very extensively practised throughout the country, there being about 750 potteries in operation, supplying about $6,000,000 worth of ware every year. Trenton, N.J., is the greatest individual centre of the manufacture.

Manufacture of pottery by colonists.

Number of potteries.

ANCIENT POTTERY — JUG.

Within the last five years the potters have begun to pay some attention to the matter of producing artistic pottery. Their forms had been, until five years ago, of the simplest and most practical description: little was done for beauty, and scarce any pottery was made for purely ornamental objects. A change in reference to form is now taking place. Within the last ten years the attention of makers has been drawn to a collection of pottery nearly two thousand years old, which was dug up from the ruins of the temples in the Island of Cyprus by Cesnola, the consul of the United States, and which was sold to the Metropolitan Museum of New-York City. The lovers of art have gone wild over these treasures, and a mania has grown up for ornamental pieces in the same shapes as many of the interesting antiques in this famous collection. The old mania for artistic china has broken out again too, and these two causes combined have presented to the pottery-makers their oppor-

Cesnola collection.

ANCIENT POTTERY. — JAR.

tunity. Many of the more enterprising firms have recently undertaken to produce jars, vases, mugs, &c., in the antique style; and the market is now full of their ware, and the sales of it are large. Some of the pieces they make they decorate at the pottery themselves in brown and black; but a large proportion of the pieces is sent to the store in the rough state, to be sold to ladies and artists who desire to decorate the jars and vases themselves. The forms of common pottery have perceptibly improved, too, along with those of the more artistic kind.

PORCELAIN PLATE.

Porcelain-ware is also made to some extent in the United States, though this is not yet one of our great industries. New York, Pennsylvania, and New Jersey have excellent factories, making ware from native earths, and decorating it with flower and leaf, and bird, insect, and animal patterns, according to the taste of the day. This branch of manufacture partakes of the character of fine art, and it is not one in which American artisans have yet won any distinguished success. What will be the result when the excellent schools of design in Massachusetts and New York have done their work a little more thoroughly, need not be referred to here; but it may be said

Porcelain.

that there is ample room in the United States for a large corps of native-American decorators. The taste of the people for choice table-ware has outrun the ability of the native factories to gratify it. Decorated china is now the attribute of the rich. It ought to be within the reach of all the people; but it never will be until there are more decorators,—a great many more,—and until all the manufactories can afford to employ them. The decorators are at present principally men of foreign birth and training. The very best class are native artists, who occasionally lay aside the easel to illuminate a jar, a vase, a plaque, or some other object of clay, for a friend or for the market. As before said, it is only the rich that can afford to engage the services of either class. It is not strange that the United States should not yet be great in china and porcelain ware, when we reflect that attention to the industry only began about sixty years ago; while, on the other hand, the porcelain countries *par excellence* of the world have practised the art of moulding and decorating this ware for a period of from three hundred to a thousand years. The best that can be said of the art as it exists in this country at the present day is, that it promises well for the future. It most certainly does that.

PORCELAIN CUP.

GLUE.

The most arid soils sometimes best repay cultivation; and things the most useless and valueless in life often turn out to be, in the hands of those who know their peculiar qualities, articles of priceless merit. It is from refuse that some of the most necessary and excellent commodities of the age are obtained. Glue is one of these commodities. It is made from the trimmings and clippings of hides, which are removed during the process of currying and tanning. Those scraps are not only useless for any other purpose than glue-making, but, were they not available for some such purpose, they would be absolutely unpleasant to have on hand. They would be hard to dispose of, and, unless speedily removed, would be a source of disease and danger. As it is, however, science has put them to use for the production of an article which society could not now get along without; for glue is of universal convenience. It enters into the binding of the books we take up every day; it cements the furniture which we use every hour of our lives; it renders writing-paper capable of taking ink without blurring; it makes turpentine and petroleum barrels tight; it joins the violin; and, in fact, performs a thousand services of the most necessary and interesting description. Were it not for the fact that this article can be made from refuse cuttings of hide which are of no intrinsic value whatever, it would be so costly, that books, paper, furniture, and all objects into the

From what it is made.

Utility.

construction of which it enters, would be so much more expensive, that the increased price might suffice to turn the scale adversely when one was deciding whether to buy those articles or not.

In glue-making, the cuttings of hide, when fresh, are put into a strong solution of lime in order to remove the hair, fat, and bits of meat, clinging to them, and to dispose the cuttings to melt readily upon the application of heat. When sufficiently treated, the scraps are taken out of the lime-water, and washed and dried. The latter process is performed in the most thorough manner; and, in order that there may be perfect desiccation, the scraps are generally stored for a long period of time. In the spring and fall the scraps are put into the melting-pot in bags of netting, and boiled with rain-water. The gelatinous substance in them dissolves readily into liquid glue. The glue is drawn off, strained, and allowed to cool and settle; and, when it becomes hard like jelly, it is sliced into sheets, and spread upon nets to dry. Drying requires two or three weeks. The sheets are ready for the store when perfectly dry, though they are usually stored away in lofts for a while before they are marketed. The climate of America is very favorable to glue-making, on account of its dryness. In moist countries, like England, the drying is not so perfectly and beautifully done.

Process of glue-making.

There are now about seventy glue-factories in the United States. Philadelphia is the principal centre of the trade, although Chicago and St. Louis have latterly attained some importance in it. The Philadelphia factories are very large.

A purely American variety of glue was invented by Mr. Spaulding. It was called "Spaulding's Prepared Glue," and under that name was extensively advertised and sold, not only in the United States, but in Europe and other parts of the world. It was made in a liquid form, and had the quality of hardening when applied to the cementation of two surfaces. Sold in bottles of small size, its convenience secured for it great popularity. Various preparations of this sort are now in the market. An ounce of nitric acid to the pound of dry glue, or three parts of acetic acid to one of dry glue, preserves the glue in liquid form.

"Spaulding's Prepared Glue."

One of the most important uses of glue is for the making of sand and emery paper,—an industry which is carried on frequently, if not generally, in the glue-factories themselves. The sheets of paper used are made from old rope so as to be very tough, or from manila-fibre direct. Sand-paper and emery-paper are largely used in all factories in which wood is fashioned for popular use, and in many other shops besides. They are comparatively recent inventions, and are of great service to manufacturers.

Use of glue in making sand and emery paper.

VENEERING.

The ancient forests of Brazil and other parts of South America contain enough trees of rare and beautiful cabinet-woods to give the whole human race furniture of solid woods. But these forests cannot be utilized at present, and will not be brought into the market for many generations; and cabinet-woods of great beauty are, therefore, rare in the general market, and costly, rather than abundant and cheap, as they might be. About fifty years ago the cost of cabinet-woods was so great, that three logs of mahogany sold for five thousand dollars apiece in London. The expense of all fine cabinet-woods, and the actual scarcity of some varieties, led to the art of sawing up beautiful logs into thin sheets, and of covering furniture, doors, picture-frames, chests, &c., made of cheaper woods, with these sheets of the rarer timber, so as to produce the same effect as though the articles were made of solid cabinet-woods, and thus to gain the appearance, without the cost, of solid wood. It was an application to cabinet-work of the idea of plating an inferior substance with a superior, which has also been utilized in silver-smithing, glass-making, and other industrial arts. Singularly enough, after veneering had been invented and practised for this object, it was found that the practice had a great merit of its own in strengthening the wood veneered by preventing it from splitting and cracking, and in enabling the workman to produce a number of panels, &c., of exactly the same graining of wood. Its utility for all these general purposes has led to its general and increasing employment.

Economy in use of veneering.

The woods which are sawed up for veneering are rose-wood, mahogany, ebony, sandal-wood, satin-wood, bird's-eye-maple, French maple, tulip-wood, and a large variety of the South-American cabinet-woods, whose names are so strange and unpronounceable, that it would not be desirable to reproduce them here. The best portions of the tree for sawing are those where the branches form, because the twisted and gnarled arrangement of the fibres of the tree in those parts of the trunk produces a wide variety of interesting forms in the graining of the wood, and deepens the color, and renders the wood more close and compact. The veneers are sawed out very thin; but the thinness varies with the value and quality of the wood, from an eighth to a hundredth of an inch. Saws of great precision, running in gangs, are used. Sometimes a different process is used, the veneers being cut off in a broad peel by a turning-lathe. This, however, is more generally resorted to in cutting sheets of bone and ivory.

Kinds of woods used.

Thickness of veneering.

The veneers are sent to the cabinet-maker rough, because the rough face assists in glueing them down. They are fastened on simply with good glue; the only care necessary being this, that they must be worked down so thoroughly as to expel the air from below them. They are

Treatment of veneers.

clamped down until cool and dry. The outer surface of the veneering is then polished, and treated exactly as though the article were made of solid cabinet-wood.

Undoubtedly a pure taste would dictate a preference for a black-walnut or common maple article of furniture which was made of solid wood, and was exactly what it represented to be, than a much more splendid and showy article, apparently of bird's-eye-maple or rosewood, which, in reality, was veneered. But veneering is not necessarily a cheat, and it has too many valuable uses to be dispensed with altogether. For instance, who would want a piano to be of solid rosewood? Who could afford to buy one of solid wood?

CARRIAGES AND CARS.

Destruction of forests.

The forests of the United States, once so magnificent, are now being swept away with a rapidity which has alarmed our statesmen, and has made the subject of replanting the devastated fields a question of vital importance. The demands upon the timber-growth of the country are enormous. Wood is wanted for millions of dwellings, for fences, furniture, shipping, railroad-ties, fuel, telegraph-poles, machinery, boxes, for exportation to foreign countries, and a thousand other objects; and, instead of the demand falling off as timber grows scarce, it is the fact, that in many cases the demand is constantly increasing. The requirements of the car and carriage factories, for instance, are increasing every year. In the days of our great-grandfathers, the occasional ancient coach, and the heavy lumber-wagon in which the freight-transportation of the country was carried on, were almost the only vehicles that rolled along the roads. The people did not own private carriages themselves. When they travelled, they took to the coach, or rode on horseback, the latter being the more customary plan. The purchase of a private carriage was such a rarity, that such an act was sufficient to stamp a man as an aristocrat, and was very likely to create a prejudice against him. So that in those days, although the people fairly lived under the branches of boundless and apparently inexhaustible forests, and though timber was as cheap as dirt, the amount of wood cut for carriage-building was so slight as to make no perceptible impression upon the forests whatever. But now things have greatly changed. Within the hundred years just gone by an era of railroad-building and carriage-owning has come in, and during the last fifty years carriages and cars have been building in increasing numbers year by year. Now, in 1878, the demand upon the forests of the country for the stuff with which to build these vehicles is something enormous and alarming. Upon the railroads of the United States there now roll 350,000 cars, and upon the highways and streets 15,000,000 carriages, stages, trucks, and carts. To replace the old and supply the demand for new vehicles of these several classes, it is estimated that the country now requires

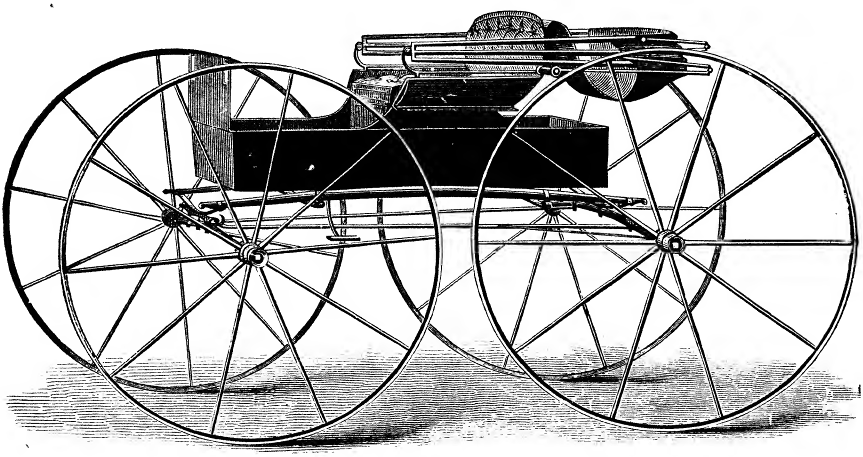
Contrast between the olden and present time.

the growth of 500,000 acres of timber annually. These figures show better than any thing else can the enormous development reached by this special industry in the United States.

First efforts in carriage-making.

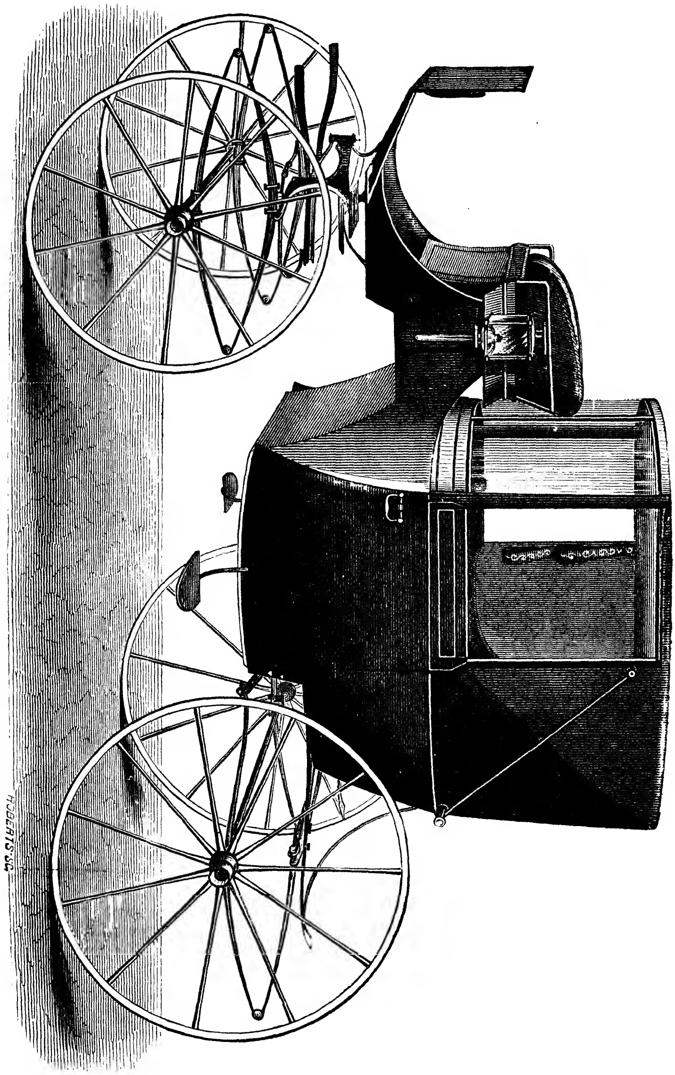
The earliest efforts of the people of America at carriage-making were put forth in the direction of building rude carts and wagons without springs for use in teaming goods to and from the mill, from the farms to town, and *vice versâ*, and from city to city. The wheels for these vehicles were all, or nearly all, imported, until the Revolutionary war; at which date the colonists, for the first time, fell to making them generally for themselves. The few private carriages of that day, one of which was owned by Washington, were imported. They were heavy, coach-like affairs, drawn by six horses, and adapted to travelling on the bad roads of that period. With the better times which came after the

Importation of carriages.



WINDSOR WAGON.

Revolution, and particularly after the war of 1812, the carpenters turned their hands to something besides heavy wagons, and especially to a new style of vehicles (namely, stage-coaches) for which there then grew up a great demand. Stage-coaches were unknown in the United States until after the Revolution. There were only 1,905 miles of best roads in the country in 1791, and the mail was carried in heavy wagons. Lines of stages were started to run in every direction, however, after 1791, in the coast States; and the requirements of the companies, recorded by a heavy tariff of forty-five per cent, soon gave carriage-building a great impetus in all parts of the country. Very little was done for the improvement of the ordinary freighting or Conestoga wagon for a long period; but the models and arrangements of the coach were things which touched the people closely, and this class of carriages received a great deal of attention accordingly. Woods were sought for to compose the axles, wheels, and body, which were, at the same time, the toughest and lightest.



DEMI-LANDAU. BREWSTER & CO.

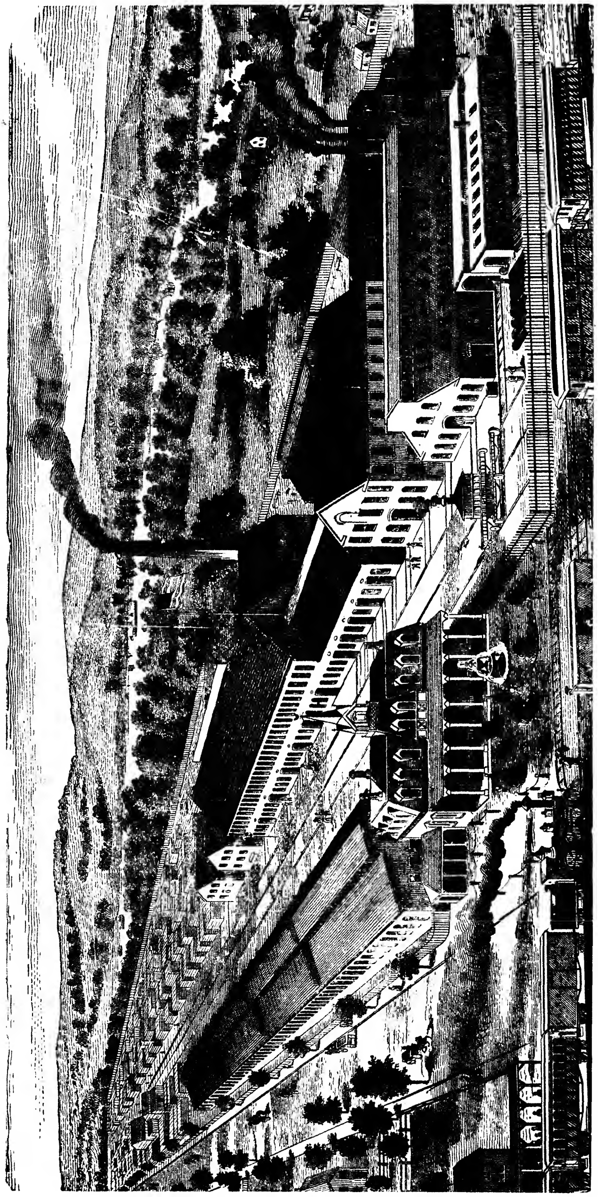
The seats were carefully cushioned. Every part of the vehicle was carefully studied and improved; and the whole coach was made light, strong, comfortable, and serviceable to a degree which had never been known before. One factory started at Troy, N.Y., about the year 1815, became famous in the manufacture of a style of coach which was far superior to the ancient models of England, and which soon came into general use in this country under the name of the

"Troy coach."

"Troy coach." The stage-coaches of the present day are still mainly of this pattern, developed at Troy, N. Y. Another firm, at Con-

"Concord wagon."

cord, N. H., became famous for another style of coach, adapted to summer travel. It had the three seats and the boot of the regular stage; but it had a wagon-body, and a light canvas top. It took the name of the "Concord wagon," and is still known by that name wherever manufactured.



WASON CAR-FACTORY, ALLSTON, MASS.

About 1830 still another style of coach was introduced, which took the name of "omnibus." It was an extremely long vehicle, a sort of ark, with two seats running longitudinally of the coach. Invented in France in 1827, it was introduced to New York in 1830, and was employed to run on regular routes in that and other cities for the accommodation of people going up and down and about town. These omnibuses are made very much smaller now than formerly, but are still run in most large cities. Their value lies in the fact that they are more exclusive than the street-car, and they supply the facilities for city travel without injuring the streets through which they run by the laying of an iron track.

Introduction of the omnibus.

After 1830 the business of carriage-building developed very rapidly, and many new ideas were introduced. The elliptical spring, invented in 1825, began to be employed. Smiths began to make the tires of their wheels in solid rings, and to shrink them on by cooling, instead of making them in pieces, breaking joints with the fellies. Hickory came into general use for wheels and frames on account of its strength and lightness. Machinery was invented to make the spokes, hubs, tops, the small metal-work, and other parts of wagons and carriages, by the thousand and tens of thousands. New styles of wagons were contrived, adapted to special needs. The business developed remarkably fast; and improvement followed improvement so rapidly, especially in the construction of pleasure-carriages, that particular builds of wagon became antiquated in less than ten years, and were superseded by something else, lighter, handsomer, stronger, and cheaper. Hundreds of new factories were started, and hundreds of ingenious brains were set to work devising new ideas in pattern, build, and materials. The general tendency of all improvements was to cheapen the cost of carriages, and make them lighter and stronger. The reduced cost, and the improved roads and growing wealth of the country, brought about a lively demand for the products of the factories; and by 1850 the manufacture and sale of carriages were enormous. The American patterns were very much admired in Europe. They were largely copied in Europe, and heavy orders were sent here for the carriages themselves.

Rapid development of carriage-building since 1830.

The factories have always shown a readiness to change the styles of their work, and to pass from one thing to another, according as fashions or the circumstances of the times have changed. Some of the factories shifted to the business of making railroad and street cars when railroads came into being, and discontinued the wagon-branch of the business altogether. Many of them took to making army-wagons during the war. Express-wagons were taken up by many of them at one period, and there has been a long rivalry between the factories for the production of the wagon which should carry the largest number of tons of goods with the least draught upon the horses. Some of this class of goods are now made to carry five tons of goods. Children's carriages have been added to the business of many firms. Some factories now make from three hundred to five hundred styles of carriages.

Large numbers of the different styles of American wagons are now exported to the different parts of the world; and America, which once was beholden to Europe for her cart-wheels, now in these latter days returns the compliment by sending back wheels, steel axles, and finished carriages, of workmanship and material superior to any thing Europe herself produces.

The growth of the business will be seen by the following figures: —

	FACTORIES.	CARRIAGES MADE.	WORKMEN.	VALUE OF PRODUCT.
1840	92	13,331	2,274	$1,708,741
1850	1,822	95,000	14,900	12,000,000
1860	7,254	270,000	37,459	35,927,000
1870	11,847	800,000	54,028	65,302,000
1873	12,500	1,000,000	75,000	100,000,000

Railroad and street cars. The business of building railroad and street cars has all grown up since 1830. It has centred principally in the Middle States, owing to the necessity of proximity to the iron and coal regions. There are now a hundred and three factories in operation in the United States and Canada, six of them being in Canda. An average of sixty thousand cars are built yearly, the majority being freight-cars of the four-wheeled and eight-wheeled types. The passenger-cars constitute less than one-twentieth of the whole number built, though, perhaps, half the total value of cars built. These cars are of the eight-wheeled and twelve-wheeled types. The early railroad-cars of the United States were merely slight modifications of the ordinary stage-coach. As soon as it was seen that the new style of travelling was to be an established thing, however, the railroad-car proper was immediately invented. At first the car was merely in principle several stage-bodies joined together, the seats being arranged in compartments, and the conductor climbing along from one compartment to the others on a foot-board outside. This style of car was the common basis from which the American and the English car of the present day has been developed. The English people, however, improved upon this ancient sort of car, merely to make it larger and more comfortable, retaining the compartment system on account of its aristocratic exclusiveness. The Americans, on the other hand, improved upon the parent vehicle, not only to render it larger and better, but to make it more democratic. The car was elongated, the doors placed at the two ends, and a row of seats placed on each side of the car; the aisle for the conductors and passengers being in the centre, and the whole interior of the car being free from compartments and partitions. Down to the time of the war, the American cars were still somewhat crude affairs. They frequently leaked during rain-storms, and the dust from the locomotive and ground found its way into the interior through the cracks at the windows. The cars were poorly ventilated, and the seats were uncomfortable. Since 1860 the cars have been so improved as to be luxuriously comfortable. The interiors have been beautified with rare woods and ornamental paintings and gilding, and more attention has been paid to the seats. George M. Pullman in 1864 went into the business of building what are called "drawing-room" or "palace" cars, which are now added to all express-trains on the great routes of travel. In these luxurious coaches the traveller can secure freedom from the crowd, and seats as comfortable as in his own drawing-room at home; and he can obtain from the porter, if desired, such refreshments as he wants. Sleeping-cars for night-travel have also been introduced since 1864. It is with this class of cars that the name of Wagner is associated.

The business of car-building is one requiring great capital and remarkable managerial ability: the number of concerns engaged in it is therefore small, as we have seen. The number engaged in the highest branch of the business, that of building passenger and palace cars, is only about twenty. At least fifty distinct trades are drawn upon to share in the construction of the best class of cars; and, in the decoration of them, fine art itself is placed under levy. The cost of cars varies from $600 for a coal or platform car to $10,000 for a first-class passenger-car, and $20,000 for a palace-car. There are palace-cars on the broad-gauge Erie Railroad which cost $50,000.

CHAPTER XIII.

CONCLUSION.

THE foregoing survey of American manufactures strikingly exhibits the variety, magnitude, and excellence of this great department of human industry. The forces and products of Nature have been drawn upon for the service of man to an amazing degree: in every direction almost has he stretched out and appropriated the rich wealth lying around him. Among his numerous triumphs, the discovery of steam, with its manifold applications, and means for applying it, is to be ranked among the first, both in the order of genius required to utilize it effectively, and in the results attained. The use of steam for rapid transit is certainly one of the grandest achievements of civilization, and it will doubtless ever continue to excite human admiration and awe. Success in this direction has led us almost to overlook the service rendered by steam as a motor for manufacturing-purposes. The stationary engine certainly merits nearly, if not quite, the consideration due the locomotive. Its invention does away with the necessity for locating mills and factories beside an eligible stream. Such establishments may now be built in our large cities, where the facilities for obtaining help, transporting raw material and finished product, and negotiating purchases and sales, afford the manufacturer marked advantages. Steam-power is much more reliable, too, than water-power, and free from certain risks. Neither drought nor freshet interferes with its operation; and so low is the cost of fuel, compared with these advantages, that the stationary engine is rapidly supplanting the mill-dam.

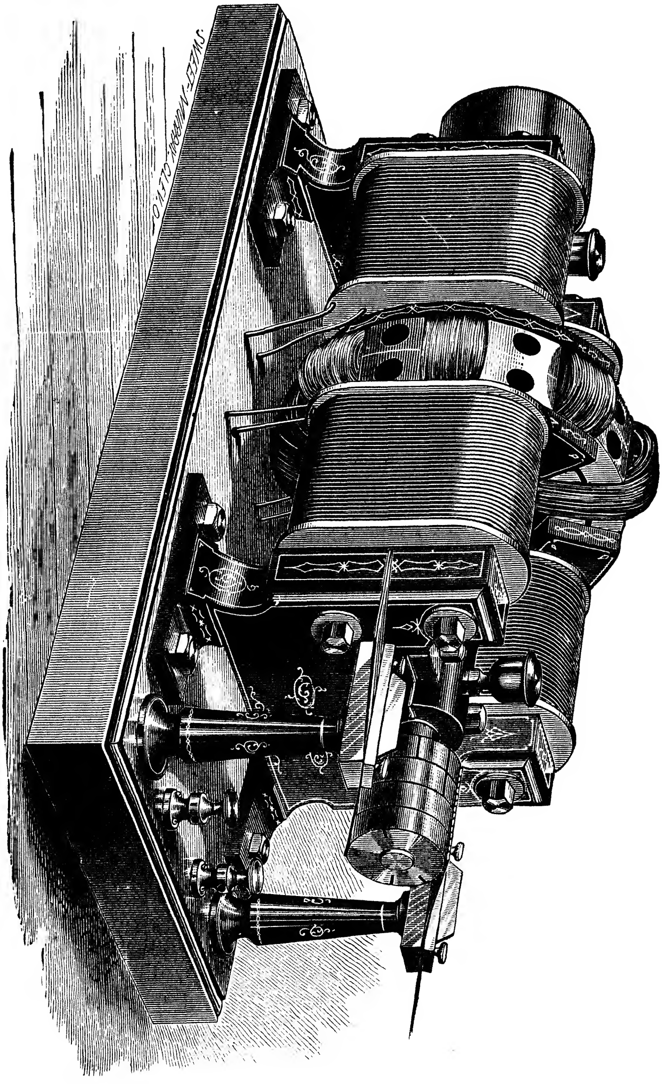
Variety and magnitude of American manufactures.

Stationary engine.

Quite as much ingenuity has been devoted by inventors to the improvement of this class of machines as to the perfection of locomotives. Their aim has been, not only to make them more cheaply, but to economize space, lessen the amount of fuel, simplify construction, and insure greater safety. A great many experiments have been tried in the way of making safety-boilers which shall never explode, and several inventors claim to have reached that consummation; but, as no such boiler has yet

Improvements in machines.

come into general use, the problem is really unsolved. It does not seem, however, to be beyond the reach of human invention; and we may con-



BRUSH DYNAMO ELECTRIC MACHINE.

fidently hope for an early triumph over the many difficulties thus far unsurmounted.

There are five kinds of stationary engines, — the beam and oscillating, which are in use upon steamboats, and the rotary, steeple, and horizontal engines. These all have innumerable modifications. In addition thereto, there are certain portable engines for such temporary uses as driving piles, hoisting building-material, and threshing grain. The first stationary engines in this country, built at the close of the last century and in the beginning of this, were chiefly designed for pumping mines. Their application, of late years, has been to manufacturing. American inventors have done much to improve these machines. J. Eve, a native of this country, obtained a patent in England in 1825 for a valuable improvement in rotary engines.

Kinds of stationary engines.

A vast stride in advance was made by the Messrs. Corliss & Nightingale of Providence some twenty-five years ago. They devised a new way of connecting the governor with the cut-off, which economized the power of steam, and so effected a great saving in fuel. The marked improvement made in this respect may be thus illustrated: The James Mills at Newburyport, engaged in the manufacture of cotton-goods, had a pair of condensing engines, whose cylinders measured twenty-four inches in diameter with a four-foot stroke. They consumed 10,483 pounds of coal daily, on the average, for five years prior to the contract made with Mr. Corliss; and it was thought that they ran to good advantage. But the makers offered a pair of high-pressure engines in their stead, on these terms: The company might pay either $10,500 in cash, or five times the value of the coal saved the first year, the choice to be made before the engines were put in. The company took the latter alternative, and were obliged to pay $19,734.22. Since then the stationary engine has been still further improved.

Economy in use of fuel.

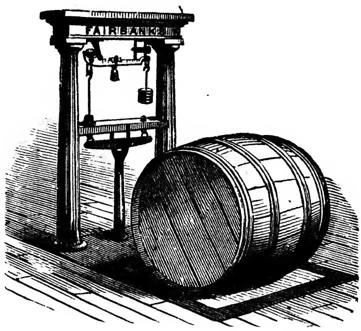
Another phase of our industrial history deserves a passing notice; and that is, the substitution of iron to a great degree for the softer metals in consequence of the greater ability of us moderns to work it. In ancient times copper was very extensively employed in the mechanic arts, not because iron was unknown, but because the artisans of those days did not understand how to work it. An illustration in point is the manufacture of weighing-apparatuses, which formerly were made of brass, and have only recently been manufactured of iron.

Substitution of harder for softer metals.

Originally our mechanisms for ascertaining weight were either a pair of scales or pans, balanced at the ends of an evenly-divided beam, or a lever with unequal arms called the "steelyard." Now these instruments have increased in variety, delicacy, and scope, so that so light a particle as $\frac{1}{6000}$ part of a grain can be detected; while a car containing many tons of metal or other heavy freight can be exactly and easily weighed. The big beam employed by the country butcher is but a form of the steelyard. The platform-scales in use in the ordinary grocery-store are operated on the same principle. The larger scales for hay, coal, and railway-cars, are still of

Scale-making.

the same kind, only that they use a system of compound instead of single levers. The town of St. Johnsbury, Vt., is famed for the manufacture of scales which have had a most extensive use in this country. It has almost a monopoly of the business in larger apparatus. The more delicate balances employed by apothecaries are made at more numerous points. The Danish steelyard, which has the article to be weighed stationary (as with the American steelyard), but with the other weight fixed and the fulcrum movable, has never come into use in this country. Another form of weighing-apparatus, however, has an extensive use in the United States: it consists of a coil of brass wire, whose elasticity is gauged by a movable index upon a graduated scale. Tin-peddlers and fish-men are generally provided with this kind. A variety of this same kind has a dial-plate attached, on which a needle rotates. Our letter-scales are but modifications of forms already described.



SCALES.

We cannot close this history of American manufacturing industries without a brief reference to three kindred processes which properly come under the head of mechanic art, though more or less nearly approaching the realm of fine art. The first of these is photography. The chemical principle on which that process depends — namely, the discoloring effect of sun-light upon paper coated with nitrate of silver — was discovered as long ago as the twelfth century; but not until 1840 — the year after Daguerre invented the process of taking sun-pictures on silver-coated plates, and Talbot simultaneously devised a way to fix a picture taken on paper in the camera — was our present photographic process rendered fairly practicable; and the largest meed of praise for that accomplishment is due to Professor J. W. Draper of the University of New York, who had for many years been experimenting in order to discover a way to set the picture when once obtained. The invention has worked a marvellous revolution in portraiture, and put it within the power and means of every one to have faithful family likenesses. In the form of stereoscopic pictures it has enabled us to procure, at a slight cost, perfect representations of great statues, paintings, distant natural scenery and palaces, and all that is wonderful and rare in the way of display in nature or in art. The process has been of rare value, too, in obtaining cheap and accurate pictures of mechanical devices, and also obtaining permanent views of rare transitory phenomena, like solar eclipses, and transits of planets across the sun's surface. The art is constantly undergoing trifling improvement in process, and meeting with a wider use in science and the mechanic and fine arts.

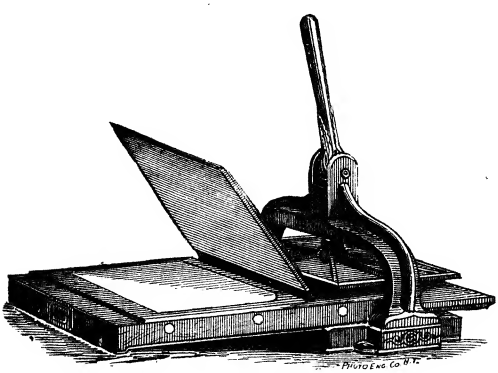
Photography.

The word "lithography" means the art of printing from a stone, and had its origin in an accidental discovery by a poor German in the latter part of the eighteenth century. His mother asked him to make a memorandum of the family washing; and, not having a piece of paper at hand, he jotted it down on a slab of peculiar stone. As it lay before him he thought of inking the lines, and printing therefrom. His subsequent experiments met with a success that attracted world-wide attention. At that time etching was a favorite process for producing pictures. Lithography somewhat resembles it. The principle involved in the operation is the refusal of an oily ink to adhere to a wet surface, and its affinity for a greasy surface. A design is drawn with a greasy crayon, prepared with great delicacy and care for the purpose, upon a variety of fine porous stone, found at its best only in Germany. The whole surface is then moistened; but the moisture clings only to the clean stone, and the design remains dry. An ink-roller being applied, the ink is rejected by such of the surface as is wet, but is taken by the lines inscribed. From the plate thus inked an impression may then be printed. Of course there are many minor stages in the process, which are essential to its success, which are not here detailed.

Lithography.

Lithography was introduced into this country in 1821, and applied both to fine-art uses and to map-drawing; its expense being far below that of copper-plate engraving, and the number of copies that could be obtained from one plate being far greater. It has met with many improvements and applications in the United States. Within twenty years the art of chromo-lithography has attained a great development. It consists of printing the different parts of a many-colored picture by separate plates for each color very much as calicoes are printed. The work requires great delicacy of adjustment, and often a large number of plates, to produce the proper mixture of tints.

Chromo-lithography.



PAPYROGRAPH.

A combination of photography and lithography has been made still more recently, with marvellous results. It has been found that a film of gelatine can be sensitized by the use of bichromate of potash, so that, on being subjected to exposure under a photographic negative, it acquires the essential characteristics of a lithographic stone. The chemical effect of the sunlight passing through the light parts of the negative is to toughen the

Photo-lithography.

gelatine, so that it will repel water, and take ink; and the parts of the film protected by the dark parts of the negative, and subsequently washed free from the bichromate, absorb water, and repel ink, when the film is finally mounted on a block, and subjected to the printer's roller. This process of photo-lithography has been adopted by "The New-York Graphic" for its illustrations, and with various modifications, and under several names, is coming into extensive use for book-illustrations and choice *facsimiles* of rare paintings.

Papyrograph.

The papyrograph, which was introduced into this country from France in 1876, and is rapidly coming into use for the purpose of cheaply reduplicating autograph-designs, circulars, price-lists, &c., consists of a sheet of paper, varnished with a water and ink proof coating, and written or drawn upon with an ink which corrodes the varnish, and leaves the lines porous. Being properly washed and dried, and laid upon a flat cushion moistened with ink, in the bed of the press, the sheet becomes a sort of lithographic plate, from which many hundred impressions can be easily taken.

BOOK III.

SHIPPING AND RAILROADS.

CHAPTER I.

WOODEN SHIPS.

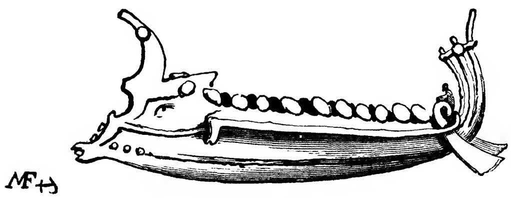
IN the age in which Columbus ventured across the Atlantic in search of a new route to India the ships of the world were all of small size compared with those of the present day. No such exchange of commodities by sea as we observe to-day had ever yet taken place, and no such long voyages were undertaken. Commerce was simply a coasting-trade between different parts of Europe, and between Europe and the Mediterranean coast of Africa. Navigation scarcely ever took place out of sight of land, except in the northern fisheries and on the peaceful Mediterranean. For such objects as merchant-ships were required in that age, vessels of less than two hundred tons' burden were of ample size; and the vast majority of all the ships afloat, of whatever nationality, were of less than that burden. A few war-ships in France, Spain, Portugal, England, and Italy, were over two hundred tons' burden, a great vessel of a thousand tons being occasionally seen. The merchant-ships were mere fishing and coasting vessels: they had two or three masts, and were generally rigged with square sails. The ships in which Columbus made the pioneer voyage across the Atlantic in 1492 are described as being, two of them, light barks called "caravels," without decks in the centre, and rising to a great height at the bow and stern, with forecastles and cabins for the accommodation of the crews. The third is said to have been decked throughout her whole length. In 1582, of the 1,232 vessels then belonging to England, only 217 were larger than eighty tons. "The Mayflower," which brought over the Pilgrim Fathers, was of a hundred and eighty tons' burden. At the time when the active settlement of America began, the Netherlands was the great shipping-country of the world. The Dutch had about 20,000 ships at sea to about 2,000 owned in England. The Spaniards and Portuguese were next in enterprise to the Dutch. The English did not begin to be eminent in shipping until fifty years after the planting of the North-American colonies, and it was the carrying-trade of the colonies that made them so.

Small size of vessels in early days.

Ship-building may be said to have been the first industry practised in

America after that of house-building. The beginning was as early as 1607, when the Popham colonists in Maine built a thirty-ton vessel called "The Virginia," which subsequently made several voyages across the Atlantic. Though the Atlantic has, since that date, been crossed in more diminutive craft than "The Virginia," a voyage in so small a vessel now would be considered little short of madness. No vessel like that could be put into ocean-trade now, and pay. "The Virginia" was a busy little ship during its existence. It came to America with the Gates and Somers expedition in 1609, and traded back and forth along the coast and to England for many years quite diligently. When Lord Delaware arrived at Point Comfort in Virginia, in the summer of 1610, he found the craft there along with three other vessels, "The Discovery," "The Deliverance," and "The Patience," which had been sent over by the London Company.

"The Virginia."



ROMAN VESSEL.

The second vessel built in America of which there is any record was a Dutch yacht called "The Onrest," which was constructed on the Hudson River, by Adrian Blok, in 1614. This yacht is antedated only by "The Virginia." It used to be a saying, that no matter where an English ship sailed, or in whatever part of the world an Englishman landed, a Dutchman and a Dutch ship were sure to have been there ahead of them. This pioneer yacht of North America fulfilled the old saying with respect to a large part of New England; for in 1614, six years before the arrival of the English colonists in Massachusetts, Adrian Blok, making a voyage through Hell Gate and Long-Island Sound, had discovered Block Island, and inspected the coast as far as Cape Cod. In 1616 he had explored the whole coast from Nova Scotia to Virginia.

"The Onrest."

The same year that the ancient Knickerbockers had thus established the naval art on the Hudson River, Capt. John Smith landed in Maine, *en route* from England to Virginia, and built there seven boats to engage in cod-fishing.

The abundance of timber and pitch-pine in this country led to systematic proceedings in the way of ship-building at a very early date. Timber was very dear in England; and the trading-companies, under whose auspices the colonies were planted, saw that it would be advantageous for them to have their ships built here. The Massachusetts Company acted as early as 1629; their very first letter to the governor and council of the colony announcing that they had sent out shipwrights, six in number, "of whom Robert Moulton is chief," to introduce this branch

Facilities for ship-building.

of business in the New World. Mechanics were also sent to Virginia for the same purpose; but the wonderful fertility of Virginia appears to have been too much for the shipwrights, and they found tobacco-planting a much more profitable occupation than the one they had been bred to. Ship-building began the soonest, and thrived the best, in Massachusetts. The first vessel built in this colony was launched into the Mystic River at Medford, July 4, 1631, for Gov. Winthrop, its owner, who called it "The Blessing of the Bay." This prosperous beginning was soon followed by the construction of a great many other vessels of small size, at different points in the colony, to be used in the fisheries and to trade; and by 1641 the industry had grown to such importance, that a regular official supervision of the building of them was ordered. It was enacted, that, "when a ship is to be built within this jurisdiction, it shall be lawful for the owners to appoint some able man to survey the work from time to time, as is usual in England. . . . If his advice is not heeded, then, upon complaint to the governor or any other two magistrates, they shall appoint two of the most sufficient ship-carpenters of this jurisdiction, and shall give them authority to view every such ship and all work belonging thereto, and see that it be performed and carried on according to the rules of the art."

Construction of vessels of larger size.

Regular ship-building was not over ten years old in the colony of Massachusetts before the carpenters undertook vessels which were of large size for that day. Richard Hollingsworth began one at Salem, in 1641, which was of three hundred tons' burden. Gov. Winthop refers incidentally in his journal to the size of the vessels which were now undertaken. He writes, "The general fear of want of foreign commodities, now our money was gone, and that things were like to go well in England, set us on working to provide shipping of our own; for which end, Mr. Peter, being a man of very public spirit and singular activity for all occasions, procured some to join for building a ship at Salem of three hundred tons; and the inhabitants of Boston, stirred up by his example, set upon the building of another at Boston of one hundred and fifty tons. The work was hard to accomplish for the want of money, &c.; but our shipwrights were content to take such pay as the country could make." "Such pay" meant here corn, calicoes, and commodities of all kinds. Lindsay, in his "History of Merchant-Shipping," says that in 1572 "the largest merchantman that sailed from the port of London was of only two hundred and forty tons' register." Yet we find that in 1642 the colonists of Massachusetts had built one of three hundred tons, which was larger than any the wealthy parent kingdom had owned seventy years before. This is in reality only an illustration of the change produced by the discovery of the continent of America upon the merchant-shipping of the whole world. With the planting of the settlements in America, and the simultaneous discovery of the route to India around the Cape of Good Hope, commerce ceased to be a coasting-trade: it became trans-oceanic for the first time in history, and every country which had any active trade whatever with the new regions of the earth was obliged to build a new and larger class of merchant-vessels for the service. The colonists in America built for the trans-oceanic trade from the start: hence the size of their ships became large rapidly. Mention is made of one, about 1643, which was still larger than three hundred tons.

In 1652 an event occurred which assisted ship-building in this country very materially: this was the passage of the famous Navigation Act under Cromwell, the law being re-affirmed in 1660 under Charles II. The object of the act, as far as America was concerned, was to secure the whole trade across the ocean to British and colonial vessels, to the exclusion of the Dutch and Spanish. The Dutch were about engrossing the carrying-trade to America at that time. As early as 1640 they had about an equal share of it with the English, except to New England; an indication of it being the memorandum which comes down to us, that on Christmas Day, 1640, there were in the ports of Virginia twelve ships from England, twelve from Holland, and seven from New England. The New-Englanders were so rich in shipping, that they carried on almost all their commerce themselves; but the colonies to the south of them were supplied with European wares largely by Dutch ships. The law of 1651 secured the whole trade to the royal and colonial shipping, and the latter got fully half of it; the consequence of the law being great activity at the colonial ship-yards, and a corresponding increase of colonial tonnage.

Navigation Act of 1651.

One of the difficulties of the colonists in building ships was the general scarcity of money. There were no silver or gold mines of any account in the country, and the colonists had only a limited amount of hard cash, which they gained by sending their grain, hides, timber, &c., to the West Indies. What little silver they got in this way was quickly despatched to Europe to pay for the manufactured commodities which the colonies were obliged to import; so that there was a constant dearth of money here, and this made it exceedingly hard to pay for a ship. The shifts they had to resort to in those days are shown by a contract made in 1741 at Newburyport, Mass., cited by Mr. J. J. Currier in his "History of Ship-Building on the Merrimack." The owners were to pay as follows: "Three hundred pounds in cash, three hundred pounds by orders on good shops in Boston, two-thirds money, four hundred pounds by orders up the river for timber and plank, ten barrels of flour, fifty pounds of loaf-sugar, one bag of cotton-wool, a hundred bushels of corn in the spring, a hogshead of rum, a hundred-weight of cheese; the remainder part to be drawn out of said Cummings & Harris's shop." A memorandum in Douglass's "Historical and Political Summary," dated 1748, refers to one ship which had been so nearly paid for in calicoes, that its owners called it a calico ship. The builder, taking his pay in goods, paid off his workmen in the same way. This simple mode of pay-

Scarcity of money.

ment lasted until after the Revolutionary war. It answered very well, too, in the majority of cases; the largest number of vessels built being, of course, from ten to fifty ton shallops, sloops and schooners for the fisheries and coasting-trade. The shallop, it may be said for those who do not know about that class of vessel, was from ten to twenty tons' burden, and was decked from end to end, and carried two small masts with lugsails. The schooner was purely an American invention, and probably grew out of the embryo of the shallop. It is related that a new vessel rigged like a modern schooner, having been launched at Gloucester, Mass., by Capt. Andrew Robinson in 1714, entered the water beautifully, and was carried by her momentum away from the shore with such speed as to show her to be a fast vessel. Some one cried out in admiration, "See how she schoons!" and the captain replied, "A schooner let her be;" and this class of merchantmen took that name accordingly.

Effect of Revolutionary war upon industry.

The Revolutionary war, and the succeeding years until the war of 1812, constituted a trying period for the ship-builders and ship-owners of this country. During the war, their vessels running along the coast and to the West Indies, and such countries of Europe as gave them a friendly welcome, were captured in large numbers by the English ships; and many a merchant was ruined by the loss of his property in this way. The building and equipping of privateers soon took the place of regular commercial enterprise; and large numbers of vessels were armed and sent to sea from the New-England ports every year, as long as the war lasted. Scores of these vessels were never heard of again. Some of them were fortunate, making captures of rich merchantmen, and bringing their owners and crews great wealth. The ships of one New-England merchant took 120 prizes worth $3,950,000, and others had brilliant luck of a kindred description; but, on the whole, it is certain that the shipping-interests of the country suffered more than they gained. Then, after the war was over, and peaceful commerce was resumed, a period of thirty years ensued, during which England assumed the right to search and detain our ships, and impress sailors of English birth. In 1806 this evil was aggravated by an English blockade of France, — a compliment which was returned by France by a declaration blockading the British isles. Each of the two powers forbade neutrals to trade with the other; and, while their bitter dispute continued, each interfered regularly with American ships, capturing them at sea, and detaining them in port, and often confiscating both ships and goods, because they were supposed to be giving aid and comfort to the enemy. Many of the captured vessels were released; but their cargoes often became worthless during the detention, and the owners lost heavily upon them. The people of the United States were grievous sufferers by these interruptions of their commerce. The government remonstrated with France and England against them, and tried to bring both powers to reason by a

Impressment of seamen.

non-importation act in 1806, an embargo act in 1807, and a non-intercourse act in 1809, judging that what touched the pockets of their merchants would produce more effect than any thing else. For the time being, these several laws imposed only a heavier, though necessary, burden upon our own ship-builders and ship-owners. They were effectual, however, with France, and partially so with England. In 1809 and 1810 Norway and Denmark had the audacity to imitate their bigger neighbors by seizing our ships also to secure payment of tolls. By 1812 the captures of American vessels had been as follows: —

Taken into Danish and Norwegian ports (1809, 63; 1810, 124)	187
Captured by England	917
Captured by France	558
Total	1,662

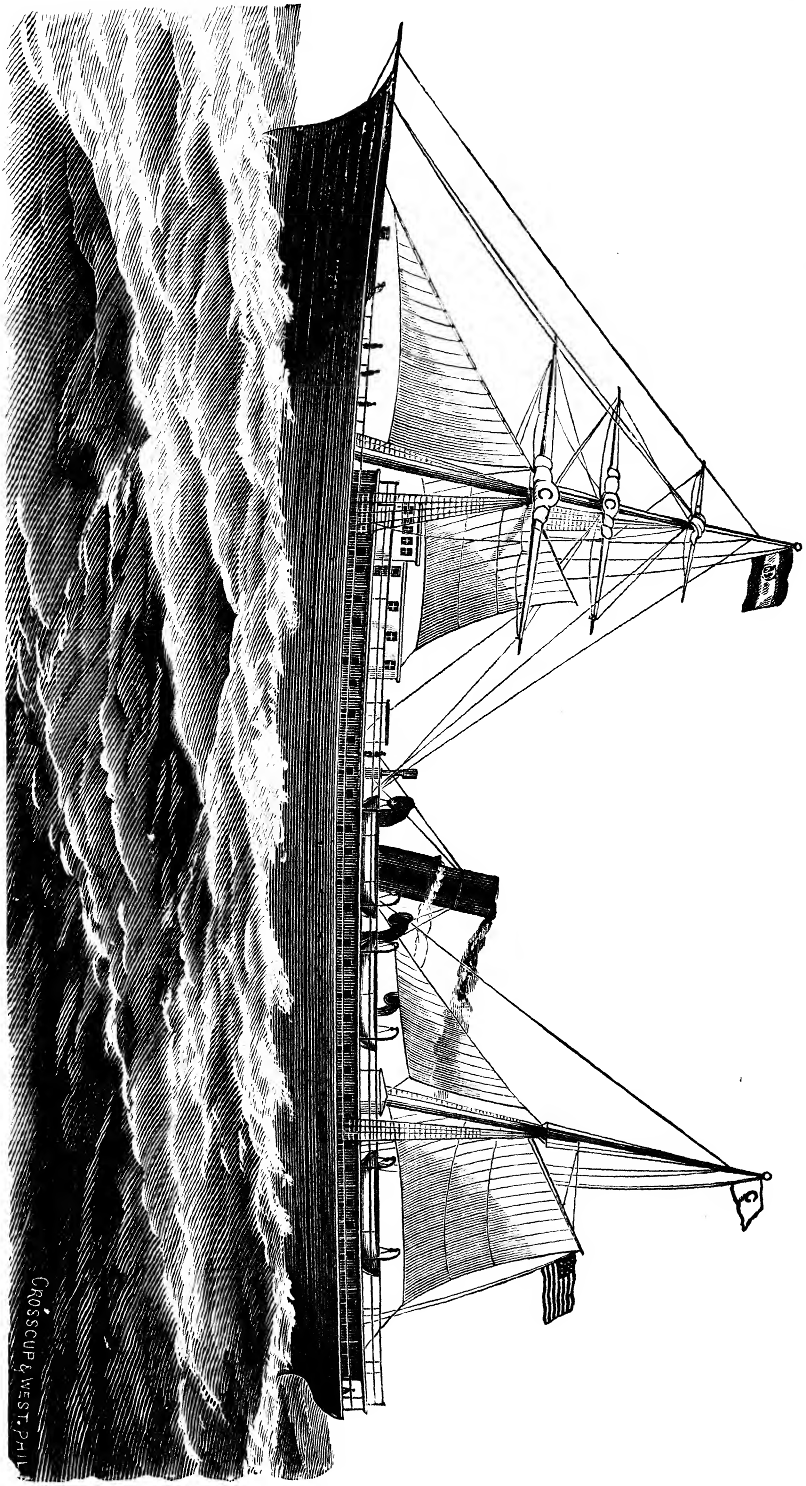
This sort of thing could be endured no longer, and accordingly this country went to war with England in 1812 to secure protection to property on the high seas and the freedom of commerce. Regular trade being almost impossible during the war, merchants, with the consent of the government, again went into privateering. The exploits of their ships were brilliant and romantic in the extreme. The United States lost 1,407 merchantmen and 270 armed ships during that war, but captured 2,360 from the enemy (750 of them being retaken, however); thus, on the whole, making a very good thing of it. Most of the prizes taken by our ships were rich merchantmen, while most of the vessels we lost were coasting and fishing craft.

War of 1812.

The United States gained two advantages with respect to shipping by these two wars and the intervening period of European interference and aggression. The first was, that the necessity of building fast ships was imposed upon our builders, and they were forced to pay great attention to their models. No one wanted to send a ship to sea unless she was capable of sailing rapidly away from a hostile cruiser if pursued and obliged to run. As early as 1782 a ship had been built in New England, the frigate "Alliance," which, being chased by a fast English ship, was able to run fifteen knots by the log, with the wind abeam, in making her escape. Our builders displayed great ability and originality in meeting the requirements of the age. They ignored the rules prevalent in Europe, and, rejecting the short, deep hulls and bluff bows, made their vessels long, with sharp and concave bows, and stems, which permitted the water to flow away from them freely. Sometimes, at first, more attention was paid to speed than steadiness; and a sixteen-gun ship, "The Neptune," is known to have capsized and sunk at Newburyport the moment she had crossed the bar on her first voyage. But by 1812 earlier faults had been corrected, and

Advantages gained by the war.

"Alliance."



STEAMSHIP.—W. P. CLYDE & COMPANY.

the ships of the United States were the handsomest and swiftest in the world. There was great compensation in that, when peace came, for the years of risk and loss which had preceded. The second advantage above referred to was more immediately the result of the brilliant victories of the war of 1812. Upon the return of peace the United States demanded that her ships should be permitted to sail the seas unmolested, and that they should be received in European ports upon the same footing as the ships of "the most favored nations;" or, in other words, that navigation should be conducted on a basis of exact reciprocity. The prestige which this country had gained in that war prompted England to accede to the demand at once; and the other nations of the world entered into treaties of maritime reciprocity soon after, or else passed laws which had the same effect. It had been customary in Europe to tax American ships entering port a heavier tonnage duty than native ships. We had returned the compliment in 1789 by taxing foreign ships entering our ports fifty cents a ton, and American ships only six cents a ton. These discriminating duties were repealed in 1815 with respect to England, and during the next twenty years with respect to most other maritime powers; and trade was placed upon an equal and reciprocal footing. The good effects were soon seen. American ships, being swifter, stancher, and better managed than those of any other commercial nation, got possession immediately of almost the entire foreign commerce of this country, and the shipping and carrying trade of the country increased very fast. Our grain, cotton, timber, tobacco, rice, naval stores, hides, provisions, and other crude products, began to go abroad in very large quantities; and the wants of this growing country made it necessary to bring to our shore from Europe immense cargoes of cloths, clothing, iron-manufactures, steel, chemicals, &c., and tens of thousands of emigrants. American ships obtained the principal part of the carrying; and, as commerce and travel increased, shipping increased too.

Superiority of American ships.

The only locality which was at all famous for its ship-building south of New-York City, in the early part of this century, was the Chesapeake Bay. The schooners and ships of this region were among the handsomest and swiftest flying our flag or any other. They took the name of "clippers;" and, though the beautiful models upon which they were constructed were soon adopted all along the coast, the Baltimore clippers were thought slightly superior to all others, and were regarded far and wide as having attained the acme of the ship-building art. The lines of packets which were started after 1815 to ply from New York, Boston, and other cities, to the European ports, and which continued to run until about the time of the war of 1861, were of the clipper-model; and, in fact, all American ships were built of that pattern, except a few of large capacity, constructed expressly to carry cotton, which were organized solely with a view to cargo-room, and had queer hulls bulging below the water-line.

Ship-building at Chesapeake Bay.

"Clippers."

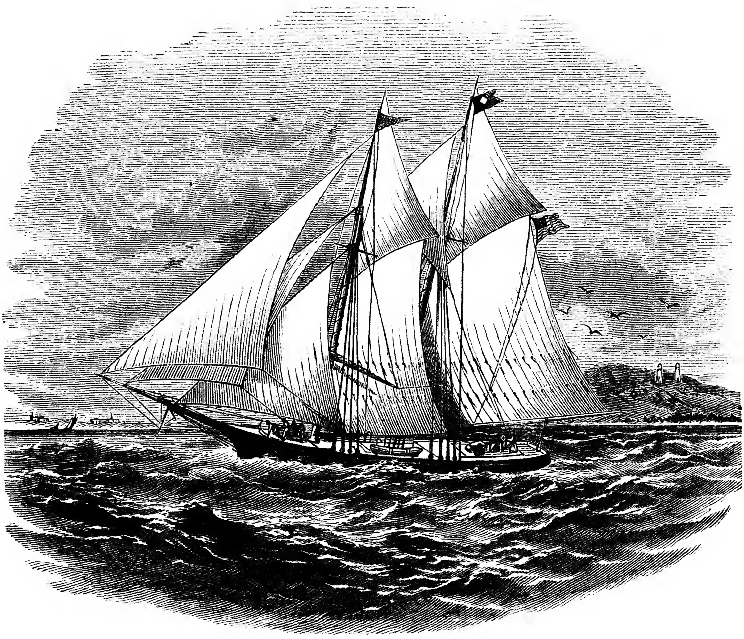
The performances of the clippers have been remarkable. The Liverpool packets from New York and Boston (varying from six hundred to nine hundred tons' burden) used to make the trip across the sea regularly from twelve to twenty days. As early as 1825 the ship "Oliver Ellsworth" ran from New York to Liverpool in thirteen days. "The Independence," one of whose sailing-days was March 5, which annually took out the President's message, once made the run across the ocean in nine days, showing a speed which is rarely exceeded at the present time by an ocean-steamer. "The Flying Scud" of the Australian packet-line from New-York City (1,703 tons' burden) was accustomed to make the whole voyage to Australia in seventy-six days with a cargo, and in 1854 once ran four hundred and forty-nine nautical miles in twenty-four hours (over eighteen miles an hour). No modern steamer can beat that: the clipper-schooners alone have beaten this time. "The Clipper City" (a hundred and eighty-five tons), a fast-sailing lumber-vessel, built in 1854 for the trade of Lake Michigan, ran regularly eighteen knots an hour, and has been known to make the astonishing speed of twenty knots. These are not exceptional cases: they are merely instances of the speed of the fast-sailing ships of the United States.

Ship-building in 1830.

About 1830 there began to be a perceptible increase in the size of the ships of the country, owing to the large coasting-trade which was springing up. The exchange of products between different parts of the seaboard was becoming very large. Cotton, rice, sugar, and tobacco were coming North: cloths, iron and steel manufactures, carriages, tools, fertilizers, India-goods, &c., were going South. Barks and ships were, in consequence, built for the trade, varying between five hundred and eight hundred tons' burden, in place of the hundred and fifty and three hundred ton schooners and brigs. The foreign trade was at the same time becoming very heavy, and thousand-ton merchantmen began to make their appearance. When gold was discovered in California, and the famous stampede of that and the subsequent five or ten years began, shipping took another step forward; and huge clipper freight-ships of a special class were built for the long voyage around Cape Horn to the new regions on the Pacific, to which the whole world was rushing. By 1850 sixteen-hundred-ton vessels were employed in the California trade; and the tonnage of the vessels increased year by year, until (in 1878) there are sailing-ships plying to San Francisco from New York of twenty-five hundred tons' burden. One gigantic clipper, called "The Ocean King" (a four-master, owned in Boston), is of four thousand' tons burden: another, "The Great Republic," is of the same size. The Californiamen, in fact, now figure in the American merchant marine very much as the East-Indiamen have always done in the English marine: they are the great ships of the sailing-fleet. This trade, being a part of the coasting-trade of the United States, is expressly reserved to our flag.

Increase in size.

By 1861 the shipping of the United States had reached a very interesting development. Beginning in 1783 with about a hundred thousand tons of ships, — few of which were more than three hundred tons' burden, and the vast majority of which were under a hundred, — the national wealth in ships increased quite steadily, in spite of all disadvantages, until in 1861 the total tonnage of the country had reached the enormous figure of 5,539,813. England alone exceeded us. The American shipping comprised the finest and largest under sail afloat, and the assortment of types they included was perhaps the most extensive under the sun. The special wants of different



YACHT.

parts of the coast and of different trades had given rise to different classes of vessels: among the number were the Gloucester fishing-boat; the Block-Island double-enders; the New-England sharpy, flat-bottomed and cat-rigged; the Long-Island and Hudson-river sloops; the clipper brigs, barks, and ships; the "kettle-bottomed" cotton-ships; the Boston ice-ship, for the Panama and South-American trade; the lumber-schooner, carrying the most of its load on deck; the fishing-dory; and the pleasure-yacht, the appearance of whose model in English waters in 1851, in "The America," built at New York, revolutionized pleasure-boating immediately. The war of 1861 caused a decrease in our shipping. In the first place it threw about a million tons of shipping out of employment, owing to the blockade of the Southern ports, and led to the sale or lease of the ships to the government, and the destruction of a large proportion of them in the war. Then Confederate cruisers began to capture our ships in the foreign trade and whale-fisheries, and burn them. Maritime ventures became so hazardous in consequence of the captures, that our merchants were afraid to sail their ships upon the open sea any longer under the American flag; and, finding a ready market for them in England, they sold a great part of them to Englishmen and others, the sales amounting to 774,652 tons, the transfers during the four years of the war exceeding the sales to foreigners for forty years preceding. A large part of the tonnage in the foreign trade was recalled, and put into coasting. The war was a terrible blow to our carrying-trade; and, although it is now thirteen years since the war ended, we have not yet recovered the ground lost during that struggle. We are getting it back slowly; but it will be several years yet before the merchant marine of the United States stands where it did in 1861.

Effect of late war upon ship-building.

The following table of selected years will show the growth and changes which have taken place since 1789, the first year in which the tabulation of accurate statistics began: —

Statistics of growth and changes.

	TONNAGE REGISTERED FOR THE FOREIGN TRADE.	TONNAGE IN COASTING-TRADE.	TONNAGE IN FISHERIES.	TOTAL.
1789	123,893	68,607	9,062	201,652
1790	346,254	103,775	28,348	478,377
1795	529,471	184,398	34,096	747,965
1800	667,107	272,492	32,893	972,492
1810	981,019	405,347	38,417	1,424,783
1813	672,700	470,109	23,819	1,166,628
1815	854,295	475,666	38,167	1,368,128
1820	583,657 [1]	588,025	108,485	1,280,167
1825	667,408	640,861	114,841	1,423,110
1830	537,563 [1]	516,979	137,234	1,191,776
1840	762,838	1,176,694	241,232	2,180,764
1850	1,439,694	1,797,825	297,935	3,535,454
1860	2,379,396	2,644,867	329,605	5,353,868
1861	2,496,894	2,704,724	338,195	5,539,813
1865	1,518,350	3,381,522	197,010	5,096,782
1866	1,387,756	2,719,621	203,401	4,310,778
1870	1,448,846	2,595,328 [2]	159,414	4,246,507
1875	1,515,598	3,169,687	118,436	4,853,732
1876	1,592,821	2,609,323	77,314	4,279,458

[1] The reduction in these two years is only apparent: it is due to a correction of the tables by dropping vessels wrecked, condemned, or sold to foreigners, which had been carried on the register for years.

[2] The reduction here is due to the larger employment of steamers in the coasting-trade since the war, one steamer doing the work of three sailing-vessels.

The ship-building of the country has concentrated chiefly in the New-England States, owing to the superior industry of the people. There does not appear to have been any other special reason for it, because other States have just as large supplies of building, copper, iron, cordage, and naval stores, and some of them a great deal more of one or all of them. From 1607 down, however, more than one-half of all the vessels of every description launched in American waters have been built in the New-England yards. New York, Pennsylvania, Delaware, Maryland, and Virginia have been building States also. South of Virginia there appears to have been little or no effort in this direction. Since 1840 there has been more or less of the building of craft for the inland waters on the Great Lakes and the Western rivers.

Ship-building in the New-England States.

A ship is a marvellous fabric. Costing, for first-class oak vessels, now about fifty dollars a ton, nine-tenths of which expense is for labor, the ship calls into requisition the services of forty or fifty distinct trades, and demands the highest engineering and mathematical ability on the part of the designer, and the ablest workmanship on the part of the builder.

> "Ah! what a wondrous thing it is
> To note how many wheels of toil
> One thought, one word, can set in motion!
> There's not a ship that sails the ocean,
> But every climate, every soil,
> Must bring its tribute, great or small,
> And help to build its wooden wall."

The construction of ships is one of the most profitable branches of industry a country can carry on. They belong to that peculiar class of products in which the raw material forms the most insignificant part, and the wages of the workmen the largest possible proportion, of the cost of the completed work. Besides that, a ship once built requires continual repair, and the repair of ships on a large scale is even more profitable to a country than is the building. It is for this reason that all the governments of the world with a sea-coast strive to have their own ships built by their own people, and to promote as much as possible the building of ships for other nations. The United States have always required American ships to be built in American yards. The enormous profits of the carrying-trade lead governments also to legislate in favor of their own shipping. The United States, for instance, have always reserved the whole business of the coasting of this country to our own flag; and for a period of fifty years it imposed an extra duty upon all goods coming from China, Japan, and the East Indies, in foreign ships, so as to secure that trade to our own vessels. Furthermore, our laws tax all foreign ships entering our ports fifty cents a ton as compared with a six-cent tonnage tax on our own vessels, whenever the foreign government to which the ships belong discriminates in any way against our vessels.

Profitableness of the industry.

The cost of wooden ships has varied a great deal since 1607, owing to the changes in the wages of labor, and other causes affecting the general range of prices of all commodities. A contract at Salem, Mass., in 1661, mentions the price per ton of a ship as three pounds five shillings, or about sixteen dollars. In 1825 first-class ships were building in the United States for thirty or forty dollars a ton. In 1840, which was the best year the race of ship-owners then living had ever known, — when tonnage was in great demand, and many vessels paid their cost in clear profits of freight, — the cost was about fifty dollars a ton. About 1848 the price had risen, possibly because large ships of the new type were fitted up very elaborately, the captain's cabin being as richly furnished as a palace-car; so that ships cost as high as seventy dollars a ton (the average price was fifty dollars). In 1860 a first-class thousand-ton oak ship built at New-York City would bring sixty-five dollars a ton, gold. The same vessel could be built in Maine for forty-eight and fifty dollars a ton. Up to this point in the history of the country, the cost of American ships, whatever it might happen to be in any one year, was, nevertheless, from five to fifteen dollars a ton less than that of vessels built in England. After 1861 the derangement of prices caused by the war made American wooden ships the most expensive in the world. The price rose in 1869 to eighty dollars a ton for a thousand-ton oak ship fitted for sea with one suit of sails, the price varying somewhat with the part of the coast on which it was built. In some yards in Maine such a ship could be launched for sixty-five dollars a ton. At the present time prices have found their old level, and oak vessels are constructed for fifty dollars a ton. Canadian vessels, built of soft woods, and therefore shorter lived, are sold for forty-five dollars a ton.

Cost of wooden ships.

A very notable change is going on in the substitution of steam craft, or boats towed by steam, for the old-fashioned coaster in the transportation of merchandise. When steamboats first came into practical use, it was prophesied that they would speedily drive off all coasting-vessels, because their trips would be made with greater regularity. They could not carry so cheaply, though; and consequently sailing-vessels have retained easily enough until now a very large portion of their ground, steamboats taking only the more costly freights and those requiring as rapid transit as possible, leaving the transportation of coal and other coarse commodities to the slower-sailing carriers. Within a few years, however, this province, too, has been invaded, as we have just described; and so rapidly are the canal barges and other vessels towed or propelled by steam gaining the carrying-trade of coal, grain, and all commodities not transported by the regular lines of steamboats, as seriously to imperil the business of the sailing-vessels: indeed, it is highly probable that in a few years they will be driven from a large portion of American waters by their too formidable competitors.

Competition between steam craft and wooden vessels.

Statistics of the world's tonnage.

According to the last report of the Bureau Veritas of Paris, it being for 1866–67, the sea-going merchant sail-vessels of the world were distributed as follows: —

FLAGS.	VESSELS.	TONS.
Great Britain	20,265	5,807,375
United States	7,288	2,390,521
Norway	4,749	1,410,903
Italy	4,601	1,292,076
Germany	3,456	375,995
France	3,858	725,043
Spain	2,915	557,320
Greece	2,121	426,925
Holland	1,143	399,903
Sweden	2,121	399,128
Russia	1,785	391,958
Austria	983	338,684
Denmark	1,348	188,958
Portugal	456	107,016
South America	273	59,458
Central America	153	59,944
Turkey	305	48,209
Belgium	55	23,344
Asia	42	16,019
Africa (Liberia)	3	454
Total	58,208	15,553,888

English eminence has grown up, in part, from the employment in her trade of iron sailing-vessels, which she found she could build cheaper than she could wooden ones. No iron sailing-ships have been built in the United States, except one only, "The Iron Age," constructed at Wilmington, Del., about ten years ago.

CHAPTER II.

STEAMBOATS.

ONE of the most imposing spectacles of this or any other age is the calm and impressive manner in which English writers claim "the glory of having introduced steam-navigation to the attention of the world," and the coolness with which they say that this invention — having, like daylight, fresh air, and other objects of great utility, been born in England — finally left its inventors "to irradiate the names of others who reaped the benefit of their labors," the most prominent of the "irradiated" being Fulton. The first British steamboat splashed its way around a lake at Dalwinston, for the first time, in the middle of October, 1788, the event accruing to the great edification of the farm-hands of the regions adjacent, who came down to see a boat "driven by smoke" at the rate of four miles an hour. Yet experiments had then been making with steamboats in America for thirty-eight years; and in 1785, three years before the first English boat was tried, John Fitch had navigated the Schuylkill in a shallop, with a paddle-wheel at the stern, driven by steam; and in 1786 he had made eight miles an hour with a second and new steamboat on the Delaware. The idea of propelling boats by some mechanical device even was not at all new with England. The ancient Egyptians had galleys which were worked by paddle-wheels propelled by oxen, the power being transmitted somewhat on the principle employed in a modern threshing-machine. The Romans had the same style of craft to carry corn and soldiers to Sicily in the days of the commonwealth. It was proposed at Berne to work vessels on the duck-principle, by constructing two tremendous web-feet, which should open and shut like umbrellas, and be operated by steam. One ingenious European had also proposed to propel boats by firing big cannon from the stern, it being ascertained by experiment that a moderate-sized ship might be driven at the extraordinary velocity of ten miles a day with thirty barrels of gunpowder. In the romantic tale of "Amadis of Gaul" the unknown author had described a fiery vessel rushing over the ocean with the speed of the wind, in a way which really answered very well as a prediction and as a description of a modern Mississippi-river steamboat

Fulton and Fitch.

racing down stream with a rival vessel, with a hundred and fifty pounds pressure on the boiler, and burning pitch-pine knots and turpentine. The whole idea of forcing a vessel through the water without the agency of human labor, and independently of wind and tide, was ages old when England invented a little twopenny four-knot vessel to splash around the precincts of Dalwinston Lake, and amuse the louts of the adjacent hillsides. England's sole credit in the way of priority is for the invention of the steam-engine. For that great machine, all hail to England! We must put our hats on again, however, when mention is made of the steamboat.

There is a great deal of romance about the ancient style of propulsion. The Indian,

> "Skimming Ontario's waters blue
> Like the swallow's wing in his bark canoe,"

and the Venetian in his stately galley rowed with double and triple banks of oars, and the Yankee with his wonderful clipper and its cloud of canvas, have been a constant theme for poets and historians. But, after all, steam speaks to poets and prose-writers alike with a more glorious voice than oar or sail: —

> "For fire is chief like haughty gold,
> And with its glow
> Fills all the night with flame."

So old Pindar sang: and the saying is far more true than ever Pindar dreamed; for fire and steam have given us the greatest ships of all time, whose achievements are of indescribable magnitude, and whose influence is more far-reaching and important than that of any other material agency under the control of man.

When the discovery of the steam-engine had set all the world thinking of a new way to accomplish all mechanical work, and long before the ideas of Watt were perfected, it was proposed to apply steam to the propulsion of boats. As early as 1750 it is said an experiment of some kind had been attempted in America, at Reading, Penn.; and Oliver Evans, who in 1768 proposed a steamboat, also made experiments at Philadelphia. Shortly after the Revolutionary war, two American inventors who had been simultaneously studying the new idea — John Fitch of Connecticut, and James Rumsey of Maryland — both brought out patterns of boats to be propelled by steam. Rumsey's first idea was to construct a boat which should go up a river by the force of the current acting "on setting-poles." He showed a model of a boat for navigating rivers on this principle to Gen. Washington on the Potomac in 1784, and in 1785 he got a ten-years' monopoly for building such boats from the Assembly of the State of Pennsylvania. Fitch experimented from the beginning with steam. His first vessel had a paddle-wheel at the stern, and was tried successfully on the Schuylkill in 1785. In 1786 a

Rumsey.

larger and more practical steamboat was tried by him on the Delaware, making eight miles an hour. This was before the adoption of the Federal Constitution, and while patents were issued only by the several States; so that Fitch had to apply to such of them as he thought would give him a favorable hearing each by itself. Pennsylvania gave him a fourteen-years' patent in 1787; and Delaware, New York, and Virginia followed her example. In 1787 Rumsey brought out an invention for moving steamboats by means of a pump, water being drawn in at the bow, and expelled violently at the stern. This was the plan of Dr. Allan in England also, that gentleman believing that the boat would be rapidly propelled; "thereby imitating very accurately what the Author of Nature has shown us in the swimming of fishes, who proceed by protrusion with their tails." Rumsey tried his plan on the Potomac, and then took it to England, where it worked well on the Thames, making four miles an hour. The inventor died in 1793, before he had reaped any substantial reward for his invention. The next invention was by Fitch, and was nothing less than the ocean-propeller, — a contrivance which most people yet believe to be an English affair, and which the English themselves, in their large and comprehensive way, definitely claim to be the originators of. The craft made use of for Fitch's experiment with a propeller was a common long-boat eighteen feet in length. The boiler was a ten or twelve gallon iron-pot, with a thick plank lid firmly fastened down upon it. The steam-cylinders were of wood, barrel-shaped outside, and firmly hooped. The connecting-rods, beam, and crank were of equally simple construction. The propeller was a regular iron screw, the blade, or flange, taking three turns around the shaft. With this device Fitch made six miles an hour, the sheet of water on which it was tried being Collect Pond, ninety feet deep, which covered the ground where the Tombs now stands in New-York City, and a large area in the vicinity. The boat was afterwards abandoned on the banks of the pond, and allowed to decay. The date of the experiment is stated as 1796.

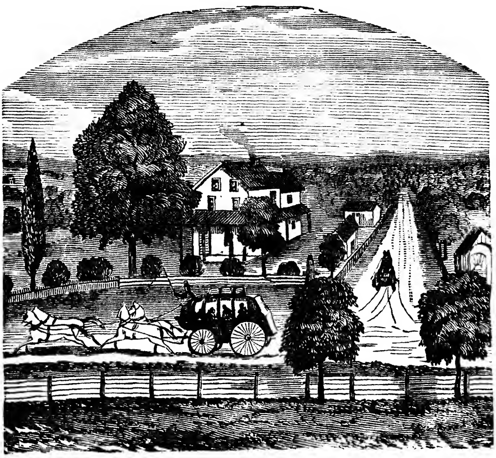
Fitch's invention described.

In 1804 Mr. Stevens of Hoboken, N.J., made a number of trips on the Hudson River with a small steamboat propelled by a wheel at the stern. He afterwards did a great many valuable things in the way of perfecting the steam-engine.

So far there had been nothing done, except in trying experiments. Fitch, in 1790, had run a boat between Philadelphia and Burlington to carry passengers, which was operated by paddles at the stern. But this was only an experiment, and was soon abandoned; and Fitch had died in 1798 a broken-hearted man, owing to the want of popular appreciation of his inventions. But steam-navigation was now to be made a success by Robert Fulton, a native of Little Britain, Penn., who had gone to Europe in 1786 to perfect his mechanical education, and push his fortune. Fulton made a great many curious experiments in locomotion in Europe, one of them

Fulton's experiments.

being an attempt to blow up the English ships blockading Brest in 1801, with a submarine torpedo, in behalf of Napoleon. He remained under water four hours and a half; and would have blown up an English seventy-four, except that she moved out of the way just in time to avoid him. He did not, in the end, blow up a ship. He afterwards tried to sell to the English a patent to blow up the French; without success, however. In 1803 Fulton launched a steamboat on the Seine below Paris, in behalf of himself and Chancellor Livingston, our minister to France, the latter of whom had taken great interest in Fulton's experiments. This pioneer boat of Fulton's met with an astonishing mishap. The builder had miscalculated the strength of the vessel; and, when the machinery was placed in the centre, she broke in two in the middle, and the whole concern went to the bottom. John Scott Russell, vice-president of the Society of Arts for Scotland in 1841, who relates this incident, says, "The shattered vessel was raised, and was found to be almost entirely broken up. How admirable are the lessons inculcated by a thorough failure! The American steamboats have ever since been distinguished by the excellence of the strong and light framing by which their slender vessels are enabled to bear the weight and strain of their large and powerful engines." Fulton, nothing daunted, fished out his machinery from the mud of the Seine, and in the fall of the same year placed it in another vessel, sixty-six feet long and eight feet wide. The vessel had paddle-wheels, but moved so slowly (only three miles an hour) as to be thought at first a failure; but Livingston and Fulton both learned from it valuable lessons, and they prepared to carry the benefit of their discoveries back to their native land immediately. They at once ordered an engine to be built by Bolton and Watt, to be forwarded to New York, to begin practical steam-navigation in American waters. Livingston got a patent from New-York State for the right to navigate its waters



FULTON'S BIRTHPLACE.

"The Clermont."

by steam for twenty years; and in 1807 "The Clermont" was launched, under Fulton's direction, on the East River at New York. She was of a hundred and sixty tons' burden, and was supplied with side paddle-wheels. A more astonished crowd of human beings had never collected on the shore of Manhattan Island since the days when the openmouthed red man saw Hendrick Hudson sail up the bay, and cast anchor off shore, than were assembled the day "The Clermont" made its first trial-trip. Everybody had said the experiment would fail. The boat had been called "Fulton's Folly;" and the whole scheme had been the standing joke of the town. "The Clermont" had not gone a hundred yards from shore, however, before the multitude which was looking on became a prey to the liveliest surprise and admiration, which almost deepened to alarm as they heard the racket of her machinery and the terrific splashing of the water, and saw the fire and smoke pouring out of her chimney. The boat

"Walked the waters like a thing of life,"

and left the overwhelmed spectators behind her at a speed of five miles an hour. She made that first trip to Albany, against the current, in thirty-two hours, scaring the boatmen and farmers along the Hudson dreadfully, especially at night, by her roaring and her fires. This vessel made regular trips to and from Albany, and was joined in 1807 by a second boat, built by the same owners, called "The Car of Neptune," and later by a third, called "The Paragon." The two latter were of three hundred and three hundred and fifty tons respectively.

"The Comet of the Clyde."

Steam-navigation was now a success, complete, practical, and triumphant; and the achievement took place in the New World, and through the energy and genius of Americans alone. It was not until 1812 that "The Comet of the Clyde," the first trading steam-vessel of Europe, was launched, and taken out for a trial-trip. John Scott Russell congratulates America upon the benefits arising from Fulton's enterprise, and says, "Although America, in common with the rest of the world, will look to this country as the source from which she derived this benefit, yet we heartily join," &c. Really America must be excused. R. L. Stevens of Hoboken, who had already perfected a practicable steamboat, would have accomplished steam-navigation before Henry Bell did on the Clyde in 1812, had Fulton done nothing about the matter; and even if Fulton was, in fact, preceded by the people on Dalwinston Lake, and if he really profited by their experiments, it was his own peculiar and original genius which accomplished what they could not, and that was something for which he was not indebted to English inventors.

Navigation of the Hudson thrown open.

The navigation of the Hudson, though patented to Fulton and Livingston, was thrown open to the public, by a compromise, in 1815. Other people wished to build steamboats, and public sentiment was unfavorable to the monopolizing of the water-courses of the country by anybody. Fulton at first claimed the monopoly of the Western rivers; but his claim was disputed, and carried to the courts, and beaten; so that, after 1815, the rivers of the country were as free to whoever might choose to navigate them by steam as they had previously been to vessels under sail.

Appearance of steamboats in the West.

Steamboats made their appearance in the West in 1812. The pioneer boat was "The New Orleans," built at Pittsburgh by Fulton at a cost of $40,000, and provided with a stern-wheel and sails. She was of between three hundred and four hundred tons' burden. In October, 1812, she made the trip from Pittsburgh to Louisville in seventy hours: she then made several trips to Cincinnati, and in December went to New Orleans, and was there put into the trade between that city and Natchez. She was wrecked on a snag in 1814. This boat paid for half her cost the first year. The second boat was "The Comet," built at Pittsburgh in 1813 by Mr. D. French, which found her way to New Orleans in 1814, and, after two trips to Natchez, went out of existence, her machinery being taken out and put into a cotton-mill. The third boat was "The Vesuvius," also built at Pittsburgh by Fulton for a company. This vessel was of three hundred and forty tons. She went to New Orleans with the others, and was burned in 1816. None of these boats had been able to ascend the Mississippi River. They went down stream well enough. "The Vesuvius" had tried to return, but failed. The ascent was not accomplished until 1815, when "The Enterprise," a small boat of only seventy tons' burden, with a single wheel at the stern, for the first time made the voyage up the rivers from New Orleans to Cincinnati, arriving there in twenty-eight days. She reached Louisville in twenty-five days, and stopped there in order to permit a public dinner to be given in honor of the event.

The first steamer in the coasting-trade was built by the Stevenses at Hoboken, while Fulton still had a monopoly of the Hudson, and was run by the outside route to Philadelphia.

Steamboating across the Atlantic.

There now remained only one field for the American steamboat-men to conquer: that was the home of old Neptune himself, — the open ocean. The crossing of the Atlantic was altogether a different matter from a voyage along the coast and up and down a great river. American builders and merchants hesitated to attempt the undertaking for many years. At length, however, the experiment was tried. A vessel called "The Savannah," three hundred and eighty tons' burden, ship-rigged, with horizontal engine and paddle-wheels, was built at Corlear's Hook, N.Y., by Crocker & Fickitt, for a company of gentlemen, who proposed to send her across the ocean for sale to the Emperor of Russia. She sailed from New-York City in 1819 for Savannah, Ga., making the trip in seven days, four of them under steam. From Savannah she went direct to Liverpool, making the voyage in twenty-two days, during fourteen of which she was under steam, moving the rest of the time under sail. Her arrival in Great Britain created a great commotion. When about entering St. George's Channel, off the city of Cork, the commander of the

Crossing of "The Savannah."

British fleet, seeing a huge cloud of smoke rising from the vessel and covering the sky, sent off two cutters immediately to save her passengers and crew from the destruction which he supposed was threatening them. The steamer paid no attention to the cutters; and the Englishmen, exasperated because their benevolence was not accepted, rowed furiously alongside several times, and fired several guns across the steamer's bow, and finally hove her to and boarded her. The officers, finding that the steamer was all right, finally let her go, and she bore away. At Liverpool her arrival created a tremendous sensation. As she came up the harbor with sails furled and the American colors flying the piers were thronged with people, who greeted the ship with enthusiastic cheers. A great many persons of distinction visited her. She finally went on to St. Petersburg. She was an object of great curiosity at every port at which she stopped, but was not sold as expected; and accordingly she set sail for home. The King of Sweden offered $100,000 for her, payable in hemp and iron delivered in the United States; but the cash was wanted, and the offer was not accepted. The ship ran home from Norway in twenty-two days. Her machinery was then taken out, and she became a sailer. She subsequently went ashore on Long Island, and was completely wrecked. The owners of the vessel are said to have lost over $50,000 by their voyage to Europe. The trouble with "The Savannah" was, that her engines were imperfect. They consumed so much coal, that the ship could not carry enough fuel for the voyage, and there was no room for cargo whatever. It was about twenty years before the steam-engine was so perfected as to make ocean navigation profitable; and, when that time arrived, the English were the first to take advantage of it; the pioneer ships, "The Sirius" and "The Great Western," entering New-York harbor almost together on the 23d of April, 1838. The honor of the first crossing of the Atlantic remains with our own countrymen; but the credit of establishing vessels in trade belongs to the English. The Royal Mail (or Cunard) steamers began running from Halifax to Boston in 1840, and they have never ceased to run to the present day. Other lines were afterwards started, and at the present time England has about a hundred and twenty-five steamers running to the United States. The Mills line to Bremen (American) was started in 1847, and the Collins line to Liverpool in 1850, as also the Garrison line to Brazil in 1865,—all from New-York City. The Pacific Mail line to China was started in 1865 also. When 1865 came, however, England had a hundred and twenty steamers running to this country, and had virtually monopolized the steamship traffic, her lines being supported by the patronage of the government. Our own lines to Europe had been withdrawn. The only line we have to Europe to-day is that of the American Company of Philadelphia, which employs four three-thousand-ton steamers in the trade.

Establishment of first line of steamers.

Growth of other lines.

In 1818 the first steamboat was built for the trade of the Great Lakes, then beginning to be considerable. It was "The Walk in the Water," named after a celebrated Indian chief in Michigan. She was built at Black Rock, N.Y., on the Niagara River, her engines being brought up from New-York City by sloops to Albany, and thence despatched by six and eight horse teams overland to the Niagara River. The different parts of the engine arrived from Albany in fifteen to twenty-five days' time. "The Walk in the Water" was brig-rigged, and of three hundred and sixty tons' burden. Being lost in a gale in 1821, she was replaced by "The Superior." The owner of the two boats was Dr. I. B. Stuart of Albany. As trade on the lakes increased, more steamers were put into the business by other people at all the large ports.

America the pioneer in steam-boating.

These were the beginnings of steamboating in America. They have been described with great minuteness, because the United States was the pioneer country of the world in utilizing the power of steam in the practical transportation of freight and passengers, and the history of early efforts is thus especially interesting; and also because in the beginnings of an enterprise is infolded its whole subsequent history, just as truly as every characteristic of a tree is outlined and predicted in the little sprout that has just poked its way out of the soil. No enterprise can be understood unless its origin is known. If the origin be thoroughly comprehended, the intermediate steps by which the enterprise attains its final development are of small account: they are merely a repetition of the steps first taken.

Importance of steam-navigation to this country.

Steam was put to service upon the water in this country about thirty years before it was employed in traffic overland; and it played a most important part in the development of the country, and in cementing together its various communities. It brought the distant territories in the North-West and at the mouth of the Mississippi River at once into immediate and patriotic relations with the older communities, and was the means of building up a thriving exchange of commodities, and unity of sentiment, between them. The same was true of the different parts of the Atlantic coast. In the settlement of the West and South the steamboat greatly assisted; and so well adapted was this new agency to the work of threading the chain of lakes, and to overcoming the vast distances of the great rivers, that by 1835 the building of steamboats in the West had become very large, and by 1856 there were more than a thousand of this style of craft actively engaged in the traffic of that portion of our domain. The steam-tonnage of the Mississippi-river Valley at that time equalled the magnificent steam-tonnage of the whole empire of Great Britain. About 1850 the old-style steamboat of the West and North, ranging from two hundred to four hundred tons in size, began to be found inadequate to the wants of trade because of its small size. The builders then began to enter upon the construction of larger craft; and they enlarged their vessels year by year, until the latter have, in 1878, attained a size, in the trade of the Mississippi at least, equal to that of the colossal trans-Atlantic steamers. One of these huge Western boats will be referred to hereafter.

On the coast a steam-packet was running between New York and Philadelphia as early as 1814, and a regular line was plying from New York to Charleston as early as 1832. After 1830 the whole coast became alive with steamboats. Lines were started in Long-Island Sound to ply in the routes to Boston, Hartford, and other New-England cities, the steamers connecting at proper points with stage-lines on the mainland, just as they now do with railroad-lines. Lines were started in Chesapeake Bay, in the waters of Virginia, and in every large river leading from the interior of the Southern States to the coast. The coasting-steamers finally crept as far to the southward as to Savannah, to which point a line began running about 1848. In 1848 steamers began running between Charleston and Havana in Cuba, under the patronage of our government. The greatest coasting-line of all was authorized to be established by the Act of Congress of March 3, 1847, in order to facilitate intercourse between the Eastern States and our newly-acquired territories on the Pacific Ocean. We had just obtained all that vast territory lying west of the Rocky Mountains by cession from Mexico. With the existing inadequate means of transportation, that region was practically as far away from the Atlantic centres of population as though it had been buried in the interior of the continent of Asia. In order to settle this new territory, it was necessary to have steamers; and so Congress authorized lines to be started in the same patriotic spirit in which it afterwards originated the Pacific railroads. Two companies were formed, — the United-States Mail, to run from New York to Aspinwall on the Isthmus of Panama, a distance of 2,000 miles; and the Pacific Mail, to run from Panama on the Pacific, 3,300 miles, to San Francisco. The pioneer steamer, "The California," 1,058 tons, left New-York City, Oct. 5, 1848, being followed within a month by the "Panama" and "Oregon," 1,087 and 1,099 tons, all three steaming for the Pacific by way of Cape Horn. The first steamer of the other line to ply to Aspinwall, "The Falcon," 891 tons, left New York in December of the same year. This line touched at New Orleans *en route* by contract. It is seldom in the history of the world that a great agency for the performance of a specific work is created so opportunely as were these two lines. While "The California" was peacefully wending its way across the tropical seas *en route* for its distant service, and its officers were wondering what on earth they would find at Panama to carry to California, the exciting story came to the Eastern States that gold had been discovered in the Sacramento Valley in extraordinary quantities. The officers of the two steamship lines at New York were at once besieged with applications for passage to California. "The Falcon" went out loaded; and when "The California" came into the harbor of Panama to get advices from home, before going on northward, she found a multitude of eager gold-seekers there awaiting her

Establishment of coast lines of steamboats.

Pacific Mail Steamship Company.

arrival, and she went on her way loaded down to the water's edge with passengers and freight. Her consorts had the same experience. Both steamship lines were a magnificent success from the start; and they themselves did more to build up our empire on the Pacific rapidly than a thousand sailing-vessels slowly working their way around Cape Horn could have done. By 1851 there were nine large steamers in the Atlantic line (one, "The Illinois," being of 2,123 tons' burden), and six in the Pacific line, one of the fleet, "The Golden Gate," being of 2,068 tons' burden. The two lines consolidated into one in 1865, and then sent out steamers to China. Since the foundation of this great enterprise other coasting steam-lines have been started, and the number of them now is legion. They ply on all parts of the three coasts, and between all principal commercial cities.

Statistics of steam-tonnage.

The growth of steam-tonnage in the United States will be shown by the following table, the figures beginning in 1823, because the steam-tonnage was then first recorded separately: —

	TONNAGE.
1823	24,879
1830	64,472
1840	202,309
1850	525,434
1860	867,937
1870	1,075,095
1876	1,172,372

The distribution of this tonnage in 1876 was as follows: —

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

Difficulties of early builders.

The principal trouble of the early builders of steamboats in this country was in devising a proper way of transmitting the power of the steam-engine to the water. Fitch tried paddle-wheels, a bank of oars, and a screw-propeller. Rumsey tried a jet of water. Subsequent inventors tried a vast variety of devices. One was an endless chain carrying a long row of paddles to play in the water at the sides of the boat or underneath the false keel. Another was the side-fan or duck-foot propeller: boats were supplied with a whole set of fins on each side. Another plan was the triple-crank paddle, — a queer combination of paddles, guiding-rods, cranks, &c., the object of which was to employ three sets of paddles, and make them dip straight down into the water, describe the segment of an ellipse in the water, and come straight out again. Any number of devices of that description were tried. Then the circular paddle-wheel was experimented with in a hundred forms. The several paddles were made to revolve so as to dip into and come out of the water perpendicularly. They were made to feather in the air, to fold up, and perform a variety of other gymnastic feats. Paddles of all sorts of geometrical forms were tried, — triangular, oblong, pointed, &c., — inventors being possessed with the idea that an imitation of the tails of fast-swimming fishes ought to be had. One queer invention was a paddle-wheel which was intended to go without steam by a pendulum apparatus. It was a rival of Fulton who conceived this brilliant thought. The wheels of his boat revolved like fury, indeed, when the boat was on the stocks; but when it was launched, and the machine set in motion, the boat did not move an inch. The builders finally settled down on the common paddle-wheel and the screw as the only useful and practical devices; and, though all the old ideas are being continually re-invented, nothing has ever been found to supersede the ones named.

Various styles of architecture.

Five different types of steamboats have grown up in American waters, two of them peculiar to America, and without equals in their way in the world. The five types are those of the common double-ender ferry-boat, driven by a powerful, quick-acting engine and paddle-wheels; the tug-boat, a little, deep-hulled craft, with engines powerful enough to enable them to handle an ocean-steamer, sometimes demonstrating four-hundred-horse power and a speed of fifteen knots; the great freight and passenger propeller, often of four thousand tons' burden, driven by a screw at the stern, for ocean-service; the American side-wheel river-steamer; and the high-pressure, side-wheel Mississippi-river steamer. The American river-steamers are models of beauty and speed, and are unequalled anywhere in the world. They have fine clean runs, with long, sharp bows as keen as razors. They divide the water, instead of raising it into a swell like the old style of Dutch and English hulls, and allow the waves gradually to unite again at the stern, so as to leave scarce any other swell behind them besides that raised by the churning of the wheels. They are remarkably long and narrow, being often twelve times as long as they are broad. The hull is built for lightness. The draught is generally moderate. The great weight of the machinery and boilers in the centre is supported by a truss, somewhat on the principle of a bridge. The arches of the truss rise high in the air above the vessel, and give to the structure a wonderful rigidity. The engines are low-pressure, and work on the principle of the Cornwall pumping-engines, with a remarkably long, quick stroke of the piston, the steam being used expansively. The American river-pistons often travel from five hundred to six hundred feet a minute; while in England the usual rate is not over two hundred and fifty. The boats are capable of a speed from twenty to thirty miles an hour. Many of the early steamers of the Collins, Mills, Vanderbilt, and other ocean and coasting lines, were substantially of this class of vessel, though built a little more substantially to meet the strain of the ocean-swells. The magnificent "Adriatic," Collins's last ship, — a vessel 330 feet long, exceeding 5,000 tons' burden, and costing over $1,400,000, built in 1856, — had a hull more of the present fashion of ocean-steamers, and fairly confirmed the latter style of hull in ocean-service. The Long-Island-Sound steamers are of the river pattern, and are now the handsomest specimens of their class in the country. They are about three hundred and twenty-five feet long. One peculiarity of the river-steamers is their huge wheels and the wheel-houses which enclose them. On the Hudson River "The New World" had wheels forty-six feet in diameter; and "The Thomas Powell," forty-feet wheels. The Sound steamers have from thirty-five-feet to forty-feet wheels. Large wheels allow the blades to enter and leave the water more nearly vertically, and diminish the concussion.

The Mississippi-river steamers are equally long, narrow, and sharp with those just described; but they generally have high-pressure engines, and they are somewhat larger, and of lighter draught. Their upper works are somewhat differently arranged; and their decks are broader, in order to secure more cargo-room. In 1876 there was launched at St. Louis one of these craft, "The Great Republic," which was three hundred and forty feet long, from ten to seventeen feet hold, fifty-seven feet beam, and a width of deck of a hundred and three feet. Her capacity of cargo was four thousand tons; and she could carry also two hundred and eighty passengers, and then have a draught of only two and three-fourths feet forward, and four feet aft, — the peculiar and necessary feature of Western travel. Her wheels were thirty-seven feet in diameter, and her cost $200,000. She was the largest river-steamboat in the world.

The screw-propeller.

The screw-propeller has, within the last twenty years, grown very popular for ocean-travel. Though invented in the United States, it was neglected there from the beginning. In 1839 England took up the idea, and gradually introduced it into her transatlantic service. Since 1861 all the American ocean and outside coasting-steamers have adopted propellers, and the side-wheelers have now disappeared from the ocean-service. Only one or two steamers on the coast still retain the paddle.

Very recently, however, another invention has appeared, in which propulsion and steering are combined in the same apparatus. The screw is the instrument employed; but it is so adjusted and operated as to perform both functions. One great advantage claimed for it is, the course of a vessel may be almost instantly changed, thus lessening the danger of collision and other similar perils. This is an American invention; and the story is told, that, during a recent trial in British waters, one of the persons on board the trial steamer, being desirous of knowing how quickly the course of the vessel could be changed by this new apparatus, was told to give the signal for making the change, when his curiosity would be gratified. Soon after, he gave the signal; and the course of the steamer was so suddenly altered as to lay him out sprawling on the deck. Recovering, and picking himself up as soon as he was able, he declared that he was perfectly satisfied of the great merits of the invention.

According to Martin's "Year-Book," the steam-tonnage of the world in 1877 was as follows: —

	NUMBER.	TONNAGE.
England	1,465	1,470,158
United States	....	1,176,000
France	522	194,546
Germany	253	167,633
Portugal	39	36,000
Austria	78	57,265
Italy	118	37,810
Belgium	24	30,397
Netherlands	86	76,827
Denmark	123	27,381
Greece	16	6,048
Chili	22	9,641
China and Japan	....	....

CHAPTER III.

IRON STEAMSHIPS.

DURING the days of the ocean-races between the ships of the Collins and Cunard steam-lines, plying between New-York City and Liverpool, two splendid steamers left England the same week for the run to America. One was "The Persia," of the Cunard line; the other the magnificent side-wheeler, "The Pacific," of the Collins line. On the way across, the two vessels met with floating ice. The sharp bow of the iron-hulled "Persia" cut the ice like paper, and passed through in safety. "The Pacific," a timber-ship, was broken up by the encounter, and took its place with the "thousand fearful wrecks" which strew the bottom of the sea under the ocean fury. This melancholy event called the attention of the two continents to the sea-going qualities of iron hulls; and from that day to the present the steam-tonnage which has been launched to brave the dangers of the open sea has been built in greater and greater degree of iron, until at present wooden steamers for deep-sea navigation are built nowhere in the world.

Wooden and iron steamships.

Attention was turned to iron ship-building in this country almost simultaneously with the rise of the art in England. The first iron boat was probably imported from England for trial; but as early as 1825, only four years after the first iron steamboat was built in Europe, a little craft of similar design and material was launched at York, Penn., for plying in the trade on the Susquehanna River. This little vessel was "The Codorus." It had a wooden frame, and drew twelve inches of water. This was the first iron boat ever constructed in America. The bars in the Susquehanna at low water seriously interfering even with the trips of so light draught a vessel as "The Codorus," she was sent South to ply on some river in that section of the country, and where she was destined to a long career of usefulness. The buoyancy and strength of this preliminary boat led to the construction of several others in Pennsylvania and New York for river-navigation within the next ten years. They varied from a hundred to three hundred tons' burden.

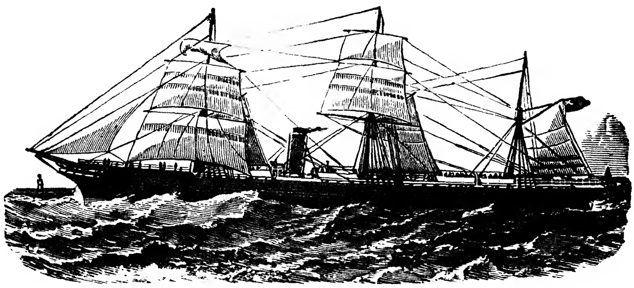
First iron craft in America.

In 1839 a steamer entirely of iron was constructed at Pittsburgh, Penn., called "The Valley Forge." Her hull and lower deck were entirely of iron, the former of fourth-inch plates, the latter of eighth-inch plates. Her frame was of angle and T iron. "The Valley Forge" was a rapid boat, easily managed, and passed successfully through several encounters with snags which would have sunk a wooden boat. She ran until the summer of 1845 as a packet-boat between Nashville and New Orleans, and was then withdrawn, and cut up into merchant-iron, nails, spikes, &c. She was broken up, not because she was an iron boat, but because Western trade then required a larger class of steamers. "The Valley Forge" carried only two hundred tons of freight, whereas thousand-ton vessels were beginning to be needed.

Iron steamer constructed at Pittsburgh.

By 1842 there was a line of iron steamboats in the coasting-trade between Hartford and Philadelphia, a line of five iron boats on the Savannah River, Ga., and a considerable number of iron tugs plying in the harbors of the North, and on the Delaware and Raritan Canal. The lighter frames and hulls and general durability of these boats recommended them to shipping-men. The building of them stopped shortly before the war of 1861, however, for the reason that our foreign, coastwise, and internal commerce had grown to enormous proportions, and required the use of vessels of great size, for the construction of which iron was so costly, that vessels built of that material could not compete with wooden vessels for freights. Besides that, few builders owned the capital necessary for putting up the expensive shops and powerful machinery suited to the business.

Progress until 1842.



STEAMSHIP. — CUNARD LINE.

The war, so great a calamity to the country in diverting from peaceful industry and agriculture for four years millions of the flower of our population, and leaving behind it desolated homes and a great debt, was a great stimulus to many important branches of national industry. Iron ship-building was one of them. Government contracts for constructing the monitors and iron floating-batteries of the war enabled various builders in places adjacent to the iron-regions to supply themselves with rolling-mills, machine-shops, and apparatus of great power and value, which, with the advent of peace, could be employed in construct-

Effect of war upon iron ship-building.

ing merchant-ships of every class. At the close of the war, pig-iron was fifty-eight dollars a ton; by 1868 it had dropped to thirty-eight dollars a ton. The general advantages of iron merchant-ships having disposed the mercantile community toward that type of vessels, orders were then given for the construction of several; and the art has ever since been practised on a continually-growing scale. Since 1868 nearly all of the steamships built for the coasting-trade of the United States, all of those for the foreign trade, and many for sound, river, and lake navigation, have been built of iron. It is evident, that, in all these trades, iron hulls must eventually supersede those of the more perishable material. They are lighter, and last twice as long. American iron has superior qualities for the purpose: it permits the use of lighter frames and plating.

The years 1872-73.

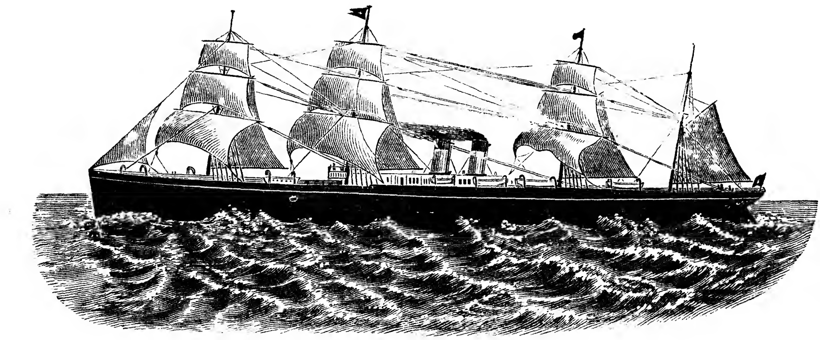
The years 1872 and 1873 constituted a new era in the history of this industry. The Pennsylvania Railroad had resolved to establish a line of first-class ocean-steamships to run from Philadelphia to Liverpool, to form the sea-division of its line of communication between the fruitful and populous interior of the United States and Europe.

American line of steamers to Europe.

Its interest in the matter induced a number of merchants of Philadelphia to organize a company to build a line of American iron steamers to run from that city in competition with the foreign lines from New York. The railroad company became a stockholder, and guaranteed the bonds of the new organization to the amount of $1,500,000. Under this arrangement, proposals from builders were asked for. William Cramp & Sons of Philadelphia, a firm whose yard had been established in 1830, were the successful bidders. They agreed to lay the keels of four iron steamships of 3,016 tons' burden, 355 feet long, to draw twenty feet six inches in fresh water, capable of carrying 920 passengers and a full cargo, at a speed of eleven knots and a half per hour, with a consumption of forty tons of coal per day, for $2,080,000. The firm comprised men of long experience; but they fortified themselves before beginning the ships by an examination of the yards on the River Clyde in England and the best specimens of foreign steam-shipping. They resolved to build four ships which should in every respect excel those of foreign construction employed in the traffic of the Atlantic, and they did build them in a thorough manner. "The Pennsylvania" was launched Aug. 15, 1872; "The Ohio," Oct. 30, 1872; "The Indiana," March 25, 1873; and "The Illinois," June 15, 1873. The line went into operation in July, 1873. This is now the only line of steamships carrying the American flag across the Atlantic. Its captains are under positive orders never to incur risk for the sake of making a quick passage,—a policy followed by the Cunard line, the oldest in the Atlantic trade, and successful in an eminent degree in inspiring the confidence of the travelling community. The ships have, nevertheless, made better average time than the foreign steamers running out of the same port. The passage to Liverpool averages eleven days nine hours. More favorable rates of insurance have been granted to these steamships than to any others in the Atlantic service, two Cunarders alone excepted. The vessels have been a success both financially and mechanically.

While the American line was building, two iron steamships of large size were constructing at the yard of John Roach & Son, a short distance below the city, — the largest works of the kind in the country. These were "The City of Peking" and "The City of Tokio," ordered by the Pacific Mail Steamship Company for its trans-Pacific service to Japan and China. They were to be the largest iron merchant-steamers in the ocean carrying-trade of the world. "The Great Eastern" was the only iron vessel which excelled them in size; but that vessel was a commercial failure, and was not actively employed in trade. The building of these two vessels excited that extraordinary interest in the United States

Iron steamships for Pacific Mail Steamship Company.



