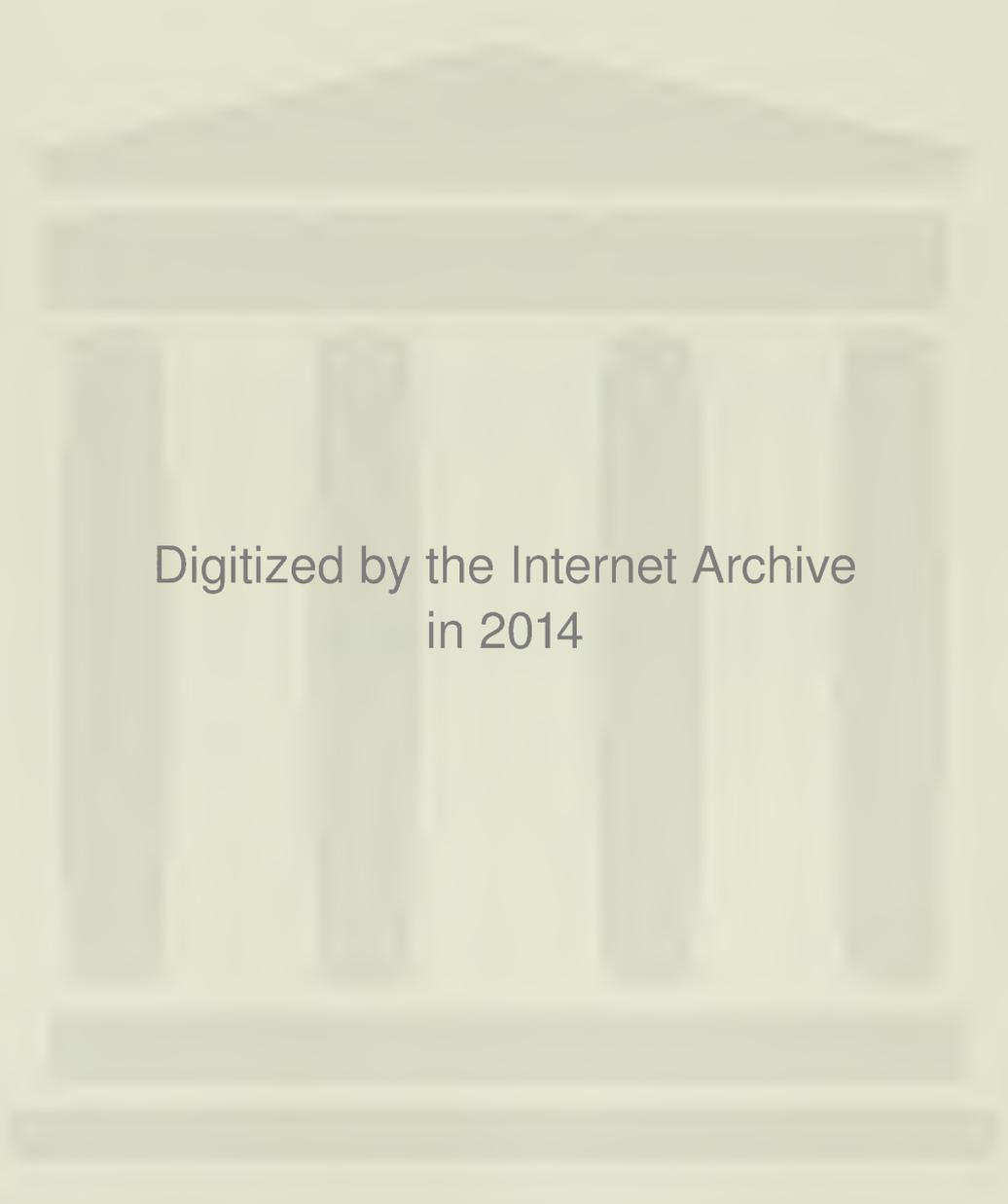


REPRESENTATIVES

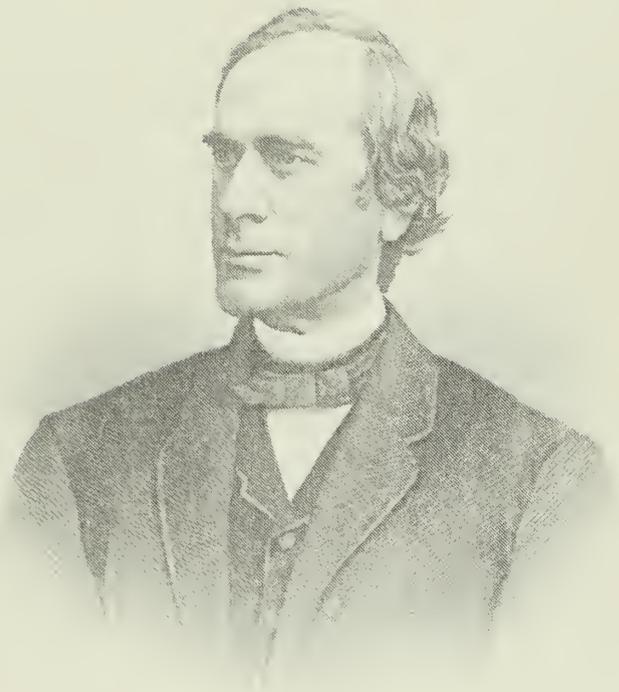
OF

NEW ENGLAND.