STEAMSHIP. — WHITE-STAR LINE.

which daring enterprise, and any effort for the supremacy of the national flag at sea, have always aroused. The launching of "The City of Peking" in March, 1874, was made the occasion of a great celebration, which was attended by a delegation from both houses of Congress, and by merchants from the leading cities of the country. "The City of Tokio" was launched soon afterwards. Both ships have since been employed with eminent success in the trade of the Pacific. They each carry over 5,000 tons of freight and 1,650 passengers, and are crack ships in every respect. They are 423 feet long. "The City of Peking" made the fastest trip ever made across the Pacific in 1875, burning forty-five tons of coal a day; while the vessels of the Occidental and Oriental line, which run in competition with her, owned and built in England, burn sixty tons a day, running on schedule time. These vessels have engines of 5,000 horse power, and are driven ordinarily at a speed of fifteen knots and a half per hour. They can run to Hong Kong from San Francisco in twenty-two days.

These ships placed upon the building of iron merchant-steamers in the United States the final stamp of success, and they initiated the era of large carriers running at great speed with a small consumption of coal. Since they were undertaken, the number of wooden steamers for the coasting and foreign trade built in this country might almost be counted on one's fingers. No one now builds of any thing except iron for those trades. Some magnificent vessels of the river type of steamer, of wood, have been produced for the traffic through Long-Island Sound between New York and the cities of New England. But this is not coasting-navigation proper: it is more like river-navigation. The hulls of some of these vessels are of iron, however.

Magnificence of new steamers.

The class of steamship which has been building for the coasting-trade is unlike any other in use in the world. It has the beautiful bow and run which have always characterized American vessels. Hull, frame, and generally both decks, are of iron. They are fitted with screw-propellers, water-tight bulkheads, compound engines, and two masts, though sometimes three, and range from 1,800 to 2,500 tons' burden. They are of light draught, so as to enter Southern harbors with facility; and some of the recent vessels built at Chester contain tanks, to be filled with sea-water and emptied, to assist them over the bars when needed. The number of iron vessels built for American owners since 1866 was, in June, 1877, as near as can be computed, 250. They ranked as follows: —

Ships for the coasting-trade.

Number of iron vessels built since 1866.

Less than 100 tons	57
From 100 to 500 tons	73
From 500 to 1,000 tons	40
From 1,000 to 2,000 tons	61
From 2,000 to 3,000 tons	9
From 3,000 to 4,000 tons	8
Over 5,000 tons	2

The total tonnage June 30, 1877, was 191,490. Of the whole number, only three were sailing-craft. In addition to the above, a number of small iron steamboats were built, and exported to South America to run on the Amazon and other rivers.

Iron ship-building keeps naturally in the vicinity of the iron and coal mines: it is leaving Boston, New York, and other cities distant therefrom, and concentrating on the Delaware. While the business is destined to reach such proportions eventually as to require the opening of iron shipyards in all parts of the country, particularly on the Mississippi River and the Western lakes, there are at present only four firms of prominence in the business, and not over ten in all. The oldest is that of William Cramp & Sons at Philadelphia. This yard was established in 1830: it

Location of business.

was engaged in building of wood until 1860, when it constructed "The New Ironsides" and a number of ironclads, and has been engrossed with iron-work ever since. Since completing the iron steamers for the American line to Europe, it has produced six iron colliers for the Reading Railroad, of 1,200 tons' capacity each, and 224 feet long; "The Columbus," an iron screw vessel of 1,850 tons for the coasting-trade, the largest which in 1874 had then been built for that service; and a number of other coasters and tugs, besides doing a large amount of government repairing. The works will employ 12,000 men. At Wilmington are situated the yards of the Harlan & Hollingsworth Company, and Pusey, Jones, & Company. The former concern is also extensively engaged in the manufacture of railroad-cars, and employs 1,000 men. It has built several of the Pacific mail-steamers, and some of the finest boats on the coast. The latter firm has made a specialty of work for the South-American rivers. The principal firm of iron ship-builders is John Roach & Son of Chester, Penn. Over $2,000,000 has been invested by this concern in shops and machinery; and the most powerful mechanical appliances in the country are to be seen at the yard at Chester and the engine-works in New York. Over $15,000,000 has been paid out by the firm, from 1872 to the present time, for wages and materials; and thirty-five iron ocean-steamers have been built, besides extensively repairing and overhauling the government ironclads. Thirteen iron steamers were built by this yard in 1877, from 1,800 to 2,500 tons' burden, to ply in the trade to Southern ports, the West Indies, and Brazil. The firm employ 1,800 men. The Penn Iron-Works at Philadelphia have also been engaged in building iron ships for several years. In addition to these, the Reading Railroad Company has invested a large amount of capital in shops at Port Richmond on the Delaware for the purpose of building iron colliers for its large distribution of coal to points on the coast. The intention is to have a fleet of fifty iron colliers. Fourteen of these have been built at the other shipyards on the Delaware. They range from 525 to 1,500 tons' burden. The boats which are to be built in the future will belong to the larger class. At Buffalo the construction of iron tonnage for the trade to the West has been going on for five years. A number of large and stanch propellers have been built for the Anchor line of steamers plying between Erie and the Western cities in the grain, provision, and passenger traffic, which are in all respects superior vessels. In 1872 13,000 tons were built at Buffalo, and 20,000 tons in 1874. The past year, only two tugs have been produced. A yard has also been opened at Wyandotte, Mich., and one at New Orleans.

Future of iron vessels.

It is believed that iron hulls will eventually replace the old-fashioned style in the general business of the Ohio, Mississippi, and other great Western streams. Experience has shown the wisdom of changing to iron. In a wooden vessel of 3,000 tons' burden, 500 tons of freight-room are sacrificed by the thicker beams and shell of the vessel. A ship of the same outward size built of iron carries 500 tons more freight. Besides this great advantage, another is gained from the fact that the iron ship lasts so much longer. Those now being produced by the American yards secure the rating of A 1 for twenty years, and are liable, at the end of twenty years, to be useful for ten years longer at least. A good stanch ship will last the merchant until he is ready to retire from business, and turn over the affairs of his house to a younger generation. Iron vessels have now been tried for fifty years, under all circumstances of storm and tempests, collisions with ice, stranding on the coast, and accidents of every description. They have constantly shown their superiority, and have saved to their owners millions of dollars which would have been lost in wooden vessels subjected to the same trials. These facts have rendered them popular with the commercial world. No one now thinks of building of wood for the open sea, any more than of hunting buffalo with pop-guns.

The fall in the price of iron since the war is giving a great stimulus to this business. It has a brilliant future before it.

CHAPTER IV.

CANALS.

THE project of uniting the different parts of our common domain with artificial water-ways occurred very distinctly to the minds of the statesmen of the Revolutionary period, who, not being so embarrassed as the public men of the present day with current questions of vast and immediate importance, had more time to think of the future, and the directions which should be given to development and public effort. The wagon-roads of the country in Revolutionary days were in a shocking condition. None of them were what would be called good roads at the present day; and the majority were in a dreadful state, full of ruts and pit-holes where the track was dry, and corduroyed with trunks of large trees wherever the track was wet. Few streams were bridged; and the crossings of all of them, by constant use, were so worn as to be difficult and dangerous. The Conestoga wagons, which did the overland freighting of the country, were continually being mired; and there was scarce a highway in the land which did not have, as a part of its regular and necessary furniture, a large supply of rails lying at the roadside, to be used in prying unfortunate teams out of the mud. The need of some better plan of transportation was fully realized by the men of the day, and canals were among the earliest expedients suggested. The improvement of such highways as were available for foot-routes received the earliest attention of Congress; but canals were discussed by the people in the several States, and their value was fully appreciated. Massachusetts proposed a canal from Boston to the Connecticut River as early as 1792, and a large number of schemes were originated in all the States. The lack of public and private capital, however, prevented any thing being done for their construction in the Revolutionary period.

Condition of early roads.

The war of 1812 made our people see the danger of delaying the improvement of the internal ways of communication any longer. It became apparent that recourse could not be had to the open sea to reach different parts of the coast in times of war, and that wagon-roads were inadequate to the needs of the country in such emergencies. At the close of the Revolution

Mr. Morris had suggested the union of the chain of Great Lakes with the Hudson River, and in 1812 he again advocated it. De Witt Clinton of New York, one of the most valuable men of his day, took up this idea, and brought the leading men of his State to lend him their support in pushing it. To dig a canal all the way from Albany to Lake Erie was a pretty formidable undertaking: the State of New York accordingly invited the Federal Government to assist in the enterprise. The canal was as desirable on national grounds as on any other. The proposition met with a rebuff, however; and then the Empire State resolved to build the canal herself. Surveyors were sent out to locate a line for it; and on the 4th of July, 1817, ground was broken for a canal by De Witt Clinton, who was then governor of the State. The canal (363 miles long) was built in eight years, at an original cost of $7,143,789. The completion of the work in 1825 was the occasion of great public rejoicing. A boat loaded with distinguished guests started from Lake Erie, first taking on board some of the water of the lake. Its progress to the Hudson River was attended by a constant succession of public demonstrations of the most enthusiastic character. When the boat had reached the Hudson River, and Lake Erie was formally wedded to that stream by pouring the waters of the lake into the river, the event was signalized by the firing of a gun; and the news was carried all the way back to Buffalo the same day by the sound of signal-guns, which were ready for the event all along the line, and which passed the news along westward by firing a salute. The same year that the Erie Canal was begun, ground was also broken in New-York State for a canal from Lake Champlain to the Hudson, sixty-three miles in length. This work was completed in 1823.

Effect of war of 1812 upon the subject.

Erie Canal.

Champlain Canal.

The construction of these two water-ways was attended with the most interesting consequences. Even before they were completed, their value had become clearly apparent. Boats were placed upon the Erie Canal as fast as the different levels were ready for use, and set to work in active transportation. They were small affairs compared with those of the present day, being about fifty or sixty tons' burden, the modern canal-boat being a hundred and eighty or two hundred tons. Small as they were, they reduced the cost of transportation immediately to one-tenth what it had been before. A ton of freight by land from Buffalo to Albany cost at that time a hundred dollars. When the canal was opened its entire length, the cost of freight fell from fifteen to twenty-five dollars a ton, according to the class of article carried; and the time of transit, from twenty to eight days. Wheat at that time was worth only thirty-three dollars a ton in Western New York, and it did not pay to send it by land to New York. When sent to market at all, it was floated down the Susquehanna to Baltimore, as being the cheapest and best market. The canal changed that. It now became possible to send to market a wide vari-

Effect of canals in cheapening transportation.

ety of agricultural produce, — fruit, grain, vegetables, &c., — which, before the canal was built, either had no value at all, or which could not be disposed of to such good advantage. It is claimed by the original promoters of the Erie Canal who lived to see its beneficial effects experienced by the people of the country, that that work, costing less than $8,000,000, and paying its whole cost of construction in a very few years, added $100,000,000 to the value of the farms of New York by opening up good and ready markets for their products. The canal had another result. It made New-York City the commercial metropolis of the country. An old letter, written by a resident of Newport, R.I., in that age, has lately been discovered, which speaks of New-York City, and says, "If we do not look out, New York will get ahead of us." Newport was then one of the principal seaports of the country: it had once been the first. New York certainly did "get ahead of us" after the Erie Canal was built. It got ahead of every other commercial city on the coast. Freight, which had previously gone overland from Ohio and the West to Pittsburgh, and thence to Philadelphia, costing $120 a ton between the two cities named, now went to New York by way of the Hudson River and Erie Canal and the lakes. Manufactures and groceries returned to the West by the same route, and New York became a flourishing and growing emporium immediately. The Erie Canal was enlarged in 1835, so as to permit the passage of boats of a hundred tons' burden; and the result was a still further reduction of the cost of freighting, expansion of traffic, and an increase of the general benefits conferred by the canal. The Champlain Canal had an effect upon the farms and towns lying along Lake Champlain, in Vermont and New York, kindred in character to that above described in respect to the Erie Canal. It brought into the market lands and produce which before had been worthless, and was a great blessing to all concerned.

Opened a market for vast quantities of produce.

How it affected New-York City.

The effect of the example of New-York State was magical. All the old projects in New England, Pennsylvania, and the South, for water-ways from point to point in the domains of the several States, and to unite the people of one State with those of another, bloomed again into being, as though the naked woods and sear hillsides had felt the breath of a celestial spring. The consequences of the building of the Erie Canal were foreseen by everybody before the work was completed; and public men did not wait to hear the firing of the guns over the achievement of De Witt Clinton's great idea before they set about planning similar works for the good of their own States. It took several years of agitation before much was accomplished; but the stimulus afforded by the building of the Erie Canal succeeded in bringing about the execution of a great many important works. No less than twenty branch canals were planned at once in New-York State. Among those projected in

How the construction of the Erie Canal stimulated the building of similar undertakings.

other States were one from Boston to the Connecticut River; one from Worcester to Providence, "on which," it was said, "there would be a mighty transportation," it being estimated that "a hundred tons of cheese and seventy-five tons of pork would annually find an outlet in it;" a canal from Baltimore to Pittsburgh; others from Long-Island Sound across the State of Maryland, and from the Ohio River to Lake Erie; and yet others in Virginia and Pennsylvania. It was a period of great excitement and public effort; and time would fail to tell of the brilliant and extensive schemes which filled the minds of all the people at that time, and whose merits were the constant theme of popular discussion. Some of these works were never built, as the capital could not be commanded to construct them. Many of them were, however, completed, to the great benefit of the several States.

Harrisburgh and Pittsburgh Canal.

Pennsylvania was one of the first in the field in practical work. She resolved to build a canal to the western part of the State for the double purpose of giving an impetus to the agricultural and manufacturing interests of her own State, and also in order to secure to the city of Philadelphia a share of the trade with the West. A line of communication from Philadelphia to Pittsburgh was accordingly planned, and undertaken at the State's expense. The project was agitated for several years before the people at large could be brought to the point of sustaining a route of such magnitude; and it was not until 1826, therefore, that ground was finally broken for a canal; but earth was turned at Harrisburgh July 4, 1826, and the work was thereafter prosecuted with vigor. A good canal was in operation from Columbia on the Susquehanna to Pittsburgh by 1836, the route being interrupted at Hollidaysburgh with a portage-road of thirty-six miles to Johnstown, which did not prove fatal to the value of the canal. Other water-ways were planned in other parts of the State, — local affairs for coal and grain transportation, — and many of them were built during this period. The canal-route from the West was pieced out at the eastern end by a railroad from Columbia to Philadelphia, and Pennsylvania thus had her through-route to the West. It reduced the cost of freight from Pittsburgh to the Delaware River from a hundred and twenty dollars a ton to thirty dollars; and, though the city never got back the trade which New York had taken from her, she gained by the new works immensely. These works were afterward sold to the Pennsylvania Railroad.

Ohio was building two canals at the same period, — one from Portsmouth on the Ohio to Cleveland, which was finished in 1833; the other from Cincinnati to Lake Erie, which was finished in 1843.

Massachusetts.

Massachusetts ordered surveys for a water-way west from Boston in 1825, and the engineers did a good deal of preliminary work in examining the ground out toward the Connecticut River; but nothing was ever accomplished by Massachusetts in this class of public works. Public attention was distracted to another style of transportation-route, — the railroad; and the energies of the State were diverted from canal-building, and applied to the work of constructing railroads.

One of the ancient projects had been for a canal from Baltimore west to the Ohio River. Washington, Charles Carroll, and other eminent men of the Revolution, had favored this idea, and had talked about it a great deal. It had slumbered for forty years, owing to the scarcity of means of the young republic; and only when the Erie Canal had been begun was Maryland aroused to a new and realizing sense of the value of the idea. Congress was finally induced to vote $1,000,000 for a canal from Georgetown to Pittsburgh; and Virginia and Maryland, as well as the cities of Washington and Alexandria, having subscribed $1,250,000 more, the work was put under way in 1828, Charles Carroll and John Q. Adams turning the first earth. The canal was very hard to build, and did not make that rapid progress which its projectors desired. It was not until 1850 that the work reached Cumberland, Md.; and when it arrived at that city it stopped. It had cost $16,000,000. Surveys have been recently made with a view to going on with it to Pittsburgh. It will undoubtedly be carried on to that city at some time or other.

Baltimore and Ohio-River project.

The Farmington Canal in Connecticut was built during this period of excitement, the Dismal-Swamp Canal in Virginia, and a number of other short local affairs in different parts of the country. All these enterprises repaid their cost to the public a hundred times over.

Farmington Canal.

After the first speculative era of canal-building had passed by, a number of other important canals were opened by different States, which still, like the Erie and the Chesapeake and Ohio Canals, play a part in the general transportation-business of the country. One was the canal from Lake Michigan at the city of Chicago to the Illinois River, a distance of 102 miles, which was completed in 1852. Another was the Wabash and Erie Canal, projected by the State of Indiana, which, after many reverses and stoppages, was finished about 1850, and was the means of creating another connection between the trade of the lakes and the streams of the Mississippi Valley. Another great route which has not been fully utilized even yet was across the State of Virginia. The idea was to connect the Kanawha River, a branch of the Ohio, with the James River leading into the sea. Over five million dollars was spent in trying to connect these two rivers; but the work was not finished, and still remains uncompleted. Congress has aided in pushing this work, and it will probably be finished during the next decade. It will open the shortest possible water-route to the sea from the grain States of the West, and especially the central States of the Mississippi Valley; and there is not the shadow of a doubt but that it will have a great traffic, and will probably change Richmond into a great commercial emporium. Railroad-building has since 1835 largely diverted the energies of the country from the construction of canals; but experiment has only

Building of other canals.

Wabash and Erie Canals.

demonstrated the wonderful value and imperative necessity of such canals as those which have been particularly mentioned. Wherever they are built, they are the cheapest route for the transaction of a heavy freight-traffic, and by their cheapness they exercise a regulating influence of the most wholesome description upon the cost of transportation on the railroads.

Effect of railroads upon canals.

It is now held by the statesmen of the country that the building of the Erie Canal was the wisest and most far-seeing enterprise of the age. It has left a permanent and indelible mark upon the face of the republic of the United States in the great communities it has directly assisted to build up at the West, and in the populous metropolis it created at the mouth of the Hudson River. None of the canals which have been built to compete with it have yet succeeded in regaining for their States what was lost to them when the Erie Canal went into operation. This water-route is still the most important artificial one of its class in the country, and is only equalled by the Welland Canal in Canada, which is its closest rival. It is now proposed to make the Erie Canal a free route, open without tolls to all who may wish to navigate it. If the canal is really made free, it will retain its position as the most popular water-route to the sea from the Great West. The Mississippi River will divert from it all the trade flowing to South America and Mexico; but for the North-West it will be the only water highway to the ocean.

Wisdom of building Erie Canal.

CHAPTER V.

THE FISHERIES.

INTIMATELY connected with the subjects of shipping and transportation is that of the fisheries. A large part of the tonnage of all prosperous maritime nations is employed in the catching of ocean-fish, and it has frequently happened that a nation has owed all its maritime prosperity to the schooling in navigation which its people acquired in this special field of employment. Venice was originally only a collection of huts of fishermen, who, finding nothing to support them on the barren islands where Fortune had destined them to reside, were obliged to live on the fish they could get out of the sea, which they either consumed themselves, or peddled to the inhabitants of the neighboring coasts. Their mode of getting a living led them naturally into trade by sea, and this was the origin and the secret of all their wonderful eminence. The Dutch were mariners and traders for the same reason. They did not live on an island: but their country was so inhospitable, that they found it more profitable to fish than to farm; and in 1600 these industrious people already had as many as three thousand boats, or busses, at sea, catching herring, white-fish, and whales. To market the catch to neighboring countries required six thousand vessels more; and the Dutch built up the great city of Amsterdam on a foundation of herring-bones, and made it, besides, a centre of trade for all Europe. The English also fished very early; and it is an interesting fact, now almost forgotten, that the Scots, who fished more than the English, were once so superior to them in shipping, that the Anglo-Saxons were very much alarmed about it, — so much so, that, in order to equalize things, the King and Parliament offered heavy bounties to their own fishermen, and ordered all the people of the kingdom to eat fish on two days of the week, so that the English might have fishing-boats, a trade, and a trading-marine, as well as their rivals. In our own country the ocean-fisheries have borne an important relation to the general shipping-interests of the several States. The men brought up on the coast where cod, mackerel, and whales have abounded, have supplied our trading-marine with the best sailors it has ever had; and it was that class

Venice.

Legislation of Anglo-Saxons.

of web-footed men — who had learned fearlessly to encounter all the perils of the sea and conquer them, and who always sailed their ships in the heaviest weather, and "never struck a topsail as long as there was a mast to fly it from" — that won for our republic its naval triumphs in 1812. They are to-day still the most valuable element in the *personnel* of our whole maritime

SAILORS.

establishment. Their ships have ever been the pioneers and reconnoitring parties of our trading-marine. They have explored every corner of the earth, and always been first in the field. The first time the American flag was ever seen in England was at the head of a whaling-ship which entered the Thames.

The early voyagers along the coast of North America remarked the abundance of fish in the vicinity of the shore from the very start. Whales were very numerous; and great shoals of them, of the largest and best kinds, came alongside of the ships of the discoverers, and played sportively in the billows, sometimes to the great consternation of the seamen, whose vessels were not very large, and who dreaded being run into by the big fellows and sunk. Even before the settlement of the continent by the English began, the mariners of Europe, having learned that there was an abundance of fish in America, flocked out with their vessels to the Banks from all parts of the Old World. It was not an unusual sight, as early as 1600, to see six hundred or seven hundred vessels off the coasts of New England taking fish. The city of Bristol in England acquired great prosperity from these new discoveries. Her people soon learned to send out boats to America, and their profits made a sensation in shipping-circles in England kindred to a modern gold stampede or an oil excitement. Whole fleets were sent out to reap a part of the new harvest. These boats were of about a hundred tons' burden. They took back to England loads that were worth three thousand pounds, of which two thousand pounds was pure gain. Portuguese, Dutch, Spanish, and Italian ships frequented the Banks, along with the others, for a long period of time.

Massachusetts settled to build up colony of fishermen.

It is said that one of the main ideas in founding settlements in Massachusetts was to build up a colony of fishermen. There is no doubt but that the utilization of the fisheries entered into the plans of the originators of the colony. The charter of Massachusetts contains a clause, saying, "Wee have given and graunted . . . all fishes — royal fishes, whales, balan, sturgeons, and other fishes, of what kinde or nature soever, that shall at any tyme hereafter be taken in or within the saide seas or waters, or any of them, by the said" . . . [the grantees being here named], "or by any person or persons whatsoever there inhabiting." To take advantage of the fisheries was one of the first enterprises of the colonists, and it was to assist them in doing so that the company in London sent over shipwrights to build vessels on the coasts of Massachusetts. Whales then swam along within sight of land, in such numbers, that, even if there had been no premeditated purpose with respect to the fisheries in sending the colonists to the barren coast of New England, the settlers would have been tempted to engage in ocean-fishing at a very early day, merely by the spectacles which passed before their eyes. But the fisheries being known before they came, and the patrons of the colony doing their utmost to encourage the settlers to embark in fishing enterprises, it is not surprising that Massachusetts became a colony of fishermen and mariners from the beginning of its existence. Nor was Massachusetts alone in this. The other New-England colonies followed closely in her footsteps, and fished as well as farmed from the date of their settlement. Every island along the coast became a centre of fishing activity, therefore, at a very early day. Every favored port became crowded with boat and ship yards. A row of villages sprang up along the beach from New-York City to the St. John's

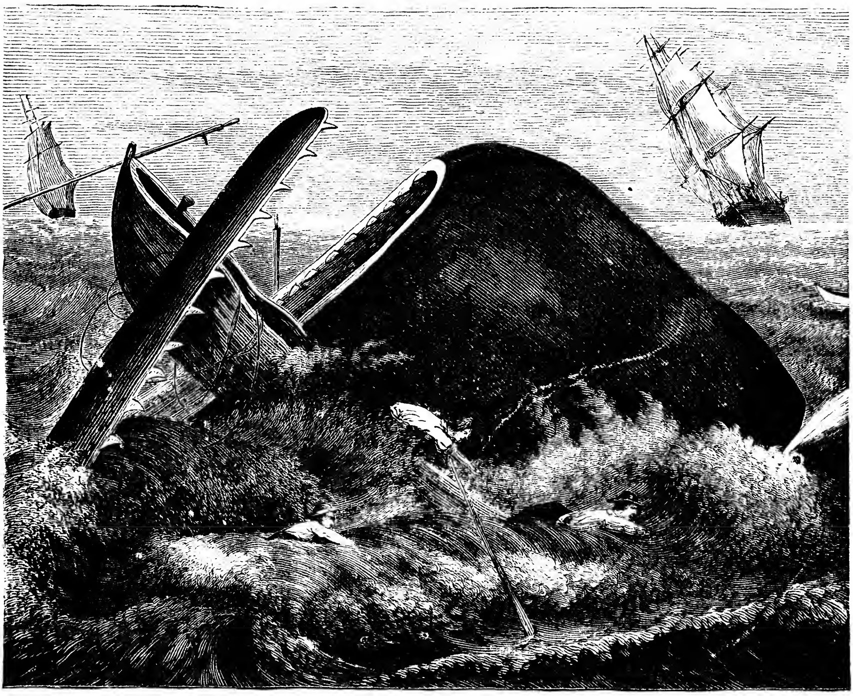
River, devoted exclusively to piscatorial pursuits; and some of them, like Gloucester, afterwards attained to a great prosperity and reputation. As early as 1731 Massachusetts had six hundred vessels and six thousand sailors at sea, half of them in the fisheries. The New-Englanders, by their superior advantages, and their hostility to the French, Spanish, and Dutch, soon got complete control of the off-shore banks, and drove all other adventurers away. Soon, obtaining more fish and whale oil and bone than they could themselves consume, they carried them to the other colonies on the continent and to Europe, and laid the foundation of the commerce and maritime eminence which have never since departed from them. The fisheries were twice annihilated by war, — namely, at the time of the Revolution, and from 1812 to 1815; and the whaling-interest suffered a severe blow again when petroleum was discovered, and when the Confederate cruisers sailed in among the fleet in the North Pacific and burned a large number of the ships. These reverses were no more, however, than all pursuits are sure to encounter from time to time in their history; and they happily were not, in general, permanent in their influence. In most cases the fisheries revived within a few years after the reverses took place. The whale-fishery was the only exception. There was one time when the fishing-captains of New England were one of the most prosperous classes in the country; namely, from 1815 to 1860. A frequent occurrence during that period was the migration of fishing-captains from New Bedford, Nantucket, and other fishing-towns, to the farms and cities of the interior of the country, to New-York State, and elsewhere, where, with their families and their snug accumulation of well-earned profits, they passed the later years of their existence in the peaceful enjoyment of inland life. It may be said, also, that no more valuable citizens were found in the inland havens, where the captains took shelter after their voyages were over, than these same hardy, upright, and intelligent men. No more valuable element exists in the population of the United States, indeed, than these fishermen of the New-England coast. Brave, temperate, industrious, patriotic, and a strong reliance in case of war, with a large percentage of quaint characters among them, they form a most interesting and important class.

Effect of wars of 1776 and 1812 upon fisheries.

Congress has diligently sought to promote the off-shore and open-ocean fisheries of the United States from the earliest days of the republic. It has looked with great favor upon these employments as the cradle of the navy and the merchant-marine. The products of the fisheries were, of course, valuable; but they were not so essential to our welfare as to make it worth while for Congress to levy taxes upon the whole country in order to obtain them. It was the employment itself, and its great public utility in training up hardy, skilful, and energetic sailors, which won favor in the eyes of Congress. The policy adopted toward the fishermen was to make the tax on their tonnage extremely light, to permit

Legislation of Congress on the subject.

them to import salt for curing fish free of duty, to impose a heavy duty on foreign fish and fishing-products, to give a bounty to all employing a boat whose crew were three-fourths Americans, and to negotiate treaties with England to secure for them fishing-rights in the British-American provinces, such as the right to land and cure fish in Newfoundland, to fish within the three-mile limit of shore, &c. The bounty to fishing-vessels was of very early date: in 1855 it was made three and a half and four dollars a ton, according to the size of the vessel. Over $15,000,000 have been paid from the national treasury to the ocean-fishermen in these tonnage-bounties alone. Never was



AN ANGRY WHALE.

money better spent. The relief granted by free salt has been a valuable form of encouragement. Salt can be imported in the ocean-steamers from England much cheaper than it can be brought from New York and Wisconsin and deposited on the coast, for the reason that the original cost is less. The steamers come this way with very light cargoes, and they are glad to load up with bags of salt for ballast, and to carry it at a purely nominal rate; while transportation from the interior of the United States to the coast is expensive. In 1870 the foreign salt consumed in the fisheries already amounted to 60,000,000 pounds a year. The consumption has since grown to 126,000,000 pounds a year.

The whale-fishery was the first, and for a long period the most important, of the fisheries. Beginning on the shores of Long Island, at Nantucket, and in Massachusetts and Maine, with the employment of a few long-boats, which put out from the shore whenever a whale came in sight, it developed until it had virtually driven the whalers of all other nationalities from the seas in open and friendly competition, and was employing 700 ships and 16,000 sailors. From 1845 to 1860 it employed from 650 to 700 vessels, the tonnage ranging in different years from 180,000 to 198,000; the capital invested in the business in ships, boats, harpoons, apparatus, &c., being $25,000,000, and the yearly product in whale-oil, sperm-oil, and whalebone, being $12,000,000. Nantucket was originally the principal centre of the interest. Her whalemen, by long practice, became more expert, and consequently more successful, than those of other parts of the coast; and she accordingly soon came to rank first in the business. New Bedford was next, and New London, Fair Haven, Southampton, Stonington, and other ports, came afterwards. Nantucket now stands only fourth upon the list, and New Bedford is the principal whaling-port of the country. The first whaling-grounds were, of course, off shore, along the North-Atlantic coast. When the fish began to get a little shy and scarce, the ships put out for regular voyages, and cruised along the Gulf Stream, and off the West Indies and Brazil. As early as 1800 they had found their way into the Pacific Ocean; but in those times they rarely filled with oil there: the captains preferred to come back around Cape Horn, and fill up in the tropics on the way home, taking sperm-whales or right-whales, as the case might be. About 1830 the whalers began to find it necessary to cruise in the most distant waters; and the ships went to sea accordingly equipped for a two-years' voyage, and two years have been ever since the regular voyage of New-England whalers. The system adopted for these expeditions grew up very naturally from the old practice of watching on shore for a whale in the offing, rowing out and capturing the prize, and dividing the proceeds among those who took part in the capture. Instead of paying the officers and men of the ships in money for their services, every voyage was made a co-operative affair. A certain share of the catch was allotted to the captain as his compensation, a certain other smaller share to the lower officers and men, and a certain proportion to the owner of the ship for profits on his investment. The part allotted to each man was called his "lay:" thus his "lay was one-sixteenth," and so on. This system was a great stimulus to enterprise, and was one secret of the remarkable vigor which the whaling-marine displayed. Many famous voyages were made. Prior to 1815, from 900 to 1,600 barrels of oil, worth from $22,000 to $40,000, was the ordinary successful catch: after that the ships were enlarged, and from 1,600 to 2,500 barrels, worth from $40,000 to $62,000, was the standard fair catch. But now and then a ship came into port having sent home during her voyage, or bringing with her, 3,000, 3,500, or 4,000

The whale-fishery.

barrels of right-whale oil. In 1842 "The Maria" of Nantucket came back from a twenty-two months' cruise with 2,413 barrels of sperm-oil, worth $70,000, this variety being scarcer and more valuable. In 1849 "The South America" of Providence, R.I., which was fitted for sea at a total cost of $40,000, came back with 5,500 barrels of oil and a large supply of bone, worth in all $89,000, paying her cost, and a dividend of 125 per cent. She had been out twenty-six months. "The Russell" of New Bedford came back in 1849, after a three-years-and-four-months' voyage, with 2,650 barrels of sperm-oil, worth $92,000. The most remarkable voyage ever made, perhaps, is vouched for by Mr. Alexander Starbuck. "The Envoy," having been condemned to be broken up, was sold to William C. Brownell of New Bedford, who concluded, after all, to send her out once more, and did send her to sea at a cost to himself of $8,000. The underwriters declined to insure her. The vessel freighted 1,000 barrels of oil from Wytootache to Manila; and then, putting into the North Pacific, she caught 5,300 barrels of oil and 75,000 pounds of bone. The receipts of the voyage were $138,450. In 1853 "The Favorite" of Fair Haven realized $116,000; "The Montreal" of New Bedford, $136,023; and "The Sheffield" of New Bedford, which had been gone four years, $124,000. "The Pioneer" of New London made in 1864 and 1865 in the North Atlantic the most successful catch ever known. Her voyage realized $150,060. These brilliant results have not been obtained of late years. After 1861 the whale-fishery ran down, owing to the scarcity and shyness of the fish, the low prices of oil consequent on the discovery of petroleum, and the high cost of fitting out ships. In 1800 a 1,900-barrel ship could be fitted out for $12,000: in 1860 a 3,800-barrel ship cost $65,000, fitted for sea. In 1877 the fleet had become reduced to 171 ships, of a capacity of 39,165 tons. The right-whales of the North Pacific, and the sea-elephants of antarctic regions, are now the principal dependence of our whaling-men; but the game is getting very scarce. It has been the prey of generations of eager men; and it will one day become extinct, unless Professor Baird, or some such man, turns his attention to their artificial propagation. Why should he not?

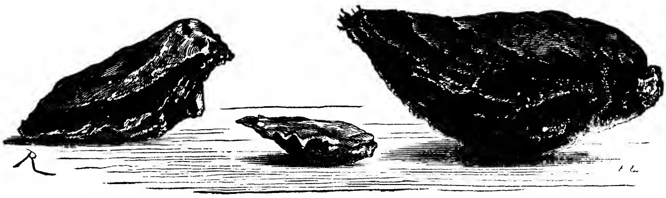
Cod and mackerel fisheries.

The cod and mackerel fisheries are now more important in respect to the tonnage employed in them than the one just described. They employed more tonnage, indeed, than the whale-fishery prior to 1830, the figures for 1829 especially being remarkable; the whaling-fleet being only 57,284 tons in that year, and the cod and mackerel boats 101,797 tons. But after 1830 the Bank fisheries fell into the second rank; and they only came to the front again in 1861, when the war, with its high prices, petroleum, &c., broke down whaling. The cod and mackerel tonnage is now 87,000, and the number of boats 2,311, nearly all of them being under fifty tons' burden, and about half of them under twenty tons. There are over 20,000 men employed in the business. The boats go out to the Banks on the co-operative plan, each man getting a stipulated share of the catch, and the owner supplying a certain portion of the outfit, and getting his pay, like the rest, in fish. The cod and mackerel are both caught with the line. The former is easily caught. The hook, baited with any thing to attract attention, though generally with small fish, is dropped until it touches the bottom: it is then hauled up slightly, so that with every lurch of the boat it will clear the bottom. A bite is signified by a slight jerk. The line is then hauled in rapidly, hand over hand, the fish unhooked, and the hook baited and thrown out again. When the fish bite freely, three hooks can be used on the same line; and, in fact, they are generally used. The crew of the boat range themselves along the gunwale on both sides, and often are kept in a state of incessant action by the eagerness of the fish. At night the fish are cleaned and salted down. Mackerel-fishing is more exciting, because the fish are gamy, and they dash madly about in the water when hooked. The mackerel swim in shoals; and, when they are biting, there is always a scene of great activity and excitement on board the boat. The rapidity with which several barrelfuls of fish can be taken from the water is wonderful. The cleaning and packing in salt are performed when the fish are slack; that is, when they are not biting well, or at night. These fish have sometimes been caught with nets; but the process is difficult and unsatisfactory, and the fishermen generally prefer the line. The value of the product of cod and mackerel fisheries is about $9,000,000 a year. A ready market is always found for the fish, and those who are engaged in the business have only the competition of the Canadians to fear. As a general rule, they hold their own against their Northern neighbors. The state of things existing just at present, however, is unfavorable to them, because, under the treaty of 1873, the United-States market was thrown open to the Canadian fishermen in exchange for the right, on our part, to fish within the three-mile limit. The Canadians gained more than they lost by this; and, although the Halifax Commission in 1877 adjudged that the United States ought to pay $5,500,000 for the superior advantages she gained by that treaty, the decision was clearly unjust, and it has so increased the odds against our fishermen, that steps were taken by Congress in May, 1878, to have the fishery-clause of the treaty abrogated.

Oyster-business.

One branch of the fisheries — which, however, is really an in-shore affair, and has never needed any special protecting care from the government — is the oyster-business. The only legislation which has been needed has been to prevent the oystermen from infringing on each other's rights. This species of ocean-inhabitant grows naturally in the cool waters all along the Northern coast, and attains a size, and delicacy of flavor, unequalled anywhere in the world. The waters of Virginia and Maryland and of Long-Island Sound are the favorite haunts of the oyster. A favorite practice in the trade is to breed the oyster in Virginia or Maryland, and bring it North by the sloop-load, and plant it in the vicinity of New-York City, and on the Long-

Island and Connecticut coasts, where it fattens. Baltimore and New-York City are the principal centres of the oyster-business. In both places millions of dollars' worth of the bivalve are put up annually in cans and kegs, and distributed by railroad to all parts of the United States and



OYSTERS ONE, TWO, AND THREE YEARS OLD.

Canada. Of late years, oysters have been sent to Europe from those cities; and the business is becoming considerable, now that the steamers have been provided with the facilities for keeping the oysters cool *en route* across the sea. The annual product is valued at about $25,000,000.

Among the other treasures of the sea which accrue to the profits of our fishermen and the luxury of our tables are the halibut, the shad, salmon, blue-fish, herring, white-fish, weak-fish, bass, clams, lobsters, eels, and other varieties. There are about thirty-five kinds in all. They are all taken in large quantities. Lobsters are canned for the general market, and are now exported in considerable quantities, as well as oysters. One branch of the business not yet mentioned has now grown so large as to take its place among the staple resources of the country, although the inhabitants of the regions where it is engaged in most sincerely wish that it had never become a staple resource, and that the fish would swim away to some hitherto unheard-of quarter of the globe, and never, never come back. This is the catching of porgies and bony fish for fertilizing-purposes. These little fishes swim in immense shoals, numbering millions of fish. They are caught in nets in the Sound, and along the northern coasts generally. The shoals are often so large as to tow, against the wind, the net and the schooner from which it has been carried out; and they sometimes carry away the nets. But, if the shoal is not too large, it can be handled. The fish are valued for their oil, which is extracted by proper processes, and also because their remains can then be

Shad, salmon, herring, lobster, and other fish.

OYSTERS GROWING TO A BOOT.

converted into guano for the benefit of the farms. The establishments where this manufacture is carried on waft a fragrance upon the breeze which does not remind one of heliotrope or the East Indies.

Disappearance of shad and salmon.

Two kinds of fish which were remarkably abundant when the country was new were the shad and the salmon. These fish have almost disappeared from some localities, and they are scarce in all. The attention of the government of the United States was called several years ago to the subject of the artificial propagation of these and other fish. Experiments were making under Seth Green, in New-York State, for the breeding of millions of lake and river fishes, and the placing of them in lakes and streams to repopulate the waters which had thus been almost emptied of their game by local anglers and spearmen. Other States were giving attention to the subject; and the United States were invited to consider the state of the coast-fisheries, and the propriety of propagating shad, salmon, &c., to replenish impoverished waters. A law was passed Feb. 9, 1871, for the creation of a fish commissioner, and Professor Spencer F. Baird was appointed by the President to that office. Since that date, extensive and minute investigations have been in progress to gain a preliminary idea of the character of the coast and of its food fishes. Professor Baird spent the summer of 1871, with his assistants, at Wood's Hole on Cape Cod, the summer of 1872 at Eastport, Me., that of 1873 at Portland, Me., 1874 at Noank, Conn., and 1875 at Wood's Hole again. No work was done on the coast in 1876, owing to Professor Baird's presence at the Centennial Exhibition to take charge of the general display of hatching-apparatus and methods of fish-culture; but research has since been resumed. The studies of the commissioner were attended with valuable results, and led to the practical hatching of shad and salmon for distribution to the waters of the several States and Territories. Up to 1877, over 26,000,000 shad, 7,500,000 salmon, and 2,670,000 white-fish, had been hatched, and placed in the waters of the United States North and South, and on the Pacific, under the supervision of the commissioner. The work is still going on, and on an increasing scale, supplemented by the active efforts of fish commissioners in a number of the States. It promises to yield valuable results in a few years, and to repay its whole cost a thousand times over. Undoubtedly the time will yet come when active efforts in the way of multiplying the off-shore fish, such as the cod and mackerel, will be attempted.

Artificial propagation.

CHAPTER VI.

RAILROADS.

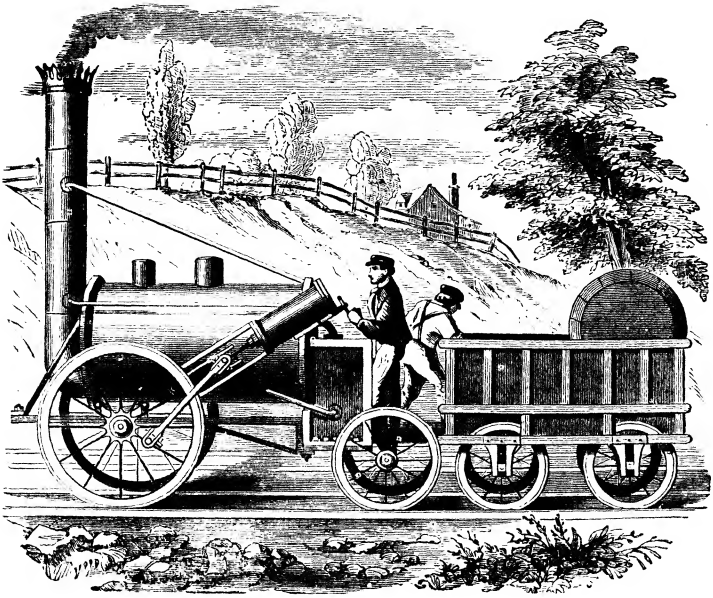
Mission of the present generation.

AN eloquent Virginian in Congress, commenting on the rapid progress of the country in mechanical invention, said admiringly, that the people of America were a race possessing much the same spirit as the Normans of old, and following much the same career of conquest and success. The only difference was, that the Normans subdued kingdoms of men, whereas the Americans were achieving the still more difficult task of a conquest over nature. The mission of our generation is to subdue the material universe, he said; and he spoke of the people of the North as "amazing the world by their feats of mechanical skill, and covering the remotest seas with the argosies of their commerce, free as the winds, and boundless as the waves that bear it." What would he have said could he have looked forward into the future twenty years, and seen a continent subdued and populated by this same people through the agency of a new and wonderful mechanical creation which flew from one part of the land to the other with a speed which defied time, and with a freedom, certainty, and regularity which laughed at storms and seasons, and which was employed in the service of a new and wonderful commerce whose magnitude and wealth dwarfed into insignificance that carried on upon the sea?

To trace the rise and progress of a railroad from its inception — perhaps in the head of some casual lounger around the stove of a country store — to its actual consummation would give a more perfect insight into the genius of the nineteenth century, and the goal toward which civilization has so far tended, than could possibly be gained by the most profound study of the pages of Buckle.

The moving causes for building railroads in this country are, for the most part, precisely the reverse of those which lead to their construction in Europe. In Europe they are built to satisfy existing requirements for increased means of communication; they are built to meet the wants of thickly-settled districts: in this country this is but one, and a minor one, of their offices. Their characteristic office here is to create such districts in places where none exist. They are causes with us, not effects. The brightest dream of the American patriot, irrespective of political creed, is to "open up" some portion of the wilderness of which the great area of his country is composed; and to do this he looks, and rightly, to the railroad as his principal aid. It must be confessed that the poetry of the railroad as the willing coadjutor of human aspiration belongs to America, in common with all new countries, rather than to Europe, where it is merely an inevitable sequence of an actual, achieved status.

The period of fifty years following the war of 1812 was one of restless activity and Titanic strides. The American mind was displaying a fertility



LOCOMOTIVE OF 1828.

and resource which had no parallel in the history of the world. Invention succeeded invention with astonishing rapidity; and scarce was the public mind aglow with some great idea for the comfort and convenience of the human race, and government and people at work to carry it into effect, when the drum-beat of a new thought would be heard, and a new *régime* be initiated, which should work wonders in the civilization and happiness of the people and the development of the wealth of the nation. In no field was progress more rapid than in that of internal transportation. Hardly had plans for building military wagon-roads to every part of our extended domain been perfected—so that the trains of huge, canvas-topped, broad-tired wagons in use in early days, with their teams of

Half-century succeeding war of 1812.

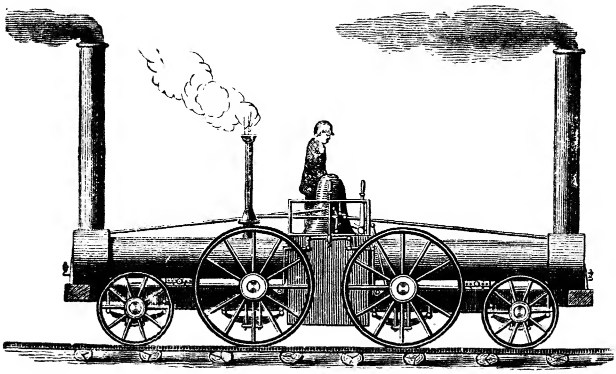
four or six big horses and "orchestra of bells," might be made thoroughly useful to the people — than steam was invented for the navigation of rivers, and canals were built for increased ease and rapidity of communication between distant parts of the interior. The old way was supplemented or superseded by something better almost before the capacities of the old way had been fully developed. In the very year that the public mind was the most excited about canals (1825) attention began to be drawn to still another and better agency of transportation, which was destined in time to overshadow all others completely, and work out public results that would have been regarded in 1825 as the wildest dreams of romance, and even in 1878 can scarcely be grasped by the human mind. Railroads were given to the world in that year, and were discussed in the United States, and soon riveted such attention, that great schemes for canal-building were dropped, and effort concentrated upon the new idea. The rapidity of progress which had preceded the invention of this style of land-transportation followed it; and in 1878 the United States with its 45,000,000 of people have 79,000 miles of road in practical operation (not of track, but of road) against 88,000 in Europe with its 300,000,000 of people, and 11,000 in the rest of the world besides with its 1,000,000,000 of human souls.

Railroads had their rise in tramways.

Railroads took their rise in the tramways in use in the mines of England and Germany for conveying heavy masses of coal and iron ore to the doors of the mines, and thence to buildings or yards for the storage or manufacture of the minerals, or to wharves or dépôts for their transfer to wagons and boats for distribution. Combined with this idea was another, for employing steam to propel carriages along common roads. These two ideas were conceived in the closing years of the last century, and were not at the time thought of together, but were made use of as totally distinct inventions. In this country the idea of a steam-carriage preceded that of the tramway. As early as 1794 Oliver Evans of Maryland used to say that the child was then born who would travel from Philadelphia to Boston in a steam-wagon. He was regarded as an enthusiast; but efforts were made for thirty years to realize his idea. A great many steam-carriages were invented. Rumors of the experiments reached England; and in the summer of 1819 a London paper had an item saying, "The Americans have applied the power of steam to supersede that of horses in propelling stage-coaches. In the State of Kentucky a stage-coach is now established, which travels at the rate of twelve miles an hour. It can be stopped instantly, and set again in motion with its former velocity; and is so constructed, that the passengers sit within two feet of the ground. The velocity depends on the size of the wheels." This item is believed to be inaccurate as to the fact of a steam-coach in practical use; but it correctly sets forth what American inventors were striving after.

Experiments in this direction were tried for many years. On some routes of travel, like that between Albany and Lake Erie, forty or fifty horse-coaches were often despatched in one day; and, could steam be used to propel them, a great saving of expense, and expedition of business, would be effected. Steam-coaches were exhibited in New York, Philadelphia, Washington, and elsewhere; and in 1824 S. T. Conn of Virginia publicly advertised for capital to form a company to run a steam-carriage on the turnpike between Washington and Alexandria. He wanted $1,200 for the purpose, — a modest sum, surely, compared with the millions of capital which it now takes to build and operate a modern line of steam-railway. Believing in the possibility of steam-coaches, and seeing the necessity of providing a solid, hard, straight road for them to travel on, the State of New York in 1825 projected a great wagon-road from the Hudson River to Lake Erie, to cost

First steam-coaches.



"THE SOUTH CAROLINA," 1831.

$500,000, and ordered surveys for it. Other States gave attention also to the subject of the improvement of their common roads.

The crude idea of a steam road-wagon was never realized, because in 1825 attention was drawn to the subject of railways. The Stockton and Darlington Railway had been opened in England in order to supply London with coal, and passenger-cars were drawn over it by a crude sort of locomotive at the rate of seven miles an hour. The stories told about this coal-tramway brought on a discussion in the United States which left the projected steam-coach quite out of sight. "The London Courier" said in 1825 of Mr. Rush, the American minister, then soon to return to this country to be secretary of the treasury, "Whatever Parliament may do" [about railways in England], "they cannot stop the course of knowledge and improvement. The American Government has possessed itself, through its minister, of the improved mode of making and constructing railroads; and there can be no doubt of their immediate adoption throughout that

Stockton and Darlington Railroad.

country." There could be none whatever; for railroads were more needed in this wild and undeveloped country than in England.

There was not a mile of railroad in America in 1825. In 1826 building began. Two short roads were undertaken almost simultaneously, — a line three miles long at Quincy, Mass., to bring down granite from the quarries; and a line nine miles long at Mauch Chunk, Penn., to bring down coal from the mines. Both were horse-roads. The Mauch-Chunk road cost from $2,500 to $3,000 a mile, being laid over a route previously used for ordinary wagons. Wooden rails were laid upon wooden sleepers lying four feet apart, being fastened thereto by wooden keys. The sleepers were supported on stone foundations, and the rails plated on the inner edge with rolled iron bars from an inch and a quarter to an inch and three-quarters wide. A gravel-path for the horses was made between the rails covering the sleepers. The wagons weighed from 1,200 to 1,500 pounds each, and were mounted on flanged wheels two feet in diameter. They carried a ton and a half each. The cars were allowed to run down five miles by the force of gravity, and were then towed to the place for dumping the coal by horses. On the Quincy road the tracks were five feet apart. Wooden rails six inches by twelve were laid on stone sleepers lying eight feet apart, which, in turn, were supported upon a stone foundation. On the top of the rails was placed a scantling two inches by four, which was plated with bar iron from two inches and a half to two inches and three-quarters wide. The wagons weighed six tons each, cost four hundred dollars apiece, and were mounted on wheels six feet and a half in diameter. Two horses drew fifty tons' weight, including the wagons, over this road, at a speed of four miles and a half an hour. On a canal the same weight could not have been drawn by two horses then faster than two miles an hour. This road cost $11,250 a mile, owing to the rock-cuttings and trestle-work which were necessary upon it. The two roads were finished in 1827. A public celebration took place on the opening of the latter. Great popular interest was felt in both, and committees came to see them from all parts of the country.

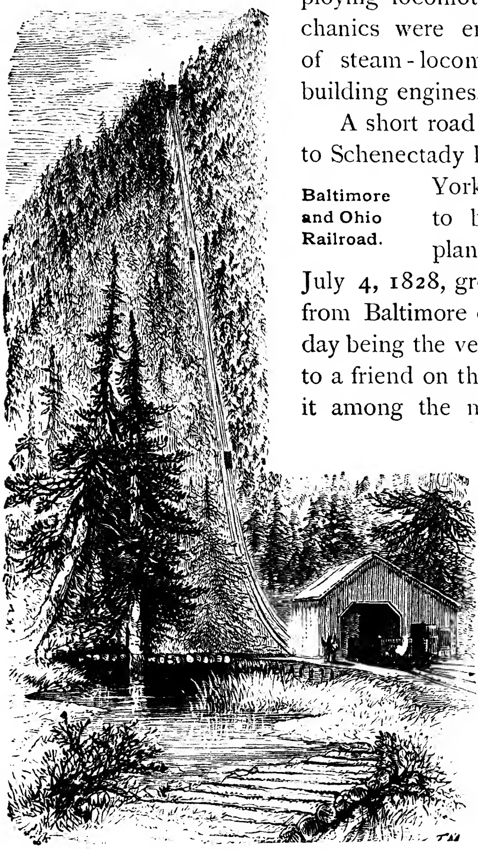
First railroads in United States.

Description of them.

No railroad had yet been built in the world for the general conveyance of passengers and goods, — not even in England. So far, all the railways had been constructed for the transportation of the products of mines over extremely short routes. Their utility for the purposes of general traffic, however, was disclosed by these preliminary experiments, and America seized upon the new idea quite as quick as England. Daniel Webster, Charles Carroll, Mr. Calhoun, Mr. Clay, and other public men, expressed a belief in their practicability; and the new era was successfully initiated. Wings were now lent to enterprise by the rivalry of cities. New York had taken an astonishing start consequent upon the opening of the Erie Canal, and was diverting trade from Philadelphia, Boston, and Baltimore, which could only be regained, if at all, by the construction of great transportation-

Early lines were all short.

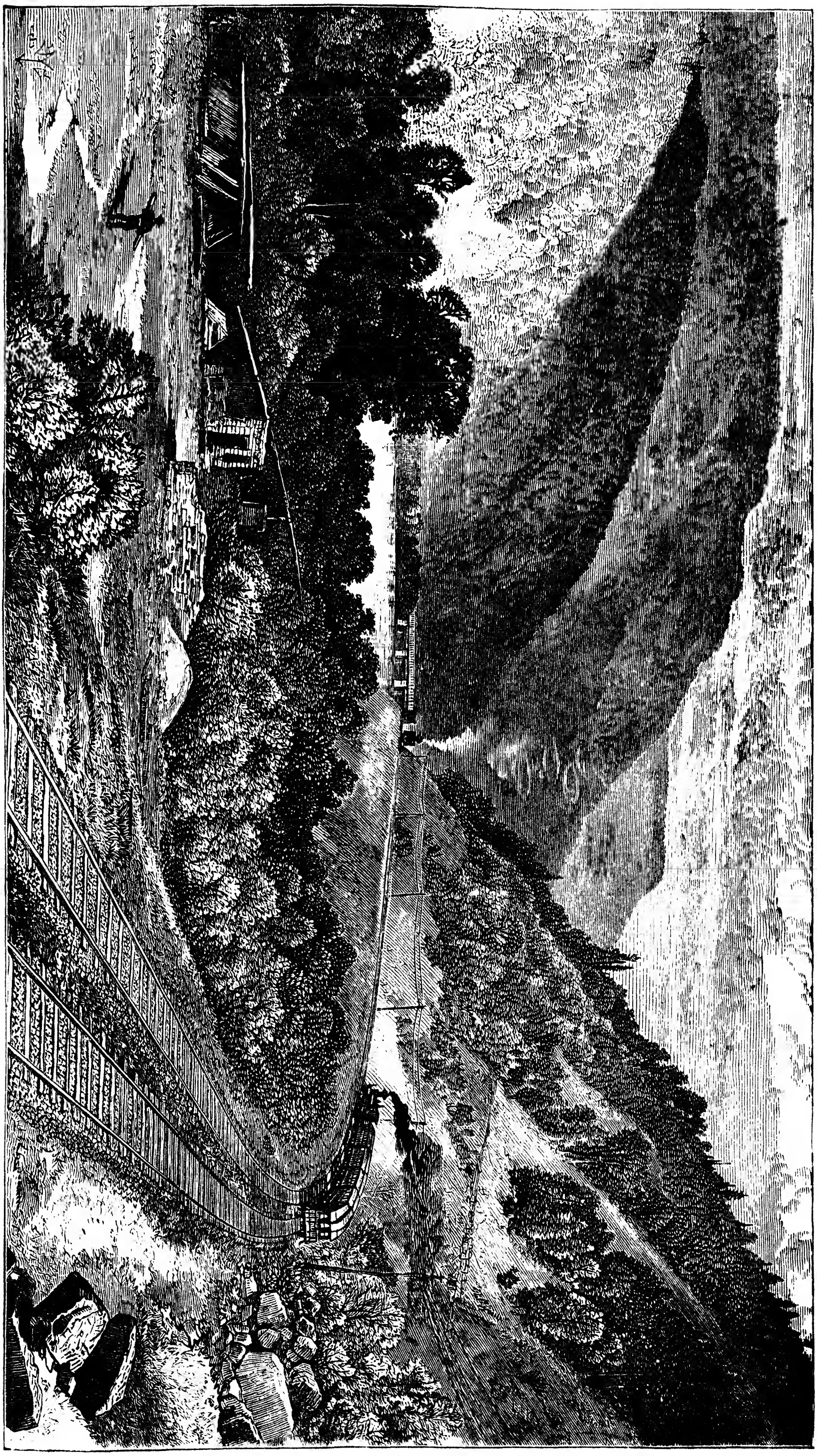
routes from those cities into the interior; and the business-men of those places set about the undertaking at once. Long lines of railway were projected from all the most enterprising seaboard cities into the more thickly-settled portions of their own States, with the idea of ultimate extension toward the West. They were all originally planned to be operated by horse-power, or by stationary engines; though the possibility of employing locomotives was kept in view, and mechanics were encouraged to study the subject of steam-locomotion, and try their hands at building engines.



ROLSTON INCLINED RAILWAY.

Baltimore and Ohio Railroad.

A short road of seventeen miles from Albany to Schenectady had been authorized by the New-York State Legislature April 17, 1826, to be operated by horses, inclined planes, and stationary engines. On July 4, 1828, ground was broken for a railroad from Baltimore out to Ohio, the president of the day being the venerable Charles Carroll, who said to a friend on the occasion "that he considered it among the most important acts of his life, second only to his signing the Declaration of Independence, if even it were second to that." Twelve miles of the road were opened to travel in May, 1830, the cars being drawn by horses, as it was not until a year or two later that the certainty of attaining greater speed by means of locomotives was assured. At first the track was laid on large blocks of stone; but, after passing the Patapsco, wooden ties and stringers were used, owing to their greater elasticity. The Baltimore and Ohio Company acted with vigor, pressing its contractors, and sending committees to other parts of the country and to England to study road-building and the capacities of steam. In 1832 the road was built to Point of Rocks, a distance of seventy-three miles; and the company had offered premiums of $4,000 and $3,500 for locomotives to run at certain rates of speed on the road of the company, by means of which they obtained "The York," built at York, Penn., by Davis and Gartner, which was able to draw fifteen tons



JACK'S NARROWS, PENN.

on a level at a speed of fifteen miles an hour. The company was delayed by litigation with the Chesapeake and Ohio Canal Company, which fought its progress; and it was not until 1853 that the road reached the Ohio River.

Railroads in South Carolina.

In South Carolina a company was incorporated, Dec. 19, 1827, to build a railroad and canal out to Hamburgh, on the Savannah River, in order to open up easy communication with the rich agricultural regions lying in that direction, the intervening districts being a wilderness of swamps. United-States engineers made the surveys, as they did for all these early railroads. The road was originally built upon trestle-work nearly the whole distance, with a thin strap-rail laid upon stringers. Charleston was the first city in the country to employ a locomotive. In 1830, when the road had been finished for only eight miles, — several months before the opening of the Liverpool and Manchester Railway in England, upon which steam-engines were employed, an event which created a *furore* of excitement both sides of the ocean, — a locomotive weighing five tons, and called "The Best Friend," was operated profitably on the South-Carolina Railroad. It was built at West Point, N.Y., under the direction of Mr. E. L. Miller of Charleston, S.C., and was the first one used in the passenger and freight business of the United States.

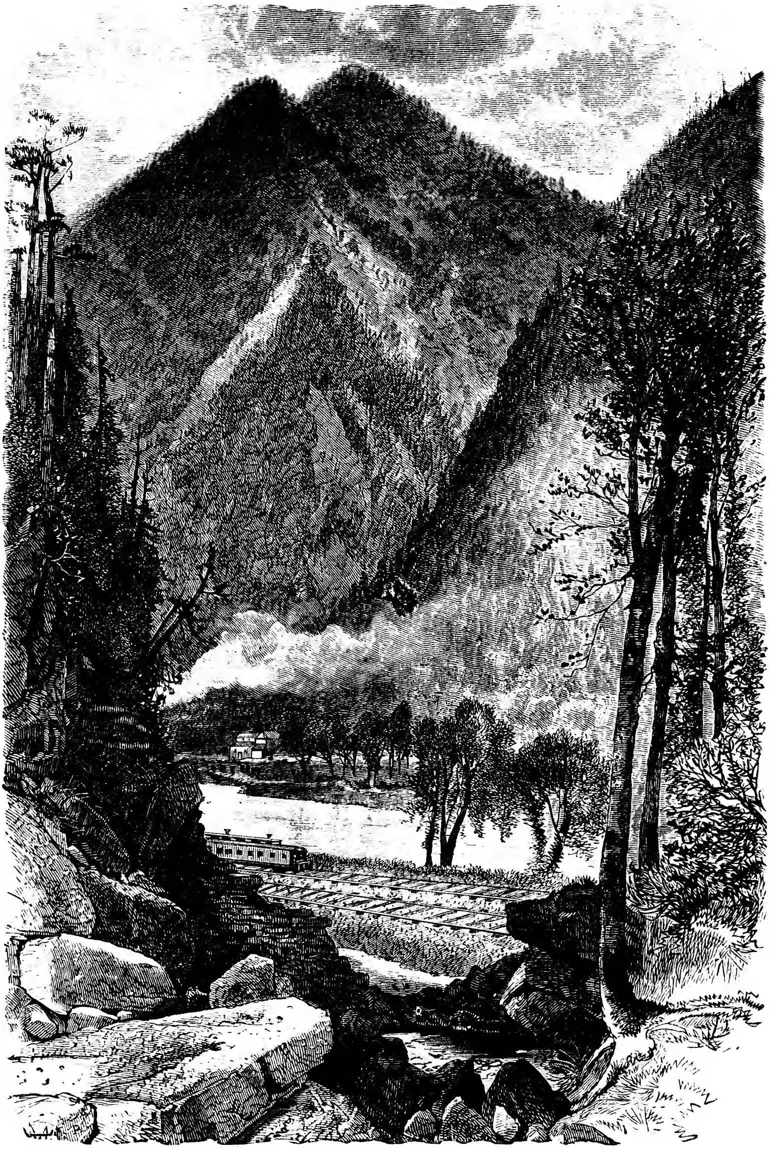
Mohawk and Albany Railroad.

In 1831 the Mohawk and Albany Railroad was opened to use. The same year the road from Richmond, Va., to Chesterfield, thirteen miles long, the second one finished in the United States, was thrown open, and a little line five miles long from New Orleans to Lake Pontchartrain.

First railroads in Pennsylvania.

Pennsylvania's transportation-route to the West was undertaken at first by the State itself. Agitation for a railroad and canal began in 1826, as soon as it was seen what a blessing to New-York State the Erie Canal had become. Surveys were made; and in February, 1828, the committee on internal improvements reported to the lower house of the legislature that a railroad ought to be built at once from Philadelphia to Lancaster and Columbia, and thence extended to the West. They said, "This will accommodate a district of country, which, from its prolific soil and rich cultivation, is considered the garden of our country. . . . A wise and equal policy will require its farther extension to the West, for the purpose of accommodating the populous and flourishing counties on the southern boundary, and connecting them with our own commercial metropolis." The State built the railroad from Philadelphia to Columbia (eighty-two miles), and the portage road from Hollidaysburgh to Johnstown, so that they were ready for use in 1832. It also built a canal from Johnstown to Pittsburgh, the total cost of all these works being twelve million dollars. This gave Philadelphia a route through to the West, and enabled her to meet the competition of other cities. While these works were in progress, a number of small roads in the

Schuylkill mining-region were building through private enterprise, and one from Philadelphia to Germantown was chartered in 1831.



ANOTHER VIEW OF JACK'S NARROWS.

Boston's first idea was to construct a canal through the State to the Hudson River to connect with the Erie Canal, and thus secure an uninterrupted water-route to the most distant regions of the West. But in June, 1825, Gov. Lincoln, in speaking upon the matter to the legislature, said, "Another means of communication has been suggested by the construction of railways." In June, 1826, a committee was appointed by the legislature to report upon the question of a railway to the Hudson. Various routes were surveyed. The legislature was slow, however, in acting, and the business-men of Boston became impatient. They visited New-York State to urge the people along the line of the Erie Canal to build railroads connecting Albany with Lake Erie, and besieged their own legislature with statements in regard to the benefits to Massachusetts of a railway to connect with the New-York roads and canal. In 1830 companies were chartered to build railroads from Boston to Providence and Lowell; and finally, in 1831, a beginning was made in the work of building westwardly, by a charter to a company to construct a road to Worcester; which was immediately organized, and the road built and opened by July 4, 1835. The Western Railroad Corporation was chartered in 1833 to build from Worcester to the Hudson. The work was considered to be of such public utility, that the State lent to the company at different times State scrip for sums which amounted in the end to four million dollars.

Massachusetts.

While those lines were building, a communication was being created across the State of New Jersey by the Camden and Amboy Railroad, between the cities of New York and Philadelphia. The road was begun in 1831, and finished in 1834.

New Jersey.

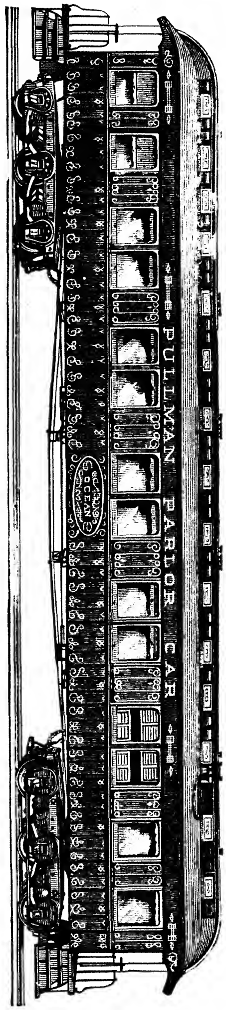
At the same time several short lines were building in New-York State,—among them being the Utica and Schenectady, chartered in 1833, and the Albany and Syracuse, chartered in 1834,—with the design of stimulating the construction of other connecting railroads, which should eventually give the State a complete through line from Albany to Lake Erie. It is an interesting fact, that even in that early period, in 1830,—in fact, when there were only twenty-three miles of railroad in operation on this whole continent,—the great project of a railroad from the State of New York to the Mississippi River at St. Louis had been conceived by De Witt Clinton, and publicly advocated in a little pamphlet, of which only a few rare copies are now preserved. The road was to be about a thousand miles long, and to cost fifteen million dollars. It was too vast a project, however, for the resources, and even the needs, of that age; and the only real outcome of the proposition was the beginning of a chain of railroads through New-York State to Lake Erie, above noted. In the two lines above referred to, Boston capital was invested; for it was foreseen, that, if the new agency for transportation fulfilled the expectations of its advocates, the disadvantages of Boston's geographical position would be annihilated, and the future all-rail route to the West would be of great advantage to her. Besides the two lines above mentioned in New-York State as then building, there were also the Ithaca and

Other lines built in New York.

Oswego, the Canandaigua Railway, a line from the Hudson to meet the Western Railroad of Massachusetts, and a few other small local lines.

The science of building and operating railroads was not well understood during the first ten years of their existence, and many wild and erroneous notions were entertained in regard to them. Roads were planned to be built on routes running over mountains and vales that a stage-coach would have found it hard to pass. One of the very early charters granted in New-York State was for a railroad from Catskill to Ithaca direct. This was in 1828; and, in the ten years following, applications were made at Albany for charters for about a hundred and forty different companies, of which number only twenty-one ever built the roads respectively projected by them. It was not known for many years whether to treat the locomotive as a toy or a machine. Horses were doing so well on all the railroads in operation, that it was supposed they would not be superseded. On the Baltimore and Ohio Road a single horse would draw a hundred barrels of flour loaded upon four cars at a speed of seven miles an hour. Experiments were making with locomotives at Philadelphia and West Point, and several of these machines were imported from England to test their abilities. But even as late as 1832, when Mr. Baldwin of Philadelphia had produced his first engine, "The Ironsides," for the Germantown road, and it had attained a speed of thirty miles an hour, its utility was so much in doubt, that the following advertisement appeared in a Philadelphia newspaper: "*Notice.* — The locomotive-engine (built by M. W. Baldwin of this city) will depart daily, *when the weather is fair*, with a train of passenger-cars. *On rainy days, horses will be attached.*" The engine was treated merely as a curiosity. The problem of the locomotive was solved in 1834 by "The Lancaster" of Mr. Baldwin's make, and Pennsylvania resolved to adopt that sort of motive-power for her railroad to Columbia. But even then there were many things about an engine not understood; and constant experiment and expenditure of money had to be resorted to before the requisite knowledge was obtained.

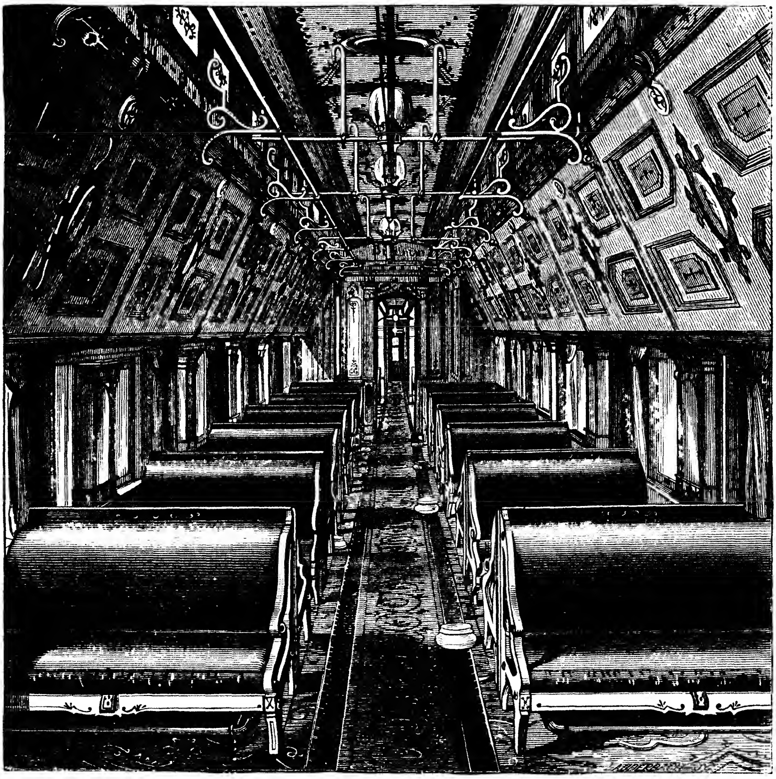
Science of railroad-building very imperfect during first decade.



PARLOR-CAR.

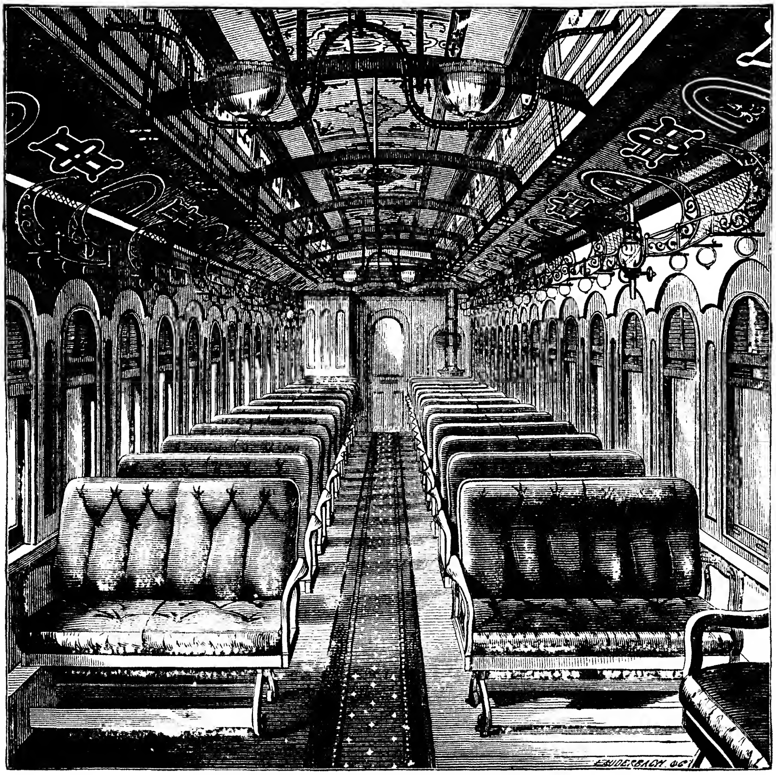
In order to facilitate the building of railroads, the States at first extended to the companies building them direct aid either from the public treasury, or by a loan of the public credit. There was a generous glow of interest in them in the public mind. The patriots never gathered for a Fourth-of-July celebration or a public dinner without drinking a hearty toast to internal improvements. The papers were full of rhapsodies upon the march of the new idea; and orators in public assemblages, and in the capitols of the state and nation, felt that they had well earned the public gratitude

Granting of public aid.



INTERIOR OF SLEEPING-CAR.

by the ardor of their advocacy of railroads, canals, and military roads. Such being the state of the public mind, every railroad enterprise wisely conceived and prudently conducted found it easy to obtain State aid to such reasonable amount as would enable its promoters to accomplish their work. Maryland was the first State in the country to grant legislative aid to railroads. In 1828 the sum of $500,000 was granted to the Baltimore and Ohio line; and in 1835 the State subscribed $3,000,000 to the stock of the company, and the city of Baltimore $3,000,000 more. Massachusetts loaned $4,000,000 to the Boston and Albany line. New York followed her example by loaning small sums to the different companies building the chain of roads out to Lake Erie, — a step which the panic of 1837 made necessary in part, since it discouraged the investment of private capital. Pennsylvania went so far as to build her first rail-route from Philadelphia to Columbia with its branches, and the canal-route on to Pittsburgh, at her own expense. The wealthy State of Virginia constructed the Blue-Ridge Railroad on her own account, and



INTERIOR OF PASSENGER-CAR.

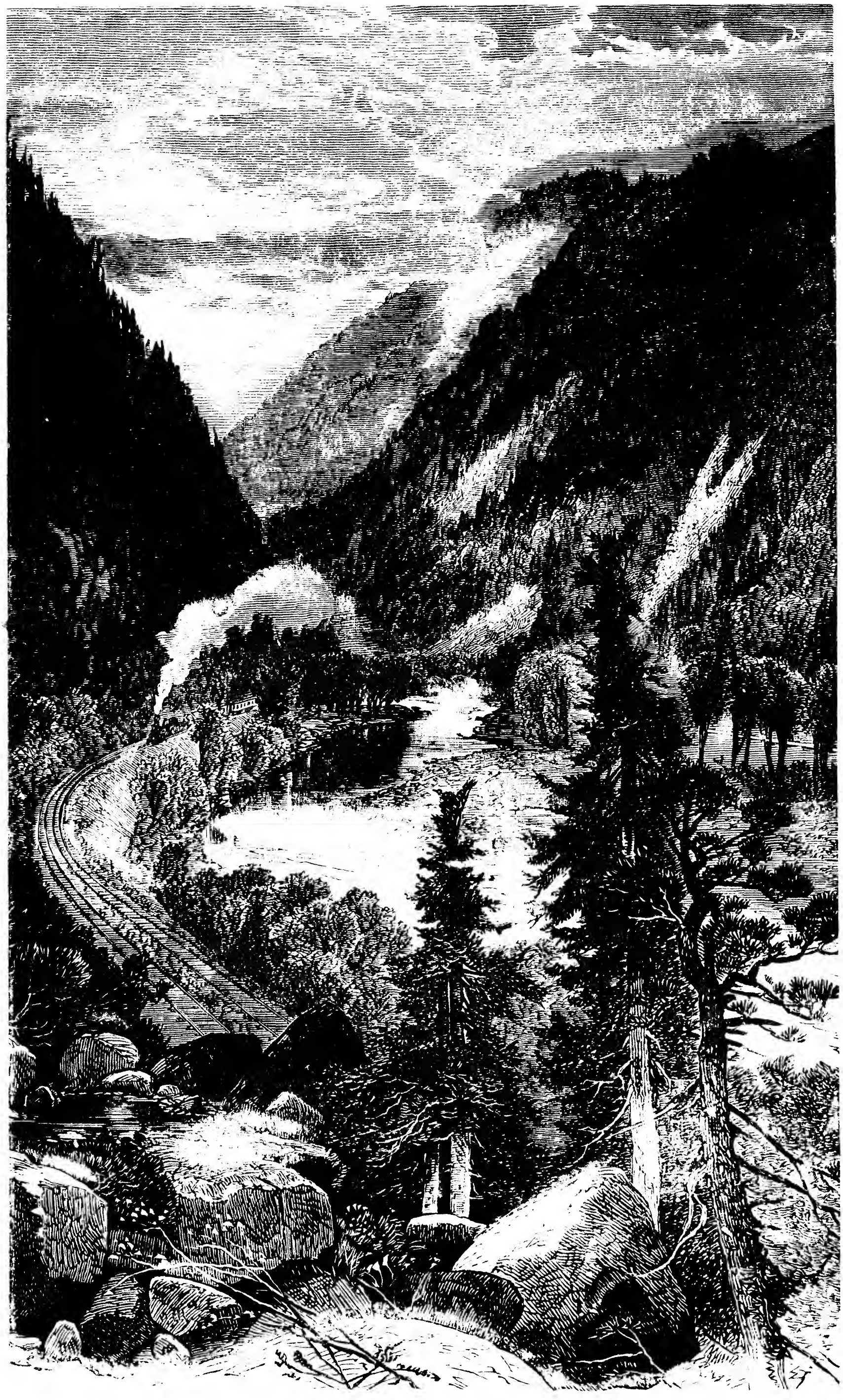
subsequently subscribed to the stock of several lines; while Kentucky loaned her credit for railroad-building repeatedly. South Carolina loaned $100,000 to her first road. The object of these proceedings was, in the main, simply to assist private enterprise; and the total amount of aid granted was a very small part of the total capital invested, being probably less than ten per cent. The works were, in the main, left to private enterprise.

During this decade several railroads were projected in Canada and the British Provinces. The Great Western Railway took its origin in one of these projects, — the London and Gore Railroad Company, which was chartered in 1834. Nothing was ever done with that charter; and the plan was re-organized in 1845 as the Great Western Company, in order to provide for a road from the Niagara to Lake Huron, and thus secure an all-rail route from the West, through Canada and the United States, to the seaboard at Boston. The road was built under this latter charter. A line from St. Andrew's in New Brunswick to Quebec was proposed in 1835, and the home government set apart £10,000 to make the surveys for it through what was then a perfect wilderness. One-fifth of the sum was expended, and further expenditures were then stopped until the boundary-question with America could be settled. Work on the road was resumed in 1847. The Erie and Niagara Company was also chartered in 1835.

Railroads in Canada and British Provinces.

Rapid transit was a subject as much talked about in those early days as in these more modern times, when a net-work of railroad-lines and telegraph-wires traverses the country in every direction, and transportation and travel engage in an eager race against time. Lines of mail-coaches were arranged to run in connection with steamboats, and every fresh victory over time and space was heralded in the public prints with enthusiasm. In 1821 it was announced as a specimen of rapid travelling, that the distance between New York and Providence had been traversed in twenty-five hours by steamboat and stage. In 1824 it required seventy-one hours and a half to go from Boston to Washington; and that was quick time too, the usual time being about eighty hours. It required nineteen days to go from Philadelphia to Natchez, and twenty-four days to go to New Orleans. When Baltimore was brought within fifty-four hours of Saratoga Springs, it was regarded as a great achievement. These specimens of rapid travelling were due to the improvement of the wagon-roads and the employment of steam on the rivers. They stimulated travel greatly; and in 1825 it was announced as a gratifying and remarkable event, that, during the Fourth-of-July celebration at Philadelphia that year, three hundred New-Yorkers were said to have been in the city; and in New-York State as many as forty coach-loads of passengers were then arriving every day at Albany by the great turnpike running out to the western part of the State. After 1832 this class of items disappeared from the columns of the newspapers, and a new variety appeared. Rapid travelling by rail became the exciting topic then, and astonishing runs from one city to another over the new style of road were recorded in the prints in place of the exploits of the mail-coaches. Even with cars drawn by horses, time was at once reduced one-half from the best achievements of the stages, and, as soon as locomotives began to be used, to one-fourth and less. Wonder and curiosity filled the public mind at the performances of the new servant of man. The papers never tired of talking about them. Crowds flocked to the railroads

Great interest displayed in subject of rapid transit.



LEWISTON NARROWS, PENN.

to see the locomotives go by; and hundreds of people went travelling who till now had had a horror of the long, rough, fatiguing voyages by stage. The locomotive was hailed by all travellers with delight. It did not reduce the cost of travel materially; but it increased the speed, and it gave an unwonted stimulus to travel and business-operations wherever it ran. Railroad-travelling has now so improved, that, in 1875, the run from New York to San Francisco was made in three days and a half; which was about the length of time it formerly took to go from Boston to Washington.

The reduction in the cost of transportation by railroads was enormous. No line twenty miles long was constructed anywhere without enabling farmers to send their cider, potatoes, apples, cheese, and produce generally, to town at from a half to a quarter of what it had cost them previously. It enabled farmers to sell vast quantities of produce, which, before that, would not pay the cost of transportation. Freight from Philadelphia to Pittsburgh was — by the railroad to Columbia, and the canal thence to the city last named — reduced from a hundred dollars to thirty dollars a ton. It was calculated in Maryland, from the experience of the first few sections of the road building out to the Ohio, that, when the line reached Cumberland, the freight upon coal, then several dollars a ton, would be reduced to one cent; and in South Carolina the railroad to the interior was found to enable the planters to send their cotton to the seaport at a few cents a bale, when it had previously cost them from three to four dollars to get it down by the rough and swampy wagon-roads.

The reduction in the expense of transportation by means of railroads is not the only benefit conferred by them. By their creation it became practicable to cultivate the soil far away from rivers and lakes, and which to-day would be lying in native, untamed wildness except for these mighty agents of civilization. The railroads long ago surpassed the rivers in importance as highways, rendering it possible to acquire from every inch of the national domain whatever riches it may possess.

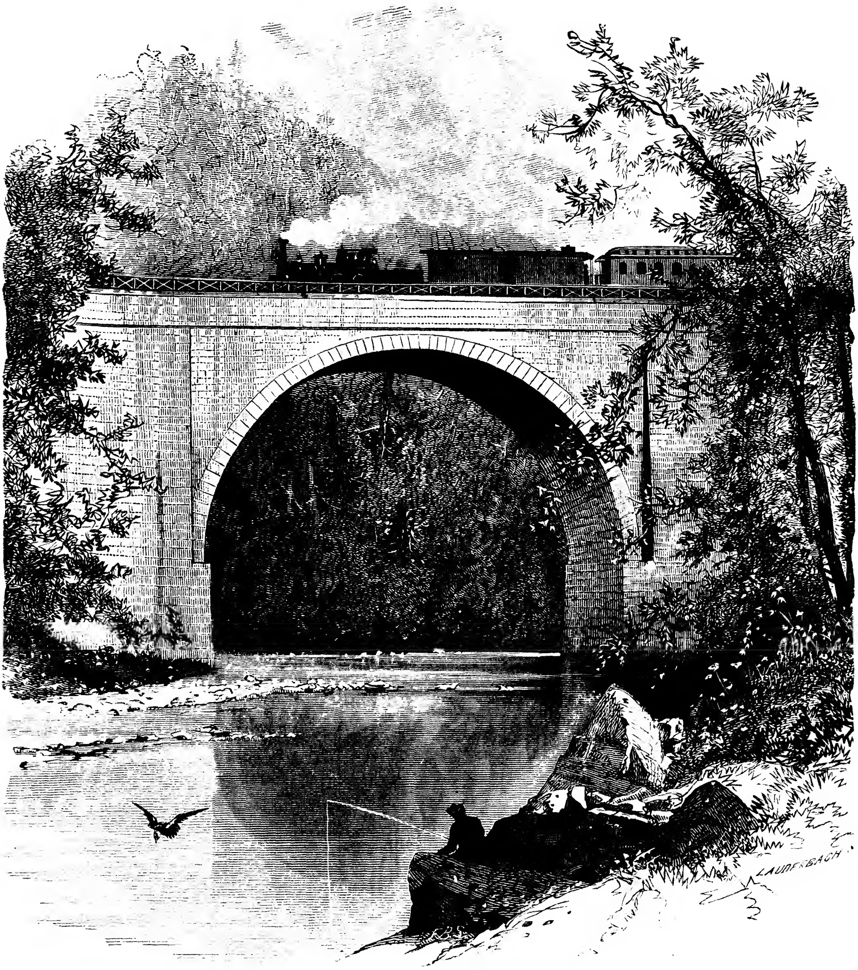
Superiority of railroads.

These achievements of the railroads and the performances of the locomotives, after 1834, finally demonstrated the value of this new agency of transportation. Its superior speed, cheapness, and comfort were fully proved, and, in fact, surpassed all prediction; and there was great confidence that the defects of the roads and tracks and rolling-stock would be corrected just as fast as inventors gave their attention to them. A passion for railroad-building accordingly set in. A vast number of companies were formed in all the older States to open up rail-communication between all the thickly-settled regions of the country; and, as fast as population advanced westward, the locomotive followed it closely, and united the cities of the new States to their sisters in the East with the iron bands of civilization. How rapid has been the progress will appear from the following table, showing the mileage of railway-construction in the United States since 1830: —

YEAR.	MILES IN OPERATION.	ANNUAL INCREASE OF MILEAGE.
1830	23	....
1831	95	72
1832	229	134
1833	380	151
1834	633	253
1835	1,098	465
1836	1,273	175
1837	1,497	224
1838	1,913	416
1839	2,302	389
1840	2,818	516
1841	3,535	717
1842	4,026	491
1843	4,185	159
1844	4,377	192
1845	4,633	256
1846	4,930	297
1847	5,598	668
1848	5,996	398
1849	7,365	1,369
1850	9,021	1,656
1851	10,982	1,961
1852	12,908	1,926
1853	15,360	2,452
1854	16,720	1,360
1855	18,374	1,654
1856	22,016	3,642
1857	24,503	2,487
1858	26,968	2,465
1859	28,789	1,821
1860	30,635	1,846
1861	31,286	651
1862	32,120	834
1863	33,170	1,050
1864	33,908	738
1865	35,085	1,117
1866	36,827	1,742
1867	39,276	2,449
1868	42,255	2,979
1869	47,208	4,953
1870	52,898	5,690
1871	60,568	7,670
1872	66,735	6,167
1873	70,840	4,105
1874	72,741	1,901
1875	74,658	1,917
1876	77,470	2,812

To the total mileage for 1876 should also be added the mileage of Canada, which is 4,929, because those railways substantially belong to and form an integral part of the American system of railway-communication. In fifty years 82,443 miles of railroad were built and put in practical operation; or, computing the length of track upon

Miles built during fifty years.

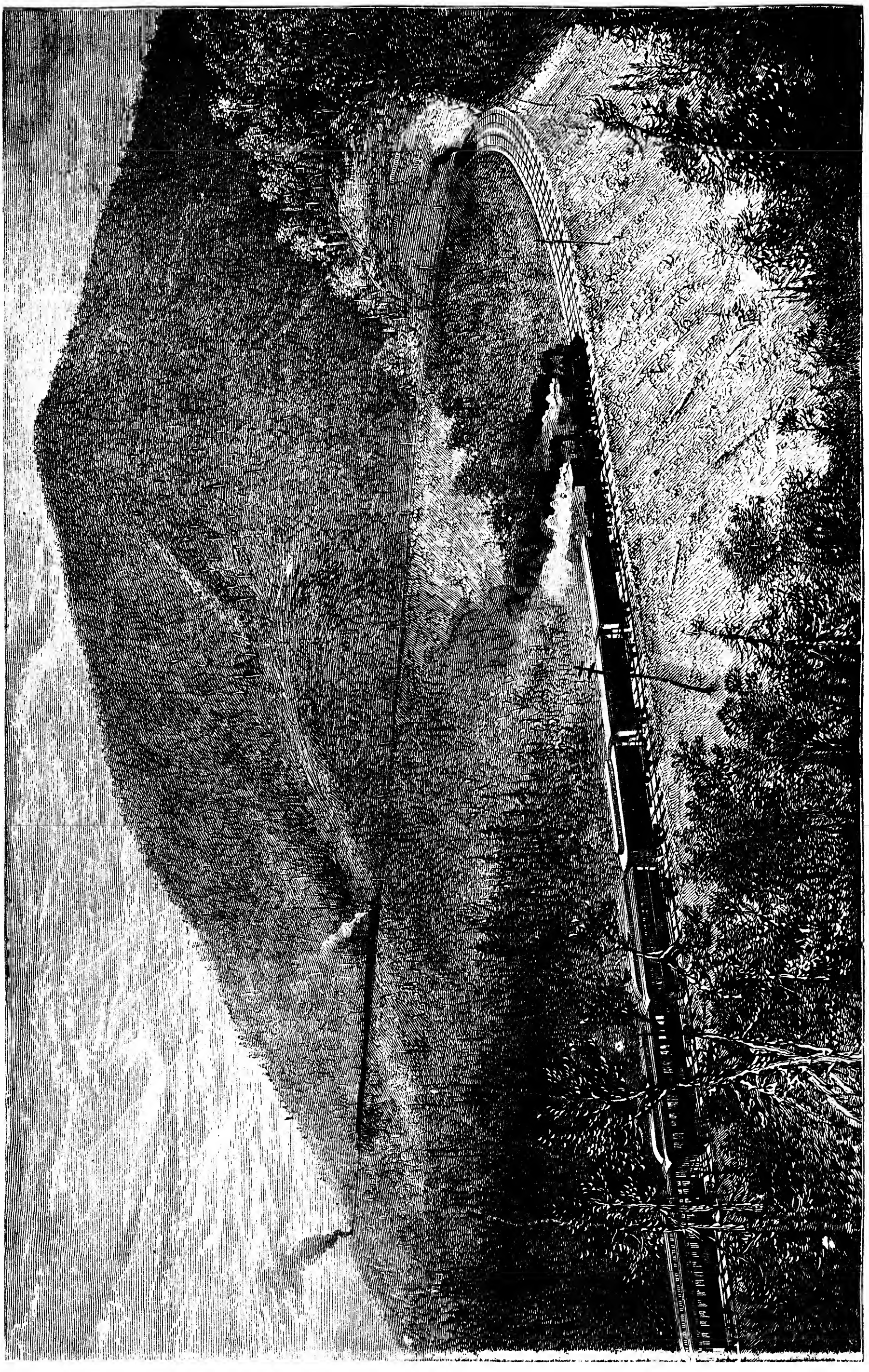


CONEMAUGH VIADUCT.

these roads, — counting in sidings, double and quadruple tracks, &c., — 98,773 miles of railroad-track were laid on this continent North of the Rio Grande in simply a half-century of effort. None of the richer and older nations can present a record like this.

The following shows the distribution of the railroads to the different States and Territories in 1876: —

STATES.	MILES OF ROAD.	EQUIPMENT OF ROADS OWNED AND CONTROLLED.		
		LOCOMOTIVES.	CARS.	COST OF ROAD AND EQUIPMENT.
Maine	1,000	167	2,811	$45,314,005
New Hampshire	940	125	2,728	23,714,859
Vermont	810	197	3,038	33,585,335
Rhode Island	189	37	291	6,129,023
Connecticut	918	260	4,833	52,912,022
Massachusetts	1,837	771	17,841	124,675,669
New York	5,525	1,667	41,168	421,593,301
New Jersey	1,601	787	23,838	146,795,016
Delaware	285	2	35	5,027,202
Pennsylvania	5,983	2,247	97,667	386,891,860
Maryland	1,107	762	19,376	100,973,120
Virginia	1,649	288	5,252	89,774,065
West Virginia	584	2	5	163,000
North Carolina	1,570	116	1,434	37,023,418
South Carolina	1,353	162	1,868	37,295,123
Florida	484	32	282	17,420,000
Georgia	2,306	318	4,643	62,038,201
Alabama	1,738	184	2,442	70,641,120
Mississippi	1,044	132	1,313	27,302,035
Louisiana	539	152	2,280	48,198,667
Texas	2,085	184	3,552	79,037,900
Ohio	4,687	1,749	38,225	373,944,388
Indiana	4,003	798	16,514	194,496,511
Illinois	7,285	1,645	41,128	415,777,140
Kentucky	1,475	299	5,030	76,655,260
Tennessee	1,645	131	1,649	29,555,822
Arkansas	788	28	307	14,881,400
Missouri	3,146	543	16,304	228,458,579
Iowa	3,939	150	3,251	106,352,984
Wisconsin	2,707	291	6,404	111,728,249
Michigan	3,395	491	12,569	139,866,082
Minnesota	2,020	153	4,039	79,754,596
Kansas	2,238	217	4,080	92,523,557
Nebraska	1,150	34	728	19,578,755
Colorado	957	30	574	30,694,150
Dakota	275	4	74	12,700,000
Utah	515	31	573	8,217,000
Wyoming	459	....	.....	....
Nevada	680	33	713	4,650,000
California	1,919	80	2,909	64,705,666
Oregon	251	14	231	7,361,664
Indian Country	279	....	.....	....
Washington	110	9	171	6,000,000
Union-Pacific	1,038	168	3,227	115,214,588
Central-Pacific	1,212	228	4,401	142,630,283
Total	77,470	15,618	399,924	$4,087,253,225



HORSESHOE CURVE, ALLEGHANY MOUNTAINS.

Thus, in the space of fifty years, there has been expended in this new and wild country the enormous sum of $4,087,253,225 in building railroads between the different parts of our domain. That so young a country, without

CHIQUES ROCK.

wealth, without capital, a region inhabited almost exclusively at first by farmers and planters, should have displayed such remarkable resources of capital, will not appear wonderful, however, when it is explained how the capital was obtained. In the early days of railroading it was felt that

Cost of railroads.

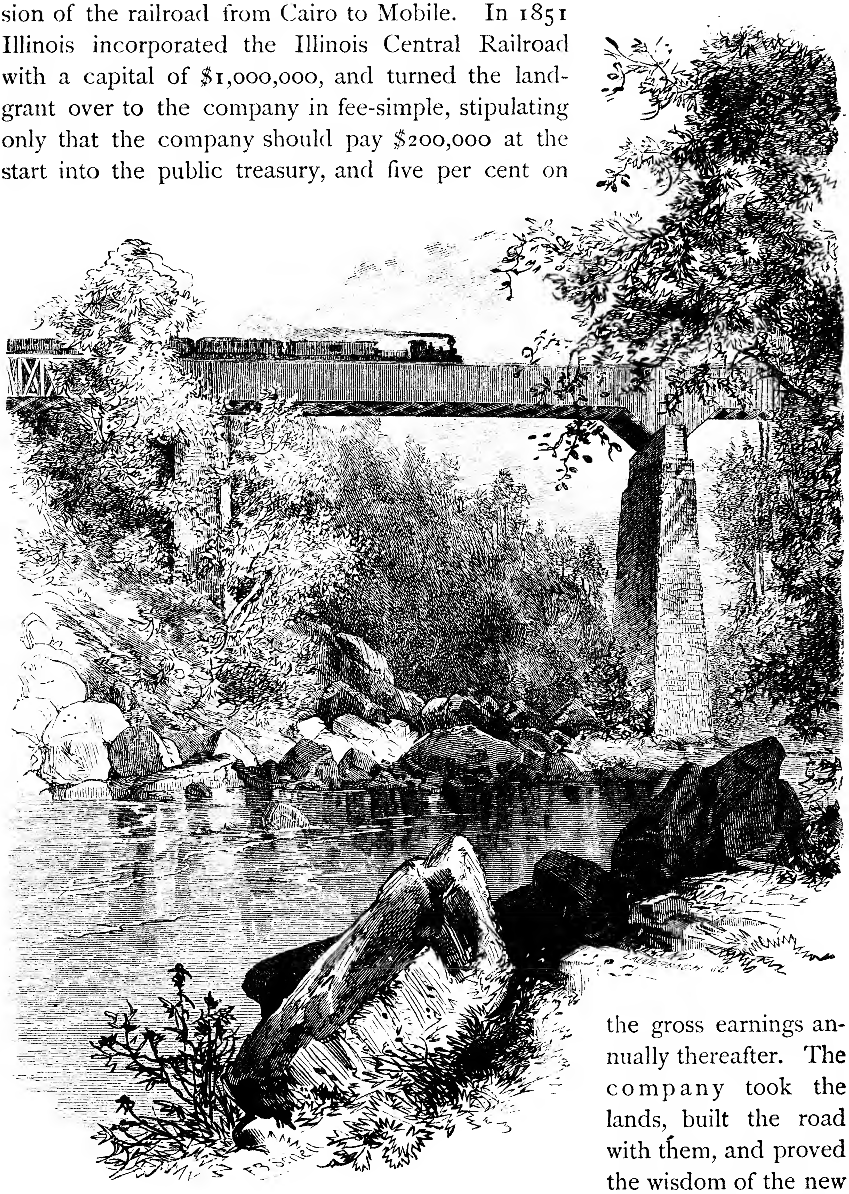
enterprises of such magnitude as were then proposed could only be carried on by the aid of the people; and accordingly public meetings were held in the cities and villages through which the roads were to run, and the best speakers of the day were engaged to awaken the interest of all substantial citizens in the public and private advantages of the roads. Subscriptions to the stock of the companies took the form, therefore, of a popular movement; and it was the characteristic of the early railroad-companies, that a vast number of small sums saved by industry and frugality were invested in them. The State legislatures aided many of them, as we have seen, by grants of credit and money. A part of the capital to build the roads was also obtained in London, whither the agents of the principal lines were sent, even in the very infancy of their respective enterprises, to see what could be done in the way of borrowing money. As railroad-extension became a popular *furore*, borrowing capital in London became a habit; and the result has been, that, in the course of these fifty years, a sum of money, estimated at not less than $400,000,000, has been obtained in England and Europe for the building of our American railroads. A large part of the money thus invested by foreign capitalists was transmitted to the United States in the form of railroad-iron. The manufacture of rails was in its infancy in this country; and England supplied us, until about five years ago, with nearly all the rails laid down here. Locomotives and cars we built ourselves; but we did not have the factories to make iron rails. From 1840 to 1877 there were imported from England 5,200,000 tons of rails, being a large proportion of the whole quantity used. The cost of the rails imported was something over $200,000,000, the price per ton being at times excessive. In 1864 it ran up one month to a hundred and fifty-four dollars per ton, though sinking back next year to eighty-three dollars, and running down in 1876 to forty dollars a ton, which is more nearly their legitimate value. Part of the capital for building the roads in the new States of the West was contributed outright by the General Government of Washington in the form of large grants of the public lands, by the pledge of which the companies were enabled to raise millions of money which they could not have otherwise secured. This policy of land-grants began in 1850. The State of Illinois had projected a grand system of canals and railroads in 1837, one feature of which was to be a rail-route from Chicago to Cairo through the central portion of the State. The Central Road was begun, and $3,500,000 spent upon it by the State, when bankruptcy overtook the enterprise, and work was stopped. In 1850, Congress, in a liberal and wise spirit, granted to the State of Illinois every alternate section of the public lands on each side of the projected road and its branches, six sections in width, to assist in carrying it forward to completion, — a grant which comprised 2,595,000 acres of land, an area larger than the State of Connecticut. The same law made grants of the same description to Alabama and Mississippi for the exten-

How money was raised.

Importation of rails.

Congressional grants.

sion of the railroad from Cairo to Mobile. In 1851 Illinois incorporated the Illinois Central Railroad with a capital of $1,000,000, and turned the land-grant over to the company in fee-simple, stipulating only that the company should pay $200,000 at the start into the public treasury, and five per cent on



BRIDGE. — CONEWAGO CREEK.

the gross earnings annually thereafter. The company took the lands, built the road with them, and proved the wisdom of the new policy of the government by paying to the State nearly $500,000 per annum ever afterwards as its share of the gross earnings of the road, and by doubling the value of the previously unsold government-lands in the State of Illinois. Those lands had been previously held at a dollar and twenty-five cents per acre, and could not find buyers. After the building of the Illinois Central Railroad, they all sold for two dollars and fifty cents per acre, and the government realized $9,000,000 for lands which had been valueless before they felt the magic breath of the locomotive. This policy of the government was based upon the idea, first, of developing the fertile lands of the West by affording the facilities for and inviting immigration; and, secondly, upon the idea of enhancing the value of its own lands by the process of settlement. So completely was all anticipation realized, that popular sentiment strongly favored the granting of lands to railroads; and it is a remarkable fact, that the people have been more willing to make land donations than the companies have been to accept them, as appears from the

TRACK AND TRACK-TANK.

circumstance that over 4,000,000 of acres have been given up by the companies, and surrendered to the government. These gifts, however, have been so badly abused in many cases, that public sentiment within a few years has undergone a radical change in respect to the recipients, and a marked disinclination has shown itself in political platforms and the action of Congress to granting any considerable portion of the national domain in the future for railroad-purposes. This renewal of interest in the public lands, and better appreciation of their value, is one of the favorable signs of national regeneration. The extent to which Congress has provided the railroad-companies of the United States with capital is exhibited by the following table of land concessions from 1850 to 1876: —

STATES.	DATE OF GRANT.	COMPANY.	ESTIMATED ACRES IN LIMITS OF THE GRANT.	NUMBER OF ACRES PATENTED UP TO JUNE 30, 1875.
Illinois	Sept. 20, 1850	Illinois Central	2,595,053	2,595,053
	Sept. 20, 1850	Mobile and Chicago		
Mississippi	Sept. 20, 1850	Mobile and Ohio River	1,004,640	737,130
	Aug. 11, 1856	Vicksburg and Meridian	404,800	198,027
	Aug. 11, 1856	Gulf and Ship Island	625,800 [1]	....
Alabama	Sept. 20, 1850	Mobile and Ohio River	230,400	419,528
	May 17, 1856	Alabama and Florida	419,520 [1]	394,522
	June 3, 1856	Selma, Rome, and Dalton	481,920	457,407
	June 3, 1856	Coosa and Tennessee	132,480 [1]	67,784
	June 3, 1856	Mobile and Girard	840,880 [1]	504,145
	June 3, 1856	Alabama and Chattanooga	897,920	552,199
	June 3, 1856	South and North Alabama	576,000	436,720
Florida	May 17, 1856	Florida Railroad	442,542	881,984
	May 17, 1856	Florida and Alabama	165,688 [1]	165,688
	May 17, 1856	Pensacola and Georgia	1,568,729 [1]	1,275,212
	May 17, 1856	Florida, Atlantic, and Gulf Central	183,153 [1]	37,583
Louisiana	June 3, 1856	North Louisiana and Texas	610,880	353,211
	June 3, 1856	New Orleans, Opelousas, and G't Western,	967,840	719,193
Arkansas	Feb. 9, 1853	Cairo and Fulton	1,160,667	1,115,408
	July 28, 1866	Cairo and Fulton	1,040,000	194,524
	Feb. 9, 1853	Memphis and Little Rock	438,646	127,238
	July 28, 1866	Memphis and Little Rock	365,539	14,606
	Feb. 9, 1853	Little Rock and Fort Smith	550,525	550,520
	July 28, 1866	Little Rock and Fort Smith	458,771	336,196
	July 4, 1866	Iron Mountain	864,000	....
Missouri	June 10, 1852	Hannibal and St. Joseph	781,944	599,031
	June 10, 1852	Pacific and South-west Branch	1,161,235	1,161,204
	Feb. 9, 1853	Cairo and Fulton	219,262	4,017
	July 28, 1866	Cairo and Fulton	182,718	....
	July 4, 1866	St. Louis and Iron Mountain	640,000	....
Iowa	May 15, 1856	Burlington and Missouri River	948,643	292,085
	June 2, 1864	Burlington and Missouri River	....	97,227
	May 15, 1856	Chicago, Rock Island, and Pacific	1,261,181	482,254
	June 2, 1864	Chicago, Rock Island, and Pacific	....	161,372
	May 15, 1856	Cedar Rapids and Missouri River	1,298,739	782,250
	June 2, 1864	Cedar Rapids and Missouri River	....	348,896
	May 15, 1856	Iowa Falls and Sioux City	1,226,163	683,023
	May 15, 1856	Dubuque and Sioux City	....	473,606
	May 12, 1864	McGregor and Missouri River	1,536,000	137,572
	May 12, 1864	Sioux City and St Paul	524,800	396,838
Michigan	June 3, 1856	Detroit and Milwaukee	355,420	30,998
	June 3, 1856	Port Huron and Milwaukee	312,384	6,428
	June 3, 1856	Jackson, Lansing, and Saginaw	1,052,469	742,900
	June 3, 1856	Flint and Père Marquette	586,828	512,529
	June 3, 1856	Grand Rapids and Indiana	629,182	629,182
	June 7, 1864	Grand Rapids and Indiana	531,800	217,434
	June 3, 1856	Marquette, Houghton, and Ontonagon	....	432,707
	March 3, 1865	Bay de Noquet	128,000	128,000
Michigan (Res.).	July 5, 1862	Chicago and North-western	564,480	517,908
Wisconsin	June 3, 1856	West Wisconsin	999,983	796,912
	June 3, 1856	Wisconsin Railroad Farm Mort. Land Co.,	....	39,929

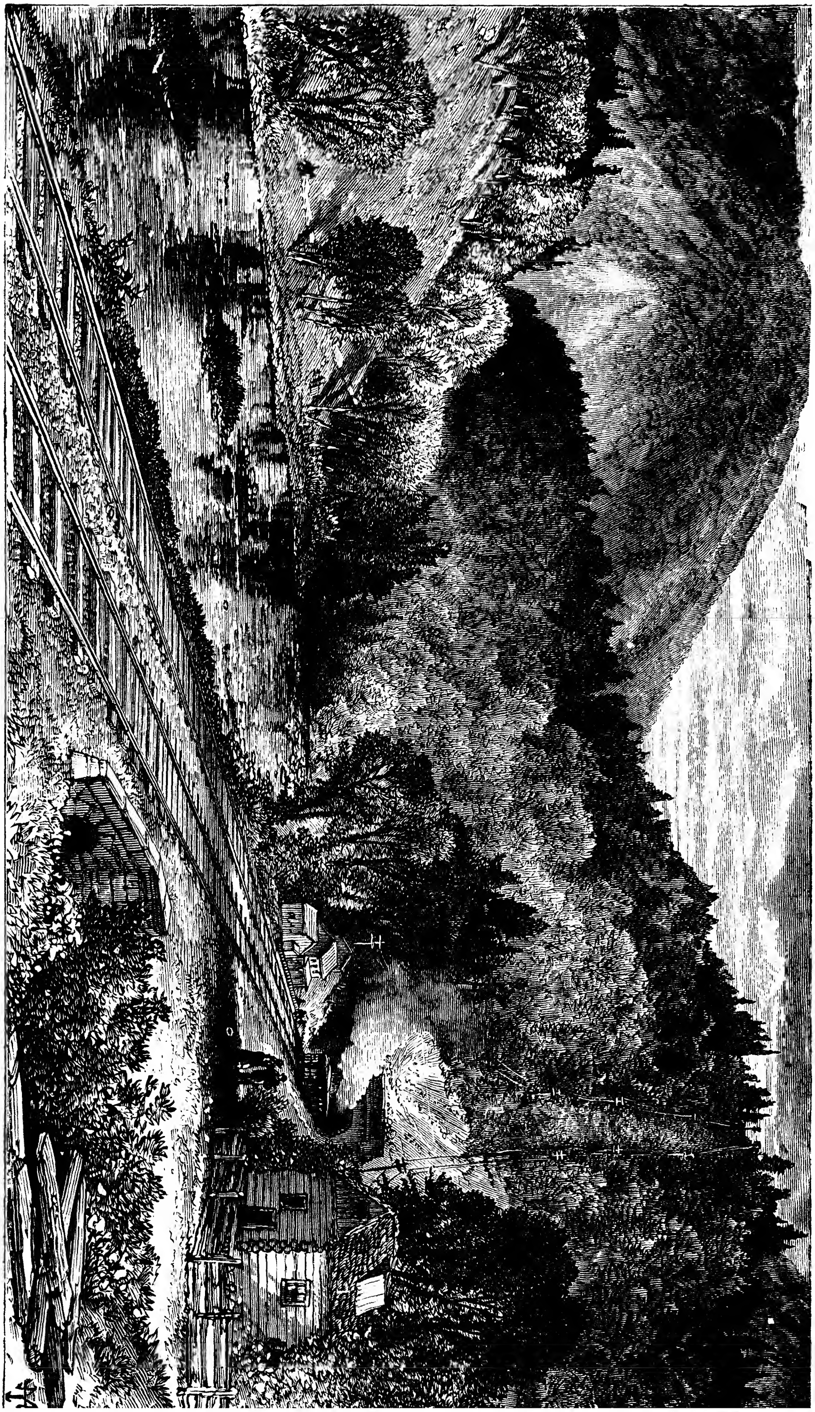
[1] No evidence of the construction of any part of these roads having been filed in the General Land Office, the grants are presumed to have lapsed; but the lands have not been restored, and Congress has not yet taken action in the matter.

STATES.	DATE OF GRANT.	COMPANY.	ESTIMATED ACRES IN LIMITS OF THE GRANT.	NUMBER OF ACRES PATENTED UP TO JUNE 30, 1875.
Wisconsin	June 3, 1856	St. Croix and Lake Superior / and Branch to Bayfield	524,714 / 318,737	524,718
	May 5, 1864	St. Croix and Lake Superior and Branch to Bayfield	565,000[1]	318,740
	June 3, 1856	Chicago and North-western	600,000	546,322
	May 5, 1864	Wisconsin Central	1,800,000	398,865
Minnesota	March 3, 1857	First Division St. Paul and Pacific	1,248,038	1,237,443
	March 3, 1857	Branch St. Paul and Pacific	1,475,000	522,925
	March 3, 1871	St. Vincent Extension (St. Paul and Pacific)	2,000,000	780,291
	March 3, 1857	Minnesota Central	643,403	179,058
	March 3, 1857	Winona and St. Peter	1,410,000	1,609,748
	March 3, 1857	St. Paul and Sioux City	1,010,000	929,566
	May 5, 1864	Lake Superior and Mississippi	920,000	743,241
	July 4, 1866	Southern Minnesota	735,000	265,394
	July 4, 1866	Hastings and Dakota	550,000	169,911
Kansas	March 3, 1863	Leavenworth, Lawrence, and Galveston	800,000	259,830
	March 3, 1863	Missouri, Kansas, and Texas	1,520,000	977,954
	March 3, 1863	Atchison, Topeka, and Santa Fé	3,000,000	2,274,686
	July 25, 1866	Missouri River, Fort Scott, and Gulf	....	22,527
	July 25, 1866	St. Joseph and Denver City	1,700,000	441,158
	July 25, 1866	Missouri River, Fort Scott, and Gulf	2,350,000	13,489
Corporations	July 1, 1866	Union Pacific	12,000,000	1,844,297
	July 1, 1862	Central Branch (Union Pacific)	245,166	186,453
	July 1, 1862	Kansas Pacific	6,000,000	506,555
	March 3, 1869	Denver Pacific	1,000,400	49,811
	July 1, 1862	Central Pacific	8,000,000	376,977
	July 1, 1862	Central Pacific	1,000,100	387,630
	May 6, 1870	Burlington and Missouri River	2,441,600	2,374,090
	July 2, 1864	Sioux City and Pacific	60,000	40,596
	July 2, 1864	Northern Pacific	47,000,000	630,717
	July 13, 1866	Placerville and Sacramento Valley	200,000	....
	July 25, 1866	Oregon Branch (Central Pacific)	3,000,000	494,059
	July 25, 1866	Oregon and California	3,500,000	236,525
	July 27, 1866	Atlantic and Pacific	42,000,000	504,478
	July 27, 1866	Southern Pacific	6,000,000	686,118
	March 3, 1871	Southern Pacific	3,520,000	41,178
	March 2, 1867	Stockton and Copperopolis	320,000	....
	May 4, 1870	Oregon Central	1,200,000	....
	March 3, 1871	Texas Pacific	18,000,000	....
	March 3, 1871	New Orleans, Baton Rouge, and Vicksburg,	3,800,000	....
Total, deducting the lands reverted			208,344,263	38,052,530

Total amount of grant.

As the estimated quantity of lands contained in the grants is somewhat more than the quantity which the companies will realize from them, owing to previous settlement, especially in Kansas, Minnesota Iowa, and Arkansas, the total grant is estimated in reality as amounting only to 183,216,733 acres, worth $52,575,000. The government also aided

[1] No evidence of the construction of any part of these roads having been filed in the General Land Office, the grants are presumed to have lapsed; but the lands have not been restored, and Congress has not yet taken action in the matter.



SPRUCE-CREEK TUNNEL, PENNSYLVANIA.

in the construction of the Pacific railroads, as enterprises of great national utility, by issuing to them bonds to run for thirty years, payable from a sinking-fund established by the companies; the bonds being issued to the companies, as fast as they finished the different sections of their roads, at the rate of $16,000 a mile on the plains, $48,000 a mile through the mountain-ranges, and $32,000 a mile between the ranges. The following table exhibits the amount of the loans to the different projects:—

Government loans.

RAILWAY.	AUTHORIZING ACTS.	PRINCIPAL.
Central Pacific	July 1, 1862, and July 2, 1864.	$25,885,120
Kansas Pacific	" " "	6,303,000
Union Pacific	" " "	27,236,512
Union Pacific, Central Branch . . .	" " "	1,600,000
Western Pacific	" " "	1,970,560
Sioux City and Pacific	" " "	1,628,320
Total	. . . .	$64,623,512

The contribution of the government, therefore, toward the capital needed for creating the railroad-system of the United States, was $144,-000,000. Large as is this sum, it is only one and three-fifths per cent of the whole amount of capital invested. That part of it which consisted in land-grants has been repaid to the government by the increased value of its other lands.

Ratio of aid to amount invested.

Another plan resorted to, after railroad-enterprises attained a magnitude which rendered inadequate the old and simple method of raising the capital for them from the savings of the people in the localities through which they run, was the issue of bonds by towns and cities. A very large number of the short lines of the country were built by means of capital raised in this way. Some of these bonds have not been paid; but the object of their issue was secured, and the roads constructed, and added to the permanent wealth of the country.

Issue of bonds.

The fifteen years just before the civil war was a period of great activity in railroad-building. It was seen that the growth of cities and the marketing of surplus products of farm, plantation, forest, and mine, were dependent on the construction of these avenues of communication. A great many important lines were projected and built in that fifteen years, among them being the Erie Railroad, the Hudson-river, the Pennsylvania, the Illinois Central, and many others. Connecting links were finished, so as to open an all-rail route from Boston to New Orleans, and from Chicago and St. Louis to all the principal cities on the Atlantic coast; so that the pine-woods and myriad factories of New England were united to the

Fifteen years prior to civil war.

cotton-fields and cane-brakes of the South, and the waving wheat and corn fields of the West to the wharves and fleets of stately ships upon the ocean-coasts. The locomotive sped through every part of the country. Regions which before were impenetrable wildernesses became gardens; and millions of human beings came from Europe to populate them, and find in the midst of them a competence and independence which they had never known in the previous part of their lives. Old cities received a new birth, and new ones sprang up in magical fashion all over the country. New industries were planted by the exigencies of the roads. There was plenty of work everywhere; and the wealth of the country developed in a manner that astonished the Old World, and formed the theme of admiring comment of statesmen and writers everywhere.

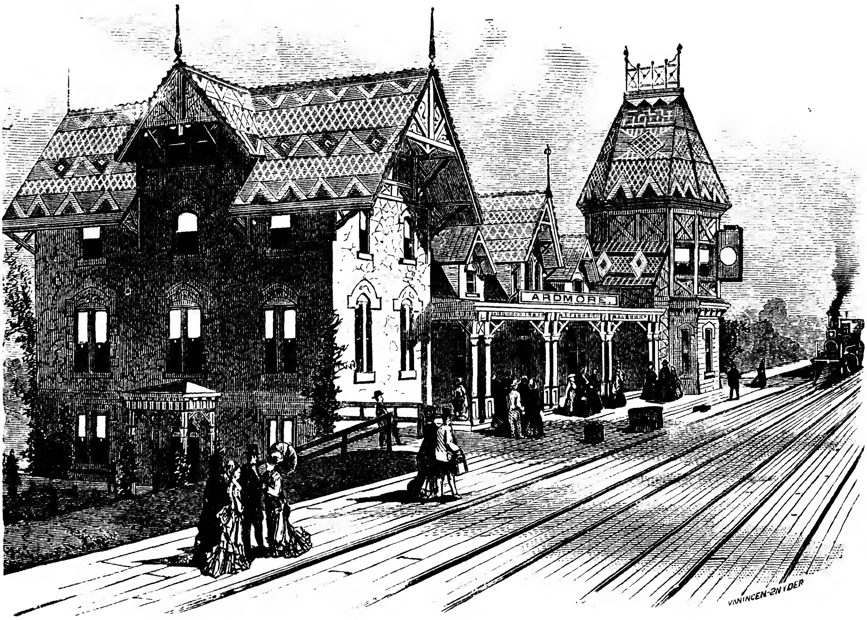
Consolidation of railroads.

In the early years of railway-traffic the transportation-system of the country presented the aspect merely of a confusion of disconnected and independent roads, managed without regard to any common purpose, and with very little respect for the wishes of patrons living beyond the termini of the several roads. The New-York Central route was composed of twelve distinct corporations and lines between Albany and Lake Erie; and for twenty or thirty years there was not a trunk-line anywhere in the country, in the modern sense of the term. Every little line of fifty miles of track was managed in delightfully autocratic style; and the only concern of its officers was to collect the charges for the transportation of freight over their line, what became of the freight after it had passed on — whether it was lost or plundered, or stood for weeks on a siding — being of no earthly interest to them whatever. The shipment of freight to any distance by rail was thus attended by all sorts of delays, vexations, and losses. This was a discouragement to trade, and thus both the roads and the public suffered by it. Out of this state of things arose several measures looking toward unity and harmony in the railway-system of the country, among them being the consolidation of connecting-lines into single companies, the lease of connecting-routes by powerful companies, — so as to secure trunk-lines from the seaboard to the productive regions of the interior, and between interior points, — and the formation of fast-freight and express companies. The growth of the trunk-lines and the rapid-despatch companies will be separately mentioned.

Massachusetts the first State to build a long railroad.

Massachusetts was one of the very first States to discover the need of a railroad the whole length of the State, and connecting at Albany with the Erie Canal. Dr. Phelps and Daniel Webster were early and earnest advocates of the measure. Two routes for a railroad were surveyed at State expense — one through the Northern, and one through the Southern countries — in 1827 and the two succeeding years. The Boston and Worcester Railroad Corporation was chartered, June 23, 1831, to build the first part of the road, — forty-three miles and a half; which task was completed July 3, 1835. The road earned a little over ten per cent on its original capital of $1,000,000 from the start. In March, 1833, the Western Railroad Corporation was chartered to build one from Worcester to the Hudson River, with a capital of $2,000,000. The company did not organize at once, owing to some uncertainty in the popular mind as to what the State most needed in the way of railroads. There was great agitation for a direct line to New York from Worcester by way of Hartford, and for a line to Norwich, Conn. By persevering efforts, the Western Railroad Corporation secured its capital by subscriptions along the route of the road; and work began in the winter of 1836. In January, 1836, the governor, alluding to this project in his

Boston and Albany Railroad.



STATION ON PENNSYLVANIA CENTRAL RAILROAD.

message, said, "Should the work in its progress stand in need of resources beyond the reach of the enterprise and means of the individual citizens by whom it is undertaken, it is believed that the public patronage could be safely extended to it as a project of vast general utility, whose successful execution would form an era in the prosperity of the State." State aid was very much needed after 1837, on account of the business prostration of the country; and three separate loans of State credit were made, amounting in all to $4,000,000. The road was opposed in New-York State by influence from the city of New York; but the managers overcame all obstacles, and on the 21st of December, 1841, opened their road from Worcester to Albany.

Celebration of event.

Public celebrations of the event took place in Boston and Albany. The road of the Western Corporation cost $7,566,791. When the Western Road was opened, a difference sprang up at once, between the two companies controlling the route from Springfield to Boston, about the rate of fare; the Boston and Worcester Road claiming an undue share of the through rate. A conflict on this subject was carried on with acrimony for more than twenty years, and was never settled until in 1868 the two roads were consolidated into one company as the Boston and Albany Railroad Company. In 1871 the Albany and West-Stockbridge Company, in New-York State, was consolidated with the corporation, thus putting the route from Albany under one management and ownership. The combined capital of the three companies was $27,325,000. At Albany this road connects with the New-York Central and the Erie-canal routes to the West, and the Albany and Susquehanna route to the coal-mines. It has brought about a great change in the ancient currents of trade. Now flour and grain coming down the Erie Canal go no longer, as of yore, down the Hudson and up the Sound, whence, in due course of time, they reach Boston by doubling around Cape Cod. All these things now go direct, and reach Boston in ten hours from Albany, against the six or seven days' transit of the old *régime*. At Boston the road has a grain-elevator with a capacity of 1,000,000 bushels, coal-pockets, warehouses, and other terminal facilities, which are not excelled in any seaport of the United States. Freight is supplied to three weekly lines of steamers to England. The Boston and Albany Road has repaid its entire debt to the State of Massachusetts, and is one of the prosperous enterprises of the country.

Hoosac-tunnel Railroad.

Another connecting link between the New-England seaboard and the New-York transportation routes to the West was completed in 1875 on the line through the northern counties of the State talked of in 1827: this is the Hoosac-tunnel Fast Freight Line. It is composed of a combination of railroads, and affords to the public a choice of routes between Albany and Boston. The component parts of the line are the Fitchburg Railroad from Boston to Greenfield (a hundred and six miles), the Troy and Greenfield Railroad and Hoosac Tunnel to the Vermont State line (forty-four miles), and the Troy and Boston Railroad to Troy (forty-one miles). The Troy and Greenfield Road with the tunnel were built by the State at a cost of $20,000,000, and are still owned by the Commonwealth. The tunnel was opened for the first train Feb. 9, 1875. The capacities of this route are not yet fully developed; but it is expected to reduce the cost of transportation to Boston, and thus increase the trade of that port.

New-York Central.

The beginnings of railway enterprise in New-York State have already been noted. Two great trunk-lines to the West have been constructed through that commonwealth since the humble commencement made between the then little old towns of Schenectady and Albany. For the northern route fourteen charters were granted; though in 1852 the number of roads had been reduced to twelve by the consolidation of the Auburn and Rochester with the Auburn and Syracuse, and the Tonawanda with the Attica and Buffalo Companies. This chain of railroads was built economically and honestly. The first of them, those between Auburn and Albany, were built originally to be operated by horse-power, and were so operated at first; but engines were soon put upon them all, the first ones being imported from England for the purpose. Nature had marked out the destiny of this chain of roads as one single route from Lake Erie to the Hudson; but they were operated as distinct lines until 1853, when an act of the legislature, passed in April, authorized their consolidation. The prudence with which they had been built, and the populous and productive nature of the regions they traversed and tapped, are exhibited by the following table, showing the value of the roads at the time of the consolidation: —

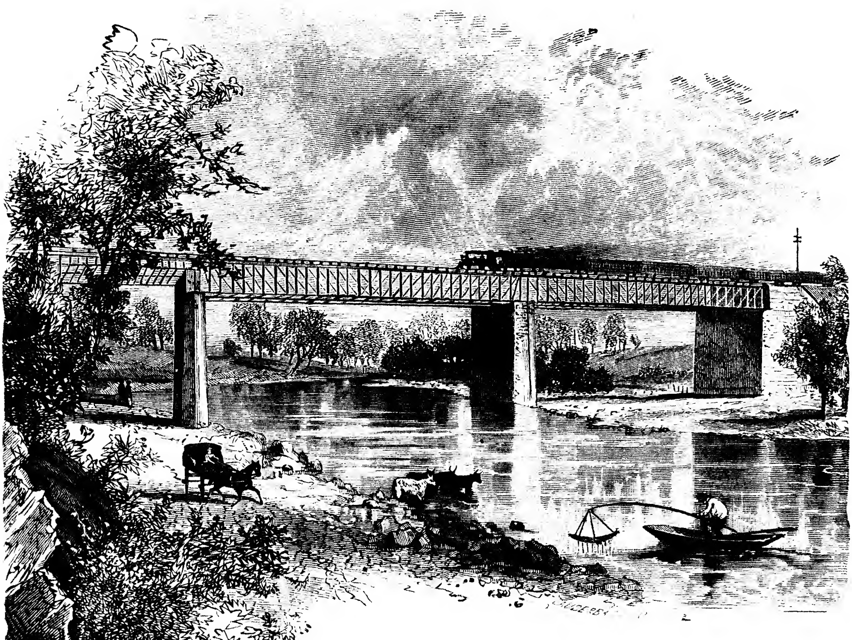
NAME OF ROAD.	STOCKS AND CONVERTIBLE BONDS.	PREMIUM OF THE STOCK (PER CENT).
Albany and Schenectady	$1,621,800	17
Utica and Schenectady	4,500,000	55
Syracuse and Utica	3,300,000	50
Rochester and Syracuse	5,608,700	30
Buffalo and Rochester	3,000,000	40
Rochester, Lockport, and Niagara Falls	2,155,100	25
Buffalo and Niagara Falls	565,000	..
Niagara Falls and Lewiston	354,260	..
Buffalo and Lockport	675,000	25
Rochester and Lake Ontario	150,000	25
Mohawk Valley	1,575,000	55
Troy and Schenectady	650,000	..
Total of stocks and convertible bonds	$24,154,860	

The terms of consolidation were, that the stock of the new company, to be called "The New-York Central," should equal the aggregate of the stock of the individual companies, and that, for the premium which the stock then commanded, six-per-cent bonds of the new organization should be issued to the holders. The total amount of bonds issued under this arrangement was $8,894,500. The debts of the companies amounted to about $2,800,000; so that the total liabilities of the new company were $35,836,796. The average cost per track was $44,485 a mile. Earnings amounted in 1857 to $8,000,000, or $14,000 a mile. The distance from Albany to Buffalo was shortened to 298 miles. Another link in the New-York Central route was completed in 1851, being the Hudson-river Railroad to New-York City, 142 miles long, chartered in May, 1846, and built at a cost

Terms of consolidation.

of $11,328,990 or $78,673. In 1864 the road fell into the control of the New-York Central, and in 1870 was permanently consolidated with it. It was agreed that the capital of the new concern should be $45,-000,000. The stock being at a premium, however, the company conceived the idea of turning the fact to advantage by giving a representative value to the increased worth of the road to which the premium was due by issuing eight-per-cent certificates, convertible into common stock

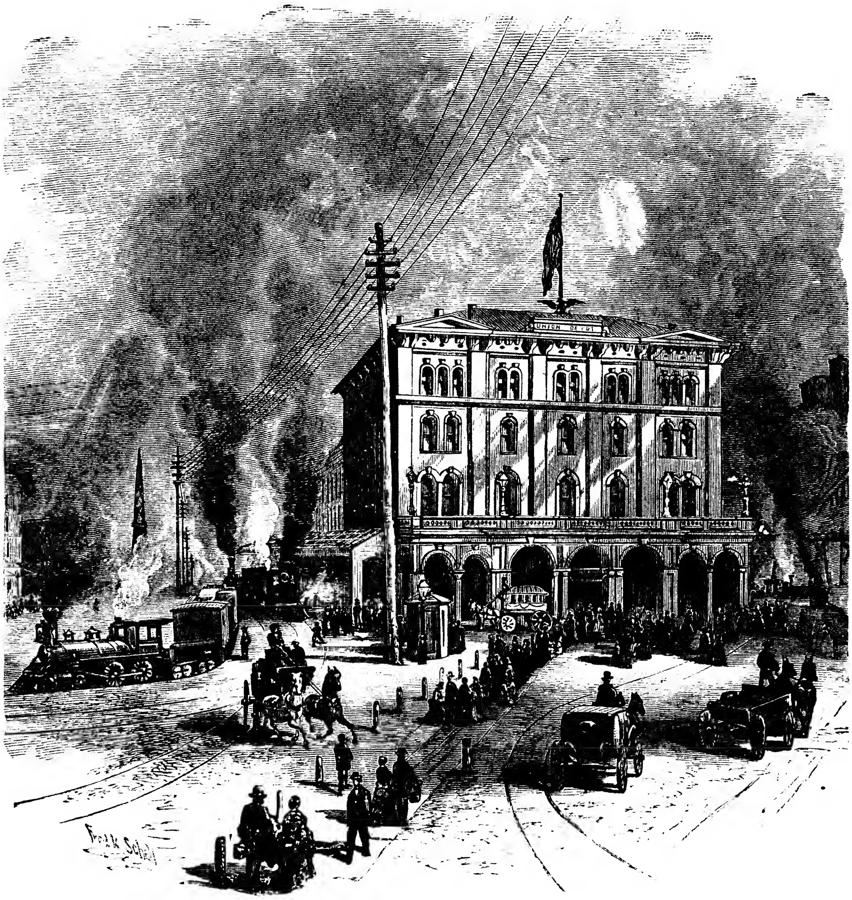
Hudson-river Railroad.



BRIDGE. — CONESTOGA RIVER.

at the option of the holder. Of these certificates $44,428,300 were issued, thus virtually increasing the stock by a stroke of the pen to $89,428,300. The corporation has since laid another double track between Albany and Buffalo at a cost of $25,000,000, paid for by the issue of bonds, thus securing a four-track road the length of New-York State; and has leased the New-York and Harlem Railroad, thus securing four tracks to the city of New York, without the necessity of laying the additional two upon the costly route along the banks of the Hudson. The road's western connections are the Lake Shore and Michigan Southern and the Canada Southern. It is operated jointly with those lines for Western business, and it carries freight indiscriminately both ways both for Boston and New York. Its New-England connections are the Boston and Albany and the Hoosac-tunnel route to

Boston. Seventy per cent of its eastward-bound freight goes to New England. The principal characteristic of the business of the New-York Central is its enormous passenger and local-freight traffic. It transports over 7,000,000 passengers a year, and in 1876 carried 6,800,000 tons of freight. The cost of freight has been reduced to three dollars a ton from Buffalo to Albany. It will be recollected that the cost was a hundred dollars a ton in the days of wagoning.



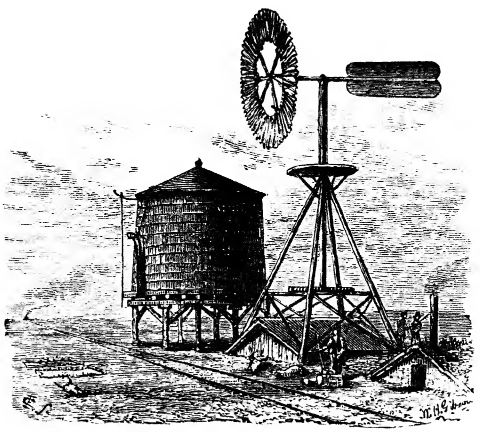
UNION DÉPÔT, PITTSBURGH.

Erie Railroad.

The Erie-railway route was planned as early as 1825, the State of New York ordering a survey for it in that year. The public interest in a railway through the southern counties of the State was very great, and a number of public conventions were held in regard to it. A company was chartered to build the road in 1832, the capital to be $10,000,000; and De Witt Clinton, jun., made a survey for it. This road was built under disheartening circumstances. The region it traversed was excessively rugged, and afforded an extremely small amount of local business to the line. No paying traffic could be expected until it was completed through to Lake Erie. The great fire in New York prevented many of the stockholders from paying for their shares. The panic of 1837 intervened, and crippled other men. The line was laid out with such poor judgment in places, that the work had to be abandoned as useless. The State loaned $3,000,000 to the company in 1840, and afterwards presented the loan to the company; but it was not until 1851 that the rails were laid to the then new harbor of Dunkirk on Lake Erie, and the through traffic, which alone sustains this great road, was tapped. The company languished, however, until 1868, when, under a new management, it was equipped with steel rails and an abundance of first-class rolling-stock, and became one of the finest railroads in America, with a large and constantly-growing business in the transportation of passengers, coal, petroleum, agricultural produce, and general merchandise. As in the case of the New-York Central, advantage was taken of the increased worth of the road, and the expenditures for its improvement, to issue new shares in large quantities; and during the four years ending Sept. 30, 1871, the common stock was increased from $46,302,210 to $86,536,910, and two years later the total liabilities of the road were $115,449,211. The inability to earn a dividend upon so large an investment involved the company in fresh trouble, and litigation without end. The road has been further embarrassed by the fact that its track has been six feet wide, while connecting roads to the West have been only of the standard width of four feet eight and a half inches. In spite of its troubles, the Erie Road is a magnificent property, and is transacting a large business. Its terminal facilities at New-York harbor are very fine; and, when the gauge of the road is reduced (as it will be in a few years, the work having been begun), it will be a formidable competitor for the through business of the West. The road is operated in conjunction with the Atlantic and Great Western and other lines to St. Louis, and the Lake Shore and Michigan Southern to Chicago. In 1876 it carried 5,972,000 tons of freight. It has, including branches, 459 miles of main line, and controls 500 miles of connections. The comparative distance from the grain-centres of the West to the seaboard by this route, in comparison with other trunk-lines, will be stated farther on.

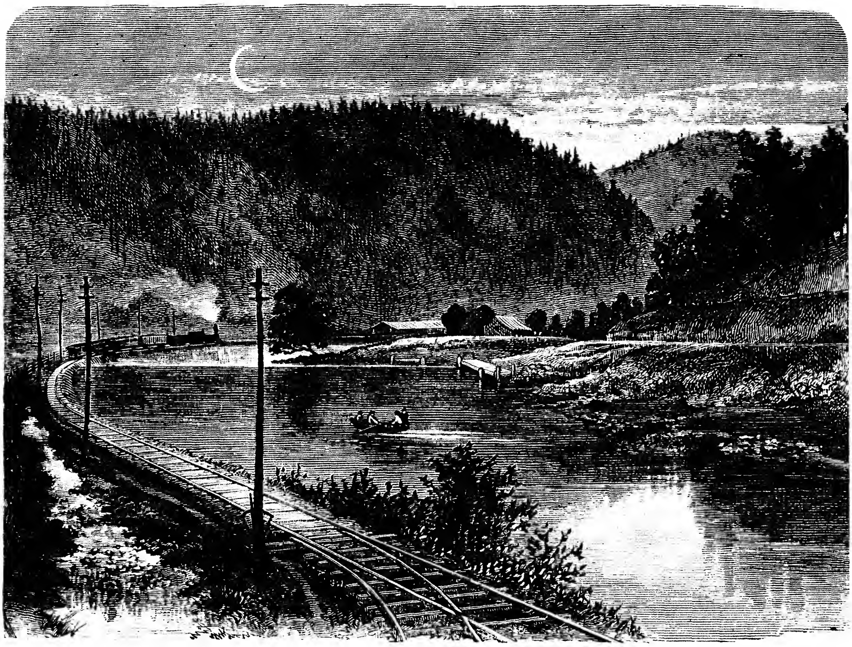
Pennsylvania Railroad Company.

Philadelphia's route to Chicago is composed of what were originally six separate railroads; and the route to St. Louis, of roads built by thirteen different companies. These roads are now all either owned, or leased in perpetuity, by the Pennsylvania Railroad Company, the most extensive railway organization in the world. This company now owns 1,505 miles of roadway, not counting in double tracks or sidings; and 4,324 miles of road are either directly controlled by or operated in its interest: in all, 5,829 miles, representing a capital of $398,267,000. These lines pass through eleven States, and extend into the heart of the cities of St. Louis, Chicago, Cincinnati, Baltimore, Philadelphia, and New York, tapping the commerce of the Ohio and Mississippi and the Great Lakes, and connecting the grain, coal, and iron regions of the interior with three of the great ocean harbors of the North Atlantic. The Pennsylvania Railroad Company was formed originally to complete the work undertaken by the State itself to give the city of Philadelphia a commodious transportation-route to the western counties of the State and to Ohio. The State line of works was first opened in 1830; but it was a broken line, consisting of two pieces of railroad, — one from Philadelphia to Columbia, eighty-two miles; the other from Hollidaysburgh to Johnstown, thirty-six miles (this one being operated by stationary engines), the two roads being supplemented by two hundred and seventy-eight miles of canal. Philadelphia was unable to compete with New York's unbroken routes by rail and canal; and accordingly a company was formed to build a railroad from Harrisburgh to Pittsburgh. In 1857 the State sold its main line of works to the Pennsylvania Railroad Company for $7,500,000 (they cost $12,000,000), and rail communication from Philadelphia to Pittsburgh then became continuous and efficient. During the late war, the Pennsylvania Road made enormous profits; and recognizing the fact that the business it was then doing was accidental, and could not be sustained except by the extension of its lines to the West, it devoted a part of its earnings to building the Philadelphia and Erie Road, and the completion of various branch lines in the State which would bring traffic to the main stem. In 1869 the company assumed control of the chain of roads constituting the Pittsburgh, Fort Wayne, and Chicago route to Chicago as lessee for nine hundred and ninety-nine years. The same year it secured a line under its own control to Cincinnati, Louisville, and St. Louis by lease. It leased the Northern Central in 1870, thus gaining connections with Baltimore and with Canandaigua, N.Y.; and in 1871 it secured control of the united railroads of New Jersey, thus getting a direct line to New York. The company now owns twenty-two branches, and controls branches and extensions by lease. Its policy has been dictated by such sound judgment, that no part of this vast network of lines is a burden upon the company, or any thing except a useful tributary to its



WATER-TANK.

business. Its capital stock is now about $53,000,000, and its total liabilities about $116,000,000. The company has a grain-elevator at Baltimore, two at Philadelphia, and two at Erie, Penn.; and at New York it has millions of dollars invested in wharves, warehouses, cattle-yards, oil-dépôts, and other terminal facilities required by a large and varied commerce. Philadelphia is the principal point of export, however, the company having established from that port a line of four American iron steamships to Liverpool by guaranteeing $1,500,000 of its bonds. This line operates at present the only American steamships engaged in trans-Atlantic trade. The Pennsylvania Company is in



MUNCY MOUNTAIN, NEAR BELLEFONTE.

all respects a colossal organization; and, whatever may be said of the danger of permitting so vast a moneyed power to grow up in this republic, it can at least be said that its operations have been of incalculable utility to commerce and the country.

Completion of the Baltimore and Ohio.

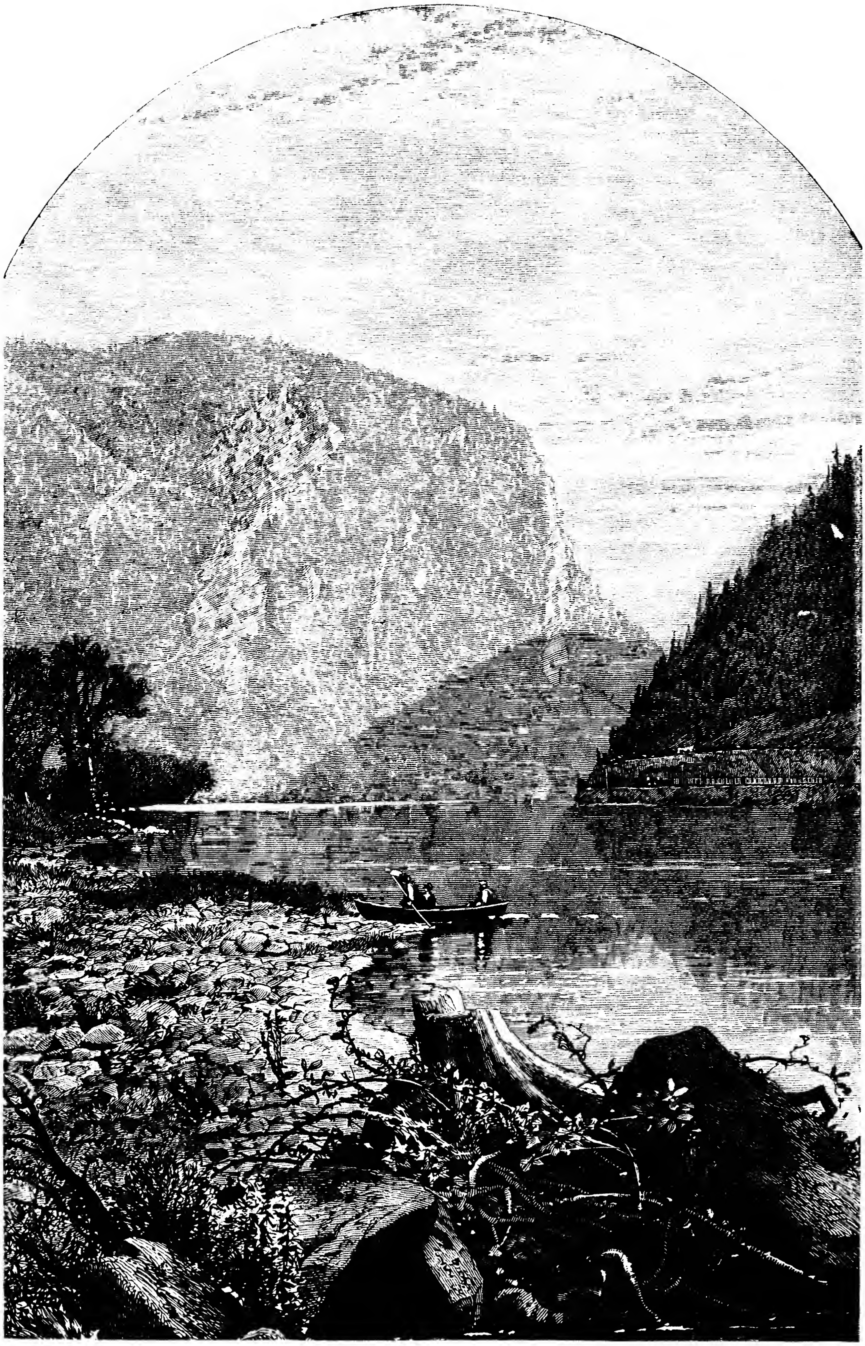
The Baltimore and Ohio Railroad, though begun in 1828, was not finished through to the Ohio River at Wheeling, a distance of 379 miles, until Jan. 1, 1853. Litigation with the canal running parallel to it, and the opposition of other conflicting interests, had made great delays. The cost of the road and equipment was $23,600,000. After the war, the company leased a number of connecting roads in order to secure the unity of operation and establishment of through rates which the other great companies had been striving for. In 1866 a connection to Columbus, O., was leased, and in 1869 another running to Sandusky. In 1870 the Winchester and Strasburgh Road was leased, thus securing the business of the Shenandoah Valley in Virginia, and paving the way for obtaining a share of the trade of North Carolina. A connection through to Chicago was secured by alliance with other roads in 1874, and another recently to St. Louis. The liabilities of the road now amount to about $56,000,000. The interest of the city of Baltimore in stock and bonds is $10,500,000. The road is wisely managed, and has a large business in coal, petroleum, grain, and general traffic. Its terminal facilities on Locust Point in Baltimore are not approached in any other seaport of the country, except at Boston: they comprise grain-elevators, coal-shoots, warehouses, oil-yards, and wharves, and are the rendezvous of innumerable sailing and steam vessels, and the dépôt of the ocean steam-lines to Europe. During the freight war between the railroad-lines in 1865 the company established its own steamship communication with England, but lost $758,000 in the venture, and soon withdrew the steamers. The road has a great future before it.

Grand Trunk of Canada.

Another system of railroads leading from the West to the seaboard has grown up north of the Great Lakes and St. Lawrence River within the last twenty years, and is termed the "Grand Trunk of Canada." The Grand Trunk Railway Company was chartered in 1852, with a capital of £3,000,000, to build a road from Toronto to Montreal. In 1853 a number of other companies consolidated with this organization, upon an agreement by the latter to carry out the contracts they had made. These contracts included the building of roads from Toronto to Sarnia on Lake Huron, from Point Levi to Richmond, and from Quebec to Trois Pistoles, and also for building the great Victoria Bridge at Montreal. These works were completed at a cost of £21,000,000. At the same time the company leased for nine hundred and ninety-nine years the Atlantic and St. Lawrence Road of Maine, extending from Portland to Island Pond, N.H., near the Canada border. This system of railways did not at first secure so large a share of the through business from the Western granaries as was expected; but an extension from Port Sarnia to Chicago has recently been effected, the line has been prudently managed, and the route has become an important part of the American system of railways. The Grand Trunk has secured a connection to Boston by way of the Central Vermont Railroad, and now competes actively with the through lines centring at that port.

Competition among railroads.

Thus, out of a confusion of disconnected railways, operated without regard to the interests of each other or the public, there have grown up five great compact and united systems leading from the great trade-centres of the interior to the seaboard. The transportation abilities of each of these five routes have never been fully taxed. It is esti-



DELAWARE WATER-GAP.

mated that the tonnage of each might be tripled. The fact that no one of the five lines has carried as much freight as it has been capable of doing has led to sharp railroad wars within the last five years, some of which were waged at great loss to the lines, freight being carried at less than cost. Various compacts have been made to harmonize the differences of the lines, and agree what the rates shall be for through freight over each, but without permanent success. Compacts have only been made to be broken. How nearly matched the different routes are, with reference to the fundamental matter of distance from the West to Liverpool, may be seen from the following statement: —

FROM CHICAGO.	MILES.	FROM SEAPORT TO LIVERPOOL.	TOTAL.
Grand Trunk to Montreal	842	....	....
Grand Trunk to Boston	1,143	2,936	4,079
N.Y. Cent. and Boston and Albany to Boston,	1,020	2,936	3,956
New-York Central route to New York . .	976	3,013	3,989
Erie route to New York	958	3,013	3,971
Pennsylvania Railroad route to New York .	912	3,013	3,925
Pennsylvania Railroad route to Philadelphia.	822	3,200	4,022
Pennsylvania Railroad route to Baltimore .	800	3,338	4,138
Baltimore and Ohio R.R. route to Baltimore,	840	3,338	4,178

Value of traffic between the West and Atlantic seaboard.

It is estimated that the through traffic between the West and the Atlantic seaboard now amounts to eight million tons annually. That portion of it which is grain is brought to the coast at an average cost of twelve cents a bushel from Chicago, the total cost from Chicago to Liverpool being about thirty-four cents a bushel. This amazing reduction is the effect of the consolidation of through routes, and competition between them.

Great lines established since the war.

Unity, as we have seen, grew up first between the lines running to the North-Atlantic seaboard. Trade set the most heavily in that direction, and the four years of war prevented for a time an alliance between the lines constituting the through routes from North to South. But since the war several trunk-lines have been formed, traversing the country in that direction. It is expected that these will bear an important part in the future in the trade with the coast of the Gulf, from which a large part of the commerce with Mexico and South America will be carried on. The principal of these lines are the following: —

1. The St. Louis and Iron-Mountain Railroad, with connections running into the State of Texas.

2. The Missouri, Kansas, and Texas Railroad.

3. The New Orleans, St. Louis, and Chicago Railroad, connecting at Cairo, Ill., with the Illinois Central.

4. The Mobile and Ohio Railroad, running also to Cairo.

5. The Louisville, Nashville, and Great Southern Railroad.

6. Three series of lines running from Washington through Virginia, by different routes, to the South and South-West; which may be designated as the Virginia and Tennessee Route, the Atlanta and Richmond Air-line, and the coast-line running through Weldon, N.C., to Savannah, and connecting with all the Southern States.

These important highways of commerce have great capacity, and thus all exert a regulating influence on freight-rates between the South and North. The trip from Boston to New Orleans can now be made by rail, by the lines leading in that direction, in three days. In the olden time, before the days of the locomotive, the trip required twenty-four days. What a marvellous change in fifty years!

Economy of railroads.

The express-business really took its rise in the days of stage-coaches, or at least before the railway-system had grown beyond its early infancy. It grew out of the robberies of stage-coaches, and of a practice, still common in all the new parts of the country, of forwarding packages of money and valuables by passengers travelling by stage. Before the establishment of the railroads, merchants and banks employed members of the legislature, and other trustworthy citizens, in their journeys to New York, Boston, Albany, and other large cities, to take with them, and deliver to their correspondents, the remittances which they did not dare put into the United-States mail-bags for fear of robbery. On the Western plains, down to within ten years, many a passenger has had his fare paid to the States from the mining-regions, in consideration of his carrying with him in the coach, and delivering to the railways on the Missouri, the bars of gold and silver which there was no other method of transmitting to the States so cheaply and safely. In 1840 this irregular practice took the form of a legitimate business through the efforts of Mr. Alvin Adams of Boston, the founder of the Adams Express Company. There was then no railroad to New York; and Mr. Adams began carrying letters and parcels to New York by stage, to Allyn's Point, Conn., and thence by steamboat to the metropolis. He was a man of singularly engaging manners and manly character, and he soon won such confidence that he gained a very large patronage. In a short time the business grew so large, that he ceased to travel himself, and engaged messengers to make the trips to New York for him. Then boxes and bundles began to be sent, and a man with a wheelbarrow was hired to do the collecting and distributing in Connecticut. Then a wagon was hired for the same purpose. This latter was so important a step, that there was much meditation about it in advance, before Mr. Adams decided upon it. When the New-York and New-Haven Railroad was completed, the company offered to give Mr. Adams a car for carrying

Rise of Express Companies.

money and valuable packages for $1,700 a month. The offer was accepted with fear and trembling, but proved a success from the start. From this beginning the business grew up, until Mr. Adams had agencies in every part of the country from San Francisco to Boston. The Adams Express Company was then formed with a capital of $1,000,000, and has ever since transacted a colossal business. In New-York State the express-business took its rise almost simultaneously with the start in New England, the pioneer in the work being Mr. Henry Wells of Aurora, N.Y. It began in the same way, Mr. Wells travelling, however, by rail, and carrying his bundles with him in the car. The express-company of Wells, Fargo, & Company, which he organized, has had as extensive a ramification over the country as that of Mr. Adams. It was followed by other companies in different parts of the country; and the institution now forms so intimate and necessary a part of the transportation-business of the country, that no railroad, however short or local, is now without its special accommodations for express-packages. The companies are an adjunct of the railroad-system of the country. They rarely own cars of their own; but they perform the service to the public which they have been called into existence to discharge by contracts with the different connecting-lines, which secure the rapid and uninterrupted transmission of packages, regardless of the conflicts of interest of the different roads, and the obstacles they throw in each other's way in the transaction of ordinary business.

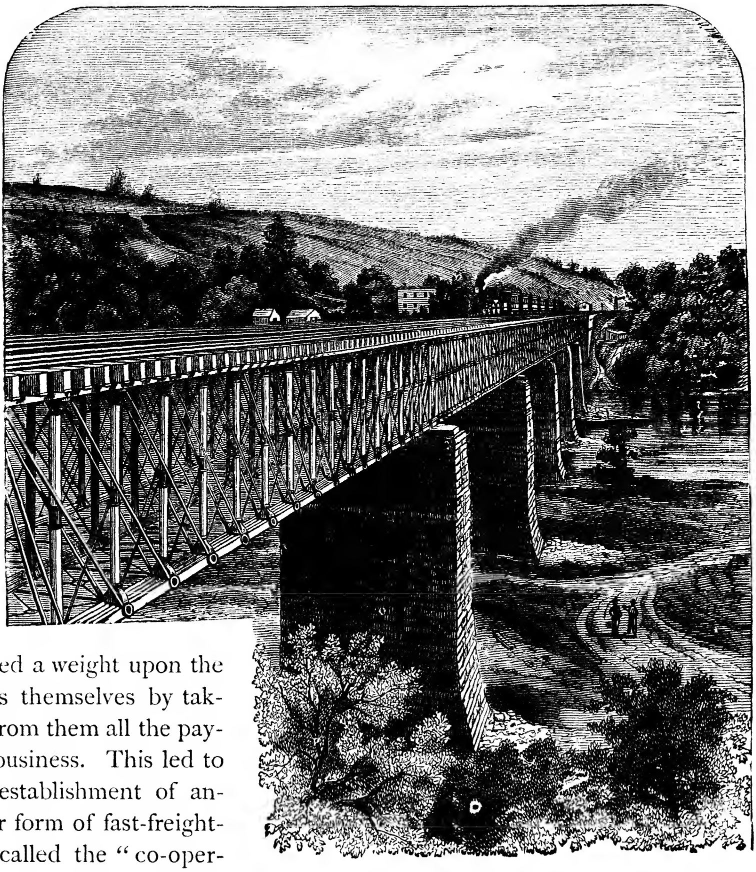
Adams Express Company.

Wells, Fargo, & Company.

The fast-freight system is only the application of this idea to the transmission of ordinary commercial freight. This system has grown up entirely within the last fifteen years. The necessity for fast-freight companies did not arise from the dangers of robbery of the cars, but from the detentions of freight in all parts of the country, owing to the discordance of interests among connecting and competing lines. Despatch and safety could not be secured without the creation of some responsible agency distinct from the railroads themselves, with which, on the one hand, the public could deal direct, and which, on the other hand, would secure that concert of action among the roads, as far as freight was concerned, which the roads could not achieve themselves. The experience of the express-companies showed how these desirable ends could be secured.

Fast-freight system.

The first form of fast-freight transmission was introduced by the Great-Western Despatch Company on what is known as the private line system. The company furnished its own cars, made contracts with the various connecting railroads, paying the roads specific sums for the privileges granted, and then established its own freight-agencies in the various cities. The Great Western was quickly followed by the Merchants' Despatch, the Union, the National, the Star, the Diamond, Globe, Empire, and various other lines, running over all the great routes of the country. There is scarcely a great railroad in the United States now over which two or three or more of these lines do not run. The private lines offered great advantages to the public: they insured safety and speed, and reduced the cost of transportation. About 1870, however, the railroad-companies began to find that this new system was not so profitable to them as it was to the public. The fast-freight lines not only absorbed the entire profits of the through traffic, but often

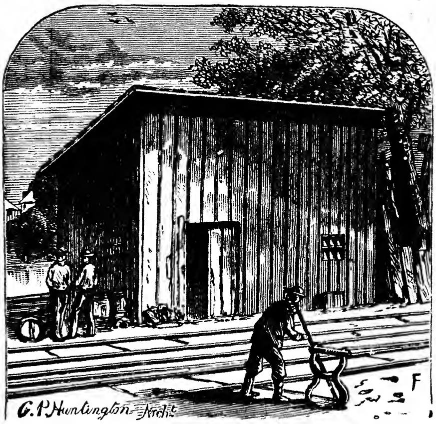


COATESVILLE BRIDGE, PENNSYLVANIA.

proved a weight upon the roads themselves by taking from them all the paying business. This led to the establishment of another form of fast-freighting, called the "co-operative," established by the roads themselves. Each connecting railway between principal points supplied a quota of cars toward the common equipment of a co-operative line. This class of lines took the designation of particular colors; and we have now, in consequence, the Orange, Blue, Red, White, Purple, and other lines. The private lines are gradually being superseded by the latter class. The Pennsylvania Railroad has assumed the management of the Star, Union, and Empire lines; and the same tendency is visible in other parts of the country. The fast-freight system has been of vast benefit to the commercial community, and is now a permanent feature of railway-transportation: it employs 60,000 cars. The Empire Line, the largest of the lines, has 4,500 cars; the Red Line, 4,000; the White, 3,000; and the Blue, 4,000.

Pacific Railroad.

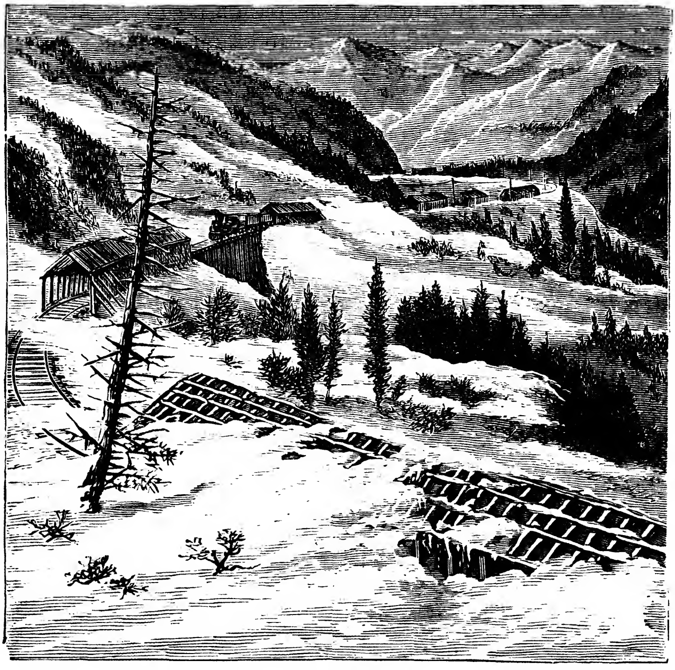
We now come to speak of a step in railroad construction which gave to our system of internal transportation a world-wide importance: this was the building of a railway across the plains and through the mountain-ranges of the Far West to connect the seaboard of the East with that of the distant Pacific. Since railways were invented, the world has been running to short cuts and rapid transit. The slow and leisurely methods of our ancestors are being gradually laid upon the shelf. The world moves faster than of old, and nothing satisfies now except the most rapid movement of commerce and travel which it is possible to bring about. When the route to India by way of the Cape of Good Hope was discovered, the merchants of Portugal and the Netherlands were content if their big, bluff-bowed ships came back from their voyages of trade in two years from the time they left port at home. For three hundred and fifty years, trade was transacted chiefly by that circuitous and tedious route. When California was settled, and the discovery of priceless deposits of gold was made, merchants were long content to trade by way of the long route around Cape Horn, their ships returning only at the expiration of a year. The age became impatient at the pace at which trade was moving. The Panama Railroad was built, shortening the trip to California many months; and then the Suez Canal was opened, shortening the voyage from China to eighty days. But there was yet much to do in abbreviating the route to Asia. From New-York City to Panama, and thence to Canton, is 11,850 miles: from England to Canton by the same route is 14,630 miles, or half the circumference of the earth. But were there a railroad across the American continent in as direct a line from New York as could conveniently be built, the trip from that metropolis to Canton would be only 10,845 miles long, and from England to New York, and thence to Canton, 13,845 miles; the distance from England to Canton by way of the Suez Canal being 12,000 miles.



FIRST OFFICE, CENTRAL PACIFIC RAILROAD.

Panama Railroad.

There had been, for several years, talk about a railway to the Pacific. The war accelerated the national impulse in favor of such a work by showing the need of an inland route to California, and facilities for the rapid transportation of troops to those far-away western portions of our domain. In July, 1862, two companies were incorporated by Congress to build the road. The Union Pacific was to begin at Omaha, and go westward: the Central Pacific, starting at San Francisco, was to build out to meet it. The Act of 1862, and a subsequent one passed in 1864, granted to the companies a right of way two hundred feet wide through the public domain, and twenty sections of land per mile, and, in addition to this, a loan of government credit to the amount of $16,000 per mile on the prairies, $32,000 per mile between the Rocky Mountains and Sierra Nevadas, and $48,000 per mile for a distance



SNOW-SHEDS.

of a hundred and fifty miles across each of those two ranges. Work began in 1863. The Central Pacific consolidated with the Western Pacific Railroad out to San José, the San Francisco, Oakland, and Alameda Company, the San Joaquin Valley, and the California and Oregon Companies. The work was prosecuted on both ends of the line with great energy, attracting the attention and admiration of the whole civilized world. In 1868 three hundred and fifty miles had been completed on the Union Pacific, and track-laying was going on at the rate of a mile a day. In May, 1869, the two roads met at Ogden, Utah, and an all-rail line existed from the Atlantic to the Pacific Oceans. The last spike driven was made of gold; and the event, telegraphed instantly to all parts of the Union, was the occasion of public rejoicing and excitement everywhere. Flags were exhibited, cannon fired, and meetings of public congratulation held, to celebrate the completion of the great national work.

Future of these roads. There is a great future before these roads. They have been successful in obtaining a share of the commerce from Asia both for United-States account and for European. Connecting with the steamships at San Francisco, they have shortened the transit from Yokohama to New York an average of a hundred and sixty days to thirty; and they are bringing into the States east of the Mississippi River now, in large quantity, the teas and other commodities which formerly took the slower routes *viâ* Panama or Cape Horn. To England they deliver teas, put on board the Atlantic steamers at New York, in forty days, which England cannot obtain in less than a hundred and twenty by steamer *viâ* the Suez Canal. This through business will doubtless be shared in the future by competing Pacific railways; but the country along the Union and Central Roads is being rapidly developed through the agency of the roads themselves, and will give them in the future a local traffic which will more than replace the falling-off in the through business.

Northern Pacific. The total volume of the through commerce will, however, be largely increased when the three new Pacific railways now projected are completed. Competition will reduce the transportation-charges, and lead to an expansion of trade. The three roads referred to are the Northern Pacific, chartered in July, 1864, with a land-grant and a loan, which now has over five hundred miles of road in operation west from Duluth on Lake Superior; the Canadian Pacific, organized in 1873, with a capital of $10,000,000, a grant of 50,000,000 acres along the main line, and a subsidy of $30,000,000; **Texas Pacific.** and the southern route to Pacific, which is building by two companies,—the Texas and Pacific from the East, and the Southern Pacific from the West,—each company having a land-grant from Congress, and the latter the enormous one of 60,000,000 acres from the State of Texas. This latter route is well under way, and should be finished in two or three years.

BOOK IV.

MINES AND MINING, AND OIL.

CHAPTER I.

MINING.

GENERAL HISTORY.

THE place which the mining-industries of a country deserve to hold among the pursuits of a nation is not to be estimated by the market-value of the product as compared with the market-value of other products of labor; for, if it were, mining would be entitled to a very insignificant rank. We manufacture every year to the extent of nearly six billion dollars; we market our agricultural products for something like three billion; while the total yield of all our mines does not sell for two hundred million. The development of agriculture and manufacturing has been peculiarly dependent upon the use of metals, the implements and machinery necessary thereto being made almost entirely from mineral substances. In other regards — in building, illuminating, transportation, printing, travel, and human intercourse — we are so utterly dependent upon metals, that we may truly say they have been the means, far more than any thing else material, of the world's civilization. Thus viewed, American mining-industry attains pre-eminent importance. Nevertheless, owing to the tardiness with which we discovered the extent of our mineral resources and to some other disadvantages, the development of these interests was greatly retarded, and belongs chiefly to the last half-century of the country's history.

Importance of mineral products.

By the aborigines a little was known of the existence and value of copper, petroleum, and silver, on this continent; and the former two were used in the region now included within the United States ages before the white man set foot on the American continent.

Aborigines ignorant of metals.

The hope of finding mineral treasure was one of the incentives that led the early colonists hither, and they were quite diligent in searching for metals. All along the Atlantic coast, almost immediately after the first settlements, discoveries were made of silver, lead, copper, iron, tin, antimony, coal, and other valuable minerals; but they were found generally in small quantities; and, in competition with foreign produc-

Search for metals by colonists.

tion, the working of mines was frequently found unremunerative. Then, too, the presence and hostility of Indians made such enterprises dangerous. Iron ore was sent to England from near Jamestown in 1608, the year after Virginia was first permanently settled; and in 1620 a hundred and fifty skilled workmen were sent to the colony to erect and operate iron-works. An Indian massacre two years later, however, put a discouraging end to proceedings. Another discouragement grew out of such blunders as the supposed discovery of gold in Virginia by Capt. John Smith. A shipload of the glittering dust was sent to England, and there pronounced to be nothing but iron pyrites.

Early efforts in mining.

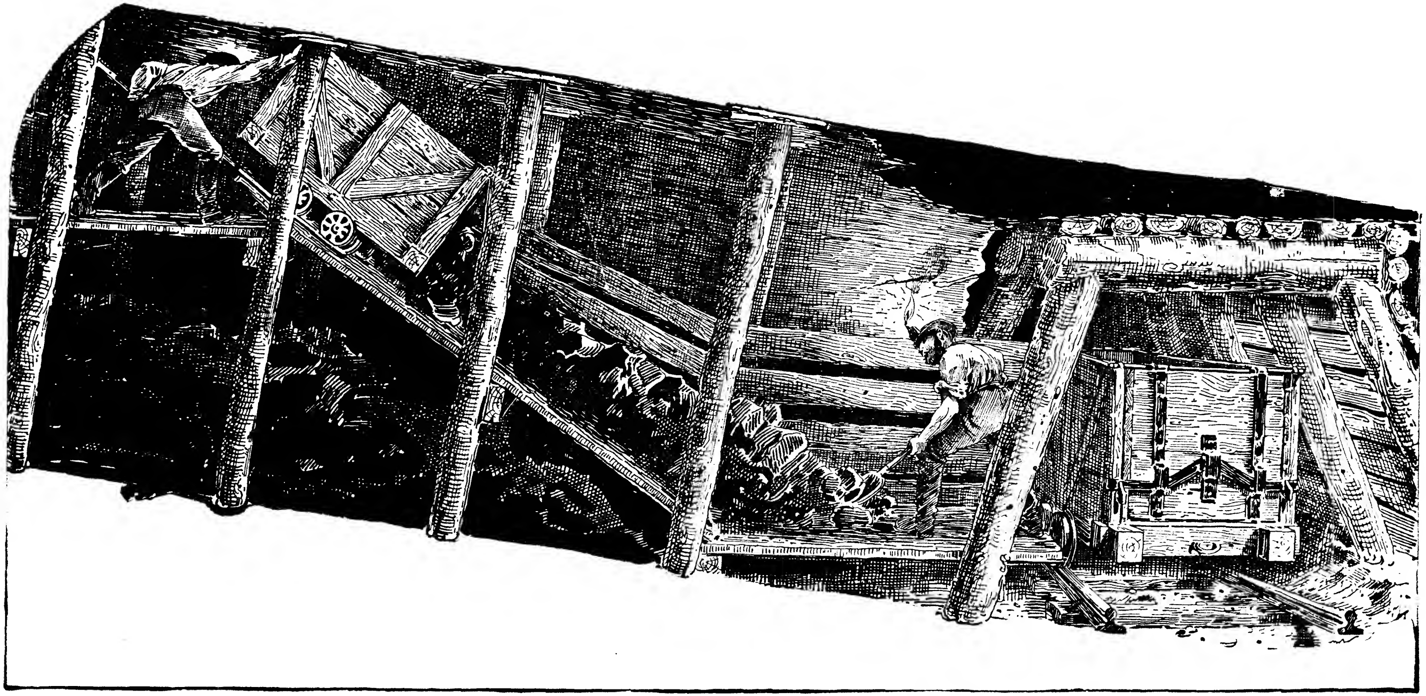
However, the plucky colonists persevered in spite of all depressions and obstacles, and made very creditable beginnings. Iron-mining was resumed permanently in Virginia in 1715. The metal was found in Massachusetts in 1628 and later, and a company was formed to work it in 1643. Rhode Island, Connecticut, New York, and Pennsylvania followed suit. Penn had discovered iron as early as 1683; but no forges are mentioned on his grants earlier than 1719–20. Lead-mining began in Missouri, then belonging to France, in 1720; and the old Southampton silver-lead mine was opened in Massachusetts in 1765. Copper-mining is first heard of in Connecticut, the Simsbury mines being worked as early as 1709; but they were abandoned as unprofitable about the middle of that century. The Schuyler mine, near Belleville, N.J., was discovered in 1719, and is historic as the scene of the building of the first steam-engine in America in 1793–94. The Lake Superior copper was first mined by the whites in 1771, and in small quantities. In the early colonial days the settlers used wood for fuel, and charcoal for the forge and smelting-works. Coal, however, was found in Rhode Island in 1768, and mined for use. The great bituminous seam near Pittsburgh, Penn., was struck in 1784. Previous to this time coal was found in quantities in Virginia; and canals were cut, connecting parallel rivers to facilitate its transportation. By 1789 quite an export trade with adjacent colonies had been built up.

At numerous other points along the Atlantic seaboard these and other metals were found prior to the Revolution. Smelting-works and forges were erected to reduce the ores, some of which, however, were exported. The home government discouraged the manufacture of metals in this country, though, at that period; which was a damper upon mining-industry.

Effect of Revolutionary war.

In the following chapters we trace more in detail the steps in the history of each branch of mining in this country. Suffice it here to say, that, from the humble beginnings just mentioned, but slow advances were made for several decades. The Revolutionary war, by cutting off supplies from England, and creating a special demand for iron and copper ordnance and lead bullets, as well as other metal for domestic and other implements, gave a peculiar stimulus to mining, although the army so drained the country of men as to leave few for such occupations.

It was not until a quarter of the present century had passed that we see any



ANTHRACITE COAL-MINING IN PENNSYLVANIA.—SKETCHED IN THE MINES.

marked strides in the mining-business. In 1820 attempts were made to mix anthracite coal with charcoal in iron-smelting: but the experiment was not successful until 1831, when the hot-blast was invented; then both the coal and iron industry took a tremendous start. In 1835 lead-mining received a wonderful impetus in Missouri and Iowa from new discoveries. Copper-mining was revived along Lake Superior about 1842, and made a sudden jump. The California gold-fever of 1849 was the beginning of the search and procurement of that metal on a considerable scale. Petroleum came prominently into notice for the first time in August, 1859, when the Drake well struck oil; and the Comstock lode was discovered in Nevada that same year, and laid the foundation of our present silver-mining business. These are the points from which the present development of our mineral resources dates.

Mining since 1825.

A review of the history of mining during this important period shows that our operations have been characterized by intense excitement and magnified speculation, by gross blunders and by great waste. Says Kimball, [It] "is an instructive narrative of fluctuating fortune, ranging through all the intermittent vicissitudes of prosperity and stagnation, of factitious inflations and calamitous recoils, of blind delusion and credulity, of stolid unbelief, of highest popularity, and general distrust." The possibility of making a great deal of money in a short time always crazes people; and the discovery of large deposits of metal, both the baser and the precious, affords just such inviting possibilities to the workman and to the capitalist. And so, in the case of each of the great discoveries of lead, copper, gold, oil, and silver, a large proportion of the country's population has been rendered frantic. An immense rush has set in toward the centre of interest; fortunes large and small, often augmented by extensive borrowing from credulous friends and relatives, have been invested in land-claims, and stock companies to work them; towns and villages have sprung up almost in a day, like Jonah's gourd. The hopes of but few out of many would be realized; disappointment and ruin ensued; and not only were poverty, sickness, and death often the result, but whole towns of the mushroom type have been almost as suddenly wiped out of existence.

Speculative character of mining.

In this mad rush of greed and excitement, other blunders besides those of investing in unprofitable lands have been made. Furnaces for smelting have been located without due regard for getting fuel; costly machinery for crushing ore has been bought, and forwarded to the scene of action, without knowing whether ore would be found at all, or whether the apparatus was suited to the kind of ore discovered; new processes for extracting metal have been resorted to, without reliable information as to their value; and other such ruinous mistakes have been committed by frenzied speculators.

There has also been an enormous waste of valuable minerals in consequence of this same impetuous desire for wealth. In the lead-regions of the

Mississippi Valley argentiferous galena is quite common, and often the lead is entirely wasted in the extraction of the little silver. In the coal-regions, especially before the organization of the present large companies and their combination in monopoly, only the richer measures would be worked, leaving a large quantity of inferior yet valuable coal on higher levels to be lost by caving. Such recklessness in handling was practised, that from a third to a half of the product was lost. The same state of things has been found in the silver country. Mines have been neglected as soon as the rich surface-deposits were procured, and the accumulation of water and rubbish have made it next to impossible to work what were really paying shafts. But a re-action has set in of late years in these regards, and this extravagance is steadily lessening.

Waste.

The two great causes, which, after the discovery of our great resources and the passion for wealth, have stimulated American mining, are the government's general policy of encouragement, and the advancement in mechanic and natural science. Under the old English laws the crown was entitled to the gold and silver found on government lands, and a certain proportion of other minerals. But in this country, although legislation has been very slight until recently, and the gold and silver miners of the Pacific coast were ruled only by self-made regulations, the government has favored the free occupation and investigation of the rocks for minerals, and facilitated the cheap purchase and lease of mining-lands. There has been a protective tariff, too, on foreign metals at times, the heaviest having been since 1861; and this has greatly promoted the development of our iron, copper, coal, and other minerals.

Principal causes of improvement.

Among the most serviceable inventions in practical mining and metallurgy for the past ten or fifteen years are the California stamp-mill for crushing quartz, the mercury amalgamation process for gold, the pan process for silver, the hydraulic process of gold-mining in alluvial regions, the application of new explosives to rocks, new methods of drilling, new blast-furnaces, and new methods of converting iron into steel.

Our independent schools in mining and engineering date from 1865. Mr. Abram S. Hewitt, speaking in 1875 of their rapid increase in number, said, "Many of them compare favorably in theoretical instruction at least, and several of them in the apparatus of instruction, with the famous schools of the Old World. The Massachusetts Institute of Technology at Boston, the School of Mines of Columbia College at New York, the Sheffield Scientific School of Yale College at New Haven, the Stevens Institute of Technology at Hoboken, the Pardee Scientific Department of Lafayette College at Easton, the excellent school at Rutgers College under the direction of Professor Cook, the new Scientific Department of the College of New Jersey, the School of Mining and Metallurgy of Lehigh University at Bethlehem, the School of Mining and Practical Geology of Harvard University at Cambridge,

Mining-schools.

the Scientific Department of the University of Pennsylvania at Philadelphia, the School of Mines of Michigan University at Ann Arbor, the Missouri School of Mines and Metallurgy at Rolla, the Polytechnic Department of Washington University at St. Louis, and the similar department of the University of California at Oakland, and perhaps some which I have omitted to name, — this is a list of schools for instruction in the sciences involved in mining and metallurgical practice of which we need not be ashamed."

National commissioner of mining.

Other agencies for the advancement of science in this class of industry are the appointment and reports of a national commissioner of mining-statistics since 1866, the organization of the American Institute of Mining Engineers in 1870, and the publication of periodicals especially devoted to such subjects, the most prominent of these being "The American Mining and Engineering Journal."

The following table, made up from the census of 1870, shows the value of the principal mineral products of this country that year: the figures for 1878 would doubtless raise the total very nearly fifty million dollars more: —

Coal	$73,524,992
Iron ore	13,204,138
Gold (placer-mined)	7,266,613
Gold (hydraulic-mined)	2,508,531
Quartz (40 per cent gold and 60 per cent silver)	16,677,508
Copper	5,201,312
Petroleum	19,304,224
Lead	736,004
Zinc	788,880
Cinnabar	817,700
Nickel	24,000
Asphaltum	450,000
Peat	8,200
Quarrying (including marble and slate)	12,086,892
Total	$152,598,994

CHAPTER II.

GOLD.

ALTHOUGH some specimens of gold were collected in North Carolina and Virginia previous to the Revolution, no excitement about the subject arose until the discovery in California in 1848. Before then the gold-miner had pursued his occupation quietly, and without ever dreaming of enormous riches suddenly acquired; but, with the discovery on the Pacific coast, all was changed. Gold had been found in California prior to this time; for Hakluyt (in his account of the voyage of Sir Francis Drake, who spent five weeks in June and July, 1579, along the coast) says, "There is no part of the earth to be taken up wherein there is not a reasonable quantity of gold and silver." Although this statement was highly overdrawn, yet it probably contained a basis of truth; for the Mexicans found placer-gold near the Colorado River at various intervals between 1775 and 1828. Still these discoveries were regarded as unimportant; and even so late as 1835, when Forbes wrote his History of California, he says, "No minerals of any particular importance have yet been found in Upper California, nor any ores of metals." Three years later the placers of San Francisquito, forty-five miles north-west from Los Angeles, were discovered. The deposit of gold was neither extensive nor rich; but it was worked steadily for twenty years. In 1841 the exploring-expedition of Commodore Wilkes visited the coast; and its mineralogist, James D. Dana, made a trip overland from the Columbia River, by way of Willamette and Sacramento Valleys, to San Francisco Bay; and in the following year he published a work on mineralogy, in which was mentioned the discovery of gold in Sacramento Valley, and of auriferous rocks in Southern Oregon. Dana did not regard his discovery as of any practical value; and, if he said any thing about it in California, no one heeded his words. Nevertheless, many persons believed the country was rich in minerals; and on the 4th of May, 1846, Thomas O. Larkin, at that time United-States consul in Monterey, wrote in an official letter to James Buchanan, who was then secretary of state, "There is no

Early discoveries of gold.

Drake.

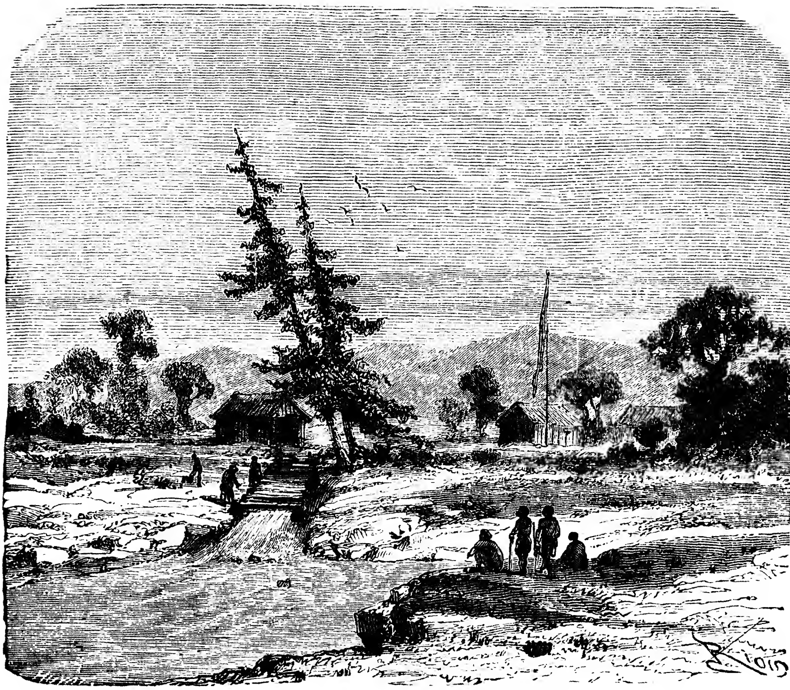
Placers of San Francisquito.

Dana.

doubt but that gold, silver, quicksilver, copper, lead, sulphur, and coal mines are to be found all over California; and it is equally doubtful whether, under their present owners, they will ever be worked."

Seven years later, on the nineteenth day of January, 1848, — ten days before the treaty of Guadalupe Hidalgo was signed, and three months before the ratified copies were exchanged, — James W. Marshall, while engaged in digging a race for a saw-mill at Coloma, about thirty-five miles eastward from Sutter's Fort, found some pieces of yellow metal which

Marshall's discovery.



MARSHALL'S SAW-MILL.

he and the half-dozen men working with him at the mill imagined were gold. Feeling confident that he had made a discovery of great importance, but knowing nothing of chemistry or gold-mining, he could not prove the nature of the metal, or tell how to obtain it in paying quantities. Every morning he went down to the race to look for gold; but the rest of his companions regarded Marshall as very wild in his ideas, and continued their labors upon the mill and in sowing wheat and planting vegetables. The swift current of the mill-race washed away a considerable body of earthy matter, leaving the coarse particles of gold behind: so Marshall's collection of specimens continued to accumulate, and his associates began to think there might be something in his gold-mine, after all. About the middle of February one of the party employed at the mill went to San Francisco for the purpose of learning whether this metal was precious, and was there introduced to Isaac Humphrey, who had washed for gold in Georgia. The experienced miner saw at a glance that the true stuff was before him, and, after a few inquiries, was satisfied as to the richness of the deposits. He made immediate preparation to go to the mill, and tried to persuade some of his friends to go with him; but they thought it would be only a waste of time and money: so he went with Bennett for his sole companion.

Arriving at Coloma on the 7th of March, he found work at the mill going on as though no gold existed in the neighborhood. The next day he took a pan and spade, and washed some of the dirt from the bottom of the mill-race in places where Marshall had found his specimens, and in a few hours declared the mines to be far richer than any he had seen or heard of in Georgia.

Washing for gold.

He now made a rocker, and went to work earnestly washing for gold; and every day he found an ounce or more of metal. The men at the mill made rockers for themselves, and all were soon busy in search of the shining stuff.

Renews his efforts.

Every thing else was abandoned; yet the rumor of the discovery spread slowly. In the middle of March, Pearson B. Reading, the owner of a large ranch at the head of the Sacramento Valley, happened to visit Sutter's Fort; and, hearing of the mining at Coloma, he went thither to see it. He said, that, if similarity of formation could be regarded as proof, there must be gold-mines near his ranch: so, after observing the method of washing, he went away, and in a few weeks was at work on the bars of Clear Creek, nearly two hundred miles in a north-westerly direction from Coloma. A few days after Reading had left, John Bidwell, formerly a representative of the northern district of the State in the lower house of Congress, came to Coloma; and the result of his visit was the organization of a party of Indians belonging to his ranch to wash for gold on the bars of Feather River, seventy-five miles from Coloma. Thus the mines were opened at several distant points.

Other discoveries.

The following was the first printed notice, in a California newspaper published in San Francisco, of the discovery: "In the newly-made race-way of the saw-mill erected by Capt. Sutter on the American Fork, gold has been found in considerable quantities. One person brought thirty dollars to New Helvetia, gathered there in a short time."

Printed notice of discovery.

On the 29th of May, the same paper, announcing that its publication would be suspended, says, "The whole country, from San Francisco to Los Angeles, and from the seashore to the base of Sierra Nevada, resounds with the sordid cry of 'Gold, gold, gold!' while the field is left half

Excitement.

planted, the house half built, and every thing neglected but the manufacture of picks and shovels, and the means of transportation to the spot where one man obtained a hundred and twenty-eight dollars' worth of the real stuff in one day's washing; and the average for all concerned is twenty dollars *per diem*."

Towns and farms were deserted, or left to the care of women and children;

CALIFORNIAN GOLD-FINDER PROSPECTING THE GROUND.

while rancheros, wood-choppers, mechanics, vaqueros, and soldiers and sailors who had deserted, or obtained leave of absence, devoted all their energies to washing the auriferous gravel of the Sacramento basin. Never satisfied, however great their profits, they were continually looking for new places which might yield them twice or thrice as much as they had made before. Thus the area of their labors gradually extended; and, at the end of 1848, miners were at work in every large stream on the western slope of the Sierra Nevada, from the Feather to the Tuolumne River (a distance of a

Rush for the mines.

hundred and fifty miles), and also at Reading's diggings in the north-western corner of the Sacramento Valley.

The news of the gold discovery was received in the Atlantic States and in foreign countries with incredulity and ridicule; but soon the receipts of the precious metal in large quantities, and the enthusiastic letters of army-officers and of men whose word was unquestioned, changed the current of belief, and created a wonderful excitement. Oregon, the Hawaiian Islands, and Sonora sent their thousands to share in the auriferous harvest of the first year; and in the following spring all the adventurous young Americans east of the Rocky Mountains wanted to go to the new Eldorado, where, as they imagined, everybody was rich, and gold could be dug by the shovelful from the bed of every stream.

Reception of news in Atlantic States.

Though the phrase "golden sands" is often heard, gold is found in a tough clay, which envelops gravel and large bowlders as well as sand. This clay must be thoroughly dissolved: so the miner fills his pan,—which is made of sheet-iron or tinned iron, with a flat bottom about a foot in diameter, and sides six inches high, inclining outwards at an angle of thirty or forty degrees,—and goes to the bank of the river, squats down there, puts his pan under water, and shakes it horizontally, so as to get the mass thoroughly soaked; then he picks out the larger stones with one hand, and mashes up the largest and toughest lumps of clay, and again shakes his pan; and when all the dirt appears to be dissolved, so that the gold can be carried to the bottom by its weight, he tilts up the pan a little to let the thin mud and light sand run out; and thus he works until he has washed out all except the metal, which remains at the bottom.

Mode of washing for gold.

WASHING WITH PAN.

The rocker, which was introduced into the California mines at their discovery, is made somewhat like a child's cradle. On the upper end is a riddle, made with a bottom of sheet-iron punched with holes. This riddle is filled with pay-dirt; and a man rocks the machine with one hand, while with a dipper he pours water into the riddle with the other. Being agitated, the liquid dissolves the clay, and carries it down with the gold into the floor of the rocker, where the metal is caught by traverse riffles, or cleats; while the mud, water, and sand run off at the lower end of the rocker, which is left open. The riddle can be removed, thus enabling the miner to throw out the larger stones which are mixed with the clay.

Rocker.

The year 1850, two years after Marshall's discovery, was marked by a multitude of "rushes," or sudden migrations in search of imaginary rich diggings. The miners, although generally men of rare intelligence compared with the laborers in other countries, had vague ideas of the geological distribution of gold; and the marvellous amounts dug out by them (sometimes a single miner extracting thousands of dollars per day) excited their imagination so highly as to prevent the formation of a sound judgment, even if they had possessed the requisite information upon which to act. Many believed that there must be some volcanic source from which the gold had been thrown up and scattered over the hills; and they thought, that, if they could only find that place, they would have nothing to do except to shovel up the precious metal, and load their mules with it. More than once, long trains of pack-animals were sent out with the confident expectation of getting loads of gold within a few days.

Early ideas of miners.

No story was too extravagant to command credence. Men who had never earned more than a dollar a day before they came to California were dissatisfied when they were clearing twenty dollars, and were always ready to start off on some expedition in search of distant diggings which were expected to yield more abundantly. Although the miners of to-day have better ideas of the auriferous deposits than those had who toiled sixteen years ago, and no longer count upon digging up the pure gold by the shovelful, yet they are now, as they have ever been since the discovery of the mines, always prepared for emigration to any new field of excitement.

Learning from experience.

Of course the chief want of the placer-miner is an abundant and convenient supply of water; and the first noteworthy attempt to convey the needful element in an artificial channel was made at Coyote Hill, in Nevada County, in March, 1850. This ditch was about two miles long, and, proving a decided success, was imitated in many other places, until, in the course of eight years, six thousand miles of mining-canals had been made, supplying all the principal placer-districts with water, and furnishing the means for obtaining the greater portion of the gold yield of the State. Many of the ditches were marvels of engineering skill.

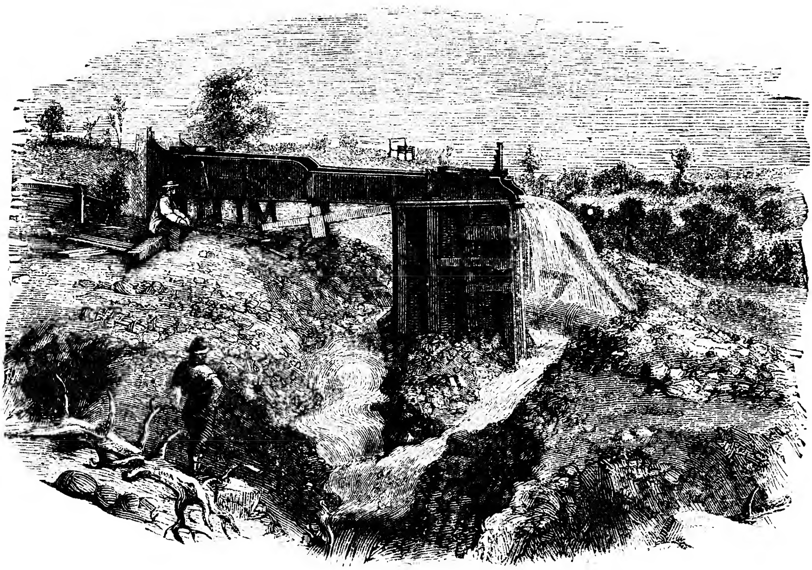
First canal.

The problem was to get the largest amount of water at the greatest altitude above the auriferous ground, and at the least immediate expense, as money was worth from three to ten per cent per month interest. As the pay-dirt might be exhausted within a couple of years, and as the anticipated profits would in a short time be sufficient to pay for a new ditch, durability was a point of minor importance. There was no imperial treasury to supply the funds for a durable aqueduct in every township, nor could the impatient miners wait a decennium for the completion of gigantic structures in stone and mortar. The high value of their time, and the scarcity of their money, made it necessary that the cheapest and most expeditious expedients for obtaining water should be adopted. Where the

Early expedients for obtaining water.

surface of the ground furnished the proper grade, a ditch was dug in the earth; and, where it did not, flumes were built of wood, sustained in the air by framework that rose sometimes to a height of three hundred feet in crossing deep ravines, and extending for miles at an elevation of a hundred or two hundred feet.

All the devices known to mechanics for conveying water from hill-top to hill-top were adopted. Aqueducts of wood, and pipes of iron, were suspended upon cables of wire, or sustained on bridges of wood; and inverted siphons carried water up the sides of one hill by the heavier pressure from the higher side of another. **Aqueducts, siphons, &c.**



PRESSURE-BOX, YUBA RIVER.

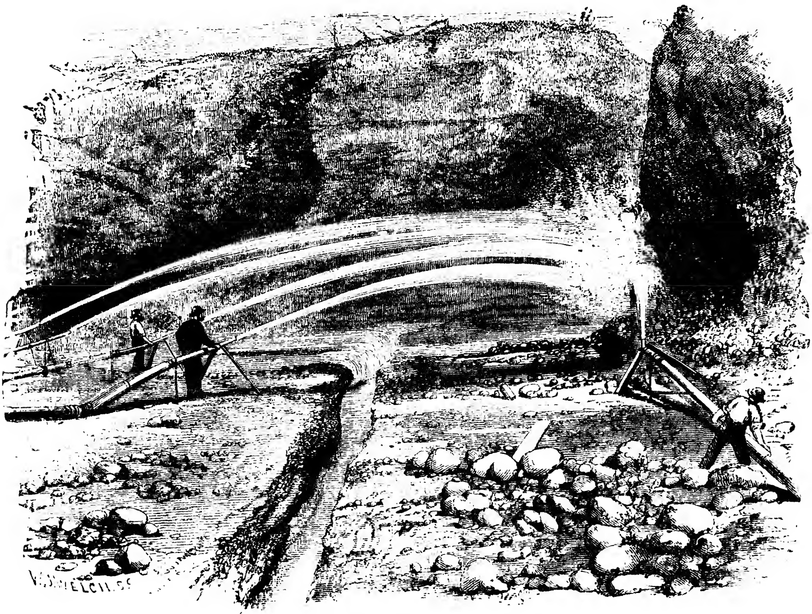
The ditches were usually the property of companies, of which there were at one time four hundred in the State, owning a total length of six thousand miles of canals and flumes. The largest of these, called the Eureka, in Nevada County, has two hundred and five miles of ditches, constructed at a cost of nine hundred thousand dollars; and their receipts at one time from the sale of water were six thousand dollars per day. Unfortunately, these mining-canals, though more numerous, more extensive, and bolder in design, than the aqueducts of Rome, were less durable; and some of them have been abandoned, and allowed to go to ruin, so that scarcely a trace of their existence remains, save in the heaps of gravel from which the clay and loam were washed in search for gold. **Ditches.**

As the placers in many districts were gradually exhausted, the demand for water, and the profits of the ditch-companies, decreased; and the more expensive flumes, when blown down by severe storms, carried away by floods, or destroyed by the decay of the wood, were not repaired.

Destruction of ditches.

The construction of hundreds of ditches within three or four years after the successful experiment at Coyote Hill created a fresh impulse to placer-mining, and greatly modified its character. New inventions, though of the rudest description, were multiplied to facilitate the process of gathering the yellow metal. Among others was the introduction of

Invention of the "tom."



HYDRAULIC MINING. — WASHING DOWN A BANK.

an implement which had been previously used in Georgia, called by the short and unclassic name of "tom." This was a great improvement upon the rocker; yet it was soon superseded by a still greater, — the sluice, which is a broad trough from a hundred to a thousand feet long, with transverse cleats at the lower end to catch the gold. With a descent of one foot in twenty, the water rushes through it like a torrent, bearing down large stones, and tearing the lumps of clay to pieces. The miners, of whom a dozen or a score may work at one sluice, have little to do save to throw in the dirt, and take out the gold.

The sluice.

Occasionally it may be necessary to throw out some stones, or to shovel the dirt along, to prevent the sluice from choking; but these attentions cost relatively very little time. The sluice is the best device heretofore used for washing gold, and is supposed to be unsurpassable. It has been used in California more extensively than elsewhere; although it has been introduced by American miners into Australia, New Zealand, British Columbia, Transylvania, and many other countries.

Superiority of the sluice.

The sluice, though an original invention here, had been previously used in Brazil; but it was never brought to much excellence there, nor used extensively; and no such implement was known in 1849 in the industry of gold-mining.

Formerly used in Brazil.

The shovel could not bring earth to the sluice fast enough, and the wages of a dozen workmen must be saved, if possible: so in 1852 Edward E. Mattison, a native of Connecticut, invented the process of hydraulic mining, in which a stream of water was directed under a heavy pressure against a bank or hillside containing placer-gold, and the earth was torn down by the fluid, and carried into the sluice to be washed; and thus the expense of shovelling was entirely saved.

Hydraulic mining.

The man with the rocker might wash one cubic yard of earth in a day; with the tom he might average twice that quantity; with the sluice, four yards; and with the hydraulic and sluice together, fifty or even a hundred yards. The difference was immense. The force of a stream of water rushing through a two-inch pipe, under a pressure of two hundred feet perpendicular, is tremendous; and the everlasting hills themselves crumble down before it as if they were but piles of cloud blown away by a breath of wind, or dissipated by a glance of the sun.

Effectiveness of various methods.

And yet even this terrific power has not sufficed. When the hills have been dried by months of constant heat and drought, the clay becomes so hard, that the hydraulic stream, with all its momentum, did not steadily dissolve it; and often the water ran off almost as clearly as ever through the sluice, and consequently was wasted.

Hydraulic mining not always effective.

The sluice could wash more dirt than the hydraulic stream furnished when the clay was hard and dry; and, to prevent this loss, the miner would often cut a tunnel into the heart of his claim, and blast the clay loose with powder, so that it would yield more readily to the action of water. Two tons of powder have been used at a single blast in some of these operations.

Efficiency of sluice.

With the introduction of the sluice, the ditch, and the hydraulic process, the hiring of laborers began. The pan and the rocker required every man to be his own master; but these new processes led to other modes of employment.

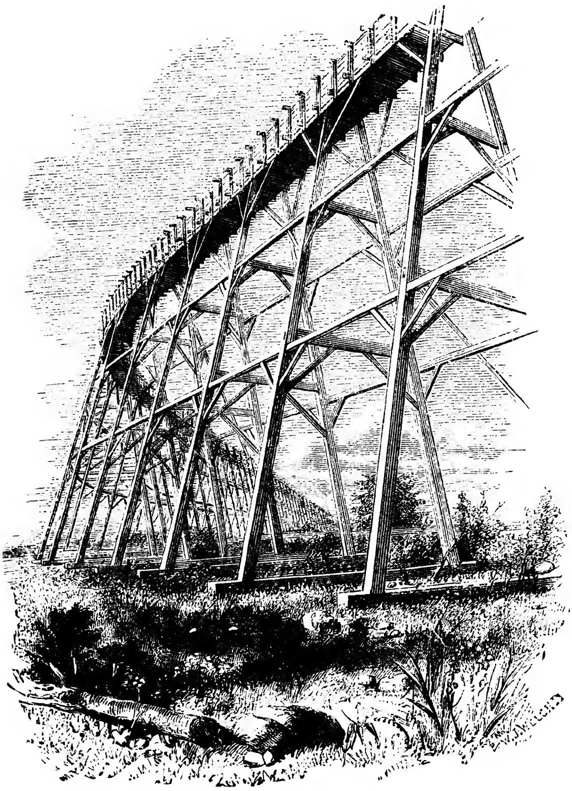
Hiring of laborers.

There was an abundance of rocker-claims in 1849; but three years later there were not enough good sluice-claims to supply one-third of the miners. The erection of a long sluice, the cutting of drains (often necessary to carry off the tailings), and the purchase of water from the ditch-company, required capital; and the manner of clearing up rendered it possible for the owner of a sluice to prevent his servants from stealing any considerable portion of his gold before it came to his possession. Thus it was that the custom of hiring miners for wages became common in the placer-diggings.

Causes leading to employment of labor.

Placer-gold, it is supposed, is nothing but loose portions which have been disintegrated from rocks by the operations of nature, and is only a very small portion of the gold not yet gathered. When Murchison wrote his work upon the rocks of the silurian age, he declared that gold-veins were confined chiefly to the silurian rocks, and that the quantity capable of extraction from them at no distant day would be exhausted. The gold-bearing rocks in the Ural Mountains in Australia, and to a considerable extent in California, belong to the silurian period. If "we cast our eyes to the countries watered by the Pactolus of Ovid, to the Phrygia and Thrace of the Greeks, to the Alps and golden Tagus of the Romans, to the Bohemia of the middle ages, to tracts in Britain which were worked in old times, and have either been long abandoned or are now scarcely at all productive, or to those chains in America and Australia, which, previously unsearched, have in our times proved so rich," — in all these lands gold has been imparted abundantly to only the silurian or the associated eruptive rocks. Yet it has been conclusively proved, since the time when the first edition of Murchison's "Siluria" was published, that gold abounds in rocks of every geological age. The explorations of Trask and Whitney in California in 1853 and 1854, and subsequently the discovery of

Placer-gold, what it is.



FLUME NEAR SMARTVILLE, CAL.

secondary fossils in the main belt of gold-bearing States, together with the discoveries in Hungary in 1862, prove that rocks belonging to the latest geological periods, even as late as the tertiary, contain productive gold-bearing veins.

Again: later geological investigation has shown that the quantity contained in the rocks, and which is accessible, is more abundant than geologists formerly supposed. Murchison maintained that the gold-veins parted, as they descended into the rocks, till they became mere threads, that could not be followed or worked to advantage. Mr. Selwyn, in his report to the English Government at Australia, in 1856 and 1857, on the mining resources of the colony of Victoria, declared that there was no evidence from the mines in that place to sustain Murchison's position, that any vein rich at the surface dies out, or suddenly becomes unprofitable. It was true that the upper portion of many veins were once far richer than they are now. But the reason was very apparent: the gold had been removed by denudation. The very fact that many veins even thus abraded were still often very rich on their present surface, went far, in his opinion, to prove that the diminution of yield in depth, even though admitted to be true on a large scale, was still so slow as not to be appreciable within any depth to which ordinary mining operations might be carried. Raymond, in his report to the United-States Government in 1870, said that most of the gold-veins might be considered as practically inexhaustible in depth: indeed, the statement of Murchison, according to this authority, "is completely overthrown by experience." Mr. G. Arthur Phillips speaks the opinion now universally acknowledged, that gold-ledges are not more liable than ordinary metalliferous veins to become impoverished in depth.

Quantity of gold more abundant than was once supposed.

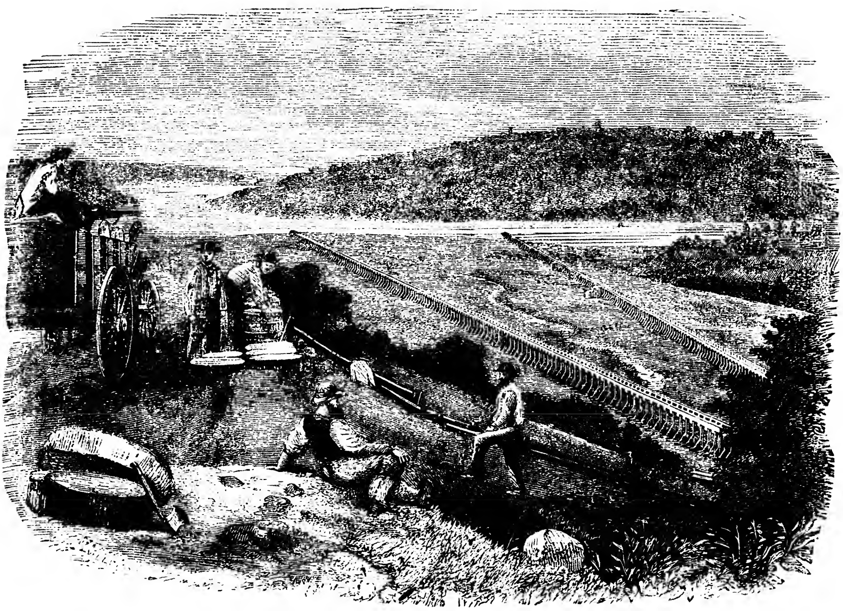
Since the discovery of the original home of gold, the extraction of it therefrom has been carried on in a more scientific manner than placer-mining. It is true that many of the earlier enterprises in the way of quartz-mining were failures. Large and costly mills were erected; a multitude of laborers were employed; but they did not know how to select the rich from the poor quartz, and too often located their mills where there was only a small pocket, which was soon exhausted. Besides, the mills were too large to be fully operated without receiving all the poor as well as the rich rock accessible in the vein; the amalgamator did not understand his business; the rich rock in which the Mexicans had worked often failed; the creditors who had loaned money for the erection of these structures brought suit to foreclose their mortgages; the work stopped; the titles of the property became insecure; and the people in the neighborhood declared that quartz-mining would not pay. What a wonderful change has occurred since those early and disastrous days!

Progress of scientific mining.

In the mode of pulverizing and reducing quartz comparatively few changes have been made. In some mills the same machinery and processes have been used, without alteration or addition, for a long period.

Failures in early quartz-mining.

There is, however, a general belief that the business has not been properly studied by any one; and it is certain that there is much difference of opinion in respect to various important questions concerning the reduction of ores. The practice is not uniform in regard to the fineness of pulverization, or the size and speed of the stamps, or the mode of amalgamation. Wood, as a material for the shafts of stamps, has given way to iron; the square form has been replaced by the cylindrical; and the stamps, instead of falling with a simple downward motion, now come



TAIL SLUICES, YUBA RIVER.

down with a twist. The mortar into which the stamps fall is now always of iron; and the stamps stand in a straight line, instead of forming a circle as they did in some mills years ago.

There are other modes of obtaining gold, which, however, are so nearly obsolete as to require only brief notice. The arastra, for instance, was used in

The arastra.

the early days to pulverize the ore. It is a Mexican contrivance, rude, but (so miners say) effective. Winnowing, or "dry-washing," was practised also by the Mexicans. It is still used in some parts of Southern and Lower California, where the ore is found too far away from a sufficient supply of water to make any other practice possible. The wind bears away the dust and light particles of earth, and leaves the gold-dust, which is heavier.

During the progress of geological surveys gold has been found in many places, but nowhere in such quantities as in California. It has been found in the White Mountains of New Hampshire, in Vermont, in New York, New Jersey, Pennsylvania, and in still larger quantities in the remaining Southern seaboard States, as far as Alabama. Doubtless, in the years to come, unless its value diminishes very much, vast quantities will be extracted from the Alleghanies, especially with the more scientific processes now in use. Gold-mining contains more of the gambling element than any other regular industry; and this is one of the reasons why it has always possessed such a singular fascination for many. But quartz-mining is robbed essentially of this uncertain element; for the business, if properly conducted, yields more regular profits than any other mode of gathering the precious metal.

Where gold has been found.

CHAPTER III.

SILVER.

SILVER is the latest of all the mineral products to attain prominence in the mining industries of the United States. Prior to the year 1859 the silver produced in this country was utterly insignificant. Only faint traces of it had been found here and there, and it was rarely made the object of special exploration. The silver coin in circulation was almost exclusively of foreign metal, as was also the plate in common use.

Latest metal to attain prominence in United States.

The early Spanish invaders of this continent found the Aztecs of Mexico, and Toltecs of Peru, possessed of great quantities of this precious metal, which was obtained from the great mountain-range, which, under different names, extends from the southern to the northern extremity of the New World. Mining was carried on even more extensively under the new governments, and immense quantities of treasure were carried home to Europe in Spanish ships. But that portion of this great treasure-vault of nature included within our present boundaries remained almost entirely free from investigation until 1849, and for ten years the search was directed almost exclusively to finding gold.

Spanish discoveries.

Silver was found, however, mixed with galena, or lead ore, in small quantities by the eastern colonists a full century before. Such a vein, for instance, was discovered in Worcester County, Mass., in 1754, and worked with profit. Another was discovered in Columbia County, N.Y., as early as 1740: this was on the estate of Robert Livingston. Near it was an iron forge for the reduction of metal obtained from Connecticut. The same year argentiferous galena was found in Dutchess County of the same State, and later in Westchester County; the former being worked by the Germans of that vicinity. In a vein of copper discovered in New Jersey in 1719 there was found silver in the proportion of four ounces to every hundred-weight of ore. The Swedes reported the discovery of silver in Pennsylvania in their day; and it was found in small quantities near Davidson, N.C., and in South Carolina along the Savannah River. Later

Early discoveries in New England, New York, &c.

the great galena-mines of the Upper and Lower Mississippi were discovered to contain a slight proportion of this precious metal. In some of these several localities the silver was abundant enough to pay for extraction, but rarely. In the early colonial days it was not possible to eliminate it as easily and successfully as now, and in most cases such experiments were soon abandoned. In later days it became more profitable, and yet in few cases were the results more than tantalizing. At the present time the North-Carolina mines are the only ones in the eastern part of the United States that are worked for this metal. No statistics are obtainable showing the exact amount of native silver produced in this country in 1850; but it is asserted, that, at that period of our history, ninety-nine of every hundred silver dollars then in use in the United States were of Mexican or Peruvian metal.

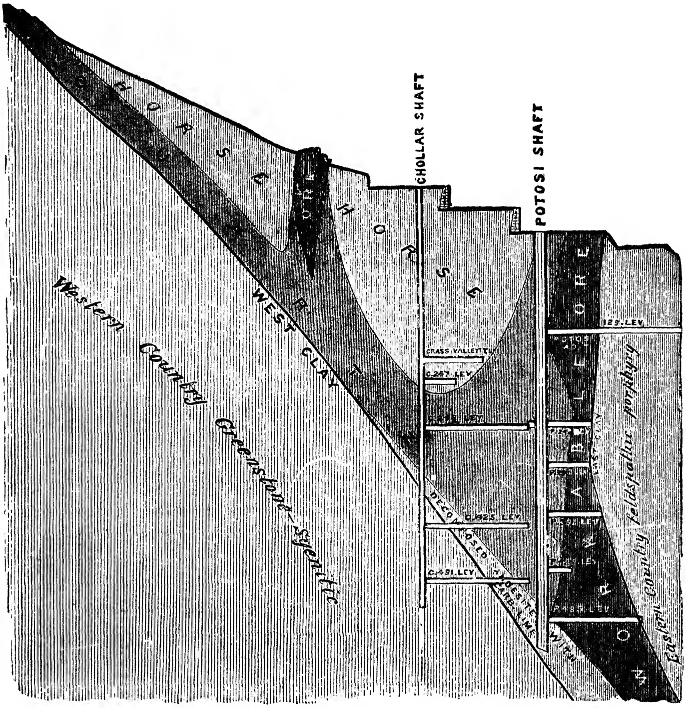
Just previous to the discovery of the famous Comstock lode, stock companies were organized in New York, Cincinnati, and many other cities, to explore and work abandoned silver-mines in Arizona which had been ceded to the United States by the Gadsden treaty. The Sonora Company of Cincinnati was the most prominent of these; but, when it began operations in 1858, it was upon a new mine, seventy-five miles south of Tucson, very near the Mexican border. Their works were at Arivaca, seven miles from the mines. Operations were also commenced seventy miles north of Tucson, in 1870, by the Maricopa Mining Company of New York, whose mines yield an argentiferous copper ore. The outlet for the product of both these mines was by wagon to Guaymas, Mexico, on the Gulf of California. These mines are upon the Pacific slope of the silver-yielding range of Sonora and Durango in Mexico. Other mines have been found and worked with profit in Arizona, farther west, near the Gila River.

Arizona.

The greatest event in the history of silver-mining in America was the discovery of the richest deposit in the world — on the eastern slope of the Sierra Nevada — in 1859. The crest of the range runs along the eastern part of California; and in the Washoe country, twenty-five miles over the border into Nevada, this magnificent vein was found. All during the interval between 1850 and 1860, those tireless, even heroic investigators, the prospectors, had ranged the whole mountain-region of the West on foot, with knapsack, hammer, and blow-pipe. As they wandered from ledge to ledge they picked out specimens here and there, cracked them, and studied the appearance of the fracture, and now and then reduced a bit of the ore with the blow-pipe on a piece of charcoal. In 1858–59 a party of these prospectors was working its way up Six-mile Cañon, in the Washoe country. There they found some rich sulphurets of silver interspersed with free gold. Immediately Henry Phinney (or Fennimore) and Henry Comstock filed a claim to a mine. The former sold out his claim to the latter for a pinch of gold-dust, not realizing the immense value of the discovery; and Comstock himself soon parted with the property, although his name still clung to the whole lode.

Comstock lode.

Prospectors keep as close watch of one another's luck as so many coast fishermen. Before practical operations began, the great possibilities of this region began to be suspected, and a vast number of claims were filed all along these eastern foot-hills of the Sierra; and, as soon as mining was actually undertaken, it was realized that the richest accumulation of this precious metal ever known was beneath the feet of the Washoe operators. Tidings of the marvellous wealth hid away there spread like lightning, not over California alone (Nevada was not then a State, and had scarcely any population), and

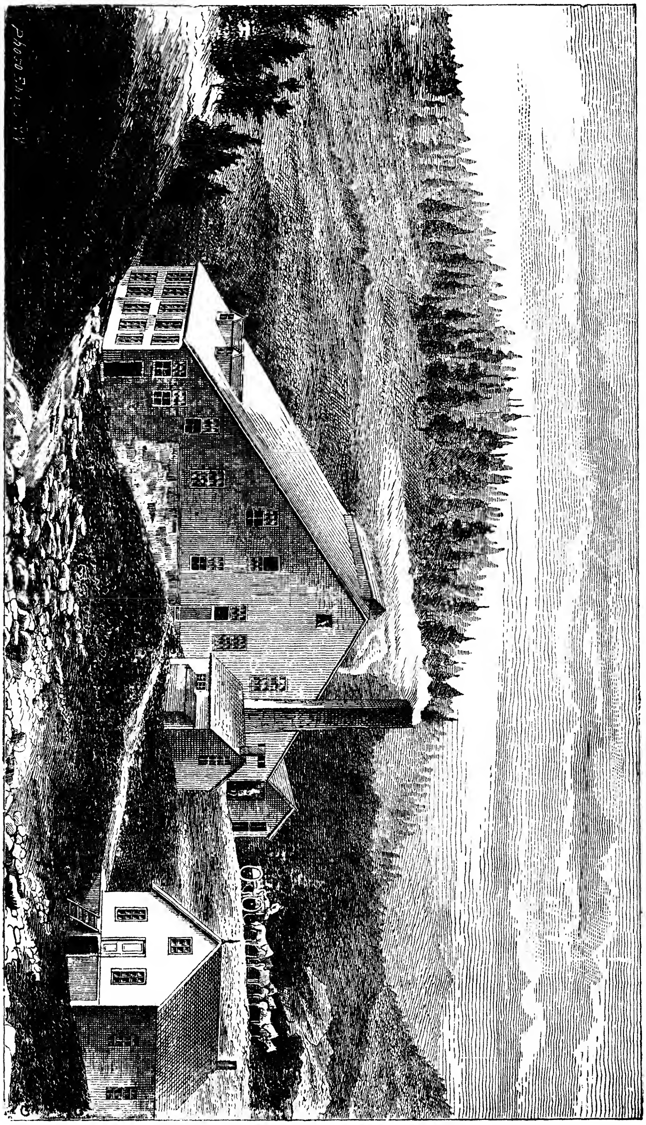


SECTION OF COMSTOCK VEIN.

not over the United States alone, but over the whole civilized world. One of those periods of frantic excitement and wild sensation ensued such as Mark Twain has made us all familiar with in his "Roughing It." A most extraordinary emigration ensued. Several large new towns sprang up, notably Virginia City, Carson City, and Silver City; Nevada took a place among the States of the Union; and the Central Pacific Railroad was extended through the region, its nearest station to the point of first discovery being at Reno, on the Truckee River, twenty miles away.

In "The Great Industries of the United States" it is remarked, "There is, perhaps, no instance so striking of the promptness and daring with which

American capitalists launch their money into an enterprise in which they have confidence as the development of this Comstock lode. In 1861 this lode was a wall of black sulphuret, bedded primeval granite and quartz, on the steep



NATIVE SILVER-LEACHING WORKS, ARIZONA.

slope of a lonely and barren mountain two hundred miles from roads and shops and wheat-fields, parted from them by the gorges and snowy peaks of the Sierras: four years afterward a city of twenty thousand inhabitants was planted on that wild declivity, and nearly two millions and a half in assessments had been paid to develop the mines."