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Yours truly

Geo. N. Curtis.

REPRESENTATIVES
OF
NEW ENGLAND.

MANUFACTURERS.

ILLUSTRATED BY PORTRAITS AND VIEWS ON STEEL.

IN TWO VOLUMES :
VOL. I.

THE FIRST IN A SERIES OF CHOICE PUBLICATIONS, WITH SUB-CLASSIFICATIONS INTO
"MANUFACTURERS," "COMMERCE," "LITERATURE," ETC., TO CONSIST OF FULL
BIOGRAPHICAL SKETCHES AND PORTRAITS OF THE MOST EMINENT MEN
IN EACH DEPARTMENT.

By J. D. VAN SLYCK.

EACH ISSUE OF THE SERIES TO BE COMPLETE IN ITSELF.

BOSTON :
VAN SLYCK AND COMPANY.
1879.

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J. D. VAN SLYCK,

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INTRODUCTION.

NEW ENGLAND is everywhere known as the home of American manufactures. Here, with comparatively unskilled hands and crude appliances, the early colonists sought to free themselves from costly dependence upon foreign manufactured products; thereby planting the germs of the mechanic arts, whence have sprung the great manufacturing industries by which, in large measure, our present commercial importance has been attained.

The few valuable fragments of history remaining to us—in council records, memorials and kindred sources—of the heroic efforts made to establish manufactures during the colonial period, have, with patient industry, been gathered and made accessible to the public in many former publications; and there have been opened abundant sources of knowledge of the general growth of manufactures from the birth of the Republic to the present time.

The introduction of cotton-machinery, the invention of the cotton-gin, the invention and introduction of the power-loom, and the employment of the steam-engine,—each of which was an epoch in the progress of American manufactures,—are also matters of common history; and the names of the men who at these times gave new impulse and new direction to operations in manufactures—which were but slowly emerging from crude and primitive methods—are as household words. But what of those who have come after them—who have widened and strengthened the foundations then laid, and, by hand and brain, have built upon them the manufacturing enterprises which are rapidly becoming the successful rivals of older European establishments? Many of them, indeed, are known in commercial centers by the products of their industries; others are known in mechanical departments for their inventions and improvements; and a few have received cursory notice in the course of general histories; but, until now, no work has appeared revealing in biographical narrative the real sources of the mental power, industry and energy which have founded and developed the great manufacturing industries of New England.

In the preparation and issue of this volume, it has been my aim and hope to make it a worthy and just tribute to the men who, during the first century of our national life, have done most to lift up our manufactures, from a feeble state and narrow limits, to their present condition of strength and breadth—compassing, as they now do, nearly the whole domain of mechanic art.

Before entering into the actual labor of this work, in marking out its plan in detail, I fully realized the importance and the extreme delicacy of choosing rightly among living men those who should be made the subjects of biography, ranking as those who had “done most” in promoting and building up our manufacturing interests; and, although having at hand the fullest *data* obtainable, feeling my utter incompetency to sit as sole judge in the matter, I sought counsel among those whose long and close connection with the various branches of manufacture gave to their opinions the weight of authority. Under such direction, the list was made; and, in the subsequent labors of the work, the facts revealed at each step seemed fully to confirm their judgments.

The utmost care has been exercised to obtain the material from the most reliable sources, and to verify, in diligent research and inquiry, all questionable dates and important statements.

Although in the construction of this work it begins with the lives of the men whose labors were memorable in the closing years of the last century, yet, in the arrangement of its contents, it seemed best to dispose the subjects alphabetically.

In the treatment of biographical sketches, I have aimed to preserve an uniformly simple, concise and true narrative; and, believing that the life lived, the acts performed, and the works achieved, worthy of printed record, to be the truest as they are the highest and only justly enduring praise of men, I have studiously avoided much use of that eulogistic “ornamentation” so often degraded to fulsomeness.

This work, whose volumes abound with instructive examples of toil, energy and skill, and in new revelations of the sources of our industrial progress and achievements, I trust will prove acceptable to the numerous patrons who have patiently awaited its completion, and also that it may be regarded by all its readers as a valuable accession to the general stock of American Biography and to the Industrial Records of New England.

J. D. VAN SLYCK.

BOSTON, Jan. 1, 1879.

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MANUFACTURERS.



Zachariah Allen,



HON. ZACHARIAH ALLEN.