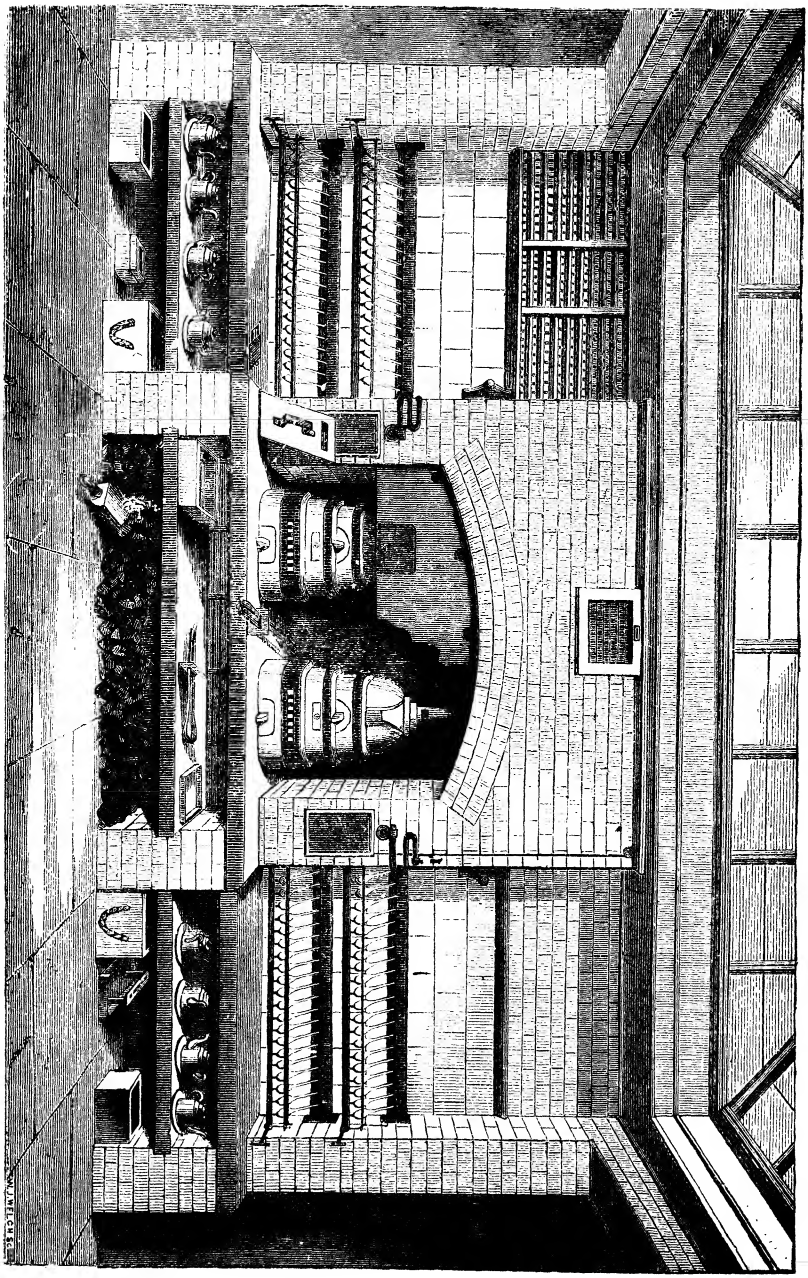
The general excitement was increased by the discovery of argentiferous deposits elsewhere in Nevada. Many thousand claims were located, not a few of which were large and well-defined, yet of little or no value. In the greater number of cases, however, they were contracted, and the lodes on which they were staked lacked the features of true veins, or proved poor below the surface. Says Mr. Kimball, "Notwithstanding wide differences in merit, most of these claims — the best as well as the worst of them — passed at greatly inflated valuations into the possession of joint-stock companies organized upon the strength of extravagant expectations. During three years, while the excitement lasted, three thousand mining-companies were incorporated in San Francisco alone to work mines in the Washoe district, their nominal capital amounting in the aggregate to a billion dollars, though their market-value never exceeded sixty million dollars. Companies still more numerous, with locations in other parts of Nevada, were formed in Eastern cities. Without waiting for the result of exploration or development, most of the companies hurried into enormous expenditures for mill and machinery, of which a great deal was unfit for any use whatever, even had machinery ever been needed; cities were built in an ambitious and luxurious style; and speculation in city and town lots was scarcely exceeded by the traffic in mining-claims. The *furore*, if any thing, grew for three years, rather than abated. In the summer of 1864 a re-action set in, it having by this time become clear, that, in the Washoe region, the only mines of any considerable and well-established value were those upon the Comstock, and even those for a time were objects of distrust; while the other regions of Nevada, of which such high hopes had been entertained, had together failed to contribute more than five or six per cent of the total production of the State, the rest having been furnished by the Comstock lode alone."

Prominent companies.

Among the more prominent companies at work on the Comstock lode are Gould & Curry, the Ophir, the Savage, the Imperial, the Yellow Jacket, and the Belcher. Up to 1865, Messrs. Gould & Curry had realized as much as all the other companies put together. To get an idea of the enormous profits of the business, it may be stated that it cost about ten dollars a ton to get the ore mined, and each ton yielded fifty dollars' worth of silver. An idea of the rapid development of these mines may be derived from the following figures. Wells, Fargo, & Company received and transported for these companies silver bullion amounting to $2,275,276 in 1861, $6,247,074 in 1872, $12,486,238 in 1863, $15,795,585 in 1864, and $15,184,877 in 1865. Altogether some $70,000,000 worth of silver was taken from the Comstock lode from its discovery up to 1866.

Production.

Thereafter, for a few years, there was a slight subsidence in the production; the lowest point touched being in 1869, when the whole lode is credited with



ASSAY LABORATORY.

only $7,528,607 of precious metal. A new development ensued, however, which was very rapid between 1872 and 1875, in which latter year the yield was $26,023,036. It is estimated, however, that forty per cent of the value of the product of the Comstock lode is in gold, which would make the proportion of silver for that year about $16,000,000. The $200,000,000 yielded from 1859 to 1876 is divided roughly into $80,000,000 gold and $120,000,000 silver. Within two years there have been rumors of still richer deposits having been discovered on this lode; but the facts are concealed from the public, probably for stock-jobbing purposes.

White-pine district.

Nearly ten years after the Comstock claim was first entered, silver was found abundantly in the white-pine district of Nevada. In some places the deposit was so rich, that, when the quartz had been mined away, sheets of almost pure metal, worth $17,000 a ton, could be torn out of the vein. This supply was limited, however, and the yield has not been steadily maintained. Silver has also been found in other parts of Nevada in smaller quantities.

Colorado, Idaho, and Montana.

Colorado in the Central-City region, and Idaho and Montana in the Wasatch region, have developed silver-mines of considerable importance since 1865; but, as yet, they do not approach Nevada in the total yield.

Present yield.

At the present time the United States produce between $20,000,000 and $25,000,000 of silver annually (which is about half of the world's product), and three-quarters of the amount comes from the Comstock lode. A contributor to "The Atlantic Monthly" remarks that this country contains the largest proportion of silver, compared with other metals, of any in the world; that the production of silver is more steady than that of gold, taking the world over; and that the signs of our silver-supply holding out well for years to come are much more promising than those concerning gold.

Demonetization of silver.

Political influences, however, as well as the discovery of an increased supply, have tended of late years to depress the price of silver considerably; so that there has been far greater variability in its value than in that of gold. Even before demonetization in 1873 it had fallen off, so that it was necessary to raise the ratio between silver and gold coinage, in weight, from $15\frac{1}{2} : 1$ to $16 : 1$. But the removal of it from a place in our dollar coinage, and the similar action of Germany in 1874, had the effect of reducing it by degrees nearly one-eighth of its former price. Since the demonetization act of 1878 was enacted, however, there has been a tendency toward recovery; and a large class of economists think it will regain its old value and place in the coinage of the world.

CHAPTER IV.

LEAD.

LEAD is found in this country all along the Appalachian range from New England to Georgia, in the Sierra Nevada, and at two points in the Mississippi Valley; but the principal development of lead-mining is confined to the last-named region and to the last fifty years of our history.

Where found.

This metal was discovered by the colonists along the Atlantic coast long prior to the Revolution; and numerous attempts to work the veins were made, though often with such poor success that they were abandoned after a few years. The re-discoveries on the Upper and Lower Mississippi about 1826 still further discouraged Eastern production; and the late civil war and other causes depressed the lead-mining industry in the seaboard States, especially the Southern ones, even more: so that now Carroll County, N.H., Washington County, N.Y., Pulaski and Wythe Counties, Va., are the only Eastern producers; and the last-named county in Virginia is the only one of the number whose yield is of consequence. Kentucky also does a trifle in this direction still; and Nevada is the only State on the Pacific side of the continent which has a lead-product large enough to be recorded, and even this is slight, and of recent development.

The earliest accounts we have of a lead-mine being actually worked in Massachusetts was in Worcester County in 1754; although the existence of deposits had been known long previously. This vein, like that at Southampton, worked in 1765, was of argentiferous galena. Lead was found elsewhere in the State, and also up in New Hampshire. In the latter State, beside the Carroll-county mines now in operation, those of the town of Shelburne, which have been abandoned, also paid. Little was made of the discovery near Middletown, Conn., until 1775, when the Assembly directed the mine there to be worked, and smelters and refiners imported from New York and New Jersey as a war measure. The enterprise never amounted to much, though. In New York, specimens were picked up to send to the mother-country, Holland, as early as 1629; but though it was found in Ulster,

Early working of mines.

Columbia, Dutchess, and Washington Counties, no attempt was made to work the veins until a party of Germans developed a mine near North-east, Dutchess County. Similar enterprises were undertaken by Livingston farther up the Hudson about the same time. Profitable mines have since been operated in St. Lawrence County, but are now abandoned. Penn knew of the existence of lead on his grants as early as 1683 certainly; but no mine was worked profitably until 1778, near Frankstown, on land once surveyed for Penn. This was a war measure, and the product was all bought up by the State. In both Chester and Montgomery Counties, mining has been kept up since in a very desultory way. The Chester-county Mining Company began operations in 1850, and kept at them only four or five years. Like enterprises of a previous date had been equally short-lived. A lead-mine, which was worked to a slight extent for a time, was found in Virginia as early as 1621; but at the time an Indian massacre terminated operations at the first iron-mine near Jamestown this lead-mine was lost, and not re-discovered until long after. Operations were begun at Wytheville as early as 1754, and in Montgomery County also about the same time. Lead-mines are known to have been worked near Fincastle, Botetourt County, during the Revolution. Those of Eastern Kentucky and Tennessee were probably utilized not long after. Veins were found in South-western North Carolina, which yielded ore containing seventy-five per cent of lead, before the Revolution. This was along the French Broad River. The famous Davidson mines are located near the centre of the State. These latter are noted for their argentiferous galena, and have been worked as much for the silver and minute quantity of gold to be obtained as for the lead. Work has been revived there since the war, and the mines have been in continuous operation nearly a century; but the procurement of lead is now no object whatever.

Where lead principally comes from.

Nineteen-twentieths of the lead produced in this country to-day, however, comes from two regions in the Mississippi Valley. One includes one county of Illinois, two of Iowa, and three of Wisconsin, contiguous to one another, and yields, perhaps, twice as much as the other, which is spread out all over that part of the State of Missouri south of the river of that name, although mining is carried on in only eight or ten counties.

Indians knew of the existence of lead.

The Indians of the Mississippi Valley knew of the existence of deposits of galena, for the ore is found in their mounds; but no evidence exists that they knew how to reduce it to lead, simple as is the process. Galena is a sulphuret, and can be reduced by merely smelting with charcoal. It is in this form that we find most of the lead in this country.

In 1700 the French priest Le Sueur made his voyage of exploration up the Mississippi, discovering many lead-mines. It was not until 1788, however, while yet all the region west of the river belonged to France, that Dubuque began operations, having obtained a grant from the Indians. He worked these mines until 1809, when he died. This tract of land — on which is situated the city that now bears his name — was ceded by the Indians to the United-States Government in 1807, and shortly afterward the representatives of Dubuque were forcibly ejected. No leases were granted until 1822, and mining was not resumed until 1826. A government survey was had in 1839, and a general sale allowed in 1844. But from 1826 the progress was marked and rapid, the business extending over into Illinois and Wisconsin; and the first great climax of the development of this region was reached in 1846, when the tariff was taken off from lead almost entirely, and agriculture began to draw off the attention and labor of that region. The city of Galena, Ill., as also other cities and villages in that section, was the product of that period of industrial growth, which was marked by much of the excitement and speculation which have characterized mining in this and other countries of the world at almost all known stages of history.

Dubuque.

Lead-mining began in Missouri in 1720, while that country belonged to France, and under the patent given to Law's famous Mississippi Company. Mine La Motte, in Madison County, named after a mineralogist who came over with Renault, was among the first discoveries. Little was done there up to the time of Renault's return to France in 1742. Schoolcraft estimates that in 1819 there were forty-five mines in Missouri, including the region in and about Washington County, and also the locality in the south-western corner of the State. At that time, he estimates, there were eleven hundred persons at work there at lead-mining; whereas in 1854 Dr. Litton thought there were not more than two or three hundred: yet at both periods the average product was fifteen hundred tons annually. This was far less than that of the Upper-Mississippi region. During the late civil war the mining-business was greatly prostrated in Missouri, and recuperated but little till nearly 1870.

Lead-mining in Missouri.

It might be remarked of these Missouri mines, that for a long time the rich, white, almost transparent carbonate found in some of them was rejected as worthless; its character not being known to the miners, who were used only to lead in the form of galena. Another great source of waste in this country has been the dissipation of lead by the process of cupellation, when there was silver enough in the ore to make that the principal object. Processes have, however, been invented, by which the vapor can be caught and congealed, and the baser as well as the choicer metal be procured.

It is very difficult to get accurate statistics concerning the quantity of metals produced in this country, and those concerning lead are regarded as particularly unreliable; but the following, taken from the census of 1870, will give an idea of the present distribution of the industry, although the production has nearly quadrupled since. The following table shows the value of the product: —

Statistics of production.

Wisconsin	$369,067
Missouri	201,885
Illinois	73,302
Iowa	50,250
Other States	36,500
Total	$736,004

This, at four and a half cents a pound, would make but 16,265,422 pounds, or scarcely more than 7,000 tons. The table of metallic production, prepared by R. W. Raymond, however, sets down the production for 1869 (which is what is really credited to the census year) as 15,653 tons.

Previous to the development of the Mississippi-valley mines, England and Spain were the two great lead-producing nations of the world, although neither of them obtained as soft and fine an article as we. From 1845 to 1852 England's average annual production was 55,000 tons: Spain's, for 1847 and 1849, was 30,000. In 1845 the United States produced 26,500 tons, or fully one-fifth of the whole quantity produced in the world. Twenty years before, we had produced only 1,281 tons of 2,240 pounds; in 1832 we produced 8,540,000 pounds ourselves, and imported 5,333,588; in 1844 we did not import a ton. From the removal of the tariff in 1846 to 1854 there was a steady decline in our production. In 1845 it was, as above stated, 26,500 tons; in 1854 but 14,000, at which figure it kept until about 1869. Our importation in 1844 was nothing; in 1859 about 64,000,000, or 29,000 tons, — twice our own production. In 1875 our production was 53,000 tons, and in 1877 our importation had dwindled to less than 7,000 tons.

England and Spain.

Tariff.

Says Kimball regarding American lead-production, "No country is so richly endowed with lead as this, nor any so little justified in importing a pound of it. In the Far West, where its development is enormous, there is no help at present against wasting what is not utilized for the extraction of silver; but it is a 'penny-wise-and-pound-foolish' policy indeed which in the Northern and Atlantic States, or wherever transportation is at hand, estimates the value of galenas only by their tenor of silver."

Remarks of Kimball.

CHAPTER V.

COPPER.

COPPER is the one metal discovered and put to a practical use by the aborigines before the discoverers from Europe came to this country; and, what is a still more interesting fact, the native Indians of long ago understood the art of hardening and tempering copper so as to make adzes, chisels, and other implements therefrom, — a step in civilization which the white man of to-day would be glad to retrace, were it not that iron and steel subserve all these purposes so admirably. The great mounds of Indian relics in the West contain articles showing conclusively that the aborigines knew of the existence and uses of copper, which they doubtless obtained from the Lake-Superior region.

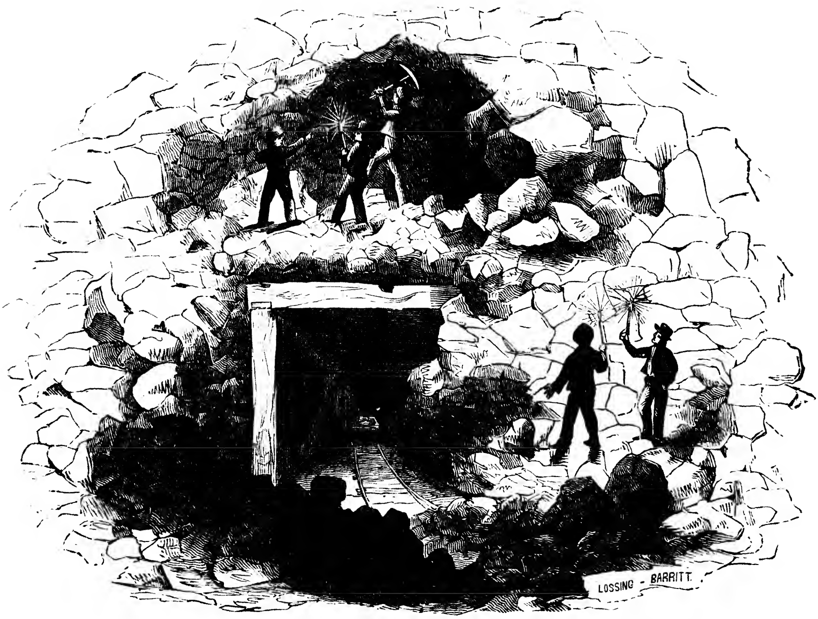
Copper used by Indians.

The search for metals was diligently conducted by colonists on the Atlantic seaboard at an early day; and copper was among the first of their findings, inasmuch as it was distributed more or less all along the ocean-side of the Appalachian range. Endicott found it in Massachusetts in 1648, and imported Swedish workmen to smelt and refine it. His mine proved less productive, however, than he anticipated. Previous to that time, copper pyrites were found in New York; but the mineral having been mistaken for gold, and the blunder having been discovered, it was little prized. The Shawangunk Mountain abounds in this form of copper; and it has been mined to some extent near Ellenville, Ulster County. The Dutch had found pure copper near Minisink, Orange County, N.Y., before they surrendered their possessions to the English. This metal was found nearly a century later in Dutchess County, in veins crossing those of galena. Copper was found in Pennsylvania in time and in sufficient quantity for William Penn to mention it in a letter of 1683. The remains of a shaft in Lancaster County show that copper was mined by the French or settlers from Maryland as early as Penn's time. An extensive vein of copper was found in Catocton Mountain, Maryland, soon after that colony was first settled. Copper was found in Virginia, along the Roanoke, in Mecklenburgh County and that neighborhood, early enough for three thousand pounds of ore to be exported in 1730. The

Early discoveries of copper.

same metal was also discovered along the banks of the James. The Blue Ridge has long been noted for its cupreous deposits; and they were discovered in Polk County, Tenn., and the adjacent districts of Georgia and North Carolina, at quite an early date. Copper was also found in small quantities in South Carolina.

Early working of mines. Among the first mines to be systematically worked for copper, excepting Endicott's in Massachusetts, were those at Granby, Conn.; to operate which a company was incorporated in 1709. About the middle of the eighteenth century, these mines, having been abandoned, were bought by the colony for a state-prison, and used as such for sixty years.



COPPER-MINING.

Mining was resumed there in 1830, but soon discontinued. Most of these ores were shipped to England. About 1719, the Schuyler mine, in New Jersey, near the Passaic, was discovered, and, prior to the Revolution, was among our most famous copper-producers. It was in a machine-shop at the smelting-works connected therewith, at Belleville, that the first steam-engine was built in this country, in 1793–94. In 1751 a copper-mine was opened near New Brunswick; and another, near Somerville, was operated before the Revolution. New Jersey and Pennsylvania also produce in small quantities the green carbonate of copper called "malachite," which is almost as precious as a jewel. Siberia, however, is the great producer of this mineral.

When it is known that in 1830 our total production of copper was not over fifty tons, and that, even in 1840, it was but a hundred tons, it will be realized how recent is the principal development of the copper-mining industry in this country. Besides the discoveries we have already mentioned, there were many others in early colonial days; but active operations were not undertaken in many of them, and in most cases they were abandoned after a few years of unremunerative labor.

The great source of American copper is Upper Michigan. Along the northern shore of that great peninsula which separates Lake Superior from Lake Michigan stretches a rich metalliferous region. In Marquette County iron abounds. Farther west, in the trap-rock which begins at Keweenaw Point, and runs through Houghton and Ontonagon Counties, metallic copper is found in rare abundance. The belt containing it is from one to twelve miles wide, and a hundred and fifty miles long. Alexander Henry was the first white man to operate a mine there. This was in 1771, near the mouth of the Ontonagon River; and his success led Dr. Franklin, our minister to France during the Revolution, to say, in connection with the probable Canadian boundary, that it should be made to run through Lake Superior, so as to include "the most and best of the copper to the United States."

Upper Michigan.

But Houghton's report on the geological features of this region first drew general attention to it, and it began to be noised abroad that this was a rare treasure-vault of copper and silver. This was indeed the case, although the silver — found in distinct nuggets nearly pure, and not mingled with the copper — proved to be much less in proportionate quantity than was supposed. Negotiations were set afoot by the government to extinguish the Chippewa title to those lands; and then ensued a tremendous rush thither of miners and speculators, and one of the greatest excitements that have ever agitated American industry. Says Kimball, —

"The copper-region of Lake Superior owes, in a great measure, its rapid and energetic development to one of those popular *furores* so frequent in America, — the 'copper-fever,' as it was termed, which became epidemic over the whole land in 1845. Preposterous fables as to the occurrence of native silver and copper, in masses, upon and just beneath the surface of the whole Lake-Superior country, to be had only for the picking up, were bruited about in all the cities, unsettling the minds and habits of the well-to-do industrious folk of the country, and opening, for the first time in the United States, a promising field, on their own grounds, to all sorts and conditions of adventurers for the exercise of the cunning manœuvres of their several *rôles*. 'The shores of Keweenaw Point,' says Mr. Whitney, 'were whitened with the tents of speculators and so-called geologists.' Leases of lots one mile square, for mining-purposes, were taken from the Federal Government with great avidity wherever they could be obtained, regardless of all intelligent discrimination as to their metalliferous character, and, indeed, of the entire absence of mineral lodes or deposits, or of the logical impossibility of their existence in certain rocks. These leases were held mainly by private speculators and joint-stock companies, whose object was less to unearth the untold metallic wealth which they were supposed to have secured than to profit either by the increasing market-value of their mining-privileges, or by the proceeds from the sale of corporation shares. Speculation after this fashion flourished for upwards of a year. In 1847 the bubble burst of its own overstrained distention; and the collapse overwhelmed in general disaster, and swept out of their mock existence, several hundred distinct corporations, while only some half a dozen survived the shock."

Mr. Hewitt says that these leases were granted under a forced construction of existing law, but were soon suspended as illegal, doubtless owing to abuses. He adds, "The Act of 1847, authorizing the sale of the mineral lands and a geological survey of the district, laid the foundation of a more substantial prosperity." It should be remarked, though, that some of this enthusiasm led to practical results, and that a few of the companies operated in good faith. This is evident from the fact, that whereas, in 1840, the whole country produced but a hundred tons of copper, the product in 1850 was six hundred and fifty tons, the gain being chiefly in the Lake-Superior region. The great development, however, has been since then.

Development of industry in Michigan.

The progress made in mining necessarily gave growth to the population, built up towns and transportation-lines, and in other ways gave importance to that section. The Hon. Alexander Campbell of Marquette, Mich., in an oration delivered early in 1861, thus touches on this point: "In 1855 Portage Lake was comparatively unknown (its population less than a thousand), while no great interest was yet attracting special attention: to-day they have a population of over six thousand souls, and copper-mines that are producing a monthly product of a hundred and fifty to three hundred and thirty tons. No man can now go to this interesting point, and behold the thrift that is everywhere apparent, — the great number of new buildings being erected, the stir of the populace, the immense investments of capital, the copper-cars as they thunder down the train-roads to the lake, the prodigious quartz-mills, and the power and success with which they stamp the copper rocks and separate the copper from the rock, the large merchandise that is carried on to supply so large a population, the new enterprises in the form of spacious docks, new hotels, founderies, stamp-mills, smelting-works, — without receiving a deep impression, especially if he possess an observing mind. Nor is this all. As these developments began to assume such proportions, some of the corporations, and a few of the enterprising citizens of the place, in order to facilitate the commerce, appropriated thirty-five thousand dollars from their treasuries and pockets to open the harbor known as Portage Entry, fourteen miles below the villages of Houghton and Hancock, which are located near the mines, and on what is known in common-place as Portage Lake; so that steamers of the largest class, with a full freight, have been enabled to cross the bar, run up to the mines, discharge their cargo, and receive the copper. Previous to this improvement, tugs and scows were used to transport the freight to and from the steamers, which dropped their anchors in the lake outside the 'entry,' to the docks at the mines, at a cost of two dollars per ton. When the lake was rough, as was often the case, steamers could not discharge or receive freight. This difficulty is now obviated, and the expense saved, while the business has much greater despatch. . . . At the other points on the copper range — Eagle Harbor, Eagle River, and Ontonagon — the development was much earlier than at Portage Lake, and first gave prominence and importance to the country. The celebrated Cliff mine, whose annual product for over ten years has exceeded fifteen hundred tons, was opened in 1845. The Copper-Falls, Central, and other mines in the same district, known as Keweenaw Point, were opened at a later day. The equally famous Minnesota mine, in what is known as the Ontonagon district, and whose product the last year was twenty-one hundred and eighty tons, was opened in 1848. The National and Rockland, whose products are now large, were opened some years after. It was the early opening of these mines, and their success under all the disadvantages which the country suffered at an early day, and the working of many others in the same districts, which have not yet been as successful, that for many years gave business and interest to the country; and now that other points, with the light and facility which existed, have bounded into being with wonderful development, it in no way detracts from those whose entire success gave birth to all that has followed."

Most of Michigan's copper is metallic, embedded in quartz; but in 1846 a vein of black oxide was discovered, which was exhausted after twenty tons were taken out. It was exceedingly rich, and had much to do with the sensation of that period.

It now remains to consider the progress made by the copper-mining industry of the country as a whole for the past few years, and note in what other regions besides this the business is carried on.

As we have already remarked, the United States produced but fifty tons of copper in 1830, a hundred in 1840, and six hundred and fifty in 1850. During the two decades thus included, the product of the whole world had increased from 25,500 to 54,700 tons. In 1853 we produced 2,000 out of the whole 55,700 tons. Our product for 1866 was 10,790 tons. The census-returns for 1870 put the total value of our copper-product at $5,201,312, which, at $400 a ton, makes about 13,000 tons; which is, perhaps, an under-estimate as to quantity. Dr. Raymond estimates that the copper-product of the country in 1875 was 15,625 tons. In 1870 the census accredited four-fifths of the whole country's yield to Michigan; and, of the

Statistics relating to production.

three counties that monopolized that State's supply, — Houghton, Keweenaw, and Ontonagon, — the first-named produced three-quarters of it.

It should be noted in this connection, that competition with the Lake-Superior region of America has seriously cut down the British production. At the close of the last century, and from that time to 1865, Great Britain was the greatest producer of copper in the world. In 1864 her yield was 14,247 tons, the joint contribution of 196 mines. The next year 203 mines aggregated only 11,888 tons, and their product is diminishing. In 1865 the United States produced 8,472 tons, in spite of peculiar disadvantages that are estimated to offset 3,000 more tons; and in 1866 we had raised our figure to 10,790. Chili has of late years come to be the great rival of great Britain and the United States, having produced 12,500 tons in 1850, and 14,000 in 1853. The blockade of the Chilian ports in 1866 by Spain cut off this supply, and gave a temporary stimulus to American and British production; but the cessation of hostilities a few months later was followed by a corresponding re-action.

SEPARATING COPPER ROCKS.

Discovery of copper in California.

In 1861, in the midst of the Washoe fever, copper was found in Calaveras County, Cal., in sufficient quantities to create a great sensation, and to incite a search for similar deposits all along the Sierra Nevada. The result was to develop a belt of copper lodes all the way from Southern California up into Oregon. Nevada and Arizona were also found to contain the metal. Few of the mines begun proved remunerative, however. Says Kimball, " Work was energetically begun in many districts, and soon sufficient was accomplished to demonstrate the extent of the copper-resources of California and neighboring territories to be nowhere equalled, and at the same time the premature character of an extensive copper-industry in interior sections of the country neither supplied with mineral coal, nor ready means of transportation. The Copperopolis (Calaveras County, Cal.) mines, which had been the first to attract attention, sustained the high opinions which had been formed of their capabilities; though, up to this time (1867), the Union appears to be the only mine that has yielded profit, it having done so from the first on a scale hitherto unknown in copper-mining, notwithstanding the many commercial obstacles it has at present to encounter."

The census of 1870 gave the following returns of the copper-production of the country for the year, by value: —

Michigan	$4,312,167
Vermont	358,845
Tennessee	310,000
North Carolina	96,000
Maryland	71,000
Nevada	30,000
Virginia	8,000
Pennsylvania	7,800
Arizona	7,000
Total	$5,201,312

As the price was then about four hundred dollars a ton, or less, it is a simple matter to reduce these figures to tons. The census commissioner remarks, however, that his estimates are not altogether trustworthy. It will be observed, for instance, that he omits California altogether; and other accounts indicate that Calaveras County in that State alone yields as much as either Vermont or Tennessee. Vermont's production, nearly a thousand tons annually, is confined to Orange County in that State; Tennessee's, to Polk County; North Carolina's, to Chatham; Maryland's, to Carroll and Frederick; Nevada's, to Humboldt; Pennsylvania's, to Berks and Lebanon; Virginia's, to Louisa; and Arizona's, to Yuma and Mohave.

Our production of copper exceeds our needs at the present time by nearly one-half, as will appear from the following statement of our exports and imports for 1877: —

	EXPORTS.	IMPORTS.
Ore	$159,550	$70,912
Pigs, bars, &c.	2,295,711	163,104
Manufactured articles	226,059	363,250
Total	$2,681,320	$596,266
Balance of exports		$2,085,054
Value of our production, about		6,000,000

The little ore we import is mostly smelted at Boston, Bergen Point (near New York), and Baltimore.

CHAPTER VI.

COAL.

THE discovery, mining, and transportation of coal is one of the most interesting as well as instructive chapters in American industrial history.

Importance of coal.

As coal is the product of some of the grandest growths and transformations in the natural world, so does it play an equally important part in modern industries and civilization. Its history is crowded with interest from that far-off time when gigantic coal-ferns grew in the greatest profusion, and during the steaming and fiery period when this enormous growth was decaying, and transforming into fuel, to our time, when the product is collected, transported, and brought to our doors, to serve a highly useful purpose.

A single fact will reveal its importance; namely, that the value of the coal mined in the United States is equal to that of all the gold, silver, and iron produced in the country.

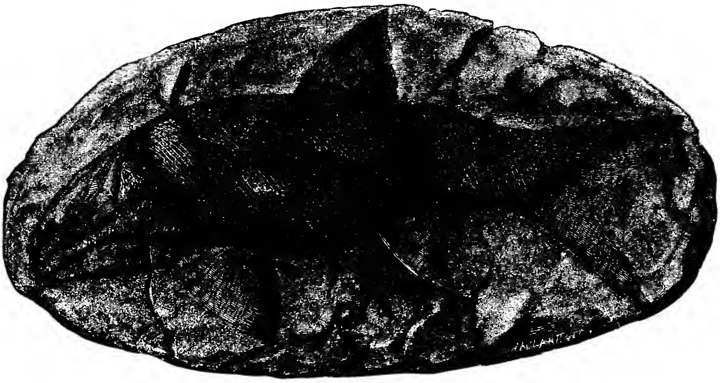
Coal-mining in the colonies.

The colonists were amply supplied with fuel from the forests; and it was not until 1750 that coal was discovered near Richmond, Va. Not much was done in the way of coal-mining until after the Revolution, when it was exported to Philadelphia, New York, and Boston: indeed, the demand at these ports for Virginia coal continued until thirty years ago.

Perhaps some of our readers will be surprised to learn how short is the history of anthracite-coal mining in Pennsylvania. It is true, the existence of coal there was known long before the close of the last century.

Discovery of anthracite coal.

To fix the date more definitely, it was in the year 1791 when Philip Gunter discovered it. He was a hunter, and lived on the eastern side of the mountain drained by the Lehigh River. On the day of this great discovery, which must certainly be reckoned among the greatest ever made on this continent, he had spent the hours in the woods without finding any game. His heart was depressed (so the story goes); for he had left his wife and children in the morning with a scanty breakfast, and both he and they were in sore need of food. As night drew on he was still several miles from home, on the summit of Sharp Mountain. As rain was falling, and darkness approaching, he quickened his steps; but, as he was running along through the woods, he stumbled over the roots of a tree, and fell near enough to a large black stone for him to recognize its color. He had heard of such a thing as stone-coal, and he thought that this must be a specimen. Giving it a few days after to Col. Jacob Weirs, who then lived near the present site of Mauch Chunk, it was forwarded to Philadelphia: and in due time it was learned that Gunter's sad hunting-day was not fruitless, after all; for he had really discovered coal. Soon after, several thousand acres of land in that vicinity were purchased at a very low figure, as it was not regarded valuable; and the Lehigh Coal-Mine Company was formed, containing among other members Robert Morris, the famous financier of the Revolution.



FOSSIL FISH.

First attempt to mine anthracite.

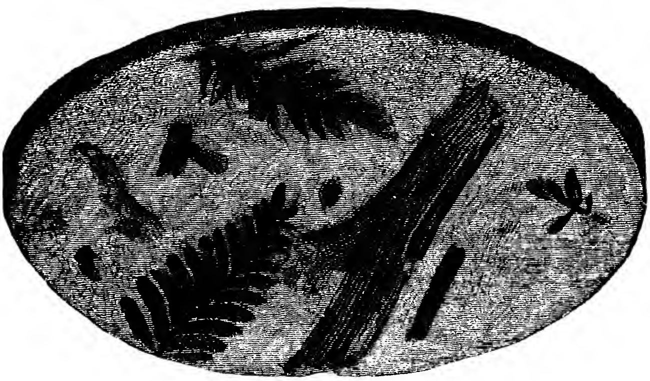
Four laborers were employed in the beginning in mining coal: yet these soon proved too many; for where was the market? Of coal there was an abundance; but where the customers? and how could it be brought to them? There were no roads; and the river ran a wild career, and would not suffer the intrusion of any kind of boat for a moment. After a short time the mine was suspended.

Improvement of navigation of Lehigh River.

In 1798 a company was organized to improve the navigation of the Lehigh River, and the prospect of opening a watery highway for the transportation of coal revived the expiring hopes of the coal company. The improvements were completed four years later; and a committee, consisting of five persons, was appointed to examine and report the condition of the river. A canoe was launched, and the party began to descend the stream. The boat glided along gracefully at first; but before going far the frail craft upset, and the committee, notwithstanding the important capacity in which they were serving, took a very sudden and unwelcome bath. It is said that two of them narrowly escaped drowning; but all succeeded in rescuing themselves, when they halted in their labors, and betook themselves to the nearest inn, where they warmed the inner and dried the outer, man, and, now that the danger was passed, laughed heartily over the occurrence. As they soon after sought their homes, it is highly improbable that the examination was continued, especially in a boat of the canoe style.

Lively experiment in transporting coal.

Whatever report was made by the committee, it is certain that the coal company resumed operations; and the next spring it was determined to send six ark-loads of coal to Philadelphia during the time of freshet, when the river was high, and many of the rocks impeding its course were submerged. Having hauled the coal to the boats by means of horses, one hundred tons were put on board of each vessel, and then the voyage began. For the first fifteen miles the river descends three hundred feet, and the current always runs rapidly; yet, swollen as the stream was by heavy rains, the current was very much wilder than upon ordinary occasions. Six men went on board of each vessel; and, having cut them loose from their moorings, they started on a very exciting voyage. We can easily imagine how animated they were as their vessels began to descend the stream. Being sheltered from the current at their place of mooring, they moved slowly at first, like a steam-engine when a long train is behind; but after a little they floated into deeper water, where they were suddenly caught by the current, and swept along with great speed. The stream was not very wide, but it roared furiously; and not only were its sides lined with rocks, but its bottom also; while many an ugly monster peered up through the foaming waters to frighten the daring navigators. The boats whirled around and past these rocks in safety, yet receiving many a thump and bump, which caused them to shake worse than Harry Gill or a man stricken with the palsy. Every moment they bent, twisted, and cracked; and those who embarked thinking they were going to have such a lively trip were realizing their anticipations to a painful excess. Oars, and whatever means they had to guide their boats, were of as little account as feathers. They were utterly unmanageable, and were swept along in so rude and unceremonious a manner as to make the heads of the boatmen fairly dizzy. As the descent



PLANT-IMPRESSIONS IN COAL.

grew more rapid, and the rocks — some half submerged, while others were in full sight — became more plentiful, the danger seemed more apparent. First one boat, and then another, swung round against the rocks, and the current rushed over her; while the boatmen managed to get to the shore as best they could, leaving their treasures to their unkindly fate. Of the six boats, only two reached Philadelphia; and these were nearly shaken to pieces.

But, when the market was reached through such great perils, the cargo met with a very slow sale, and most of the purchases were simply for trial. Finally, the municipal authorities bought a quantity to feed an engine, which was then in use pumping water to supply the city; but it is said that all their attempts to burn it proved unavailing. "Disgusted with what they esteemed a nuisance, they caused what remained of it to be broken up, and scattered over the foot-walks of the grounds. And here and thus ingloriously terminated, for a period of seventeen years thence ensuing, the operations of the Lehigh Coal-Mine Company." Such is the history of the early movement to open the great anthracite coal-region of Pennsylvania, and find a market for this now highly-prized fuel.

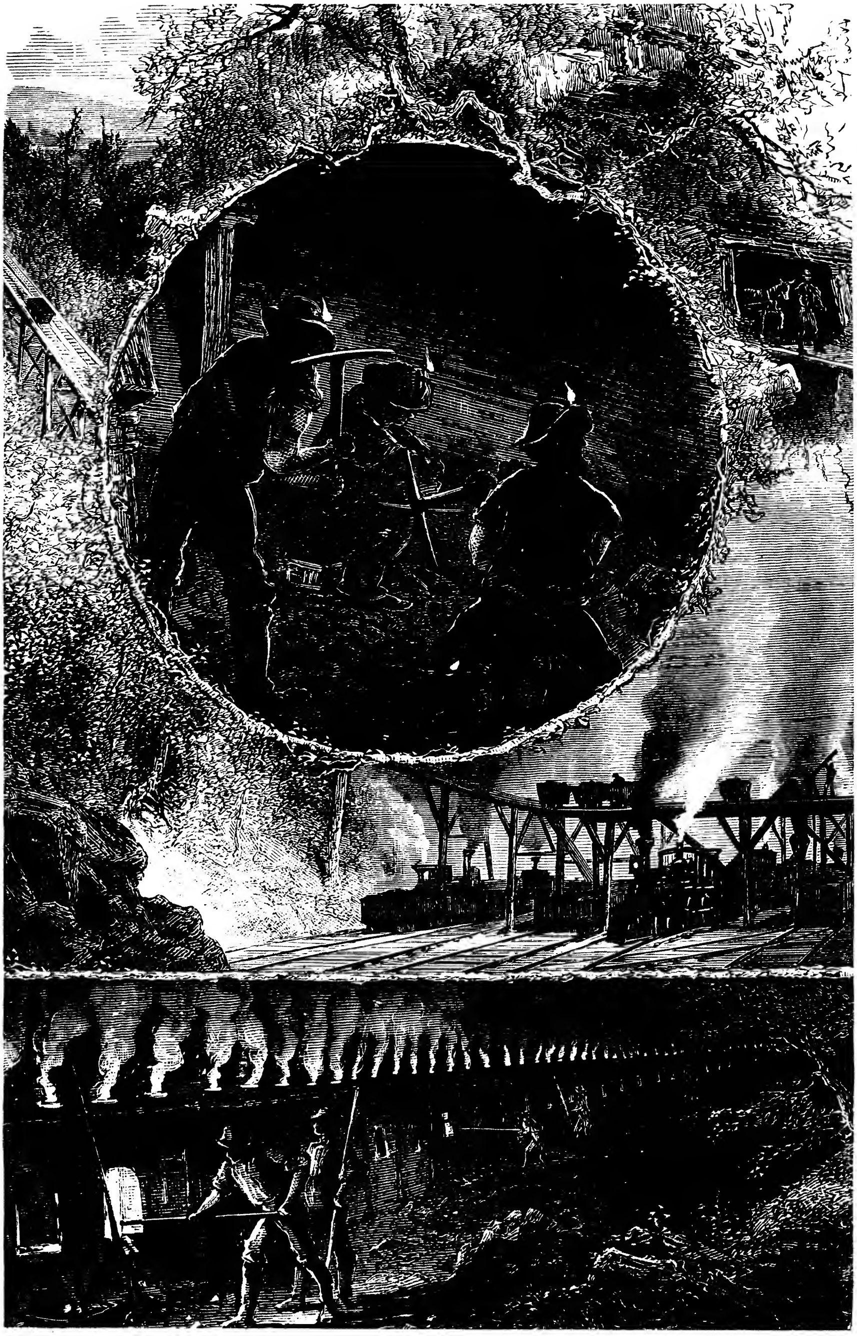
Failure to sell coal.

In 1810 coal was found in the vicinity of Pottsville, which was tested by the blacksmiths there, who proved able to ignite it. It seems almost unbelievable to us in these days that there should ever have been any doubt about the burning-qualities of coal; yet in truth, during the early part of this century, this was the greatest difficulty in the way of introducing it into market. In 1817 Col. George Shoemaker loaded several wagons with coal from Pottsville, and sent it to Philadelphia. But they had not forgotten their experience with the coal from Lehigh Valley. Still he was able to sell considerable quantities by guaranteeing to all who insisted upon it that the "stones" would burn. Some, however, who bought, failed to ignite them, and their indignation was kindled. Their friends tormented them for their exhibition of folly, and the clouds began to grow black around the colonel's head. Writs were issued for his arrest, and he beat a retreat. By pursuing a circuitous path, he was able to reach his home without falling into the clutches of the law-officers of the town. Among other purchasers was the Fairmount Nail-Works. A whole morning was spent by the proprietor and his men in trying to light the stone, but without success. All sorts of experiments were tried: it was raked, poked, and blown upon with huge blowers, but all in vain. Finally, the men, disheartened and desperate, shut the furnace-door, and went off to dinner. All the while they are gone, we imagine we can hear them talking about those black stones which would not burn, and how the proprietor had been imposed upon, and had thrown away his money; how their forenoon had been wasted; and what would have been accomplished had they gone on their regular track, and not attempted to try uncertainties. But, when they come back, imagine their consternation in beholding the furnace-door

Discovery of coal at Pottsville.

Early effort to sell it.

Discovery of true method of igniting it.



COAL-MINING AND COKE-BURNING.

red-hot, and the fire within glowing with intensest heat! There they stand, wonder-stricken, all their many prophecies overthrown, with the secret of burning coal at last found out, and which was now to work such a mighty revolution in the industries of the country. The secret was soon blazoned abroad through the press; and the next time Col. Shoemaker appeared in the streets of Philadelphia he was not chased by indignant coal-purchasers, nor compelled to take lodgings in jail. His guaranty had proved good, and from that hour a new impetus was given to the production of anthracite coal.

Resumption of coal-mining by Lehigh Coal-Mine Company.

As wood near Philadelphia was growing scarce, the price was raised so high, that the Lehigh Coal-Mine Company once more renewed operations. In 1820 they shipped 365 tons to Philadelphia, and 1,000 tons the following year. In 1822 the amount reached 2,240 tons, and as much more the year following. Previous to this time a company had been formed to improve the navigation of

HOLING COAL.

the Schuylkill River; and in 1823 the two concerns were merged under the title of the "Lehigh Coal and Navigation Company;" and, having a large capital, they began such improvements as the rapidly-increasing business demanded.

Improvement in modes of transportation.

The river was made navigable for boats, which were but little more than square boxes twenty-five feet long and eighteen feet in width. A writer says, "At first two of them were joined together by hinges, so as to allow them to bend up and down in passing over the sluices; but as the boatmen became more accustomed to the work, and the channels continued to be improved from time to time, the number of sections thus lashed together was increased, until their whole length reached a hundred and eighty feet. They were piloted and steered with long oars like a raft. Machinery was devised for jointing and putting together the planks of which the boats were made; and the men were so expert at it, that five of them could put together one of the sections and launch it in forty-five minutes. Boats of this description were used until 1831, when the coal-production had increased to such an extent, that the boats employed to transport it, had they all been stretched out into line, would have reached over fourteen miles in length. Upon the completion of the Pennsylvania Canal in this year the Lehigh was converted into a slack-water navigation, with locks and towing-path for horses. It has been operated in this way ever since, with no less advantage to the public than to the company themselves."

The next improvement worthy of note in the way of transporting coal was nothing less than the construction of a railway, nine miles in length, from the summit of Sharp Mountain to the river. This was begun in January, and finished nine months afterward. With a single exception, it was the first railroad built in the United States. For many years it drew visitors from every part of the country; and it is said, that, whenever a railroad was proposed, a preliminary committee was appointed to examine and report its characteristic features. The grade was very great (about a hundred feet to the mile), so that loaded cars moved by their own gravity; while they were drawn back by mules, which were favored with a free ride in the other direction. It is recorded that they enjoyed their ride exceedingly, expressing their approbation of the arrangement by all the tokens which long-eared animals are capable of using. They learned to regard the privilege of riding down as an inalienable right, and no earthly pretext could induce them to go on foot.

Construction of railroad at Sharp Mountain.

While the affairs of the company operating in the Lehigh region were going on swimmingly, the coal-deposits in Schuylkill County were not neglected. In 1822 1,500 tons were shipped over the Schuylkill Canal; and four years later, when the canal had been thoroughly repaired, 17,000 tons were sent to market; and the amount swelled to 60,000 tons the year following. As the coal-trade was now thoroughly established, stoves and hearth-grates adapted for such fuel were made; and the public, very slow at first in using it, had become excited. The coal-region was explored, and lands which had long been regarded as worthless found eager purchasers at fancy prices. Towns were laid out, roads were built over mountains and along their steep sides, railroads and canals were projected, new mines were opened; in short, the fever of speculation set in almost as strongly as it did in California when the gold-discoveries were blazoned abroad. It is said that within a period of six months from the outbreak of the speculative movement, which continued active for nearly three years, five million dollars had been invested in the coal-lands in Schuylkill County. Tracts which were purchased in 1827 for five hundred dollars were sold two years afterward for sixteen thousand. This fact will show to what height speculation had been carried.

Coal-mining in Schuylkill region.

The mode of conducting mining-operations in this coal-field was quite different from those in the Lehigh region. There a single company mined all the coal; while in the Schuylkill region a large number of operators were engaged in the business. It is true that a couple of concerns were organized, possessed of a considerable amount of capital; but there were many beside who leased their lands, and who produced only small quantities compared with the output of the present day. The expensive, wasteful, and slow mode of mining can be comprehended from the single fact, that the same number of master colliers were required to produce a hundred thousand tons as are now engaged in producing forty times that quantity. Still it was not to be expected that this new industry would be economically conducted in the beginning. Perfection in mining, like perfection in every other pursuit, was to come only by manifold experiment. The leases of the operators usually covered a "run" upon the out-crop, or strike of the vein, of from fifty to seventy yards, with an allowance of sufficient space to perform the necessary outside functions of a mine conducted on strictly ancient principles. The pits varied from thirty to forty feet in depth, and the coal was hoisted in wooden buckets by means of a rope and windlass. The same "machinery" drained the mine of water, unless the influx was extraordinary; in which emergency its abandonment became a matter of necessity. A few of the more enterprising operators — such as had a "run" of one or two hundred yards on the vein — erected gins, and raised their coal and water by horse-power. These, however, were the Napoleons and Cæsars of the trade, who thought nothing of shipping two or three thousand tons per annum. Every thing proceeded cheerfully and satisfactorily until 1830, when the market became suddenly and unexpectedly overstocked. The increased production was frightful, — 63,000 tons over the previous year. Prices fell to a ruinous figure. The paper of the shippers was protested, and many of the mines were discontinued. The implements employed in mining were converted into cash, and more than one operator fled from the region to some other which afforded a safe immunity from imprisonment for debts. Among other consequences, there was a large diminution in production during the following year.

Mode of conducting mining in Schuylkill region.

Two years later the business revived, and the shipments exceeded 209,000 tons; which was more than double the quantity mined during the previous year. In the same year, many marked improvements were effected in the mining and transportation of this "stone" fuel.

Revival of business.

COAL-MINERS.

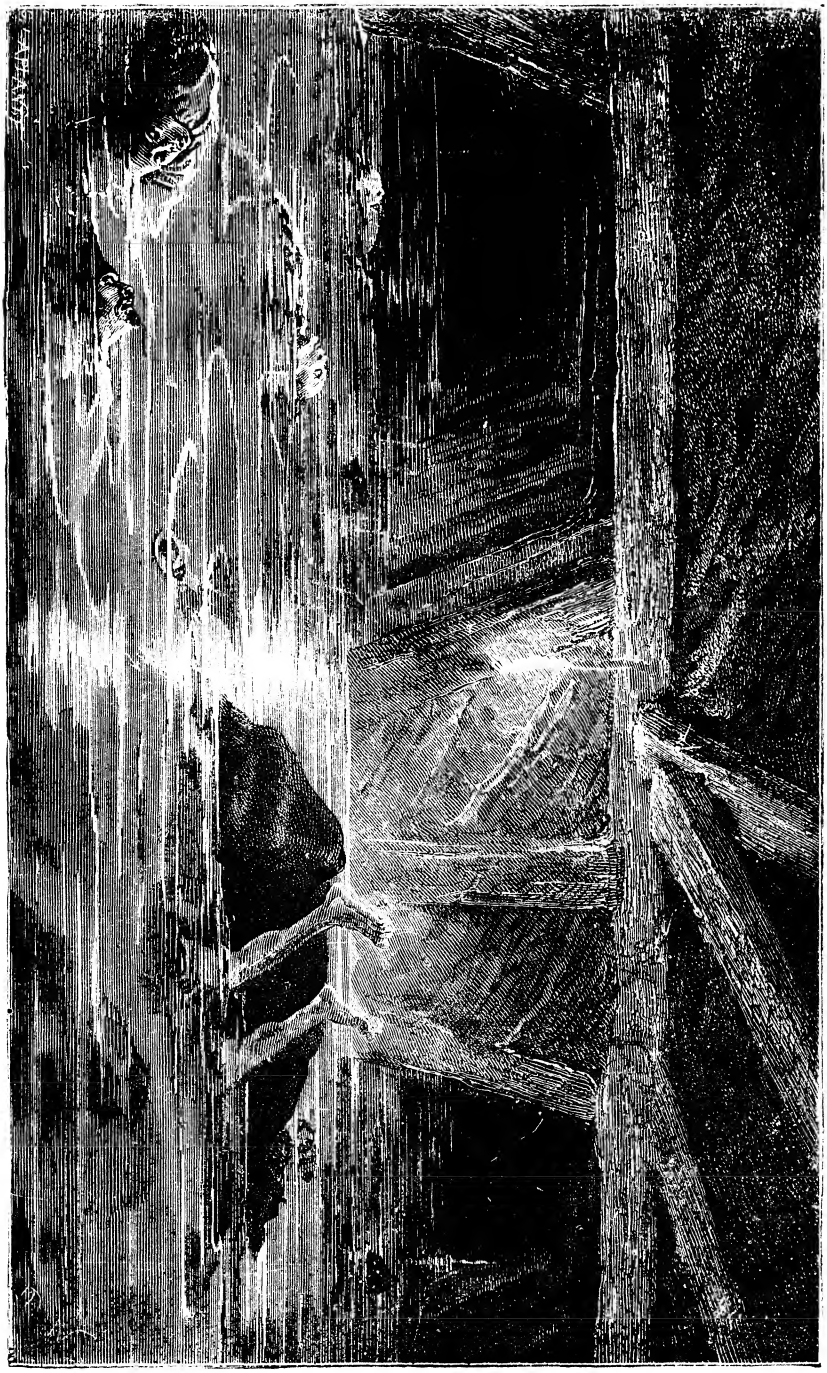
Miners are exclusively foreigners, who come chiefly from England, Ireland, Scotland, Wales, and Germany. There is nothing peculiar about their appearance, except that, when at work, a lamp is attached to the side of their cap, and they are usually besmeared with coal and mud. They are a healthy class of people; and, though their life is one of unusual peril and gloom, they rarely abandon it for any other pursuit. In the West, during dull seasons, efforts have been made to employ them in farming, but without success. They prefer to live below ground, amid the darkness, dirt, and danger of the coal-regions, to a life above in the sweetness of sunlight, and surrounded with greater excitement. So much for the force of habit. Indeed, they have become so accustomed to their toil, and to the positions often necessary for them to assume in the course of their daily tasks, that painful as these would be, especially after a few moments, to other people, miners are often seen even in their hours of leisure occupying them. One may go into a saloon where miners are in the habit of congregating during the evening, and he will see perhaps half a dozen, or twice or thrice that number, sitting around in the form of a circle on the floor, their legs bent under them; and there they will sit for hours engaged in social conversation.

Nationality and habits of miners.

The miner has acquired the reputation of being a lawless man, whose hand is against every one outside of his own class; but this is an altogether one-sided view. They are quite as industrious and law-abiding as other workmen; and though many of them are quite ignorant, and steeped in prejudice, yet they possess many noble qualities, and constantly are performing deeds in the way of rescuing their imperilled brethren which testify in the strongest manner to their sympathy and heroism. As their work is amid constant danger, they are schooled in bravery; and every now and then an instance occurs of devotion to the suffering, and heroism displayed in their rescue, which is thrilling. Who does not remember the account reported in "The New-York Tribune" last year? One evening, as the men were on the point of leaving work in a mine in Wales, the roar of rushing water was heard, and the galleries and tunnels suddenly began to fill. The water had broken through from an abandoned and flooded mine, and of course rose in the main shaft and the lateral workings until it found its level. Most of the men made their escape; but when the roll was called fourteen were missing. An exploring-party went down to look for them. They found all the galleries within a few hundred yards of the bottom filled to the roof; but a knocking heard behind a wall of coal indicated that some of the missing men were imprisoned alive in a gallery which sloped upward, its mouth being under water. The wall was several yards thick. Volunteers went at it with their picks. The prisoners worked from within. In a few hours they could hear one another's voices. But, the moment a hole was broken through, the confined air, kept under great pressure by the rising water, burst out with a terrific explosion, and one of the imprisoned miners was shot into the opening as if he had been blown from a gun. He was taken out dead. Four others in the chamber with him were rescued uninjured. Knockings, however, were heard farther on; and it appeared that other missing men were in a similar but still worse predicament. — shut into a chamber of compressed air. It is with

Bravery of miners.

Rescue of miners in Wales.

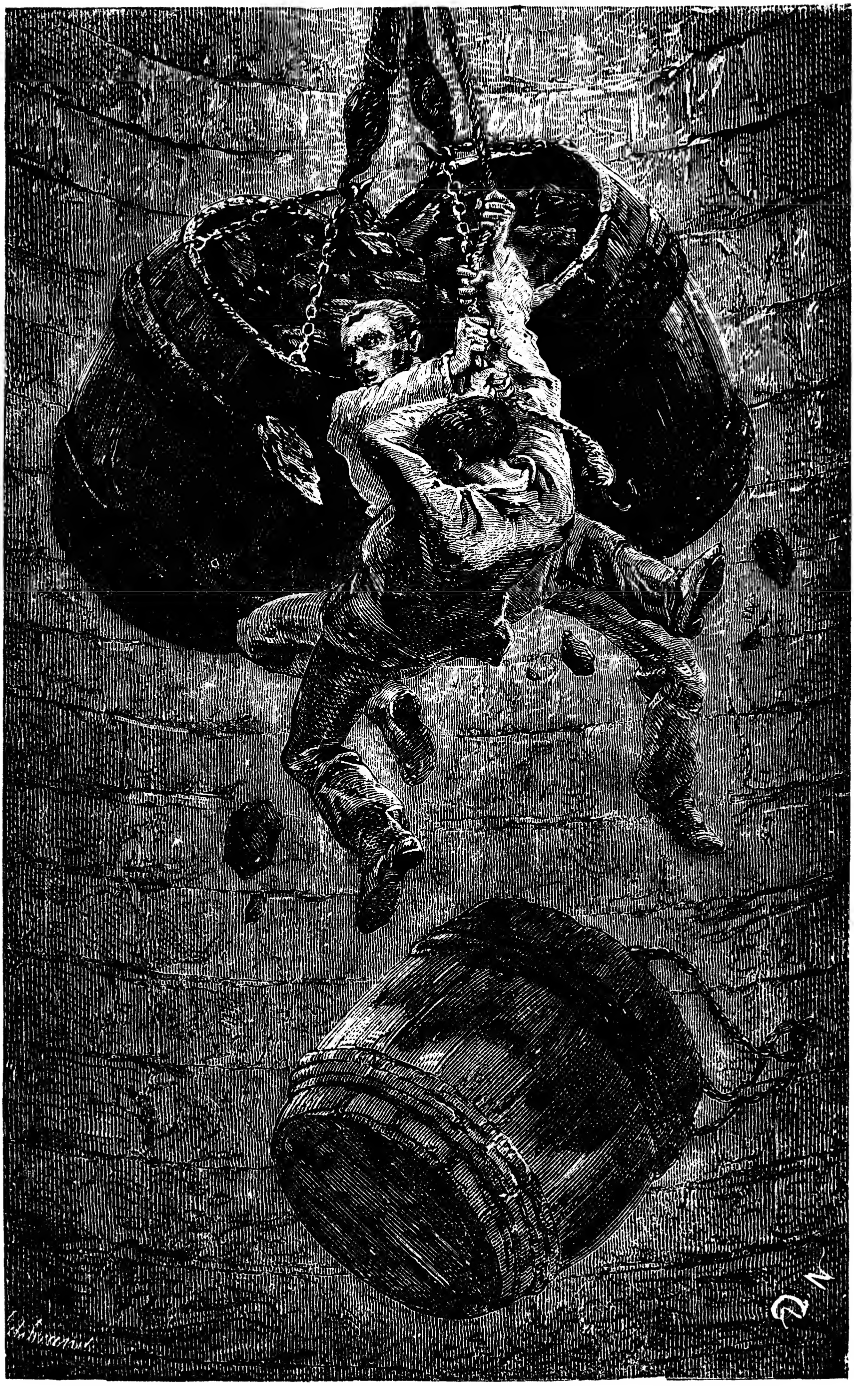


INUNDATION OF A MINE.

the efforts to release this second party that the chief interest of the story begins.

Extraordinary energy displayed.

The wall behind which they were confined was in a heading that was flooded, and nothing could be done with the pick until the water had been pumped out. Divers first attempted the perilous feat of reaching the opening from the main shaft through half a mile of water, and it was afterward ascertained that one of the men within had tried to escape in the same way. This, however, was impossible. It was not until the fifth day that the volunteers were able to begin digging. The distance to be cut was a hundred and twenty feet. The work went on day and night with an eagerness that seemed like desperation; and yet it was so slow! Cutting through the solid coal in a gallery not more than three feet high, where the water, only kept down by constant pumping, threatened every moment to rise and ingulf them, with trouble from gas, and the danger of another explosion of air always before them, the rescue-parties took their lives in their hand whenever they went into the mine; and their wives followed them with sad eyes as they entered the shaft, doubting if they would come up alive. The hope of saving their comrades, shut up so long without food, was at best but a forlorn one. To reduce the danger from the sudden liberation of the air, — danger not only of a violent explosion, but of a sudden rise of the water in the chamber as soon as the pressure should be relieved, — air-tight doors were constructed in the cutting, and an air-pump was set in operation to establish an equilibrium on both sides of the wall. A week after the accident, voices were heard; and the working-party were cheered by a faint cry, "Keep to the right side; you are nearly through." The next day the work had made such progress, that an iron tube was forced eight feet through the barrier of coal, and an attempt was made, but without success, to introduce milk through it to the famishing prisoners. The miners learned then that there were five of their comrades in the chamber, all alive, but two of them nearly exhausted. At night there remained only eighteen inches to be cut away, and the excitement rose to fever-heat. An enormous assemblage of people surrounded the mouth of the mine; physicians were in readiness; a temporary hospital was prepared; and a house near by was put in order for the sufferers, if haply they should be got out alive. The state of the work was discussed in Parliament, and bulletins were flashed at short intervals to the farthest ends of the kingdom. But, just when it seemed that a few strokes of the pick might complete the labor, an eruption of gas took place, and the working-party had to run for their lives. In time, however, the air was renewed, and the work went on. The afternoon of the tenth day a hole was knocked in, and one of the cutting-party entered the cavern. All was still. In their weak condition, the agitation of the moment made the imprisoned men speechless. The rescuer felt about, and, not finding any one, shouted, "Don't be afraid!" The answer came, "All right, we are not afraid;" and then a pair of rough arms were thrown about his neck. The



COLLISION OF TUBS IN A SHAFT.

first to be taken out was a boy named Hughes: and it is related that when the car came to the surface, and the long suspense was over, the vast crowd of spectators "did not cheer, nor use any of the ordinary means of showing enthusiasm; all seemed too serious for that."

Miners usually receive a certain sum per ton for mining coal; but for several years disagreements between them and their employers in respect to wages have been numerous, leading, in some instances, to very serious consequences. It is not an easy matter to ascertain the exact truth concerning these controversies; but, if the account which we shall now proceed to give does not perfectly square with the facts, it is not because we have failed to make many inquiries, nor through indifference to present correctly so important a page of our history.

Difficulty in adjusting wages.

When prices rose during the war, including the price of coal, it is affirmed upon good authority that miners, notwithstanding the greatly enhanced cost of living, received no higher wages without first making a demand, and then following it up with a strike, or a threat of that nature. As operators were making large profits, they were very unwilling to suspend operations; and so the demands of the miners were complied with, and wages were several times advanced.

Advance of wages during the war.

Production in a few years enormously increased; and during the spring of 1868 the coal-market was glutted, and prices went down as low as they were in 1844, with the single exception of a short period at the outbreak of the war. Had the coal-mining business been in the hands of a few operators, as it was ten years before, the market would have been obliged to suspend production; but the business was now carried on chiefly by five companies, which had a large amount of capital invested, and which could not suspend operations. It was deemed necessary, however, to reduce the wages of the miners. The latter contended that a reduction of their wages would not prevent the glut of coal; that as long as all the companies continued to work every mine, and to open new ones, there would be an incessant glut, and it would be impossible to find a market for coal, even if the workmen consented to work without wages. Twice did the workmen submit to reductions, but urged each time the folly of overloading the market. But the companies were determined; and the history of 1868 was a succession of strikes, suspensions, agreements, resumptions, and again suspension, accompanied by violent fluctuations in price, and at one time an advance to the very highest figures of war times.

Strikes during 1868.

The following year (1869) things grew worse. The winter had been mild, and there was an accumulation of more than seven hundred thousand tons of coal belonging to the five principal companies. After vain efforts among themselves to agree upon a reduction of the supply, the miners, with great shrewdness, offered a voluntary suspension of thirty days to enable the companies to work off their accumulated stocks. The offer was

The strike of 1869.

accepted; and, under pretence of this so-called strike, the companies increased the freight-charges over their roads nearly one-half, ran up the price of coal to very high figures, and reaped a small fortune from the suspension. When the thirty days had expired, the companies expected the men to go to work at the old wages: but the men declared, not without an appearance of justice, that, if the market-price of coal was to depend upon their suspending and resuming work, they were certainly entitled to some portion of the advantages of their action; and they demanded, that, if coal advanced beyond that price, their wages were to advance in proportion, — on precisely the same principle as that which the companies had invariably enforced in reducing wages the moment the selling-price of coal declined. This was called the "basis system," the supposed lowest price of coal being taken as the basis of wages. The companies at first were unwilling to accede to this proposition; but, after a long struggle, several of them submitted. Others have refused to this day, preferring to pay the men higher wages rather than recognize the hated basis.

For the next three years no very serious strikes occurred, although grumblings were heard, and occasionally there was an outbreak. No very general disturbances arose, however, until the close of 1874. As the year was drawing to a close, another strike was inaugurated, against the advice of the Labor Union which had been formed, and without the faintest realization of the long and bitter contest which was to come before even a short-lived peace was secured.

Strike of 1874.

It will be remembered that this was not long after the panic, when nearly every kind of business was depressed, and when prices were tending downward, with no probability of a recovery. Notwithstanding this very clear outlook, the miners demanded an increase of wages; and, the demand being refused, a strike took place. The strike, however, in the beginning, was not regarded as serious, although at an early day the workmen were informed that not only would their demands not be acceded to, but that wages would be reduced. This was not, however, believed, and matters remained quiet; good humor, in the first instance, prevailing. The strike was inaugurated at a time when the great body of workmen expected to be idle; navigation had closed; the winter stock of coal of the East and South had been laid in: it was the period of limited demand, of what is termed "dead work," in preparation for the coming season. As, however, the attitude of the Coal Exchange was firm, very early came annoyances in the refusal of the men to allow even sufficient coal to be mined for the use of the furnaces on the line of the road and for the locomotives of the railroad companies. In the mean time the general business and manufacturing interests of the country were still more depressed. By the latter part of February, 1875, all hopes of even a partial revival of business in the spring had died out. Many of the large manufacturing and iron establishments of the country, which had struggled through the past year on the accumulated capital resulting from

Commencement of strike.

RESCUE WITH GILBERT'S APPARATUS.

seasons of prosperity, either totally stopped work, or ran on half-time; whilst the area of the anthracite coal-market had somewhat extended, the uses were being curtailed, and a large falling-off in the demand during the coming year was felt to be a certain prospect. The facilities for mining coal created a supply largely in excess of the demand; and the fact was perfectly understood, that no combination of the coal-mining companies would enable coal-operators to run on full time, and maintain prices of coal or wages.

Growing intensity of strike.

"As a consequence, in the beginning of March, 1875, when the policy of the coal-operators was fully developed, the struggle began in earnest, the operators maintaining that the reduction of wages was to them a matter of necessity; whilst the Labor Union remained firm in the demand that at least the prices of the preceding year should be maintained. The stock of money accumulated by very many of the workmen was now exhausted, and a call was made on kindred associations for assistance. These associations sympathized with the struggles of the miners and laborers; but they had their own interests to guard, and in most instances had themselves yielded to the pressure of the times. The response was, therefore, made with a necessarily sparing hand."

Crisis reached.

Many were willing to go to work, but feared the Molly, whose history will soon be sketched. "Intense feeling began to manifest itself on both sides. The Labor Union yielded the position, so far as the question of reduction was concerned, but, as a question upon which its existence was involved, demanded to have a voice in the settlement of the basis of wages. A number of coal-operators were willing to commence work on these terms; but the great coal-mining companies, with the entire approval of many individual operators, refused to treat with the Labor Union at all. By the action of the great carrying companies in the regulation of freights this policy was enforced."

Defeat of the miners.

At length, in June, 1875, the miners yielded. This was the most severe defeat the miners had experienced. "Most of the 'labor-strikes' previously inaugurated had been local in their character; in some instances, confined to particular collieries; in others, to districts; and again, in others, to the coal-shipments by particular lines of railway. In none of these contests had the men suffered overwhelming defeat: they had not always, it is true, obtained their full demands; but the result had generally been a compromise, in which their power was acknowledged, and the outrages committed either by unruly members of the Union, or indirectly resulting therefrom, were, to a certain extent, condoned." But in this, the longest and most expensive strike to miners as well as to operators, the former were compelled to succumb. Yet it had been begun contrary to the advice of many of the leaders; for they saw with the eye of a prophet the whirlwind that was to come. With declining markets and an over-production of coal, what could the miner expect beside lower wages, unless it were no wages at all?

THE MOLLY MAGUIRES.

Why a consideration of the Mollies is necessary.

This is not a lovely or engaging theme: yet no pursuit is without its darker side; and, if the history of coal-mining be shaded more heavily than most of our numerous industries, it must be remembered that most of the workers in it live a dark, sunless life, and it is quite in keeping with the industry itself for terrible incidents to arise therein.

The record of the Molly Maguire in this country is very brief, but very sad and terrible. The society to which he belongs is neither new nor recently known; for it had its birth long ago in the Emerald Isle, and many an incident of thrilling interest has been wafted to our shore. These we have not space to relate: besides, the cup of their misdeeds, notwithstanding their short existence in the anthracite regions of Pennsylvania, was long ago filled to overflowing.

Record of Mollies in this country of brief duration.

JAMES KERRIGAN.

Ribbonmen of Ireland.

All of our readers have heard of the famous Ribbonmen of Ireland, whose deeds fill so large a space in the annals of crime in that country. The society was organized to maintain the rights of tenants, which the landlord, according to general belief, sought to crush out. He was regarded, not as the rightful owner of the land, but as a usurper, who, if possible, was to be extirpated from the soil. Time, instead of burying this belief, only strengthened it; while the breach between the two classes was still further widened by differences in religion and education, and the rank and poisonous growth of prejudice. "Under the influence of such prejudice and feelings," says a writer who has thoroughly studied the subject, "a certain unwritten code of laws, or 'tenant rights,' came into being, by which the tenant claimed to possess his leasehold estate, without, under any circumstances, the right of dispossession existing in the landlord. The landlord might be desirous of improving his estate, or rent be largely in arrears: nevertheless, any action on his part in maintenance of his right of property, was, under the Ribbon code, to be resisted to the death. But not only upon the landlord did the Ribbonmen exercise their deadly vengeance: other tenants entering upon the possession of the disputed property were, equally with the landlords and land-agents, the victims of murderous and generally fatal attacks. This society sprang into existence in the early part of the present century, maintained its unhallowed existence for many years, and only received permanent check upon the execution of Hodgens and Brun, convicted of conspiracy to murder Patrick McArdle, at Carrickmacross, in 1852." Such, in brief, is the history of the rise of this world-famous society.

Ancient Order of Hibernians.

How long it was after their appearance in the anthracite regions before they obtained control of the Ancient Order of Hibernians is not known; but the history of this association under the new *régime* deserves notice, for it has been very imperfectly understood by the public. Previous to its capture by the Mollies, this society had borne an honorable record for its many deeds of disinterested benevolence. It was because of its good name that the Mollies were so desirous of getting control of it; for they hoped, under the guise of its fair reputation, to do many things which could not be easily done in any other manner. It is unnecessary to describe here how the Mollies executed their design: suffice it to say, that in due time this order was completely under their baneful control, and in its name a series of outrages were committed which the entire land vividly but sadly remembers. It has been questioned, however, whether any organizations belonging to this order existing beyond the anthracite regions were drawn into the fatal net. Doubtless assistance, in the way of contributing money to defend the Mollies when their crimes were exposed and they were brought for trial, was rendered by many members who resided elsewhere; but certainly it has never appeared that any society in an organized capacity furnished such assistance. It was contributed personally, not in a corporate or organized way; and therefore there is no reason for charging the societies belonging to this order, lying beyond those directly implicated, as guilty of sympathizing with the Molly Maguires, or furnishing any assistance. The sins of members individually are not to be visited upon the organizations themselves; for, if they are, what church or other social organization can plead innocence?

Labor Unions.

The conquest of the Labor Unions ere long by the Mollies was as easy and successful as the subjection of the Ancient Order of Hibernians. Yet the public generally have formed a wrong idea of these Labor Unions, on account of the presence and activity of the Mollies amongst them; just as the worthy fame of the Hibernian Society was blasted by the conduct of the Mollies, who in an evil hour, and when no wrong was suspected, came in and stealthily took possession of the organization. It may be thought singular how so small a number, compared with all the miners, were able to effect this result; and hence many have believed that the Mollies were far more numerous, even in the beginning, than they were in fact, or else that very many of the miners were in sympathy with them. Either alternative is without much foundation, as we shall endeavor to prove before concluding this chapter.

Let it be remembered that the coal-workers, though for the most part foreigners, are not so densely ignorant as to be unable to perceive their rights, and comprehend their surroundings. Though possessing less education than the average American, they are neither so ignorant nor lawless as many suppose them to be; and one who is well qualified to judge declares that none rejoice more earnestly than they in the belief that a reign of terror is over, and that law and order will rule once more.

Wrong impression respecting their ignorance.

Keeping this point in sight, we proceed to note that the Labor Unions arose as a defence to the demands of capital, which was massing itself to control the entire anthracite-region. When almost the whole field was absorbed by five companies, representing an enormous amount of capital, and capable of dictating any terms it pleased to the workmen, so long as they continued in their old ways, was it not about time for them to do something to meet this mighty power which hung over them like a thunder-cloud, and which grew blacker every moment?

Object of "Labor Unions."

MANUS KULL.

We do not see how any one can blame them for combining. If they did wrong, it was not in taking this step, but in subsequent ones. At first they had no hostile intentions against life or capital: it was only to protect themselves, and prevent future aggression. Unluckily they had not been going long before the Mollies stole in, and announced their unwelcome presence. Under their evil sway the Unions made new demands, founded harsher rules for the government of members, and extended their power over the miners who held aloof from the organization. Thus they went on until they demanded of the mining-companies that no man should be employed or discharged without the sanction of the Union. To this demand others were added of hardly less imperious nature. The manner and hours of working, and the superintendents and bosses, were regarded as under their control. Moreover, they claimed the right to determine the rates of wages, and times of payment, and other equally extravagant and surprising demands. Says Mr. Dewees, "Some of these acts are attributable to the circumstances which gave them the power, and others to the pernicious influence of the band of criminals who foisted themselves among them. Whilst it is an act of simple justice to the leaders

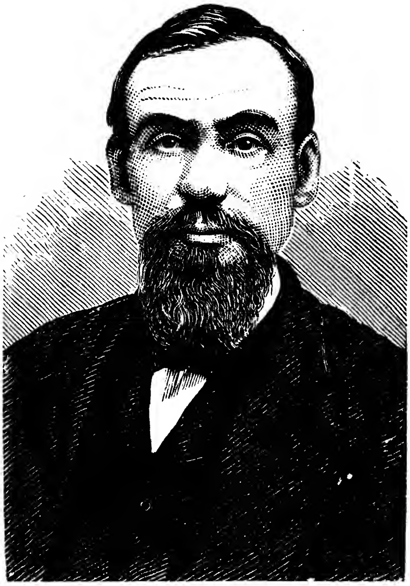
Not to be blamed for combining.

Their demands and powers.

of the Labor Union to acknowledge, that, as a general rule, the true interests of the working-men, from their stand-point, were sought to be obtained peaceably and through compromise, and whilst, in such efforts, they had the approval of the great body of the society, unreasonable demands were pressed through the influence, and granted through fear, of the Molly Maguire.

"Under the influence of organization and of general prosperity," continues Mr. Dewees, "the Mollies increased in numbers and in power. Throughout the coal-regions they completely controlled the organization known as the A. O. H., or Ancient Order of Hibernians, and, using that order as a cloak, endeavored to increase still further their numbers and their influence, on the pretext that the order was chartered by the legislature for legal and proper purposes as a benevolent association. The ambition of the leaders among them, many of whom deserted labor and the mines for the more congenial and influential positions of small tavern and saloon keepers, kept pace with their increased power. They sought not only to control the movements of the Labor Union, to inspire whole coal-mining interests with a fear of their displeasure, but also to have a potent voice in politics." Their more especial ambition was to control the affairs of the township, and control the collection and expenditure of the public funds. Possessed of but little taxable property themselves, it was of immense importance to them to get hold of the public purse, and be able to empty and replenish it according to their own will and pleasure.

Aims of the Mollies.



THOMAS P. FISHER.

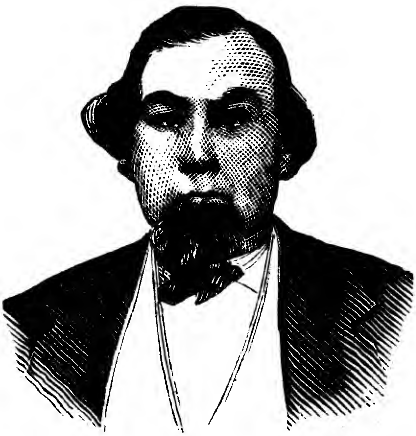
As they were successful in an eminent degree in their designs, the history of their management is but little more than a repetition of the management of the Tweed ring on a smaller though not less frightful scale. Large sums were assessed to repair roads which needed only a small outlay for this purpose; and even the school-funds were perverted, though it is believed the misapplication was not as extensive. They almost succeeded, in Schuylkill County, in electing as associate judge a notorious Molly who has since been convicted of crime. Both of the great political parties bid for their support, and the rewards demanded and received were neither few nor small. "Rumors of a vote to be given on account of a pardon to be extended

Doings of Mollies.

to some offender or offenders whom no perjury could save from the meshes of the law have been common; and such pardon, following quickly after the result of an election has become known, has given those rumors a force and effect they would not otherwise possess."

The effect of such an accession of power to an organization so irresponsible, corrupt, and desperate, may be easily imagined. Nor is it difficult to trace the devastating effects of the organization upon the property, designs, and even lives, of those who dwelt in the coal-regions. "The owner of productive coal-lands," says Dewees, "wearied by the continual struggle between his tenants and the men, whereby his income was seriously impaired, was glad to sell his lands at a moderate figure in comparison with their true value; whilst the owner of unproductive lands, borne down by taxes, and seeing no hope in the future, was glad, at a comparatively small price, to dispose of property that was becoming an intolerable burden. The control and management of the mines, the manner of their working, the right to employ and discharge hands, were passing away from the owners, and were fast resting in, not the Labor Union proper, but the Labor Union under the direction of the Molly Maguires."

Effect of their operations.



PATRICK HESTER.

Prosecution of Mollies by railroad-companies.

The time had come for the great companies to make a determined effort to rescue their property. After a long period of suffering, and another of preparation, the blow was struck which delivered them of an enemy whose history, though short, had been truly terrible, and whose long catalogue of misdeeds the public have read and remember with horror.

Two causes of success of Mollies.

It may be wondered how it was possible for any organization in this late age, in a county of Pennsylvania, — whose courts were supposed to be always open, and where the law never failed of execution through lack of force, — to continue such hellish work for so long a period. Two causes conspired in a remarkable degree to aid them in their dark and bloody work, the absence of either of which would have proved fatal to their plans.

Secrecy.

The first was secrecy. It is difficult, perhaps, for many to realize how thoroughly this idea is engraved into the texture of the Irish race. To inform of a crime, in many instances, is regarded a wrong as great as the crime itself; and to such an extent has this feeling developed, that it has truly become a part of the Irish character. In the plottings of the Mollies a large number were engaged, yet the utmost secrecy was preserved; and their ways and movements would have been unknown to this day, for aught we know, had not a detective been sent among them. From the beginning to the end of their fearful career they kept their own secrets until secrecy would no longer avail any thing. It is a wonderful trait of character which they have exhibited, nor could it have bloomed so perfectly on American soil during the short period the organization has existed. This trait is the product of many years of education, — education of a fearful sort, in which tyranny and revenge were the twin stimulating forces.

The other cause is the secrecy afforded by nature for executing their designs. Vast forests lie in close proximity to the villages, to which the Mollies could flee and find sure protection. It was not possible to fill the woods with police; and a hunt there after the law-breaker would have proved a fruitless undertaking. Thus a shelter was afforded for the criminal, so secure as to stimulate him in executing his lawless purposes.

Secrecy afforded by nature.

In this chapter we have paid less attention to the Molly-Maguire movement (as that is known to all) than to underlying causes of it, as well as the machinery employed to accomplish their designs. It is a singular blur upon the industrial history of the United States, and one which will not soon be forgotten.

Singularity of Molly-Maguire movement.

LATER HISTORY.

Having traced the history of mining and transporting coal to 1830, let us take up the thread at that point, and follow it until the present time. The anthracite-coal fields of Pennsylvania, which embrace nearly all that kind of coal known in the world, lie in three basins, or valleys, which are called the southern, middle, and northern coal-fields. Though the total area is only 472 miles, the coal is of such great average thickness, varying from fifty to a hundred feet, that the entire region is estimated to contain 26,361,070,000 tons; from which amount, after deducting one-half for waste in mining and breaking the coal for market, and for other losses occasioned by faults and irregularities in the beds, 13,180,538,000 tons are left. Subtracting from this amount the 206,666,325 tons mined between 1820 and 1870, there is still remaining a sufficient supply, allowing consumption to go on at the rate of 25,000,000 tons per year, to last for 525 years.

Extent of coal-fields.

It was in the southern or Schuylkill region that mining-operations of any importance first began. In 1833 a charter was granted for building a railroad from Philadelphia to Reading; and a year or two later it was empowered to extend its road farther, so as to pierce the anthra-

Reading Railroad.

FALLING-IN OF A MINE.

cite-coal regions of Schuylkill County. The road was completed in 1842, and was fifty-eight miles in length; but it has stretched itself out, by building additions and leasing other roads, until it has found its way into every valley of the southern and middle coal-fields, and in the year 1870 operated 1,168 miles of single-track railroad, of which 466 miles were located in the coal-regions.

The Delaware and Hudson Canal Company was chartered as early as March, 1823, to run from Rondout on the Hudson to Honesdale on the Delaware River; from which point the northern or Wilkesbarre coal-field was entered by the addition of a short railroad extending to Carbondale. About a quarter of a century later the Pennsylvania Coal Company was formed, being composed, either wholly or nearly so, of stockholders and directors of the Hudson and Delaware Canal Company. To this new concern was leased a portion of the coal-lands owned by the present organization upon condition that the coal mined should be always transported over its line to Rondout.

Delaware and Hudson Canal Company.

Pennsylvania Coal Company.

A few years later, however, when the Erie Railroad was in full operation, and the organization of the Pennsylvania Coal Company had somewhat changed, it began shipping coal over the new route to Jersey City and other points. This action of theirs gave rise to a famous lawsuit between the two companies, which lasted for a long time, and was conducted with a great deal of ability as well as bitterness. The president of the coal company studied law, so it is said, for the very purpose of taking an active part in the defence of the suit, and was, in fact, the chief counsel in defending the company from its enemies. In the end the Pennsylvania Coal Company won their cause, which virtually ended the agreement; and since that time it has transported coal over the Erie Railway without any further interference by the rival concern.

Lawsuit between Delaware and Hudson and Pennsylvania Coal Company.

The Delaware and Hudson Canal Company was not simply a carrier of coal, but mined it also, having purchased large tracts in the beginning, and added more from time to time, according to the judgment of its managers.

Miner and transporter of coal.

In 1853 two other railroads were chartered, which also engaged in the business of mining coal, as well as in transporting it, — the Delaware, Lackawanna, and Western Railroad, which entered the northern coal-field at Scranton; and the Lehigh-Valley Railroad, which confined its operations to the middle coal-field. Although it was simply a carrier of coal in the beginning, a union was effected with the Beaver-Meadow Railroad, which was also a miner; and thus the fifth great mining-concern was engaged in this great and rapidly-growing industry.

Delaware, Lackawanna, and Western.

The year previous, however, the New-Jersey Central Railroad, concerning which so much has been heard of late, was chartered to extend from the sea-coast to Easton, Penn., on the Delaware River. At first it was simply a transporter of coal; but, not content with doing this, it

New-Jersey Central.

was possessed with a more ambitious aim, and accordingly leased the Lehigh Canal and the Lehigh and Susquehanna Railroad Company, together with the mines which these concerns were operating, and, in addition, the Wilkesbarre Coal Company, which was chartered in March, 1849. These six companies have been the chief miners and transporters of anthracite coal for several years, although other concerns have also mined and transported considerable quantities. The chief interest of anthracite-coal mining, however, centres around the railroad corporations above mentioned, which united the business of mining with that of transporting coal.

Five companies chief miners and transporters of coal.

Until within a very few years, the Delaware and Hudson Canal Company had been uniformly prosperous. Its affairs have always been conducted by a conservative board of directors; and with its short, easy, and cheap mode of getting coal to tide-water, for years it yielded rich returns, and all of its affairs were highly prosperous. But, when other railroads undertook to mine as well as to transport coal, this concern also believed it was necessary, in order to retain its markets, to lease and build railroads; and, accordingly, the Albany and Susquehanna Railroad was leased, and other roads extending northward to Whitehall and Rutland, while a railroad was built from the former point to Montreal. This was a bold push, and the experiment has not yet proved successful; but it is too early to pronounce final judgment upon the scheme. The new policy has its friends and its enemies; and a much longer space is required to determine whether it will fulfil the anticipations of its projectors, or continue a burden from which relief in some way must ultimately be sought.

Later history of Delaware and Hudson.

Concerning the New-Jersey Central, its history is fresh in the public ear; for its terrible collapse occurred only a short time ago. For several years after its plans were developed, it was successful. Enormous quantities of coal were mined and transported; its stock rose very high, and was regarded so secure, that large numbers of persons along the line of the road invested in it, in some cases, all they possessed; trust-funds were put into it; and it was supposed to be one of the most profitable concerns of the day. But the company saw its unlucky hour, and collapsed, scattering ruin and misery far and wide. The immediate causes of this sudden decline will be soon given.

Later history of New-Jersey Central.

The history of the Reading Railroad is, perhaps, the most astonishing of all the railroads concerned in mining coal. In the beginning it was simply a carrier, the mining of coal being done by a large number of operators, who, for the most part, leased the privilege of mining, as we have previously described. But, like the Delaware and Hudson Canal Company, it felt impelled to unite the two branches of mining and transporting coal: so another company, called the Reading Coal and Iron Company, which was really the same thing as the railroad itself, was organized,

Later history of Reading Railroad.

principally to engage in the business of mining this fuel. At once it began the purchase of coal-lands, and this policy was continued until large tracts were acquired. New mines were opened in every direction, railroads were built and leased, and large tracts in the anthracite-coal field were purchased. Pretty nearly the entire anthracite-coal field is now owned by the five companies which have been already described.

Pennsylvania Central.

The Northern Central Railroad of Pennsylvania owns some coal-land in the Shamokin Valley, which lies in the middle coal-field; and, as this company is leased to the Pennsylvania Central Railroad, it may be reckoned as the sixth largest concern engaged in the business.

Effect of new policy.

While the Reading Railroad was merely a transporter of coal, its dividends for many years were regularly earned and paid; but, with a change of policy (whether necessary or not is a question lying outside of our province), the outlay for the extension of roads and leases, the purchase of coal-lands, and the opening of new collieries, were attended with enormous expense. Then the strikes occurred which we have already described, and the prices of coal began to decline; and the railroads which were engaged in this business of mining coal saw that it was necessary to do something in order to continue the payment of dividends. The production of coal had enormously increased, and so had their expenses: what, then, was to be done?

Combination.

It was finally determined to form a combination for the purpose of limiting the production of coal, the amount which each of the five companies should furnish, and the rates for selling the same. This seemed a bold measure, and was strenuously opposed by many of the newspapers; but the companies saw no other mode of relief. Such a combination was no new thing; for long ago English mine-owners united for the purpose of fixing the price of coal.

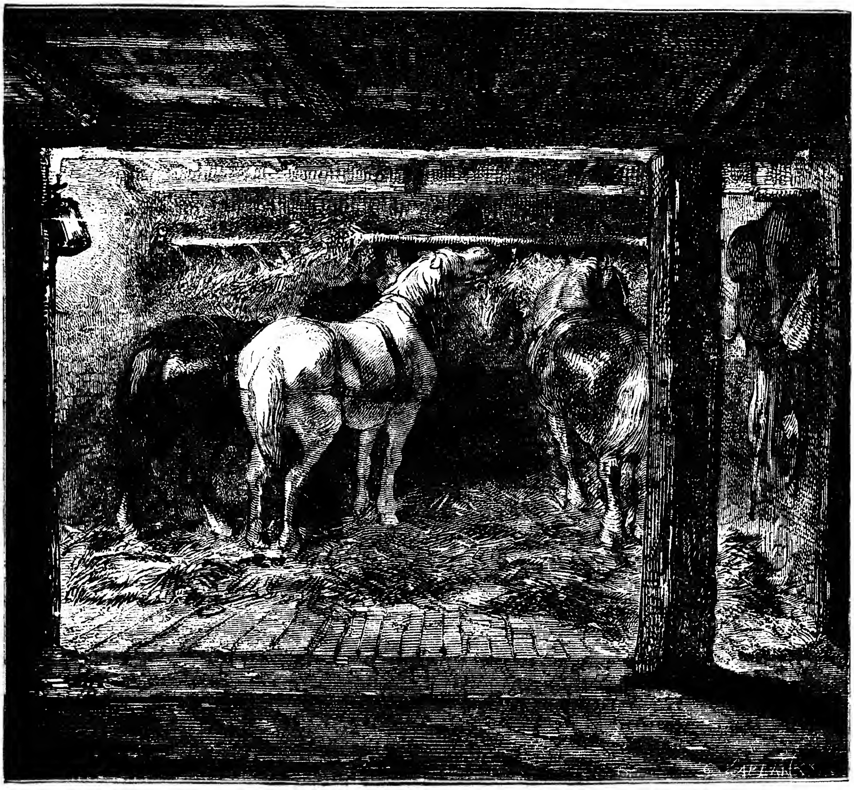
Short life of combination.

Evasion of agreement.

This modern combination, which was formed in 1873, had only a short life; though, during the three years in which it held together, it had a very remarkable history. Great as the necessity for its existence seemed to be among those who entered into it, they were constantly violating it in one way and another, each being anxious to dispose of more coal than was permitted by the agreement. All sorts of schemes were devised for escaping from it; while, of course, each concern strenuously maintained that the others should maintain the compact inviolate. All the railroad-companies transported more or less coal for private operators; and, as the quantity which they were allowed to mine was not fixed in the stipulation, in some cases their product enormously increased, although it was generally believed that the railroad-companies themselves were carrying and selling their own coal under other names. Then rates were cut, and various expedients were resorted to by the several companies to increase their sales beyond the limit fixed by agreement.

One of the new phases which appeared in the business was the cutting-out of the middlemen, in great measure, by the Reading Railroad Company. It sold coal by retail, as well as in larger quantities, at Philadelphia and other places, and sought, so far as possible, to bring consumers into direct communication with themselves, thus saving the profits of the middlemen. This caused some ill feeling among them, as one may readily

War on middlemen.



STABLE IN A MINE.

imagine who knows any thing about human nature; and they succeeded in procuring an investigation, by order of the legislature of the State of Pennsylvania, into some of the doings of the Reading Railroad, particularly their mode of selling coal. The company emerged from the contest completely victorious; and since then nothing has been said about short weights and other practices on the part of this concern.

Investigation of Reading Railroad by legislature.

The repeated violations of the agreement among the companies concerning the production and sale of coal led to an abandonment of it, and at once the price of coal began to decline. This also affected the price of stocks; and after a short time the New-Jersey Railroad succumbed, and passed into the hands of a receiver. Thousands who had invested their fortunes in it were either seriously crippled or ruined; for the stock rapidly fell from 116 to 23. Never was the collapse of a vast corporation more unexpected, sudden, or terrible; never were the judgments of men more completely set at nought; never was a solid enterprise more speedily ruined by too sanguine calculations, and what proved to be unwise management.

End of combination, and effect of dissolving it.

BITUMINOUS-COAL MINING.

The bituminous coal field is far more extensive than the anthracite; for it underlies the western half of Pennsylvania, the eastern portion of Ohio, West Virginia, Eastern Kentucky, and, stretching through Eastern Tennessee, extends as far as Alabama, embracing an area of coal-bearing rocks of nearly fifty-eight thousand square miles. Coal of this kind is also found in Michigan and Indiana; the bed in the latter State being a continuation of that in Illinois, where was made the first discovery of coal of which any written account is preserved. It was discovered by Father Hennepin in 1669; and in his Journal, published in 1698, there is a map on which is located a coal-mine by the side of the Illinois River, near Ottawa. This, unquestionably, is the earliest notice on record of the existence of coal in America. The coal-bearing strata comprise a larger area than in any other State in the Union, although the coal-measures of Iowa, Kansas, and some of the other States, are very extensive.

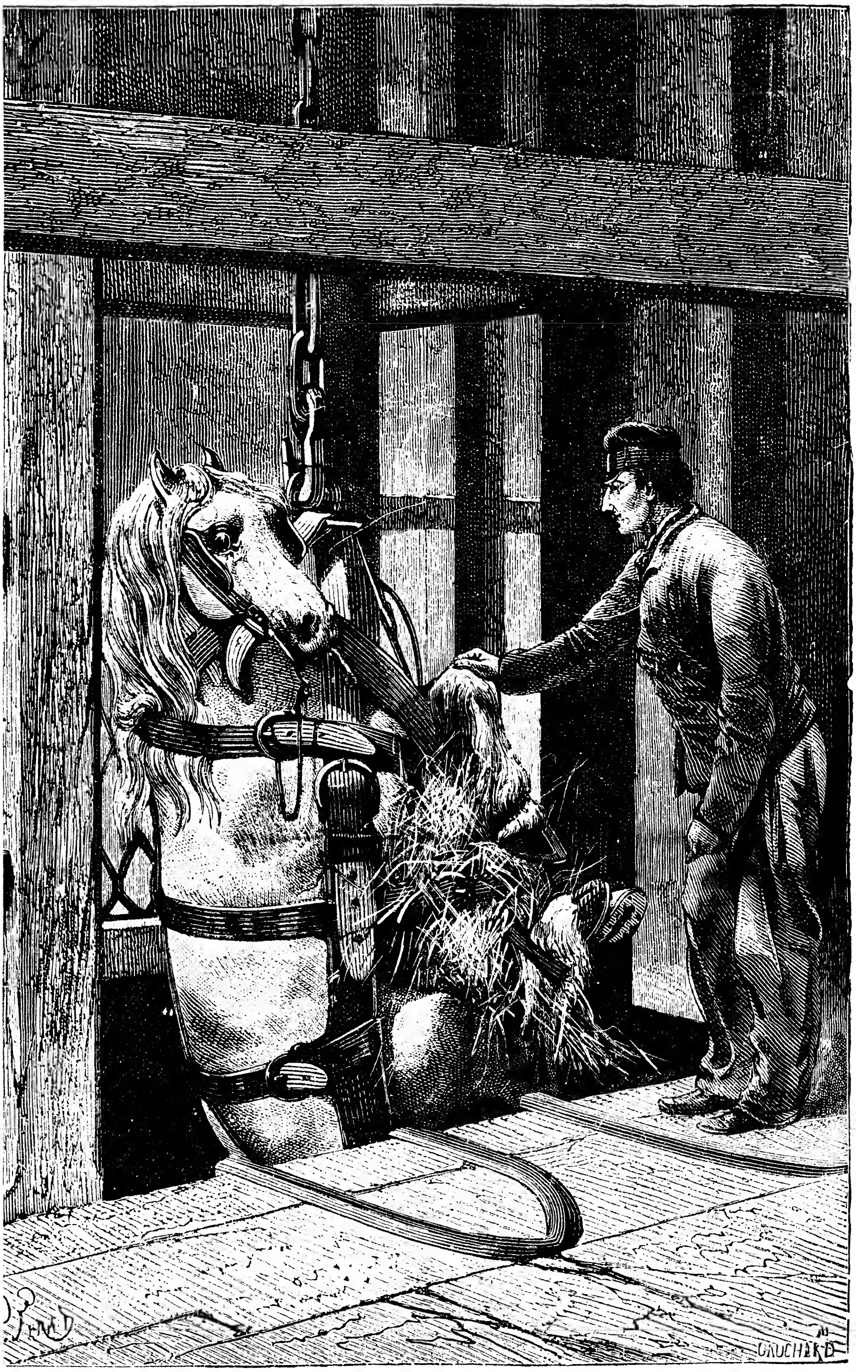
Extent of bituminous-coal field.

Along the eastern border of the field in Pennsylvania and Maryland are several small areas which contain a semi-bituminous coal, which lie between the pure bituminous coal farther west and the anthracite regions on the east. The position of this coal, thus lying between the two so differently-formed coals, has given rise to a great deal of speculation concerning the formation of coal; but no theory has yet gained extensive currency. The two localities most extensively worked are Blossburgh on the north, and Cumberland, Md., on the south; but there are other points which have been worked to advantage, — at Broad Top, Johnstown, Towanda, and Ralston. The Blossburgh region was opened by railway in 1840; and two years later the Cumberland field was pierced by the Baltimore and Ohio, which first brought this coal to tide-water, displacing the bituminous coal of Virginia.

Semi-bituminous-coal field.

This enormous area of bituminous coal, which, including lignite, stretches across the continent, and as far north as Alaska, is being continually opened up and employed for a highly useful purpose. The mode of extraction somewhat differs from that in the anthracite mines; and as the openings are far more numerous, while the men

Area of bituminous coal.



DESCENT OF A HORSE DOWN A MINE-SHAFT.

employed in each are fewer, no such extensive combinations among them have arisen, nor have strikes been so numerous or disastrous. Still there have been some, especially in Ohio, and of a very serious nature too, requiring the presence of troops to protect the property of the operators and of those who were willing to work. But a more curious condition of things happened in the autumn of 1876 in the coal-districts of St. Clair and Madison Counties, Ill., from which St. Louis, the manufacturers around there, and the steamboat interest, chiefly derive their supplies. It is not often, especially in these "hard times," that the spectacle is presented of a numerous body of workmen voluntarily going into idleness in order to get lower rates of wages; yet that is precisely what happened in this instance.

Strikes less frequent than in anthracite-coal fields.

Until February, 1876, the miners were getting out coal at the rate of two cents per bushel. They had formed a Union among themselves; but, as there never was a Union yet which did not generate a non-Union, it was not long before it was discovered that a numerous body of "blacklegs" (the *sobriquet* of men not belonging to the society) were at work for less than the regulation prices. Thereupon, in order to beat them with their own weapons, the Union men proposed to the operators to work for one cent and a half per bushel. Their intention, of course, was to starve out the non-Unionists; but the operators, failing to discover how their interests would be promoted by the adoption of a crushing-out policy of this kind, refused to accede. The Union men then quit work, and remained idle for a fortnight or so; when, failing to carry their point, they returned to work at two cents a bushel.

Singular strike.

The Western coal-miner has been more fortunate in obtaining and retaining higher prices for his work than his fellow-laborer in the anthracite regions. Yet, since this strike occurred, several reductions have been made; though it is probable that in every case these were necessary in order to save operators from a loss. Heavy as the decline in wages has been, those operating mines in many cases have lost much.

Higher wages received by Western coal-miner.

Concerning other strikes among the miners, as we shall consider them in another place, it is unnecessary to say more here. The development of bituminous-mines has never involved so much risk and large preparatory outlay as anthracite-mining, and production has kept more nearly apace with the wants of the people: consequently no great panics or collapses have occurred; and the history of the business, as a whole, has been peaceful, and fairly prosperous. It is true that disturbances in some localities have arisen from strikes and other difficulties with the miners; but, for the most part, these have been short, and no severe losses have followed in their train.

Bituminous and anthracite-coal-mining compared.

It is more difficult to collect statistics concerning the production of bituminous coal than anthracite, on account of the much larger number of mines, and varied regulations of the different States; but we will close the chapter by adding a few, which at once show the importance of this branch of coal-production: —

Statistics.

STATE.	TONS.
Pennsylvania	7,800,356
Maryland	2,345,153
West Virginia	608,878
Ohio	2,527,285
East Kentucky	35,488
Tennessee	133,418
Alabama	11,000
Michigan	28,150
Indiana	437,870
Illinois	2,624,163
West Kentucky	115,094
Iowa	263,487
Missouri	621,930
Nebraska	1,425
Kansas	32,938
Arkansas	
Texas	
Virginia	61,803
North Carolina	
Massachusetts	
Rhode Island	14,000

The above table represents the production of bituminous coal during the year 1869: the production of anthracite for the same year was 16,375,678 tons.

YEAR.	TONS.
1870	17,819,700
1871	17,379,355
1872	22,084,083
1873	22,880,921
1874	21,667,386
1875	20,643,509
1876	19,000,000
1877	21,323,000

CHAPTER VII.

IRON.

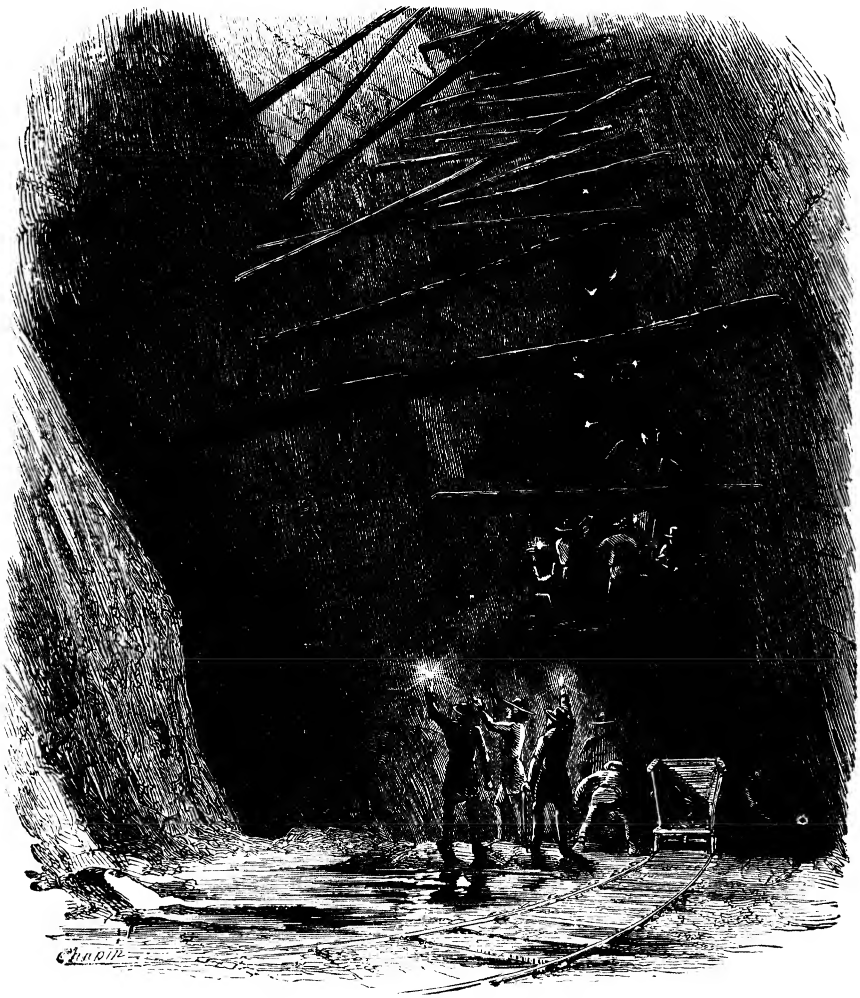
THERE is no known variety of iron ore entering into the commercial and industrial transactions of the world, no matter how famous or rare, which does not have its exact counterpart in the United States. The celebrated ores of Sweden, which supply to England the best iron she makes, have an exact *facsimile* in those of Central North Carolina; while New York and other States possess ores substantially resembling them in great abundance. The equally famous blackband iron of Scotland is duplicated in Ohio, Virginia, and Alabama; the titaniferous ores of Norway lie in great beds of incalculable richness and value in Northern New York and Virginia; the spathic ores for steel-making (carbonates) are abundant in Connecticut and New York; and the manganiferous varieties, so desirable for the manufacture of spiegeleisen (consumed in the Bessemer steel-works), exist in Missouri and elsewhere in all luxuriance. The whole Lake-Superior region abounds in hematites and magnetic ores of the richest character, and Missouri contains deposits unequalled in extent and purity in the most celebrated regions of other parts of the world. Bog-iron ores are scattered all along the northern Atlantic seacoast. Not only in quantity, but in variety, the iron of America is the most remarkable in the world; and when we consider that its quantity is so enormous that it cannot be exhausted for centuries to come, nor the fuel required in its manufactures, it will be seen how favored a part of the earth is this republic. Its people, with such supplies of iron to manufacture, are certain to be rich, strong, free, and aggressive, even if there were nothing in the character of the race to make them so.

Variety of ores.

The first iron-mining in the United States was done in Virginia by the early colonists of Jamestown. The little band of white men who emerged from the ship which had brought them from England, like the animals from Noah's ark, to populate and occupy a new and strange world, kept their eyes wide open and their wits about them when they took up their residence in Virginia; and they were soon aware of all the resources of the region of which they had taken possession. John

Early iron-mining in Virginia.

Smith, having returned from his voyage up the Chickahominy River, which he had thought was a water-way leading to the Pacific Ocean, settled down to the conviction that the Virginia Colony would have to depend for its future wealth on the resources of Virginia alone, and not on those of India; and he



IRON-MINE.

set about with his people to labor truly to get a living in that part of the world to which it had pleased God to call them. One of the first discoveries which was made created a great excitement in the colony, which took the form of what would be called in the Territories in these times a gold "stampede."

The gold "stampede."

Iron pyrites had been found; and the excited colonists, who immediately saw themselves rolling in wealth in their mind's eye, sent a ship-load of it to England. This was the first iron-mining in America. Gloom followed the discovery of the true character of those yellow crystals; but that did not prevent Virginia from being the first colony, after all, to begin iron-mining seriously. The bog-ores and brown hematites of the vicinity were soon brought to light; and in 1608 a quantity of them was sent to England, and seventeen tons of good merchant-iron extracted therefrom. In 1620 iron-works were erected to utilize these ores. In 1702 the bog-ores of Massachusetts were put to use; and, for a century at least after that date, the spongy iron crusts from the bottoms of the bogs all along the whole North-Atlantic coast were taken out freely, and converted into pig and bar iron by the colonists.

Salisbury ores of Connecticut.

The stony ores of iron in Connecticut were discovered as early as 1651, when Gov. Winthrop obtained a license, with extraordinary privileges, for the working of any mines that he might choose to open. The legislature took cognizance of the ores of the State several times afterward. It does not appear, however, that any iron-mines were worked, in consequence of the charters and privileges granted, until very nearly the time of the Revolutionary war. The famous Salisbury beds of brown hematite (a hydrated peroxide containing fifty or sixty per cent of metallic iron) were then opened. These beds were a great source of strength to our forefathers in the Revolutionary war, and they have now been the means of supporting the population of that part of Connecticut in active and profitable industry for a period of over a hundred and thirty-five years. The Salisbury ore-hill still supplies the furnaces of the Barnum-Richardson Company, and the metal retains its reputation to-day for a good tough car-wheel iron. The quantity of shot, shell, and cannon, cast from Salisbury iron during the fight for independence, was very large. Another iron-mine of Connecticut was also worked at a very early date. It was opened at Mine Hill in Roxbury in 1760, as a silver-mine, by Hurlbut and Hawley, and was worked again in 1764 under a German jeweller named Feuchter. It is said that this latter ingenious person supplied the company from time to time with a small ingot of silver, which he said he had obtained from the mine, but which is at present believed to have been obtained, if at all, from Mine Hill, by a process which is popularly termed in these days "salting." These ingots affected the company as the bag of oats on the wagon-tongue affects the charger harnessed behind it. They were a stimulus to renewed efforts to reach the rich stores of silver which were ever thought to be only a few feet farther down in the rock; and the company kept on until it had sunk a shaft a hundred and twenty-five feet deep: it then gave up in disgust. A New-York company afterwards tried its hand at silver-mining here, and still later a Goshen company. Finally a resident of the locality, by the name of Asahel Bacon, who realized better than the other owners of the mine that the way *ad astra* was not up a step-ladder, and who saw more wealth in hunting, *per aspera*, for a humbler metal than silver, tried the mine for iron, and got out an ore which yielded a very tough iron and an excellent steel. It was thereafter mined only for iron.

New Jersey, Pennsylvania, North Carolina, and Maryland were also mining iron twenty or thirty years before the Revolution. The first-named State has always been the main dependence of the furnaces of the great Lehigh region in Pennsylvania. Its ores are the rich magnetic oxides, with some specular peroxides and limonites, and are needed in Pennsylvania for mixture with the brown hematites of that region. In New York the mines of the northern part of the State were opened after 1800. The iron of the other States of the Union was taken from the ground, and manufactured, as fast as the wave of population flowing in from the Eastern States and from Europe had subdued the soil, and had given the different localities a census large enough to demand the creation of other industries besides agriculture.

Iron-mining before the Revolution.

The citizen who is interested in the resources of his country, and desires a general idea of the subject now under discussion, would not be edified by a minute account of the beginning of the mining-industry in each of the several States of the Union. The details would be confusing, and no useful end would be subserved by relating them. Instead of going into the subject in that way, it is proposed to give merely a general account of the character of the principal ores found in the United States, and of their distribution. The character of the deposits of a few of the great iron States will be glanced at afterwards, with possibly some detail.

There appears to be no better practical classification of the ores than Professor J. P. Lesley's. It is as follows: —

Classification of ores.

1. Primary ores, including the specular and magnetic, and the red oxides or red hematites.
2. Brown hematites (limonites).
3. Fossil ores.
4. Carbonates, including those of the coal-fields.
5. Bog-ores.

Three-quarters of the iron made in the United States is from the first two classes. The magnetic ores are the richest of all. They are an oxide of iron containing about seventy-two per cent of iron and twenty-eight per cent of oxygen. They are heavy, black, compact, or in coarse crystalline grains, and mixed with quartz and other rocks. Chunks of the ore are magnetic, and not only affect the needle, but often support small bits of iron like nails. The richness of this variety of iron ore makes it peculiarly fit for working in a bloomary-furnace. The Catalan forge, invented in old Spain, was set at work upon this class of ore; and in Northern New York and North Carolina, where it abounds, a large number of bloomaries are still employed in its reduction.

It is often difficult to work, and is consequently more generally smelted with the hematites.

Specular ore, so called from the shining plates in which it is often found, is a peroxide of iron containing seventy per cent of the metal and thirty per cent of oxygen. It is very nearly the same as the magnetic variety, but differs from it in being red (making a red powder instead of a black powder), and having distinct qualities, which are observable in smelting. It makes metallic iron very fast. It is generally found in the vicinity of the magnetic ore, and is widely distributed throughout the United States. The red hematites are merely a variety of the specular ores.

Specular ore.

The fossil ores, which comprise the so-called red fossiliferous and oölitic ores, are found in shale, limestone, and sandstone formations, in bands of ore which are generally from one to six feet in thickness. Attention has been recently called to the enormous deposits of red fossiliferous oxides in the State of Alabama, where they exist in bands from fifteen to twenty and thirty feet in thickness. The fossiliferous ores appear to have been formed by the filtration of iron into beds of marine shells, which they gradually replaced in the form of peroxide of iron. They vary in richness from twenty to sixty per cent of metallic iron. Wisconsin has seventy-five per cent ores. The beds abound in the forms of organic life, encrinital stems, and fossil shells. The oölitic variety is often found compact; but, both in Middle Pennsylvania and Wisconsin, it appears often in the form of grains resembling flaxseed. The fossiliferous variety is divided into hard and soft ores, the former often resembling red hematite; but its blood-red powder always betrays its true character. The red oxides are eagerly sought after wherever found. They contain carbonate of lime and silica, and are therefore easily worked; and their richness and good qualities make them desirable ores.

The hematite ore is a peroxide of iron containing from seventy-two to eighty-five per cent of the metal. This class of ore constitutes the great body of the iron of Pennsylvania, Connecticut, and Tennessee, and is found in greater or less degree in all the iron-producing States. It occurs in large deposits of irregular form, sometimes in ledges and strata of great size, as in Missouri and Pennsylvania, and often in scattered lumps and blocks. In Michigan it occurs in lens-shaped masses of great extent. The hematites are readily and cheaply worked; but, as they contain very little silica, the magnetic ores are generally added to them, these ores containing quartz; and a silicious limestone is employed for a flux in smelting.

Hematite ore.

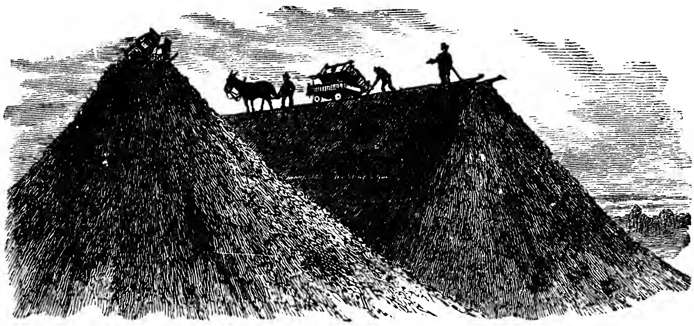
The carbonates are not of the highest importance; but they are good ores wherever found, and are so readily reduced, owing to the amount of lime they contain, as often to require no flux whatever. They occur in Great Britain in enormous quantities, but occupy a minor position among the ores of the United States. The carbonates are found in seams, in balls, or flattened spheroidal masses, and are often called the "kidney" ores in consequence. They are easily picked out of the shales in which they exist. The spathic ore is a carbonate. The mine in Roxbury, Conn., to which allusion has been made, is of this variety. It contains sixty per cent of the protoxide of iron, thirty-six of carbonic acid, and some manganese, lime, and magnesia.

Bog-ores.

The bog-ores form at the bottom of ponds or in sandy loam, being deposited by chalybeate waters. They formerly were worked to a large extent in the coast States, but attract little attention now, except in Wisconsin, where they are found in extraordinary abundance in Wood, Portage, and Juneau Counties.

Distribution of ores.

As for the distribution of the iron ores of the United States, it would be far easier to tell where iron does not exist than to set forth where it does. The great magnetic iron-range of North America begins in Maine, and courses thence southward through the coast States in a massive rampart until it terminates in an abutment upon the Gulf of Mexico. In this range the magnetic, specular, red hematite, and limonite (brown hematite) ores are found in close proximity to each other, and in masses which set figures at defiance, and absolutely overwhelm the imagination. In Pennsylvania the magnetic and specular ores about entirely disappear from the range, though they are present in it, and are occasionally worked. They re-appear after passing the border of the State, however, and are found in every commonwealth lying between Pennsylvania and the Gulf, including Kentucky and Tennessee. As though Providence had designed that this republic should present a front of iron to the foreigner in every direction from which a foe might invade our soil, the immense metallic deposits of the Atlantic States repeat themselves in the Lake-Superior region in the States of Michigan, Wisconsin, and Missouri, extending as far south as into Arkansas. The ores are magnetic, specular, and hematite. Farther westward, in the Rocky Mountains, and in Oregon and California, these ores have been discovered in inexhaustible beds; and in the Territory of Utah a deposit has been recently brought to light in the southern part of the Territory, which presents an iron scowl toward Mexico, and which is, perhaps, the richest discovery of iron yet made on this continent. Twenty-eight mountains, the smallest the size of the famous Iron Mountain of Missouri, stand in a group, absolutely laden with the richest forms of the ore; and China, Japan, India, and Mexico could draw their supplies of iron and steel from that group of peaks alone for ages. Indiana, Illinois, and Iowa, lying within the iron rampart which seems to rear its head upon every border of the republic, contain no important bodies of iron ore. Indiana and Iowa contain carbonates and bog-ores which are workable; but Illinois has very little iron of any character, and that little so contaminated with sulphur as to be worthless. All except Iowa are great iron-working States; but they get their ores from Michigan and Missouri. Ohio receives about five hundred thousand tons from Michigan. The position of these three States as iron-manufacturing regions is due to their beds of coal, it being found as a rule that it is cheaper to transport the ore to the coal, and that consequently the great coal States are more likely to be filled with blast-furnaces and rolling-mills than those which have iron, but no fuel, and are distant from the coal-measures of the country. The carbonates appear all to lie within the basin surrounded by the magnetic iron-range. They are abundant in Eastern Kentucky, in the Hanging-Rock region of Ohio, and in Central Pennsylvania; and they exist in West Virginia, Connecticut, and Indiana. The fossil ores are found in Western New York, Pennsylvania, Tennessee, Kentucky, Alabama, and Wisconsin. Titaniferous iron is found in large quantities in Northern New York, and also in North Carolina, Virginia, Vermont, Rhode Island, Pennsylvania, and probably elsewhere; while the manganiferous ores, so valuable for the purposes of Bessemer steel-making, exist in Georgia, Missouri, Maryland, New Jersey, Arkansas, and Maine. Blackband veins are found in Muhlenburgh County and on the east fork of the Little Sandy, in Kentucky; in Tuscarawas County, O., where the



IRON-DUMPS.

largest supply in the country is found and worked; and in small quantities in Virginia, Alabama, and Pennsylvania. The last ore of any account, the first one worked in this country (namely, that taken from the bogs), was once worked extensively in Delaware, where, between 1814 and 1841, about three hundred thousand tons were taken out. Extensive deposits are found under a black mould near Georgetown; but they are neglected now, and there is not a blast-furnace in the State. Bog-ores are found in all the northern coast States, though they are no longer worked, and also in Indiana and Wisconsin.

In some of the States of the Union the deposits are of such enormous extent, and so interesting in character, that they deserve special mention.

Lake-Champlain region.

New-York State has long been celebrated for its mines, especially for those of magnetic and specular ores in the wild region lying between Lake Champlain and Lake Ontario. Not only has New York supplied her own furnaces from these mines, but also those of other States; and she has also furnished all the rolling-mills east of the Alleghanies from them with the material for fettling or lining the plates of the puddling-furnace. So important are these ores to the iron-makers of the country, that they contract for them regularly at the beginning of every year; and the mine-owners pay no attention to orders received after a certain date. The most extensive deposits are in Essex and Clinton Counties, where they occur in vast cliffs and ledges, in masses and veins, as black oxides, also as a red powder, and in steel-bright crystalline masses. West of Port Henry are beds of great purity, now the property of the Port Henry Iron Company, where the ore is sixty feet thick, and is worked in an excavation a hundred feet deep, and from a hundred to three hundred feet wide. This ore, mixed with phosphate of lime, makes an excellent fertilizer; and it is a curious fact, that works were once built at this mine to manufacture fertilizers, to the neglect of the iron. Immense deposits occur also in Franklin, Jefferson, St. Lawrence, and Warren Counties, all in that region; but they have been scarcely touched as yet. In Warren County there is a bed of magnetic ore at least eight hundred feet thick. Work upon it began some time ago, but was abandoned for the reason that titanic acid was found present in it in considerable quantities, and the furnace-men did not know how to treat the ore. The same is true of other deposits of this region Titanic acid has been a great terror of the furnace-men of the United States; and they have hitherto neglected ores containing it, notwithstanding the fact that the pig-iron made from them is worth twice as much in the market as other iron. The celebrated titanic ores of Norway have been successfully worked in England; and the product brings a price three times as great as any other iron, owing to the circumstance, that, when worked into armor-plates, the iron will sustain a terrible strain, equal to a hundred thousand pounds to the square inch. The strongest cast-iron ever tested in America stood no more than fifty thousand pounds' strain. It is believed that the titanic ores of New York will now no longer be neglected. Sheffield capital has, it is said, been attracted to the region within the last five years; and the ores will probably be mined ere long, on a large scale, for steel-making. Iron-men claim that the working of titanic ores constitutes to-day one of the most inviting fields for the employment of capital. In Southern New York, near the mouth of the Hudson River, magnetic ores exist in Putnam, Orange, and Westchester Counties, and red and brown hematites in Columbia and Dutchess Counties, in astonishing abundance. The Stirling mines of Orange County were discovered in 1750 by Lord Stirling, who owned them. The iron was sent to England, and was noted for its strength and polish.

Rhode Island.

Rhode Island, without a single blast-furnace, and almost wholly given up to cotton spinning and weaving, contains more iron, in proportion to her population, than any State in the Union. The principal deposit is at Cumberland Mountain, which is one great bed of iron. The ores of the State are magnetic and red hematite. As early as the French war in 1755, the colony worked the Cumberland mine, mixing the ore with hematite from Cranston, R.I., and casting cannon therefrom to be used in battle against the French and Indians. In 1800 cannon were again cast from these ores, at the village of Hope, by Mr. John Brown, who had a contract with the government, and who cast his guns hollow. One, perhaps more, of these old guns, is still in existence. Rhode Island entirely neglects her mines, owing to the lack of coal; but her lines of coal-steamers from Philadelphia ought now to supply her with the means for working these deposits. The industrial production of the State could be easily doubled by the mining of iron.

Pennsylvania.

Pennsylvania contains more than one-third of the blast-furnaces, and produces fully one-half of the pig-iron, of the United States. Nevertheless, without her priceless mines of coal, she would scarcely be a great iron-manufacturing State. She is surpassed in wealth of iron ore by at least fifteen other States in the Union, and is obliged to import hundreds of thousands of tons of ore annually from New York, Michigan, and New Jersey, in order to work her own iron successfully. Magnetic ores are rare in Pennsylvania, and form no great part of the product of the State. The principal dependence of the furnaces, as far as local ores are concerned, is upon the brown hematites, or limonites, which are found in limitless quantities throughout the eastern, south-eastern, and central portions of the State. Fossil ores are found in Central Pennsylvania and the Broad-Top region of the southern part of the State in great abundance; but the ores are lean, and the iron of this great State is principally made from the brown hematites mixed with the magnetites of other regions. Discoveries of iron are being made every year by the Pennsylvanians. It is an interesting fact, as showing the former imperfect state of information about iron in this country, that the old Cumberland furnace, built in 1790 at Dickinson in Cumberland County, had great difficulty in its early years to obtain ore. Most of what the furnace consumed was taken from mines miles away, and hauled over bad roads at a great expense of trouble and time. Recent investigations have disclosed the fact that the furnace was itself actually planted upon a bed of ore of vast extent, of the existence of which no one had had any knowledge.

New Jersey.

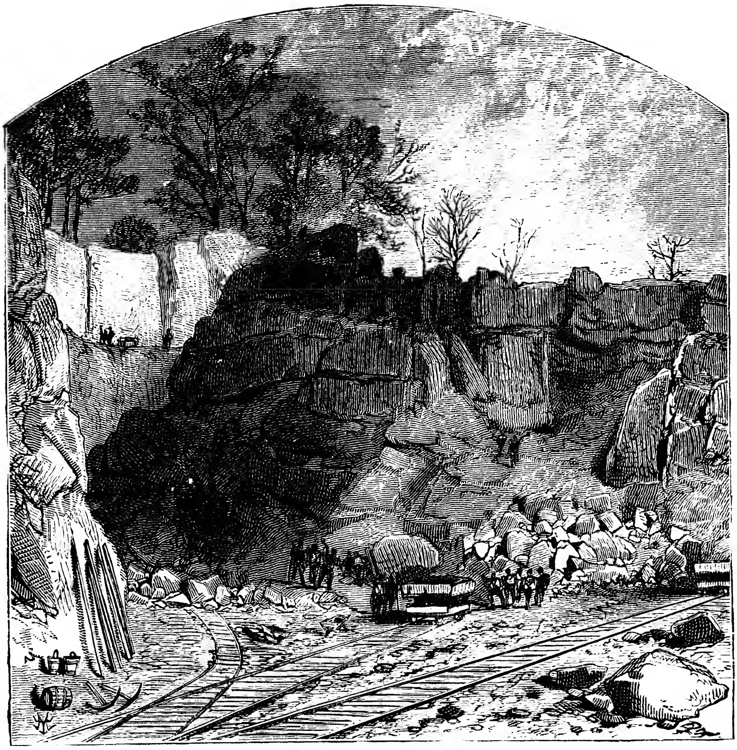
The New-Jersey mines have yielded as much as 670,000 tons of ore in a year, that being the case in 1873; but never has there been a production of pig-iron of over 150,000 tons therefrom, and the production at present is only about 30,000 tons a year. This result is due to the exportation of the greater part of the ores to Pennsylvania, where they are consumed by the great furnace-companies of the Lehigh coal-region in admixture with the Lehigh hematites. The ores are almost entirely magnetic oxides, with some specular peroxides and limonites. They lie in the counties of Sussex, Passaic, Morris, and Warren, covering an area of four hundred square miles, and show no signs of exhaustion, though some of them have been worked for a century and a half. The Franklinite magnetic ore of the Wallkill Mountain is remarkably curious and refractory. It is a black ore containing sixty-six per cent of peroxide of iron, sixteen per cent of zinc, and seventeen per cent of red oxide of manganese. It supplies an iron of wonderful strength and hardness, and is greatly used in the construction of burglar-proof safes.

The Virginias. The two Virginias are both full of iron. They produce little in the manufactured form yet, being fourth-class States in that respect; but their future is a great one. The colonial manufacture was of bog ores and brown hematites near the sea. The great deposits of the Virginias were not then known: they have, in fact, only been brought to light of late years. Every effort at examination now reveals fresh iron in some part of the State. As far as discovery has gone up to the present time, it indicates the existence of the most valuable deposits of magnetic and red oxides, and rich brown hematites, all along the eastern slope of the Blue Ridge, especially along the James-River Valley near Lynchburg. In this iron belt the metal is found in such quality, that in 1871 it was bringing fifty-five dollars a ton in Philadelphia; while Lehigh iron was selling for thirty-five and forty dollars. Brown oxides and carbonates are also found in the Appalachian coal-fields. The ores are lean, but abundant. In West Virginia so much of the country is still under timber, that its resources with respect to iron are ill understood; but rich red and brown hematites certainly exist in Putnam, Giles, Craig, Monroe, Alleghany, Mercer, and Tazewell Counties. The State has an abundance of timber and coal for working them.

Kentucky, Tennessee, and North Carolina. The great magnetic iron-range which we have so far been following goes on through Tennessee, Kentucky, and North Carolina, endowing each of those States with an immense wealth of ore, and ends at the Gulf of Mexico in the magnificent deposits of the State of Alabama. Alabama is still a virgin region; but so huge are her stores of iron and coal, so near together do the iron, coal, and limestone lie, and so near are they all to the sea, that it is supposed that to this State the world may look for its future supply of cheap pig-metal. Iron can be made in Alabama, and transported to England and sold there, with more profit than the same grade of metal can be made for in the kingdom. Capital could be more judiciously invested in the mines of this young and aspiring State than on lands in any other part of the world. The ores are the red hematites and the fossiliferous. The latter of these extends from a point near Pratt's Ferry in Bibb County to the upper end of Wills's Valley in De Kalb County: on the west it runs up to Murphree's Valley. The veins often "pinch" to one foot in thickness; but sometimes they are six, ten, fifteen, and thirty feet in thickness. The hematites occur in enormous beds in the northern part of the State. In the Red-Mountain region the stratum is of solid ore thirty feet thick, yielding about fifty per cent of metallic iron of the very finest description. The ore is the red hematite, soft, and remarkably dry. A common laborer, with a pick and crowbar, can get out a ton of it in a few hours. The brown hematites yield about fifty or sixty per cent of metallic iron. It is claimed that pig-iron can be produced in Alabama at twelve dollars a ton, the cost in Pennsylvania being twenty dollars a ton.

The Lake-Superior iron-mines were first opened about 1846. The first trials of their ores in the East were at the old Sharpsville (Penn.) furnace in 1854. In 1856 the shipments of Lake-Superior ores by Eastern furnaces had fairly begun, and amounted to 7,000 tons: since then the shipments have grown to over 1,000,000 tons a year. Michigan and

Lake-Superior region.



CUT IN IRON MOUNTAIN.

Wisconsin produced 190,000 tons of pig-iron in 1873, but now make only about 150,000 tons. Five-sixths of the ore produced is exported to Ohio, Pennsylvania, Indiana, Illinois, and other States. Only two classes of ores have been found in the Lake-Superior region, and they the richest and best: they are the rich hematites, containing about seventy per cent of metallic iron, and the magnetic oxides, yielding, when nearly pure, seventy-two per cent. A number of varieties of these ores are recognized as the specular, the slate, the soft red-and-brown, and the fine-grained and steely ores: they all occur in enormous beds, lying in the ridges running along the southern shore of Lake

Superior, and off southerly into Wisconsin. It is reported by the geologists that this iron was probably dissolved out of the pre-existing strata by chemical agency, and deposited by filtration in great horizontal beds, which were afterwards exposed to heat and pressure, and then upturned in folds and displaced. By subsequent erosion the tops of the ore-beds were removed, giving to the folds the appearance of fissure-veins. The largest hematite deposits are near Negaunee and Ishpening and at Cascade. Near Negaunee the deposits are lens-shaped, and one or two of them have been worked out. That region has sent 1,300,000 tons of hard and soft hematite ore to market since 1856. The ore of the Cascade region is a hard slate. In the vicinity of Humboldt and of Smith Mountain, eight miles therefrom in a southerly direction, are the largest mines of magnetic and specular ore now being worked in the State. At Humboldt a tunnel has been driven into the mountain to get access to the magnetic and specular ores of the Washington mine, which lie in four seams between strata of talcose, schist, and quartzite. The tunnel is 450 feet long, and cost $1,000,000. At Smith Mountain the richness and purity of the specular ore are unparalleled. The deposit lies against the north face of the ridge. Upon entering the openings of the mine the visitor is confronted with a face of ore as glittering and splendid as metallic silver, whose beauty is unblemished by seams of rock or inferior ores, but whose texture is as uniform as refined metal. Other rich mines are found to the westward of Smith Mountain, in the vicinity of Lake Michigamme, and also near L'Ance. They constitute what are called the mines of the Marquette District, — a region which contains the largest deposits of rich iron ores in the world. Northern Wisconsin contains deposits of the magnetic oxides similar to those in Northern Michigan: they are found principally in the Pinokee range. The State has also brown hematites, fossiliferous ores, and bog-ores.

Missouri.

The only other region that need be referred to in detail is Missouri. The deposits of this State all lie south of the Missouri River, with the single unimportant exception of the red hematite beds of Callaway County. The celebrated Iron Mountain is the largest single deposit of ore in the known world which is being worked. It may yet find a rival in the iron-peaks of Utah; but at present it stands without a peer. Deposits are frequent all through the southern portion of Missouri, extending also into Arkansas. Pilot Knob, Shepherd Mountain, Cedar Hill, and Buford Mountain, are among the great beds. The great mines are all being actively developed. The ore is sent out of the State almost entirely to be smelted, the export amounting to 400,000 tons annually. The principal species of ore are the specular, red hematite, and limonite. The oldest and richest deposits are in the iron-bearing porphyries, — a geological formation which is regarded as being of the same great age as those of Michigan, New Jersey, and Sweden. They exist in all sorts of shapes, veins, beds, and pockets, some very regular, and others broken and irregular. At Iron Mountain there are beds of specular ore on the surface from four to twenty feet thick, and, within the mountain, masses of ore with decomposed porphyry between. The ore is nearly a pure peroxide, containing seventy per cent of metallic iron. There are 2,000,000 tons of it in this deposit. Magnetic particles are scattered through the mountain. At Buford Mountain the ore is rich in manganese. The Pilot-Knob, Benton-Creek, and Simmons-Mountain mines are of specular ore, and contain from 500,000 to 1,500,000 tons each. The red hematites and limonites are scattered throughout the iron region in irregular deposits.

Richness of country in this mineral.

It ought to be evident from this hasty glance at the wonderful resources of this republic in respect to iron, and from the additional fact that the blast-furnace capacity of the country is now more than equal to its wants, that the era of high-priced metal through which the country has been passing, and which appears to have terminated with the panic of 1873, is really and truly at an end, as well as apparently so. With more iron ore than any other country in the world, with coal in unsurpassed abundance, and with means for cheap transportation fully adequate to the wants of the age, and an abundance of labor, we have all the requisites for the working of iron upon an enormous scale, and consequently for its production at a price which will bid defiance to foreign competition. It could only be by some extraordinary demoralization of the labor of the country, or some unwonted demand for iron in other parts of the world, that iron would ever be likely to rise again to seventy-three dollars a ton, as it did in the year 1864. The probabilities are, that America will, in the course of the next five years, become one of the world's regular sources of supply for pig-iron in competition with England.

CHAPTER VIII.

MINOR METALS.

AMONG the minor metals produced in the United States, zinc is the most important. Its existence in this country, in greater or less abundance, was discovered at a very early day. In one form or another, and often in combination with the ores of other metals, it was repeatedly found along the Appalachian chain. It was known in colonial days to be stored away in the Grand Monadnock in New Hampshire; but only the most insignificant quantity has ever been practically mined in that State. Northern New Jersey and Eastern Pennsylvania were also known to contain several compounds of zinc at an early day. The red oxide is only found near Franklin, Sussex County, of the former State; but sulphides, carbonates, silicates, and other ores, are found in that neighborhood and at the Wheatley and Perkiomen mines in Pennsylvania. The one county above specified, and Northampton County, Penn., are the only two in that section that are profitably engaged in the production of the metal. We have already spoken of the lead-deposits of Wythe County, Va.: zinc is also found there to a limited extent. The famous Davidson mines of North Carolina abound in this metal, and they are credited with an even greater product than those of Pennsylvania and New Jersey. Large deposits of zinc are known to exist in Eastern Tennessee. One locality spoken of is at Mossy Creek, a little north-east of Knoxville; and another is about forty miles from that city, at Powell's River, Campbell County. As yet, however, this resource has not been developed. A lead-mining region in Arkansas, including Lawrence, Marion, and Independence Counties, is said to show the same very favorable indications, but without their having been turned to account. Zinc is obtained in small quantities from Iowa and Lafayette Counties, Wis.; and might also be procured, probably, from the Rocky-Mountain range.

Zinc, where found.

While this useful metal is by no means rare or of recent discovery in this country, its systematic and profitable production dates back only a few years. American zinc, or spelter, is of a better quality for some purposes, notably galvanic batteries, than the foreign article; and we now produce some $800,000 worth annually, which is enough for our home-consumption: we import only a very small quantity; but the character of the ores was such, that the metal could not easily be extracted. In 1838 experiments were made with New-Jersey ore at the United-States Assay Office. Zinc was obtained; but the process cost more than the product, and this announcement quite discouraged operations for over ten years. In 1850 the New-Jersey Zinc Company opened mines on Stirling Hill, near which the Passaic Company afterward sunk shafts. The New-Jersey Company have taken out the finest specimens of zinc ore the world ever saw. In 1851 they sent to the Great Exhibition in London a single mass weighing 16,400 pounds, which attracted great attention. The Franklinite which accompanied this rich ore, however, proved a great embarrassment; and, after much expenditure, labor was temporarily abandoned. The New-Jersey Company afterward worked mines in the Saucon Valley, north of Friedensville, Penn.; near which the Pennsylvania and Lehigh Zinc Company also began operations simultaneously in 1853. For this latter corporation a Mr. Hoofstetter erected a smelting-furnace, and made costly experiments in 1856; but these also proved failures. Subsequently Joseph Wharton of the Pennsylvania and Lehigh Company, and Samuel Wetherill of Bethlehem, where the company's furnaces are located, hit upon a new idea. Neither of them met with encouraging success at first; but finally the obstacles were all overcome, and work progressed finely thereafter. The Saucon mine was the first to get under way again, about 1858–59; and the Lehigh was put on a paying basis in 1860. Success here soon encouraged it elsewhere; but these mines, those of New Jersey, and those of Davidson County, N.C., furnish all but about one-fortieth of the country's product.

Its production profitable only in recent times.

New-Jersey Company.

The manufacture of paint from white oxide of zinc as a substitute for lead-paint was conducted profitably by the three corporations above named before they could realize any thing from their efforts to produce metallic zinc. The New-Jersey Company was organized in 1849, and its success led to the formation of the Pennsylvania and Lehigh Company in 1853; and the two, in like manner, induced the organization of the Passaic Company in 1856. The discovery of the possibility of economically utilizing the red oxide for this purpose was made in Europe; but the process now in extensive use was invented by Richard Jones of Philadelphia in 1850.

Zinc-paint.

Tin is found in small quantities in several parts of this country, but has never been mined on any systematic plan. The ores are of too poor a quality to pay for working; although specimens were found some years ago near Jackson, N.H., containing from thirty to forty per cent of the metal in crystals. It has also been discovered in appreciable quantities in California, Idaho, near Paris and Hebron, Me., and near Goshen and Chesterfield, Mass. Traces of it have also been detected in the iron ores of the Hudson Valley and in the zinc of New Jersey.

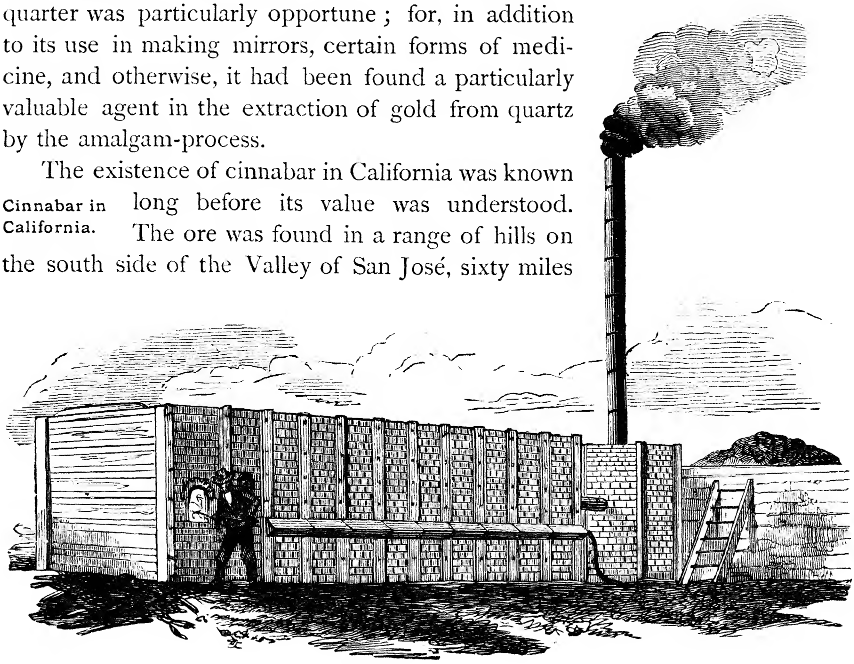
Tin.

Quicksilver, or mercury, is a metal which is very rare, and for which the world is largely dependent upon this country. The greatest producer known is the Almaden mine in Spain, from which the Greeks imported the ore — red cinnabar — seven hundred years before Christ. About half of the total supply comes from that source. After this mine, that at Idria in Austria long ranked second; but for a time the State of California has held this position, though she may not just at present. This metal has not been discovered anywhere in this hemisphere, except in the Rocky Mountains and Andes. Peru and Mexico yielded large quantities before California's store was revealed. The discovery in this last-named quarter was particularly opportune; for, in addition to its use in making mirrors, certain forms of medicine, and otherwise, it had been found a particularly valuable agent in the extraction of gold from quartz by the amalgam-process.

Quicksilver.

The existence of cinnabar in California was known long before its value was understood. The ore was found in a range of hills on the south side of the Valley of San José, sixty miles south of San Francisco, and was used by the Indians for a pigment, its vermilion hue rendering it particularly valuable in the adornment of their persons. Indians came thither from as distant a point as the Columbia River to obtain this desirable paint. As early as 1824 the whites began to search for the ore, having learned of its existence from the aborigines, and hoping to extract gold or silver from it. Its real character was not discovered, however, until 1845: whereupon operations were immediately begun by Andres Castillero. Little was accomplished, however, owing to the Mexican war, until 1850, when a company of Englishmen and Mexicans engaged extensively in mining and smelting. The mine was named "New Almaden."

Cinnabar in California.



QUICKSILVER-WORKS.

New Almaden mine.

This whole region of country had already come into the possession of the United States; but the government did not discover the flaw in the miners' title, and stop proceedings, until 1858. In these eight years more than 20,000,000 pounds of quicksilver were extracted, at a profit of more than $8,000,000. The production during this period was second only to that of Spanish Almaden. The action of the Federal authorities led the American discoverers to look elsewhere in the neighborhood, and they found cinnabar within a mile of the first mine. A shaft was sunk, called "Enrequita," and a company formed, in June, 1860, called "The California Quicksilver Mining Association." Nearly 500,000 pounds were obtained the first year from this mine; and soon after the same company opened another mine, called "The Providencia," from which they obtained some cinnabar.

On the same range of hills the Santa Clara Mining Company of Baltimore opened a mine which yielded 200,000 pounds the first year (1860). Prospecting has since discovered cinnabar up in Lake County, and mining and smelting are now carried on there with profit.

Santa Clara Mining Company.

One of the most valuable discoveries of cinnabar has been made at New Idria, in Fresno County, on the Big Panoche Creek, some hundred and thirty miles south-east of San Francisco. The property has been in litigation for many years. One McGarrahan laid claim to it on the pretence of having a title from the Panoche Indians, (or was it from the Mexican Government?) but the United-States Government, not regarding the title valid, granted the land to the New Idria Quicksilver Mining Company. The courts have sustained the latter in all contests; but the controversy is not yet ended. The New Idria Company are now in possession, and operating the mines.

New-Idria Company.

It is impossible to get accurate figures of the total production of this country; but the exports of quicksilver for 1877 alone amounted to 3,625,713 pounds, and the total yield could hardly have been less than 5,000,000, which is only equalled, if at all, by Spain. If California does not now stand at the head of the producers of quicksilver in the world, she doubtless will shortly. The value of her product can be estimated from the price, — nearly fifty cents a pound.

Extent of production.

Platinum is found in this country only in California and Oregon, where it exists in pure scales mingled with scales of gold in placers. It is collected in too small quantities to make any accurate statement of its value possible. Its presence has also been detected in Rutherford County, N.C., and in the copper and lead of Lancaster County, Penn. Most of our supply is imported, Russia being the chief producer of the world. It is valued principally because of its power of resisting the action of heat and the strongest chemical agents; but this very quality makes it hard to work.

Platinum.

Nickel is a hard, white metal, which for a long time was used almost exclusively to make the alloy known as "German silver," the proportions of its ingredients being eight parts of copper to three each of zinc and nickel. But since 1857 it has been utilized in our coinage to some extent, and still more recently the hardness and lustre of the metal have led to the extensive plating of steel and copper ware with it. For this purpose it is far preferable to silver. Says "The Eighty Years' Progress," "The metal has been mined at Chatham, Conn., and is met with at Mine La Motte, Mo., and other localities where cobalt is found. It occurs in the greatest abundance at an old mine in Lancaster County, Penn.,[1] where it is associated with copper ores. The mine was originally worked for copper, it is said, more than a hundred and thirty years ago,[2] and was re-opened for supplying nickel for the United-States mint on the introduction of the new cent in 1857. The sulphuret of nickel, containing, when pure, 64.9 per cent of nickel and 35.1 per cent of sulphur, is in very large quantity, in two veins of great size, one of which has been traced six hundred feet and the other over nine hundred feet in length. In 1859 it was producing at the rate of two hundred tons of nickel ore, and ten tons of copper ore, per month. A pyritous variety of nickel ore, called seigenite, is found at Mine La Motte, Mo., and in Carroll County, Md. In Gaston and Lincoln Counties, N.C., similar ore was found by Professor Wurtz."

Nickel.

Two exceedingly hard white metals, which are very rare, and used for scarcely any thing but pointing gold pens, are found with the gold and platinum washings of the Pacific-coast States: these are iridium and osmium, and are generally alloyed by nature with one another.

Iridium and osmium.

Cobalt, prized particularly for the rich blue color it imparts to glass, and of rare occurrence, was obtained in this country as early as 1787 at Chatham, Conn., where it is found in combination with arsenic, and associated with nickel. The mine has been worked irregularly in the present century. Traces of it are found also in Maryland. Mine La Motte, in Missouri, furnished for some time an oxide combined with manganese; but the vein is now virtually exhausted. A like ore is found in Gaston and Lincoln Counties, N.C.: it is mingled with galena, blende, tin-bearing iron, and other metallic compounds.

Cobalt.

Chrome, or chromium, occurs in combination with iron, the ore being called chromate of iron. It is used chiefly as a coloring-matter in dyeing and printing calico. The deposits are generally in the serpentine rocks of the United States. The Base Hills near Baltimore, the Maryland line just south of Chester and Lancaster Counties, Penn., Hoboken, Staten Island, and Northern Vermont, yield it in greater or less quantities. The locality mentioned along the Maryland and Pennsylvania border, however, is the source from which the greatest quantity is obtained. In this region the ore was not only embedded in the rock whence it was mined, but was found

Chrome.

[1] This is the only establishment returned in the census as producing in 1870.
[2] This was written in 1860.

in loose fragments among the serpentine rocks upon the tracts called the "Barrens." This latter supply was exhausted about 1854; but mining still continues at a small profit.

Manganese.

Manganese is a metal of little value for itself; but one of its ores, pyrolusite, by giving up its oxygen readily, is of great use for chemical purposes. It is largely employed in the manufacture of chloride of lime, or bleaching-powder. Its faintly reddish color makes it serviceable, also, in destroying the greenish tinge of glass, in the manufacture of which it is generally employed. Pyrolusite is found, according to "Eighty Years' Progress," along the range of hematite ores from Canada to Alabama, and has been mined to a considerable extent at Chittenden and Bennington, Vt., West Stockbridge and Sheffield, Mass., on the Delaware River near Kutztown, Berks County, Penn.; and it abounds, also, in different parts of the gold region, as on Hard-Labor Creek, Edgefield District, S.C.

CHAPTER IX.

QUARRYING.

MINERALOGISTS are accustomed to discriminate between the deposits of metals and stone by applying the term "veins" to the former, and "beds" to the latter. Our rocks, being mostly of sedimentary formation, lie in horizontal strata, except where the same have been upheaved into mountains by the gigantic subterranean forces of nature. But metals are usually found in cracks or fissures running more or less perpendicularly through the stone formations, the deposits having been made by injection of molten matter from below, or by infiltration and accretion brought about by the circulation of metal-freighted currents of water at a time when the rocks were submerged. This distinction between veins and beds is carried still further by the application of the word "mine" to the excavation for metals and carboniferous deposits, and of "quarry" to that made for the removal of stone.

Distinction between mine and quarry.

It needs no explanation to show that quarrying could not have been carried on in this country until stone was needed for building and paving purposes, or for such art and minor mechanical uses as the rarer stones are put to. But, as a matter of fact, quarries were not opened until long after the need was felt. Of course the early settler found the log-cabin, the corduroy road, and the wooden bridge, sufficient for his requirements; and loose stone enough for foundation-walls could easily be gathered on the surface of the earth. Yet, even after the desirability of more handsome and durable building-material for public edifices in the colonial cities was keenly appreciated, the ample resources which nature had afforded in this country were slighted, and brick and stone were imported by the Dutch and English settlers from the Old World. Thus we find the colonists of New Netherlands, afterwards New York, putting yellow brick on their list of non-dutiable imports in 1648; and such buildings in Boston as are described as being "fairly set forth with brick, tile, slate, and stone," were thus provided only with foreign products. Isolated instances of quarrying are known to have occurred in the last century; but they were rare. The edifice

Colonists did not engage in quarrying.

known as "King's Chapel," Boston, erected in 1752, is the first one on record as being built from American stone: this was of granite, brought from Braintree, Mass.

Granite is a rock particularly abundant in New England, though also found in lesser quantities elsewhere in this country. The first granite quarries that were extensively developed were those at Quincy, Mass.; and work began at that point early in the present century. The fame of the stone became wide-spread, and it was sent to distant markets, — even to New Orleans. The old Merchants' Exchange in New York (afterwards used as a custom-house), the Astor House in that city, and the Custom House in New Orleans, all nearly or quite fifty years old, were constructed of Quincy granite, as were also many other fine buildings along the Atlantic coast. In later years, not only isolated public edifices, but also whole blocks of stores, have been constructed of this material. It was from the Quincy quarries that the first railroad in this country was built: this was a horse-railroad, three miles long, extending to Neponset River, built in 1827.

Granite, where found, &c.

Other points in Massachusetts have been famed for their excellent granite. After Maine was set off as a distinct State, Fox Island acquired repute for its granite, and built up an extensive traffic therein. Westerly, R.I., has also been engaged in quarrying this valuable rock for many years, most of its choicer specimens having been wrought for monumental purposes. Statues and other elaborate commemorative designs are now extensively made therefrom. Smaller pieces and a coarser quality of the stone are here and elsewhere along the coast obtained in large quantities for the construction of massive breakwaters to protect harbors. Another point famous for its granite is Staten Island, N.Y. This stone weighs a hundred and eighty pounds to the cubic foot, while the Quincy granite weighs but a hundred and sixty-five. The Staten-Island product is not only used for building-purposes, but is also especially esteemed for paving after both the Russ and Belgian patents. New York and other cities derive large supplies from this source. The granite of Weehawken, N.J., is of the same character, and greatly in demand. Port Deposit, Md., and Richmond, Va., are also centres of granite-production. Near Abbeville, S.C., and in Georgia, granite is found quite like that at Quincy. Much Southern granite, however, decomposes readily, and is almost as soft as clay. This variety of stone is found in great abundance in the Rocky Mountains; but, except to a slight extent in California, it is not yet quarried there.

Granite, having little grain, can be cut in blocks of almost any size and shape. Specimens as much as eighty feet long have been taken out, and transported great distances. The quarrying is done by drilling a series of small holes, six inches or more deep, and about the same distance apart, inserting steel wedges along the whole line, and then tapping

Process of quarrying.

each gently with a hammer in succession, in order that the strain may be evenly distributed.

A building-material which came into general use earlier than granite is brown freestone, or sandstone; although its first employment probably does not date back farther than the erection of King's Chapel, Boston, already referred to as the earliest well-known occasion where granite was used in building. Altogether the most famous of American sandstone quarries are those at Portland, opposite Middletown, on the Connecticut River. These were worked before the Revolution; and their product has been shipped to many distant points in the country. The long rows of "brown-stone fronts" in New-York City are mostly of Portland stone; though in many cases the walls are chiefly of brick covered with thin layers of the stone. The old red sandstone of the Connecticut Valley is distinguished in geology for the discovery of gigantic fossil footprints of birds, first noticed in the Portland quarries in 1802. Some of these footprints measured ten by sixteen inches, and they were from four to six feet apart. The sandstone of Belleville, N.J., has also extensive use and reputation. Trinity Church in New-York City and the Boston Athenæum are built of the product of these quarries. St. Lawrence County, N.Y., is noted also for a fine bed of sandstone. At Potsdam it is exposed to a depth of seventy feet. There are places, though, in New England, New York, and Eastern Pennsylvania, where a depth of three hundred feet has been reached. The Potsdam sandstone is often split to the thinness of an inch. It hardens by exposure, and is often used for smelting-furnace hearthstones. Shawangunk Mountain, in Ulster County, yields a sandstone of inferior quality, which has been unsuccessfully tried for paving; but it wears very unevenly. From Ulster, Greene, and Albany Counties sandstone slabs for sidewalks are extensively quarried for city use; the principal outlets of those sections being Kingston, Saugerties, Coxsackie, Bristol, and New Baltimore, on the Hudson. In this region quantities amounting to millions of square feet are taken out in large sheets, which are afterwards sawed into the sizes desired. The vicinity of Medina in Western New York yields a sandstone extensively used in that section for paving and curbing, and a little for building. A rather poor quality of this stone has been found along the Potomac, and some of it was used in the interior of the old Capitol building at Washington. Ohio yields a sandstone that is of a light gray color: Berea, Amherst, Vermilion, and Massillon, are the chief points of production. St. Genevieve, Mo., yields a stone of fine grain, and of a light straw-color, which is quite equal to the famous Caen stone of France. The Lake-Superior sandstones are dark and coarse-grained, but strong.

Brown sandstone.

Potsdam sandstone.

In some parts of the country, where neither granite nor sandstone is easily procured, blue and gray limestone are sometimes used for building, and, when hammer-dressed, often look like granite. A serious objection to their use, however, is the occasional presence of iron, which rusts on exposure, and defaces a building. In Western New York they are widely used. Topeka stone, like the coquina of Florida and Bermuda, is soft like wood when first quarried, and easily wrought; but it hardens on exposure. The limestones of Canton, Mo., Joliet and Athens, Ill., Dayton, Sandusky, Marblehead, and other points in Ohio, Ellittsville, Ind., and Louisville and Bowling Green, Ky., are great favorites West. In many of these regions limestone is extensively used for macadamizing roads, for which it is excellently adapted. It also yields excellent slabs or flags for sidewalks.

Limestone.

One of the principal uses of this variety of stone is its conversion, by burning, into lime for building-purposes. All limestones are by no means equally excellent in this regard. Thomaston lime, burned with Pennsylvania coal, near the Penobscot River, has had a wide reputation for nearly half a century. It has been shipped thence to points all along the Atlantic coast, invading Virginia as far as Lynchburg, and going even to New Orleans. Smithfield, R.I., and Westchester County, N.Y., near the lower end of the Highlands, also make a particularly excellent quality of lime. Kingston, in Ulster County, makes an inferior sort for agricultural purposes. The Ohio and other Western stones yield a poor lime, and that section is almost entirely dependent on the East for its supplies.

Marbles, like limestones, with which they are closely related, are very abundant in this country, and are also to be found in a great variety of colors. As early as 1804 American marble was used for purposes of statuary. Early in the century it also obtained extensive employment for gravestones. Its use for building-purposes has been more recent than granite and sandstone in this country, and it is coming to supersede the latter to a great degree. For mantles, fireplaces, porch-pillars, and like ornamental purposes, however, our variegated, rich-colored, and veined or brecciated marbles were in use some time before exterior walls were made of them. Among the earliest marble buildings put up in this country were Girard College, Philadelphia, the old City Hall in New York, and the Custom House in the latter city, afterwards used for a sub-treasury. The new Capitol building at Washington is among the more recent structures composed of this material. Our exports of marble to Cuba and elsewhere amount to over three hundred thousand dollars annually, although we import nearly the same amount from Italy. And yet an article can be found in the United States fully as fine as the famous Carrara marble. We refer to that which comes from Rutland, Vt.

Marbles.

This State yields the largest variety and choicest specimens. The marble belt runs both ways from Rutland County, where the only quality fit for statuary is obtained. Toward the north it deteriorates by growing less sound, though finer in grain; while to the south it becomes coarser. A beautiful black marble is obtained at Shoreham, Vt. There are also handsome brecciated marbles in the same State; and in the extreme

Vermont marbles.

northern part, near Lake Champlain, they become more variegated and rich in hue. The peculiar variety known as "serpentine" is also very plenty in the Green-Mountain State. Serpentine and verd-antique were hewn out in slabs for fireplaces at Milford, Conn., before 1820, and taken to New Haven, New York, and elsewhere. Such other marble as is found in New England is of an inferior quality. That quarried near Thomaston, Me., is nothing more than limestone; but the gray and clouded tints have led to its wide use for mantles. Glenn's Falls, N.Y., is also noted for a limestone that passes for marble, being black, and quite highly prized: it takes a good polish. The pillars of Girard College came from Berkshire, Mass., which ranks next after Vermont in reputation.

Extent of marble-bed.

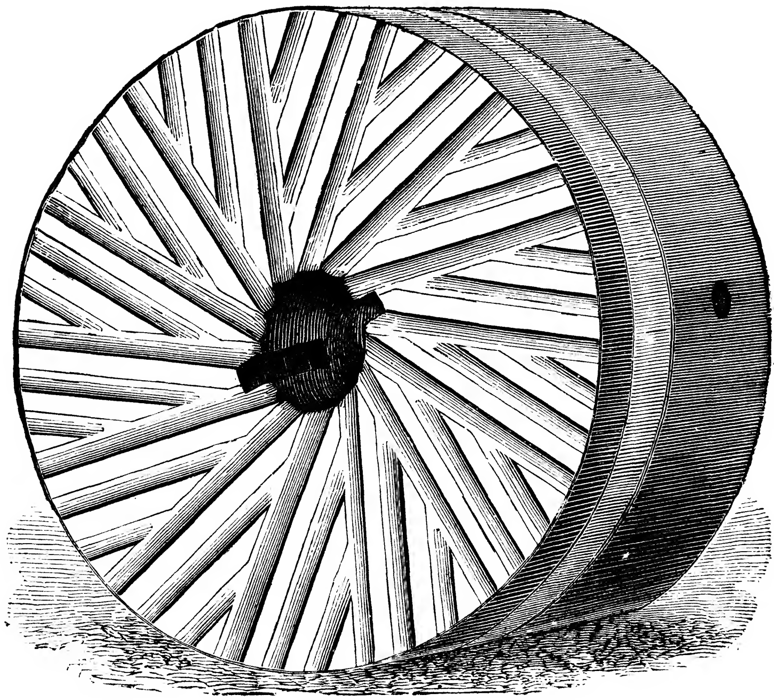
The marble-belt extends from New England through New York, Pennsylvania, Maryland, the District of Columbia, and Virginia, Tennessee, and the Carolinas, to Georgia and Alabama. The material of which the United-States Sub-Treasury of New York was built came from the East-Chester quarries, and the main portion of Girard College is from Pennsylvania marble. Chester County in that State yields a fine quality of serpentine also. Brecciated or veined marble is found on the Maryland side of the Potomac, at the Point of Rocks. This, and some of the variegated and high-colored varieties obtained near Knoxville, Tenn., nearly equal that of Vermont. The Potomac and Tennessee marbles were used more or less in the new Capitol and other public buildings at Washington. Good marbles in the South and West are of exceptional occurrence. The Rocky Mountains, though, contain a vast abundance and variety.

Slate.

Slate was known to exist in this country to a slight extent in colonial days. It was then largely used for gravestones, and to some extent for roofing, tiles, and school-purposes. But most of our supplies came from Wales. Even in the present century it has been quite common for ships to go out from the United States with cargoes of cotton, and bring back slate in return.

It is stated by one authority that a company was formed to work a slate-quarry in Northampton County, Penn., as early as 1805; but another says no quarry was opened there until 1826, when James M. Porter and Samuel Taylor engaged in the business, obtaining their supply from Kittanninny Mountain. But the former statement seems to have been applied to roofing-slate, and the latter to the manufacture of slates for schools. From 1826 the business developed rapidly, the village of Slateford being an outgrowth of it, and large rafts being employed to float the products down the Schuylkill to Philadelphia. By 1860 the industry had reached the capacity of twenty thousand cases of slates, valued at ten dollars a case, annually; and in 1854 three hundred thousand feet of lumber were consumed in making slate-frames alone.

In 1839 quarries were opened on the Piscataquis River, forty miles north of Bangor, Me.; but poor transportation facilities prevented the product reaching a market easily. Vermont began to yield perceptibly in 1852. Castleton and Poultney in Rutland County, and Guilford, Windham County, are the chief points of production in that State. New York's quarries are confined to Washington County, near the Vermont line. Maryland has a limited supply from Harford County. The Huron Mountains, north of Marquette, Mich., also contain slate; and fine beds are said to exist in Pike County, Ga.; but they have not been developed.



BURR MILLSTONE.

Grindstones, millstones, and whetstones are quarried in New York, Ohio, Michigan, Pennsylvania, and other States. Mica is found at Acworth and Grafton, N.H., and near Salt Lake: but our chief supply comes from Haywood, Yancey, Mitchell, and Macon Counties, N.C.; and our product is so large, that we can afford to export it. Silex, or quartz, for the finer varieties of glass, is obtained chiefly from Lanesborough, Mass., and Stonington, Conn.

Grindstones, millstones, &c.

CHAPTER X.

SALT.

SALT is the one great mineral which enters into the diet of mankind, and to so wide an extent, that it is called one of the necessaries of life. It is known, however, that the American Indians never used it until after they learned the habit from the whites.[1] Their meat was cured by smoke and drying, or "jerked;" and for seasoning they sometimes used the ash of certain plants. The craving for salt, nevertheless, seems to be natural to many wild and domesticated animals, the deer of this country having been hunted more frequently at the "salt licks," about which they rendezvoused, than elsewhere.

Use of salt by Indians.

The first white men who settled on this continent derived their supplies of salt from the old country; but the great distance of this source, and the expense of the commodity, soon stimulated effort to make it for themselves. As the reader is well aware, the principal uses of salt are for the table, the dairy, preserving meat, and curing fish. The last-named was the more prominent need of the early colonial days, inasmuch as our fisheries were among the first and foremost of our industries. Accordingly there was a great demand for the coarser grades of salt, especially in New England, at the very earliest period of our history.

Salt in the colonies.

How soon the manufacture of salt first began here is not positively known; but there are references to salt-works on Cape Charles, Va., as early as 1620 in the colonial records; and to such an extent was the business carried on, that, by 1633, this colony was exporting salt to New England. Salt is obtained in three different ways, — from solid beds of the mineral, from springs or wells which have their origin in otherwise inaccessible salt-beds, and from the ocean, which may have acquired its saline prop-

Ways of obtaining salt.

[1] The Peruvians made and ate salt when Pizarro made his famous conquest of their country, and De Soto found the Florida Indians making salt from springs near the banks of the Arkansas River. They employed earthen pans in the manufacture, and moulds, which turned out small square cakes, which they traded for furs and mantles. Long before the manufacture of salt was begun by the whites, it was brought by the Indians of Western New York to Quebec and Albany, with their furs, for trade, from the Onondaga Springs, which was their source of supply.

erties by dissolving great deposits of this substance, or have retained it from the days of the creation. Owing both to the precedents of the manufacture in the Old World, and to the fact that as yet neither salt-springs nor rock-salt had been found in this country, the first attempts made by the American colonists were with sea-water, which was collected in ponds and vats, and subjected to artificial heat. Doubtless these first salt-works of Virginia were of this kind.

Erection of salt-works at Portsmouth.

The first beginnings in New England were made in 1621. In that year a company erected salt-works on the present site of Portsmouth, N.H.; and in 1622 a salt-maker was sent over to Boston by the London proprietors to begin this important manufacture. This individual appears to have made great boasts of what he would accomplish, and yet to have treated the art as a peculiar mystery for the sake of blinding those who were employed to assist him. Thus the colony was led to incur the expense of erecting a storehouse for salt before any had been manufactured. In 1623 he was sent with his pans to Cape Ann, so as to be nearer the seat of the fisheries; but, before summer was over, he burned the works, thereby spoiling most of his pans. This and other early enterprises were under the control of the government; a fact which has many parallels in history. The greatness of Venice was, in a measure, due to her monopolizing the salt-manufacture of her domain; and for a time that of Rome was under governmental regulation. The famous salt-manufacture of Syracuse, N.Y., and of that neighborhood, is partly under the State's auspices, inasmuch as the government reserves its right to the springs, and sells the salt water to the manufacturers. After the transfer of the authority over Massachusetts from London to Boston, this industry appears to have been put on a plane with all others, and to have been conducted by private enterprise. This was the case with the salt-works founded at Salem in 1636. The Colonial Government encouraged activity and ingenuity in this direction by granting especial privileges to inventors of new methods. We find the Assembly of Connecticut doing the same thing. The younger Winthrop was authorized in 1647–48 to take land for the establishment of salt-works at Pequod (New London) and elsewhere, and the State commissioners were authorized to buy two hundred tons a year of him at the rate of three shillings a bushel. How far he availed himself of these concessions does not appear.

Salt-making at mouth of Raritan.

French people landed at the mouth of the Raritan River, N.J., in 1631, who began salt-making there. The Swedish Government instructed the governor of its colony on the Delaware to engage in salt-making in 1642. In the Dutch colony on the Delaware, at New Castle, salt was made to such an extent in 1657, that shipping stopped there for supplies. In what is now New York attempts to make salt were begun quite early by the Dutch; but as early as 1649 it was charged against the proprietary West-India Company's servants in the New Netherlands, that they had wasted the public money in fruitless attempts to manufacture salt and other commodities. By the middle of the seventeenth century French missionaries had discovered the saline springs in Onondaga County, N.Y., and rumors of them had reached the Dutch settlements; but the settlers made no attempt for nearly a century and a half to utilize this resource. We have already mentioned the early attempts in Virginia. That colony still further encouraged the industry by prohibiting the importation of foreign salt after 1683. The New Netherlands had imposed a heavy tariff on the importation long before. Sir Nathaniel Johnson, governor of the Leeward Islands, took up his residence in South Carolina in 1689, and, besides rice, wine, and silk, gave some attention to the production of salt. He named the place on Sewee Bay, where he conducted his operations, the "Salt Ponds." Colonial legislation encouraged the industry in 1725.

Sir Nathaniel Johnson.

Without further detail, it may be remarked that the business of making salt from ocean-water was carried on, with more or less governmental encouragement, in all the Atlantic colonies prior to the Revolution. Only a small proportion of what was needed, however, was produced at home; and a heavy importation was carried on, mostly as ballast in the ships returning from Spain and the wine islands. It was also obtained from the West Indies, although our salt-trade with Turk's Island and the neighboring manufacturing localities has been mostly of a later period. We also imported English (Liverpool) salt somewhat before the Revolution. Foreign salt was prized more highly than that obtained from Tortugas, as the latter impaired the quality of the fish cured with it; and, in order to sustain the quality and reputation of the fish-exports, Massachusetts declared in 1670 that no fish cured with Tortugas salt should be merchantable. So small was the accumulation, and so irregular the supply, of salt in those days, that the arrival of a cargo of salt greatly depressed the price. Thus Gov. Winthrop writes in 1646, "There arrived yesterday a Dutch ship of three hundred tons, with two hundred and fifty tons of salt, sent by Mr. Onge of Lisbon, so as salt was abated in a few hours from thirty-six to sixteen a hogshead."

Salt importations.

During the Revolution salt was very scarce and costly in this country, owing to the check put upon commerce, to the withdrawal of men from the paths of productive industry to military pursuits, and to the occasional destruction of salt-works. A number of these were destroyed in New Jersey by British troops during the war. A special guard of a hundred men was applied for to protect salt-works in Cape-May County in 1777; and Congress urged upon the colonies, that they each encourage salt-manufacturing. Salt ran as high as six dollars a bushel during most of the Revolution, and even as high as eight, and was always in demand: indeed, at times, it formed a sort of currency.

Salt-making during the Revolution.

The following anecdote is related of those dark days. During the encampment at Morristown, N.J., in 1780, provisions were exceedingly scarce; and continental money so depreciated, that four months' pay of a private would not buy a bushel of wheat for his family. The ordinary army rations were poor enough even for the rank and file; but, as is always customary, it was thought necessary to provide the officers with something more delicate, purchased, of course, at their private expense. "We have nothing but the rations to cook, sir," said Mrs. Thompson, a very worthy Irish-woman and housekeeper, to Gen. Washington one day. "Well, Mrs. Thompson, you must then cook the rations; for I have not a farthing to give you." — "If you please, sir, let one of the gentlemen give me an order for six bushels of salt." — "Six bushels of salt! For what?" — "To preserve the fresh beef, sir." One of the aides gave the order. The next day his Excellency's table was remarkably well provided. Washington misunderstood the source of this bounty, and, sending for Mrs. Thompson, told her that she should not have expended her own money in this way, when there was no chance of her being repaid. "I owe you too much already for the debt to be increased; and our situation is not, at this moment, such as to induce very strong hopes." — "Dear sir," said the lady, "it is always darkest just before daylight; and I hope your Excellency will forgive me for bartering the salt for other necessaries which are now on the table." She had sold the salt to the country-people, at eight dollars a bushel, in exchange for provisions.

How salt was formerly made.

With a few slight exceptions, all the salt made in this country until near the close of the last century was obtained by boiling, or evaporation by artificial heat. As early as 1671, however, there had been talk in Massachusetts of making salt "by the sun;" and the government encouraged the formation of a company to try this process. The solar method was employed to some extent on Long Island, too, by exposing the sea-water to the sun and wind in shallow vats. New Jersey also resorted to this device, the salt water being condensed by natural evaporation in ponds to nearly ten times its natural strength, and then being boiled in kettles. It required from two hundred and fifty to three hundred gallons of sea-water to make a bushel of salt. The discovery of particles of salt on clam-shells along the beach suggested the idea of solar evaporation to the salt-boilers at Harwich, Cape Cod, and led to experiments which were but partially successful in 1774 and the few years immediately thereafter. At length a partnership was formed, in which John Sears, a sailor, was the leader, and which erected salt-works on this principle at Dennis, Barnstable County. They constructed a vat one hundred feet by ten in size, with a level floor and a curiously constructed roof. At first the sea-water was conveyed thereto by buckets; but afterwards, in 1790, a pump was obtained from the stranded British ship-of-war "Somerset," and a windmill erected to work the pump. The establishment met with great ridicule, and was long known as "John Sears's Folly;" but it was successful, and led to the establishment of a large number of similar works on Cape Cod, Cape Ann, near New Bedford, and elsewhere. This industry was carried on extensively during the first quarter or third of this century, but since 1830 has declined. A few years ago, however, there were to be seen some of these old windmills still standing. The discovery of richer salines than ocean-water very naturally destroyed the more costly and laborious enterprises.

Utilizing salt-springs in Onondaga County.

A great revolution in salt-manufacture was wrought by the utilization of the valuable salt-springs of Onondaga County, N.Y., to which we have already referred. These were known very early to the Indians. Father Lallemant is the first white who is recorded as having visited them. Le Moyne, a Jesuit, mentions them in 1653. In 1770 Onondaga salt was well known in Quebec and Albany, whither the Indians brought it. The whites first made salt there in 1787; in which year, or the following one, the Oneida Indians ceded the lands to the State. Leases were then granted to manufacturers, who sunk wells, and went to pumping from the rich salines beneath. But the State reserved the control of this mineral production to itself, and soon took charge of the pumping. It still maintains the management of this work, and supplies the water to consumers, who pay the State a tax on the salt produced. At one time the duty was twelve cents on a bushel of fifty-six pounds; then it was reduced to six cents, and then to one: but to such an extent has the business developed, that the State has thus obtained an enormous revenue. At first the system of solar evaporation adopted on Cape Cod was employed; but now seven-eighths of the salt produced at Syracuse, Salina, and the adjacent centres of manufacture, are obtained by boiling. Here, as with the sea-water, expedients have been devised for separating the other mineral substances, such as Epsom and Glauber salts, from the article manufactured for the market.

Extent of production.

In 1789 the product from the Onondaga springs was about five hundred or six hundred bushels, and the price, anywhere within sixty miles, was reduced to half a dollar a bushel, — a remarkable reduction. In 1859, the culminating date of production in this region, the annual product was 7,521,335 bushels, which cost the manufacturers to make about six cents a bushel. To such dimensions has the business grown, that whole villages of vats and brick "blocks" for containing the kettles have sprung up around Syracuse. The commerce in salt, and supplies for the salt-makers, has done much to pay the expense of constructing the Erie Canal and the railroads of that section.

An interesting story is told in connection with the early development of the Onondaga salines. Towards the close of the last century the Federal Government let contracts for the supply of the United-States troops with provisions at Oswego. At this time Gen. James O'Hara, an enterprising and well-informed citizen of Pittsburgh, Penn., undertook a contract, believing that he could execute it at less cost from that basis of supply, in consideration of certain advantages which he at first concealed, than any one could from the

Mohawk River, whose head-waters were not far from Oswego. Accordingly, he established a line of communication by rafts up the Alleghany and French Creek from Pittsburgh, a wagon-portage across to Erie on the lake of that name, a boat-line to Black Rock near Buffalo, another boat to carry still nearer Niagara, a wagon-portage around the falls, and a third boat-line thence through Lake Ontario to Oswego. Vessels were built on Lakes Erie and Ontario expressly for this business. It was a part of O'Hara's contract that he should retain his barrels when their contents were consumed. These barrels he then filled with salt, which he caused to be brought from Syracuse in wagons, and re-shipped them over the same route by which they came from Pittsburgh.

MAKING SALT.

At this time Pittsburgh had obtained her salt from Philadelphia by pack-horses, which came in trains across the mountains. The business of supplying all these settlements west of the Alleghanies, and down the Ohio River, centred at this point; and salt brought eight dollars a bushel. But O'Hara was now able to deliver it at Pittsburgh for half that price, and make a handsome profit; and, as he had a monopoly of the Onondaga supply, he could destroy all competition. Capital was soon invested in trade with Syracuse, however; and in a few years the price was brought down to twelve dollars a barrel of five bushels. A few years later, the development of the Virginia and Western Pennsylvania salines still further reduced the price.

There are numerous other valuable salt-deposits in this country, the principal ones being in West Virginia, Ohio, Pennsylvania, and Michigan. West Virginia, while yet the new State of that name was included within the original limits of the old one, was famous for salt-wells along the line of the Great Kanawha River. Attention was drawn to the springs by seeing the deer visit them. The early wells were bored only thirty feet deep; but subsequently a depth of seven hundred or eight hundred feet became common, while even fifteen hundred has been attained. Gas was obtained from these wells, which was burned to heat the kettles; but this practice has since been discontinued. In 1829 this region produced at the rate of 1,000,000 bushels annually; and by the outbreak of the war the product had reached nearly 3,000,000, and formed the principal part of the salt manufactured in Virginia. The amount has since been increased to nearly 5,000,000; and from its separation, until recently, West Virginia ranked next after New York as a salt-producing State. The other salt-deposits of that vicinity are in the south-western part of old Virginia, in Smyth and Washington Counties, along the north fork of the Holston. Here there are beds of rock-salt; but no wells that are available are found outside a very limited locality. This one product, and the plaster-banks, give almost exclusive business to the branch railroad of the Virginia and Tennessee line penetrating that section. Prior to the war it had developed its product to something like 300,000 bushels a year; but since that period its yield has been inconsiderable, the census of 1870 returning but 2,063 bushels.

Other salt-deposits.

Virginia.

Pennsylvania has a considerable salt district along the Alleghany, Kiskiminetas, and Beaver Rivers. Wells were first sunk here in 1812 to the depth of two hundred feet; and in 1829 salt was produced there at the rate of twenty or twenty-five cents a bushel, while farther west it cost at least fifty. In 1850 the annual production was over 900,000 bushels, and at that time Pennsylvania ranked third as a salt-producing State. Since then Ohio and Michigan have stepped in ahead of her.

Pennsylvania.

Ohio's salt-springs are mostly in the southern and south-eastern parts of that State, along the Muskingum, Hocking, and Scioto Rivers, and on the Ohio River at Pomeroy, opposite the mouth of the Great Kanawha. The first attempts in that State to make salt were in 1798, at the "Old Scioto Salt-Works" in Jackson County. The wells were only thirty feet deep; and six or eight hundred gallons of the brine were needed to make a bushel of the salt, which was dark and poor. But even this article brought three or four dollars a bushel as late as 1808. Until after 1850, when the total product was about 500,000 bushels, the development of the business was slow; but the wells, which were then but four hundred or five hundred feet deep, were sunk to a depth of twelve hundred, where much stronger brine was obtained, and the business so improved, that by 1857 the estimated product of the State was nearly three times that of 1850. In 1870 it had reached

Ohio.

almost 3,000,000 bushels. The heavy carburetted hydrogen gas which comes from these wells has been extensively used for heating the kettles in which the salt was boiled. The Wabash salines, well known in early colonial days, have been the basis of quite a little salt-making industry in Indiana and Illinois, which has now declined. Kentucky and Tennessee have also abounded in salt-licks and working-wells. Kentucky has had quite a reputation for her salt in times past. Missouri, Minnesota, Arkansas, and several other States, have also salt-springs of slight value.

Other States.

One of the most remarkable developments in this industry has been that of Saginaw County, Mich. The salt-licks of the deer were well known to the first settlers, and in 1838 unsuccessful attempts were made at manufacturing salt there. The legislature passed a law in 1859 offering a bounty of ten cents a bushel on the salt produced in the State. This gave a slight impetus to the manufacture. A well was sunk six hundred and sixty-nine feet in East Saginaw, and in the last six months of 1860 a yield of 23,000 bushels of excellent salt was obtained. Prior to this time the product had been insignificant; but in 1870 it amounted to nearly 4,000,000 bushels, and Michigan then ranked next after New York and Virginia. Since then she has outstripped both; and though she has not yet reached New York's figures of 1860, which were upwards of 7,000,000, the competition has cut down New York's product to less than 5,000,000 bushels annually. The great secret of the success of the Michigan salt-makers is the economy secured by combining the salt-boiling business with lumbering. The salt-wells abound in the great lumber-districts around Saginaw Bay. The saw-mills are run by steam, and the furnaces fed by saw-dust. The wells are pumped by engines, and the surplus steam is used to carry on the evaporating process. Thus the item of fuel is entirely saved in the expenses of production, and salt can thus be produced more cheaply than anywhere else in the country.

Saginaw region.

The annual product of salt in the United States at the present time is about 20,000,000 bushels; of which Michigan produces about 6,000,000; New York and West Virginia, each, 4,500,000; Ohio, nearly 3,000,000; and the other States, something over 2,000,000. Yet this is but about half of our consumption; for we imported in 1877 over 18,000,000 bushels. A mere trifle, less than 75,000 bushels, — most of which went to Canada, — was exported.

Annual product in the United States.

CHAPTER XI.

PETROLEUM.

Youth and eminence of the industry.

ALTHOUGH petroleum is one of the oldest mineral products of which mankind is known to have made use, the business which it has given to the people of the United States is the most recent of all our prominent industries. It is less than twenty years since the production of petroleum in large enough quantities for it to supplant our candles, spirit-lamps, sperm-oil, and rosin and coal gas, as the popular means of illumination: and yet our coal and iron are the only two mineral products which this country now yields in larger measure of value; and, except cotton and cereals, it is our most valuable article of export.

Antiquity of the discovery and use of hydro-carbons.

Bitumen and naphtha, two forms of this same hydro-carbon deposit, were found in other parts of the world in the earliest historic period. Bitumen, or asphaltum, was used as a cement in building ancient Babylon. The cerements of Egyptian mummies were smeared with it, that the corpses might be the better preserved; and it is the presence of that substance, dried to a rosin, which makes the mummy such excellent fuel in the Orient. The Scriptures make frequent reference to the rock giving out fountains and rivers of oil; and inasmuch as Jacob is said to have been embalmed, and as embalming undoubtedly meant being wrapped after the manner of the Egyptian dead, there is excellent reason to believe that rock-oil was known not only in the days of Job and Moses, but even before the time when Israel served the Pharaohs, thirty-six centuries ago. Indeed, we may trace its appearance still farther back.

Asphaltum used in the Tower of Babel.

The Tower of Babel was erected over four thousand years ago, and its builders used "slime for mortar." In the ruins of Chaldean edifices near Bagdad, known to have been contemporaneous with the Tower of Babel, there have been found pieces of reed cemented with asphalt. However, when one remembers that geology proves the carboniferous age of the world's formation to be millions of years before our day; that the era which saw the production of the bitumen of Egypt, the asphalt of Mesopotamia, and the coal and oil of Pennsylvania, was all one, —

the interval between its discovery and use by those who lived about the Lower Nile and the people of the United States is but as a day.

Wide distribution of the deposits.

The bitumen used by the Assyrians came from slime-pits near the River Is, a tributary of the Euphrates. It was also found in very ancient times near the Caspian Sea, and the product of Bakoo still continues to supply all Persia with the means of illumination. The oil there is light-colored and very choice. Asphaltum, only another form of the same substance, has been found about the shores of the Dead Sea, which is supposed to cover the ancient cities of Sodom and Gomorrah. In India and Burmah petroleum has been in use as a medicine, and for illuminating-purposes, no one knows how long; the excavation of wells and pits in the Rangoon District for procuring the oil, its collection, transportation, and sale, amounting to quite an industry. Burmah and the Bakoo District rank next to America as producers. In China the people have found this same treasure in the form of gas rather than oil, and have bored artesian wells without number, simply to get this product as a means of light and heat. Some of these wells have been bored fifteen hundred and two thousand feet deep, and the machinery by which the work is performed is very curious and crude. When the cavity where the gas is confined is finally reached, an explosion of terrific violence often occurs, and the orifice of the well is with the utmost difficulty secured, especially if the escaping gas takes fire. Mgr. Imbert, a Catholic missionary in China, thus describes one of these catastrophes: —

The fire-wells in China.

"The flame, which was about twenty feet high, flitted about without burning any thing. Four men volunteered to risk their lives in endeavoring to arrest it. They cast a large stone on the mouth of the well; but it was instantly hurled far into the air. Three of the men were burned, and the fourth escaped only by a miracle. Neither water nor earth would extinguish the flames; until at length, after two weeks of incessant toil, a sufficient quantity of water was conveyed to the adjacent heights, where it was collected in a little lake, and suddenly let loose on the well in one volume with success."

Description of burning-well.

This gas is conveyed long distances by bamboo pipes, and is used for lighting salt-mines and to heat furnaces, the extremities of the pipes being tipped with metal to prevent their being burned; although the gas-flame does not usually adhere to the tip, as in the case of our artificial illuminating-gas, but hovers about it at a short distance. In Java and Japan the oil which yields this gas is found in small quantities.

Economizing gas.

There is little record of any form of coal, petroleum, or natural gas, being found in Africa, elsewhere than in Egypt; but they have been found plentifully in Europe, — though not together, it may be remarked. Wales, the great coal-producing region of Great Britain, does not yield petroleum, although the burning-well at Wigan, Lancashire,

Distribution of oil in Europe.

is in a coal-region. France, Belgium, Northern Italy, and Hungary have yielded either oil or gas, or both, in comparatively insignificant quantities, for over two centuries; but little effort has been made to secure the possible deposits below by any thing like modern appliances. Very recently something has been done in South Germany, and near the Volga in Russia, to utilize the oil-deposits that have been discovered there; but as yet no effect upon the world's supply or the world's market has been wrought.

Just at the close of the last century, petroleum was discovered in small quantities in the West Indies; but production has never practically amounted to any thing there.

The first white settlers who came to the United States found that the natives were familiar with and made use of rock-oil, which they skimmed from the surface of springs and pools. It was supposed to possess rare medicinal virtues; although it has little recognized effect nowadays, except as a cathartic, sudorific, anti-spasmodic, and bane to the tape-worm. It was also found an excellent balm for wounds, and a good medium in mixing the Indians' war-paint. But it is well known to all students of American-Indian history that there was a race of aborigines, closely allied to the Toltecs and Aztecs of Mexico, who occupied much of the territory of the United States before the red men came whom Raleigh and the Pilgrims found here. That earlier and more highly civilized people have left many tokens of their former residence here; and among them are placed by some *savans* the devices found near Titusville, Penn., for the collection of rock-oil. In the valley of Oil Creek are found a number of pits, fifteen or twenty feet deep, either circular, oval, or square, and carefully cribbed and walled with timber. The oil has preserved the wood from decay, no one knows how long; but their location, character, and resemblance to the oil-pits of Burmah, indicate plainly enough that they were constructed to obtain petroleum; and as trees have been growing from the bottom of these pits for two and three centuries, if not longer, the period of their disuse is carried back to a time precedent to the first white settlements in the United States.

Petroleum known to the American aborigines.

In various parts of the American continent the early settlers have found what they have called tar-springs, or streams and pools of water mingled with strongly odorous rock-oil. This substance was discovered by explorers near the mouth of the Athabasca River, in British North America, nearly a century ago. It has been found near Lake Huron, and in other parts of Canada; but nowhere in that country has its production become a business of any consequence, except at Enniskillen, in the western peninsula of the Province of Ontario. Since 1860 the oil-industry has grown up to quite respectable proportions, though insignificant as compared with the business of the United States.

Tar-springs.

The fact is, that the production of petroleum for the world's use is almost exclusively a monopoly of this country, and is chiefly confined to the region of Western Pennsylvania and West Virginia. The same series of oil-bearing rocks extend to Kentucky. Says the annual report of the New-York Produce Exchange for 1875-76,—

Petroleum a monopoly.

"The oil-belt in West Virginia is now being surveyed, and the survey is to be continued to the Big Sandy River, on the boundary-line of Kentucky, for the purpose of the future development of oil-production. Colorless petroleum has been found in Nevada, near a place called Black Rock, where there are two springs, from which flows colorless oil, aggregating from eighty to ninety gallons daily. In Colorado, six miles north of Cañon City, there are oil-bearing rocks, from which an excellent quality of petroleum is obtained at a depth of from two hundred to four hundred feet. In the Tulare Valley in California, fifteen miles west of Tulare Lake, there are petroleum-springs which were first discovered by a government surveying-party in 1854. The oil from these springs is of the heavy lubricating variety, and is much more valuable than the burning-oil produced in Western Pennsylvania, and is similar to that of West Virginia. In Los Angeles County, Cal., in the township of San Fernando, a refinery for petroleum was established about four years ago by a stock company. At this place there are five producing-wells, each about a hundred and forty feet deep, giving an aggregate daily product of crude oil of from forty to fifty barrels. There are also wells at Ventura, and a refinery, turning out twenty barrels of refined oil daily. At Wheeler's Cañon, sixty-seven miles from Ventura, there are oil-wells; and a pipe-line is being laid from the former to the latter place. In the Cumberland Valley, in Kentucky, there is an extensive region of country underlaid with coal-bearing rocks. In boring for salt in 1829 on Little Renox Creek, about half a mile from Big Renox Creek, in Cumberland County, oil was struck; and the well called the 'Great American' well continued to flow daily for a considerable period, producing a thousand barrels of crude petroleum. Recent borings in Cumberland County have resulted in obtaining oil in large quantities. The oil-bearing rocks are said by Professor Owen to extend into Tennessee." To this it may be added, that oil has also been struck in Ohio, and in 1866 there were some six or seven hundred wells in Trumbull County. At Pomeroy, Meigs County, still later, highly productive wells have been bored. There has been some boring in Alleghany County, N.Y., but with little result. Indeed, at points innumerable throughout the country, attempts have been made to strike oil; but, except at those here specified, these enterprises have been mostly failures.

Extent of oil-region.

The report we have above quoted continues: "In Western Pennsylvania the oil-district commences at Edinburg, about twelve miles north of St. Petersburg, in Clarion County, and extends to a point about two miles south of St. Jo, in Butler County, being nearly forty miles long, and varying from twenty to several hundred rods in width. The southern extremity of this belt has proved to be the most prolific portion of the present oil-producing territory, including a distance of about seven miles on the line of the belt. At Parker's Landing, about fifteen miles from St. Jo, the oil-belt crosses beneath the bed of the Alleghany River.

"A new oil-region has been somewhat developed in McKean and Bradford Counties, in North-western Pennsylvania, in the territory between the Philadelphia and Erie Railway and the Atlantic and Great-Western. The want of facilities for transporting oil has checked production."

Insignificance of the oil-industry until 1859.

Until between 1850 and 1860 the finding of oil in this country was scarcely ever viewed otherwise than with indifference or annoyance. Its appearance in the salt-springs of Ohio and elsewhere proved very detrimental to the interests of the salt-boilers, and on that account the sight and smell of it were detested. Yet so early as the commencement of this century it was collected for market in Western Pennsylvania. Wherever the oil would manifest itself by bubbling up with water through the soil, pits were dug, and the two liquids allowed to accumulate; and then blankets were thrown upon the surface of the oil (which floated on the water), soaked with the greasy mineral, and then wrung out into tubs. A Mr. Cary, one of the more enterprising of the early settlers along Oil Creek, is reported to have collected or purchased cargoes of this oil from his neighbors, put it into five-gallon kegs, slung one on each side of a horse, and thus conveyed it to Pittsburgh, a distance of seventy or eighty miles; and it is related, that, at a later period, "Gen. Hayes, who settled in Franklin (Venango County) in the year 1803, . . . purchased at one time the entire product of the region, amounting to sixteen barrels, which he sold in Pittsburgh for about a dollar per gallon." These two incidents serve admirably to illustrate the diminutive proportions of the petroleum-industry of America during the first half of the present century.

The famous Drake well, and its influence.

The true beginning of the great era of petroleum-development in this country, and indeed of the world, was Aug. 28, 1859; when an artesian well, sunk on the lands of the Pennsylvania Rock Oil Company, near Titusville, struck a vein of hydrogen gas mingled with oil. We shall have more to say presently of this organization, its previous experiments, and its employment of Col. E. L. Drake to undertake this enterprise. This well was sunk to a depth of sixty-nine feet and a half, where a cavity was struck, and the drill immediately sunk more than a foot. Previously the natural oil was obtained by pumping from salt-wells, or from pits, as above described; the processes being slow and laborious, and the product small. But here was a vein of oil struck in such quantity, that it rose in the well to within five inches of the earth's surface, and yielded four hundred gallons of oil a day, unmingled with water.

This unparalleled and splendid success opened up to people's imaginations the most tremendous possibilities. Excitement ran high. Attention was directed to the locality, and to the new mode of procuring this abundant product. Enterprise was stimulated to a remarkable degree. Everybody wanted to buy land, and to bore. Property rose immensely in value for miles around: the field of operations was rapidly extended down Oil Creek and Alleghany River, and numerous wells were sunk. Few of them paid, however; and a slight re-action soon set in. It should be remarked, that as yet pumps were necessary to extract the oil; and hence the year of 1859, with its great accomplishments, was rather a period of promise than of realization.

Excitement produced by this discovery.

The great element of success in the oil-industry was the use of the artesian well; but a better application of the principle was necessary. In 1860 some one conceived the idea of sinking wells to a greater depth than formerly, believing that the more productive veins were deeper down. Accordingly wells were bored to the third stratum of sand-rock, alternately piercing shales and other deposits, and going to the depth of several hundred feet. The result of this experiment was startling. An accumulation of oil and gas was struck, which was under such heavy internal pressure that the boring-apparatus was hurled from the whole length of the bore, and the contents of the vein gushed forth in a torrent of great impetuosity. These wells were tubed and secured with great difficulty, and the science of managing them necessarily attained great development in a short time. The quantity of oil now obtained was vastly increased, some wells flowing as much as three thousand or four thousand barrels a day for a long time. This yield was not steadily maintained, however, the quantity and force of the discharge lessening gradually, — sometimes suddenly and unaccountably when oil was struck near by, — until pumping became necessary in the course of a few weeks or months; and, finally, wells that had made their owners a huge fortune would become unproductive. Old wells were known, though, sometimes to recover some of their former productiveness.

Deeper wells reach richer supplies.

From the year 1860 the development of the petroleum-industry was so rapid and vast as to be without a parallel in American history, all things considered. Though the oil-lands proper were contained within a small geographical area, the influence of the excitement and greed of gain thereby aroused extended all over the country, and even to foreign lands. Companies were formed to bore for oil in thousands of places where traces of petroleum had been noticed for years previous. Land that was theretofore, and even then, worthless, brought fabulous prices. In the oil-region itself it was next to impossible to buy land. The business of getting out and refining oil grew like Jonah's gourd. Derricks, tall, strange, but useful, sprang up by the thousand. Cities, even, came into being almost in a day. Huge fortunes were made in weeks. There was a new class of shoddy aristocracy created by the wealth produced by petroleum. The ignorant but lucky, the low but shrewd, suddenly became immensely rich. New branches

The sudden and vast development of the industry.

of industry essential to the operations of the oil-interest — improved mining apparatus and processes, railroad extensions, new kinds of cars, pipe-lines, oil-boats, tanks, refineries, barrel-factories, lamp-factories, ship-building, co-operative organizations of producers, transporters, refiners, and exporters — were required to meet the exorbitant and pressing demands of the petroleum-traffic. Banking, insurance, and other interests, were required to enlarge their facilities. The arteries of domestic trade and transportation were made to pulsate with unnatural life and vigor, and our whole business-system was quickened into abnormal activity. Our foreign commerce was rapidly extended, petroleum leaping to the third rank among our exports inside of fifteen years.

But the lowering of prices in consequence of increased production ruined many owners of small wells. Speculators bought land at high prices which proved good for nothing. Money was lavished on derricks and boring-implements and labor, which never returned the adventurers one single cent; and, as the money was often borrowed, the chain of individual disaster sometimes had several links. The world hears mostly of men's successes, and little of their failures; but along the pathway of the petroleum-interest's progress are strewn a host of wrecks of fortune.

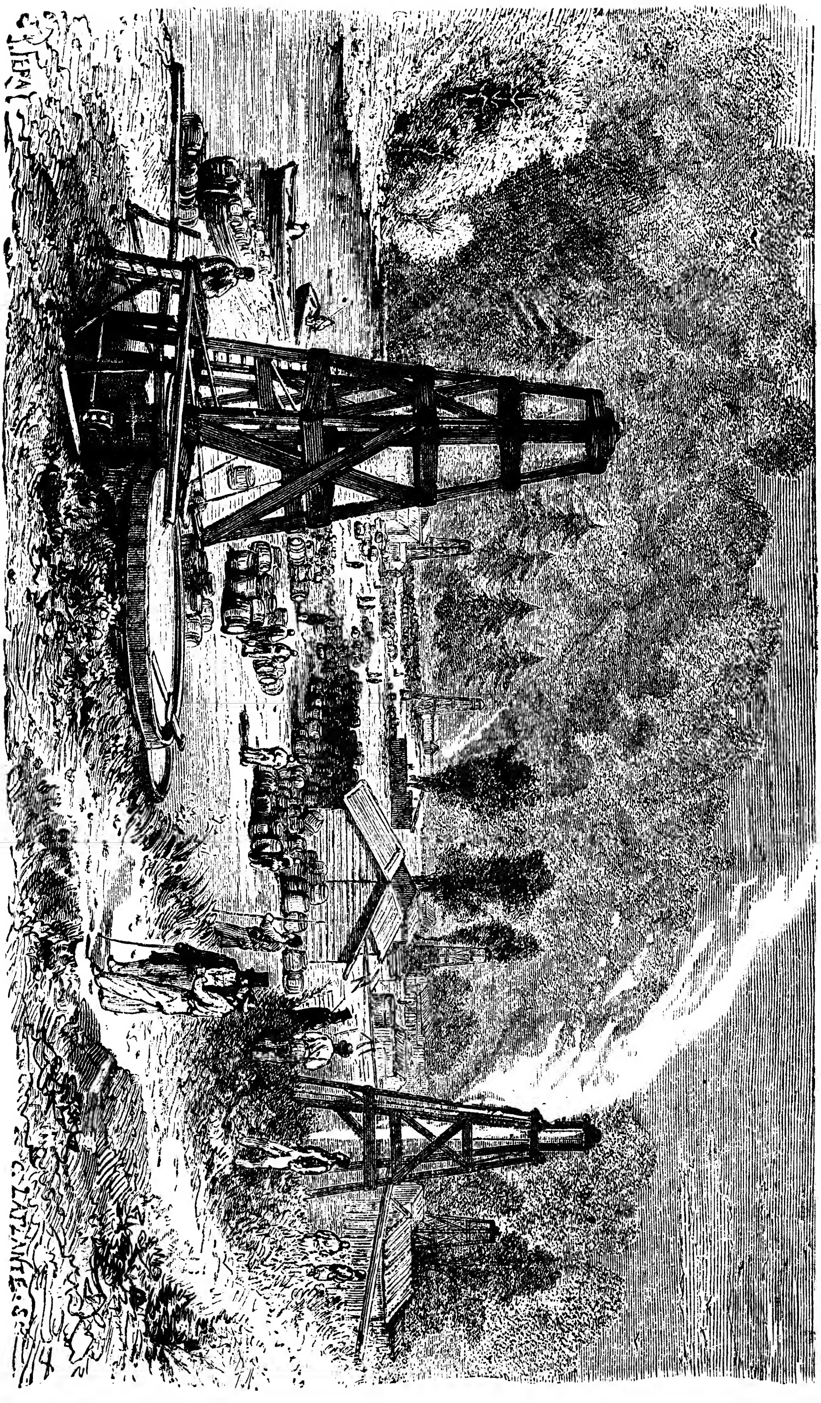
Early experiments in refining oil.

It is necessary that one know something about the experiments which had been made to produce artificial illuminating-oil before he can fully understand how Col. Drake came to bore for natural oil, and also how the way was opened for promptly utilizing these newly-discovered products. Nearly three centuries ago coal gas was discovered in England, though it was not used until about 1792. The experiments connected with its manufacture yielded also various natural oils, and Swiss and French chemists set themselves to utilizing these. Mr. James Young of Bathgate, Scotland, took out a patent for distilling oil from coal in 1850, and later got one out in the United States, which expired in 1871. The product of the first distillation was a dark, crude oil, which it was necessary to refine before using. Our word "petroleum" means rock-oil, and applies more particularly to the natural product distilled from carboniferous shales in Nature's laboratory by the inner heat of the earth. The artificial product from distilling coal is known as "kerosene." The crude oil in each case, however, is very much the same in composition, as are also the refined oils from the two sources.

First refinery in United States.

The Kerosene Oil Company founded the first distillery and refinery in this country, on Young's system, at Newtown Creek, L.I., in 1854. They utilized bituminous coal. The business rapidly extended, especially in Ohio, where soft coals abound; and in 1860 there were no less than twenty-five refineries in that State alone, six in Kentucky, one in St. Louis, eight or ten in Virginia, ten in Pennsylvania, five in the immediate vicinity of New-York City, and seven in New England.

Coincident with the distillation of an illuminating-oil from coal were experiments to perfect a lamp that would burn it. Used as our old sperm-oil or



OIL-WELLS AT TAR FARM, PENN.

spirit-gas was, kerosene had a deep red flame, and gave off smoke and an offensive odor. The invention of the modern burner and chimney to make the consumption complete, clarify the flame, and avoid the smoke and stench, was largely the work of Americans, though the Austrians assisted greatly. The kerosene-lamp was practically perfected before 1860.

Kerosene-lamp.

Thus it will be seen, that, while kerosene was not produced in large enough quantities to bring it into very common use, it was widely known, and all the facilities for its use were devised. It only remained to find the natural oil in large quantities, therefore, to make it cheap, and its use universal. For this latter consummation the world is indebted to George H. Bissell, formerly of the firm of Eveleth & Bissell. In the summer of 1853, while visiting friends at Dartmouth College, where he had graduated, and whither he had now come from New Orleans in pursuit of health, he was shown a bottle of crude petroleum taken from the neighborhood of Titusville, Penn. About this time he met a former New-Orleans friend, Mr. Eveleth, and broached this subject to him. They went next year to Venango County, and leased the principal oil-region for ninety-nine years, free of royalty, paying only five thousand dollars outright. The lands were trenched, and the accumulating surface-water and oil were pumped into vats by one hired man and the apparatus of a saw-mill. Three barrels of oil were taken thence to New Haven in 1855 to be analyzed by Professor Benjamin Silliman, jun., the expense being borne entirely by Eveleth & Bissell.

Eveleth & Bissell's experiments.

Elaborate and thorough tests were made, which showed that the petroleum on distillation would yield a number of distinct products; among them naphtha, or the lightest and most colorless of illuminating-oils, a fine lubricating-oil, dark and heavy, benzine, and paraffine. The oils were found to possess certain advantages over other oils, such as less tendency to thicken from cold. The gas manufactured from the petroleum could not be used with an ordinary burner, but gave a good flame with an argand.

Products discovered from analysis.

This report excited great interest in New Haven, and capitalists there wanted to buy a share in Eveleth & Bissell's interest. They obtained a third thereof, the original proprietors retaining two-thirds; and then they all united in forming a corporation known as "The Pennsylvania Rock-Oil Company," whose aim should be the collection and sale of oil from their lands. The work of trenching was continued; but in 1857 it was proposed to sink an artesian well. This was not done, however, until 1859, as stated heretofore. The work was done under the direction of one of the stockholders, Col. E. L. Drake, formerly a conductor on the New-York and New-Haven Railroad. The result of his experiments we have already stated.

Excitement over Silliman's report.

The transportation of oil is one of the most important of its dependent interests. Next after knowing how to utilize a natural product, and how to derive it, the work of carrying it from the point of production to the places of consumption, or at least to the great centres of distribution, is the most essential feature of the interest; and this is peculiarly true of petroleum. The two modes of conveyance utilized at first in the oil-region of Pennsylvania were horse-power and barges.

A barrel of oil weighs about three hundred and sixty pounds, and seven or eight of these made a load for a team. Such was the immense amount of teaming to be done, and so remunerative were the rates at first, that small fortunes were made by the proprietors of single establishments. A thousand teams would often go over the roads from the wells to some large town the same day; and the mud formed by the rain, the leakage of oil, and the travel, was something fearful. Wagons and teams would often be ruined in a few days by this severe usage; but the profits would enable a man to buy anew very frequently without loss. But teams were not relied upon, where, as was often the case, water-transportation could be had.

Transporting oil.

The oil-region lies along the valleys of Oil Creek and the Alleghany River; and the wells were never very many miles away from these two streams, and often close to them. At first barges were used to carry barrels: afterwards the oil would be discharged right into barges made especially for the purpose. At first these receptacles, holding anywhere from twenty-five barrels to twelve hundred, would be without decks or partitions, and thus were easily upset and emptied: afterwards bulkheads were put in to keep the oil from being shaken about, and to prevent the craft's balance being easily disturbed. A vast amount of timber was used in making them, and the yards where they were built and kept would show many square acres of closely-arranged boats.

Use of barges.

The "pond-freshet," a deluge of stored water in Oil Creek, had for many years been resorted to by the lumbermen of that region in order to carry their numerous and immense rafts down the shallow stream to the Alleghany. These rafts, of course, were swept down simultaneously; and the great perils and catastrophes made the occasions highly exciting and dangerous. The adoption of this expedient to carry down the oil-barges, in fleets of about two hundred at a time, led to even greater casualties and adventure than ever. The price which the shippers paid the owners of the dam for a pond-freshet varied from a hundred dollars to two hundred and fifty, although as high as four hundred dollars has been paid. This was raised by assessment, the cost being but a few cents a barrel, the oil brought down by one freshet often amounting to fifteen thousand or twenty thousand barrels; but there is record of forty thousand barrels coming down at one time. Pittsburgh, at the junction of the Alleghany and Monongahela Rivers, was long the great centre where the oil-shipments accumulated and were distributed; and a fleet of a thousand barges and tow-boats was used on the Alleghany and Ohio Rivers.

"Pond-freshet."

But the railroad companies were soon alive to the imperfection of horse and boat transportation. All the existing lines in Western Pennsylvania rapidly made extensions, and numerous local roads were built by new corporations. By 1867 the whole oil-region was covered with a network of railroads; and from this circumscribed area many threads of communication reached out toward Ohio, Lake Erie, Buffalo, Olean, Philadelphia, Baltimore, and Pittsburgh. The many new towns and villages built up by the oil-interest had the most perfect railroad-connection with the outside world. The oil, whether pumped or spouting, was discharged into elevated sheet-iron tanks of enormous capacity; from these were extended pipes of greater or less length to the branch railroad-tracks; and platform-cars bearing tanks of from forty to fifty barrels' capacity were thus very easily freighted. The refining-interest was then developed rapidly at great distances from the producing region; but it was confined principally to a few cities either on the Atlantic seaboard or on Lake Erie.

Railroads.

A still greater step in oil-transportation was taken when the construction of long pipe-lines from the oil-region to large cities was undertaken. Iron pipes of two inches diameter, closely jointed, are laid in shallow trenches, generally along the railroad-lines. As the cold cannot affect them, they work as well in winter as in summer. Gravitation usually causes the oil to flow through them with sufficient rapidity, although pumping-engines are sometimes employed. The pipe companies receipt for the amount taken into their pipes from the tanks, as shown by the gauges, and agree to deliver the registered quantity at the terminus of their line, often hundreds of miles away. This being the cheapest method of transportation, producers are forced to utilize it, or lose money. As the pipe-lines have been bought up and concentrated by a few persons, the transportation of crude petroleum from the place where it is produced to the place where it is refined and marketed is in the hands of a monopoly, who are thus able to control the markets of the world; and, as the refining and exporting have likewise been centralized and allied with the pipe-line interest, the production and price of oil are completely controlled by the "ring."

Pipes.

Before proceeding briefly to state the development the oil-interest has attained, and to consider the probable future of the production, it may be remarked, that few industries of the country have been and are affected by catastrophe so easily and suddenly as the petroleum. Fire and flood have done damage at one time or another to petroleum in large quantities, and not only wrought the ruin of proprietors and speculators, but have decidedly affected the general market. A crush of oil-boats in an ice-gorge in December, 1862, at Oil City, robbed the owners of over fifty thousand barrels of oil, and involved a loss, real and contingent, of five hundred thousand dollars. Before the event, the ice-blockade in the river and the scarcity of oil at Pittsburgh put the price up to thirty-one and thirty-two

Loss of oil by fire and flood.

cents a gallon: a few days after the disaster, when the channel was open, the price was only nine cents, and it kept receding the rest of the winter. The next year forty large oil-boats were burned on the creek; and one of them burned up a fine suspension-bridge at Franklin, the total loss amounting to a hundred and fifty thousand dollars. The drifting masses of rose-colored flame afforded at night a magnificent scene. The breakage of bulk in immense quantities, and the catching fire of oil on the water, have also wrought devastation to wharves and shipping for miles. Spouting-wells have taken fire from adjacent engines, and bursting tanks that held thousands of barrels — first flooding a wide area, including buildings, wells, and machinery, and then becoming ignited — have also figured prominently in the many disasters that are recorded in petroleum's history.

Production.

There are no statistics to show the amount of oil produced in 1859; but the owners of the Drake well at first controlled the supply, and kept the price at twenty dollars per barrel the last four months of the year. During 1860 the price ranged from two dollars to twenty dollars, the average being nine dollars and sixty cents. The production rapidly increased the latter part of that year and through 1861. While the home-trade was hardly developed, still less was the export trade. The overstocking of the market without sufficient outlet ran the price down to ten cents a barrel during a good part of 1861, the average for the year being forty-nine cents. In 1862 our foreign trade had become immensely developed, amounting to 10,387,701 gallons, or 250,000 barrels. In 1863 we nearly trebled this, and in 1864 had quite done so. Our total product in 1864 was over 1,000,000 barrels, of which we exported three-quarters. Ten years later, our export was nearly 6,000,000 barrels, — an increase of eightfold; and, as the exports bore about the same relation to our home-consumption, the total production had risen to between 7,000,000 and 8,000,000 barrels. This increase was not at an even rate; yet it was steady. In 1864 the price advanced to an average of seven dollars and sixty-two cents a barrel, a slight check in the production having been experienced, and the outlet having been enlarged. During the next six years it fluctuated between nine dollars and a half and three dollars. From 1872 to 1876 the average export was over 5,000,000 barrels. In the last-named year the exact export was 6,594,237 barrels out of a total product of 10,191,452. The value of the export of 1876 was a trifle under $50,000,000, and of the total product about $75,000,000. In 1877 our product was increased about one-third; but the price fell off nearly one-fifth on an average for the year, and for all grades of oil and residuum. The yield might be said to have been worth nearly $90,000,000.

Capital invested.

This is nearly equal to the amount invested in oil-lands, tankage, and machinery for pumping crude petroleum. The railroads and pipe-lines built especially for the petroleum interest represent $25,000,000 or $30,000,000 of capital, and the refineries something less. Petroleum, therefore, pays over sixty per cent upon the capital invested annually; which shows the advantages of a monopoly controlling an interest.

Future supply.

It is a very interesting question, how long our petroleum-supply will hold out. Thus far, while individual wells have always proved short-lived, our yield has steadily increased through a period of eighteen years. We have no rival in the world to fear at present, and our increase keeps pace with the increasing demands of the world. The enlargement of our yield might be more rapid, were that of the demand likewise; and if oil shall be found in other quarters of the globe in large quantities, and our production is necessarily reduced in order to avoid overstocking the market, we shall be more economical in the exhaustion of our treasure. But the best judges seem to think that the supply is practically unlimited, as is that of our coal. Though it may have filtered hundreds of miles laterally from the point of its formation, owing to the porous character of some of the adjacent strata of rocks, the fractured condition of others, and the upheaval of vast ranges of mountains from the original level of their composite strata, there is little question that the oil has been distilled from coal and from carboniferous shales that could not be used for fuel. As our enormous consumption of oil does not equal the oil-producing possibilities of the coal we consume, as the shales have yielded oil beside that derived from the coal, and as we have drawn on our coal-account with Mother Earth much more largely than on our oil-account, it is reasonable to suppose that she will continue to honor our drafts unlimitedly for many generations to come.

BOOK V.

BANKING, INSURANCE, AND COMMERCE.

CHAPTER I.

BANKING.

EARLY COLONIAL PERIOD.

NO country has ever tried so many experiments in banking as the United States. This is due to several causes. In the first place, while the nations of the earth had from a very early day used money of various kinds, and individual money-lenders had practised their profession for centuries under more or less rigid governmental regulation and protection, the idea of joint-stock corporations to carry on the business, whose notes, properly secured, should form a popular currency, came into notice in the world only after the foundation of the American colonies. Furthermore, the peculiar forms of colonial and national government in this country, and the spirit of the people, to say nothing of the lack of individual capitalists in early times, stimulated and gave free play to business-enterprise to a much greater extent than was possible under the monopolistic and monarchical institutions of Europe.

Varied experiments in American banking.

As early as 1715, when the mystery of banking was first attracting the attention of European financiers, John Colman of Massachusetts, and other merchants, proposed to establish a bank which should issue notes, the security therefor being land. A party immediately sprang up which opposed this scheme, and which advocated, instead, a system of loaning by the Provincial Government to the inhabitant, on interest payable annually, which should be applied toward the public expenses. The governor and his council refused to sanction Colman's project, and referred him to the legislature. Nothing daunted, he effected an association which presented the matter to that body. The opposition there met them with a counter-proposal for the issuance of a provincial loan to the extent of fifty thousand pounds; and this was adopted. Thus it will be seen that the government of the Bay State in its early days was, as was eminently proper then, paternal in its helpfulness. Inasmuch as the mercantile portion of the community regarded the above-mentioned loan insufficient for their needs, and clamored for more, the Col-

First American project.

man party were encouraged to continue their contest for the establishment of private banks of issue, but without success.

The system of money-lending adopted by Massachusetts soon found favor in other colonies, nearly all of which had tried the experiment before the breaking-out of the Revolution. Benjamin Franklin heartily approved the plan; which, by the way, proved decidedly profitable to the colonies which embarked in it. So long as the security taken was ample, of course the taxpayers incurred no risk; yet there was constant danger of loans being based upon insufficient security. This system, as also that devised by Colman, was tried with occasional variation; but all of these experiments proved somewhat inefficient and short-lived.

Extension of the system.

The first institution worthy of the name of a bank, organized in this country, was founded, not with any purpose of enriching those connected therewith, nor of facilitating ordinary trade, but of patriotically assisting the infant republic of the United States to achieve its national independence. At a meeting of citizens held in Philadelphia June 17, 1780, it was resolved to open a "security subscription to the amount of three hundred thousand pounds, Pennsylvania currency, real money," the same to be used in purchasing necessary supplies for Washington's army. At this time the soldiers were in extreme need, and on the verge of mutiny; and the Federal Government was unable to make the requisite provision for the emergency, although it was expected to re-imburse the subscribers ultimately. Thomas Paine, the distinguished free-thinker, and at that time clerk of the Pennsylvania Assembly, was active in promoting the scheme, and enclosed five hundred dollars toward making up the fund to Blair McClenaghan, who, as also Robert Morris, subscribed two hundred pounds in hard money.

Bank of North America.

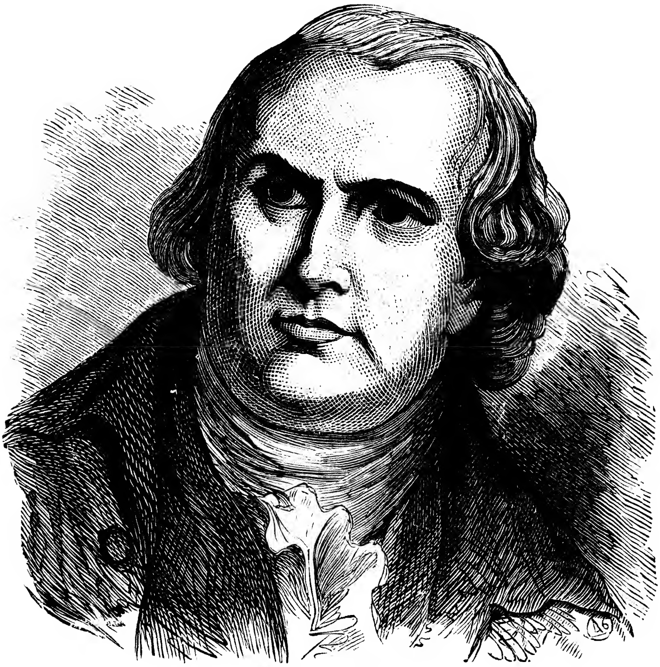
Four days later the matter was brought up in the Continental Congress, which then met in Philadelphia, and a committee was appointed to confer with the inspectors and directors of the proposed institution. Subsequently the committee reported a series of resolutions, which were unanimously adopted, appreciatively recognizing the intention of the associators, accepting their patriotic offer, and pledging repayment.

Congressional proceedings relative thereto.

The eminent financier and patriot, Robert Morris, then superintendent of finance, devised, in the spring of 1781, the system on which the bank should operate; and, on the 26th of May, Congress approved it. In December the institution was by that body formally chartered as the Bank of North America, with a capital limited to 10,000,000 Spanish silver-milled dollars. The amount of capital paid in by the individual stockholders did not, however, exceed $85,000. The superintendent of finance, to encourage the undertaking, subscribed $250,000 to the stock on behalf of the government; but the national finances were so far exhausted, that the bank was subsequently obliged to release $200,000 of the

Robert Morris's connection therewith.

subscription, and its remaining stock paid in was sold to persons in Holland. The bank was opened for business on Jan. 7, 1782. Before the month of July following it had loaned to the government $400,000, and to the State of Pennsylvania $80,000.



ROBERT MORRIS.

Further history and success of the bank.

The legislature of Pennsylvania granted the company an act of incorporation of perpetual duration on April 1, 1782, which was repealed in 1785; but the bank continued its business under the act of Congress. A change of parties in 1787 brought with it a renewal of the charter by the State of Pennsylvania, limited, however, to the term of fourteen years, with a capital of $2,000,000. In 1790 Hamilton, in his report, refers to the "ambiguous situation in which the Bank of North America has placed itself by the acceptance of its last State charter," and concludes, that as this has rendered it a bank of an individual State, with a capital of but $2,000,000, liable to dissolution at the expiration of its charter in fourteen years, it would not be expedient to accept it as an equivalent for a bank of the United States. The State charter of the bank was renewed from time to time until Dec. 3, 1864, when it became a national bank, retaining its original name, with a capital of $1,000,000, and a surplus of nearly the same amount. Although such was not originally intended to be the case, the institution has proved profitable to the stockholders; for the annual dividends from 1792 to 1875, a period of eighty-four years, averaged only a small fraction less than eleven per cent.

FIRST BANK OF THE UNITED STATES.

Alexander Hamilton moves for a national bank.

The experiment of the Bank of North America had demonstrated the value of an institution which should make loans to the government as well as to private individuals; which should take and place government bonds as our "syndicates" do now; and which should furnish the people a secure paper currency to supplement the limited amount of coin in circulation. But Alexander Hamilton, the great Federalist, who had been so influential in securing the adoption of the new Constitution in 1787, and who was Washington's first secretary of the treasury, held that the Bank of North America had then become a State institution, and that a National bank should be organized. England had such a one, and France also. With a foresight which has been singularly justified by the experience of the country with greenbacks at a later day, he objected to the issue of paper money directly by the government, as of "a nature so liable to abuse, and, it may even be affirmed, so certain of being abused, that the wisdom of the government will be shown in never trusting itself with the use of so seducing and dangerous an expedient." Accordingly, in an elaborate report made Dec. 13, 1790, covering the above points, he recommended the incorporation of the Bank of the United States; and his plan, substantially unchanged, was adopted by Congress, and approved by the President, the 25th of the following February.

Its basis and government.

The capital of the bank was fixed at $10,000,000. One-fourth of all the private and corporate subscriptions was to be paid in gold and silver, and three-fourths were to be paid in United-States stock bearing six per cent interest. Two millions were to be subscribed by the United States, and paid in ten equal annual instalments by loans from the bank, or, as Mr. Hamilton describes the operation, by "borrowing with one hand what is lent with the other." The board of directors of the bank was to consist of twenty-five persons, not more than three-fourths of them to be eligible for re-election in the next succeeding year. The bank had authority to loan on real-estate security, but could only hold such real estate as was requisite for the erection of suitable banking-houses, or should be conveyed to it in satisfaction of mortgages or judgments. No stockholder, unless a citizen of the United States, could be a director; and the directors were to give their services without compensation. The bills and notes of the bank were made receivable in payment of all debts to the United States.

From the day it was first proposed, the Bank of the United States was a bone of political contention; the North favoring it, and the South disapproving. The line which divided its friends and foes was not only sectional, but partisan: the Federalists, and subsequently the Whigs, constituting the former; and the Republicans, or, as they were also called, the Democrats, composing the latter. The original act of incorporation was opposed in the House of Representatives by James

Political sentiment regarding it.

ALEXANDER HAMILTON.

Madison (afterwards President) and eighteen others, all but one of whom were from Virginia, Maryland, and the Carolinas. Thomas Jefferson (then secretary of state) and Edmund Randolph (attorney-general), in opinions requested by Washington, also disapproved. The grounds taken by the opponents of the charter were a denial of the general utility of banking systems, and opposition to the special provisions of the bill; but the main force of their objections was directed against the constitutional authority of Congress to pass an act for the incorporation of a national bank. The supporters of the bill in the House of Representatives numbered thirty-nine, — a majority of twenty, — all of them, except four, being representatives of Northern States, among whom were Fisher Ames, Elbridge Gerry, and Theodore Sedgwick, of Massachusetts, Roger Sherman and Jonathan Trumbull of Connecticut, Elias Boudinot of New Jersey, and Peter Muhlenberg of Pennsylvania. Hamilton (secretary of the treasury) and Knox (secretary of war), in official opinions rendered to the President, maintained the constitutionality and the policy of the act.

The average dividends of the bank from its organization to March, 1809, were at the rate of eight and a half per centum per annum. The 5,000 shares of $400 each owned by the United States were disposed of in the years 1796 to 1802 at a considerable profit; 2,220 shares having been sold in the last-mentioned year at a premium of forty-five per cent. According to the treasury-records, the government subscription, with the addition of the interest which was paid by the United States on the stock issued for it, amounted to $2,636,427.71; while there was received by the treasury in dividends, and from the sale of the bank-stock at various times, $3,773,580, the profit realized by the government being $1,137,152.29, or nearly fifty-seven per cent on the original investment.

Success of the bank.

The twenty-years' limit of the bank's charter expired March 4, 1811; and application was made for its renewal in April, 1808. Again the question became political, although party lines were not drawn strictly. Congress investigated the matter in 1810. Mr. Gallatin, then secretary of the treasury, favored the renewal, and said of the first bank, that its affairs, "considered as a moneyed institution, have been wisely and skilfully administered." The vote in the Senate, Feb. 20, 1811, resulted in a tie; and the Vice-President, George Clinton, threw his casting vote against the measure. Henry Clay opposed it; while Mr. Crawford and Mr. Pickering favored it, the latter acting contrary to the instructions of the Massachusetts legislature. The legislatures of Pennsylvania and Virginia instructed their representatives to oppose it on the ground of unconstitutionality. In the House the bill was defeated by a minority of one.

Agitation for renewing the charter unsuccessful.

Financial evils of a serious character now ensued, and greatly distressed the country; the trouble being greatly augmented by the paralyzing effect upon industry of the embargo of 1807 and the war of 1812–14. In the first place, the State banks, and even unchartered institutions, inflated the paper currency until it sadly depreciated. In 1811 the outstanding State-bank notes amounted to $28,000,000; in 1813, between $62,000,000 and $70,000,000; in 1815, between $99,000,000 and $110,000,000; and in 1819, between $45,000,000 and $53,000,000.

Serious financial evils resulting.

Floods of this currency were in fractions of a dollar, from six cents upward. Much of this being irredeemable, it passed for a great deal less than its face. Again: in September, 1814, all of the banks south of New England suspended specie payments. This also depreciated their notes. Furthermore, the United States, which had not yet established treasure-vaults of its own, had some $9,000,000 on deposit with the suspended banks, which numbered about a hundred, and from which it could not recover its money for many years; in some cases, never. The government's own credit suffered in consequence. During 1813 and 1814 it issued stocks to the amount of $42,269,776, which were to run twelve years at six per cent, but which had to be sold at fifteen per cent discount. On Feb. 24, 1815, the war being over, a loan of $8,856,960, running for nine years at seven per cent, was negotiated at par; and yet another loan of $9,745,745 for only nine months, at six per cent, yielded the following year only ninety-five per cent of its face. It should be borne in mind, too, that, even while selling these bonds below par, the government was obliged to receive paper money, which was worth much less than its own face; so that its loss was double. These were the most important results of the State-bank system during the interval between the first and second banks of the United States,—from March 4, 1811, to Jan. 7, 1817.

Another vain attempt at revival.

On Oct. 6, 1814, Mr. Dallas was appointed secretary of the treasury; and on the 14th of the same month, in response to an inquiry from the Ways and Means Committee of the House of Representatives, he reviewed all the evils just recounted in an elaborate and earnest argument, and strongly recommended the organization of a national bank. This and the experience of the country revolutionized sentiment in Congress; and in January, 1815, that body granted a new charter to the old Bank of the United States. But Mr. Madison, who had then been President nearly six years, and who had opposed the establishment of the original bank, vetoed the bill.

SECOND BANK OF THE UNITED STATES.

Re-establishment.

On the 10th of April, 1816, a bill was approved by President Madison, which was the second and last charter of the bank granted by the General Government. The plan proposed by Mr. Dallas was modelled upon the charter of the first United-States Bank, and the act of incorporation as finally passed did not differ materially from the plan proposed by him. The charter was limited to twenty years, expiring on March 3, 1836. The capital was fixed at $35,000,000, $7,000,000 of which was to be subscribed by the government, payable in coin, or in stock of the United States bearing interest at five per cent, and redeemable at the pleasure of the government. The remaining stock was to be subscribed for by individuals and corporations, one-fourth being payable in coin, and three-fourths in coin or in the funded debt of the United States. Five of the directors were to be appointed by the President; and all of them were required to be resident-citizens of the United States, and to serve without compensation. The amount of indebtedness, exclusive of deposits, was not to exceed the capital of the bank. The directors were empowered to establish branches; and the notes of the bank, payable on demand, were receivable in all payments to the United States. The penalty for refusing to pay its notes or deposits in coin, on demand, was twelve per cent per annum until fully paid. The bank was required to give the necessary facilities, without charge, for transferring the funds of the government to different portions of the Union, and for negotiating public loans. The moneys of the government were to be deposited in the bank and its branches, unless the secretary of the treasury should otherwise direct. No notes were to be issued of a less denomination than five dollars, and all notes smaller than a hundred dollars were to be made payable on demand. The bank was not, directly nor indirectly, to deal in any thing except bills of exchange, gold or silver bullion, goods pledged for money lent, or in the sale of goods really and truly pledged for loans, or of the proceeds of its lands. No other bank was to be established by authority of Congress during the continuance of the corporation, except such as might be organized in the District of Columbia with an aggregate capital not exceeding $6,000,000; and, in consideration of all the grants of the charter, the bank was to pay to the United States a bonus of $1,500,000 in three annual instalments. The bank went into operation Jan. 7, 1817.

Grave difficulties surmounted.

This period was particularly critical. Property had depreciated; the contraction of State-bank circulation was rapidly going on, and bank-failures were frequent and numerous. Individual and corporate business-enterprises were still languishing in consequence of the war and currency evils. This made up-hill work for the new United-States Bank. Its managers were still further embarrassed by an attack on them in Congress. In November, 1818, a committee was appointed to investigate its affairs, which, in December, reported that it had violated its charter in four instances, and in February, 1819, recommended a repeal of the same. This assault failed, however, as the resolution did not pass. In the last-named year, the bank, feeling the responsibility of its influence upon the business of the country, made an herculean effort. It imported seven millions of specie from Europe in order to restore soundness to the currency. This enterprise cost it half a million; and, owing to the mismanagement of the Baltimore branch, over three millions were lost outright. Yet the bank and the business of the country eventually recovered. Popular industry and governmental finance prospered from 1820 to 1835. In this interval the national debt was paid, and the stock of the bank rose in the market until it commanded a premium of twenty per cent. "Long before the election of Gen. Jackson," says Mr. Parton, "the bank appeared to have lived down all opposition. In the presidential campaign of 1824 it was not so much as mentioned, nor was it mentioned in that of 1828. In all the political pamphlets, volumes, newspapers, campaign-papers, burlesques, and caricatures of those years, there is not the most distant allusion to the bank as a political issue."

In 1837, when the Federal charter expired, the bank's stock stood at twenty-five per cent premium, and the institution was making money. The profit realized by the government in the mean time will be seen from the following statement: —

Bonus paid by the bank to the United States		$1,500,000 00
Dividends paid by the bank to the United States		7,118,416 29
Proceeds of stocks sold and other moneys paid by the bank to the United States		9,424,750 78
Total		$18,043,167 07
Five-per-cent stock issued by the United States for its subscription to the stock of the bank	$7,000,000	
Interest paid on the same from issue to redemption,	4,950,000	
		11,950,000 00
Profit		$6,093,167 07

Andrew Jackson makes war on the bank.

Andrew Jackson came to the presidency March 4, 1829, and soon began a crusade against the bank. In his message to Congress the following winter he advised a consideration of the constitutional objections to re-chartering the institution. Agitation, mild at first, gradually increased. In July, 1832, Congress granted a renewal of the charter, and President Jackson vetoed the bill. A few months later an intention was manifested of removing from the bank all the government deposits. In the winter of 1832–33 the House passed a resolution declaring that these moneys were safe where they were. But the election of the previous fall had insured a Democratic House to succeed this one. After his second inauguration in 1833, therefore, the President ordered his new secretary of the treasury, Mr. Duane, to remove the deposits, and distribute them among certain State banks. That gentleman declined to do so, and was therefore displaced by the President, who appointed Attorney-Gen. Taney his successor. Mr. Taney executed the mandate of his superior, and gave his reasons therefor to the new Congress on its meeting in December. The Senate, by a vote of twenty-six to twenty, censured the President for what it termed a usurpation of authority, and voted, twenty-eight to eighteen, that the moneys had been safe where they were. The House, on the other hand, approved the President's course, declared that the Bank of the United States ought not to be rechartered, resolved that the State banks be continued as depositories, and authorized the investigation of the bank and its branches.

Mr. Taney announced, that, while the new deposits would go to the State banks selected as depositories, those already in the United-States Bank would only be removed gradually. Its managers, however, although it had specie enough in its vaults to meet a demand from the government in full, made a pretence of fear of a sudden attack from the treasury department, and created an artificial stringency in the coin-market. Meanwhile the State banks rapidly increased their issues of paper, the increase being from $61,000,000 in 1830 to $149,000,000 in 1837. Whereas in 1830 a committee of the Senate had reported that "the country is in the enjoyment of a uniform national currency (notes of the Bank of the United States), not only sound and uniform in itself, but perfectly adapted to all the purposes of the government and the community, and more sound and uniform than that possessed of any other country," yet, but seven years after this (on the 10th of May, 1837), all the banks then in operation, with the mammoth United-States Bank of Pennsylvania among them, went into suspension as if by common consent, or, as Col. Benton has it, "with a concert and punctuality of action which announced arrangement and determination such as attend revolts and insurrections in other countries;" and he declares that "the prime mover and master manager of the suspension was the Bank of the United States, then rotten to the core, and tottering to its fall, but strong enough to carry others with it, and seeking to hide its own downfall in the crash of a general catastrophe." This allegation derives some support from the report of the committee of the stockholders, made in January, 1841, after the failure of the bank. They say, "The origin of the course of policy which has conducted to the present situation of the affairs of the institution dates beyond the period of the recharter by the State." Favored by the importation of $20,000,000 of specie, the New-England and New-York banks resumed in 1838; but the Philadelphia banks made three unsuccessful attempts before they finally accomplished resumption in February, 1841. But between 1837 and 1843 they had contracted their circulation from $149,000,000 to $58,000,000.

Results of removing the deposits.

The managers of the United-States Bank did not wind up its affairs when the expiration of its charter drew near, but secured a new charter from the State of Pennsylvania, which was issued Feb. 18, 1836, only thirteen days before the old one expired. Under this title it proceeded to do business as before. The new charter, however, was obtained on condition of assisting in State improvements, canals, railroads, navigation companies, and turnpike-roads, to the extent of about $5,000,000. Col. Benton regards this pledge as a form of bribery, in addition to which he attributes the grant of the charter to personal corruption of the legislature by the managers of the bank. The State never received its bonus, however. The bank, as has been seen, suspended specie payments as often as other State institutions, and finally succumbed to trials which other banks, more prudently managed, survived. It made an assignment of certain securities, on May 1, 1841, to secure 5,000,000 of post-notes which other banks had

Winding up of the United-States Bank.

taken in exchange for its demand-notes. The second assignment was made June 7, 1841, to secure its notes and deposits, "among which were notes and deposits of the late Bank of the United States, incorporated by Congress;" so that it appears to have been, up to 1841, using its old issues. The third and final assignment, made on Sept. 4, 1841, covered all its remaining property, — "to provide for the payment of sundry persons and bodies corporate which the bank is at present unable to pay."

Nicholas Biddle had been the president of the bank from January, 1823, to March, 1839, when he resigned, leaving the institution, as he said, "prosperous." The shares, however, were sold at that time at 111, instead of 125 as in 1837, and were quoted in April, 1843, after its failure, at $1\frac{7}{8}$.

The liquidation of the bank is briefly stated in a letter to the national comptroller by Thomas Robins, Esq., president of the Philadelphia National Bank, who is believed to be the only survivor of its numerous assignees. He says, "All the circulating-notes of the Bank of the United States, together with the deposits, were paid in full, principal and interest; and the accounts of the assignees were finally settled in 1856. There were no funds, and no dividend was paid to the stockholders of the bank: the whole $28,000,000 was a total loss to them. The 7,000,000 of stock held by the United States previous to the institution becoming a State bank was paid in full to the government; so that the United States lost nothing by the bank." With this experience in banking the government was long content.

The present national-bank system.

The exigency of a civil war twenty years later required a fiscal agency between the United-States Government and the people of the country and of the world, by which the former's loans could be rapidly negotiated. In the earlier days, the Bank of the United States had performed this work: later, the syndicate of New-York bankers have accomplished it. But in 1861 the old expedient was too unpopular, and the new one was not yet devised, if, indeed, it were practicable. Accordingly, Mr. Salmon P. Chase, then secretary of the treasury, proposed to enact a general law providing for the conversion of State banks all over the country into "National" banks; the transformation being facilitated by taxing the old banks, and granting special immunities and privileges to the new ones. The object of the law was to effect the sale of government bonds extensively. This was brought about by requiring the banks to invest their capital in these bonds, and deposit them at Washington as security for their circulation, which was allowed to equal only ninety per cent of the bonds so deposited. This gave the government ready money, and at the same time secured a uniform paper currency, which was everywhere receivable, and equal to government notes or "greenbacks." The proposition did not meet with favor at first, however. A bill was prepared, in accordance with the secretary's wishes, by the Ways and Means Committee, in December, 1861; but such was the objection to it, that it was laid aside for a time: indeed, it was not resuscitated until February, 1863, when the Finance Committee of the Senate reported it to that body. Ten days later it passed by a vote of twenty-three to twenty-one; and eight days afterward the House concurred, seventy-eight to sixty-four. Within a week the President had approved the measure, and it went into immediate operation. This system has continued ever since, with no material modification, and is as nearly perfect as a banking-system can be. The security of the

SALMON P. CHASE.

notes already referred to, their uniformity throughout the whole country, and the rigid system of quarterly statements, of reserves to meet a demand, and of governmental inspection, account for the popularity with which the national banks have been regarded.

STATE BANKS. — MASSACHUSETTS.

The second local bank in the United States.

We turn now to survey briefly banking under State auspices. Without examining in detail the history of each particular State, it will suffice to note the course of events in some of the representative sections of the country. We have already noted the failure of Colman's efforts early in the eighteenth century. But Massachusetts kept the subject in mind, and was, therefore, peculiarly susceptible to the influence of Pennsylvania's example. Already mention has been made of the Bank of North America, which was opened in Philadelphia in March, 1782. The success of this institution led, two years later, to the organization of the Massachusetts Bank, which received its charter from the legislature on Feb. 7, 1784. This was the first local bank established in that State, and the second in the United States. Its capital was limited to $300,000, of which $253,500 had been paid in when it commenced business on July 5 of that year.

Success of the experiment.

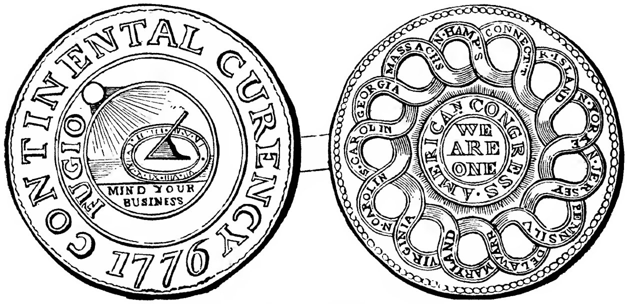
During the ninety-two years which have elapsed since this bank was established, it has passed but two dividends; the first instance occurring at the close of the war of 1812, and the second during the financial crisis of 1836. But, when the bank was converted into a national association, it compensated for these omissions by declaring an extra dividend of ten per cent. Up to June 1, 1874, a period of ninety years, the ratio of its losses to the total amount loaned was but four-hundredths of one per cent. In the eighty years of its existence as a State bank, from 1784 to 1864, the whole amount of circulating notes issued by it was $4,674,177, of which the amount lost, or not presented for redemption, was $22,111, or not quite half of one per cent.

Examinations ordered, and small bills prohibited.

No further bank-charter was granted by this State until 1792, in which year the Union Bank was organized, with a specie capital of $1,200,000, of which $400,000 was subscribed by the State. During this interval the currency was in bad condition. Small bills had nearly driven specie out of circulation, when, in 1792, the legislature prohibited any further issue of notes of a less denomination than five dollars. Provision was made for legislative examinations of the Union Bank, and it was made the depository of the funds of the commonwealth. It was also required to loan not exceeding $100,000 to the State at five-per-cent interest, and provisions of a similar nature appeared in most of the charters subsequently granted. In 1795 Massachusetts incorporated her third bank, the Nantucket, with a capital of $40,000; and in the same year the Merrimack, at Newburyport, was established. The prohibition against the issue of small bills was waived in the case of these banks, each of them being allowed to issue notes as small as two dollars.

Development of scientific banking.

It should be borne in mind that the science of banking was, at this period of our history, in its infancy; not only infancy of proportion, but of idea. It was not yet understood exactly what the true province of a bank was, nor yet what was the best way to make such an institution secure. Then, too, as an inheritance from the mother-country and past ages, the grant of the privilege of banking was a special, not a general one; and, in return therefor, the grantees were expected to make some particular return to the government. We have noticed this in the bonuses exacted for the United-States bank-charters both by the Federal Government and that of Pennsylvania. We notice, in the case of Massachusetts, that she exacted a loan from the Union Bank, the second she ever chartered. On the other hand, the government took the institution under its special protection, and insured success by subscribing a third or so of the capital of the proposed bank. In nearly all the charters granted subsequent to the year 1793 provision was made for a State subscription, usually about one-third of the capital. Under these provisions the State became largely interested in the banking-business, holding in 1812 about $1,000,000 of bank-stock, the total bank capital in the State being then about $8,000,000.



CONTINENTAL PEWTER MONEY.

Governmental inspection.

Colman's idea was to secure a bank's notes by mortgages on land. The Colonies and States seem to have trusted largely to the character of the bankers for honesty and good management to whom charters were given. But, by degrees, the necessity for some sort of surveillance began to be felt. Provision had been made in 1792 for a legislative examination, which, no doubt, was a pretty thorough and methodical thing in those days; but this inspection was probably ordered, in a great measure, on account of the Union Bank being a depository of State funds, and less out of regard for the business-community. In 1799 a law was passed prohibiting the issuing of notes by unauthorized associations; so that governmental inspection had a greater value. This enactment was modelled after one of the British Parliament in 1741; but its enforcement in New England almost produced a rebellion. In 1803 the examination was made an executive function; and the banks were required to make out returns, like the railroads and insurance companies in certain States now: these returns were to be semi-annual, and to be sent to the governor and council. In 1805 another enactment required that they be sworn to.

Evils arising notwithstanding.

But all this legislation was insufficient to make the bank-notes sound money. The law prohibiting the issue of bills in smaller denominations than five dollars was violated, and notes as small as twenty-five cents became very plenty. This drove specie out of circulation. The banks issued larger notes, too, beyond reason; and in 1809, when the embargo had paralyzed commerce and trade, and business was depressed, bank-notes were often at fifty-per-cent discount. The crisis was so great, that several banks failed altogether. In 1810 the legislature passed a law fixing a penalty of two per cent a month for failure to redeem notes on presentation; which somewhat helped matters.

In 1799 Massachusetts had five State banks. The returns made in 1805 showed sixteen in operation, with a capital of $5,760,000, of which $5,460,000 had been paid in. Only one more was chartered before 1811; for the interval was a very trying one for banks. In that year two more were chartered, and nearly all the old ones were re-chartered, the new grants reducing the circulation from twice the capital to only fifty per cent in excess. In 1812 the State began taxing the banks one-half of one per cent on their capital.

History for the first quarter of this century.

The Massachusetts banks did not suspend in 1814, as did so many others all over the country; which was attributable, in a great measure, to the fact that the laws of the State imposed a heavy penalty for non-payment of their notes. The whole number of banks chartered previous to Jan. 1, 1825, was forty-nine, with an authorized capital of $20,800,000. Of this number, however, nine had either failed, discontinued, or had never gone into operation. Reductions in capital of many of the remaining banks had also taken place, leaving at the date named forty banks in operation, with $14,305,000 of authorized capital, of which $13,300,000 had been paid in; so that, at the close of the first forty-one years of banking in Massachusetts, not less than eighty-two per cent of the whole number chartered, together with seventy per cent of the capital authorized, still remained in existence. In this year the limit of circulation was still further reduced to the amount of the capital paid in.

The Suffolk-Bank system.

Two measures combined to raise the value of bank-notes: one was forcing the banks to redeem on presentation at their own counter, and the other was the initiation of a system by which other banks co-operated to secure such redemption. In the present day, when government-notes and national-bank notes are current everywhere at par, it is hard to realize how quickly a note depreciated at any distance from the bank which issued it. This was especially the case with notes from the banks of other States. There were no facilities for the holder visiting the bank to demand payment, and there was a doubt whether he would get the money if he did so visit it. In 1813 a movement toward a reform in the bank-currency began. Bills of banks in other States were then at a discount in Boston from three to five per cent, and the notes of Boston banks had nearly disappeared. The New-England Bank, organized in that year with a capital of $1,000,000, instituted the system of sending foreign bills for redemption to the banks which issued them, and charging the bill-holders only the actual expense of transmitting the notes and returning the proceeds. This was the beginning of the system of redemption afterward known as the Suffolk-Bank system. This system was more fully developed at a later period (1825), when five of the Boston banks — the Suffolk, Eagle, Manufacturers' and Mechanics' (now the Tremont), the Globe, and State — undertook its management. For a long time the system was bitterly opposed by those banks interested in preventing a return of their circulation; but it was eventually successful. Its exclusive management was finally assumed by the Suffolk Bank; which bank compelled the redemption at par in Boston of the notes of the New-England banks by a system of assorting and returning the notes to the place of issue, and its operations were continued down to the establishment of the national-bank system. The amount of New-England bank-notes redeemed at the Suffolk Bank from 1841 to 1857 was as follows, in millions of dollars: —

DATE.	MILLIONS.
1841	109
1842	105
1844	126
1845	137
1846	141
1847	165
1848	178
1849	199
1850	220
1851	243
1852	245
1853	288
1854	231
1855	341
1856	397
1857	376

The first really comprehensive banking law of Massachusetts was passed in 1829, under which new banks were required to have fifty per cent of their capital *bona fide* paid in specie before commencing business. It also prohibited loans to shareholders until their subscriptions were entirely paid in, and limited the amount of loans on pledges of its own stock to fifty per cent of the capital. The limit of circulating-notes was increased to twenty-five per cent in excess of the paid-in capital; and debts due to or from any bank, exclusive of deposits, were restricted to twice the amount of such capital, the directors being held personally liable for any excess. On Jan. 1, 1837, there had been organized in all a hundred and thirty-eight banks, with an authorized capital of $40,830,000. Of this number, four had never gone into operation; while, of the remaining hundred and thirty-four, no less than thirty-two had either failed, or had forfeited or surrendered their charters, in consequence of the financial panic of that year. The nominal capital of the banks that failed was $5,500,000: their liabilities were $11,283,960, of which $3,133,129 was for circulation, and $1,577,738 for deposits. The loss to their shareholders was estimated at $2,500,000, and to the public at $750,000 more; making a total loss of about $3,250,000, or nearly thirty per cent of their entire indebtedness. During the fifty-two years from 1784 to 1836 ten banks only had failed or discontinued, the total losses to

New legislation for security.

their shareholders and the public probably not exceeding a third of a million of dollars. One of the results of this crisis was the adoption by Massachusetts of a system of official examinations of the banks through the agency of a board of bank-commissioners, who were required to make annual examinations of every bank, and special ones whenever requested by the governor of the State.

Free banking law of 1851.

A free banking law was passed in 1851, very similar in its provisions to that of the State of New York (to which we shall presently refer); but not more than seven banks were ever organized under it, the system of chartered banks, which had so long prevailed, mainly occupying the field down to the time of the national banking system. Upon the establishment of the latter system, the State did much to facilitate the conversion of State into National banks; and the first institution to avail itself of this privilege was the Safety Fund Bank of Boston in 1863, under the title of "The First National Bank of Boston." The conversions progressed so rapidly, that in October, 1865, but a single bank remained doing business under a State charter. At the latter date, of the hundred and eighty-three State banks which existed in 1863, four had been discontinued, and a hundred and seventy-eight had become national banks.

Profits of Massachusetts banks.

A writer in "Hunt's Merchants' Magazine" for 1840 has compiled the statistics of the dividends paid by the Massachusetts banks in the last half of each of the thirty-two years from 1808 to 1839 inclusive. As the State in 1813 imposed an annual tax of one per cent on bank capital, the writer mentioned separates the whole time into two periods, and finds, that, for the five years ending with 1812, the average semi-annual dividends paid by all the banks was three dollars and seventy-two cents upon each hundred dollars of capital; while, for the twenty-seven years which followed the imposition of the bank-tax, the average semi-annual rate was two dollars and ninety-six cents per hundred. Taking the whole period of thirty-two years together, the semi-annual average was about three and one-tenth per cent. Assuming that the dividends paid in the first half of these years did not differ materially from those paid in the last half, the average annual dividends on capital were, for the first five years, seven and forty-five hundredths per cent; for the succeeding twenty-seven years, five and ninety-three hundredths per cent; and, for the whole period, six and seventeen hundredths per cent; or at the rate of about six and one-sixth per cent per annum for the whole period. The average annual ratio of dividends to capital of the national banks of Massachusetts from 1870 to 1876 was nine and six-tenths per cent, and the ratio of dividends to capital and surplus for the same period was seven and six-tenths per cent.

NEW YORK.

The Bank of New York began business in 1784 under articles of association drawn by Alexander Hamilton, who was a member of its first board of directors. This bank was chartered by the legislature on March 21, 1791, and was the first bank in the State organized under legislative sanction, and the third bank in the United States. It was organized with a capital of $900,000, in shares of $500 each. The State subsequently subscribed for a hundred shares, making the capital $950,000; and the bank commenced business on May 2, 1791. In 1832 the capital was increased to $1,000,000 by a State subscription of $50,000, $15,000 of which was for the use of common schools, $20,000 for Union College, and $15,000 for Hamilton College. On May 1, 1852, it was re-organized as a free bank under the general laws of the State, with a capital of $2,000,000. On Jan. 6, 1865, it became a national bank, the capital having previously been increased to $3,000,000. During its seventy-four years of existence as a State bank it paid a hundred and sixty-two dividends, varying in amount from three to five per cent semi-annually, averaging a little more than eight per cent per annum, and amounting in all to over six times its capital. Since it became a national bank, dividends have been declared at the rate of ten per cent per annum. The gross losses during the history of the bank amount to about $750,000; having never exceeded one-quarter to one-half of one per cent of capital during any single year, except during the intervals from 1837 to 1842, and from 1873 to 1875. The bank was a favorite of the Federal party at the time of its organization.

Bank of New York.

The two great features of State-banking in New York are the vast influence politics have had thereon, and the great security devised by her laws. The first charter granted was to Federalists; and for several years men belonging to the opposite party could secure charters only with the utmost difficulty,—a denial the more oppressive because they were not treated at existing banks with the same accommodation as were Federalists. The Republicans in New-York City having met with this latter experience, and anticipating the former trouble, applied to the legislature for a charter for a water company; but a provision was artfully introduced which gave the corporation banking-privileges. The phraseology was not understood fully, and the ruse succeeded. Thus was established the Manhattan Company in 1799 largely through the efforts of Aaron Burr, Hamilton's great rival. In 1792 the Bank of Albany had been chartered; but it was controlled by Federalists. Accordingly, there was soon a plea for a new bank to be run by Republicans. In 1803 some persons appealed to the legislature to charter the New-York State Bank at Albany, and alleged that the other institution in that city was very oppressive. The other two neighboring banks — the Farmers' near Troy, and the Columbia at Hudson — were also controlled by Federalists. By admitting the Clinton and Livingston interest to the privilege of holding some of the stock (a privilege that was very valuable), the charter was finally obtained from what would now be regarded as a Republican-

Partisanship and banking.

Democratic legislature. A clause was contained in the original bill, granting the corporation the exclusive right to the Syracuse salt-springs on condition of $3,000 a year being paid the State for the first ten years, $3,500 the next ten, and $4,000 annually for the next ten; but this was stricken out before enactment. The same year (1803) the Federalist interest sought a charter for the Merchants' Bank of New-York City, but was refused. A fresh application for a charter was then made in 1804, business having been started and continued under articles of association; but not only was this denied, but a restraining act was passed, especially designed to stop their further proceedings. Indeed, not only were the Democrats connected with Aaron Burr's institution desirous of maintaining that and the Manhattan Bank as monopolies, but they thought it very presuming in the Federalists to ask a Democratic legislature to give them any favors. However, the petition was renewed; and after very hot debates and a violent altercation, in which two senators, both having the title of judge, came to actual fisticuffs within the senatorial precincts, the bill of incorporation passed the Senate by a majority of three votes.

WASHINGTON HALF-DOLLAR.

Bribery in bank legislation.

This unnatural obstruction which partisanship placed upon legislation led, very naturally, to the use of corrupt means to secure charters. There was no particular contest after the one just mentioned until 1812, when application was made for a charter for the Bank of America with a capital of $6,000,000. We have already stated how the Bank of the United States paid both the Federal Government and the State of Pennsylvania bonuses for a charter. It was proposed to give New-York State $600,000 for this Bank-of-America charter; but it was demanded that no other bank be chartered for twenty years. To catch votes, it was also provided that immense loans were to be made the State to build canals, and to the farmers. But it was furthermore evident that actual bribery was resorted to in both houses of the legislature; and when the Assembly had voted, fifty-eight to thirty-nine, to give the charter, and it was apparent that the Senate would concur, Gov. Tompkins prorogued the legislature. Later, a greatly modified charter was granted instead. A clause was inserted in the Constitution of 1821, which required the assent of two-thirds of both branches of the legislature in order to incorporate a moneyed institution. The only effect of the restrictive clause was to increase the evil by rendering necessary a more extended system of corruption.

The restraining law.

Already reference has been made to the restraining law of 1804. This was nominally to secure the public interest by preventing the circulation of an unsound currency; but it is believed that it was enacted in the interest of existing monopolies. It prohibited any person, under a penalty of a thousand dollars, from subscribing to or becoming a member of any association for the purpose of receiving deposits, or of transacting any other business which incorporated banks may or do transact by virtue of their acts of incorporation. This law prohibited associations of persons from doing a banking-business; but individuals and incorporated institutions subsequently issued bills in denominations as low as six, twelve, twenty-five, fifty, and seventy-five cents. To prevent the further issue by irresponsible persons of currency in the similitude of bank-notes, which had become a great evil at the close of the war of 1812, the Restraining Act of 1818 was passed; which provided that no person, association of persons, or body corporate, except such bodies corporate as were expressly authorized by law, should keep any office for the purpose of receiving deposits, or discounting notes or bills, or for issuing any evidence of debt to be loaned or put in circulation as money. This law remained upon the statute-books for thirty-two years, and, after various unsuccessful attempts, was finally repealed in 1837, — one year before the passage of the free banking law.

FIRST UNITED-STATES DOLLAR.

Progress in banking.

From 1791, when the Bank of New York was incorporated, until the declaration of war with Great Britain in 1812, nineteen banks were chartered, with an aggregate capital of $18,215,000. Ten of them still exist, and are institutions of high rank. Between 1812 and 1829 twenty-four more were chartered, with a capital of $25,105,000, of which $13,770,000 was for banks in New-York City.

Safety-fund banks.

As yet there had been no legislation looking to the security of bank circulation, so little had the science of banking developed. But in 1829, when the charters of some forty banks were about to expire, Gov. Van Buren recommended the passage of a law, which was enacted in April of that year, providing a system of insurance of bank-notes based upon a custom prevalent among Chinese merchants. The law provided that all new or rechartered banks should pay an annual tax of one-half of one per cent on their capital stock until three per cent had been paid in, and the fund should be used by the State treasurer to redeem the notes and pay the debts of insolvent banks. If the fund became impaired at any time, new contributions were to be made to bring it up to a normal size. The law allowed the issue of notes to twice the amount of the capital, and loans to two and a half times the amount of capital. This safety-fund law did not accomplish its purpose. In 1841–42 eleven banks failed, whose capital was $3,150,000: their liabilities, which the State had to meet, amounted to $2,558,933. These eleven banks had contributed but $86,274 to the safety fund; and even down to Sept. 30, 1848, all of the safety-fund banks had contributed but $1,876,063. The State issued six-per-cent stock to make up the deficiency, and was partly re-imbursed by new contributions from the banks. The law was amended, however, in 1842, so that the safety-fund became a security for circulating-notes only, and no other debts.

The law of 1829 also provided that there should be three commissioners to examine the banks, and report annually to the legislature on the condition of those institutions. The law provided that one commissioner should be appointed by the Governor and Senate, one by the banks of the southern part of the State, and one by the remaining banks. But in 1837 the Governor and Senate were authorized to select them all; and, this power being abused for political ends, the work of examination was in 1843 taken from the commissioners, whose office was abolished, and given to the comptroller. In 1851 the present office of bank superintendent was created instead.

Bank commissioners.

Already we have mentioned how politics affected the procurement of charters in the early days; the privilege of banking being a rich one, and hence regarded as part of the spoils of office. This was also the case with the safety-fund banks, whose stock was sold mostly to political friends and favorites of the agents selected for that business. This produced an immense deal of discord and animosity in business, social, and political circles, and much corruption. The office of bank commissioner was also made a political prize, and was sought for by men utterly incapable of performing its delicate judicial duties. It was the re-action in public sentiment against this state of affairs, but more particularly against the grant of special privileges, which led to the enactment of the general banking law.

More political abuses.

The free banking system of New York was authorized in 1838. Its two great features were, that it opened the privileges of banking, on certain conditions, to all persons alike; and it provided much better security for the redemption of notes than had yet been provided. The system of deposits with the comptroller for security was the one on which the national banks of a later date were based. It was originally that all banking associations, on depositing stock of the State of New York or of the United States, or any State stock which should be, or be made, equal to a five-per-cent stock, or bonds and mortgages on improved and productive real estate, worth, exclusive of the buildings thereon, double the amount secured by the mortgage, and bearing interest at not less than six per cent per annum, should receive from the comptroller of the State an equal amount of circulating-notes. Previous to the year 1843 twenty-nine of these banks, with an aggregate circulation of $1,233,374, had failed; and their securities, consisting of stocks and bonds and mortgages amounting to $1,555,338, were sold for $953,371, entailing a loss of $601,966. The avails of the securities were sufficient to pay but seventy-four per cent of the circulation

Free banking system.

alone. The losses to the bill-holders occurred only in the case of those banks which had deposited State stocks other than those of New York. The law was thereupon so amended as to exclude all stocks, except those issued by the State of New York, and to require those to be made equal to a five-per-cent stock. An amendment in 1848 required that the stocks deposited should bear six per cent interest instead of five; and that the bonds and mortgages should bear interest at seven per cent, and should be on productive property, and for an amount not exceeding two-fifths of the value of the land covered by them. Subsequently, on April 10, 1849, the law was again so amended as to require that at least one-half of the securities so deposited should consist of New-York-State stocks, and that not more than one-half should be in the stocks of the United States; the securities in all cases to be, or to be made, equal to a stock producing an interest of six per cent per annum, and to be taken at a rate not above their par value, and at not more than their market-value.

Two other interesting features of the later State-bank legislation in New York were the requirement that the banks redeem their notes at some agency in New York, Albany, or Troy, and that stockholders should be individually liable for the obligations of the bank to the extent of their shares. The latter provision was incorporated into the Constitution of 1846. The former was a law of 1840, which allowed a discount of one-half of one per cent on redemption: in 1851 the discount was reduced to one-fourth of one per cent. The New-York-City banks, however, soon inaugurated the Suffolk-Bank system already described, and divided the discount between themselves and the redemption agency. Such banks as did not provide for redemption were forced to close up.

Redemption and liability.

OHIO.

Ohio's first banking institution, incorporated in 1803, five months after the State's admission to the Union, was called "The Miami Exporting Company." Its purpose was to build up trade in that new section of country. Its capital was $500,000, in shares of a hundred dollars each, to be paid for with five dollars cash, and the rest in produce and manufactures, subject to the approval of the president and directors. It subsequently issued bills, redeeming them with bank-notes; but it was obliged to close up after a few years. The first bank in the State was that at Marietta, with a capital of $100,000, chartered in 1808. Another was chartered at Chillicothe the same year, and four more between that time and 1816; in which year six charters were granted new banks, and the old ones were rechartered. Eleven more had been chartered by 1832; but, with two or three exceptions of double that amount, $100,000 was the nominal capital of all these banks. The interest on loans was restricted to six per cent by law.

First ventures.

In 1833 the Franklin Bank of Cincinnati was chartered with a capital of $1,000,000; and the Ohio Life and Trust Company, incorporated the next year, had the same. The latter institution failed in 1857, with estimated liabilities of $7,000,000. In 1845 a State bank was authorized, with a capital of $6,150,000, and with sixty-three branches. Not more than thirty-six branches were ever established, however.

Three large banks.

A particular feature of bank-legislation in Ohio was the comparatively heavy taxation, based, doubtless, upon the theory that it was a valuable privilege to engage in banking, and upon the feeling against capital that has often characterized the laboring-classes. As early as 1816, when the Bank of Cincinnati, with a capital of $600,000, was incorporated, a law was passed requiring all banks to pay to the State such a sum as would, at the expiration of their charters, amount to a twenty-fifth part of their whole stock. In 1825 this was changed, so that the tax was upon dividends, — two per cent on all previously made, and four per cent thereafter. The tax was raised to six per cent in 1831. In 1852 another tax-law was passed, which, by a forced construction, imposed upon banks twice, and sometimes thrice, the burden put upon other property; but such was the pressure, that much of the capital was sent into adjoining States.

Bank-taxation.

An attempt was even made to tax the two branches of the United-States Bank at Cincinnati and Chillicothe in 1819. The State imposed a tax of $50,000 on each, should they continue to do business after Sept. 15 of that year. The bank applied for an injunction against the auditor, and secured it from the United-States Circuit Court; but that officer, on the pretence that he had not been properly served with the notice, seized $98,000 at the Chillicothe banking-house, and turned it over to the State treasurer. The Circuit Court ordered its return, however; and in 1824 the Supreme Court of the United States confirmed this decision.

Taxing the United-States Bank's branches.

The Act of 1845, establishing the State Bank, required, that, in order to create a safety-fund, an amount equal to ten per centum of the circulation of each of the branches should be paid to the Board of Control, which was authorized to invest the same either in stocks of the State or of the United States, or in bonds secured by mortgages on unencumbered real estate of at least twice the value of the amount secured thereby, which should be payable on demand to the State Bank of Ohio; and each branch was entitled to receive the interest accruing on the stocks and bonds in which its portion of the safety-fund was invested. In case of failure, the stocks and bonds of the insolvent bank were first to be applied to the redemption of its outstanding notes before any part of the safety-fund belonging to the other branches should be so applied. The State was divided into twelve districts, and a portion of the capital of the State Bank was allotted to each. Sixty-three branches in all were authorized, with charters to continue

The safety-fund system.

until 1866. Five banks previously chartered were authorized, upon certain conditions, to avail themselves of the privileges of the act. The branches were under the supervision of a Board of Control, consisting of one representative from each branch, which was to furnish all the circulating-notes. These were limited by the charter to "double the amount of capital on the first $100,000; 150 per cent on the second $100,000 or part thereof, and 125 per cent on the third $100,000 or part thereof." There were thirty-six of these branches in operation in 1856, with a capital of $4,034,524, and circulation of $7,112,320. At that date the Ohio Life and Trust Company was the only bank created prior to 1845 still in existence.

Further security exacted of other banks.

The law of 1845 also authorized the establishment of other banks than the State Bank and branches; but such independent institutions were required to deposit with the State as security, not simply one-tenth of the amount of issue, but an equal amount. In 1856 there were nine of such independent banks, with a combined capital of $587,500, and a circulation of $893,839.

Free banking.

Thus far the banks had been especially chartered. A general law was passed in 1851, allowing any association to engage in the business of banking on substantially the same conditions as the independent banks just mentioned, — the deposit of State and United-States stocks to the full amount of the issue. Most of the banks so organized were forced by taxation to go into liquidation.

Charter renewed.

In April, 1856, an act was passed incorporating the State Bank of Ohio and other banks, similar in its general provisions to the Act of 1845, the charters to continue until May, 1877. The act, however, contained a personal-liability clause, and it also prohibited the General Assembly "from imposing any greater tax upon property employed in banking under this act than is or may be imposed upon the property of individuals."

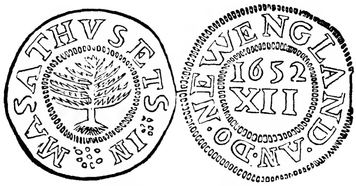
Summary of history.

In 1835 there were, in all, thirty-four banks in operation in Ohio, having a capital of $5,819,000; in 1837 there were thirty-three banks, with a capital of $9,247,000; and in 1840 there were thirty-seven banks, with a total capital of $10,000,000. On the 1st of January, 1845, but eight banks were in operation, with an aggregate capital of $2,171,807. In 1855 there were fifty-one banks, whose capital amounted to a little more than $6,000,000. In 1856 thirty-six of the banks which had been organized in the State had failed, their notes being entirely worthless; while eighteen others were in process of liquidation, their notes being quoted at fifty to seventy-five cents on the dollar. There were fifty-six banks in existence in the State in 1863, with an aggregate capital of $5,674,000, of which number seven were independent banks, with a capital of $350,000, and thirteen were free banks, with a capital of $1,270,000. The State Bank of Ohio, with thirty-six branches, had a capital of $4,054,000; loans, $8,653,000; deposits, $5,631,000; circulation, $7,246,000; and specie, $2,217,000; together with a safety-fund of $814,800 invested in bonds and mortgages.

INDIANA.

Banking in Indiana under State laws has been chiefly conducted by the State Bank and its branches. In 1820 the State had but two banks. The State Bank was incorporated in 1834 with ten branches, afterwards increased to thirteen: these were made mutually liable for each other's debts. The only tax laid was twelve and a half cents on each share, for educational purposes. The parent bank kept the plates and unsigned notes of the branches, issuing the latter only at the rate of twice the capital stock paid up. Most of the capital came from out of the State; although the State Government subscribed to a million, and also lent its credit to other shareholders to the extent of half of their subscription, taking mortgages on real estate for security.

A State bank the chief reliance.



PINE-TREE SHILLING.

The State Bank of Indiana and its branches were managed with rare ability. They began business at a trying period, just before the crisis of 1837, which bankrupted so many institutions in the West and South. The Bank of Indiana suspended specie payments from 1838 to 1841; in which latter year it held $1,127,518 in specie, had a circulation of $2,960,414, and deposits amounting to $317,890. So well was the institution managed, that the stockholders received dividends averaging from twelve to fourteen per cent annually for twenty years. In 1854 the charter expired; but it was renewed, with a capital of $6,000,000, and fifteen or twenty branches. During the crisis of 1857 it did not suspend, though it contracted its issues prudently. In 1861 it called in most of its notes, but re-issued them the next year to buy coin.

Excellent management.

The new Constitution of 1851 forbade the organization of any more banks except under a general law. Such a one was enacted in 1852, which provided that United-States stocks, or stocks of the several States, including those of Indiana (then worth about ninety-five per cent), should be deposited with the auditor as security for circulating-notes, the stocks to be made equal to one bearing six-per-cent interest. The law did not require a board of directors, nor that the stockholders should be citizens of the State. In October, 1854, there were eighty-four of these banks; and the returns of sixty-seven of them at that date exhibit $7,425,000 of circulation, with a total authorized capital of $32,900,000. The oppressive tax-law of Ohio having driven capital from that State, it was to a considerable extent invested in the free banks of Indiana. In 1856, of ninety-four free banks, fifty-one had suspended, and their notes were selling at from twenty-five to seventy-five per cent discount in Cincinnati.

General banking law.

ILLINOIS.

The record of State banking in Illinois is not quite so bright as that of Indiana in the earlier history of the two States. The first bank was started in Illinois in 1813, five years before it was emancipated from Territorial government to the dignity of a State. It was located at Shawneetown, and the whole Territory then had but fifteen hundred inhabitants. A regular charter was not given it until 1816, when it was incorporated for twenty years, with a nominal capital of $300,000. Large government deposits were given it, and it greatly extended its credits; but in 1821 it suspended specie payments, and did little business until 1835. The legislature then revived it by granting a new charter which should run until 1857, increasing the capital to $1,400,000, and subscribing for the increase on behalf of the State, authorizing the issue of stocks therefor.

Disastrous beginnings.

The second venture was a State bank, the Constitution of 1818 ordering that only such a one should be chartered. The act of incorporation created a Bank of Illinois in 1821, with a capital of $500,000, to run ten years, to be owned by the State, and managed by the legislature. $3,000,000 were directed to be issued and loaned on mortgages, with notes for one year at six-per-cent interest, and in sums not exceeding 1,000 dollars to each individual; the notes to be renewed on payment of ten per cent of the principal annually. The circulating-notes of the bank were receivable for taxes, and for all debts due to the State or the bank. These notes were soon thereafter quoted at seventy-five cents on the dollar, then at fifty cents, and finally at twenty-five cents; when they ceased to circulate altogether. Members of the legislature received their compensation in depreciated currency at its market-value, which the State was compelled to redeem at par; and a loan of $100,000 received in these notes at par was paid out at fifty cents on the dollar.

An unsuccessful State bank.

We have already referred to the revival of the Shawneetown Bank in 1835. Simultaneously a new State bank was chartered. Its capital was at first fixed at $1,500,000, but was increased to $2,000,000, and subscribed for by the State. It was required to take up the $100,000 loan above mentioned, but was allowed fifty days for the redemption of its own bills. But this institution was shortly compelled to suspend payment, and in 1841 it went into liquidation. In the same year an act was passed to preserve its charter, which had been forfeited, provided it would pay $200,000 of the State debt; but in 1843 two acts were passed,—one to diminish the State debt and put the State Bank in liquidation, and the other to reduce the public debt by a million of dollars and to put the Bank of Illinois at Shawneetown in liquidation. The stock of these banks subscribed for by individuals was lost, and about $90,000 belonging to depositors and bill-holders remained unpaid, as well as $46,909 belonging to the government. The State took possession of its bonds held

Worse luck next time.

by them, amounting to $3,050,000; and, by direction of the governor, they were cancelled, and burned, in the presence of the legislature, in the capital square of Springfield.

During the year 1843 a general banking law, similar in its provisions to the free banking law of the State of Indiana, was passed. The report of the bank commissioners for 1861 states, that, in 1857, the bank circulation of the State amounted to $5,500,000, which was secured by $6,500-000 of the bonds of various States, of which amount $4,500,000 were Missouri sixes. In 1861 the amount of Missouri bonds had been reduced to $3,026,-000, and the circulation increased from $5,500,000 to $12,300,000. About three-fourths of the securities then held by the auditor were the bonds of the Southern States.

A general banking law.

KENTUCKY.

The Bank of Kentucky was incorporated in 1804, twelve years after the admission of the State, with a capital of $1,000,000. Forty new banks were incorporated in 1817, with an aggregate capital of $10,000,000; but no provision was made for the redemption of their notes in specie. They issued large amounts of notes, and many of them failed within a year of their establishment.

The first few banks do poorly.

For relief, the legislature, in 1820, chartered the Bank of the Commonwealth of Kentucky, with a capital of $3,000,000, pledging the public faith for the redemption of its circulation, and setting aside certain lands south of the Tennessee River for a guaranty fund. If a creditor refused to take these notes in payment of a debt, the debtor was allowed by law two years in which to pay it. This feature of the law was at first declared to be unconstitutional; but a new court was appointed, which reversed the decision. As a consequence, the notes of the bank soon became worth but fifty cents on a dollar. A very bitter contest ensued between the new court and old court parties, lasting five years, and ending in the repeal of the stay-law or replevin act. The bank's circulation was suppressed and finally destroyed by authority of the legislature.

A stay-law for relief.

This bank was conducted under State auspices, the legislature selecting its president and directors, its dividends accruing to the State, and notes being issued to the extent of $3,000,000. On the plea that these were bills of credit, and that the State had no right to issue such under the Constitution, a debtor of the bank who had obtained a loan in this currency refused to pay; but the Supreme Court of the United States held that the notes of the bank were not bills of credit in the meaning of the Constitution.

Other constitutional questions.

In 1834 there were established the Bank of Kentucky, with a capital of $5,000,000, the Northern Bank of Kentucky, capital $3,000,000, and the Bank of Louisville, with a capital of $5,000,000; all of which were in existence in

1856, with an aggregate capital of $7,030,000. All of these banks suspended payment in 1837, and resumed in 1842, with an aggregate circulation, at the latter date, of $2,800,000. This amount was increased by subsequent issues, until in 1850 it had reached $6,683,000. The Southern Bank of Kentucky went into operation in 1852 with a capital of $1,300,000, and charters were also subsequently granted to four other banks with large capitals. Twenty-seven Kentucky banks failed in 1854; but in 1856 there were thirty-four banks and branches still in operation in the State, with an aggregate capital of $11,730,000, and with a circulation of about $13,300,000.

Remaining history.

TENNESSEE.

Several unsuccessful ventures.

The Nashville Bank was incorporated by the Tennessee legislature in 1807, with a capital at first limited to $200,000, and afterwards raised to $400,000. Several branches were authorized; but they soon closed with loss to all parties. Another bank, the Farmers' and Mechanics', was started in Nashville in 1819 with $400,000; but it became insolvent within a year.

Two State banks.

In 1811 the Bank of the State of Tennessee was chartered and started at Knoxville. Its capital was $400,000, and nine branches were authorized. But in 1820 the State Bank of Tennessee was incorporated at Nashville, with a capital of $1,000,000. The State funds were to be deposited at the bank, which was authorized to sell $250,000 of six-per-cent State stocks to be used as capital. It created agencies to loan money in every county, according to its wealth and population, in sums not exceeding $500 to any one person. The loans were to be made on a credit of twelve months, and be secured by mortgage on real or personal property worth double their amount. The proceeds of Hiawassee lands and other funds were pledged for the redemption of the circulation, which was guaranteed by the State, and which was issued to the amount of $1,000,000; but it was soon at a discount of ten per cent below the value of United-States bank-notes. The bank was under the supervisory control of directors elected by the legislature. Six years after it commenced operations, it had an available capital of about $500,000, chiefly derived from the sales of lands. The bank was finally closed in 1832, with considerable loss to the State. Previous to the passage of the act under which it was established, Gen. Jackson addressed to the legislature a memorial denouncing its provisions, and declaring the proposed act to be in violation of the Constitution of the United States. Judge White of Tennessee, in a speech in the Senate of the United States on March 24, 1838, stated, that, "in 1820, there were two State banks in operation in Tennessee having the same name, and that laws were passed to force into circulation paper money, and to prevent levies of execution, unless creditors would agree to receive irredeemable bank-paper.

Nearly all the other banks started for some years were large ones with branches. The Union Bank at Nashville was incorporated in 1832, with five branches, and a capital of $3,000,000, one-third of which belonged to the State. The Planters' Bank in the same city, with six branches and $2,000,000 capital, of which the State subscribed a part, was incorporated the following year. The next institution was the Farmers' and Merchants' Bank of Memphis, chartered in 1835, with a capital of $600,000. It failed in 1847, greatly to the loss of its bill-holders. The other banks.

The place of the old State Bank, unpopular and unsuccessful, was taken in 1838 by the incorporation of a new Bank of Tennessee at Nashville, with an actual capital of $3,226,000, the nominal capital being $5,000,000. The capital was made up from the assets of the old State Bank, and by the sale of $1,000,000 of State bonds. It had several branches, which were under the direction of the parent institution. In 1849 its capital was reduced to $2,250,000. Three other banks were incorporated, with an aggregate capital of $1,100,000, within the next three years. A free banking law was passed in 1852, authorizing the organization of banks upon a deposit of bonds of the State equal to the amount of their capital. One more State bank.

MISSISSIPPI.

When Mississippi came into the Union in 1817 she had but one bank, and no more were chartered until 1830. Meantime, however, the capital of this one was raised from $100,000 to $950,600. One bank 1817-30.

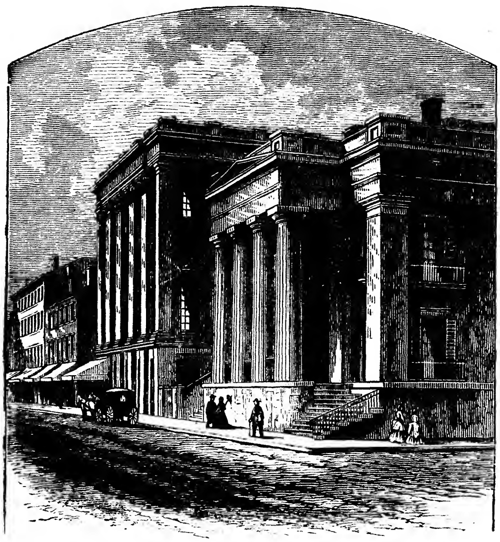
In the last-named year the Planters' Bank of Mississippi was started with a capital of $3,000,000. Two-thirds of this was subscribed by the State, which issued six-per-cent bonds therefor, on which a premium of $250,000 was realized. This was made a sinking-fund, and the State's dividends were devoted to paying the interest on its bonds. The bank paid ten per cent annually; and the State sinking-fund steadily grew until September, 1839, when it amounted to $800,000. The State then transferred its stock to the Mississippi Railroad Company; but the sinking-fund was subsequently lost almost entirely. A large and prosperous institution.

In 1837 the number of banks in the State had increased to eighteen, with an aggregate capital of $13,000,000, more than $5,000,000 of circulation, and more than $24,000,000 of loans. Increase of business.

In 1838 the Mississippi Union Bank was chartered, with a capital of $15,500,000, to be "raised by means of loans to be obtained by the directors of the institution." The State authorized the issue of $15,000,000 of guaranteed bonds which were to be loaned to the bank. $5,000,000 were issued in 1838, and were sold to the United-States Bank of Pennsylvania. The next lot of $5,000,000 were issued in 1839. A huge institution.

The following year, however, the first steps were taken by the State authorities toward repudiating this obligation. The governor issued a warning proclamation against any further negotiation of these bonds; and in 1841 he addressed the legislature, claiming that his proclamation had defeated the illegal sale of the second issue of bonds. His message to the legislature showed that the Union Bank had \$13,491,000 of suspended debt and unavailable assets, \$3,034,000 of circulation, and \$4,349,000 of specie. Shortly after, he proposed that the issue of \$5,000,000 made in 1838 be repudiated outright. The legislature declared in reply, that "Mississippi will pay her bonds, and preserve her credit inviolate." But they were repudiated, and have never been paid. The bonds issued to the Planters' Bank were not officially repudiated: but the people refused in 1852, by a majority of 4,400 votes, to authorize a tax to redeem them; nor is a reversal of that decision now probable.

Repudiation.



BANK OF MOBILE.

CHAPTER II.

INSURANCE.

THERE is some dispute about the antiquity of the insurance-business, several countries claiming the honor of originating it. There are traces of it as far back as the Punic wars between Rome and Carthage. The government of Rome guaranteed to contractors who were carrying provisions and arms to Spain, that they should be held free from loss if their boats were destroyed by storm or the enemy *en route* to the province. In the time of the Emperor Claudius, there was a period of great scarcity at Rome; and, in order to encourage importations of corn, the emperor took upon himself whatever loss or damage mariners might suffer from shipwreck or tempest while bringing the grain to Rome. This was certainly a species of insurance. It was not resorted to as a regular business, but was a resource for an extraordinary occasion. It is related that the generous offer of Claudius was taken advantage of in a way which shows that the human heart is the same in all ages of the world, and that it makes very little difference under what clime the race lives, or what language it speaks, in regard to the passions and impulses which move it. Humanity is the same everywhere and under all circumstances. Shipwrecks were pretended to have occurred which never took place: old, shattered galleys were purposely sunk at sea, and the crew ostentatiously saved in small boats. Large sums were demanded and obtained for these alleged losses. Several years afterward the fraud was discovered, and some of the contractors were seized and punished. Spain and Portugal dispute the real credit of having invented insurance as a practical business-pursuit. Portugal in 1367 had a king by the name of Fernando, who did more for his realm than had ever been done for it before, or has been since, except by Jean II. Fernando strove to build up commerce; and, in order to give security to it, he invented and put into operation some sort of marine-insurance. Barcelona, in Spain, in 1431, made an ordinance on the same subject, and made marine-insurance thoroughly practical and successful. This was before the days of the magnetic needle, and it was

Antiquity of insurance.

Marine-insurance.

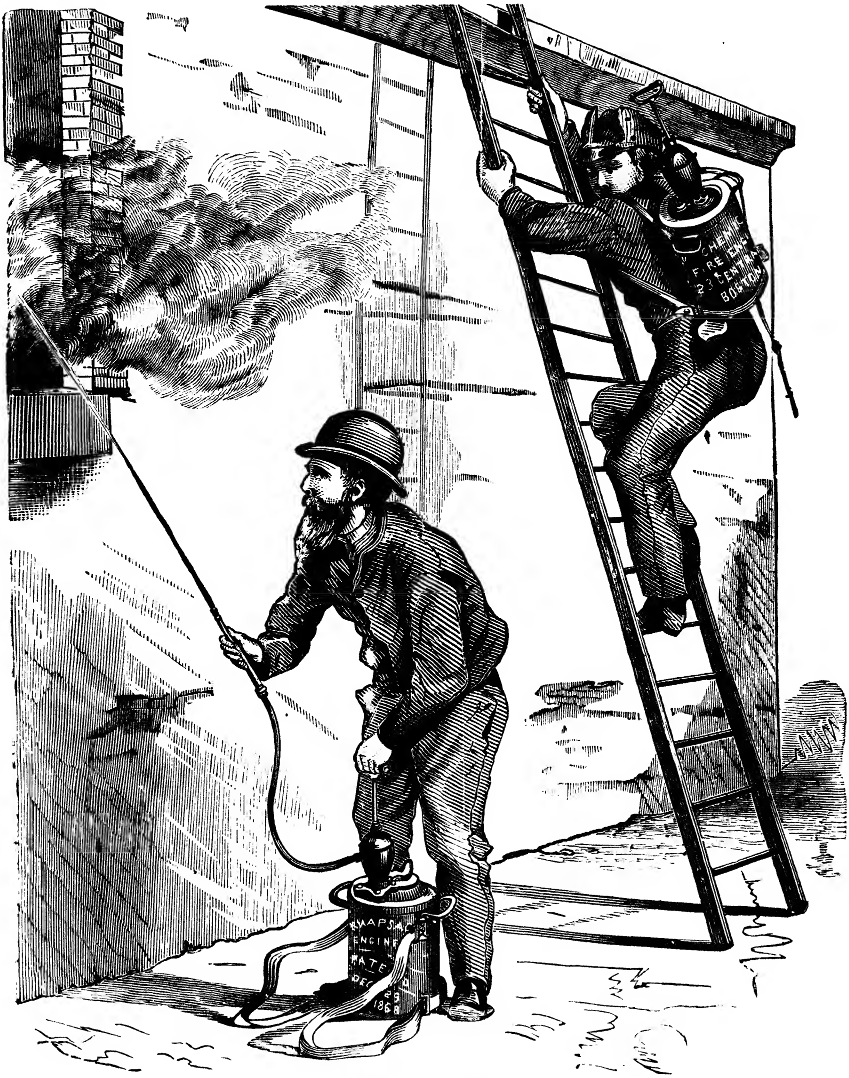
in an age when the Saracens swarmed on the Mediterranean as pirates. Navigation was an extremely perilous affair, and something like insurance was necessary to give security and expansion to commerce. The Barcelonians made their port the greatest on the Mediterranean in course of time by their insurance and other regulations. Marine-insurance thus long preceded all other forms of the business. It was soon adopted by all commercial nations.

Life-insurance.

The next branch of it to be introduced was life-insurance. This part of the business grew out of this very matter of commerce. Mariners of the early ages were so exposed to capture, that they came, in time, to stipulate with the freighters in whose behalf they undertook a voyage, that, if captured, they should be ransomed. There are traces of this in records at Rouen of 1361, and the practice became quite general in after-years in Spain. Pilgrims to the Holy Land made the same arrangement. Out of this practice grew life-insurance proper. It is interesting to observe that there was against life-insurance a most violent prejudice from the very beginning in Continental Europe. It seemed to be setting a premium upon murder to insure a man's life, and society was in altogether too lawless a condition in that age to make it judicious to create extra inducements for killing. Genoa in 1588 enacted that "securities, bonds, or wagers, may not be made, without the license of the senate, upon the life of the pope, nor upon the life of the emperor, nor upon the life of kings, cardinals, dukes, princes, bishops, nor upon the life of other lords or persons in constituted dignities ecclesiastical or secular." Decrees were made forbidding life-insurance positively in Amsterdam in 1598, in Rotterdam in 1604 and 1635, and in France in 1681. The opposition to it in France is only relaxing at this day. The business was not established in England until 1706, when the Amicable Society was started. After that, however, the idea became popular. The Royal Exchange and the London Assurance Companies were started in the time of George I. to insure lives; the Equitable was started in 1762; and the business soon gained a more vigorous foothold in that kingdom than in any other part of the world, this being due to the greater security to life in that free and wisely-governed country. The only other country in the world in which life-insurance has since that age attained any great stature is the United States. The facts will be more particularly set forth hereafter.

Fire-insurance.

Fire-insurance came upon the scene next, and accident-insurance last of all. Somewhat the same feeling was entertained in regard to fire-insurance at first as with respect to life. In 1609, it is related, an ingenious person suggested to Count Anthony Gunther von Oldenburg, that, as a new species of finance, he might guarantee his subjects against the loss of their houses by fire on condition that they would pay to him a specified sum annually, according to the value of their houses. The count did not object to the formation of a company for doing a thing like that; but he said for himself that he doubted if it could be by him "honorably, justly, and irreproachfully instituted without tempting Providence, without



FIREMEN AT WORK.

incurring the censure of neighbors, and without disgracing one's name and dignity." The sturdy count continued: "God has, without such means, preserved and blessed for many centuries the ancient house of Oldenburg; and he will still be present with me through his mercy, and protect my subjects from destructive fires." The plan does not appear to have been agitated again in Europe until after the great fire in London in 1666, when it was immediately brought up. The agitation which the subject excited then was remarkable. We have never had any thing like it in America, as far as purely business-themes are concerned, unless it was the silver-dollar agitation of 1877; and that was comparable to the fire-insurance *furore* in England only in intensity, not in duration. After the fire of 1666, there ensued in England six years of hot discussion and pamphleteering. It was proposed that the city corporation should insure the houses of the town. The city did finally insure a great many houses; but in 1682 the Common Council became frightened, and backed out, and cancelled the contracts. In 1696 the Hand-in-Hand Fire Office, a private company, was started to do what the corporation did not want to do; and in 1706 the Sun Fire Office was started. The business then became systematized and practical, and rapidly attained very large proportions. The London Assurance was incorporated in 1720, and is still in existence, and doing a gigantic business. The Hand-in-Hand Company is the only one of the earlier period now surviving.

Accident-insurance.

Accident-insurance has all grown up within the present century, and is merely a once minor detail of the business, which has now grown to such proportions as to be able to stand alone.

Principles of insurance.

Before proceeding to depict the origin, adventures, and development of the insurance-business in America, a few words will be proper in regard to the principles upon which this extraordinary variety of commercial speculation is founded. The general principles are the same in all branches of insurance. A large proportion of the losses and deaths which take place in the world are the result of the crime or misconduct of individuals. This was more true of the middle ages, when the governments were feeble; but it is also true to a certain extent now. In order to reduce losses and deaths from crime and negligence to the lowest possible point, governments have been instituted, whose duty it is to assist by every means in their power the efforts of individuals to protect themselves and their property, to support a police for the purposes of prevention, and to maintain courts and prisons for the purposes of punishment. A good government imparts vast security to property and life; but, in spite of all that governments can do, losses and deaths still occur. Gales blow in from the sea which the signal-service flags did not predict in time, and the coast is strewn with wrecked ships; conflagrations break out in cities, and on steamboats and railroad-trains; collisions, explosions, the fall of buildings and bridges, and other unforeseen events, occur; and sickness carries away prematurely those in the soundest health. Few men are so rich that they will not feel heavily the weight of the loss of a mill or a house by fire, or a ship by wreck. The majority of families in the world are not so well provided with funds that they can endure without financial suffering the loss of the life of the men who are their main stay and support, and the consequent termination of their main income. Before the days of insurance, most men would have been impoverished by the loss of their buildings by fire; and a large proportion of the families of lawyers, military and naval officers, professional men, artists, and mechanics, would have been doomed to suffering by the death of the head of the family, whose income, of course, would terminate with his life. In early times, in New-York City, a man who was burnt out was generally forced to make an appeal to the public for contributions of money to set him on his feet again. Insurance obviates this distress by death, and loss of property by fire and accident, which is sure to fall on a large number of individuals every year, by distributing the loss in each case among a great many people, instead of allowing it in each case to fall with all its weight upon one. It is found that losses by fire, wreck, accident, and death, obey certain laws. Take ten thousand houses in a special part of the country, for instance, and watch how many of them burn up, year by year, for a period of twenty years. If an average of ten houses burn up every year, it can pretty safely be taken for granted that ten houses will continue to burn up every year regularly, circumstances remaining the same. Now, a company will be found which will aim to insure ten thousand houses a year. As it will have to pay on an average for ten houses consumed by fire annually, it assesses upon the ten thousand the value of ten houses a year; and each owner of a house pays in to the company his ten-thousandth part thereof annually: so that the loss of the ten burned houses does not fall on the ten men who own them, but on the whole ten thousand. Every man is willing to pay his insignificant contribution every year for the protection and security it gives him; and, when his turn comes to be visited with calamity, his burden is taken up by the other ten thousand men upon whom it is distributed, and lifted from his shoulders. That, in substance, is the principle of fire-insurance. It is expressed the most perfectly in the so-called mutual-insurance companies. But it is upon this same principle that the joint-stock companies are founded also. It is the same with life, marine, and accident as with fire insurance. The average number of deaths and casualties every year is ascertained by observation and experience, and the business then organized on the same theory as before.

Progress of insurance.

Now for the story of the progress of insurance in the United States. It is an instructive one in many respects, and a melancholy one in others. It certainly is an important one, as will be seen when one reflects that the people of the United States are now paying annually the sum of $150,000,000 at least for the protection and security which insurance gives them; and that, in return for this large payment, the companies are guaranteeing to the people indemnity against loss to the amount of $10,000,-000,000.

MARINE.

Marine-insurance appears to have been the first branch of the business which engaged attention in America, just as it had been the first in practice in the Old World. The colonies were pre-eminently commercial, and felt the need of marine-assurance from the beginning of their business activity. At first they took out their policies in England; but, even before the Revolutionary war, there was talk about the business among the colonies themselves. In 1721 an advertisement appeared in a newspaper in Philadelphia, as follows: —

Marine-insurance in the colonies.

"Assurances from losses happening at sea, &c., being found to be very much for the ease and benefit of the merchants and traders in general; and whereas the merchants of the city of Philadelphia and other parts have been obliged to send to London for such assurance, which has not only been tedious and troublesome, but even very precarious, for the remedying of which an office of public insurance on vessels, goods, and merchandise, will, on Monday next, be opened by John Kopson, at his house in the High Street, where all persons inclining to be insured may apply; and care shall be taken by the said J. Copson that the assurers or underwriters shall be persons of undoubted worth and reputation, and of considerable integrity in this city and province."

Colonial advertisement.

In 1725 Francis Rawle of Philadelphia suggested that there should be a marine-insurance office under the sanction of the colonial legislature. His pamphlet on the subject is said to have been the first work which was issued from Franklin's press. Neither Kopson nor Rawle accomplished any thing, however; and Mr. Fowler, a writer on insurance, says, that, for seventy years afterward, the traders of Philadelphia continued to seek their insurance abroad. In New-York City a marine-insurance office was opened at last in the year 1759, Kefeltas and Sharpe being the clerks. A rival office was opened the same year, with Anthony van Dam for clerk; and in 1778 the New Insurance Office was opened. These were all for marine-insurance. The underwriters were simply wealthy men of the city. Each man subscribed his name for the sum he agreed to pay in case of loss of the ship or cargo. Insurance was thus carried on by individual underwriters in the commercial cities for a few years, until, very near the beginning of the present century, the business assumed a more organized character.

Francis Rawle.

Several companies were being formed for fire and life insurance, and the idea was applied to the marine branch of the business also. In 1794 the first two marine companies in the United States were formed in Philadelphia, the city which was really the birthplace of the whole insurance system of this country. These were chartered companies, and were called "The President and Directors of the Insurance Company of North America," and "The Insurance Company of the State

Formation of first marine companies at Philadelphia.

of Pennsylvania." These two companies, founded in a city which has been by no means the greatest of the seaports of the country, have made the proudest record of any American maritime companies. They have weathered every gale of the century, and are still doing business to-day on an enormous scale. Boston was second in the field. The Massachusetts Fire and Marine Company was formed in that city in 1795, and did a large business for many years. It remained in existence until 1848, when its charter was revoked. With the return of comparatively peaceful times after the Revolution, commerce increased very fast, and companies sprang up in several places. Thirty-two insurance companies were formed before 1800, and ten of them were exclusively, or in part, for the taking of maritime risks. They were as follows: —

1794. Insurance Company of North America, Philadelphia.
1794. Insurance Company of the State of Pennsylvania, Philadelphia.
1795. Massachusetts Fire and Marine, Boston.
1796. Charitable Marine Society, Baltimore.
1797. New-Haven Insurance Company, New Haven.
1797. Charleston Insurance Company, Charleston, S.C.
1798. New-York Insurance Company, New York.
1798. United Insurance Company, New York.
1799. Newburyport Marine, Newburyport, Mass.
1799. Boston Marine, Boston.

The Union Mutual was started in Philadelphia in 1804. All of these companies had all the business they wanted to do, and prospered finely, until that troubled period of four or five years just before the war of 1812; when the interferences of England with our commerce made the business extremely precarious, and subjected the companies to great and unexpected losses. Frightened by the interferences of England, merchants abandoned their vessels hastily to the companies which had insured them; and one of the Philadelphia concerns lost half of its capital in consequence of this practice. The companies met this new state of things by issuing regulations against improper abandonment of vessels; but, in spite of all precautions they could enforce, they were frequent and heavy losers by the operations of those years of uncertainty and war. After the war the companies again became prosperous, losses diminished to a low average, and the companies made money. The usual result followed, — the formation of new companies.

Effect of war with Great Britain.

About the year 1828 the marine companies were subjected to new losses, arising from a circumstance which brings back forcibly to mind the example of the Roman navigators in the time of Claudius, and which revealed again the one weak point of insurance; namely, the temptation it presents to the commission of fraud. The companies began about 1828 to be called on to pay for a large number of vessels wrecked on the Atlantic and Gulf

Losses in 1828.

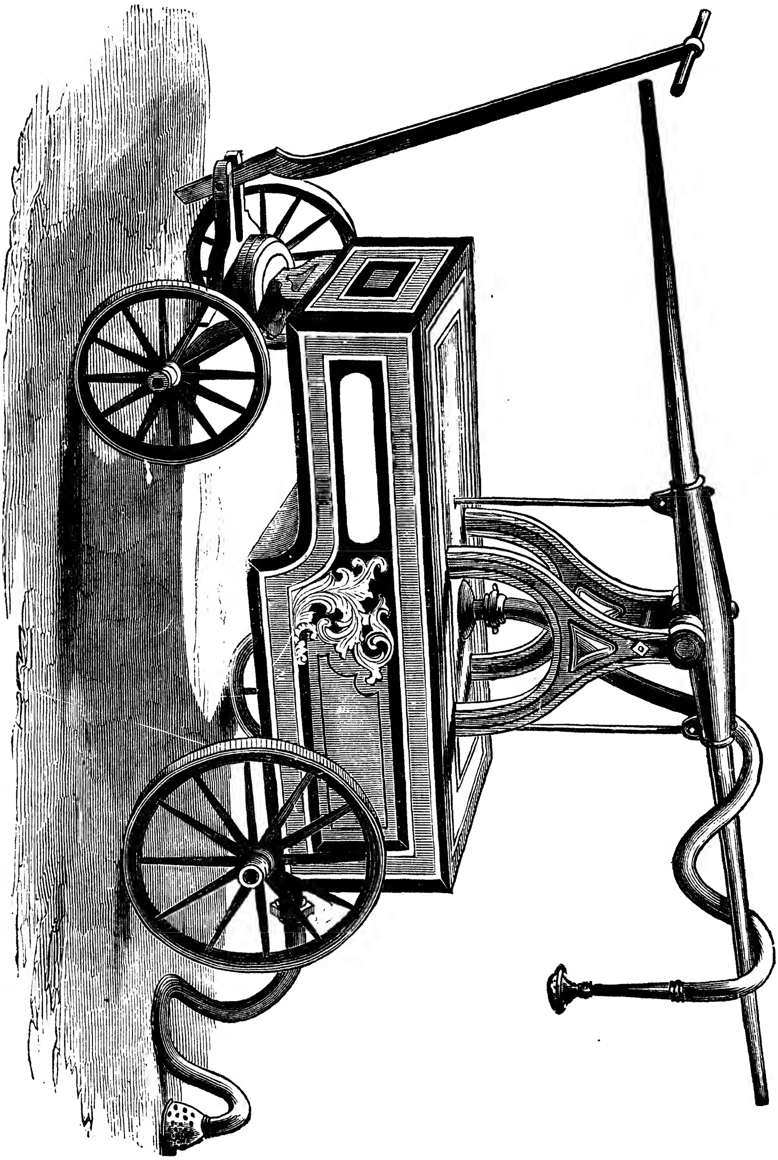
coasts and in the West Indies by intention. Vessels were deliberately scuttled at sea, or run ashore in collusion with wreckers, in order to secure the insurance on them. Others were run into some port in the West Indies, and condemned; ships of the most worthless description being abandoned to the companies at enormous prices. The wreckers added to the evil by decoying honest ships ashore with false lights. This state of things continued for seven or eight years. The frauds were finally discovered, and many a merchant of reputation was ruined by the exposure; but the practice was not stopped until the companies had been subjected to a fearful strain.

Marine companies were established in the following States in the years named, the companies being the first of any kind in those States, and generally doing a fire as well as a marine business: —

Alabama	Montgomery-County Insurance Company	1836
Illinois	Alton Marine and Fire	1835
Indiana	Lawrenceburgh Insurance Company	1832
Mississippi	Mississippi Insurance Company (at Vicksburg) Protection Insurance Company (at Natchez)	1833
Missouri	Missouri Mutual Fire and Marine and others	1837
Texas	Brazonia Insurance Company	1837

From 1830 to 1840.

Although the number of companies increased during this decade between 1830 and 1840 in consequence of the wonderful growth of commerce, the year 1840 found the companies in a state of very uncertain prosperity. Several of the more recently-organized companies were compelled to wind up their affairs. All the other concerns were losing money; and this department of the business seemed to be in danger, for a second time, of being blotted out. The losses of ships by wreck had become so numerous once more as to set at defiance all previous calculations of the law of averages; and there seemed to be nothing in view for the companies, except to re-adjust the whole system of marine underwriting, or to go out of business. That which brought about this condition of things, however, was not the action of the elements; but it was once more the avarice and misconduct of man, against which the law of average is of no avail. The wreckers at different points on the coast, particularly at Key West, were again at work; and they followed up their trade with such hardihood as to enter the principal ports of the United States, and attempt deliberately to bribe ship-captains to cast away their vessels. In too many cases they succeeded. Merchants were either actively or passively engaged in the commission of these frauds. There was little popular sympathy with the companies. The consequence of it all was, that one-third of all the losses of the companies from 1820 to 1840 is estimated to have been the result of the corruption and ungrateful malice of those whom marine-insurance was established to benefit and protect. The companies now began to withdraw from the marine-business, and to extend their fire-risks; and in a few years the former branch of the business would



HAND FIRE-ENGINE.

have become extinct, had it not been for the exposure of the frauds and the prosecution of offenders. In 1844 the Philadelphia companies organized a board of marine underwriters for their own protection; and, by its action, stability and confidence were once more finally imparted to the business.

The marine concerns which were opened in the West after 1832 were for the taking of risks upon vessels engaged in lake and river transportation.

Marine-insurance companies in the West.

That business became very large after 1850. There were ten or twelve hundred vessels on the Northern lakes, mostly sailing-craft, and about as many more on the Western rivers, which, in turn, were mostly steam-vessels. The insuring of these vessels called for the existence of numerous companies, which were duly formed, and did business on a large scale. There was a fault, however, in the system upon which these companies went to work. Competition led them to take risks without much regard to the goodness of the vessels. Ship-builders, finding that slightly-built vessels secured as large a policy at as low a risk as stout ones, put less and less timber and iron into their work; and a class of weak vessels was thereupon created in the trade of the lakes, which could not buffet the storms, and which in a blow were almost sure to be wrecked, unless they happened to be safe in harbor at the time the storm broke out. The grand jury of Northern Ohio made a report in 1855, Mr. C. C. Hine says, in which they stated, that, while there were only 1,190 vessels afloat on the lakes at the end of 1854, the wrecks of that and the six previous years had amounted to 1,560 in number. The state of things was so serious as to require public attention. The evil was finally remedied in 1855 by the formation of the Lake Underwriters' Association, which prescribed rules as to how vessels should be built, and which agreed to take no risks except upon vessels which came up to their requirements. This gave a new life to the business; and, while the companies began now to make money under the new order of things, the public also came to be benefited by it through the greater security to life and property.

The war of 1861 formed another era in the marine-insurance business of the country. For the first two years of the war, the companies on the

Effect of late war.

Northern seaboard made a great deal of money. They all raised the rates of insurance; and one New-York company, whose receipt of premiums was only $6,000,000 in 1860, took in $10,000,000 in 1863, with American navigation all the while declining. If the first two years were prosperous, however, the following two were not. The cruisers which slipped out of the ports of England to prey upon the American ships changed the face of things materially. During the last two years of the war, the companies nearly all lost heavily; and one of them, "The Columbian," failed outright in spite of its gains, because of a loss of $1,000,000 on ships destroyed by the unexpected cruisers. The end of the war found the business very much reduced in amount; and it has not yet recovered the proportions it enjoyed before that struggle began, simply because there are fewer ships and cargoes to protect. The ocean-tonnage of the United States is even now only about one-half what it was before the war. The single feature of the situation which was encouraging was, that no new marine companies had been started, and that those still doing business were generally in a sound condition, and could be relied upon to give a good guaranty of indemnity in case of loss to such ships as they admitted to their books. Connected with the losses of the war of 1861 are the facts concerning the Geneva award. The claims of the United States against Great Britain were presented in gross, and covered both the losses of private citizens and those of the insurance companies. The award was $15,000,000. Of this sum, however, the Congress of the United States has permitted only a part to be distributed. Although the losses of the insurance companies formed a part of the ground of our claims against Great Britain, the companies have been refused a participation in the distribution of the award, — an injustice against which they still protest, and which they are trying to have corrected.

Benefits of companies.

The marine-insurance companies have been beneficial to the United States in more ways than one. The security they impart to the commercial ventures of our merchants is their most valuable office; yet they do much more than that for the comfort and material well-being of our people. They prescribe rules and a standard by which ships must be built in order to secure the most advantageous rates of insurance; and, as it is cheaper in the long-run for an honest merchant to have his insurance as low as possible, he accordingly finds himself obliged to build a good ship. This of itself is a means of prevention against loss by wreck and accident; and, it is hardly necessary to say, it also renders voyaging vastly more safe to the people of the ship, and persons bound across the sea on the pursuits of pleasure or business.

Statistics.

There is an absence of exact statistics in regard to the development of the marine-insurance business, because there is as yet no central authority to which all the companies report. Most of the marine companies combine a fire-business with their marine operations, and the returns of the two branches of the business are not kept separate. It is estimated, however, that the marine companies of the United States now have outstanding risks to the amount of $400,000,000. Of this large sum, $186,000,000 are at the port of New York, and perhaps $100,000,000 at the port of Boston.

FIRE.

Organization of first fire-insurance company.

It is stated by the insurance authorities that not a single building in America was covered by a policy of fire-insurance before the year 1752. In that year the first fire-insurance company was organized, in imitation of similar companies in London, by a number of citizens of Philadelphia. It was called "The Philadelphia Contributionship for the Insurance of Houses from Loss by Fire." Benjamin Franklin was the president of the company. This concern was organized somewhat upon the principle of a mutual society. The man who wished to have his house insured deposited a sum of money, the interest upon which belonged to the company. The man making such a deposit became a member of the company. Losses and expenses were paid out of the deposits and the interest arising therefrom, and at the end of seven years the account was balanced with each member. The policy ran for seven years; and each member was liable to the amount of his deposit, and half as much more. A good deal of information has been preserved in relation to this pioneer of American fire-insurance companies, possibly because so much of it is of a quaint character. It seems, according to Mr. C. C. Hine, the editor of "The Insurance Monitor" at New York, that, instead of appropriating the two-shilling fines laid on absentees at the monthly meetings of the company to the use of the company, the contributors spent them in putting up milestones on the roads leading into Philadelphia. They dotted the roads with these stones for twenty miles around. In 1783 the house of one of the contributors caught fire from a burning shade-tree; and the company thereupon refused to take risks on houses with shade-trees around them, except at enormous rates. This led to dissatisfaction; and the second fire-company in America was finally started in consequence of it, called "The Mutual Assurance Company for the Insurance of Houses from Loss by Fire," dating its origin from 1784. This new company took for its symbol and trade-mark the "green tree," and accepted risks on houses surrounded by shade-trees. The symbol of the "Contributionship" was the badge of two clasped hands, — the same as that adopted by the pioneer Hand-in-Hand Society of London. Like the London company, the pioneer in Philadelphia is still in existence, and doing business.

Insurance in New York.

The subject of insurance was agitated in New-York City in 1770, 1784, and 1785; but nothing appears to have been done in the way of forming companies, owing to the bad financial condition of the times. The return of peace and the establishment of a strong national government appear to have given new life to all business-enterprises, and then in 1787 New York's first company was started. The Mutual Assurance Company was immediately formed for the local uses of the city. The same year the Baltimore Fire-Insurance Company was incorporated. The new National Government having fairly got into running-order, charters were applied for in various States, and by 1800 nineteen fire-insurance companies were doing business in the United States. Some had the right to do a marine-business, and some had inland privileges also. They were the following: —

1752. Philadelphia Contributionship. (Fire.)
1784. Mutual Assurance, Philadelphia. (Fire.)
1787 and 1795. Baltimore Fire. (Fire.)
1787 and 1798. Mutual Assurance, New York. (Fire.)
1794. Baltimore Equitable. (Fire.)
1794. Norwich Mutual, Norwich, Conn. (Fire.)

1794. Insurance Company of North America, Philadelphia. (All.)
1794. Insurance Company of the State of Pennsylvania, Philadelphia. (All.)
1794. Mutual Assurance Company, Richmond, Va. (Fire.)
1795. Maryland Insurance, Baltimore. (Fire and Marine.)
1795. Massachusetts Fire and Marine, Boston. (Fire and Marine.)
1797. New-Haven Insurance Company, New Haven, Conn.
1797. Charleston Mutual, Charleston, South Carolina. (Fire.)
1798. Georgetown Mutual, Georgetown, Maryland. (Fire.)
1798. Massachusetts Mutual, Boston. (Fire.)
1798. New-York Insurance Company, New York. (All.)
1798. United Insurance Company, New York. (All.)
1799. New-Hampshire Insurance Company, Portsmouth, N.H. (Fire.)
1799. Providence Washington, Providence, R.I. (Fire.)

Most of these companies are still in existence, though not all with their original names. The Mutual Assurance of New York, for instance, retained that name only until 1846, when it was re-organized as the Knickerbocker, and under that title is still a flourishing concern. In addition to the above, there was a private concern at Hartford, Conn., as early as 1793; but all record of it has been lost except a single policy, which has been found to indicate that the company once existed.

The Union Mutual was formed in Philadelphia in 1803; the Eagle Fire, in New York, in 1806; and the Albany, at Albany, N.Y., in 1811. Other companies were also the outgrowth of those times; but the three which have been named are the only ones which have led a connected existence to the present time, and are still extant. The old Norwich Fire (Norwich, Conn.) was incorporated in 1803, but was crushed in 1871 by the Chicago fire.

Early appearance of London companies in the United States.

One of the features of fire-insurance at that early day was the opening of offices in the principal cities of the country by London companies. Many people preferred to insure with the London offices, because they possessed so much larger capital. The Phœnix had an office in New York as early as 1805. When the troubles which led to the war of 1812 took place, however, the hostility felt in this country toward England caused the State of New York to pass a law excluding the foreign companies from doing business within her territory. In 1809, Pennsylvania, Maryland, and South Carolina did the same; although the latter State, which was more friendly to English interests, repealed the prohibition the following year.

Rise of insurance companies in Hartford.

In 1810 fire-insurance was established on a small scale in a little New-England city, which was destined in a few years to become famous for its insurance-interests, and to have erected upon its principal streets a number of buildings, devoted to the occupancy of insurance companies, finer than any business-structures in the country, except those in the great metropolitan communities. It was in that year that the Hartford Fire-Insurance Company was incorporated at Hartford, Conn., with a capital of $150,000. This enterprise was a timid venture, and for several years was a plant so tender, that one good fire would have snuffed it out of existence prematurely. The total income of the company for the first year was only $4,498. Its expenses were five hundred and thirty dollars only; three hundred dollars going to pay the salary of the only employé, the secretary, and thirty dollars being expended for rent and fire-wood. By 1820 the income had only risen to $10,102 a year; but after that the business of the company began to grow, and the corporation soon became a great concern, with a national reputation, taking risks amounting to tens of millions annually, and with an income which grew in time to exceed two millions. This, like most of the early companies, was a joint-stock concern. The capital was small at the start, — only $150,000; and, though now $1,000,000, was increased to $300,000 only in 1854. On the other hand, the risks were large, amounting in 1854 to over $10,000,000. But the policies were well placed, and in 1854 the losses annually were only about $300,000; and the premiums, being adapted to the losses, gave the company an income of $500,000 a year, without touching the capital. Thus the losses were all paid from the premiums, and a handsome surplus left for distribution in the form of dividends, or for investment as a surplus fund. The success of the Hartford Fire, and the safety of this form of business, led to the formation of other companies. The Ætna came first, appearing in 1819; and then the Protection. The Hartford-County Mutual came along in 1831, the Phœnix in 1854. Such has been the growth since 1810, that, in spite of the losses caused by the great fires of recent years and other depressing causes, the city of Hartford has in the year 1878 ten insurance companies in full operation, having an income of $11,000,000 annually, and insuring property to the amount of $680,000,000.

Causes of their growth.

The growth of the Hartford companies was in large part due to a cause, which, being taken advantage of afterward by other companies, brought about an expansion of the whole business of insurance. Until the Ætna started in 1819, the business of the several companies had been almost entirely of a local character. Each concern was as much circumscribed by the limits of the neighborhood it was in as the township cider-mill and the early county flouring-mill. The Ætna appears to have conceived the idea of creating a network of distant agencies, and obtaining business in all parts of the country. Possibly the practice of New-England manufacturers in sending out peddlers suggested the idea; but, whether it did or not, the Ætna adopted the agency-system, and soon built up an enormous and prosperous business. The Hartford Fire adopted the system also, and in the course of twenty years the practice became common with all large and aspiring companies. The city which invented it, of course, profited by it the first, and proportionately the most.

Every thing went swimmingly with the companies up to the year 1835.

The computation of the average number of losses in the year and the adjustment of premiums thereto was effectively done, and the companies had themselves alone to blame if they did not make money. They did make money, and new and rival organizations were continually coming into the field to reap a part of the golden harvest they were gathering. In 1835 the first severe blow was struck at the insurance interest by the great fire in the city of New York on the night of Dec. 16. By noon of Dec. 17, five hundred and twenty-nine stores and forty-one other buildings in that city, south of Wall Street, were burned to the ground, and left in smoking ruins, and $15,000,000 worth of property had been consumed. This totally unexpected and overwhelming visitation wiped out of existence every one of the fire-insurance companies of New-York City (twenty-six in number) except the North River, the Greenwich, and the Bowery. All of their $9,450,000 of capital which could be made available, together with $2,000,000 placed by them in Boston and elsewhere, was consumed in paying the losses. They paid over every cent of money they could realize from their assets; and twenty-three companies either wound up their affairs entirely, or began business again with capital freshly subscribed, and upon an entirely new foundation. This calamity produced a sensation in the United States more extraordinary even than the greater fire at Chicago in 1871, for the reason that fire-insurance was new in this country; and from the experience of the preceding twenty years, and the brilliant success of a few notable companies, public confidence in the companies had become excited to a degree which has never been paralleled in the history of the United States. Insurance had come to be considered so safe, that the courts had been in the habit of directing explicitly that trust-funds and savings should be invested in the stock of the companies. The best men of the day had given the weight of their sanction to these investments, and widows and orphans had put large sums of their money into the stocks of these companies in order to deposit it where it would certainly be secure and remu-

Great fire of 1835.

HARTFORD FIRE-INSURANCE COMPANY.

nerative. The re-action after the fire of 1835 was consequently dreadful. The whole country stood aghast. Public confidence in the joint-stock companies was profoundly shaken; and so much did capitalists distrust them, that new companies could not be formed fast enough to re-insure the property which had been deprived of protection by the failure of the New-York societies. The danger of concentrating the risks of a company in cities was made apparent, and altogether a new aspect was given to the whole business.

Fire of 1845.

What little faith in the stock-system was left after the fire of 1835 was badly shattered by the New-York fire of 1845, when four hundred and fifty buildings in the business-centre of the city were destroyed, and $6,000,000 of property lost, — an incident which brought about a fresh lot of insurance bankruptcies.

Consequences of these fires.

The fire of 1835 (and incidentally that of 1845) had two important consequences: one was the improvement of the apparatus in use for extinguishing fires; the other was the formation of a vast number of mutual fire-insurance companies in all parts of the country.

Fire-apparatus. **Fire-engines.** **Paid fire departments.**

With reference to the first matter, it may be said that it was through the influence of the companies that attention was now drawn to the subject of steam fire-engines, to that of paid fire departments, and to the need of city water-works. The insurance companies of New York gave an order in 1840 to have a steam fire-engine built, and one was built by Mr. Hodges, and tested, in behalf of the companies; and inventors, then being set to work at the subject, soon had practical steam fire-engines in operation in various parts of the country. The Croton water was introduced to New York in 1842. Paid fire departments in the principal cities were slower of introduction; but they came along in a few years, and mostly through the efforts of the companies. By 1862 all large cities had them except New York, and the system was introduced there in 1865. Besides using their influence to secure these things, the underwriters did one thing more. In 1839 the companies in New York organized and employed a paid fire patrol, which has ever since been in active and successful operation, and has been of incalculable benefit for the preservation of property. Boston, Philadelphia, Chicago, and other cities, organized similar patrols in imitation of New York. Their cost is a mere fraction of the value of the property which would be destroyed without the agency of their services. The celebrated London Corps was organized by Capt. Shaw of the Fire Brigade of that metropolis, after witnessing the performances of the Insurance Patrol of New York. The underwriters also effected a salutary change in the combustible character of buildings, by their action in regard to rates of insurance, &c.

The second immediate effect of the fire of 1835 was the formation of a large number of mutual insurance companies. There had been some discontent in the public mind at the joint-stock system, because of the unlimited power which it conferred on the companies for making money from the public without imposing a corresponding liability. For instance, a company would be formed with, say, $150,000 capital, of which ten per cent would be paid in at the start, and possibly the whole of it within the course of a few years. Upon this slender basis of capital the company would proceed to erect a colossal top-heavy superstructure of risks, frequently amounting from $5,000,000 to $10,000,000. The company would assess the policy-holders from $50,000 to $100,000 a year, and from that sum of premiums would pay the occasional losses by fire occurring year by year, amounting generally from $40,000 to $60,000 a year. The company would then put a portion of the profits into a surplus guaranty-fund, and divide the rest, thus making an exceedingly handsome thing of it. The stockholders of that class of companies used to get their whole capital back in dividends every four years. At the end of twenty years a great fire might occur which would bring upon the company a loss of $2,000,000. The concern would have its $150,000 of capital, perhaps $200,000 of surplus fund, and $100,000 of receipts for premiums for the then current year, in all $450,000, with which to meet a two-million-dollar loss. The stockholders would have no liability beyond the $450,000; and though they had enjoyed the benefit of large profits for twenty years, and had got the amount of their investment back several times over, the policy-holders could not compel them, in the hour of their extremity, to restore one cent of the gains thus acquired, and save the owners of the burned property from loss beyond the amount of the $450,000 referred to. After the fire of 1835, when the field was cleared so suddenly of insurance companies, the current feeling toward joint-stock concerns found expression immediately in a demand for mutual charters. Under this system the corporation has no capital: the losses are paid from the premiums, as in the original Philadelphia Contributionship, and the profits are divided among the policy-holders. No greater security was gained than under the other system; but the policy-holders who paid the premiums secured their share of the profits, and thus got a part of the benefits of the system which was sustained by their money, and theirs alone. The security was as good, after a few years, as under the joint-stock plan; for all the surplus was transferred to a guaranty-fund, and a capital thus created. The sole weak point of the system was the danger that a heavy loss might occur in the first few years of the mutual concern. This danger was met by the formation of mixed companies, with a capital subscribed, which could be called on in case of emergency; the business being conducted otherwise upon the mutual plan.

Formation of mutual companies.

The rage for mutual companies manifested itself first in New-York State, where a large number of buildings were left without insurance by the bankruptcy of the existing companies, and where there was a demand for new corporations accordingly. In 1835 there were only five applications to the legislature for insurance-charters; but in 1836 there were over fifty, one-half of them being for mutual companies; and, during that and the following year, forty-four charters were granted for the organization of that class of concerns. The applications came principally from the inland cities and towns of the State, where the people resolved to separate the fortunes of their property, as far as possible, from the special hazards and concentrated risks of large cities. The excitement over mutual companies soon extended to other States. During the next ten years they multiplied rapidly throughout New England and all the Middle States; and the idea was adopted throughout the West, where a field for business was just opening. The mutual plan was extremely popular, because in the rural communities, where capital was scarce, companies could be formed without its aid; and, in the cities, those who paid heavy premiums for insurance received, in return, part of the profits of the business. As has already been indicated, this rage for mutual companies received a new impetus in 1845 from the six-million-dollar fire of that year in New York. The failure of more of the Eastern joint-stock companies was the result of the fire; and, as these companies had had agencies in different parts of the country, the localities where those agents had offices were deprived of insurance accordingly. Local companies upon the mutual plan were found to fill the gap thus created. New Orleans, which had theretofore depended on the agency system, was one of the sections which now organized mutuals for fire, marine, and life purposes. The mutuals of that city, by the way, secured by their promptitude a monopoly of the city and river business until 1857, when local stock companies began to compete for the business.

Their growth in New York.

Their spread in other States.

The mutual system was far more advantageous to the general public than the other. When prudently managed, the companies were found to afford ample security, especially outside of the large cities, and the policy-holders secured protection at an extremely low minimum of expense. The mutual system grew rapidly, therefore, especially in the three great insurance States of Massachusetts, New York, and Pennsylvania. It was stimulated in New York by the celebrated law of 1849, which was passed by the legislature without one dissenting voice, and which was simply designed to be a general law to facilitate the formation of companies without the delays consequent upon applying for a special charter. That it did "facilitate" things there is no question; for forty-two companies had been formed under the law by 1853. Growth was so rapid, that, by 1855, the bulk of the farm and village property in the three States above named was covered by the policies of the mutuals; and the same was true of other States.

Advantages of mutual system.

Unfortunately, with this rapid extension of a system which promised to be of such public importance, there came demoralization, speculation, and fraud. The profits of the companies were large, and speculators and wreckers forced their way into the insurance system to carry

Defects in system.

out deliberately-planned schemes of oppression and wrong. The story is the same, in its general outline, in each of the States of Pennsylvania, New York, and Massachusetts. But the wildest swindling was in New York. In that State, the law of 1849, which formed the pattern for the insurance legislation of other States, provided that mutual companies in New-York and Kings Counties must not start without a hundred applicants, nor with less than $300,000 in marine premiums, or $200,000 in fire premiums, for which notes must have been already given. Elsewhere in the State, only $100,000 in notes were required. Any number of persons not less than thirteen might incorporate. What followed in New-York State after that law is so well told in the report of James M. Cook, comptroller of the State in the year 1854, that the words of the report are copied herewith : —

Errors in the law, evil consequences.

"One of the fundamental errors of the law of 1849 was in the method of aggregating the original capital, by placing no reasonable limit to the amount of each of the notes forming it. Any mutual company could be formed out of the county of Kings or New York by thirteen persons giving premium notes to the amount of $100,000, and actually commence the business of insurance without a dollar in money, even while the property actually insured under the bogus notes was of less value than the notes represented. These notes could be withdrawn by the makers as fast as they could get *bona fide* premium notes from insurers who actually desired insurance on their property. Thus the original capital, as it was termed, would disappear exactly in the ratio that agents could cajole real risks to supply its place. This defect is remedied by the law of 1853, by the wholesome provisions of its sixth section.

Error in mode of paying officers.

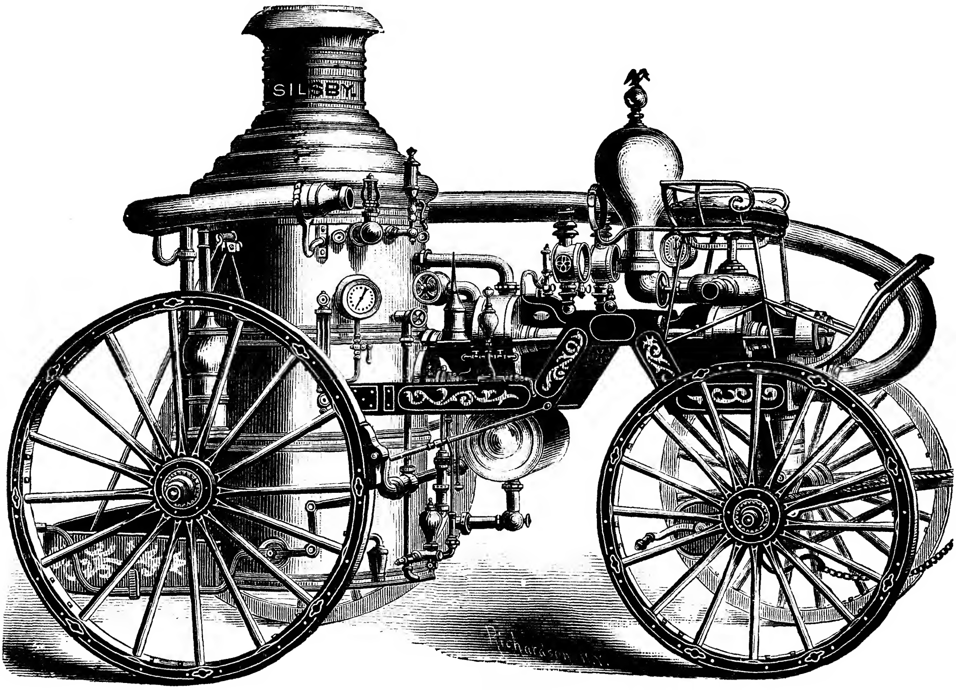
"A greater and more serious difficulty grew out of this apparent and sometimes real necessity of quickly obtaining policies to supply the place of the original notes. Connected with this process prevailed a practice at war with all sound business-transactions : I mean the practice of paying both officers and agents by the policy, instead of fixed salaries. Let me describe the results flowing from this method of business. Competition reduced the amount for which the note should have been taken ; and, for the same reason, the cash percentage was, of course, too small for the risk. Business increased with the reduction of the cost of insurance, both in the amount received in notes and in cash payments. Agents redoubled their activity, as the measure of their pay depended, not on the qualities, but on the number, of the notes they obtained ; not on the kind of buildings, or the amount insured thereon ; a farm was as good for their purpose and for their profit as a modern fire-proof store. Salaries increased for the officers with such magical celerity, that time was flying almost too fast to even sign policies. Soon losses came, as come they will ; and the money received to-day was paid for the losses of yesterday. The happy Paul of to-day paid the percentage upon his premium note which was to insure his property for five years, without the remote suspicion that he was to be the sorrowful Peter of a comparative to-morrow. 'All went merry as a marriage-bell.' Soon everybody within their control in the respective beats of agents was insured; new fields and new agents were sought: but distance lent no enchantment to the view presented by the agents, or perhaps a new competition was created by some envious neighbor. The number of policies began to fall off; the receipts of cash on premium notes for the percentage became 'small by degrees, and beautifully less;' property would burn up; and the managers began to doubt the policy of taking any but farm-risks. The summit level of folly, spurred on by avarice, had been reached; and, as the ascent was with the speed and splendor of the rocket, the descent, as a matter of course, was like the stick that guided it upward. Tax upon tax followed in quick succession upon their premium notes, amid the muttered curses of those who were compelled to pay them. Credit or standing as a company only existed as the snow of last winter, — a matter of remembrance.

"This was sometimes followed by a spasmodic effort to prolong existence. A flaming handbill in large letters is posted, announcing that "this company takes none but farm-risks," or that it has separate classes of risks, with a grand sum total of the amount of their premium notes, and exhibiting a large amount of moneys in the hands of the agents and in the course of transmission to it. Under this state of things, the agents, with the sagacity peculiar to their class, retire in disgust from the employ of the company; and while they sing pæans to some younger brother in whose employ they are, and who is destined to the same foolish and unpitied fate, they freely comment upon and express their doubts as to the management and honesty of the elder one. The beginning of the end has come. *Exeunt omnes* of the managers of the company. The curtain falls; and a receiver, appointed by the court, makes his bow before the astonished audience, and gives notice that the farce of folly, avarice, and mischief has ended, and that the tragedy of collecting a sufficient percentage on the notes to pay the liabilities of the company will soon begin."

Number of failures.

The picture is faithful to the life. The companies in New York adopted the mixed premium and stock-note plan, and pushed a reckless agency business in different parts of the country. In less than ten years of the passage of the law, five-sixths of the companies formed under it went down, entailing a loss of $2,000,000 on the community. Of the forty-two organized from 1849 to 1853, thirty-three were swindles, and failed outrageously. By 1859 there were left in New-York State only twenty-eight of the sixty-two mutuals doing business in 1853; and of the twenty-eight the majority had been organized under special charters prior to 1846, and had adhered strictly to the mutual plan. By 1860 only seven of the nearly sixty mutuals formed under the law of 1849 still survived in New-York State.

Twenty-one mutuals failed in Pennsylvania from 1853 to 1860, owing to the same causes; that is to say, an erroneous plan of doing business, and the deliberate swindling of speculators who organized the companies for the sake of large salaries and plunder. In Massachusetts the mutual companies which were formed from 1844 to 1860 were nearly every one of them closed by the latter year through the action of the courts, or by consolidation with better concerns. Pennsylvania was the champion State of the intentionally bogus companies; but scarce any State in the North was free from them.



STEAM FIRE-ENGINE.

Statistics.

It is difficult to obtain exact statistics concerning the fire-insurance business in the United States, owing to the absence of laws in many of the States requiring reports; but the situation in 1860 in the New-England and Middle States, including a hundred and forty companies in the South and West, was as follows: 417 companies; capital, $40,-000,000; cash premiums paid every year, $25,000,000; fire-risks, $2,300,000,-000. After 1860 the business was conducted more prudently throughout the country, owing to the enactment of judicious laws, and the establishment of State supervision of the companies in New York and Massachusetts. The insurance department of the latter was founded in 1854; that of New York, in

1859. In imitation of those two States, Connecticut established a department in 1866; Ohio, in 1867; Iowa and California, in 1868; Illinois and Missouri, in 1869; Wisconsin and Kentucky, in 1870; and Michigan, in 1871. The wild-cat companies have been nearly driven out of existence by these successive enactments and the action taken under them.

Fire-insurance since 1860.

From 1860 to the present time the growth of fire-insurance has been generally sound, though marked by extraordinary features. The number of buildings in the country — which was only 3,362,337 in 1850, and 4,969,692 in 1860 — had increased in 1870 to 7,042,833 in spite of the devastation of the four-years' war. Competition and the mutual system had reduced the cost of insurance; and the protection of dwellings, stores, and factories, by policies of insurance, had become universal. There were causes at work which compelled the companies to exercise great prudence; such as the increasing use of petroleum for lamps and for lighting fires in stoves, the lawlessness engendered by the war, and the temptation to burn heavily-insured property for the sake of securing the insurance. But these dangers were, on the whole, offset by the general adoption of steam fire-engines and paid fire departments throughout the country, and the general erection of fire-proof buildings. When the war was approaching a close, the prospects of the fire-insurance business were bright, and the companies were hopeful and happy. With the burning of Charleston, S.C., and the loss of $7,000,000 of property thereupon, and the destruction of other Southern cities in that last year of the war, there began a series of losses by fire in this country such as had never been seen on the face of the earth. During the year ending May 1, 1865, over $50,000,000 of property was burned in the United States, mostly in the South of course, only $5,000,000 of it being in the North. This loss fell generally on the English companies and on a few Southern companies, many of the latter being crushed by their losses. On July 4, 1866, a fire broke out in the city of Portland, Me., caused by a boy's fire-cracker, which burned out $10,000,000 worth of property in the business quarter of the city. This was a heavy blow to the New-England companies; but it was an "airy nothing" compared with the experience of 1871, 1872, and 1873. From 1866 the daily record of losses became so large, that, in the country at large, the companies were called upon annually to make good losses amounting to $10,000,000 or more. This was sufficiently serious; but in 1871 came the shock of a great calamity. On Oct. 7 of that year one of the most destructive fires which had ever occurred in Chicago had broken out and been subdued. On Sunday evening, Oct. 8, a barn caught fire (owing, it was said at the time, to the kicking over of a milk-pail and a lamp by a cow) at the junction of De Koven and Jefferson Streets, in an inflammable part of the city; and, at the end of two days, more property had been consumed than in the historic London fire of 1666. In London 13,000 buildings were burned, covering 500 acres; and the loss was $50,000,000. In Chicago 17,450 buildings were burned, covering a tract about four miles long by one wide, an area of 2,124 acres, and worth with their contents, at a moderate calculation, $160,000,000. This was a quarter of the total actual valuation of the real and personal property of the city, which in 1871 was only $620,000,000. The fire rendered 98,500 people homeless, 50,000 of them leaving the city within a few weeks; and 250 lives were lost. On the burned property there was $98,000,000 of insurance, $23,000,000 of it being by New-York companies. The total loss was distributed among two hundred companies, of whom sixty-four failed in consequence of their losses. Eleven of the companies were in Chicago, sixteen in New York, five in Hartford, five in Providence, four in Boston, three in San Francisco, and the rest scattered all over the country. Only about $49,000,000 were realized by the policy-holders. Chicago's actual loss, including loss of business and depreciation of property, was estimated at fully $150,000,000. Two fires in Boston followed this calamity. One began Nov. 9, 1872, and in thirty-six hours destroyed 776 buildings, worth, with their contents, $80,000,000 (the wares in them being valued at $60,000,000), upon which there was an insurance of $56,000,000. Fourteen lives were lost by the fire. In Boston the fire was remarkable, because it swept away a large number of imposing granite edifices which had been deemed absolutely fire-proof. A larger proportion of the insurance was paid in the case of this fire, and again there was a wiping-out of companies. Another fire occurred in Boston in 1873, destroying property worth $1,500,000, insured for $1,100,000. Thirty-two companies closed their doors in consequence of the Boston fires, twenty-six being Massachusetts companies, and twenty-two of the latter number being joint-stock concerns, leaving only eleven joint-stock companies in Massachusetts. These great calamities have been succeeded ever since by a number of smaller ones in other parts of the country. Two or three million-dollar fires have taken place in New York, and one or two in Chicago. One in Pittsburgh was more disastrous, and the number of small fires swells the yearly aggregate now to about $10,000,000.

This is an extraordinary record; and, should the history of the next twenty years present a similar picture of destruction, it will become a problem, whether fire-insurance can continue to prosper. It is confidently believed, however, that the calamities of Chicago, Boston, New York, and Pittsburgh, have now called such attention to the subjects of the architecture of cities, water-supply, patrols, and fire-apparatus, that the chances of any other great city being entirely or even partially destroyed by fire during this generation are very much diminished.

Companies in 1876.

In 1876 the fire-insurance companies of the United States had increased to eight hundred and fifty-one, including thirty-four foreign companies doing business here. From the following table no idea is gained of the comparative importance of the insurance interest in the various States; as Connecticut, for example, transacted more business than several other

States which had a much larger list of companies. They were distributed as follows: —

Alabama	11
California	7
Connecticut	31
Delaware	4
District of Columbia	11
Georgia	6
Illinois	9
Indiana	5
Iowa	7
Kansas	2
Kentucky	13
Louisiana	17
Maine	42
Maryland	18
Massachusetts	85
Michigan	40
Minnesota	2
Mississippi	1
Missouri	29
New Hampshire	37
New York	121
North Carolina	2
Ohio	58
Pennsylvania	177
Rhode Island	24
South Carolina	1
Tennessee	13
Texas	7
Vermont	6
Virginia	16
West Virginia	6
Wisconsin	9
Foreign	34
Total	851

The risks assumed by these companies amount to something over $10,000,000,000, the people of the United States paying for this protection a sum variously estimated from $100,000,000 to $150,000,000 yearly. This is indeed a very heavy tax to pay in order to be secure from the consequences of one's own negligence, or the accidents or wrong-doing of others; but human nature is such a poor thing, that no man is regarded as prudent now-a-days who does not carry a proper amount of insurance upon his houses, barns, factories, ships, or merchandise. It is a very rare thing to see a structure of any sort, possessing much value, that is not, in part at least, insured; though occasionally an insurance-fund is accumulated by companies out of which they reimburse themselves whenever losses arise. The following was the business done by a few of the principal companies in 1875: —

ORGANIZED.	COMPANY.	CAPITAL.	ASSETS.	INCOME.	LOSSES FOR YEAR.	RISKS IN FORCE.
1819	Ætna (Hartford) . . .	$3,000,000	$6,878,000	$4,097,000	$2,059,000	$269,984,000
1853	Agricultural Insurance Co. (Watertown, N.Y.) .	200,000	1,058,000	542,000	267,000	206,471,000
1852	Continental (Hartford) . .	1,000,000	2,845,000	1,677,000	733,000	195,168,000
1820	Fire Association (Philadelphia)	500,000	3,457,000	1,341,000	507,000	136,990,000
1829	Franklin Fire (Philadelphia) .	400,000	3,308,000	1,208,000	586,000	165,380,000
1859	Germania (New York) . .	500,000	1,710,000	992,000	378,000	86,814,000
1850	Glen's Falls(Glen's Falls, N.Y.)	200,000	747,000	338,000	187,000	65,192,000
1852	Hanover (New York) . .	500,000	1,592,000	1,044,000	433,000	96,948,000
1810	Hartford (Hartford) . .	1,000,000	3,032,000	2,066,000	998,000	139,965,000
1853	Home (New York) . . .	3,000,000	6,047,000	3,393,000	1,682,000	356,804,000
1794	Insurance Co. of North America (Philadelphia)	1,000,000	5,167,000	3,351,000	863,000	174,596,000
1849	Niagara (New York) . .	500,000	1,465,000	864,000	469,000	67,338,000
1825	Pennsylvania (Philadelphia) .	400,000	1,557,000	677,000	316,000	63,537,000
1854	Phœnix (Hartford) . .	600,000	1,950,000	1,556,000	871,000	115,826,000
1867	Watertown (Watertown, N.Y.)	200,000	694,000	352,000	187,000	109,193,000
1837	Westchester (New Rochelle, N.Y.) . .	200,000	823,000	807,000	402,000	72,112,000

Perhaps forty other companies take risks amounting to from $20,000,000 to $50,000,000. All the rest do a business of under $20,000,000. The above table very fairly illustrates the proportion of assets and receipts to losses and risks common in all companies.

LIFE.

We now come to another branch of the insurance-business which has had its own independent growth and history, and which has passed through vicissitudes as unique and interesting as the others.

Introduction of life-insurance.

Life-insurance in this country is as ancient in its origin as the fire and marine branches. It was introduced in a modified form as early as 1769. On the 7th of February of that year, the proprietaries of Pennsylvania appear to have issued letters-patent to a company called "The Corporation for the Relief of the Widows and Children of Clergymen of the Communion of the Church of England in America." The object of this society was to secure to the widows and children of clergymen the payment of an annuity after the death of the contributor. The contributors paid eight, sixteen, or twenty-four dollars per annum, as they pleased; and, if fifteen annual payments had been made, their families thereby secured an annuity of five times the amount of the annual payment, — forty, eighty, or one hundred and twenty dollars, as the case might be. If the number of payments was less than fifteen, the annuity was reduced accordingly. Charters were taken out for this society in New York and New Jersey, and in 1787 they were renewed in all three States. The New-York and New-Jersey branches were afterwards discontinued; although the charters remain in force, it is believed, to this day. The original society is still running, though on a very small scale. It scarce attracts attention now, except as an historical curiosity, although its benefits are really valuable, and are shared by a number of people.

The example of Pennsylvania was followed in Maryland in 1784. A corporation of Episcopal clergy was formed on exactly the same plan.

No regular life-business was done in this country, however, until 1812. The same feeling against putting a price upon the life of a human being was prevalent as in earlier times in Europe. It was looked upon as a speculation which the laws of God could not sanction. This prejudice wore away, however, with time; and in 1812 the first life company of the United States was started. It was in Philadelphia of course, the City of Brotherly Love and of a great many other good things besides. It was called "The Philadelphia Company for Insurances upon Lives and granting Annuities." It had a capital of $500,000, and began business in 1813, using the mortality-tables of Dr. Price, which were then in use in England. This table passed out of use long ago; but it may be interesting to quote it here for comparison with the one now in use, which will be cited farther on. It is as follows: —

1812.

Pennsylvania company.

AGE.	EXPECTATION OF LIFE, IN YEARS.	
	MEN.	WOMEN.
Birth	14.25	18.1
5	31.05	37.12
10	30	36.89
15	26.74	33.43
20	23.85	30.01
25	21.40	26.8
30	19.42	23.98
35	17.56	21.62
40	15.61	19.25
45	13.78	17.17
50	11.95	15.12
55	10.3	12.89
60	8.69	10.45
65	7.39	8.39
70	5.81	6.16
75	4.09	4.39

This table was based upon the observation of the average length of life of ten thousand people. It gave an excessive mortality-rate, however, even for

England; and an experience of about twenty years convinced the company in Philadelphia that it was excessive also for the United States. The company therefore reduced its premium-rates in 1831, and again in 1837. The first tables of vital statistics in America made up for insurance-purposes were prepared by the Philadelphia concern for its own use from the mortality-reports of the city.

Reduction of rates.

In 1830 there became apparent a perceptible impulse toward the formation of regular companies for life-insurance. Some of the fire companies had joined a limited life-business with their other privileges: but the total business was a mere thistle-blow in the air to the clouds above, compared with the business which could be developed by regular life companies; and in 1830 the regular companies began to make their *début* upon the stage. The Baltimore Life and the New-York Life and Trust appeared in 1830. In New York the Farmers' Loan and Trust, incorporated in 1822, revived its life-privileges. In Philadelphia the Girard Life and Trust was chartered in 1836, the Globe Life and Trust in 1838, and the Odd Fellows' Life and Fire in 1840. Then, in the West, there was incorporated in 1840 the Ohio Life and Trust of Cincinnati; in the South, the Southern Life and Trust of Mobile in 1836, and the Ocean Mutual Marine and Life in New Orleans in 1835. The premium-rates of these companies were about the same as the mutual rates now in vogue. Life-insurance was scarcely understood in the United States when the majority of these companies began business. If the ancient prejudice was gone, the principles upon which life-insurance was based were not, at any rate, well understood. These companies had to educate the public. They did it well, and established the business in permanent favor in the United States. By 1840 the beneficent results of the business were so well understood, that the State of New York passed a law by which the benefit of the policy was secured to the wife, free from the claims of her husband's creditors. The importance of that law was seen at a glance. It was soon adopted in other States. It gave a great lift to the whole business of life-insurance.

Formation of other companies in 1830 and at a later date.

Within seven years after 1840 five great companies began business in this country, introducing a new era in life-insurance. The first to appear was the New-York Mutual. It was chartered April 12, 1842, with thirty-six of the most prominent merchants of New-York City as the incorporators, Aspinwall being the name at the head of the list. There was no guaranty-capital; but the law required that the company should not begin business until it had received applications for $500,000 of insurance. In order to make a sure thing of it, the company waited eight months, until the applications had amounted to over $700,000; and on Feb. 1, 1843, it threw open its doors for business. It was the first mutual life company in the United States, and it has been the most substantial and successful. In 1844 the New-England Mutual was started in Boston. It had been chartered in 1835; but

Period of 1840.

owing to the monopoly enjoyed by the Massachusetts Hospital and Life Company, chartered in 1825, it had not thought fit to begin business before the year stated. In 1841 the Nautilus Company of New York was chartered, with fire and marine privileges. It did not begin business at once, but got its charter amended so as to include life-privileges too. It opened its doors in 1847, confining itself to the life-business entirely. In 1849 its name was changed to the New-York Life. The State Mutual Life of Worcester, and the Mutual Benefit of Newark, N.J., completing the list of five great mutuals, came into the field in 1845.

Object of companies.

The one object of all these companies was to reduce the cash cost of life-insurance, and to perfect the science of the business, so as to popularize these investments, and make them safe. All except the Mutual Life adopted the part-note system. In 1846 the Connecticut Mutual of Hartford was started upon the same plan as the others. These six companies won their way rapidly; and, in ten years from the time the first of them opened its doors, they had driven every other life-insurance company from the field, except the Pennsylvania, the Girard, and Corporation of Episcopal Clergy in Pennsylvania. These three survive, as do the six pioneer mutuals.

Fate of various companies.

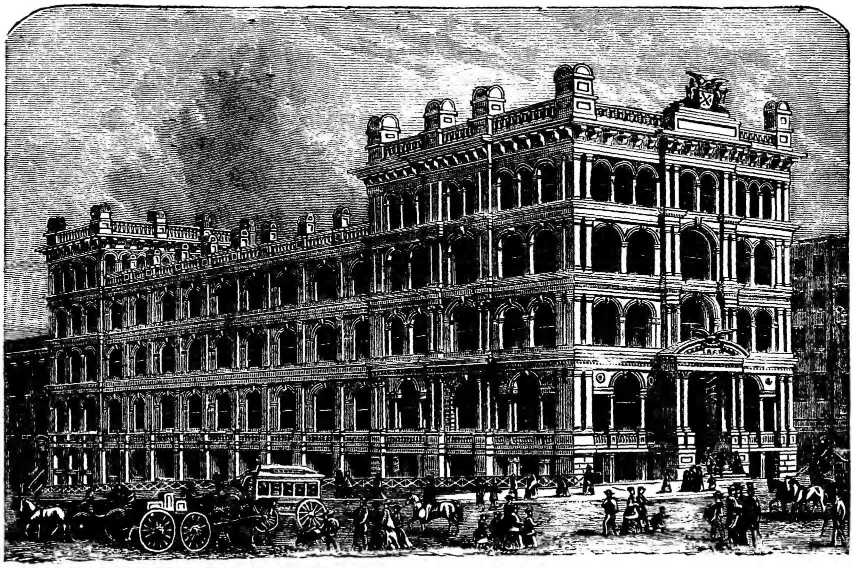
With 1846 the record of unsuccessful life companies begins. The Mutual Life of Baltimore was founded in that year, but was unable to get business, and it disappeared in five years. In 1847 six companies were formed; but only one, the Penn Mutual of Philadelphia, now survives. Five companies were started in 1848: three of them were in Philadelphia, and they soon disappeared: two of them — the Union Mutual of Maine, and the National of Vermont — were successful. In 1843 three companies started in Louisiana, and one each in North Carolina, New Jersey, and Connecticut; but they soon dissolved. In 1850 twelve more were chartered, — two of them in the South, and two in the West. Seven of them soon failed, re-insured in other companies, and went out of sight. The other five, all in the East, survived. The situation in 1850 was as follows: —

	COMPANIES.
Connecticut	6
Pennsylvania	13
Maryland	2
Louisiana	4
New Jersey	3
Ohio	2
Kentucky	2
New York	5
Massachusetts	3
Vermont	1
North Carolina	1
Georgia	1
Maine	1
Foreign	3
Total	47

Of this number twenty-eight have since closed or withdrawn, three of them being the foreign companies. The year 1850 was very prolific in companies. Fourteen were started, and about as many more sprang up in the next five years. The competition engendered by these new companies threw the whole field of life-insurance into commotion. Companies came up like mushrooms year after year, and suddenly appeared on the principal streets of cities, with gilded signs, and showy buildings paved in colored tiles, and ornamented with frescos and bronze railings and statuary, with porters in uniform to receive the visitor; one New-York company hiring a gigantic colored ex-member of the South-Carolina legislature, over six feet high, to act in that capacity. An army of agents was employed by them to flood the country, and besiege the wealthy to take out policies on

Their fate since 1850.

Mode of doing business.



NEW-YORK LIFE-INSURANCE COMPANY.

their lives; and all the agents were supplied with printed books for their private contemplation, entitled "A Few Practical Suggestions," or some similar name, containing such instructions as these: "There must be hard, persistent work." "Talk life-insurance on its merits. Never let any man who has an income go without showing him that his life has a money value" (a whole chapter being given to the work of showing the agent how to put the case to a man). "Talk large amounts; but there are many wealthy men whose families would not suffer in case of their death: these are the men who can best afford to pay a premium; they can pay for a handsome insurance, and not feel it." "Don't make too large promises about dividends." And so on, until the

"Practical Suggestions" have covered every inch of the field. The companies, in fact, had discovered that there was money in life-insurance; and they began a systematic effort to swell the business of taking risks to the utmost possible point, in order to realize therefrom a number of enormous salaries to officers, and the use of the surplus funds of the business for speculation. Prudent and honest companies did much during this period to elaborate tables-of-mortality statistics (the New-York Mutual pre-eminently), and to put the business otherwise on a solid basis: but the fever of speculation burned in the veins of half the existing companies; and the business was pushed at a reckless rate, and on unsound and ruinous principles. By 1860 the withdrawals of companies had been as numerous as their multiplication, and in 1860 only twenty-two of which there is any record were doing business in the United States. Those twenty-two had outstanding insurances to the amount of $180,000,000 on 60,000 citizens, their receipts of premiums being $7,000,000 a year.

With the war, life-insurance received a new impetus. A new era of feverish competition, speculation, showy companies, and ruin, began. In 1864 the policies had increased to $400,000,000. In the next four years seventy new companies sprang up, and insurances ran up to $1,600,000,000. Life companies were the especial feature of the tendency of enterprise in the West. All the offices were run on the high-pressure system. Mr. Hine says, "Solicitors extolled the merits of their own and depreciated those of rival companies in almost every town and village in the country, aided by pamphlets, periodicals, and prospectuses, picturing in magnificent figures the attractive features of the new philanthropy. Railroads and the national debt were about the only things deemed worthy of comparison with such a business. Excessive outlays and defective management were alike concealed by the enormous volume of new business which every enterprising office was able to report at the end of successive years; and the suggestions of speculative re-action and a possible collapse were unheeded in the rich harvest that was being reaped." The experience of the mutual fire corporations in the speculative days of their history has already been related. The wild schemes of the fire mutuals were now more than paralleled by the life mutuals, and wild-cat companies were formed and presented to the public eye in a manner which forcibly calls to mind the company so keenly satirized by Dickens in "Martin Chuzzlewit." One would imagine, on reading Dickens's description, that the satire was levelled at the bubble concerns of America. The portrait is lifelike, and may be reproduced here: —

Effect of war.

"The Anglo-Bengalee Disinterested Loan and Life-Insurance Company started into existence one morning, not an infant institution, but a grown-up company, running alone at a great pace, and doing business right and left; with a 'branch' in a first floor over a tailor's at the west end of the town, and main offices in a new street in the city, comprising the upper part of a spacious house resplendent in stucco and plate glass, with wire blinds in all the windows, and 'Anglo-Bengalee' worked into the pattern of every one of them. On the door-post was painted again in large letters, 'Offices of the Anglo-Bengalee Disinterested Loan and Life-Insurance Company;' and on the door was a large brass plate with the same inscription, always kept very bright, as courting inquiry, staring the city out of countenance after office-hours on working-days and all day long on Sundays, and looking bolder than the bank. Within, the offices were newly plastered, newly painted, newly papered, newly countered, newly floor-clothed, newly tabled, newly chaired, newly fitted up in every way with goods that were substantial and expensive, and designed (like the company) to last. Business! — look at the green ledgers with red backs, like strong cricket-balls beaten flat, the court-guides, the directories, day-books, almanacs, letter-boxes, weighing-machines for letters, rows of buckets for dashing out a conflagration in its first spark, and saving the immense wealth in notes and bonds belonging to the company. Look at the iron safes, the clock, the office-seal, in its capacious self-security for any thing. Solidity! — look at the massive blocks of marble in the chimney-pieces, and the gorgeous parapet on the top of the house. Publicity! — why, 'Anglo-Bengalee Disinterested Loan and Life-Insurance Company' is painted on the very coal-scuttles. It is repeated at every turn, until the eyes are dazzled with it, and the head is giddy. It is engraved upon the top of all the letter-paper, and it makes a scroll-work around the seal, and it shines out of the porter's buttons, and is repeated twenty times in every circular and public notice, wherein one David Crimple, Esq., secretary and resident director, takes the liberty of inviting your attention to the accompanying statement of the advantages offered by the Anglo-Bengalee Disinterested Loan and Life-Insurance Company, and fully proves to you that any connection on your part with that establishment must result in a perfect Christmas-box and constantly increasing bonus to yourself; and that nobody can run any risk by the transaction except the office, which, in its great liberality, is pretty sure to lose. . . .

Anglo-Bengalee Disinterested Loan and Life-Insurance Company.

"Lest, with all the proofs and confirmations, any man should be suspicious of the Anglo-Bengalee Disinterested Loan and Life-Insurance Company; should doubt, in tiger, cat, or person, Tigg Montague, Esq. (of Pall Mall and Bengal), or any other name in the imaginative list of directors, — there was a porter on the premises (a wonderful creature in a vast red waistcoat and a short-tailed pepper-and-salt coat), who carried more conviction to the minds of sceptics than the whole establishment without him. No confidences existed between him and the directorship; nobody knew where he had served last; no character or explanation had been given or required; no questions had been asked on either side. This mysterious being, relying solely on his figure, had applied for the situation, and had been instantly engaged on his own terms. They were high; but he knew, doubtless, that no man could carry such an extent of waistcoat as himself, and felt the full value of his capacity to such an institution. When he sat upon a seat erected for him in a corner of the office, with his glazed hat hanging on a peg over his head, it was impossible to doubt the respectability of the concern. It went on doubling itself with every square inch of his red waistcoat, until, like the problem of the nails in the horse's shoes, the total became enormous. People had been known to apply to effect an insurance on their lives for a thousand pounds, and, looking at him, to beg, before the form of proposal was filled up, that it might be made two. . . . He was grave with imaginary cares of office; and having nothing whatever to do, and something less to take care of, would look as if the pressure of his numerous duties, and a sense of the treasure in the company's strong room, made him a solemn and thoughtful man."

Re-action since 1872.

With 1872 the second tide of speculation again ceased to flow, and the re-action came. Companies carelessly conducted, which had allowed their expenses, commissions, and salaries to intrench upon their capital, began to go down. Collapse followed collapse in all parts of the country. Disaster was postponed, in many cases, by the officers swearing deliberately to false statements in regard to the assets of their several concerns. The salaries of $20,000 and $30,000 they were paying themselves were too large to relinquish without a fight. But State supervision was relentless, and insisted upon searching examinations into the affairs of suspected concerns; and not only were a large number of concerns compelled to close up their affairs along from 1872 to 1878, but in many cases their officers were sent to prison for deliberate fraud and perjury. Some of the men thus summarily and sternly punished had occupied prominent places in the community for integrity and godly lives. The losses inflicted upon the policy-holders amounted to millions. No sympathy has, therefore, been felt for the punished officials of the bankrupt companies.

Present condition.

This era of investigating by State officials, of failure and prosecution, has again cleared the air in life-insurance. The business is again on a sound basis; and, although the salaries and expenses of some of the companies are yet too large, it is believed their affairs are again in a healthy condition. Of course the business of life-insurance has received a tremendous shock by such an awful disclosure of wide-spread mismanagement, and it will probably be a long time before confidence in the really sound companies will be fully restored. The innocent cannot help suffering with the guilty, and this trite truth is emphatically the case with those insurance companies which are truly worthy of confidence; but, in the end, the fact that they passed safely through such a trying ordeal will increase the faith of the public in their soundness, and thus naturally bring renewed prosperity.

Statistics.

Sixty-one companies are now doing business in the United States, distributed as follows: —

Maine	1
Vermont	2
Massachusetts	6
Connecticut	9
New York	15
New Jersey	1
Pennsylvania	5
Ohio	2
Indiana	1
Michigan	1
Wisconsin	1
Missouri	3
Iowa	2
Kansas	1
Kentucky	1
California	1
Alabama	2
Georgia	1
Virginia	1
Louisiana	1
Maryland	1
North Carolina	1
District of Columbia	2
Total	61

The policy-holders number about 900,000. The sum of $75,000,000 is paid for premiums, and $50,000,000 is disbursed annually to the policy-holders. The companies hold $400,000,000 of assets, and have insured lives to the amount of $1,900,000,000. No other nation except England can show such a record. In England, in 1871, there were 136 life-companies, with 1,243,349 policy-holders, the risks amounting to £301,213,144. In Germany, in 1871 (and this includes Austria and Switzerland), there were only thirty-six companies against ninety-one in the United States. The policies were 424,922 in number only, and the insurances 401,000,000 thalers. In France, in 1871, there were 97,841 policy-holders and 973,000,000 francs of life-insurance.

"The primary relation of a company to its policy-holders," says C. T. Lewis, "is that of the seller to the buyer of insurance. In its simplest form, it has no complications or difficulties but those which arise between every seller and his customer. The company determines at what price it will offer its insurance: the purchaser pays the price, and his family is entitled to the amount insured whenever he dies." In taking life-risks, two tables are now used by the American companies. They are called the American-Experience, and the Actuaries' or Combined-Experience tables. The former is the product of the Mutual of New York. They differ from each other by a mere fraction only, and are to all intents and purposes substantially the same. The following will illustrate the Combined-Experience table: —

Tables used in insuring risks.

AGE.	NUMBER OF LIVES.	NUMBER OF DEATHS FROM PRECEDING YEAR.	EXPECTATIONS OF LIFE.
10	100,000	.....	48.36
15	96,636	3,364	44.96
20	93,268	3,368	41.49
25	89,835	3,433	37.98
30	86,292	3,543	34.43
35	82,581	3,711	30.87
40	78,653	3,928	27.28
45	74,435	4,218	23.69
50	69,517	4,918	20.18
55	63,649	5,868	16.86
60	55,973	7,656	13.77
65	46,754	9,219	10.97
70	35,837	10,917	8.54
75	24,100	11,737	6.48
80	13,290	10,810	4.78
85	5,417	7,873	3.36
90	1,319	4,098	2.11
95	89	1,230	1.12
99	1	88	.50

Statistics of failures.

The following are a few figures relative to the failure of life-insurance companies in the United States. The total number of failures has been one hundred and fifteen companies, eighty-three of the number having been chartered since 1860, and seventy-one of the eighty-three since 1865. The years and the States in which the failures occurred were as follows: —

YEAR.	
1840	2
1851	2
1852	5
1853	5
1855	2
1856	4
1857	4
1861	1
1862	2
1863	2
1864	1
1865	2
1866	2
1867	2
1868	5
1869	8
	49

YEAR.	
1840–69	49
1870	6
1871	8
1872	14
1873	17
1874	5
1875	9
1876	7
1877	2
Total	115

STATE.	
Alabama	2
California	1
Connecticut	7
District of Columbia	1
Delaware	3
Georgia	2
Indiana	1
Illinois	11
Kentucky	2
Louisiana	4
Minnesota	1
Michigan	1
Maryland	2
Missouri	8
New York	31
New Jersey	6
North Carolina	2
Ohio	6
Pennsylvania	12
Rhode Island	1
South Carolina	3
Tennessee	6
Texas	1
Virginia	1
Total	115

It was the disgraceful failure of the Ohio Life and Trust Company of Cincinnati as a bank which is said to have started the panic of 1857. The first great failure after that date was that of the Great Western Mutual of New York in 1870. From 1870 on, the companies came tumbling down like a row of trees in the woods which the wood-chopper had prepared for a grand combination crash by cutting away the trunks so that they were all just ready to fall, and then starting them so that each one should fall against its neighbor. One company would be closed by the attorney-general, and its affairs put into the hands of a receiver. Its policy-holders would be re-insured in some other brand-new and equally weak company, which would go down in turn, often in

Failure of Ohio Life and Trust Company in 1857.

the very same year. Each failure was worse than the preceding; and when 1876 and 1877 were reached, and the Continental, the Security, the American Popular, and the Atlantic Mutual went down, an examination of their affairs revealed a shamelessness of corruption, and depth of inefficiency, in the management of the first three, which shocked the moral sense of the American people, and led every man to ask the question of his neighbor, "Well, who is there in the community that we can trust now?" The Continental had $51,000,000 of insurances, the American Popular $10,000,000, and the Security $20,000,000, when they went down.

Failures in 1876-77.

The following is the business which is now being done by the best of the now existing companies; the old Mutual of New York being put at the head of the list, — a place it deserves, not half so much from the magnitude of its colossal business as from the excellence and soundness of its management and the substantial foundation upon which it stands (the figures being for Jan. 1, 1876):—

Business done by present companies.

DATE OF CHARTER.	NAME.	ASSETS.	INCOME.	PAYMENTS TO POLICY-HOLDERS.	NUMBER OF POLICIES.	RISKS.
1847	Mutual of New York . .	$78,534,000	$20,400,000	$12,674,000	92,393	$305,057,000
1850	Ætna (Hartford) . . .	21,822,000	5,526,000	3,453,000	56,743	91,454,000
1850	Charter Oak (Hartford) .	13,314,000	4,448,000	2,096,000	26,481	58,796,000
1846	Connecticut Mutual (Hartford)	43,410,000	9,818,000	6,206,000	66,209	185,076,000
1859	Equitable (New York) .	28,585,000	9,571,000	5,335,000	48,700	178,632,000
1845	Mutual Benefit (Newark, N.J.)	31,300,000	6,751,000	5,526,000	43,015	134,104,000
1830	New York (New York) .	30,505,000	7,944,000	4,131,000	44,461	126,132,000
1857	North-western Mutual (Milwaukee, Wis.) .	17,044,000	4,053,000	2,004,000	36,428	67,124,000
1851	Phœnix Mutual (Hartford)	10,133,000	3,298,000	1,934,000	30,281	60,247,000

The Germania, Globe, Home, Manhattan, Life Association of America, Knickerbocker, John Hancock, New-England Mutual, Pennsylvania, Providence Life and Trust, Union Mutual, and Union Central, do a large business, and have risks outstanding amounting to from $20,000,000 to $60,000,000.

ACCIDENT.

This is the last of the four departments of the insurance-business. It is the creation of the single mind of one man, — Mr. James G. Batterson of Hartford, Conn., who, while abroad, had noticed the workings of accident-insurance in Europe, and who, upon his return, organized the Travellers' Insurance Company of Hartford for introducing the business to this country. His company was chartered in June,

Creation of accident-insurance companies.

1863. It took some time to get it into operation, and the first contract was made upon the street. In March, 1864, Mr. Batterson happened to meet Mr. James Bolter in front of the post-office at Hartford; and the latter asked him, "What will you take to insure me for $5,000 if I get killed by accident in going from here to my house on Buckingham Street?" — "Two cents," replied Mr. Batterson. "Agreed; here is your money," said Mr. Bolter. This was the first insurance for accident in America. The two cents thus earned were preserved by Mr. Batterson, and are still exhibited in a frame. The first written policy was issued to Mr. Batterson himself for $5,000 in April, 1864.

Success of the enterprise.

In two years the success of the Travellers' was assured. The American mind is quick to seize upon new ideas of this sort, and in 1865 and 1866 eleven new companies of various kinds to do a casualty business were organized and in operation in New York. They all soon retired, however, leaving the field to the Travellers'. By the end of 1865, so rapidly did the business of the latter grow under the good management of its president and founder, that it had 27,000 policies in force, with an income of $500,000, and risks amounting to $85,000,000.

In 1866 seven of the accident-insurance companies consolidated, and formed the Railway Passengers' Assurance Company of Hartford. Mr. Batterson became president of that also; and the two concerns, the Railway Passengers' and the Travellers', have since attained a national reputation and a great business. The former confines itself chiefly to the general accident business; while the latter has a life business also, its risks now amounting to over $90,000,000.

To the casualty business a Plate Glass company was added in New York in 1870. Other cities have since formed similar organizations. They have met with moderate success.

CHAPTER III.

COMMERCE.

COMMERCE relates to the exchange of products; transportation, to the moving of them: and, having already considered the latter subject, we shall now confine ourselves strictly to the former, although the two are often treated as identical.

ANTE-REVOLUTIONARY PERIOD.

Commerce divided by Revolution.

The history of the foreign commerce of the United States is very sharply divided by the Revolution into two periods, inasmuch as the laws regulating it were radically changed by that event. We shall first proceed to sketch the colonial policy inaugurated by Great Britain, which was prolific in mistakes, and which finally led to the war of separation between the colonies and the mother-country.

Great Britain's colonial policy.

Great Britain was not slow in declaring her intention to make the colonies as profitable to herself as possible. To accomplish this, she adopted a policy which required the colonies to buy of her, irrespective of competing markets; and forbade their engaging in pursuits which in any way conflicted with the interests of English manufacturers. Let us briefly glance at the manner in which these ideas were executed.

One of the earliest industries[1] in which the colonies engaged was that

[1] In the second voyage of Capt. Newport to the (Virginia) colony in the latter part of 1608 the company sent out in the ship — which brought also a crown for the sachem Powhatan, and orders for his "crownation" — eight Poles and Germans to make pitch, tar, glass, mills, and soap-ashes; which, had the country been peopled, would have done well, but proved only a burden and hinderance to the rest. A colonial historian says, "No sooner were they landed, but the president dispersed as many as were able, some to make glass, and others for pitch, tar, and soap-ashes. Leaving them at the port under the council's care and oversight, he himself carried thirty about five miles down the river to learn to cut down trees, make clapboards, and lie in the woods." The council in London, complaining that no gold and silver was sent, wrote an angry letter to the president, threatening, that if the expenses, two thousand pounds, were not defrayed by the ship's return, they should be deserted. To this Capt. Smith returned "a plain and scholarly answer" by the ship, which was at length despatched with the trials of pitch, tar, glass, frankincense, and soap-ashes, with what wainscot and clapboard could be provided. This cargo, of the value of which we are not informed, appears to have been the first export made from the British colonies to a foreign country, with the exception of a load of sassafras gathered near Cape Cod in 1608, and consisted almost exclusively of manufactured articles, in the strict sense of the term.

of ship-building. The rivers were lined with abundant forests: water-power was readily utilized, and this industry proved very successful from the beginning. In New England especially, and afterward in New York and Philadelphia, ships of two hundred and three hundred tons were built, which were loaded with lumber, fish, live-stock, and other articles, and then sailed for the West Indies, where the cargoes were exchanged for sugars, which were taken to England in the same vessels, and there sold. Not unfrequently the ships themselves were disposed of in the mother-country; for, as timber was so plentiful, they could be made more cheaply at that time on this side of the Atlantic than anywhere else. Thus the business of ship-building, the trade with the West Indies, and the sale of ships, constituted prominent features of a very lucrative business. Other vessels, laden with spars and timber, proceeded directly to British ports, as well as those of other European countries, where ships and cargoes were often sold in the same manner.

Ship-building.

Early voyages.

The commerce of the colonies with the West Indies early attracted the attention of Great Britain. Scarcely had twenty-five years passed since the settlement of New England before a series of trade regulations were adopted by the British authorities for the purpose of monopolizing the carrying-trade thus established. In the reign of Charles II. the celebrated statute was passed, entitled "An Act for the encouraging and increasing of Shipping and Navigation." It was enacted, that "from and after the first day of April, 1661, no sugars, tobacco, cotton, wool, indigo, ginger, fustic, or other dyeing woods, of the growth, produce, or manufacture of any English plantations in America, Asia, or Africa, shall be shipped, carried, conveyed, or transported from any of the said English plantations to any land, island, territory, dominion, port, or place whatsoever, other than to such other English plantations as do belong to his Majesty," &c. The act was designed virtually to secure to the English markets the produce of the colonies, and was but an extension of an act passed in 1650 by the Parliament of Cromwell, restricting the import and export trade of the colonies to English or colony built ships.[1] The list of articles named in it, which was extended from time to time, embraced what were known as enumerated articles. Two years afterward, in 1663, it was enacted that "no commodity, of the growth, produc-

Trade regulations during reign of Charles II.

[1] The doctrine of each sovereignty of the world grasping and holding the largest number of monopolies possible, to make the most of its opportunities, and to keep its rivals down, was so ingrained and steeped into the people who settled this country, that they manifested the same spirit. In order to encourage the building of ships and other vessels, and increase the trade of Perth Amboy, which at one time sought to rival its neighbor New York in commerce, the Assembly of New Jersey, in 1694, prohibited the exportation of any timber, planks, or boards of any kind, hoops, or hop-poles, except directly to England, the West Indies, the Summer and Wine Islands. The object of this measure was to monopolize the transportation of its only export, — an experiment which proved injurious to both New Jersey and New York. Notwithstanding the obvious defects in the system, it was continued; and in 1714 duties and other restrictions were imposed on the exportation of some commodities when they were shipped to neighboring provinces. Indeed, the system was continued with considerable vigor until the time of the Revolution.

tion, or manufacture of Europe, shall be imported into the British plantations but such as are laden and put on board in England, Wales, or Berwick-upon-Tweed, and in English-built shipping, whereof the master and three-fourths of the crew are English." The effect of this would be to compel the colonies to buy, as the former did to sell, in the English markets exclusively. But these laws were very little regarded by the colonies, with the exception of Virginia, where they excited remonstrance and almost rebellion, and were not, until a later period, enforced upon them. The primary object of the monopoly was to prevent the commercial rivals of England from supplanting her in the colonial trade; although the deeper object, as we shall very soon see, was to put most of the trade into the possession of England alone.

Independence feared.

Even at that early date, there were those who feared that the prosperity of the colonies would pave the way to independence. Said one writer of that day, "The colonies are beginning to carry on trade: they will soon be our formidable rivals. They are already setting up manufactures: they will soon set up for independence." The "Discourse on Trade," by Sir Josiah Child, before quoted, thus expresses the prevailing opinion of this class: "New England is the most prejudicial plantation to this kingdom. Of all American plantations, his Majesty has none so apt for the building of shipping as New England, nor none so admirably qualified for the breeding of seamen, not only by reason of the natural industry of that people, but principally by reason of their cod and mackerel fisheries; and in my poor opinion there is nothing more prejudicial, and in prospect more dangerous, to any mother-kingdom, than the increase of shipping in her colonies, plantations, or provinces."

Evasion of laws necessary in order to continue purchases of England.

It was only by an evasion or relaxation of the laws, says Bishop, which was connived at by the revenue officials, that the colonies were ever enabled to pay for the enormous amount of British manufactures and European merchandise annually received from England; which, at the beginning of the eighteenth century, amounted to nearly £400,000, and, toward the close of the provincial period, £3,500,000, or nearly one-fourth of the English export trade of those periods. None of the colonies north of Maryland ever had balances in their favor, but were, on the contrary, much in arrear. The obligations could only be met by circuitous trade, carried on, in contravention of the trade acts, with foreign countries, whence they derived most of their specie and remittances suitable for returns to their English creditors. By this illicit traffic English commerce was as much benefited, probably, as that of the colonies. Lord Sheffield admits, that, between the years 1770 and 1773, the colonies must, by this circuitous trade, have remitted to England upward of £30,000,000 in payment of goods taken from her, over and above their remittances in produce and fish. Ships built for sale, as has already been remarked, constituted an important element in this foreign colonial trade, the value of which was usually remitted in specie, or bills of exchange on London.

Let us look across the sea for a moment, and learn how the English over there carried on commerce with the colonies. Joshua Gea, in a work upon the "Trade and Navigation of Great Britain," which appeared in 1729, says, "We have a great many young men who are bred to the sea, and have friends to support them. If they cannot get employment at home, they go to New England and the Northern colonies with a cargo of goods, which they sell there at a great profit, and with the produce build a ship, and purchase a loading of lumber, and sail for Portugal or the Straits, &c., and, after disposing of their cargoes there, frequently fly from port to port in the Mediterranean till they have cleared so much money as will pay in a good part for the first cost of the cargo carried out by them, and then, perhaps, sell their ships, come home, take up another cargo from their employers, and so go back and build another ship. By this means, multitudes of seamen are brought up; and, upon a war, the nation is better provided with a greater number of sailors than hath heretofore been known. Here the master becomes merchant also, and many of them gain by this lumber-trade great estates, and a vast treasure is thereby yearly brought into the kingdom in a way new and unknown to our forefathers; for indeed it is gaining the timber-trade heretofore carried on by the Dutch and Swedes, our plantations being nearer the markets of Portugal and Spain than theirs are."

How England carried on commerce with the colonies.

Notwithstanding the historic trade acts of Great Britain, which were designed to cripple colonial commerce, it was actively carried on in the manner described, especially with the West Indies and the mother-country. It is proof of a pretty lax administration of the laws in those days; but there were a great many merchants interested in making these exchanges, from whom the policy of England, if rigidly enforced, would have evoked bitter opposition. Probably the government was well aware of the fact, and consequently was more willing to acquiesce in the infraction of the laws than if they had been in perfect harmony with the sentiment of the time. So exchanges went on. To the West Indies were carried lumber of all kinds, fish of an inferior quality, — the better sorts going to the Roman-Catholic countries of Europe, — beef, pork, butter, horses, poultry, other live-stock, tobacco, flour, bread, cider and apples, cabbages, and onions; for which was received, in return, molasses, besides silver and gold, which metals were transmitted to Great Britain to pay for the commodities purchased there. While no gold and silver mines were known in America, the Spanish settlers in the West Indies were rich in the precious metals which they were receiving from Mexico and Peru; and from this source the colonists received something like an adequate supply to discharge their obligations to the mother-country. But for this illicit trade, the colonies would soon have

Trade carried on, notwithstanding trade acts.

been drained of their supply of the precious metals, and the English merchants would have found only a poor market for their wares in America. America had only a small supply of the articles which the people of Great Britain wanted in return for their commodities. Fish, tobacco, and ships were the chief exports, besides gold and silver, to that country; and these alone would have gone only a little way in payment for the goods wanted of her.

Colonial fisheries.

It may not be out of place to describe, in this connection, the fisheries of the colonial period. In those early times, cod, salmon, mackerel, sturgeon, and other kinds of fish, were abundant along the coast and in the rivers, and large numbers of men were employed in catching, curing, and packing them. But the New-Englanders also frequented the famous Banks of Newfoundland, as far as the coast of Labrador, where enormous quantities were caught. Indeed, those waters are scarcely less abundant to this day. Besides their own catch, the colonists used to buy of the Newfoundland fishermen, paying therefor in rum of New-England manufacture, and also in other things coming from either the colonies or the West Indies. The following statistics will give the reader an idea of the quantity of the warming fluid which was sent to the provinces of Nova Scotia, Quebec, and Newfoundland, for the four years preceding the Revolution: —

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

The fish obtained by both capture and purchase were properly prepared for market, and sent to the various ports of Europe. The choicer qualities were sent to Southern Europe, and the proceeds were remitted in bills of exchange to England to pay for merchandise consumed in America. A few of the best fish, however, also found a market in Great Britain; while the inferior sorts went to the West Indies, and were eaten as a relish to the plantains and yams which constituted the staple diet of the slaves.

Whale-fishery.

After the peace of 1763 with France, the whale-fishery, which theretofore had not been an important industry, developed rapidly; and the seas between New England and Labrador were vexed with a goodly number of vessels engaged in the hazardous but exciting undertaking. As the tariff on oil and bone was reduced at this time, a new impetus was thereby given to this industry; so that, before the year 1775, more than a hundred and sixty vessels were thus profitably employed. The oil and whalebone were shipped chiefly to Great Britain; while candles were made of the spermaceti, which were also exported thither.

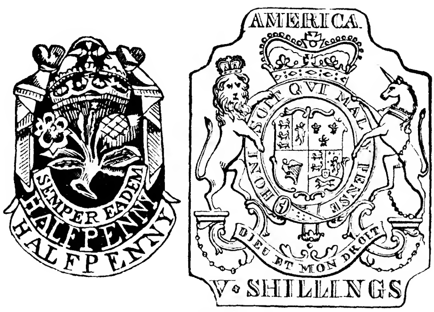
The most unremitting attention was given to every thing likely to yield any profit, and so thoroughly wide-awake were the colonists as to obtain the appellation of "the Dutchmen of America." Their prosperity was closely watched from the other side of the water; and as their trade diminished with Great Britain, and increased more with other countries, in spite of custom-houses and watchmen, while manufactures at home were growing, the British House of Commons in 1731 instituted through the Board of Trade an inquiry with respect to the laws made, manufactures set up, or trade carried on, detrimental to the trade, navigation, or manufactures of Great Britain. Among other facts reported were the following, which will doubtless interest the reader, as they throw much light upon the character of the colonists at that time, the extent of their trade, the progress of home manufacture, and how laws which were designed to oppress the colonies and enrich the merchants of Great Britain had been turned with deadly effect upon those who had made them: —

Cause of commercial prosperity.

"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 the 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 used wholly by the shipping, and that the works of that province were not able to supply one-twentieth part of what was necessary to the use of the country. They had no manufactures in the province of New York that deserved mentioning (their trade consisted chiefly of furs, whalebone, oil, pitch, tar, and provisions); no manufactures in New Jersey that deserved 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; 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 thirty shillings 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 lessen the importation of calicoes and some other sorts of East-India goods. They also make some small quantity of cloth, made of linen and cotton, for ordinary shirting and sheeting. By a paper-mill set up three years ago, they make to a value of two hundred pounds yearly. There are also several forges for making bar-iron, and some furnaces for cast-iron or hollow-ware, and one slitting-mill, and a manufactory for 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 from water-carriage, and the land is 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 in 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 which 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 not prohibited from receiving from the foreign sugar colonies the money, rum, sugar, molasses, cocoa, indigo, cotton, wool, &c., which they at present take in return for provisions, horses, and lumber, the produce of that province and New Jersey, of which he affirms the British sugar colonies do not take 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 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; and that they export horses and lumber to the West Indies, and receive in return sugar, salt, molasses, and rum. We 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."

Effect of Stamp Act.

Upon the conclusion of the war with France in 1763, Parliament thought the colonies ought to pay a share of the bills growing out of the contest which was waged chiefly for their defence. Accordingly, resolutions in favor of a Stamp Act similar to the one which had long been known in England were passed in 1764. This measure was followed next year by another, declaring all written instruments used in the colonies null and void, unless executed upon stamped paper, or parchment charged with a duty by Parliament. This bill at once roused intense opposition here, and was the prelude to the Revolution. The colonies immediately faced these measures by declaring that they would cease their importations from Great Britain; and so effectually did they execute this purpose, that British merchants loudly clamored for the repeal of those laws which had worked such an unexpected injury to their trade. Their request was complied with; and, just a year from the time of their enactment, these obnoxious laws were swept from the statute-book.



STAMPS.

Taxation of imports.

In 1767, however, Charles Townsend introduced into Parliament another bill, imposing duties on glass, pasteboard, paper, painters' colors, and tea, which passed into a law, and once more aroused the opposition of the colonists to remonstrances, petitions, and non-intercourse acts. The merchants of Boston, in October, passed resolutions — in which they were followed by other towns — not to import, or deal with those who should import, tea, glass, paper, or colors, so long as the duties on those articles remained unrepealed. Resolutions were at the same time formed to encourage by all prudent ways and means home manufactures, and glass and paper were especially mentioned as worthy of encouragement. The British exports to the colonies at once fell off again from £2,378,000 in 1768 to £1,634,000 in 1769, and the repeal of the act was loudly demanded. Public excitement was once more allayed in 1770, temporarily, by the reluctant withdrawal of five-sixths of the duties, leaving but a nominal tax of threepence per pound on tea, as a testimony of the asserted legislative authority of Parliament.

Says Bishop, "The trade acts were, in many respects, a manifest violation of the rights of the colonists to make the most of their industry. Unless exemption were guaranteed by their charters, a right to exact from them a contingent for the general expenses of the empire of which they were an integral part seemed to rest upon the same prerogative by which the parent state assumed in other cases to legislate for its dependencies. The legislatures of Massachusetts and New York had indeed, ten years before, enacted a provincial Stamp Act; the former granting to his Majesty duties on vellum, parchment, and paper, for two years, toward defraying the charge of this government. That of New York, passed the following year, continued four years in operation. But the impost was now resisted upon the principle that the colonists were not amenable to a statute which they had no voice in making; and, upon this question of prerogative, the empire was dismembered."

Bishop on trade acts.

How the continuance of this policy resulted the world knows. It was opposed by the colonies, and in the end came revolution and separation. But, before this step was taken, a long series of experiments in the way of imposing and resisting taxes were tried on both sides. Laws were passed, to be modified or repealed at the next session of Parliament. In the year 1767 several measures favorable to colonial trade were enacted; but the next witnessed a renewal of the fiscal schemes of the previous ministry by the imposition of a duty on paper, glass, painters' colors, and tea, providing for the quartering of soldiers in the colonies, and for a more effectual enforcement of the revenue system by the establishment of a custom-house. Although the people had so readily receded from the determined stand taken against the Stamp Act, and a sum of £15,000 was voted to be raised by a tax on foreign sail-cloth and lawns, to be paid in premiums on flax and hemp imported from the colonies, this and other favorable legislation did not prevent a renewal of the opposition to the new plan of taxation. Boston, in town-meeting, Oct. 28, commenced the former system of retaliation and redress by declaring that the "excessive use of foreign superfluities is the chief cause of the present distressed state of this town, as it is thereby drained of its money; which misfortune is likely to be increased by means of the late additional burdens and impositions on the trade of the province, which threaten the country with poverty and ruin." Resolutions were made to abstain from the use, after Dec. 1, of such foreign articles as "loaf-sugar, cordage, anchors, coaches, chaises, and carriages of all sorts, horse-furniture, men's and women's hats, men's and women's apparel ready made, household furniture, gloves, men's and women's shoes, sole-leather, sheathing and deck nails, gold, silver,

Effect of the system.

and thread lace of all sorts, gold and silver buttons, wrought plate of all sorts, diamonds, stone, and paste-ware, snuff, mustard, clocks and watches, silversmiths' and jewellers' ware, broadcloths that cost above ten shillings per yard, muffs, furs, and tippets, and all sorts of millinery-ware, starch, women's and children's stays, fire-engines, china-ware, silk and cotton velvets, gauze, pewterers' hollow-ware, linseed-oil, glue, lawns, cambrics, silks of all kinds for garments, malt liquors, and cheese." Thus the regulations which were designed to yield such a revenue to Great Britain signally failed in their purpose.

Non-importation and non-exportation act of 1774.

On the 10th of September, 1774, was passed by the Continental Congress, then in session at Philadelphia, the famous non-importation and non-exportation resolutions, which constituted a pledge on the part of the colonists, "under the sacred ties of virtue, honor, and love of country," not to import, after the 1st of December, any goods whatever from Great Britain or Ireland, or British goods from any place; not to import or purchase any slave imported after that time, after which they would wholly discontinue the slave-trade; not to import or purchase East-India tea; to suspend the non-exportation agreement until Sept. 10, 1775; to request merchants as soon as possible to order their factors in Great Britain not to ship any goods to them on any pretence whatever; to use their utmost endeavors to improve the breed and increase the number of sheep by killing them as seldom as possible, and not exporting them, but selling them on moderate terms to their neighbors who might need them; to encourage frugality, economy, and industry, and promote the agriculture and manufactures of this country, especially that of wool; to discontinue and discourage every species of extravagance and dissipation, shows, plays, &c.; to use, on funeral occasions, only a ribbon or a piece of crape on the arm for gentlemen, and a black ribbon and necklace for ladies, and to discourage the giving of gloves, scarfs, &c., at funerals. It recommended venders of goods not to take advantage of the scarcity occasioned by the association to ask for more than they had been accustomed to; that goods imported after the 1st of December ought to be either reshipped, or stored at the owner's risk, until the non-importation agreements ceased, or be sold, and the owner re-imbursed the first cost and charges, the profits to be devoted to the Boston sufferers. Committees should be chosen, in each county, city, and town, to carry out the resolutions, and report violations; and the committee of correspondence should frequently inspect the custom-house, and inform each other of the state thereof: that all manufactures of the country should be sold at a reasonable rate; and that no trade, commercial dealings, or intercourse, be had with any colony or province that did not accede to or should afterwards violate the agreements, but they should be held unworthy the rights of freemen, and as inimical to the liberty of their country. These resolutions met with general approval, and continued in force until peace with Great Britain was declared.

POST-REVOLUTIONARY PERIOD.

With separation and peace came a new era in the history of American commerce. During the Revolution it had sadly waned; indeed, it was nearly ruined. But, as soon as hostilities were declared at an end, the king removed all legal restraints upon intercourse with the United States, dispensing with a manifest for a time even on the arrival of an American vessel in a British port. Trade at once revived; the imports to this country amounting to $30,000,000, while the exports were about one-third of that sum, for the first two years of peace. This inequality in the balance of trade caused much distress; but the needed remedy was within reach, and was speedily applied. Thereupon prices fell, imports were checked, and in 1788 these were nearly equalled by our exports. In 1790 our exports amounted to upwards of $20,000,000, and our imports footed up $23,000,000.

Commerce during the Revolution.

The remedy to which we here refer was an act of retaliation designed to put American shipping on an equal footing with that of Great Britain, and thus insure reciprocity. The old country forbade that produce be imported to her harbors, except in British bottoms. Immediately Congress enacted that foreign produce should not be landed on our shores, except from American ships. Under this arrangement, vessels had to go one way empty. This had the effect of securing a treaty by which Great Britain conceded equal privileges to American ships with her own, as between the ports of the two countries. This was the first of three great principles in international usage, all in the direction of commercial freedom, which the United States established; the other two being, that neutral ships make free goods, and that a neutral nation is responsible for the damage done by privateers fitted out in her ports. Thus it will be observed that the young republic of the West has championed the rights of mankind upon the sea as well as upon land; and, as those of the sea are exclusively commercial, her championship has been of the greatest value to whoever navigates the common highways of the world. The commerce of the world has been benefited and promoted by the pride, pluck, and conscious dignity of the American nation.

Commercial freedom.

The prompt and decided self-assertion of commercial equality cannot be appreciated in these present days without a recollection of the exclusive maritime supremacy of the Dutch over the whole world prior to the time of Charles II., and of the subsequent monopoly of the world's commerce by Great Britain. Viewed in comparison with precedent history, it was a singularly bold assumption.

Importance of maintaining commercial equality.

Another noticeable influence upon the development of America's foreign trade, immediately after the Revolution, was the rise of our enterprising, shrewd, and adventurous merchant-princes, who designed the most daring and successful commercial expeditions, comparatively speaking, this country has ever known. They sent ships to all parts of the

Merchant-princes.

globe, even to China, founding in this last-named quarter a trade that has never ceased to grow; and so summarily punishing the Algerine pirates in the Mediterranean, that American trade on that sea enjoyed unusual freedom from that pest. Among the most prominent among these men was William Gray of Boston, whose reputation soon became world-wide, and as honored in the East as 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, put therein the hard dollars as they sold the fish, and pay out from it as they bought the rum, molasses, and sugar, tie up the balance, and hand it in at the counting-room on their return home in lieu of all accounts. The honesty and judgment of their proceedings were beyond question, and the problem of the 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 a still more extensive operator. He first projected the enterprises to the northwest coast, and laid out with profound skill schemes which it took ten years to ripen; 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. Girard's ships were actively engaged in commerce with the West Indies at the time of the revolution in San Domingo, and carried away many rich refugees. His wealth received large accessions from the property placed on board by those who could not escape. The Patersons of Baltimore led the commerce of that city: and behind these leading names, which are associated in history with vast fortunes, came a crowd of lesser ones; for the mercantile intellect was as busy in this country at that time as was military, political, and literary genius throughout the world.

William Gray.

Stephen Girard.

The internal agency that led to the national self-assertion and this bold individual enterprise was doubtless the enthusiasm of independence. Already the colonists were a commercial people: triumph over England inspired them to greater ventures; freedom and success stimulated further action; and the imposition of a tariff, the organization of a bureau of commercial statistics, and the establishment of our currency on a sound basis, awakened confidence in our commercial strength at home and abroad.

Effect of independence in stimulating commerce.

Another impulse was given to our commerce by the sudden development of the cotton production at the commencement of this century, which we have elsewhere described at some length. The invention of the cotton-gin gave a sudden development to this industry, and gave us a new and valuable commodity for export. In 1790 we exported

Effect of cotton production.

but \$42,285 worth of cotton: in 1807 the amount was valued at \$14,232,000. Later, still vaster dimensions were attained. But, in the last year here cited, our cotton alone formed nearly one-third of the value of our total export. It might be mentioned in this place, that just previous to this time the South had become greatly depressed, business-wise; for her blacks had not been able to earn their own living. Hence in 1808, some years after the evil began to be first felt, the further importation of slaves was prohibited by an amendment to the Federal Constitution; and, as the vessels engaged in this traffic were chiefly of New-England ownership, the check was not fully enjoyed by the commercial interest. Other events, however, at that time, distracted attention, and prevented any expression of resentment.

Napoleon.

A cause external to American politics and enterprise also gave new stimulus to American commerce soon after the Revolution. The ambition of the great Napoleon led to war between England and France at the close of the eighteenth century, and thus the shipping of both nations was unsafe at sea. The carrying-trade was therefore assumed by the navigators of this country, who brought much of the West Indies and other produce designed ultimately for Europe, and much of the exchange freight, to our shores *en route*. The stoppage of production in Europe on account of a general war created a greater demand for American food-products and manufactures, and thus increased our domestic export trade. An interesting triangular exchange of credits occurred at this time. England had large credits in this country at that time on account of certain shipments of manufactures: the United States was acquiring large credits in France on account of shipments of produce. England had no direct trade-relations with France, but wanted to transfer money to the Continent for political uses; and so bought these American credits in France, taking them in payment of our debts to her.

Embarrassments of Anglo-French conflict.

While, on the whole, the Anglo-French conflict was advantageous to us at first, it had its embarrassments, and was afterwards disastrous in its influence upon our commerce. In 1793, England, jealous of seeming benefits derived by France from this arrangement, domineeringly forbade American vessels to carry food to any port occupied by French troops. She also exercised the right of impressing American seamen into her own navy. Under these and other orders Americans were robbed of much property, and war was threatened; but matters were smoothed over by a treaty negotiated by Mr. Jay, by which the sum of ten million dollars was awarded us. This enraged France, which began to seize our ships; but Napoleon put a stop to such proceedings in 1800. But further embarrassments ensued. England declared all of Europe, from the Elbe to Brest, in a state of blockade, thus prohibiting American ships from entering there. Napoleon retaliated with the Berlin decree of November in that year, prohibiting all intercourse with the British islands. Both sides issued further and more comprehensive edicts of the same insane

SHIPPING ON THE DELAWARE.

sort; and finally, in 1807, to avoid war, the United-States Government laid an embargo upon commerce altogether. So violent was the re-action in American commercial circles, that our government was forced to modify very essentially this action next year, substituting non-intercourse laws for the first enactment. Still our commerce was sadly crippled, and was long in recovering from the effects of this blow. It is an interesting fact in this connection, that, in 1803, Jerome Bonaparte, brother of the great Corsican, married into the Paterson family of Baltimore, already spoken of as eminent in commerce. The Paterson interest, through Jerome, was successful in gaining stealthy admission to French ports for what was, after all, much-coveted produce. This, however, was chiefly before the embargo of 1807.

Embargo.

This was the culmination of a long period of remarkable commercial activity and prosperity. An immediate and remarkable decline ensued. Before considering the latter, therefore, it is worth while to briefly review the former. The treaty of peace which acknowledged American independence was signed in 1783. The loose confederation of States was succeeded by the present union under the new constitution in 1789. From the following year our commercial statistics date. The embargo occurred in 1807. The following table shows the development of our commerce in the interval, and the check put upon it by this enactment, and the delay in recuperation: —

YEAR.	TONNAGE.	DOMESTIC EXPORTS.	FOREIGN EXPORTS.	TOTAL EXPORTS.	IMPORTS.
1790 . .	474,374	$19,666,000	$539,156	$20,205,156	$23,000,000
1807 . .	1,268,548	48,669,592	59,643,558	108,343,150	138,500,000
1808 . .	1,247,596	9,433,546	[illegible],997,414	22,430,960	56,990,000
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

Second war with Great Britain, and its effect.

These international complications led at length to war with England, which lasted from 1812 to 1815. The result of that war, it will be remembered, was the establishment of the principle, that England had no right to board our merchant-vessels, and claim our seamen for her citizens; and also that the merchant-marine of a neutral nation, in time of war, might go where it pleased without molestation. It is a well-known fact that this triumph was accomplished chiefly by the American navy; and it is worth remembering that that navy was greatly strengthened by the influx thereto of hardy sailors from our now paralyzed merchant-marine. At first it was feared that the magnificent British navy would destroy ours in almost no time, and Congress was determined to send the government ships up the rivers for refuge; but, at the earnest solicitation of the naval officers themselves, they were permitted to go to sea. "The astonishment in Europe," says Kettell, "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."

War had paralyzed all other industries as well as commerce. Agricultural produce, finding no outlet, accumulated in warehouses; ships lay idle at the wharves; property depreciated; and credits became overstrained. Something like a panic ensued upon the declaration of peace; but general business soon recuperated, owing to the improvement brought about by the escape of penned-up agricultural produce, the establishment of the Bank of the United States, and the imposition of a tariff on the heavy importations that followed the war.

All industries paralyzed by it.

Several important changes now took place in our various industries. That department of agriculture which produced food was depressed, because no longer called upon by Europe for such large supplies: indeed, our foreign trade in food did not again develop for thirty years. Cotton was called for more than ever at home and abroad, and its culture rapidly developed. In 1818 fully forty per cent of $73,854,000 worth of exports were of raw cotton, or more than double what they were in 1807. The commercial interest of New England, which had opposed the war, and had been prostrated thereby, was discouraged by the falling-off in the foreign demand for food-products, and still more by the resumption of their own carrying-trade by the other countries. It will be discovered, from the table which we shall presently give, that this latter branch of American industry never regained the dimensions of the period just before the embargo. Accordingly, capital was withdrawn from the shipping-interest, and put into manufactures, which were protracted by the increasing tariffs of 1816, 1818, 1819, 1824, and 1828. These, in turn, checked the importation of foreign goods after the first rush consequent upon the peace of 1815. The combined effect of all these causes was to reduce our imports, lessen our re-exports, increase our domestic exports, keep the balance of trade very nearly even, and induce a period of unusually quiet, even trade, whose proportions were rather less than those of the period preceding the embargo of 1808. This latter fact can be perceived from a comparison of the following figures with the preceding table: Average exports of domestic produce for each of the years 1821–30, $53,610,502; average foreign, $22,964,383; total average export per year, $76,574,885; average import, $79,863,340.

A notable feature of the commerce of the era of which we are now speaking was the endeavor of Great Britain to control it by more peaceful means, but not less certainly than before, by making her ports the great point of exchange between the United States and such other countries as traded with her. This was largely effected by the "warehouse system."

Warehouse system.

"Inducements were held out," says Kettell, "by facilities of entry, and advances on merchandise, to attract thither the produce of all nations; because, under such circumstances, not only did 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 of them would glut them. To make a profitable voyage, therefore, a 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 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 around 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 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-Kong 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 funds already provided through the United-States Bank by sales of American produce. This centralization of trade in England, however, became inconvenient. The American ships that now began to carry cotton, tobacco, rice, and some breadstuff, 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, *viâ* 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 out cotton 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."

Panic of 1837; causes of it.

We now approach an important event in the financial and industrial history of this country; namely, the panic of 1837. It is not within the scope of our present purpose to show all its causes and effects, but merely its relations to our foreign commerce. Suffice it, therefore, to say, that the era of land speculation from 1830 to 1837 undermined the spirit of industry, and lessened our production. In agricultural circles, cotton was almost the only commodity that continued to increase in yield and export; and this it did steadily and rapidly. As for food, not only did our exports fall away to almost nothing, but in 1836 we were reduced to the shameful necessity of *importing* wheat from Russia. In 1831 the high tariff on imported manufactured goods was greatly reduced. It was then discovered, that, in the movement of capital after the war of 1812–15, more was invested in domestic manufactures than was wise. There was over-production, and pernicious competition even at home. The reduction of the tariff let in a flood of foreign goods at lower prices, and still further paralyzed the manufacturing industry; so that this class of our exports fell off. By consulting the table which we shall give a few pages hence, the reader will see how abnormal was the excess of imports over our exports during the decade 1831–40. In the year 1836 alone this excess amounted to upwards of $61,000,000, which was twice the balance of trade against us during the whole ten years prior to 1830. As a further indication of the demoralized condition of business, it may be remarked, that the increase in imports was chiefly in articles of luxury, — silks, wines, &c.; yet in the mean time we were doing less remunerative labor to pay for such things than usual. Thus, while the imports of silk rose from less than $6,000,000 in 1831 to $23,000,000 in 1836, and silks, wines, spirits, and sugar, from $13,550,000 to $41,850,000 in the same period, the export of flour and other provisions fell from $28,000,000 to barely more than $14,000,000. At this period our credit was remarkably good in London; and not only was merchandise sent here on credit, but capital was loaned to start banks in the West wherewith to promote land speculation. The crops were good in England, money was plenty, and capitalists felt liberal; besides, the large fire in New York in 1835 — which destroyed $18,000,000 worth of goods, and created a special demand from abroad to that extent — was regarded as a piece of good fortune for the British merchant, rather than otherwise. One cause that operated to blind our eyes to the coming collapse was the over-estimate of the value of our exports. The course of business at that time required shipments of American produce, mostly cotton, to firms abroad, who made advances on the consignment at a certain ratio less than the faces of the invoice. The produce afterwards sold for the account of the owner, and not infrequently did not bring the amount of the advances. Thus, if cotton were shipped at sixteen cents a pound, and twelve cents were advanced, the amount realized might be only eleven cents. Hence the real exports of the country were not always measured by the export value.

The grand crash came in 1837. Like all such crises in this and other countries, it took even the business-men two or three years to fully understand how it came about, and the people even longer. At length it was realized that while speculation in land or any thing else, ample credits from home and foreign capitalists, and plenty of banks-bills based upon credit, gave a temporary and artificial prosperity to a nation, the only basis of real wealth was labor in the production of something to sell, and enough of it not only to supply our own consumption, but also to send abroad to pay for what we bought there. Accordingly, personal and mercantile credits came to an end, individuals and merchants stopped running in debt, and the country applied itself to productive industry. The effect is clearly discerned in the statistics given in our next table. Our imports for the decade ending 1850 were slightly less than for the previous ten years, and our exports vastly more; and the balance of trade against us was cut down from $260,753,154 to $7,219,199 for the two periods. In the years 1813, 1821, 1825, and 1827, owing in some cases to abnormal influences, our exports had exceeded our imports, but only to a slight extent. In 1825 the excess was a little over $3,000,000, which was more than in any of the other years here named. But in 1840 the country had so well mastered the teachings of the recent panic and hard times, that our exports exceeded our imports by $25,000,000. We could not keep up this advantage, however. Thrice during the next decade did our exports exceed our imports: in 1842 the difference was $4,589,447, in 1844 it was $2,765,011, and in 1847 it was $12,102,984. Yet in the other years we ran behind enough to wipe this all out, and remain $7,219,199 in debt to Europe; which, however, as we have already remarked, was a vast reduction compared with the previous ten years.

Causes not understood.

A force which tended to equalize trade at this time was the Irish famine of 1846. In 1842 the British Government removed the prohibition upon importations of American cattle and provisions, and reduced the duties on corn, which were finally abolished in 1849. Under the influence of the former enactments the export of dairy products, bacon, barrelled pork and beef, and grain, began to grow. But, when the tremendous demand of 1846 came, a wonderful impetus was given to food production and export, and a development imparted to the agricultural interests of this country which

Irish famine of 1846.

has since steadily continued. Our exports rose from $106,000,000 in 1841 to $150,000,000 in 1848; and the gain was principally in food, which constituted one-half of the value of the exports of 1847. The Irish were led at this time to adopt corn instead of potatoes for the staple of their diet. From this and other like causes, American produce obtained a permanent foothold in the foreign market; and, although a slight subsidence in the trade ensued shortly, the growth soon increased, and then kept up steadily and rapidly to the present day, its dimensions rivalling those of our huge cotton export.

Importation of specie.

The heavy export of produce and its quick cash sales in 1847 brought us a specie import of $24,121,289, — a receipt never before paralleled in our history. This enlivened business wonderfully. But the French revolution next year, turning upon property-rights, depressed the home-market in France, and, by lowering prices, induced a heavy temporary export to this country, which soon absorbed our extra cash. This movement was facilitated by a reduction in our tariff in 1846. Inasmuch as business was then on a sound basis in this country, no harm was experienced in consequence.

Tariff of 1846.

Export of bullion.

The next remarkable feature of American commerce was the heavy export of gold bullion resulting from the discovery of mineral wealth in California. Our cotton and food exports had already risen into prominence. As yet, petroleum was comparatively unknown; and American manufactures, while steadily growing in proportions[1] and gaining a better place in our own markets, were advancing but slowly in competition with those of England in the other emporiums of the world. In 1848 gold was found near Capt. Sutter's fort in California. Although the influx of adventurers quickly attained large dimensions, the product of the precious metal did not amount to much until 1850, when it was about $9,000,000. This steadily increased, and our total export of bullion for the following decade was $507,000,000. The gold *furore* here and in Australia stimulated the transportation to both regions of immense quantities of food, clothing, machinery, and other commodities, thus stimulating both our import and export trade; the former, however, more than the latter. In 1847, for the eighth time in our history, our exports exceeded our imports. This was the case again in 1851. But the heavy importation of goods for the California trade, and the slight relaxation of industry for purposes of gold-seeking and land speculation, turned the balance heavily against us for the next three years; and though the scales turned again in our favor during the next five years, yet the whole decade left us indebted to the Old World nearly $11,000,000.[2]

[1] The total value of our manufactures caught up with that of agricultural production, and passed it forever in the race shortly before 1850.

[2] Only thrice since 1854 has the balance of trade been against this country. It is noteworthy, that whereas, prior to 1850, the balance of British trade was in favor of that kingdom, it has since been increasingly the other way. The imports and exports of France are almost identical.

It is unnecessary to point out here the causes of the panic of 1857, or to show its general resemblance to the one twenty years before. It is enough to say here that it was preceded by heavy foreign credits, and by the extensive investment of foreign capital in the railroads of the Mississippi and Ohio Valleys, which were called for by the sudden agricultural development of that region, and to build which immense quantities of rails were imported from England. The general effect of that panic upon our commerce was to slightly diminish our exports, and largely lessen our imports, the following year; but that was about all. An attendant circumstance, if not one cause, of the panic of 1857, was the failure of the Louisiana sugar-crop, which caused us to import $55,000,000 worth of that commodity, or five times the amount imported in 1850.

Panic of 1857.

It will be seen by the following table, that while it took the country full ten years to learn the lessons of the panic of 1837, and to recover from the effects of it, the interval from 1850 to 1860 was one of remarkable prosperity. Our total trade with foreign lands during the decade immediately preceding our civil war was more than during the twenty years prior to 1851.

YEAR.	DOMESTIC EXPORTS.	FOREIGN EXPORTS.	TOTAL EXPORTS.	IMPORTS.	BALANCE OF TRADE.
1791–1800 .	$293,634,645	$191,344,293	$484,968,938	$591,845,454	$106,876,516
1801–10 . .	383,401,077	372,536,294	755,937,371	927,663,500	171,726,129
1811–20 . .	462,701,288	127,190,714	589,892,002	688,120,347	98,228,345
1821–30 . .	536,104,918	229,643,834	765,748,752	798,633,427	30,355,826
1831–40 . .	892,889,909	199,451,994	1,092,351,903	1,302,476,084	260,753,154
1841–50 . .	1,131,458,801	129,105,782	1,260,564,583	1,267,783,782	7,219,199
1851–60 . .	2,766,799,881	226,950,036	2,993,749,917	3,004,591,285	10,841,368

In estimating the influence of our civil war upon American commerce, it needs to be remembered that commerce and transportation are not identical. While it was unsafe to ship goods under the American flag while the rebel cruisers were afloat, there was no interference with such trade as was carried on in foreign bottoms. The rebel cruisers depredated upon our fishing-fleets, especially our whalers; but still greater damage was done to this latter branch of industry by the marvellous and sudden development of our petroleum product just before and during the war. We may attribute to the war, then, the diminution of our exports of fish and oil.

Effect of civil war upon commerce.

The real harm done to commerce by this internecine conflict was the lessening of actual production and the impairment of our credit. The former effect was most marked in the stoppage of cotton-culture, and consequently of cotton-exports. This is the principal explanation of the falling-off of domestic exports noticeable in the table which

Effect upon production and credit.

we shall shortly give. The capture of New Orleans opened up a small supply of the stored crop of 1860, which now began to find its way to market. The great bulk of the hidden cotton, though, was not obtained until 1865; and it figured in the exports of the following year. For four or five years after the war, cotton-culture recuperated slowly; but since 1870 it has figured as prominently among our exports as before the war. The impairment of credit, and consequent high prices, lessened importation; but, when the Rebellion was suppressed, confidence in the ability of American merchants to pay recovered, and importation increased. The total dimensions of our trade from 1861 to 1865 inclusive was much less than from 1856 to 1860 inclusive: but the balance of trade was even more in our favor during the war-period than during the corresponding interval before; so that the people of the country, in the capacity of private persons, more than paid Europe for what she sold us by their labor.

Two notable features of the war-period of our history were the sudden development of our petroleum-industry, and the discovery and production of the famous Comstock lode, each of which is treated at length in other departments of this book; but we mention them here to say that the two products formed a conspicuous part of our exports during the era of which we are now speaking. Gold had fallen off in production and export; and, shortly after the war, silver lessened gradually also. The petroleum-export, however, has steadily increased.

Development of petroleum-industry.

Two influences growing out of the war exerted a peculiarly stimulating effect on production, and so increased our trade immediately upon the termination of hostilities. One was the imposition of a heavy tariff on imports, which promoted manufacturing; and the other was the invention, manufacture, and extensive use of labor-saving machinery for both agricultural and manufacturing purposes. These facilities were needed to replace the men called off by the army and navy. When the survivors came back, the new facilities enabled the country to hugely augment its production in all departments of industry. The effect was to greatly increase our export of food of all kinds, slightly increase our export of manufactures, and lessen our importation of the latter.

War-tariff.

The panic of 1873 and consequent period of "hard times" were brought on by chiefly the same causes as induced the panics of 1837 and 1857. First, there was an immense over-production of manufactured goods; second, agricultural activity had led to the construction of new railroads, notably the Northern Pacific, which were not really needed; third, credits were vastly overstrained for personal luxury and indulgence, commercial extension, and speculation in oil-lands, mining-stocks, and railroad-building; fourth, an inflated paper currency had imparted false values to property, which now began to shrink. That usual prelude to a panic, a remarkable excess of imports over exports, was noticeable in 1872. In 1871 we exported

Panic of 1873.

$50,000,000 more than we imported: in 1872 we imported $68,000,000 more than we exported. So much for causes. The effect of the panic at home was to check manufacturing, lessen credits, reduce consumption by promoting personal and individual economy, lower prices, stay importation, and facilitate export. Hence, on the whole, our foreign commerce has been enlarged since the panic; but, as the surplusage of manufactured products has been worked off, the export trade has slightly diminished, and importation begun to revive. This and several other facts referred to in the last page or two will appear from the following table: —

YEAR.	DOMESTIC EXPORTS.	FOREIGN EXPORTS.	TOTAL EXPORTS.	IMPORTS.	BALANCE.
1860[1] . .	$373,189,274	$26,933,022	$400,122,296	$362,166,254	$37,956,042
1861 . .	228,699,486	20,645,427	249,344,913	286,598,135	37,253,222[2]
1862 . .	213,069,519	8,147,771	222,217,290	205,771,729	14,445,461
1863 . .	305,884,998	26,123,584	332,008,582	252,919,920	79,089,662
1864 . .	320,035,199	20,256,940	341,292,739	329,562,895	11,729,844
1865 . .	306,306,758	30,390,365	336,697,123	234,434,167	2,262,956
1866 . .	550,684,277	14,742,117	565,426,394	445,512,158	119,914,236
1867 . .	438,577,312	20,611,508	459,188,820	417,831,571	41,357,249
1868 . .	454,301,713	22,601,126	476,902,839	371,624,808	105,278,031
1869 . .	413,961,115	25,173,414	439,134,529	437,314,255	1,820,274
1870 . .	499,092,143	30,427,159	529,519,302	462,377,587	67,141,715
1871 . .	562,518,651	28,459,899	591,978,550	541,493,708	50,484,842
1872 . .	549,219,718	22,769,749	571,989,467	640,338,766	68,349,299[2]
1873 . .	649,132,563	28,149,511	677,282,074	663,617,147	13,664,927
1874 . .	693,039,054	23,780,338	716,819,392	595,861,248	120,958,144
1875 . .	559,237,638	22,432,724	581,690,362	553,906,153	27,784,209
1876[3] . .	685,545,352	23,311,538	708,856,890	461,818,499	247,038,391
1877[3] . .	671,632,366	23,618,923	695,251,289	504,013,000	191,238,289

The necessity for finding an outlet for our excessive stock of domestic manufactures has led to much enterprise in the way of reaching foreign markets formerly occupied almost exclusively by Europe. To India, China, and Brazil especially, within the past four years, extensive exportation of American goods has been effected. This is particularly the case with cotton-cloths; although, besides these, we have been able to stop the sale of other foreign articles in our own markets, and compete successfully in other parts of the world. Paper of all grades, from the finest stationery to the coarsest wrappings and pasteboard, now goes

Necessity of finding new outlets for trade.

[1] The figures here given for 1860 and the next sixteen years are for the fiscal years ending June 30, not the calendar years ending Dec. 31. The calendar year 1860 shows a balance of trade against us of thirty-four million five hundred thousand dollars, which here enters into the statement of the fiscal year 1861.

[2] Balance against us. The other balances here given are in our favor.

[3] Calendar, not fiscal year.

abroad. Agricultural implements go in vast quantities to Europe and elsewhere. This movement is still further aided by the efforts of the State Department at Washington, under President Hayes, to utilize the consular service in finding out what American commodities might find a better market in each quarter of the globe where our nation is represented. We can give this chapter no more fitting conclusion, perhaps, than the following analysis of our export trade for 1875, which appeared in "The New-York Times:"—

Value of exports.

The value of our foreign exports can be expressed by nine figures; but the character of that branch of our commerce,—the articles, quantities, and values embraced,—and its world-wide diffusiveness, cannot fail to interest and instruct those not in the habit of making their own generalizations from confusing statistical tables. The entire value of merchandise exported from the United States during the last fiscal year, computed in national currency, was $693,039,054. The gold valuation of the same was $652,913,445; which is greater than the valuation of our foreign imports for the same period by over $57,000,000, and the balance of trade is consequently in our favor by that amount. Many of the articles enumerated in the list of exports which are grown or manufactured in the United States are also found in the list of articles imported from abroad. The simple statement of this fact should suffice to show the folly of Americans sending their money abroad for articles which may be purchased at much lower prices, and of equally good quality, at our own manufactories.

Quantity shipped to various countries.

As the United States furnish the principal market for the sale of British merchandise, so Great Britain and her dependencies offer the principal markets for our exported productions. We sent to the markets of that nation during the last fiscal year merchandise to the value of $440,945,870; which is nearly two-thirds of the entire value of all our exports for that period. Of that amount there was shipped direct to England $308,876,292, and to Ireland and Scotland $64,690,216. The value of merchandise received last year from Great Britain was $255,180,597 gold. Next to Great Britain, Germany is our best customer, $64,344,622 being our receipts for her purchases. To France and her dependencies we shipped $50,485,045 worth of merchandise, of which France received directly over $50,000,000 worth. Spain and her colonies paid us $33,505,549, of which there was from the mother-country $11,643,715, and from Cuba $19,597,981. To Belgium we sent merchandise valued at $20,197,515; to the Netherlands, $15,156,309; Russia, $10,284,803; Italy, $8,378,666; Turkey, $2,549,493; Denmark, $2,430,791; Norway and Sweden, $2,385,088; China, $1,629,165; Japan, $1,808,107; Brazil, $7,562,852; United States of Colombia, $5,123,845; Mexico, $4,073,679; Hayti, $4,265,686; Chili, $2,730,617; Peru, $2,518,494; Argentine Republic, $2,478,513; Venezuela, $2,334,139. The countries named are the largest markets for the sale and consumption of our productions. The countries which purchased least from us are Greece, $32,668; Liberia, $123,463; San Domingo, $514,633; and the Sandwich Islands, $623,280.

Shipments of cotton.

If cotton is no longer called king, it is still the largest and most valuable article of export, and brought to this country last year $211,223,580. In exchange for that large sum of money we exported 2,903,075 bales, or 1,358,602,303 pounds. Of that quantity England alone received over 875,000,000 pounds, and paid us $136,952,187. From France we received for the same staple $27,187,222; from Germany, $17,250,000; Russia, $8,479,481; Spain, $8,266,178; Ireland, $3,855,303; the Netherlands, $2,779,265; Italy, $1,974,114. In cotton-fabrics we exported 17,872,-322 yards, valued at $2,350,000. It will surprise many readers to learn that England received of those fabrics 1,145,786 yards, valued at $132,857. Brazil, however, bought most of our exported cotton-fabrics, the yards numbering 2,236,950, of which the value was $291,674. France, which taxes us so heavily for fabrics of her own manufacture, bought only $8,000 of our cotton-fabrics; while Germany patronized us in that line of goods to the value of $46,000.

Cotton-fabrics.

The Chinese consumed of our cotton-fabrics 1,749,440 yards, paying us $204,354; which is a sum equal to twice the amount we paid China for fire-crackers. Chili took 1,680,960 yards, and sent us, to pay for them, $210,970; while Mexico bought 1,363,915 yards for $158,-366. The remainder of that class of fabrics went to Asiatic and South-American countries, the British East Indies receiving nearly $75,000 worth. The other exported articles manufactured from cotton, and not enumerated above, are valued at $745,850. Our total receipts for exported raw cotton and manufactures of cotton foot up $215,089,081. Our imported manufactures of cotton for the year were valued at less than $25,000,000.

The starving millions fed. Breadstuffs.

Breadstuffs are next to cotton in valuation of exports, amounting to $161,-198,864. These were consigned to nearly every nation on the globe, the only European countries not receiving them being Austria, Denmark, Greece, Norway and Sweden, and Turkey. Of wheat we exported 71,039,928 bushels, valued at $101,421,459; wheat-flour, 4,094,-094 barrels, valued at $29,258,094; Indian-corn, 34,434,606 bushels, valued at $24,769,951. England receives most of our breadstuffs. 43,128,552 bushels of wheat, 1,307,286 barrels of wheat-flour, and 10,299,483 bushels of Indian-corn, went to her markets last year. Scotland received 3,903,630 bushels of wheat, 353,495 barrels flour, and 2,235,026 bushels corn; while Ireland received 17,609,837 bushels wheat, 43,203 barrels flour, and 13,764,-814 bushels corn, which was more than one-third of the entire quantity of corn exported during the year. France took 2,223,366 bushels wheat, 7,260 barrels flour, and 452,951 bushels corn; and Germany bought 886,485 bushels wheat, 21,960 barrels flour, and 825,620 bushels corn.

France bought three times as much flour as Germany; while Germany bought three times as much wheat as France, and twice as much corn. In the same time Ireland consumed six times as much of our wheat as both France and Germany, thirteen times as much corn as both these countries, six times as much flour as France, and twice as much as Germany. Belgium received 3,709,694 bushels wheat, 72,401 barrels flour, and 84,798 bushels corn; Netherlands, 3,160,435 bushels wheat, 26,389 barrels flour, and 51,718 bushels corn. Of barley we exported 320,399 bushels, valued at $210,738; oats, 812,873 bushels, valued at $383,762; rye, 1,564,484 bushels, valued at $1,568,362. Of Indian-corn meal we shipped 387,807 barrels, worth $1,529,399; and rye-flour, 59,820 barrels, worth $388,313. We also exported 11,142,429 pounds of bread and biscuit, worth $676,197, the greater part of which is consumed in the British West Indies. Belgium and Germany consumed about two-thirds of the rye exported, and Cuba more than one-half of the rye-flour. Canada and the West Indies bought most of the Indian-corn meal; while the British West-India islands, Honduras, and Guiana consumed over seven of the eleven million pounds of bread and biscuit exported. Peru received 135,193 bushels of barley, being over one-third of the entire quantity exported; England took over 79,000 bushels; and 24,752 bushels went to British Australasia. One half of all the oats exported went to Canada; the other half going to the West Indies, Central and South America, and Eastern Asia.

Bacon, beef, and other provisions.

The value of provisions other than breadstuffs exported was $78,317,087. Bacon and hams, beef, butter, cheese, eggs, lard, pork, fish, and vegetables are embraced under this head, and were distributed over the whole world. Bacon and ham lead the list; 347,405,405 being the number of pounds, and $33,383,908 the valuation. The beef was valued at $2,956,676, and the 4,367,983 pounds of butter at $1,092,381; which is just $100,000 more than enough to pay for the sardines we imported from Europe last year. We distributed abroad 90,611,077 pounds of cheese, which brought us $11,898,995. It may be stated here, by way of comparison, that we paid last year for butter and cheese imported $1,354,495 gold. England is the largest consumer of our cheese, nearly 70,000,000 pounds having been the amount sent her. Germany bought over 10,000,000 pounds, and Scotland nearly 9,000,000. China and Japan each took about 29,000 pounds, and 14,000 pounds went to the Sandwich Islands. The West Indies consumed the greater portion of the remainder. Germany bought from us 64,436,920 pounds of lard; England, 33,581,107 pounds; Belgium, 28,174,335 pounds; Cuba, 22,186,472 pounds; France, 9,937,387 pounds; Scotland, 9,429,771 pounds. The entire quantity of lard exported was 205,527,471 pounds, valued at $19,308,019. Ireland, Russia, and Turkey are the only European countries which did not purchase lard from the United States. Of pork we exported 70,482,379 pounds, worth $5,808,712. About one-third of the pork went to Europe. Of the West-India islands, Hayti bought 10,976,705 pounds, and Porto Rico 2,476,262 pounds. For onions exported we received $52,000, and for potatoes $471,332.

For green and dried fruits we received $994,163. The dried apples exported weighed 4,234,736 pounds, the valuation being $294,893. Of this article Germany bought 2,811,915 pounds, or more than half of all that was exported; the Netherlands bought 489,612 pounds; Australia, 226,332; England, 209,389; France, 59,358; Japan, 21,644; China, 2,371. Of green apples we sent abroad 123,533 barrels, worth $204,-312. Of these England received 36,814 barrels; Scotland, 27,085; Germany, 2,427; Sandwich Islands, 2,109; Liberia, 1,286; Australia, 300; Russia, 29; Mexico, 6,547; and Cuba, 4,729. For fruit other than apples we received $211,308, and for canned fruits $283,649.

Dried and green fruits.

For iron, and manufactures of iron, we received $9,578,694, and for steel $4,119,344. Machinery was shipped to almost every nation in the world; bringing us, in return, $3,357,909. For our machinery Germany paid $908,883; England, $197,134; Scotland, $84,724; France, $17,773; Belgium, $28,532; Japan, $99,295; China, $7,228; British East Indies, $2,079; Cuba, $559,679; Mexico, $383,006; Peru, $229,564; Canada, $270,000; United States of Colombia, $208,669. We sent abroad seventy-nine locomotives, valued at $1,147,366. Of these Russia took fourteen; Cuba, twelve; Chili, nineteen; Brazil, thirteen; Canada, nine; Argentine Republic, four; Mexico and the Central-American States, each three; and Peru, two. For the forty-eight stationary steam-engines exported were paid us $74,749: all these, except one sent to Liberia, were purchased by neighboring American countries. American stoves to the value of $102,398 were pretty well distributed among foreign nations, England even purchasing to the extent of $1,000. Of manufactures of steel we sold abroad edge-tools to the value of $941,016; cutlery, $47,162; files and saws, $21,496; muskets, pistols, and rifles, $2,340,138; other manufactures of steel, $225,457. Most of our cutlery went to Canada and to countries south of the United States. England took $906 worth; France, $510; Germany, $483. For edge-tools Germany paid us $34,836; England, $19,425; France bought none. Our best market for edge-tools was the United States of Colombia, where we sold $324,121. Australia bought from us to the value of $122,945; Mexico, $113,-697; Canada, $97,171; Brazil, $75,292. Australia sent us for files and saws $4,852; Mexico, $2,812; Cuba, $2,547; Canada, $6,667; England, $703. For fire-arms England paid us $774,598; Germany, $288,719; France, $1,750; Turkey, $169,960; Cuba, $496,426; Argentine Republic, $239,192; Mexico. $113,846.

Iron, steel, machinery, and tools.

The total value of agricultural implements sent abroad was $3,089,753. These are classified as follows: Sixty-three fanning-mills, valued at $2,645; horse-powers, fifty-nine, valued at $30,685; mowers and reapers, 16,139, valued at $1,797,130; ploughs and cultivators, 17,639, valued at $236,203; other implements valued at $1,023,090. All the fanning-mills went to Canada; Chili bought all the horse-powers except one, which

Agricultural implements.

was sent to Scotland; Germany purchased 9,613 mowers and reapers, more than one-half of all exported, for which she paid $1,167,323; England bought 3,838; France, 1,030; Sweden and Norway, 462; Russia, 187; Chili, 171; Scotland, 146; Argentine Republic, 292; Canada, 293; Netherlands, 52; Australia, 12: the rest were scattered over the West Indies and South America. More than one-half of all the ploughs and cultivators exported went to the British possessions in Africa, the exact number being 10,504: Chili took 2,423; Argentine Republic, 1,938; Peru, 593; Uruguay, 697; Brazil, 237; Mexico, 132; Cuba, 274. Only eighty-five were sent to Europe, of which England received eighty-three, and France two. The Sandwich Islands bought thirteen; Australia, sixty-two; Japan, two. The miscellaneous implements were pretty widely distributed. About $300,000 worth went to Europe, and the rest to the West Indies, and to Central and South America.

American books.

We exported last year books to the value of $584,950. The records of the exports show that readers of American books are to be found in all parts of the world. For books we received from England $95,688; and from Canada, who was our largest purchaser of books, $138,189. Germany paid for our books $26,515; France, $7,515; Brazil, $82,222; the United States of Colombia, $77,809; Japan, $32,664; the Argentine Republic, $23,821; Cuba, $23,779; Mexico, $16,207; Australia, $14,268; China, $8,758: Sandwich Islands, $4,627. Other countries purchased in amounts ranging from $100 up to the lowest sum specified above.

Unclassified articles.

The coal exported reached 763,402 tons, valued at $3,823,750; all of which, except about 2,000 tons, went to American countries. For clocks we received $1,070,822; England contributing of that amount $533,600; Germany, $103,688; Japan, $61,485; China, $12,461. Nearly $10,000 worth of American watches were also sent abroad to record the passage of time. For carriages and carts we received $578,433, most of the trade being with American countries. Germany, however, purchased American carriages to the value of $22,924; and England, $12,840. We sent billiard-tables around the globe, and received, in return therefor, $59,378; of which sum the United States of Colombia contributed $24,930. For brooms and brushes we received from nearly all the countries in the world $127,593; and for shoe-blacking, over $76,000. For cables and cordage, rope and twine, we received $1,379,462; and for hides and skins other than fur, $2,560,382. Hoop-skirts are going out of fashion, and last year we sold abroad only $15,302 worth. For combs we received $7,535: on the contrary, we sent to foreign countries $409,029 for combs during the same period. Whether we should have exported more combs, had we imported less, is referred to American comb-makers for discussion. For oils of all kinds, including the products of our oil-wells, we received $41,121,707. For naval stores we were paid $7,384,570. Tobacco brought us $32,968,528, — a sum about equal to what we paid for our imported silk-goods. Tobacco was chiefly exported in the leaf; and the number of pounds was 318,097,804, and the value $30,399,181. Over 100,000,000 pounds of leaf-tobacco went to Germany, and about 63,000,000 to Great Britain. We received for distilled spirits $1,164,616; and for beer, ale, and porter, $39,602. During the same period we paid foreigners for malt liquors over $2,500,000. For 7,435,064 pounds of starch we received $420,809. The living animals exported yielded $3,310,388. They were,—hogs, 158,581, valued at $1,625,837; horned cattle, 56,067, valued at $1,150,857; sheep, 124,248, valued at $159,735; horses, 1,432, valued at $169,303; mules, 1,252, valued at $174,125; all other cattle exported, together with fowls, were valued at $30,531. Little more than one-fifth of the entire value of exports was carried in American vessels, the record standing thus: Exported in American vessels, $165,998,880; exported in foreign vessels, $521,394,909.

BOOK VI.

TRADE-UNIONS AND EIGHT-HOUR MOVEMENT.

CHAPTER I.

TRADE-UNIONS.

NO one will deny the vast importance to which trade-unions have attained, unless he belongs to that class of persons who fail to see the truth because they do not wish to see it. Moreover, the influence they wield over their members is enormous, and a marvel too, because obedience is so general, while being purely voluntary. It is true, that, in submitting freely to organized rule, it is believed they are really promoting their own personal advantage; yet this does not always appear; and when the interest is unseen, or thought to be opposed to the interest of the individual, his temptation to disobey is great. Such discipline, therefore, as trade-unions often exhibit, must excite admiration, however bitterly they may be condemned.

Importance of trade-unions.

Trade-unions have their origin in the rise of factories. So long as workmen were isolated in their tasks, and could not meet in large numbers, no organization existed among them; and the dominion of the employer over his men was complete. But times have changed. Great factories have arisen, employing thousands. When they daily assemble under the same roof, tend the same machine, and work at the same table, is it not natural, nay, reasonable, to confer and act together upon questions in which all are mutually interested? Besides, manufacturing cities have sprung up, busily engaged in producing the same commodities, thus augmenting the mutual personal interest. Sheffield, Manchester, Lyons, Verviers, Lowell, Pittsburgh, Fall River, are names of great cities, in each of which nearly all their capital and skill are united in a single industry.

Origin of trade-unions.

Railways and other facilities of easy communication also lend their aid in forming these unions, by bringing workmen together, and enabling them to render fraternal assistance. A recent writer upon the condition of the operatives in the factories of Wurtemberg remarks, that, if its scattered industry had been a source of much inconvenience and some pecuniary detriment to the manufacturers, combinations among workmen have been rendered difficult, if not impossible. "The oper-

Effect of easy modes of communication.

atives of isolated spinning-factories scattered along the banks of woodland streams or collected together in smaller numbers in the neighborhood of rural towns, or weavers who worked dispersed in their own domiciles, and only came into casual contact with one another on their way to and from their common employer, — these men had little occasion for or incentive to hostile combination." But this state of things has passed away in that country, as in almost every other, by creating the railway, the factory, and the manufacturing city.

Discontent between employed and employer.

While stating this as the immediate or superficial origin of trade-unions, the deeper one, as experience is daily rendering clearer, is the discontent existing between workmen and their employers respecting the division of profits. In the language of Mr. Hewitt, an iron-manufacturer, whose testimony before the Trade-Unions Commission of Great Britain evinced wide observation coupled with the deepest insight into the subject, "Trade-unions are a symptom of the re-adjustment of the relation of capital and labor."

Unions contain intelligent men.

Nor can it be said these unions contain only workmen of inferior skill and intelligence. The proportion between the skilled and unskilled varies, doubtless, in different trades and at different times. "It is probable, that, in many trades, some of the best and most educated men stand aloof. It has not, however, been suggested by any one that the union is ever composed of the inferior order of workmen, though it may not invariably be composed of the superior. In some trades, and those requiring the greatest skill, it seems to be admitted that the union contains the great bulk of the most skilled men, as the engineers, the iron-founders, the painters, glass-makers, printers, ship-builders, and others." [1]

Right to form these associations.

Respecting the right to form these associations, it is just as evident that laborers have the right to combine in order to get their dues as masters have to resist an advance of wages. As long ago as when Adam Smith wrote, he said that "masters are always and everywhere in a sort of tacit but constant and uniform combination not to raise the wages of labor above their actual rate. To violate this combination is everywhere a most unpopular action, and a sort of reproach to a master among his neighbors and equals." This is rather too highly colored to represent the truth in the United States; yet the statement is partially true even in respect to employers in this country.

Reasons for combining.

The reason for combining is to form a reserve-fund, by means of which workmen seek to put themselves upon an equal plane with the capitalist in bargaining for wages. The latter, having such a fund, occupies a vantage-ground in respect to the workman; for the capitalist is a combination himself. Workmen, in combining, seek only to get what capitalists already possess; namely, a reserve-force, so that they can bargain for

[1] Messrs. Hughes and Harrison, Dissenting Report, p. 33.

their labor upon favorable terms. It seems impossible to frame an argument for preventing the sons of toil from doing this, unless the old-fashioned and exploded idea be maintained, that workmen are bondmen to the capitalists, who, consequently, have the sole right to determine the rewards of labor. In France, where the notion still lingers, we hear now and then of efforts to regulate the price of labor by law, but in no other country. Freedom to labor is as universally recognized as any other right. All have their choice to work separately, or unite and form a partnership or other organization, if they like.

It was a long period before workmen in England were permitted to form these societies, so strongly intrenched were capitalists in the legislation of the realm. In 1799 the following act of Parliament showed the willingness of that body to legislate against the combination of workmen: "Contracts entered into for obtaining an advance of wages, for altering the usual time for working, or for decreasing the quantity of work (excepting such contract be made between a master and his journeyman), or preventing any person employing whomsoever he may think proper in his trade, or for controlling the conduct, or any way affecting any person or persons carrying on any manufacture or business in the conduct or management thereof, shall be declared illegal, null, and void."

Early laws relating to the subject.

This statute illustrates how workmen were regarded in that day. Not until 1827 did Parliament repeal all statutes prohibiting workmen from combining. Until then, employers and Parliament had taken it for granted they alone could regulate wages.

In France the law permitting workmen to combine was not decreed until 1864. Prior to that period the "Penal Code" contained the most rigorous stipulations against combinations of workmen. They were characterized as misdemeanors, and the promoters of them were punished with from two to five years' imprisonment. It is fair to state that the combination of employers for the purpose of unjustly depressing wages was also declared to be illegal, though the punishment inflicted was less severe.

In the several states constituting the German Empire various laws were in force relating to the rights of workmen until 1867, when a new enactment went into operation throughout the empire, declaring that "all prohibitions and penal provisions directed against persons engaged in industry, trade, assistants, journeymen, or factory-operatives, on the ground of their co-operating and uniting for the purpose of obtaining more favorable wages and conditions of labor, more especially by means of strikes or discharge of workmen, are repealed;" thus guaranteeing to the industrial classes the right to form trade-union associations.

In the United States workmen have no just reason to complain; for they have always stood upon the same footing with capitalists, and have enjoyed the unquestioned right to form trade-union societies. It is true, in colonial times, the price of labor was sometimes regulated by law; but so were the prices of every thing which were exchanged. Labor was never singled out as the only thing requiring State regulation. The rights of the laborer have been as jealously guarded as the rights of those for whom he has toiled. Not until very recently has the old doctrine been revived, that the State has a right to control the price of labor. Gov. Brown of Georgia, in an annual message to the legislature of that State, did remark that "labor must be controlled by law." There is no occasion for fearing the re-establishment of this doctrine on republican soil. Liberty to contract for labor is a right too deeply grounded to be crushed out by the action of Gov. Brown, or by any one else holding a similar opinion.

All this by way of clearing the field for inquiring into the purpose of trade-unions and the soundness of their methods.

Object of trade-unions.

Their purpose is twofold: first, that of an ordinary friendly or benefit society, — namely, to afford relief to the members of the union when incapacitated from work by accident or sickness, to provide a sum for the funeral-expenses of members and their wives, and sometimes to grant superannuation allowances to members disabled by old age; second, that of a trade society, — namely, to watch over and promote the interests of the working-classes in the several trades, and especially to protect them against the undue advantage which the command of a large capital is supposed to give the employers of labor.

Many societies exist having only one object in view. Some are purely friendly societies: others are organizations for promoting the interests of members in their various trades, without any reference to their social welfare. For years, in all the countries of Europe, societies of the former description have flourished, while trade-unions are of recent creation. Thus we have seen that workmen in France were not permitted to combine in order to raise the rate of wages until 1867; but they have helped each other in an organized way during sickness and old age, and provided for burial, and done other humane acts, for a long period. And this applies as truly to many other countries as to France.

Arguments for and against uniting two purposes in trade-unions.

It has been found desirable generally to unite the two purposes; and in this form most trade-unions exist, especially in the United States. Considerable opposition to them as thus constituted has been manifested, because persons who are friendly to purely benefit organizations, and hostile to those organized for purposes of trade, oppose societies combining this double purpose. No enemies to friendly societies have appeared; for their purpose is a most noble one, and the good they have done is incalculable. The amount yearly distributed to sick members, and expended for burial and other like purposes, is an eloquent testimony to the character of these institutions; but, in uniting the two objects, trade-unions taint the sensibilities of some people, who are moved on this account to compass their destruction.

Much can be advanced in favor of and against this coupling of ends. Did they remain separate, friendly societies would have the sanction and support of all; for their usefulness none will dispute. Besides, they would grow in numbers, and swell their income. Thousands who would not join trade-unions aiming to affect the price of wages only would gladly join societies of a friendly nature. A great many workmen beyond the pale of unionism are likely to remain outside, who are desirous of joining their fellow-workers in alleviating distress, and, consequently, of laying the foundation for receiving aid in return. Moreover, benevolent men live everywhere who would willingly join friendly organizations, and contribute moral and financial assistance.

On the other hand, trade-unions are dignified and ennobled by superadding a friendly and humane purpose to that of a trade society. Though they inflict much evil, the enmity against them is somewhat softened when the good they do is remembered. But we cannot agree with Mr. Morrier, that the strength of the English system depends upon the two-edged purpose to which the funds of trade-unions may be applied. Doubtless they are stronger when created in this manner; but their vitality depends upon something more substantial than this.

Nor is any moral principle violated in bestowing this double function upon the society. Provided the members know what they are giving their money for, — whether sickness, burial, strikes, or any thing else, — there is no opportunity for practising fraud; and they probably do know, both by personal inquiry and by experience, how unions employ their funds. Mr. Morrier is hardly fair in saying they are raised for purposes of peace, but are applicable to the purposes of war. It is known before they are given for what purposes they may be used. No deception is necessary, nor is it practised, in raising funds for these societies.

Whenever a society unites both purposes, it is evident that a separation of funds for any particular object is quite impracticable. The cry is heard every now and then that a division of the resources for friendly and trade objects ought to be made. It comes from some one who either does not understand the nature of the organization, or is so keen as to see, that, by providing several funds, collision would oftener arise among the members respecting their appropriation, ending, perhaps, in disunion. This will appear clearly when the nature of the organization is more fully explained.

Manner of deriving and spending income.

Its income is derived from members, who pay a certain sum weekly, monthly, or annually, according to its rules. This sum, as remarked, is devoted to several purposes. One purpose is to provide something for sick members during their illness; another is termed an accident-benefit, which consists of a sum given to those who lose their tools; while a third is a burial-fund. Besides these, some of the richer unions have additional funds for reading-rooms, libraries, donations, and charitable subscriptions.

The benefits conferred often extend much farther. One of the most frequent and costly objects of donation is to members out of work. This is occasionally so large as to maintain all the workmen of a trade during a period of disaster. During the year 1867 the engineers of Great Britain spent almost three hundred thousand dollars in this manner, and the iron-founders nearly two-thirds of that sum. The great service thus rendered in keeping a large number of working-men and their families from the cold field of pauperism no one will question.

First trade-union in United States.

The earliest germ of a trade-union in the United States appeared in Philadelphia soon after the beginning of this century. In 1806 a remarkable trial arose from the efforts of several members of such an association to prevent, by violent and unlawful methods, others from working. Eight persons were indicted; and in the indictment they were charged for not being content to work at the usual prices, but for contriving to increase and augment them, and endeavoring to prevent, by threats, menaces, and other unlawful means, other artificers from working at the usual rate, and uniting into a club or combination to make and ordain unlawful and arbitrary rules to govern those engaged in their trade, and unjustly exact great sums of money by means thereof. Eminent counsel were engaged on both sides. The account of the trial here given is taken from "Lippincott's Magazine,"[1] which says that the evidence showed in the clearest manner that a system of frightful thraldom had been put in force. A witness named Harrison stated, that, when he reached the United States in 1794, he found this system of terrorism prevalent. He went to work for a Mr. Bedford, and presently got a hint, that, if he did not join the association of journeymen shoemakers, he was liable to be "scabbed;" which meant that men would not work in the same shop nor board or lodge in the same house with him, nor would they work for the same employer. The case of this man seemed exceptionally hard. He made shoes exclusively; and, when "a turn-out came to raise the wages on boots," he remonstrated, pleading that shoes did not enter into the question, and urging that he had a sick wife and a large family. But it was all to no purpose. He then resolved that he would turn a "scab," unknown to the association, and continue his work. But, having a neighbor whom it was impossible for him to deceive, he went to him, and said that he knew his circumstances, and that his family must perish, or go to "the bettering-house," unless he continued to work. This neighbor, Swain, replied that he knew his condition was desperate, but that a man had better make any sacrifice than turn a "scab" at that time. He presently informed against him, and Mr. Bedford (his employer) was warned that he must discharge his "scabs." He refused, saying, that, "let the consequence be what it might, we should sink or swim together." However, one Saturday night, when all but Harrison and a man named Logan had left him, Bedford's resolution gave way; and he exclaimed,

[1] March number, 1876.

"I don't know what the devil I am to do! They will ruin me in the end. I wish you would go to the body and pay a fine, if not very large, in order to set the shop free once more." The fine offered was refused, and Mr. Bedford's shop remained "under scab" for a year. Still Mr. Bedford, who must have been a very plucky fellow, would not give Harrison up, but removed in 1802 to Trenton. Harrison stated, that although he could not, had Mr. Bedford given him up, have got work anywhere else, and that he might have ground him down to any terms, yet he (Bedford) very nobly always gave him full price. At length, by paying a fine, Harrison became reconciled to his persecutors, and Bedford's shop was once more free.

William Forgrave said that "the name of a 'scab' is very dangerous: men of this description have been hurt when out at night." He had been threatened, and joined the association from fear of personal injury. A vast deal more of evidence was given, and eloquent speeches delivered by counsel; but the foregoing gives the sum and substance of the case.

In the course of the summing-up, Recorder Levy said, "To make an artificial regulation is not to regard the excellence of the work or quality of the material, but to fix a positive and arbitrary price, governed by no standard, but dependent on the will of the few who are interested. . . . What, then, is the operation of this kind of conduct upon the commerce of the city? It exposes it to inconveniences, if not to ruin: therefore it is against the public welfare. How does it operate upon the defendants? We see that those who are in indigent circumstances, and who have families to maintain, have declared here on oath that it was impossible for them to hold out. They were interdicted from all employment in future if they did not continue to persevere in the measures taken by the journeymen shoemakers. Does not such a regulation tend to involve necessitous men in the commission of crimes? If they are prevented working for six weeks, it might lead them to procure support for their wives and children by burglary, larceny, or highway robbery."

The jury found the defendants "guilty of a combination to raise their wages;" and the court sentenced them to pay a fine of eight dollars each, with costs of suit, and to stand committed till paid.

Later history of trade-unions in United States.

After this early attempt at unionism, nothing more was heard of any similar experiment for fifty years; though this long period of repose was not due probably so much to the result of this early venture as to other conditions. There was no need of creating trade-unions, inasmuch as every person found instant employment at favorable prices. Across the ocean the condition of the working-man was very different, and he sought to combine with his fellows at a much earlier period in order to secure higher wages and other advantages. Unionism in this country attracted no attention until after 1860, when its presence and power were first felt in the mining regions. Workmen there sought to obtain higher wages; and, in order to succeed in this end, they formed themselves into unions, believing that they would be more likely to achieve success than if they dealt with their masters single-handed. As wages rapidly advanced, the miners naturally ascribed the result to the power of unionism; and forthwith other unions were formed of men engaged in a great variety of pursuits. Generally speaking, wages were advanced in every trade; and the members of these associations were swift to conclude, that, as the wages of miners had rapidly risen, it was due to the resistless power of their associations. They never stopped to think that the pay of thousands of men who were not members of any sort of a union was also increased; that the wages of household servants went up to a high figure, although no combination existed among them for this purpose. The day-laborers—whether employed on the farm, or engaged in working upon the streets, or working here and there as they could find employment—all reaped higher rewards for their toil, although combinations amongst them were never dreamed of, and were indeed impossible.

Whether we are right in our deductions or not, trade-unions rose as by magic, and spread themselves over every part of the country. In the larger cities, like New York, Philadelphia, Boston, and Chicago, they made their power most potently felt, and held numerous meetings, at which their principles and beliefs generally received an enthusiastic airing. Communism found many an advocate among them; and, next to their belief in unionism in general, this doctrine has struck the deepest root in the mind of the average working-man. It is not indigenous, but purely a foreign importation: yet the plant has been carefully nursed; and, however unwelcome it may be to many, communism has here found a fruitful soil.

Rapid growth.

Besides holding meetings, public as well as private, and discussing their situation, and, to some extent, their principles and beliefs, it cannot be said that unionism accomplished very much in the way of securing higher wages during the first stage of its existence, if the advance in wages to which we have referred were due to other causes than combinations among workmen. It is fair to say, however, that workmen themselves ascribed the rise of wages which occurred about the time of the formation of their unions, or soon after, to their existence. These two facts, however, none will deny,—that many unions were formed between 1860 and 1865; and, during that period, wages rapidly rose. This created the impression among the working-men that their unions were the cause of their success; and they were led to embark in a new experiment, a brief history of which we will lay before the reader in the next chapter.

Success of trade-unions.

CHAPTER II.

EIGHT-HOUR MOVEMENT.

IT was about 1867 when the agitation began among the working-classes for the enactment of laws prescribing eight hours as a legal day of labor. Their reason for this law was, that more time was needed for culture and pleasure than they enjoyed under the former arrangement; and the request to them seemed not only reasonable, but they manifested considerable surprise if any one differed from them. On the other hand, many regarded the measure of no importance from any point of view, as no one thought of making the law compulsory, so as to prevent the making of contracts for a longer or shorter period of service. The chief opponents to the measure were those who feared the working-men would demand ten hours' pay for eight hours' work; and that, if a reduction in pay were made corresponding with the reduction in service, strikes and other untoward difficulties would occur.

Object of the law.

The law was enacted in most of the States and by the Federal Government, and the effect thereof soon began to appear. At first the Federal Government reduced the number of hours during which the workmen in its employ at the navy-yards and other places were engaged in conformity with the law, yet continued to pay them the old rates; which was a great victory for the laborers. But there was no uniformity about the matter. In some trades the day was reduced to eight hours, and a reduction of twenty per cent was made in their wages. Whenever this result was experienced from the working of the law, workmen were generally willing, nay, desirous, of returning to the former terms of employment. In some cases the men demanded a reduction of hours without a reduction of pay; and this demand resulted in strikes, the most important of which occurred at the works of Messrs. Brewster & Company of New York, the famous carriage-manufacturers. Four-fifths of the men struck, and remained idle two weeks, when work was resumed without any concession on the part of the employers.

Law everywhere evaded.

During the year 1872 the movement reached its height; and in all the large cities and important centres of industry there were frequent meetings among the working-men, at which the subjected was agitated, and strikes, and prosecutions for violating the law, were threatened. In most of such gatherings it appeared clearly enough that the chief aim of the friends of the law was to get the same pay for eight hours' work as for ten; which, of course, was an addition of twenty per cent to the cost of labor, — an advance which employers very generally were unwilling to pay. The clouds of the impending panic were beginning to form: some trades had already experienced a slackened demand, and this large advance was not regarded as warranted by the future prospects of business anywhere. In some cases employers were unwilling to have their laborers do less than ten hours' work per day, whatever might be the amount of wages paid them. Said a member of the firm of Steinway & Company, the famous piano-forte manufacturers, in reply to the question, "Would you agree to the eight-hour system, provided the men did not ask for ten hours' pay?" "No: we would not agree to any thing less than ten hours, whether they wanted eight hours' pay or not." Many other employers similarly situated, or who were unwilling to reduce their production, entertained a similar opinion. Thus opposition between employer and employed increased: the meetings of the latter class multiplied, at which the denunciation of employers became more frequent and violent. Everywhere strikes were threatened, and many actually broke out. In 1873 a panic swept over the land. Many factories, furnaces, and shops were closed, and thousands were thrown out of employment. The strife soon was to get work upon the best terms possible, and the cry for eight hours for a day's work ceased almost as suddenly as the cry was raised.

Movement at its height.

Collapse of movement.

CHAPTER III.

LATER HISTORY OF TRADE-UNIONS.

WE now pass on to the third stage in the history of trade-unions and of employment of labor in this country. The eight-hour movement was ascribed to the influence of these unions; yet it probably would have taken place, just the same as strikes would, even if these institutions had never been created. Perhaps the eight-hour movement rose more speedily in consequence of the existence of organizations among the laboring-men, and it may be that measures were pushed with greater force and confidence by reason of the solidarity existing among them; and the same thing may be said of the working-men in respect to strikes: nevertheless, these have occurred where no unions were known; and in many cases, as we shall show before concluding this chapter, unions have been formed on the edge of a strike, and as a consequence of it, rather than as its cause.

Third stage of trade-unions.

Strikes, which in the fourteenth century had their counterpart in the Jacquerie riots, are the last argument to which working-men resort in order to get an advance of wages. In England, workmen have oftener struck to resist a fall than to secure a rise of wages. Says Mr. Brassey, " Resistance to a proposed reduction was the cause of the engineers' strike in 1852, of the strike at Preston in 1853, of the strike in the iron-trade in 1865, and of the strike of the colliers at Wigen in 1868." The strikes in the United States have generally sprung from a similar cause. The weavers at a cotton-mill in New York, having had their wages reduced three cents a yard, struck to regain the old price. The sounding-board makers in a piano-factory struck on account of a threatened reduction of ten per cent in their wages. One thousand operatives employed in a carpet-manufactory in New York struck against a similar proposed reduction. The potterymen of Trenton, N.J., were on a strike which lasted several months, causing a loss of three hundred and fifty thousand dollars to the employers and of fifty thousand dollars more to themselves, determined to accept no reduction for their labor. The cordwainers of New York struck for a period of nine months against a pro-

Result of strikes.

posed reduction of twenty per cent; and other instances might be noted. What Mr. Brassey has observed concerning English strikes applies to all those mentioned: "Masters had found it necessary, in consequence of the depressed state of trade, to reduce the rate of wages; but the men, ignoring the circumstances of the trade, and looking only to what they believed to be a degradation of their position as workmen, refused to accept the reduction." This remark is emphatically true of the strikes which have occurred in the United States since the panic of 1873. Profits have greatly declined; prices in general have been heavily shrinking; and a reduction of wages in most cases was regarded as absolutely necessary. The reduction of wages, however, has been followed by strikes everywhere of varying degrees of duration, loss, and violence. During the period when strikes were ordered to secure an advance of wages, victory crowned the measure; but the strikes of later years to resist a fall of wages have rarely met with success.

Recent strikes.

It would require altogether too much space to recount the story of the more recent strikes which have occurred in the United States; and we shall, therefore, allude to only a few of them. Two very notable strikes arose among the operatives of the cotton-mills at Fall River to resist reductions in wages, in which several thousands of employees participated. The factories had been losing money in the manufacture and sale of goods, and a reduction of wages was absolutely necessary in order to continue the business. The operatives deemed the reductions too large; and, while they were willing to work for less, they thought the employers demanded a larger reduction than was necessary to secure them against loss in the manufacture of their goods. When the first reduction was ordered, it was hoped that it would be the last: but, as the prices of manufactured goods continued to decline, a second reduction soon became necessary; and it was this which gave rise to the chief opposition among the operatives. All their efforts, however, to prevent a reduction, were unavailing; and, what was still worse for them in the end, the most active opponents to the reduction were prohibited from working in the factories. A list of them was prepared, and circulated among the mills; and the regulation was rigidly enforced. Not long after, a strike occurred in the Wamsutta Mills at New Bedford on account of a reduction of wages, which ended in the same way as the previous strikes at Fall River. As wages were rapidly reduced in almost all trades, strikes broke out almost daily in all parts of the country. Even the rice-fields of the South were swept with the wave of discontent; and the strikes of the working-men threatened, at one time, the ruin of the crop.

Railroad-strikes.

Thus one strike succeeded another, until a climax was reached in the summer of 1877, when the workmen employed by the Baltimore and Ohio Railroad struck for the retention of the wages they were at that time receiving, but which the company had proposed to reduce. The company announced, that, on the 16th of July, their resolution would go into effect;

and, for several days previous to the event, mutterings of discontent were heard among the conductors, brakemen, and firemen, especially among those who were employed in running freight-trains. On the day fixed the storm broke forth. The employees who conducted the freight-trains refused to work, not only in Baltimore, but throughout the line of the road. There was at once a total suspension of transportation. The company endeavored to procure other men to run the trains: but it was soon found that the strikers were determined not to allow them to move; and they dragged the crews from the engines and cars, extinguished the fires, and openly avowed their determination to resist by force the passage of freight-trains until the company had complied with their demand for rescinding the order reducing their wages. The lawlessness and violence of the strikers rapidly increased, while sympathetic mobs formed at the various points where the strikers were the most numerous. The governor soon found that the State militia which had been called out were unable to cope with so formidable an insurrection: so application was made to the President, who immediately responded to the call, and sent troops to aid in restoring order. The wave rapidly swept northward; and within two days the train-hands of the Pennsylvania Railroad at Pittsburg also struck, and stopped the movement of all trains east and west. **Pittsburgh riot.** The attempts of the municipal and county authorities to restore traffic failed; and by the evening of the 20th of July, three days after the commencement of the strike, a large number of trains, containing thousands of head of live-stock and merchandise, were massed at Pittsburgh. Every effort to move freight with the aid of the workmen who remained in the faithful employ of the company proved unavailing. In the mean time, the State troops were ordered out; though, three days after the riot began, only six hundred men and officers had assembled for duty.

Gen. Pearson, who commanded at Pittsburgh, fearing that the majority of his troops were in sympathy with the strikers, the first division of the National Guard was ordered to join him. At two o'clock in the afternoon of the 21st, the first detachment of the Philadelphia division, numbering six hundred and fifty men, under command of Gen. Brinton, bringing with it two Gatling guns and a large quantity of ammunition, arrived at the Union Dépôt in Pittsburgh. After a short delay, to feed the soldiers, the movement to open the road began. Preceded by the sheriff, and carrying the Gatling guns, the troops were marched down the tracks, between the lines of freight-cars. For some distance the road was comparatively clear; but, as the column approached Twenty-eighth Street, it met a constantly-increasing crowd, through which it forced its way into the dense mass at the foot of the hill. The lines pressed the crowd slowly and with difficulty back on either side of the road, until that portion of the tracks enclosed by the hollow square so formed was clear.

An attempt of the sheriff to arrest some ringleaders who had been prominent in the previous outrages raised a commotion, during which stones were thrown by the mob. The troops were ordered to charge bayonets, and, in doing so, came in immediate contact with the pressing and excited mass. Several pistol-shots were fired, and a volley of stones thrown from the crowd, from those on the hillside, as well as others; and violent attempts were made to wrest the muskets from the soldiers. Having been wedged in among a surging body of rioters growing more and more aggressive, many of whom were attempting to crowd the soldiers from the ranks or wrench the muskets from their hands, and as a few moments more would have broken the ranks, and involved the individual soldiers in inextricable and helpless confusion among their foes, the soldiers fired. Under the circumstances, they did right to resist the attempt to disarm or overpower them. A soldier is stationed or commanded to move as a soldier, and has the undoubted right, in the execution of his order, to prevent himself from being forced from his post, or disarmed. As soon as relieved of the pressure, the commands of the officers at once stopped the firing. From proximity to the crowd, the firing was wild and high as well as desultory, and took effect principally upon the hill. Panic-stricken, the crowd upon the hillside and adjacent streets, and immediately surrounding the soldiers, scattered in all directions, carrying with it many of the Pittsburgh soldiers; and the main body of the rioters fell back along the track. In the *mêlée* fifteen or twenty soldiers were wounded, the majority with pistol-balls, and a number of the mob killed and wounded.

At this time the troops were undoubtedly masters of the situation; and a determined advance in all directions, and co-operation of the civil authorities, would have driven away every vestige of the mob, and, by activity and care, might have prevented it from re-assembling. As it was, though unskilfully executed, the movement produced the result intended; but, though offered a guard for each one, the railway officials were unable to move their trains, from the impossibility of finding engineers and crews who were willing to man them at that time. The troops held their ground an hour or two, during which time the rioters gradually returned, and collected about in squads. About six o'clock the troops were withdrawn, and placed wholly within the round-houses and adjacent buildings. No pickets or guards were left outside. From this time on the troops were kept on the defensive, which gave the mob a great and fatal advantage. The mob, rapidly increasing in numbers and boldness after dark, broke into various gun-stores and armories, arming themselves; and a desultory firing was kept up during the night, without effect upon the soldiers, and with considerable loss to the rioters. From that time onward, for several days, the rioters were masters of the situation. The military were totally inadequate to quell them: indeed, the next day they felt obliged to withdraw into the open country. As no engineers could be found to run trains, re-enforcements could proceed only at a slow rate: so the insurrection gained strong headway. Finally, disregarding all law, and consideration for private property, the rioters began the wholesale destruction of property — cars, engines, freight, and buildings — belonging to or in the possession of the Pennsylvania Railroad Company. The government was called upon to aid in suppressing the insurrection; but only a few troops were in the East, though these rendered very effective service. While several of the State organizations manifested much sympathy with the strikers, and in many cases refused to serve at all, the national troops came promptly to the rescue, and never showed any signs of wavering. In a few days, however, the riot at Pittsburgh had spent its force; and on Monday, the 30th of July, the railroad companies centring at that point resumed business, and communication was opened with all parts of the country.

In the mean time the disturbances spread rapidly over the State. In Philadelphia, by the courage and activity of the mayor and police, supported by the great body of the citizens and the press, and in Harrisburgh, through the coolness and promptness of the sheriff of Dauphin County and the mayor of the city, and the public spirit of the citizens, who responded to the call of the authorities, the disturbances were speedily quelled. In Reading the costly railroad-bridge over the Schuylkill was burned on the evening of the 22d, and freight-trains stopped. The Sheriff of Berks County proving unequal to the situation, Gen. Reeder, with two hundred and fifteen muskets of the Fourth Infantry, National Guard of Pennsylvania, was sent there by Gen. Bolton; and in a severe street-fight after dark, on the 23d, — in which many of his command were injured more or less severely with stones, and eleven of the crowd killed, and above fifty wounded, — the rioters were dispersed. These troops, having been subsequently demoralized by the action of the Sixteenth Regiment, were withdrawn; but the next day (the 24th), upon the arrival of a detachment of United-States troops under Col. Hamilton, the road was re-opened.

Spread of riots to other places in and out of the State.

In the middle coal-field of Luzerne County, the miners, under the prevailing excitement, struck on the 25th of July, and all trains were stopped upon the roads running through that region. At Scranton, on the 1st of August, a large body of men, endeavoring to drive the workmen from the railroad-shops and factories, were courageously dispersed by the mayor and his *posse*, in which conflict that officer was severely injured, and three of the rioters killed and a number wounded. As the trouble was serious and threatening, and rapidly growing beyond the control of the mayor and his small force, brave and determined as they were, the first division, under Gen. Brinton, was ordered to that region, followed immediately with other forces; and on the 3d of August the railroads were once more put into regular operation. A body of troops, regular and militia, were stationed there until the early part of November, when, all fears of any disturbances being removed, they were withdrawn. Slight outbreaks which had occurred in various other places had been easily suppressed either by the local authorities or the presence of the United-

States or State troops; and before the middle of August all the railroads throughout the State were running on schedule time, and by the early part of November all manifestations of lawlessness had disappeared.

It was in Pennsylvania, and especially at Pittsburgh, that the riot rose to its greatest height, was the most destructive, and was least easily quelled. On the 21st of July the wave rolled into the State of New York, and was first felt along the line of the New-York and Erie Railroad. Shortly after, trains were stopped on the New-York Central Road, and large and excited crowds of men gathered at Albany, Syracuse, Buffalo, Hornellsville, Corning, Elmira; while the peace of the city of New York even was seriously threatened. The governor ordered the entire force of the National Guard to hold itself ready to move at a moment's notice, and several regiments were ordered to various parts of the State. The prompt action of the governor, and the discipline and efficiency manifested by the troops, had the good effect of speedily subduing the disturbance; and, within a week, order was restored throughout the State.

But little commotion was experienced in New England, and no trains were interrupted by rioters. In the West, however, serious delays occurred, though nowhere was such violence practised as in Maryland and Pennsylvania. Many trains were stopped. In some cases, the reduction of wages which had been proposed did not take place; and overtures of one sort and another were made satisfactory to the railroad employees, and thus their anger was appeased. Having originated among this class of working-men for the most part, the rioting extended no farther; though, in Pittsburgh, others, to some extent, participated. They were aggrieved over the reduction of their wages, and thought that various changes in the arrangement of the railroads ought to be made before calling upon them to accept any lower compensation for their services. Their requests having been refused, and their reason becoming dethroned, they pursued a wild course, which proved, perhaps, more injurious to them than to any other class of people. It was one of those wild, thoughtless movements which every now and then break out when least expected, and which give a great jar to society; but this last blaze went down as suddenly as it arose, because it did not spring from any fuel which could burn long. It was only a flash, terrible for the moment, blinding, bewildering, and frightening many, yet leaving no dangerous residuum. There are persons who tremble over the possible recurrence of these scenes; yet the public is so alive to the danger, on the one hand, and those who indulged in them must be so convinced of their folly, on the other, that the repetition of this singular outbreak is not likely soon to occur.

Effects of strikes upon business.

The consequences of striking ofttimes have not been very carefully considered before engaging in them, otherwise many of these occurrences never would have happened. In Antwerp there were at one time nearly fifty establishments devoted to the manufacture of cigars, and employing about ten thousand workmen and apprentices. During the summer of 1871 all the operatives instituted a strike for the purpose of getting a reduction of working-hours, though not of wages; and also of procuring a discharge of the apprentices. Means were furnished to the operatives; so that the strike was prolonged for four months and a half, when work was resumed. In the mean time, what had happened to the Antwerp cigar-trade? It had received a serious blow from which it has never recovered. Those who had been accustomed to obtain a supply of cigars from this quarter went elsewhere when their demands could not be fulfilled, and have never returned. A few years ago a strike occurred in the State of Nevada, which led to the same disastrous conclusion. In the silver-mines of Grass Valley, three hundred Cornish miners who were receiving four dollars a day struck upon the introduction of a new kind of blasting-powder which was found to effect a considerable saving of labor. They insisted upon following the Cornish system of mining: the result was, that the mines were closed forever. The pottery-men of Trenton, N. J., by indulging in a strike which entailed a direct loss of three hundred and fifty thousand dollars upon their employers, and fifty thousand dollars upon themselves, crippled the business so severely, that it has not yet recovered; and, while the loss has been keenly felt by the proprietors, the workmen have been the greatest losers. With the sharp competition now raging in every kind of business, it is sensitive even to the slightest shock; and, when so violent an interruption occurs as a strike, the consequences not infrequently are severe and lasting. The foregoing illustrations are only a few of the many which may be given.

Trade-unions not always responsible for strikes.

Terrible as strikes often are, they cannot always be laid at the door of trade-unions. Many entertain the opposite opinion; and it is desirable to present the truth upon this point as clearly as possible, even if considerable space be required for the purpose. All the members of the Trade-Unions Commission were in accord on this point concerning English strikes, and the language used in the leading and dissenting reports is almost the same. To quote from the chief one: "It does not appear to be borne out by the evidence that the disposition to strike on the part of the workmen is in itself the creation of unionism, or that the frequency of strikes increases in proportion to the strength of the union. It is, indeed, affirmed by the leaders of unions, that the effect of the established societies is to diminish the frequency, and certainly the disorder, of strikes, and to guarantee a regularity of wages and hours, rather than to engage in constant endeavors to improve them."

Richest unions have fewest strikes.

This evidence throws into bold relief a good feature of trade-unions. Admitted upon the best authority that they are not the authors of strikes, the strongest, richest, and most extended of these organizations have had the fewest strikes and disputes; while the wages of their members and their hours of labor show the greatest permanence. The Society of Engineers, of which Mr. Allan is secretary, is very numerous, embracing the principal portion of the workmen engaged in that business in Great Britain. At one time the society had a reserve-fund of seven hundred and fifty thousand dollars. So great is their power, that Mr. Beyer, a partner in one of the largest iron-founderies in England, represented himself as wholly in the control of the union. But their wages, notwithstanding their power, have been scarcely raised for twenty-five years, except by the voluntary act of their masters.

Feeblest unions strike most frequently.

The feeblest unions — those just struggling into existence perhaps, or which have the least control over their members — oftenest indulge in strikes. Not infrequently unions are formed when the spirit for striking is rife; and, consequently, they are charged with instituting strikes which would have happened whether unions existed or not. When men are dissatisfied with their wages, they can easily subscribe a small fund for the purpose of striking, and create a union which is not intended to exist beyond the occasion giving it birth. The proceedings of such bodies ought not in justice to be charged to the regularly-constituted union. It is said of the English tailors' and iron-workers' unions, that they "never possessed the power or the permanent character of such societies as the Amalgamated Engineers and Amalgamated Carpenters;" and these are the trades in which the loudest complaints are heard of the frequency of strikes. Numerous strikes and lockouts have occurred in the coal-mining districts of Wales and Derbyshire; but no unions have flourished in those regions. In the United States most of the unions are young, hardly in working-order, having no accumulated funds, the discipline exercised being exceedingly lax; the machine in every way bearing evidence of hasty and rude construction. While they have wrought mischiefs which cannot be excused, yet we may, in a spirit of fairness, believe that many of these would not have arisen had the unions been in longer and more perfect operation.

During the years 1875 and 1876 many unions were created in the United States during strikes, or with special reference to them. The societies grew out of a striking disposition, but not the strikes from the creation of the unions. Nevertheless, the hated trade-unions are unjustly accused of originating grave evils which would have happened in any event. As these organizations grow older and more stable, and select more capable leaders, they will be managed with greater wisdom, and capital will have less cause to fear them.

Do stronger unions abuse their power?

It is questioned whether the diminished frequency of strikes among powerful unions arises less from want of disposition to strike on the part of the members than from the fact that their organization is so powerful, as, in most cases, to obtain the concession demanded without recourse to this measure. Perhaps this is so; but surely it will not be denied that the Trade-Unions Commission, who raised this query, did not glean a scintilla of evidence upon the point in their most thorough and in every way creditable investigation. We can comprehend what influence these powerful organizations could exert if they chose, and how masters had better submit to their demands, though declaring them wrong, than go through the painful uncertainty of a strike. In several instances, masters have confessed themselves within the power of trade-unions: if this be true, they could obtain new concessions without a conflict of any kind. Possibly, if several of the societies were less strong, they might not have received some of the benefits which have come to them peaceably, and perhaps none at all. Let us not forget, though, that there is no evidence on the subject; and in the absence of this the question is purely speculative, and cannot receive a definitive answer.

Stronger unions are better guided.

The reason why the richer and more powerful unions moderate the disposition for strikes is not merely to conserve their funds, nor because they obtain concessions by reason of their power, but because they are more wisely conducted than the newer and smaller organizations. The government of each branch of the union is vested in a committee and local secretary elected from time to time by the members; while the government of the whole society is commonly vested in a general or executive council elected by the branches, and a general secretary elected by universal suffrage of the entire organization. Both the executive council and the committee of the several branches are required to govern themselves according to established rules; and, when these do not exist, they must rely upon their judgment, subject to an appeal to the general body. Instituting and conducting strikes is the most important function of every well-organized union's council. It is these councils which have toned down the disposition of workmen so much in regard to strikes; for, generally, the best men are selected for these places, — men of the most intelligence, and who are the best capable of ascertaining the condition and profits of the business in which workmen are employed. These leaders, from their superior knowledge and capability to find out the true condition of business, can judge better than the members; and hence it is that strikes among the larger and more wisely-conducted unions are diminishing. And this we regard as a very hopeful feature of trade-unions. One thing the toiling classes need is correct information concerning the business in which they are engaged. They imagine their employers are getting very rich oftentimes, when they are running at a loss, though keeping the fact concealed. The strikes which occurred in the cotton-mills of New England during 1875 are unanswerable proof of this remark. Most of them had earned no profits for several months; yet the operatives in several cases unwisely demanded an increase of wages. Had they known any thing about the condition of trade, they would have comprehended the folly of asking for an advance when employers were keeping them busy at a loss. Personal knowledge or wise leadership would have saved them from a contest with their employers which was sure to end in the laborers' defeat. They were the dupes of ignorant and wild leaders, instead of wise and temperate ones; and behold the result! Every one who knew any thing about the condition of the cotton-trade was certain the strikes would end in failure; for, in fact, the owners were quite as willing to have the men unemployed as not. Prejudice and ill feeling between employed and employer help kindle the laboring-man's imagination respecting the profits accruing from his labor. Now the leaders of unions are in a situation to learn more perfectly the exact nature of things, and this is why they advise more peaceful measures.

Here a streak of light issues from these organizations, especially since the establishment of boards of arbitration and conciliation for the settlement of differences between men and masters. Members having confidence in their councils are able to submit questions to third parties for settlement. They could do what would be impossible were they unorganized. Should all the men in a shop strike, and the attempt be made to leave the differences between them and their masters to some person for arbitration, the difficulty would be in organizing the workmen for consultation; and even were a temporary organization formed, and representatives selected from it to confer with their employer, they would not command such confidence as those who were recognized as leaders, and thoroughly knowing the condition of business.

How unions aid conciliation.

It is asserted that these very councils foment strikes when they ought not. Being paid officers, they regard it as part of their duty, it is said, to advise striking occasionally. This is thought to be their occupation. They are chosen to wage war, not to maintain peace. These notions are erroneous. Only a very few persons connected with trade-unions receive any pecuniary reward; nor do they constantly agitate for higher wages and other benefits. This we suppose they do, in some cases; yet it is quite clear, that, in general, the tendency of their advice and counsel is to moderate the striking disposition of those under their direction and control. Strikes began long before trade-unions were ever thought of: they are incidental to collecting men in masses as they have been collected by the erection of factories. The union does give an increased power of striking: it can deal a harder blow; but, instead of giving it, an increased sense of order, subordination, and reflection, is exhibited. Does any one doubt the truth of this? Listen to what the General Secretary of the Amalgamated Society of Carpenters and Joiners says in his last report: "Our demands on our employers for wages and reduced working-hours, which have been moderate in their character, and which have been a consequence, not a cause, of the enhanced cost of the necessaries of life, have generally been courteously conceded; and thus our disputes have been few and unimportant. I sincerely trust that an amicable relationship between employers and employed may be permanently maintained. Although we may be told, that, in accordance with the law of supply and demand, we are justified in pressing for all the advantages we can

Do councils foment strikes?

possibly obtain in busy times, and that we should accept whatever may be offered to us when trade is depressed, I hold that such a policy is advantageous neither to employer nor employed, and cannot benefit the general public. Wherever our employers are disposed to meet us in a fair and conciliatory spirit, our members will do well to meet them with equal cordiality, to carefully consider any arguments that may be advanced, and thoroughly examine both sides of the question at issue. If employers and workmen are determined to act fairly by their opponents, as well as to secure justice to themselves, matters of detail may be arranged, differences amicably settled, and results secured which would be far more satisfactory to all parties than any thing which could be obtained by a strike or lockout." Who can find fault with this advice, or maintain that working-men are not better off under such leadership than they would be each one struggling for himself? Do not these words give promise of restored harmony between capital and labor? Surely trade-unions thus directed ought to be encouraged, not condemned.

We have reserved for the close a word or two in the way of contrasting the trade-unions of the United States with those existing in European countries. In those, the ranks of labor for centuries have been full; the power of capital has been enormous: and fairness requires us to say that the working-man there needed far more protection than was given him by law; far more than he, under the most favorable circumstances, received. Harsh and unjustifiable as are some of the rules and methods of trade-unions there, they are grounded in the most solid reasons; but in the United States the case is very different. Even if employers be found selfish and too grasping, an enormous public domain is open for settlement; and thither can the oppressed son of toil always fly for relief. No one has studied the case of the working-men with greater care and devotion than Thomas Hughes of England; for years he has fought their battle without flinching: yet, when he visited this country a few years ago, he delivered a lecture to the working-men of New York, in which he said, —

Contrast of working-men in United States with those in Europe.

"I have no right to offer counsel to either side, and may possibly be even regarded with suspicion by employers of labor over here, as I have been till lately by those of England; but as I have helped the working-men at home to fight their battles, and have had the happiness of earning their confidence, I trust their brethren here will take the few words I have to say to them in good part, and as those, at any rate, of a friend. Is it, then, the fact, that you, the working-men of the United States, are running simply on the old tracks, and are furbishing up the old weapons of trade-unionism, which have so often run into the hands of those who wielded them? Are you really trying by your organizations to control the free will of those of your body who are not unionists; to put restrictions and limitations on the

Thomas Hughes's opinion.

hours of labor, the admission of apprentices, the use of machinery, the rate of wages, and to carry out your ideas by the old method of strikes? These things have been done often enough in England. If not wise even there, at least they had a justification which here is wholly wanting. Where the labor-market is overstocked, and there are often two men waiting for one man's place, I can understand, and have often sympathized with and defended, rules and practices intended to spread work evenly, and requiring self-sacrifice from the ablest workmen, that all of fair capacity might earn a livelihood. Where all the natural wealth of the country (if I may use the phrase) is already monopolized, where lands, mines, waters — all the raw material out of which wealth is created — are in private hands, and there is the keenest competition for the use of them, as there is with us, one must not be too critical as to the methods by which the great body of producers have endeavored to secure their share of the products. But here you have well-paid employment waiting for every man who is ready to do an honest day's work. Here the natural wealth of the country is, for all practical purposes, unappropriated, and lying around you in almost unbounded profusion. You have nothing to do but to exercise a little thrift and foresight for a few short months, to spend for that time less than you earn, and there are the means in the hands of every one of you of obtaining house, land, whatever form of wealth you are most eager for, with only too great facility.

"On what possible plea of reason or justice or necessity, or even of hand-to-mouth policy, can you undertake to control or limit the right to work on his own terms, in his own way, of any man, when there is ample room for twenty times your present numbers, and your land is crying out for all the work which every man among you can put into it? When the great trade-unions of England are becoming every day more peaceable and reasonable as they become more powerful, and are jealous of every expenditure which is not for some provident or benevolent purpose, are the unions and the working-men of America going to pick up the old armor, instead of leaving it to rust where it lies, and to spend the earnings which belong to the wives and children as much as to them in a crusade for preaching the gospel of idleness? I cannot believe it; for, if there is one truth which this nation has hitherto preached faithfully to the rest of the world, it is the gospel of work."

It is not for us, in narrating the industrial movements in this country, to add any thing to them in the way of criticism. Unwelcome as trade-unions are to most employers of labor, and however unnecessary they may be, their existence is a fact; and, though many a strike has ended disastrously to their members, with only a few exceptions they have not disbanded, nor have they manifested the slightest intention of so doing. There are persons who have cherished the belief that a few severe reverses would put an end to the organization; but those who have deluded themselves with such thoughts have not studied with sufficient care the nature

Future of trade-unions.

of trade-unions. Very likely they ought to disband; perhaps there is no excuse for their existence: but it must be remembered that these are not the thoughts of unionists themselves. They believe in the necessity of organization in order to secure and preserve their rights; and as long as they do, though many more disasters may befall them, and severer ones than those which they have yet experienced, trade-unions will probably live, and perhaps thrive even the more because of their defeats.

BOOK VII.

THE INDUSTRIES OF CANADA.

THE INDUSTRIES OF CANADA.

IT is proposed in this book to make a brief general statement in regard to the industries of the nation which is growing up on the northern border of the United States, and with which this country is intimately connected by ties of race, language, trade, and destiny. It has not been unusual of late years to observe laments in the Canadian newspapers to the effect that Canada has no industries. Certain branches of manufacturing which are carried on extensively in America and in other parts of the world are not yet practised in Canada, and general development has not taken place as rapidly as south of the St. Lawrence. Noting this fact, writers lament that Canada has no industries. The government statistics tell a different tale. Surely a land richly endowed by nature, and happy in being occupied by a free, intelligent, and active-minded race, which already produces 80,000,000 bushels of grain yearly, 15,000,000 gallons of petroleum, over 200,000,000 cubic feet of lumber, 800,000 tons of coal, and a value of $250,000,000 in general manufactures, whose fisheries yield $12,000,000 annually, and which exports in a fair year $89,000,000 worth of goods, must have busy and profitable industries. Such is, indeed, the case with Canada. Her industries are numerous and varied, have attained a most satisfactory development, and are fully sufficient to keep her population profitably employed. The story concerning them is interesting, and will now be succinctly related with a pen which will not at any rate fail in its task from any lack of admiration for what has been accomplished by the spirited people of the Dominion.

Importance of Canadian industries.

THE FISHERIES.

At present the fisheries constitute the greatest individual source of wealth to the people of Canada. Not only do they employ more men in profitable industry than any other pursuit except farming, and not only do they form the easiest and least expensive of occupations, but they carry in their train a variety of other industries, like ship-building, transportation, &c., whose prosperity they insure. They are, besides, practically inexhaustible. The Gulf Stream, flowing northward near the American coast, is met in

Magnitude of the fisheries.

the vicinity of Newfoundland by currents from the polar basin; and by the deposits which take place at the meeting of the opposing waters are formed vast submarine islands, or "banks," whose shallow waters are the feeding-grounds of immense shoals of migratory fish which resort thither annually. The reproductive powers of some of the varieties, the cod particularly, are very great; and there is a probable impossibility that these species can ever be destroyed by human means. The whole sea is their breeding-ground. These fish are not found on the banks alone: they visit the Gulf of St. Lawrence, and the shores of all the maritime provinces of Canada, in unlimited numbers; and the quantity of them that will be taken for ages appears to depend only on the efforts that will be put forth for the purpose. This remark refers more particularly to the cod, mackerel, and herring. Certain of the inshore varieties, migratory and otherwise, such as the salmon, shad, smelt, and lobster, have shown a susceptibilty to decrease with excessive fishing; but they still exist in enormous numbers, and their capture engages the services of thousands of men annually. These latter fisheries the Government of the Dominion is taking steps to restore by breeding and by protective laws; and they show such a capability of responding to fostering measures, that they, too, may be termed practically inexhaustible. Besides the salt-sea fisheries, there are others in the interior, upon the lakes and rivers, which are very profitable in their way, and employ a great many men.

Early development of the industry.

The people of the maritime provinces are peculiarly fitted by origin and training to turn to account the advantages of their geographical situation. The early French, Spanish, and Portuguese navigators of these coasts, all discovered the plentifulness of the fish in the neighboring seas, and the unlimited abundance of the herds of walrus and seals which swarmed on the islands of the Gulf of St. Lawrence. As early as the first part of the fifteenth century they were aware of the great sources of wealth which surrounded these shores. The reports they made to their respective governments brought whole fleets of fishing-vessels to their waters; and in process of time the hardy adventurers, instead of coming out in the spring and going back in the fall, as they were wont to do at first, went ashore, and settled permanently on the fishing islands and coasts. This was particularly the case with the French, who swarmed to this region from the Norman, Basque, and Breton seaports in great numbers, and became permanent residents of the country. The most extensive fisheries of the early times were the walrus, seal, and cod; but, when the former two had nearly disappeared, the settlers fell back upon cod, herring, and mackerel.

Disappearance of the walrus.

Great Britain finally contributed her quota to the population of the maritime provinces from her own fishing-ports; and thus the country was taken possession of by a body of energetic men, who, though of different nationalities, were one in their love for the sea and the past training which fitted them for the cultivation of the rich fishing-grounds which they had come over here to enjoy. Agriculture was for a long period neglected, and, in fact, even despised. The whole population was sustained by the fisheries and navigation alone. This state of things changed after a while: for the more far-sighted began to clear the land, and raise grain and cattle, in order to take advantage of all the resources of their situation; and they found their profit in so doing. But, while this change has continued to go on until agriculture has received a very considerable development in the maritime provinces, fishing has, nevertheless, always been the main-stay of the people, and apparently always will be.

The government report for the year 1877 shows the magnitude to which the Canadian fisheries have now attained. The figures are as follows; the statistics for Newfoundland for 1874 being added to the table, as properly belonging there, although the island is still politically independent of the Dominion: —

Statistics for 1874.

DISTRICTS.	BOATS.	VALUE OF BOATS.	FISHERMEN.	SHOREMEN.	VALUE OF PRODUCT.
Gaspé	2,970	$213,000	3,306	1,674	$616,309
Bonaventure . . .	1,111	204,000	1,455	247	130,715
Labrador . . .	1,865	416,000	2,795	1,281	954,285
Magdalen Islands . .	767	252,000	1,500	597	366,170
Anticosti Island . .	375	29,000	416	117	135,352
St. Lawrence River .	1,840	21,000	3,061	....	362,314
Nova Scotia . . .	11,064	1,504,000	25,859	....	5,527,858
New Brunswick . .	3,710	285,000	8,307	....	2,133,236
Prince Edward Island .	1,486	77,000	4,285	....	763,035
Ontario	1,267	68,000	3,867	....	438,223
Manitoba . . .	.....	....	.....	....	24,023
British Columbia . .	161	11,000	444	745	583,432
Total . . .	26,616	$3,080,000	55,295	4,661	$12,034,952
Newfoundland . .	12,000	....	32,000	....	9,000,000

It is worthy of remark, that, whereas manufacturing and many other pursuits have been obliged to curtail production since the flush times prior to 1873, the fisheries of Canada have steadily increased their product year by year. There has been no falling-off owing to the hard times: on the contrary, the market for fish becomes more eager and active every year; and the larger catch is merely the response to a growing demand. The completion of the Intercolonial Railroad in the maritime provinces within the last few years has been a powerful auxiliary to the fishermen. The difficulty of distributing fresh fish in former years compelled the fishing-people to salt down their catch in barrels, or preserve it by canning, in order to save it, and get it to a

Increase of product since 1873.

Effect of Intercolonial Railroad.

market. By the opening of the Intercolonial Railroad they are now enabled to transmit salmon, cod, halibut, lobsters, and other fish, fresh, and packed in ice, from the shores of the Gulf of St. Lawrence and other fishing-coasts to market in a few hours, and at greatly reduced prices. This has rendered the trade more profitable by reducing the expense of transportation, and has led to its expansion by bringing the catch into the centres of population in a perfectly fresh state. The same results may be expected when the parts of Canada more distant from the sea-coast are better united therewith by the future railroads of the Dominion. There will be an enlargement of the market for fish, and a consequent increased activity among the pursuit of the treasures of the fishing banks and coasts; there will be less canning and salting, and more packing in ice (something of this sort being already seen in the abandonment of canning and salting establishments in New Brunswick); and there will be more boat-building, more freighting by rail and ship, more training of hardy seamen for the merchant-marine, and a larger body of non-agricultural people to purchase the produce of the farms.

Statistics for 1877. The following table will show the character and yield of the different fisheries of the Dominion (Newfoundland being omitted), the figures being for the year 1877:—

FISH.	QUANTITIES CAUGHT.	VALUE.
Codfish	....	$3,561,199
Herrings	....	1,522,091
Mackerel	....	1,667,815
Haddock	....	475,722
Salmon	....	855,687
Alewives, bbls.	15,313	67,298
Smelts, lbs.	2,266,202	135,972
Lobsters, preserved, lbs.	8,085,569	1,212,835
Oysters, bbls.	29,568	88,704
Fish and clams for bait and manure, bbls.	222,379	195,724
Fish-oils, galls.	466,579	303,276
Seal-skins, pieces	20,312	43,915
Pollack, cwt.	58,746	205,611
Hake, cwt.	77,454	271,090
Halibut	....	48,732
Trout	....	173,499
White-fish	....	210,625
Shad	....	80,256
Whale-oil, galls.	13,716	6,858
Cod-oil, galls.	225,129	112,564
All other fish and products, including fresh and salt water varieties, the catch in each case never exceeding $60,000	....	795,479
		$12,034,952

At Newfoundland the principal fisheries are of cod, seal, herring, and salmon, ranking in importance in the order named. In 1874 the catch of cod amounted to 1,500,000 quintals. In 1873 107 vessels, with 8,062 men, were employed in sealing (twenty of these vessels being steamers), and 525,000 skins were taken.

Principal fisheries at Newfoundland.

Cod-fishing is the industry upon which the inhabitants of the maritime provinces and Newfoundland chiefly rely for a living. It is practised alongshore in Nova Scotia, New Brunswick, and the islands of the Gulf of St. Lawrence, and at the banks two or three miles from shore, as well as at the great banks in the open sea. It is mostly carried on in small boats near shore. The great banks in the gulf and open sea have been comparatively neglected. Only a few years ago, the interest of the people of Newfoundland in the great banks was confined to the sale of bait to the Americans and French who were enterprising, or who, having larger capital, built large boats for the industry, and pushed out boldly into the stormy waters avoided by the Canadians. Newfoundland and gulf fishermen now, however, understand the advantages of deep-sea fishing. Cod being sometimes scarce along the shore, owing to a lack of food or other causes, they have of late been fitting out vessels for the bank-fisheries, where cod never fail, by reason of their always finding there an abundance of food. Cod is found in the gulf the whole year round. Other specimens of fish frequent the gulf at specific periods of the year, and seals and whales follow them in more or less. But these varieties retire, or disappear; whereas cod, though most abundant alongshore in the spring, when the herring and caplin strike in, are nevertheless found either alongshore or on the banks from one end of the year to the other. Speaking of the abundance of cod in the gulf, Mr. N. Lavoie, the fishery-officer of the gulf, says, "The great extent of the Canadian fishing-grounds, and, above all, their inexhaustible wealth, are not sufficiently appreciated by our own people. Men of education who visit the coast of Gaspé for the first time cannot sufficiently express their wonder at seeing such abundance, and are compelled to own that its shores might afford a comfortable living to thousands of adventurers, who would find these sources of wealth more accessible than the gold-mines of California, and secure more prosperity than could afford wages paid for working in unhealthy manufactories of the United States." The reason why these fisheries have not been appreciated, that is, utilized, is, that, though the richest fishing-banks in the world are found in the gulf and about its mouth, the facilities for distributing their treasures to market on shore have been limited, and the inducement to embark in the capture of cod upon a scale commensurate with the abundance of the fish has been lacking. Now that railways are building, a great change is taking place in the business.

Cod-fishing.

The chief difficulties which beset the cod-industry arise from the scarcity of bait, from the lack of large boats, and the competition of the Americans.

The cod is remarkable for its voracious appetite. It follows the shoals of small fish in to the shore in May and June, in order to feed upon them; and even devours its own young. It frequents most the banks where food is abundant, and migrates along the shores according as the means of satisfying its eager stomach are provided for it by the sea. A great deal of bait is consumed in catching it; so much indeed, that Professor Hind estimates that the cost of bait is one-seventh in the production of all cod and halibut. In order successfully to carry out cod-fishing, therefore, a large supply of bait is necessary. The fish ordinarily used for this purpose are herring, caplin, mackerel, launce, squid, smelt, trout, and clams. Some of these varieties, such as the mackerel, have now grown scarce in certain localities from over-fishing; and the cod-boats are at times very much delayed in consequence. The demands of the United-States schooners for bait at the Newfoundland Banks caused the trade in herring and caplin to take such proportions, that the Government of the Dominion has been informed that the enactment of measures to protect the small fish from extinction would be hailed with pleasure. In 1876 cod struck the southern shores of the gulf in August; and the fishermen supposed for a while that they would have to forego reaping the rich harvest presented to them, because they had no bait. Those of the Gaspé coast were able to avail themselves of the rush of cod only by employing several boats during the whole fishing-time in bringing clams taken on the rocks at low tide from the north shore, from forty-five to sixty miles distant. No less than five thousand bushels of clams were thus carried away for bait by the Gaspé fishermen while the fish were running; but they secured six thousand extra quintals of cod in consequence of it. It is said that about eighteen hundred boats had to lie idle for three or four weeks in the best fishing-time in 1877, on the Gaspé coast alone, for lack of bait; and the same general fact is true of other fishing-districts. The attention which has been called to this subject of late will doubtless be followed by suitable action by the Government of the Dominion.

Difficulties in cod-fishing.

The small size of the Canadian boats, growing out of too great a dependence on shore-fisheries, is another drawback. The migration of small fish, the temperature of the water and air, and various other physical causes, operate to make the shore-fisheries uncertain; and, when the cod are scarce, the fishermen are restrained from pushing out to the banks, where they might always load their vessels, by the small size and frail character of their boats.

Small size of boats.

It is also held, in some of the provinces, that great injury has been done by the United-States fishermen by their over-eager pursuit of mackerel, which has served at times for bait, and by the American practice of trawl-fishing offshore, which secures to the Americans the best and largest cod, and otherwise injures the cod-fishery for the Canadians. The

Trawl-fishing.

trawl or bultow fishing is carried on by a long rope buoyed and anchored, to which are attached from seventy-five to a hundred lines baited. The trawl being taken out from the schooner, and set, the men return to the schooner, and fish with hand-lines; while the trawl, left to itself, is doing its special work besides. Sometimes, when the trawl is hauled in, it is found to have fish on every line. This practice, the Nova-Scotians claim, gives the best and largest fish to the Americans, because of the large extent to which they employ it: it kills a large number of small and useless fish; and it keeps the fish offshore by reason of the large quantity of bait used, and prevents them from coming inshore.

There is nothing in these drawbacks to the Canadian industry, however, which enterprise and patience will not overcome, especially if the government takes judicious action in regard to them.

Salmon-fishing.

The salmon-fishery is second in interest among the different branches of this industry. The catch is less in amount than some of the others; but the fishery excites greater enthusiasm both among pleasure-hunters and fishermen, and is more eagerly pursued. Before the confederation of the Provinces, the salmon were almost extinguished in Canada, owing to reckless modes of fishing. The fish were netted at the mouths of the rivers as they ran in during the spring to spawn, and as they ran out in the fall. They were taken in the rivers with nets, spears, and line; and, on Sunday, poaching was carried on as actively as during the week. Many of the coast counties had fishery acts; but they were almost a dead letter. After the confederation, laws to protect the salmon were enacted, and the means created for carrying them out. It was difficult to enforce the law. Respectable fishermen were hard to convince that the laws which interfered with them were really in their interest, and poachers would not be restrained anyway. The government finally won the day, however; and the rivers are now being allowed to restock themselves. Artificial breeding is also going on at several important establishments. Good results are already apparent at the streams emptying into the gulf; and, though there is yet over-fishing on the other coasts, there is little doubt but that the public policy will ere long prevail there also. Says Mr. Lavoie, the fishery-officer, "Had not the government taken the matter in hand, what would at the present time be our humiliation in seeing these fine and numerous streams which strangers so much admire left to the discretion and caprice of net-fishermen, who have no other notion but to destroy, without calculating the consequences! To what irretrievable loss and deprivation would we now be subjected, had not the government spent time and money to protect and increase salmon in these streams!" An illustration of the good results of protection of the salmon is presented by the record of fly-fishing on the Ste. Anne des Monts River for the last seven years. The catch by angling was as follows: —

Action of the government.

Artificial breeding.

YEAR.	NUMBER OF SALMON.	AVERAGE WEIGHT, POUNDS.
1871	8	17
1872	12	18½
1873	87	17½
1874	140	19½
1875	69	21
1876	116	19½
1877	76	19½

The measures for the increase of salmon include action in regard to putting sawdust and mill-rubbish into the rivers in the lumbering districts. This discharge of rubbish is very large. The quantity of sawdust put into the Ottawa River alone every year is more than 12,300,000 cubic feet, — a bulk which is considerably increased by bark, slabs, buttings, and other refuse of the mill. This stuff greatly injures the streams into which it is put. A law has been enacted against it, and the government is also agitating in favor of the erection of furnaces by these mills for burning the rubbish. The law is little observed in any of the provinces; but that it will ultimately prevail the officers are confident.

Mackerel is caught chiefly by the Nova-Scotians. The fish is plentiful at times in the gulf; but the catch there is not so great as on the other coasts. The fish is taken by hand-lines, seines, and trap-nets. The catch of 1877 was larger than that of the year before, owing to the larger use of trap-nets. This method is becoming popular with Canadians, and there are now numerous applications for licenses to use that sort of net. While the mackerel-catch is large, it is, on the whole, smaller than it used to be, owing in large part to the seining of mackerel on a large scale by the American schooners offshore. The fish are intercepted before they reach the shore, and often do not reach the three-mile limit at all. The Canadian authorities have given much attention to the mackerel-fishery of late, owing to the falling-off in the catch. It has been claimed by the Americans that mackerel and herring come from the waters of the American coasts, and that their visit to the Canadian coasts is a migration or accidental fact. This the Canadian commissioner of fisheries combated before the Halifax commission. His observations convinced him that the fish frequenting the shores of the maritime provinces merely retired to deep water when the cold weather set in, still remaining in the vicinity of the places where they were born. He maintained this view of the case with great animation, and accounted for the decrease of fish through excessive seining by means of it. It is upon this theory also that Professor Hind and others believe that the fishery can be fully restored in time to its former prosperity by proper regulations and enterprise on the part of the authorities.

Mackerel.

Decrease in quantity.

The whale, herring, trout, hake, haddock, and other general fisheries, need not be mentioned in detail; but perhaps the seal and the lobster business may be referred to, owing to the interest which attaches to them.

Sealing is practised in the spring and fall. The points from which it is carried on are Newfoundland, Anticosti, Magdalen Islands, Labrador, and, though on a small scale, on the southern coast of the gulf. Sealing has enriched hundreds of outfitters; and the industry, though not unattended with uncertainties, appears to be inexhaustible. Between four hundred thousand and five hundred thousand are caught annually, the number exceeding five hundred thousand in good years. In addition to these, about six thousand seals are taken annually in British Columbia on the Pacific coast. The migrations of seals formerly took place in such dense herds, that the spectacle has been described as resembling that of the heads of cattle crowded into a narrow lane. This used to last for weeks in old times, and the shores of the islands of the gulf and the mainland surrounding it were fairly alive with barking swarms of animals. The migration lasts for only two or three days now; and, when the spectacle is over, the season's fishing is at an end. Seals sometimes go very high up the St. Lawrence, having been seen as far up as the Saguenay. In the gulf the seal are caught in several ways. They are taken off the coast of Labrador with nets, which are set in the water to take them as they are hugging the shore in their migrations. They are also even caught with hook and line. The Newfoundlanders go out and hunt them with guns and spears on the ice-fields. The enthusiasm with which the Newfoundlanders go into the business has been already exhibited in the figures for 1873. In 1877 they fitted out twenty-four steamers manned by 4,000 men, and thirty-six sailing vessels with 2,658 men, and despatched them all to the ice-fields. They had great success, taking 412,000 seals, whose pelts sold from a dollar and twenty-five cents to a dollar and fifty cents, and whose oil sold for forty-five cents a gallon. They were taken chiefly in the neighborhood of Newfoundland, where the captains said they saw thirty seals to one in Greenland. The outfit for these sealing-voyages is very expensive. It includes houses, stores, trying apparatus, &c., on the land; craft with nets, harness, lead, anchors, guns, boats, &c., and provisions for the men. The cost of steamers is greater than that of sailing-vessels; but there is a greater certainty of success, because the vessel can poke its way around among the ice-floes, regardless of wind and tide. Half the cargo goes to the owners, the other half to the ship's crew; the captain taking half of that half, or a quarter of the whole. One of the steamers sent out in 1877 got a cargo worth $120,000. The Newfoundland Government does not permit steamers to sail for the ice-fields before the 10th of March, this regulation being designed to prevent too great a slaughter of the seal. From the islands of the gulf sealing is carried on from shore by nets, by a few schooners from forty to eighty tons' burden which seek

Sealing.

Where found.

How caught.

the floating ice in the gulf, and by killing the game on the ice grounded near shore. Great danger attends the latter practice. The sight of a field of ice covered with these valuable animals, whose slaughter is so easily effected by a blow on the nose, and whose furs are so precious, throws the fishermen on shore into a fever of reckless excitement; and they rush at the chance of gain, forgetful of the fragility of the links which hold the field of ice to the shore. A change of tide or wind is apt to loosen the field, and carry it off to deep water; and the death of the hunter, who is too far away to regain the shore, is almost an absolute certainty. A great many lives have been lost by imprudence in this direction. Five seals are taken on the ice, however, to one caught in the nets; and the temptation to go out upon the floating fields is one which no true Canadian ever neglects.

Lobster-fishing.

Very little attention was paid to the lobster-fishery in Canada until the grounds where that crustacean is caught on the American coast began to be exhausted. The great fisheries took up all the time of the Canadians; and this rare and delicate shell-fish, so highly prized in the States, was caught by them only to a small extent. When the Maine and Massachusetts coasts had become almost depopulated of the lobster, the firms engaged in canning repaired to the adjoining coast of Nova Scotia, unwilling to give up a business which was exceedingly profitable, and for whose products there was a lively demand in American families. By 1876 there had been forty-seven canning-factories brought into operation in Nova Scotia (American and Canadian) between Cape Sable and Sambro alone; and others were in profitable operation on Prince Edward Island, along the Bay of Fundy, and on other fishing-coasts. Excessive fishing soon reduced the number and size of the lobsters, until it required, on an average, two lobsters and a half to produce meat enough to fill a pound can, the crude fish weighing only from two to four pounds. About six or seven years ago the packers thought of taking a look at the gulf coasts, and, to their delight, found certain portions of them swarming with shell-fish. No Canadian had yet taken advantage of this mine of wealth, which would yield such large profits to the first companies which should undertake the business. There was a clear field for enterprise; and an American firm opened a canning-establishment in 1874 at Carleton on the Bay des Chaleurs, while a Halifax concern started another at the Magdalen Islands. Other firms soon followed, and there was a *furore* in the business. The profits made for the first two or three years were dazzling. The fish were large, often weighing from ten to fourteen pounds, — a noble size compared with those of the puny lobsters on the American and Nova-Scotia coasts. Inconsiderate fishing, however, completely ruined the grounds at Carleton, Maria, Bonaventure, New Richmond, and other places; and the same thing followed which had previously taken place in Nova Scotia, — canning-establishments had to be abandoned, and the firms had to move to new waters.

Canning-factories.

In 1874 no less than 216,432 pounds of lobsters were canned at Carleton and Maria; but only 9,315 pounds at the latter place in 1875, and in 1877 none at Carleton. The factory at the latter place was completely given up. At the Magdalen Islands the Halifax concern opened establishments which rivalled in size the largest anywhere on the North-Atlantic coasts. It caught very large lobsters at first, and made enormous profits. The fish were too eagerly pursued, however; and the catch of 240,000 lobsters in 1876 yielded only 124,000 pounds of meat. In 1877 the firm's three establishments caught 692,760 lobsters; but the smaller size of the fish resulted in a product of only 227,104 pounds of canned meat; the large catch and the reduced size of the lobsters indicating a probable extinction of the fishery at an early day, unless measures are taken to give the grounds a rest, or protect the species from inconsiderate fishing. The eagerness with which the lobster has been and is fished in Canada is shown by the yearly increase of the catch after the Americans first resorted to the Nova-Scotian coast, by the decrease caused by excessive fishing, and by the revival of the business after the catch began in the Gulf of St. Lawrence. The figures are as follows: —

Decrease in quantity.

YEAR.	POUNDS (IN CANS).	VALUE.
1869	61,000	$15,275
1870	591,500	92,575
1871	1,130,000	282,500
1872	3,565,863	882,633
1873	4,864,998	1,214,749
1874	8,047,957	2,011,989
1875	6,514,380	1,638,659
1876	5,373,088	795,082
1877	8,090,569	1,213,085

There is no doubt but that the development of the business of lobster-canning in Canada has been due to the ruin of the New-England grounds by the Americans; but it is easy to foresee a rapid decline in the industry in the early future, unless inconsiderate fishing is restrained by the action of the government.

Decline of industry, unless the government interferes.

It was formerly the custom to chronicle a yearly decline of the fisheries of the various British provinces in America. Since 1869 the annals of the business show a yearly increase consequent upon the opening of new markets on shore *viâ* the Intercolonial Railway, and the ready market which has been found for Canadian fish abroad. The yearly product has nearly trebled since 1869, as will be seen by examining the following very interesting figures: —

Increase in fisheries since 1869.

1869	$4,376,526
1870	6,577,391
1871	7,573,199
1872	9,570,116
1873	10,547,402
1874	11,681,886
1875	10,350,385
1876	11,012,302
1877	12,034,952

The yearly export has grown very large. It amounted to $7,000,402 from Canada, and about the same from Newfoundland. The purchasers were the United States, South America, the West Indies, and Europe.

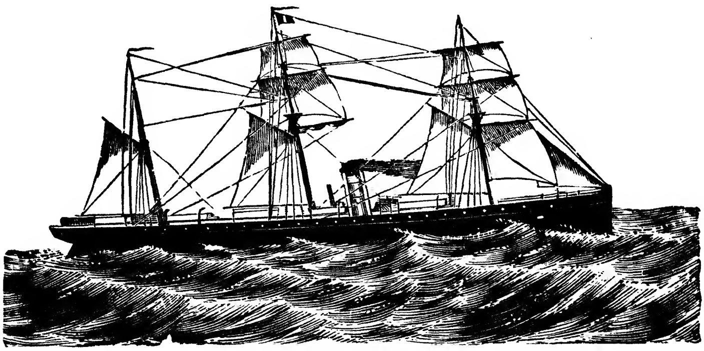
Action of Dominion Government.

The Government of the Dominion is taking intelligent and energetic action for the improvement of the fresh-water fisheries of Canada, some of which have become nearly extinct by the unceasing spoliation of many generations of men. It has now seven public establishments for the active reproduction of fish; namely, at Newcastle and Sandwich (Ontario), Tadousac, Gaspé Basin, and Restigouché (Quebec), Bedford in Nova Scotia, and Miramichi in New Brunswick. These hatching-houses are the means of placing about fourteen million young salmon, white-fish, and sea-trout in the rivers and lakes annually. The system, though well organized, is in its infancy. The results of its work are already gratifying: what will they not be in the future, when the work of the present produces its full effect, and the system is expanded and developed?

THE LUMBER-TRADE.

Extent and magnificence of Canadian forests.

The magnificent forests of Canada have long been the admiration of travellers and the pride of the people of the Provinces. They originally clothed nearly the whole surface of the country; and though now cleared away to a great extent along the Great Lakes and in the more thickly-settled regions of the country, yet they rear their heads in unbroken majesty in the valleys of the St. Lawrence and Ottawa and in the northern portion of the Province of Ontario, and cover hundreds of thousands of square miles of territory. Prior to 1759, when Canada, with its little population of sixty-five thousand souls, was transferred from the flag of France to that of England, the primeval forests of this region had hardly felt the settler's axe. Fishing, and the pursuit of forest-animals for their furs, were about the only occupations of the inhabitants. Occasionally a few ships were built; but the idea of felling the trees of the forests so as to clear up the land, or to transport it to distant lands where timber was scarce, never entered the heads of the people. The entire exportation of the country at that time amounted only to £115,415 a year, chiefly in furs and fish. After the English flag was unfurled over the Provinces, the influx of population caused some attention to be paid to timber-cutting; and after 1800 the scarcity of timber in England and in the West Indies led to the loading of ships with the products of the forests, and the transportation of them in considerable quantities to those parts of the earth. **Exportation of timber.** The trade became active in 1809, 1810, and 1811, owing to the duties levied by England upon timber from the countries of the Baltic. Those duties were imposed for the benefit of the British provinces in America; and the people of the latter took advantage of them, building a great many ships for the purpose, and freighting timber to the mother-country actively. The war of 1812 checked the business temporarily. The ships of the Provinces were in danger of capture by American privateers if ever they put out to sea; but, after the war, Canada was rewarded for her loyalty to England by regulations which permitted her timber, grain, and provisions to enjoy certain advantages in the trade to the British West Indies and the mother-country which were not



STEAMSHIP. — ALLAN LINE.

accorded to those of the United States. The trade became active again, and has remained so ever since, the market for Canadian lumber widening year by year, extending to South America and elsewhere, until the forests of the Provinces became one of their principal sources of wealth. In 1842 the duties on timber in England were changed. Baltic timber had been taxed a duty of fifty-five shillings a load, and Canadian timber ten shillings. In 1842, at the time England was remodelling her whole commercial system, the duty on Baltic timber was reduced to thirty shillings, and that on Canadian to one shilling. The change alarmed the lumbermen of Canada, who feared the ruin of their business. **Effect of lower duties.** It turned out to be a great help to them, however; and, in place of ruining the market for Canadian lumber, it stimulated the market instead. The lowering of the duties cheapened the selling-price of lumber, and caused a greatly-increased consumption; and the difference of duty in favor of Canada gave the timber from that region the preference in the market. In 1872–73 the exportation had reached the enormous figures of $28,586,816 in one year. Within the last five years the sales of Canadian lumber have fallen off considerably. This is due chiefly to the general stagnation of business the world over, but partly to the abrogation of the reciprocity treaty. The depression in the business can be considered only as temporary. The exportation still remains at the very high figure of $20,000,000 a year.

Statistics of production.

There is no means for stating accurately the present production of forestry-products in Canada; but the timber cut and sawed into lumber cannot be less than 320,000,000 cubic feet in quantity. In 1870, according to the census, the production was as follows: —

	CUBIC FEET OF SQUARE PINE.	CUBIC FEET OF SQUARE OAK.	CUBIC FEET OF TAMARACK.	NUMBER OF PINE LOGS.	NUMBER OF OTHER LOGS.	CUBIC FEET OF MISCELLANEOUS TIMBER.
Ontario . . .	16,315,901	3,144,554	1,223,444	5,713,204	1,255,090	10,590,943
Quebec . . .	9,223,575	53,635	3,994,878	5,011,532	3,628,720	10,414,710
New Brunswick .	391,059	7,360	360,825	1,214,485	3,533,152	2,192,608
Nova Scotia .	260,658	96,494	116,816	477,187	897,595	3,088,003
Total . .	26,191,193	3,302,043	5,695,963	12,416,408	9,314,557	26,290,264

To which are to be added 1,939,000 cubic feet of maple, and 1,832,000 of elm. The standard log is twelve feet long and twenty-one inches in diameter. The above figures would make the product for 1870 about 412,945,903 feet. The production was one-third larger in 1873; but it has since fallen slightly below the figures for 1870.

Varieties of timber.

The principal trees are the magnificent white-pine (which often grows to a height of two hundred feet, and affords a square log sixty feet long and twenty inches in diameter), the red-pine, the white-oak, tamarack, elm, beach, walnut, cedar, maple, bird's-eye and curled maple, and ash. The sugar-maple is a prominent feature of Canadian woodlands; but it is too valuable a tree for its sugar to be felled for its timber. A cluster of sugar-maples is a valuable addition to a farm; and so much is this tree prized and utilized in Canada, that the product of sugar from it in Canada in 1871 amounted to 17,267,000 pounds. A single tree yields two or three pounds in a spring; and a single farmer will often make 2,000 pounds of it, worth ten to thirteen cents a pound. The timber-districts are all owned by the government.

How right to cut timber is obtained.

The manufacturers obtain the right to cut timber by purchasing a "berth," or "limit," at public auction, getting possession in this manner of a tract of land at a cost of a dollar to a dollar and fifty cents per square mile. He becomes the tenant of the government at a fixed rate, and, in addition, pays a slight duty per cubic foot of squared timber cut, and on each standard log. About twenty-five per cent of the timber cut is square; about forty per cent is in logs; and thirty-five per cent is underbrush, or useless or damaged wood.

Lumbering is carried on at present chiefly in the valleys of the Ottawa and St. Lawrence, the operations being on the largest scale in the former. The large lumber-factories of the Ottawa, especially those of the Chaudière, severally get out from 25,000,000 to 40,000,000 feet of lumber in a year, and employ 800 men and 300 teams throughout the year. The Gatineau Mills at Chelsea have "limits" covering 1,700 square miles, and employ 1,000 men in winter and 500 in summer, producing 35,000,000 feet of lumber annually. The business is carried on at great expense. Men, horses, and oxen have to be transported into the forest to the proper point for operations, and camps built for them, and material accumulated for their support during the long season of felling and hauling. Hay is purchased as near to the camps as possible; but, as it has to be hauled a long distance into the forest to reach the camps, it is never obtained except at a very costly rate. The supplies for the men consist of salt pork and beef, peas for soup, tea, flour, potatoes, beans, and onions. The fare is simple; but it is of the best quality, because the men are fastidious, and will take nothing that is inferior. Spirits are seldom if ever introduced to the camps. The camps consist of log and board shanties capable of containing from twenty-five to fifty men apiece. The only opening through the walls is the doorway. There are no windows, and no chimney. To compensate for the lack of these architectural features, a large opening is left in the roof, which is chimney, window, and ventilator all in one. Three sides of the shanty are occupied by sleeping-berths, and the fourth by that important and much-respected personage the cook, with his tables and apparatus. The fire is built in the middle of the floor, *à la mode* Alaskan; and the kettles are suspended over it from the iron crane in the opening in the roof. In this airy and healthy style of house the hardy wood-choppers pass their leisure hours between the intervals of work. They smoke, read, play cards, spin long yarns, and comport themselves in the most rational, law-abiding, and God-fearing manner possible. When the camps have been prepared, the stores accumulated, the roads cut down to the river or some stream emptying thereinto, and all made ready for work, the regiments of wood-choppers are brought up from the settlements, and work begins.

Lumber-factories.

Gatineau Mills.

Food and camps of lumbermen.

The land is not cleared entirely of timber, as is popularly supposed. There is no object in doing that. It is only the farmer, who wants a field devoid of shade and of roots, who completely clears the soil. The choppers select only the best trees. The small ones are as worthless to them for timber as freshly-hatched goslings for feathers. They pass the small trees by; and the consequence is, that the forests renew themselves every fifteen years. The danger of an exhaus-

Only the best trees are selected.

Renewal of forests.

tion of the timber-supply is not, therefore, so great as is supposed. The destructive fires which sweep through these primeval groves in dry seasons threaten the timber-supply to a far greater extent than does wood-chopping.

When the trees are felled, the logs are marked with a brand, or slash, peculiar to the manufacturer who is working the "limit." They are then hauled down to the river, and set afloat. They float down stream (if in the Ottawa) to the Chaudière, where they are caught by a boom stretched across the river, and guided into ways leading to the saw-mills of their respective owners. A common sight in the lumber-regions is to see a huge raft of logs securely bound together, sometimes containing a hundred and fifty thousand cubic feet of timber, coming down stream in compact array. It is organized like a brigade of troops, the logs being joined together in "draws," or sections, each one in charge of its special gang of men, and these sections, in turn, united into a great raft. At every considerable rapid the raft is dispersed into its component draws, which are taken down the rapids singly. At the foot of the fall they are again joined, and the raft glides on gracefully down stream, fluttering with banners and covered with shanties, and with camp-fires burning brightly on earthen hearths. Sometimes the logs are sent down in confused rafts, or drives, being carried down from the heart of the woods by the spring freshet, which follows the melting of the snow. In these instances the logs come down stream in terrific fashion, thousands upon thousands at a time, tumbling and turning upon one another at the rapids, getting jammed here and there into tremendous masses, requiring the desperate efforts of the men to liberate them again with their iron-shod poles, and then shooting down stream again with the roar and rush of a cavalry charge, until they reach some broad, calm sheet of water, where they slacken their pace, and submit to be caught by a boom, and directed peacefully here and there to the respective saw-mills to which they belong.

Rafts.

These great forests, which were formerly esteemed only as the haunts of game which were prized for their fur, and were threaded only by daring adventurers in pursuit of these animals, are now justly regarded as a mine of wealth to the people of Canada. They exercise a great influence on the general prosperity of the country. They employ 11,000 men every year in wood-chopping, and the saw-mills employ 40,000 more. They yield hundreds of thousands of dollars' worth of produce annually in the form of ashes and bark, the gathering of which employs another large body of men in profitable industry. The distribution of the enormous quantity of $20,000,000 to $28,000,000 worth of timber to foreign lands annually engages the services of hundreds of ships with their crews of mariners, and contributes largely to traffic of important lines of railroad. The government derives a revenue from the business, and farmers adjacent to the lumber-districts find a most profitable market for their produce in supplying the camps and villages with

Canadian forests a mine of wealth.

A source of revenue to government.

needed stores. The business quickens twenty other trades, and, like the sun, gilds every interest which comes within the reach of its rays. With regard to the future, nothing can be said on the subject which would be better than the following words from a statement by the Mercantile Agency of Dun, Wiman, & Company, printed in January, 1877, summing up the business-outlook in Canada: "This particular asset in the nation's wealth" [the timber-region] "is gaining in value with a rapidity hardly dreamed of, and the realization of which is only a question of time. So scarce has accessible and marketable lumber become, that it is alleged that plots of land, now cleared farms, with all appliances, are really less valuable than if the trees stood in undisturbed majesty thereon. Even certain towns in former lumbering-districts would bring less than if the land they occupy were covered with pine-forests. Over-production has cheapened this great staple, and the waste of years may well be atoned for by a few years of cessation and depression. Nothing will eventually be lost by this delay in realization: indeed, the yearly gain in value of this valuable product will more than compensate for what appears to be loss and disaster at the present moment."

Future of this industry.

MINING.

A large part of the territory of Canada is valuable only for its mineral resources, this being more especially the case with the region lying along the shores of Lake Superior. The Ottawa Valley is also rich in minerals. New Brunswick and Nova Scotia have iron and coal in immense quantities, in close proximity to each other and to the limestone required in the process of iron-smelting for flux. The Rocky Mountains are full of the most important commercial ores, and British Columbia has an endowment in this direction which would make the everlasting fortune of any country with plenty of population and capital. Nevertheless, the mining-industry in Canada is more a matter of the future than of the present. Scarce any thing has been done toward utilizing the vast stores of mineral wealth which lie buried in the rocks and mountains of the country. It is not even yet accurately known what that mineral wealth is in its character and full extent, except in a general way. It is only known that the endowments of the country by nature are such, that at a future day Canada will bring to bear a heavy competition against the United States and England for the supply of the world's market with iron and the other commercial metals.

Richness of country in mineral wealth.

Quebec and Ontario have no coal; but there are rich deposits of this fuel in the maritime provinces, in Manitoba, the North-west Territory, and British Columbia. The principal mining of coal takes place at present in Nova Scotia. The mines there have been worked for a long period; and the production is now very large, amounting in 1875 to 781,165 tons, and in 1877 to 757,496 tons. About one-third of the product

Coal-mines of Nova Scotia.

is exported to foreign countries. In British Columbia, 154,052 tons of coal were mined in 1877. The mines are on Vancouver's Island; and the mineral is in very high esteem on the Pacific coast for gas, factory, and household purposes. Its principal market of sale is the city of San Francisco.

Export of product.

Iron is mined chiefly in the Ottawa Valley, in Nova Scotia, and in the vicinity of Lake Superior. In the first-mentioned region, magnetic ore of the best quality is found in all the mountains on the north side of the river. The proportion of magnetic oxide in the ore is about ninety-three per cent, and the yield averages sixty-nine per cent of metallic iron. It is said that this valley produces a car-wheel iron which has no superior in America. The metal has been used for that purpose at Toronto, and Cleveland, O., and is valued for its tenacity and durability. The region is so overgrown with forests, that the full extent of the mines is not known; but that the quantity of iron which can be taken out is enormous is apparent from the prodigal abundance in which it has been found wherever sought for. In places it lies upon the ground in blocks large and small, and the strata of the mountains wherever opened are seen to be full of valuable veins. A fire which burned off the woods in 1871 disclosed the existence of a hundred million tons of iron ore in one hill. The only mines which are being worked at present are in the township of Hull, at the village Ironsides. The situation is somewhat remote from the principal markets; but it is very favorable for manufacturing. Labor is cheap, water-power is abundant, and fuel costs scarce a song. This region is known to contain plumbago, kaoline, lead, and pyrites, as well as iron; but these minerals remain undisturbed in the beds where they were deposited by the volcanic forces of the early ages of the world. In Nova Scotia the production of iron ore is from fifteen thousand to twenty thousand tons yearly, it being consumed almost entirely in the blast-furnaces of the iron and steel company at Londonderry. Notwithstanding the great resources of Canada in respect to iron, the manufacturers still continue to import a large part of their pig-iron, rather than make it at home. The whole iron-industry, in fact, is only in the very first stages of development. About twenty blast-furnaces, a few forges, two rolling-mills, and two steel-works, substantially comprise the iron-enterprises of Canada; and in 1877 only half of these establishments were in operation. Recently mining-operations have been begun energetically at the Snowdon mine, in Ontario; the intention of the proprietor, Mr. Myles of Ontario, being to take out thirty thousand tons in 1878, and smelt the ore at Port Hope. He has a contract with an American firm for the purpose.

Iron.

Extent and superiority of ores.

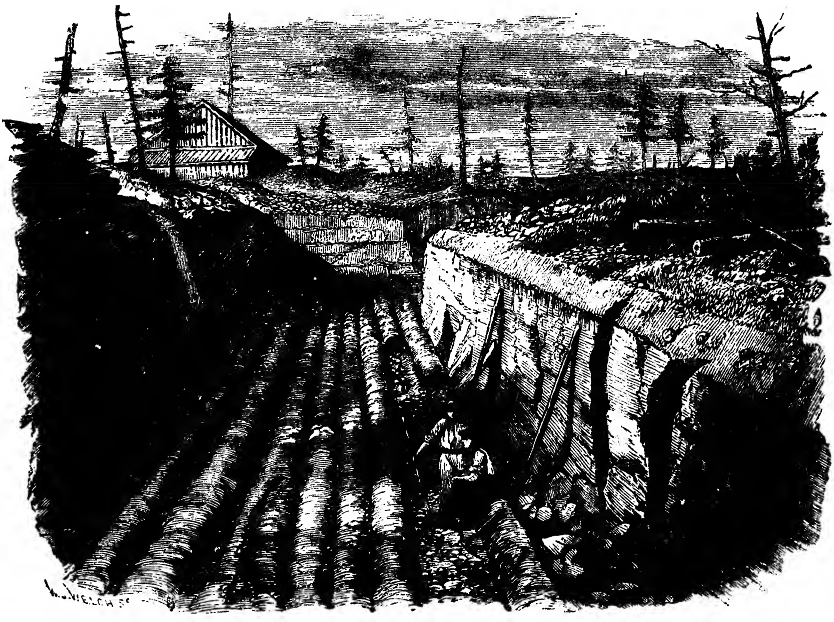
Production of iron ore in Nova Scotia.

The Snowdon mine.

Silver.

Silver ores are found in the Province of Quebec, and have been worked for many years. Recently, still richer ores have been found in the Lake-Superior region. They have yielded wonderful results. The region is now being carefully surveyed by the officers of the government, with a view to ascertain more fully its capabilities. Gold, which, up to 1870, was found almost exclusively in Nova Scotia (the few ounces gathered yearly in Ontario and Quebec hardly deserving mention), is now known to exist in large quantities in this same region north of Lake Superior, which is so rich in all the metals, that it would almost seem as if, in some great war of the Titans against heaven, the gods had rained mountains of iron and gold and silver and copper upon this region in the effort to exterminate the rebellious giants who inhabited it. Extensive tracts of gold-bearing quartz are reported. Within the basin of the Nipigon, a hundred and seventy

Gold.



CORRUGATED GOLD-QUARTZ, WAVERLEY.

miles long and eighty miles broad, the upper copper-bearing series obtains its greatest development. Distinct belts of the rock extend along the line of the lake to Thunder Bay and Fond du Lac; and in one of these, called the Lake-Shebandowan band, the gold-bearing rock is found. Gold-bearing veins are reported at Cross Lake, on the Red-River route. Rich copper-regions are reported still farther to the west. These mines nearly all await the pick and gunpowder.

Copper.

Among the other mineral resources of Canada are zinc, cobalt, manganese, gypsum, granite, sandstone, marbles of every imaginable color, slate, and petroleum. A magnificent display of specimens of

Zinc and other metals.

these and all other metals and minerals of Canada was made at the Philadelphia Exhibition in 1876. The following is a statement, from the census of 1871, of the raw mineral product of Canada for the year, the principal items alone being given: —

Statistics of production.

	IRON ORE, TONS.	COPPER ORE, TONS.	COAL, TONS.	PEAT, TONS.	GOLD, OZ.	SILVER, OZ.	PYRITES, TONS.	MANGANESE, TONS.	GYPSUM, TONS.	PETROLEUM, GALLS.	STONE FOR DRESSING, CUBIC FT.
Ontario .	30,726	1,934	......	.....	199	69,197	500	...	4,230	12,969,435	2,093,711
Quebec .	92,001	11,326	......	14,597	341	......	2,300	...	.....	....	1,674,362
N. Brunswick . .	3,070	50	13,502	160	.....	......	.....	475	13,659	....	810,552
N. Scotia,	3,566	......	657,506	15	19,331	......	.....	160	96,544	....	628,171
Total .	129,363	13,310	671,008	14,772	22,941	69,197	2,800	635	114,433	12,969,435	5,206,796

What a pity that by the side of this modest statement cannot be placed the figures of the mineral product of Canada a hundred years hence, when the mining-industry of the region will have grown from the squads of the scattered recruiting-sergeants to a grand army planting its banners on all the fortresses of trade, and by its achievements winning the applause and respect of the whole world! Of course, the figures for 1877 are somewhat better for all the classes of product mentioned, except petroleum; but they do not change the embryonic character of the industry, and would not make a comparison with the product of a hundred years hence any less interesting. With reference to petroleum, it may be said that the product is falling off, owing to the exhaustion of the wells. The manufacture in the fiscal year of 1872–73 was still 12,168,406 gallons: but in 1874–75 it was only 4,009,663; and in 1875–76, 4,838,215.

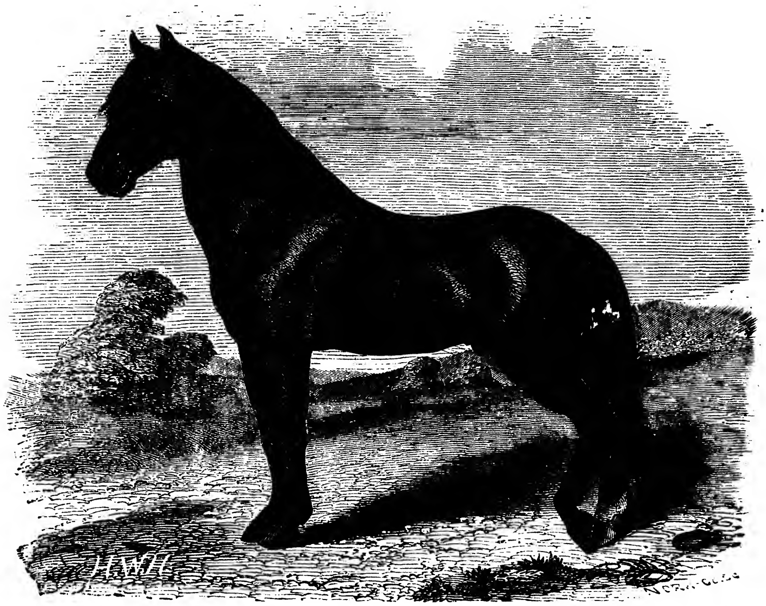
Future developments of mineral wealth.

FARMING.

The vast territories of the Dominion of Canada, stretching northward from the United States, and comprising an area larger than that of the United States leaving out Alaska, and not much smaller than that of Europe, is popularly regarded, by most people who reside beyond their borders, as delivered over to the austerities of a barren soil and an inhospitable climate. The old stories that used to circulate in Europe and elsewhere about the Canadian winters have turned millions of people, seeking a home in the New World, away from the regions north of the lakes to the broad and fertile States lying south of them. The Canadians, it was supposed, would have to dress in furs, and live by timber-cutting, trapping, and fishing. There never was a more idle fiction. No doubt a large part of the territories of the Dominion in the extreme north are characterized by long and dreadful winters, short summers, and unfruitful soils: but, on the other hand, the

Extent of territory.

fact has been repeatedly recognized in debates in the American Congress, that Canada is, in that respect, no worse off than the United States, whose dry and burning plains in the Far West appear almost beyond the power of man to reclaim; whereas these same plains, upon passing into Canada, change their character. The Rocky Mountains, being less elevated, and having a narrower base, admit the passage of clouds from the Pacific Ocean; and the fertilizing showers descend upon that happy region which are withheld from the plains in America. At the same time, the isothermal line of 60° for summer — which, in the eastern provinces, is no farther north than about the forty-eighth parallel — rises on the Canadian plains to the sixty-first parallel. The



CANADIAN HORSE.

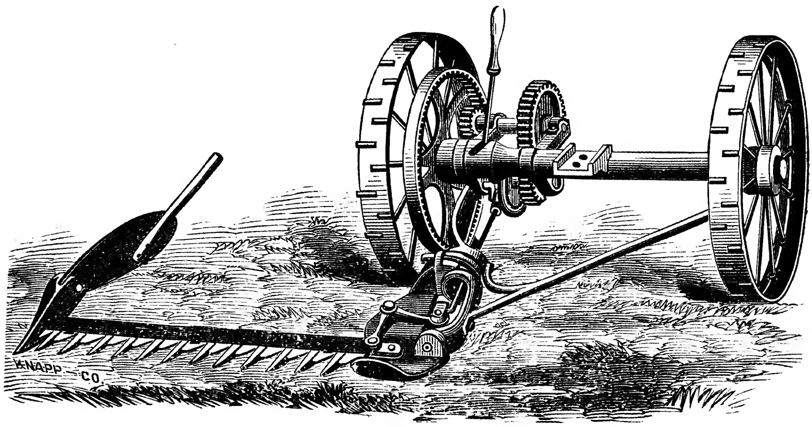
soil is rich; and thus, for a distance of twelve hundred miles northward from the boundary of the United States, there stretch vast plains, upon which wheat, barley, the grasses, and many root-crops, will thrive bounteously. In Ontario, Quebec, and the maritime provinces, the land and climate are well suited to agriculture; and farms are seen in every part of the inhabited portions of the Provinces, as fertile, thrifty, and well kept as anywhere on the continent. With the exception of Labrador and the extreme north, the whole territory of Canada is equipped with rich lands and a pleasant climate. Its agricultural capacity is simply enormous, and the value of the unoccupied regions is incalculable.

Vast area capable of cultivation.

Agriculture began to be practised in Canada on a liberal scale about the time of the war for American independence. That war caused an influx of population from the States which had formed the American Union; and, as has been already stated, the population of Canada were rewarded for their loyalty to the king, both during that war and the one of 1812, by special privileges in supplying the West Indies and England with grain, provisions, and lumber. This was a great encouragement to farming both in the maritime and upper provinces. After

Beginning of agriculture.

Immigration in 1872.



CANADIAN MOWING-MACHINE.

1812, considerable immigration to Canada took place. The whole population of the region had been, in 1790, only about 200,000; but in 1825 what are now the Provinces of Ontario and Quebec alone had 637,000. The country after that filled up very fast. In 1871 the population of Canada was 3,602,321, it being distributed as follows: —

Population of country in 1790.

Ontario	1,620,851
Quebec	1,191,516
Nova Scotia	387,800
New Brunswick	285,594
Manitoba	11,593
British Columbia	10,586
Prince Edward Island	94,021
Total	3,602,321

Increase of farmers.

A very large proportion of the incomers to Ontario and Quebec went immediately into farming, and agriculture was inspired with fresh life in all of the Provinces. In 1854 occurred an event which was a great stimulus to this interest. A treaty of reciprocity with America was entered into, being signed by the Earl of Elgin for Canada, on the 5th of June of that year. This opened to Canadian farmers a market for their produce such as they had never known. A de-

Reciprocity treaty of 1854.

mand for barley suddenly sprang up, and the cultivation of that grain spread rapidly throughout the grain-growing counties. Barley almost excluded wheat from among the list of Canadian crops. The wheat-crop of 1856 had been a failure, and farmers were discouraged with the idea of planting it. They raised barley instead, buying wheat and flour from the United States. The war of 1861 in the United States then broke out, and the era of high prices began. The treaty was abrogated in 1866, but the high prices continued; and until 1873, when the financial crash took place, or, in other words, for a period of nearly twenty years, Canadian farmers had the benefit of the most lucrative market in the world for the sale of their barley, wheat, dairy-produce, and other goods. During that period agricultural exhibitions were instituted. Dairy-farming, with its concomitants of butter and cheese factories, was developed. Ontario went largely into the pork-packing business. So profitable did farming become, that farms rose to the value of a hundred dollars an acre. Since 1873 it has been found necessary to seek a larger market for the surplus produce of Canada in South America, Europe, and the Indies. The market has been found, however; and Canada has no more difficulty in disposing of her grain and provisions than before, though the prevalent depression of prices prevents her from obtaining the bounteous profits of the era of war and reciprocity. One of her best customers is England.

The barley-crop.

Abrogation of treaty in 1866.

Prosperity of farmers for twenty years preceding 1873.

Their progress since 1873.

It is regretted that there are no later returns than those of 1871 in regard to the total product of this interest. The figures for that year, however, serve to give a fair idea of what the farmers of Canada are doing. They are as follows:—

Statistics for 1871.

	WHEAT (BUSHELS).	BARLEY (BUSHELS).	OATS (BUSHELS).	RYE (BUSHELS).	BUCKWHEAT (BUSHELS).	CORN (BUSHELS).	POTATOES (BUSHELS).	HAY (TONS).	MAPLE-SUGAR (POUNDS).
Ontario . .	14,233,389	9,461,233	22,138,958	547,600	585,158	3,148,467	17,138,534	1,804,476	6,247,442
Quebec . .	2,058,076	1,668,208	15,116,262	458,970	1,676,078	603,356	18,068,323	1,225,646	10,497,418
New Brunswick.	204,911	10,547	3,044,134	23,792	1,231,091	27,658	6,562,355	344,793	380,004
Nova Scotia .	227,497	296,050	2,190,099	33,987	234,157	23,349	5,560,975	443,732	151,190
Total . .	16,723,872	11,406,038	42,480,453	1,064,358	3,726,484	3,802,830	47,330,187	3,818,641	17,276,054

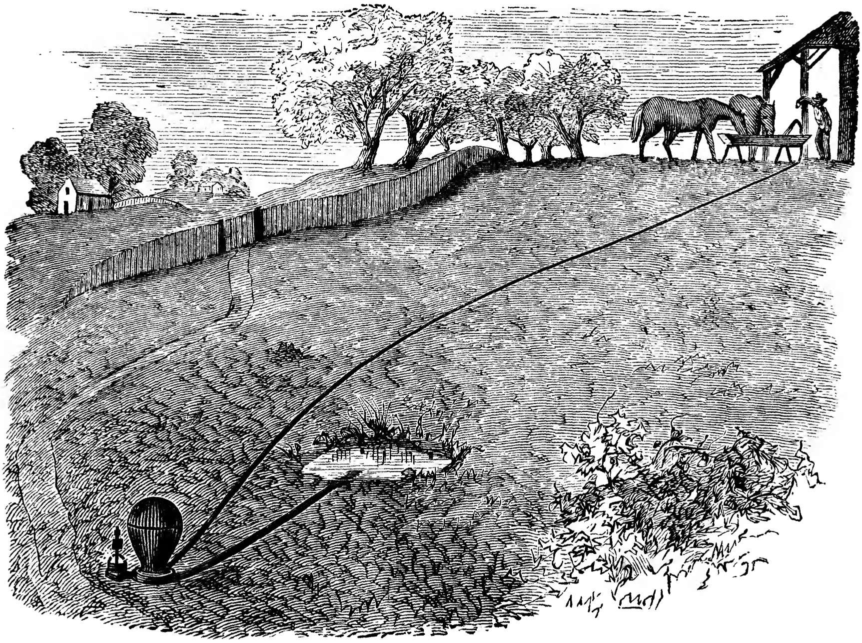
A few later figures are the following: In 1875 the splendid wheat-crop of that year made the production for the fiscal year ending June 30, 1876, as much as 26,834,680 bushels, of which 8,600,000 bushels were exported in flour and grain. The pork-packing of 1876 was 244,742 head, making about 38,000 barrels of pork.

Wheat-crop for 1875.

In regard to dairy-produce, Canada now fully supplies her own market

Dairy-produce.

Townships on the border of the United States buy a small quantity of American butter and cheese; but the whole quantity of both will not exceed 250,000 pounds, and is too insignificant almost for mention. On the other hand, the export of both of these articles is now very large, showing how admirably the interest has been developed, and what a



FARM-SCENE.

large surplus Canada produces beyond the demands of her own consumption. The increase of the export of cheese has been due to the attention paid to the factory-system. The exportation has been as follows: —

YEAR.	BUTTER (POUNDS).	CHEESE (POUNDS).
1869	10,853,268	4,503,370
1870	12,259,887	5,827,782
1871	15,439,266	8,271,439
1872	19,068,348	16,424,025
1873	15,208,633	19,483,211
1874	12,233,046	24,050,982
1875	9,268,044	32,342,030
1876	12,392,367	35,024,090

The export price of butter has remained at an average from nineteen to twenty-one cents and a half; and that of cheese, from eleven to twelve cents and a quarter.

The principal development of the factory system in Canada dates from 1871. The success of a few factories which had been tried led to the rapid building of a large number of others. The system everywhere met with the support and encouragement of farmers, who soon came to discover, that by clubbing together, and building a factory to which the milk could be sent for conversion into cheese, they could save themselves the expenditure of much time and labor, and get in return, perhaps, a better quality of cheese than if they had made it themselves. The Province of Ontario has been the most active in the building of factories; and its yearly conventions of factory-men, farmers, and scientists, interested in cheese and butter making, are among the most valuable and interesting of the meetings which take place in the province. Canadian cheese has, by means of the attention paid to its manufacture, now attained a reputation in the commerce of the world which is unsurpassed. At the Philadelphia Exhibition it made a decided sensation, and the demand for it in Europe is increasing every year.

Introduction of the factory system.

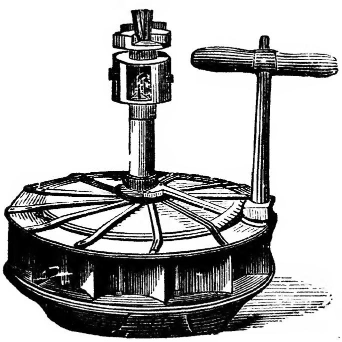
The total exportation of farm-products from Canada now, including live cattle and horses, meats, and wool, amounts to the very large sum of $30,000,000 to $35,000,000 annually.

Farm-products.

MANUFACTURING.

With reference to general manufacturing, it may be said that the Canadian provinces have had essentially the same experience as all agricultural and maritime states since the world began. The people have followed the pursuits which required the least expenditure of toil, and those which the natural resources of the country suggested the most directly; and these were, in Canada, fishing, lumbering, and farming. Some parts of the Dominion are still only one step removed from this original and natural condition of things, in which the large body of the population are sustained by open-air pursuits. The most extreme instance is the case of Newfoundland, which has no manufactures except those simple and necessary arts of carpentry, blacksmithing, &c., without which the fishery-business could not be carried on. It has no general manufacturing whatever. Nova Scotia and New Brunswick occupy the first terrace above the position of exclusively agricultural, fishing, mining, and timber-cutting provinces. They are supplied with nearly all the ordinary shops for the manufacture of carriages, boots and shoes, clothing, machinery, iron-work, furniture, and other articles of general consumption, which the Provinces require; and they have, besides, a cotton-factory or two, iron and steel rolling-mills, large ship-yards, and other establishments, the operation of which requires large capital, and great manual skill on the part of the working-men. The two more densely-settled Provinces of Ontario and Quebec are also well supplied with the shops needed for the production of articles of common use. They have in addition made a considerable advance into the field of general manufacturing, and have now fully laid the foundations of that which will become, following the growth of the country, a great and thriving national industry. They have cotton and woollen factories, chemical-works, distilleries, machine-shops, locomotive-works, great carriage and agricultural-implement factories, and many other of the higher and more important classes of establishments. They have not factories enough yet fully to supply their own market with cloth, manufactured iron and steel, cutlery, fancy-goods, glassware, railway-material, and many other things which their high civilization demands; but neither has their neighbor the United States, which is far more populous, and has far more capital. The Canadians are ambitious, and are not content with the situation, when they reflect that they are obliged to import about $70,000,000 of manufactured goods every year to supply the deficiencies of their own production. They are anxious for a policy which shall bring about a more rapid building-up of their own factory-interests. Their spirit in regard to the matter is that which always moves a free, intelligent, progressive race; yet it must be said that the development thus far is commendable, and will compare favorably with that of any other agricultural people.

Provinces of Ontario and Quebec farthest advanced in manufacturing.



TURBINE-WHEEL.

Annual importation.

Desire of people to promote domestic manufactures.

The following table shows the degree of development which the industries of Canada had obtained in 1871, the year of the census: —

	CAPITAL.	EMPLOYEES.	WAGES.	RAW MATERIAL.	PRODUCT.
Ontario . . .	$37,874,010	87,281	$21,415,710	$65,114,804	$114,706,799
Quebec . . .	28,071,868	66,714	12,389,673	44,555,025	77,205,182
New Brunswick .	5,976,176	18,352	3,869,360	9,431,760	17,367,687
Nova Scotia . .	6,041,966	15,595	3,176,266	5,806,257	12,338,105
Total . .	$77,964,020	187,942	$40,851,009	$124,907,846	$221,617,773

The product increased considerably during the three years following the census.

Among the largest items in the list of manufactures in 1871 were the following: —

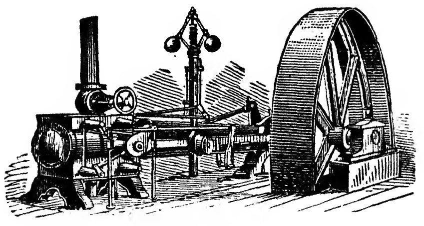
	NUMBER OF FACTORIES.	EMPLOYEES.	VALUE OF PRODUCT.
Boots and shoes	4,191	18,719	$16,133,638
Furniture	854	4,366	3,580,978
Carriages	2,636	7,798	4,849,234
Flour	2,295	4,992	39,135,919
Machinery and castings	430	7,653	7,325,531
Leather	1,142	4,207	9,184,932
Ships	252	6,046	4,432,262
Spirits	20	467	4,092,537
Ale and beer	137	918	2,141,229
Woollen cloth	270	4,453	5,507,549
Woollen cloth (home-made), about	....	.....	7,000,000
Sawed lumber	5,254	35,681	30,256,247
Chemicals	....	.....	816,250
Engines	....	.....	1,044,000
Paper	....	.....	1,071,651
Ropes and cordage	....	.....	769,000
Musical instruments	....	.....	622,162
Carding and fulling	650	1,224	2,253,794

Beginning of period of active development.

The period of active development of general manufacturing began in 1855 with the reciprocity treaty; but was not due to that treaty, however, except in part. The years of 1855 and 1856 were those in which the Grand Trunk Railway was building, — a road which it cost a hundred and five million dollars to get into complete operation. The enormous sums spent by the Grand Trunk Company among the people, the employment it gave to all the spare labor of Canada, the heavy importation of working-people from the Old World to assist in constructing the road, and the shops built to supply the road with material, gave a tremendous stimulus to every business-interest in Canada. In 1859 the protection principle was infused into the tariff of Canada by Mr. Galt; and after 1861 the farmers of Canada became extremely prosperous by reason of the large prices they were obtaining for their produce in America under the reciprocity treaty, thus enabling them to become good customers in the purchase of manufactured wares. These things all assisted Canadian industry. Factories sprang up throughout the Provinces like magic; and the period was one of universal activity, bustle, and prosperity. In 1866 the reciprocity treaty was abrogated. This, in its nature, was a blow at Canadian interests. It certainly was so regarded north of the St. Lawrence and the lakes. It cut off the ready and profitable market the farmers had for so long enjoyed, and placed them

Tariff of 1859.

under great disadvantages for the sale of their produce. It is well known that whatever seriously affects the farming community quickly re-acts upon every other occupation in the country. The ill effect of the abrogation of the treaty was, however, averted by prompt action on the part of the people of the Dominion. With true northern vigor they set on foot compensatory measures, and industry and agriculture continued to thrive side by side. What was done is referred to by Sir Edward Thornton, in his "Memorandum of Commercial Relations" submitted to the government at Washington in April, 1874, as follows: —



CORLISS ENGINE.

Vigor displayed in building up manufactures.

"The industry of Canada had been largely attracted to the supply of the American market with commodities for home consumption as well as for foreign exportation; and the repeal in 1866 of the reciprocity treaty, under which so vast a trade had grown up, rendered imperatively necessary prompt measures to open new markets for the sale of Canadian produce. These measures were at once taken. Under the influence of the formal notice given by the United States, in 1865, of their intention to terminate the treaty, confederation of the Provinces, then under discussion, was hurried up, and became a *fait accompli* within fifteen months after the repeal. The Intercolonial Railway was at once undertaken, at a cost of over twenty million dollars, at the national expense, to secure direct communication to and from the Atlantic Ocean at Halifax and St. John on Canadian soil. Commissioners were despatched to the British and other West-India islands, and to the South-American States, to promote the extension of direct trade between them and the Dominion. The enlargement of the canals, and the improvement of the navigation of the lakes and the River St. Lawrence, the construction of the Bay-Verte Canal to connect the waters of the Bay of Fundy and the St. Lawrence, the subsidizing of ocean and river steamship lines, and the promotion of the great ship-building and fishery interests, all received a new and vigorous impulse."

Construction of Intercolonial Railroad.

The building of the Intercolonial Railroad was alone, for a time, a great compensation for the repeal of the reciprocity treaty. At one time, in 1871, there were employed in the construction of it 133,694 men and 11,960 boys, 29,426 horses, and 324 oxen. The huge sums disbursed in Canada for the labor of creating this road and its plant did much to atone for the loss of free markets in America. Another cause operated concurrently with those above mentioned to sustain Canadian industry during this period. The state of affairs in America, under the influence of a heavy internal taxation, a protective tariff, and the speculative prices which grew out of the war, gave to Canada what Mr. Thomas White, jun., calls "an absolute, entire, and complete protection of all the industries of the country." In order to induce the maritime provinces to unite in the confederation, the protective duties introduced by Mr. Galt were lowered almost to a free-trade basis, — to a low-tariff basis, at any rate. But the high cost of labor and materials in the United States saved Canada from American competition; and so her industries went on expanding and thriving in spite of the repeal of 1866, which seemed so much against her.

Manufacturing interests since 1873.

Since 1873, manufacturing in Canada has encountered the same re-action as it has in other parts of the world. The collapse of speculation and unsettling of the markets have, however, been met with the same pluck and energy which characterized the Canadians in previous crises. Manufacturers have reduced expenses and production to give the markets a chance to recuperate, and they have been exceedingly wide-awake in the matter of opening up new fields for the sale of their wares. They were present at the Philadelphia Exhibition in force, and made a display of goods which attracted marked attention. Their whole exhibit of agricultural tools was bought by the Australian commissioners for transportation to Australia. This was followed up by the Canadians sending a ship or two to Sydney direct, loaded with goods for the great Exhibition there, and for sale. They made a better show in that Exhibition than the Americans did, and they have been active ever since in working up that market. They have also paid fresh attention to South-American and Indian markets, and are leaving no stone unturned to find a place where Canadian goods can be introduced, and their sale made to yield a profit. When business revives, they will be in a most admirable position to catch its first and best fruits.

Sydney Exhibition.

Ship-building.

One of the most characteristic of Canadian industries is ship-building. The practice of the art by that people is historic, it having come down from the earliest times. The bulk of the building is done in the maritime provinces and on the Gulf of St. Lawrence, where the facilities for it are better than in any other part of the country, and where the fisheries make constant demands upon the yards. In 1871 the distribution of the yards was as follows: —

	NUMBER OF SHIP-YARDS.	WORKMEN.	VALUE OF PRODUCT.
Ontario	19	450	$359,212
Quebec	43	2,164	1,351,416
New Brunswick	78	1,364	1,086,714
Nova Scotia	112	2,058	1,634,920
Total	252	6,046	$4,432,262

In 1877 the number of vessels built in Canada was 508, of which 365 were launched in New Brunswick, Nova Scotia, and Prince Edward Island. This refers simply to vessels large enough to be registered. There were built in addition a large number of small boats for fishing-purposes alongshore, the production of which may have been as many as 2,000, there being built four of these independent small boats on an average to one of the registered craft. The figures for Newfoundland are not at hand. Of the 508 vessels built in 1877, 110 were sold to foreigners. The Canadian ships are generally built of soft wood, — that is, spruce, hackmatack, and pine, — in distinction from oak, the latter wood being the more common wood in American ships. They are good sailers, and last for from twelve to fifteen years. The Canadian merchant-marine in 1871 included 5,672 vessels, 399 of them being steamboats, and 2,019 barges.

Ships built in 1877.

Electrotyped and Printed by Rand, Avery, & Co., Boston