FOR the many interesting and instructive facts relating to the early history and progress of the useful arts in America, accompanying the following brief memoir of a long and active life in manufacturing, literary and scientific pursuits, we are indebted to its eminent subject, Hon. Zachariah Allen, by whose courtous favor and kindness access was had to his journal of the passing events which he has habitually recorded.

The subject of this memoir was born in Providence, R. I., in 1795, within a hundred yards of the celebrated Roger Williams Spring, where the first settlers of the State originally landed. This location had belonged to the ancestor of Mr. Allen (on the mother's side), Gabriel Bernon, who was a Huguenot from La Rochelle, and fled from thence to Boston, with Faneuil and other refugees, on the revocation of the Edict of Nantes.

In the second volume of the Third series of the Publications of the Massachusetts Historical Society, it is recorded: "Gabriel Bernon obtained a grant of 2500 acres of land in Oxford (Worcester County, Mass.), and built there a Corn Mill, a Fort for protection against the Indians, a Wash-Leather Mill, and also laid out some considerable expenses for the benefit of the town."

The same historical publication records, that, "In 1720, Gabriel Bernon presented a petition to Gov. Shute, of his Majesty's Council, and to the General Court, asking protection against claimants of the 2500 acres of land granted by Messrs. Dudley and Stoughton, and located by his late Excellency, who accompanied him to put him in possession, which he had retained more than thirty years, and expended above two thousand five hundred pounds for defense against the Indians, who killed some of the first settlers. He is from one of the most ancient families in France, and embarked with his family, servants, and several other families, he

paying passages for above forty persons to Boston. By being hindered from the sale of his plantation, he is put to the utmost extremity; being now nearly eighty years of age, and having several children still dependent on him, after having spent more than ten thousand pounds toward the benefit of the country in buildings, in making nails, rosin, hats, stuffs, etc."

The river adjacent to his plantation still bears the name of "French River," which serves to perpetuate the memory of the first Huguenot settlers in Worcester County. The preceding extracts indicate that this aged Huguenot built the first mill in Oxford, and originated some of the first manufactures in Worcester County, before the settlement was attacked by the Indians.

It further appears, that the same pious zeal which induced him to quit the vine-clad hills of sunny France, and the enjoyments of social life, for obtaining religious liberty in the wilds of New England, even amid hostile Indians, was persistently maintained to the end of his life; for, according to Arnold's History of Rhode Island, "To the persevering piety and untiring zeal of Gabriel Bernon, the first three Episcopal churches in Rhode Island owed their origin." These were Trinity Church, in Newport; St. John's Church, in Providence; and Saint Paul's, in Narragansett.

Other ancestors of Mr. Allen were Thomas Harris, brother of William Harris, one of the original six settlers who landed with Roger Williams; and Joseph Crawford, of Scottish descent, one of the early proprietors of Providence. The name of Zachariah Allen appears on the early records of the Plymouth Colony. The father of Mr. Allen resided in Providence, and became extensively engaged in commerce with the West Indies and East Indies. To dispose of the cotton cloths imported from the latter country, he made arrangements for printing them; and thus incidentally was led into this new branch of business in America, as appears by the following statement, in an address delivered before the New York Historical Society, in 1852, by J. G. Dudley, Esq., and printed by the New York Statistical Society:—

"As early as 1790, Herman Vandeusen, from Mulhausen, settled in East Greenwich, R. I., and there commenced block printing of imported cotton cloth, but soon relinquished the attempt. At that time Zachariah Allen, ancestor to the present distinguished manufacturers and calico-printers of this name in Rhode Island, being largely engaged in the East India trade, was among the first who had India cottons printed in this country."

The New York address also states: "Block printing was early commenced in Philadelphia by Mr. Thorp, an Englishman. His nephew built print-works for the firm of Crocker and Richmond, in Taunton, Mass., between 1820 and 1824. There, I believe, was put in operation the first cylinder printing-machine in New

England ; which, with engraved rollers, was imported from England at great hazard of penalties, prohibiting the exportation of machinery." Even the self exportation of skilled workmen was then prohibited ; and Mr. Samuel Slater had to smuggle himself out of the kingdom.

In connection with this brief mention of the important event of introducing roller printing into America, Mr. Allen's journal states that he was in Manchester, England, in the year 1825, at the time of the procurement of this calico printing-machine by Mr. Richmond, who explained the mode in which he accomplished the shipment of it to America. Mr. Richmond carried out the model of a new and admirable arrangement of compound wheel-work, connected with belted cones, — now denoted the "differential motion," — then recently invented by Mr. Asa Arnold, of Smithfield, R. I., for winding cotton-rovings on the bobbins of roving and fly-frames. For this invention, which nothing has yet been able to supersede, Mr. Asa Arnold deserved the entire credit ; which he, to some extent, failed to receive, owing to the then comparatively small importance of the cotton manufacture in this country. To obtain this improvement and secure a patent right to the sale of it in Great Britain, Mr. H. Houldsworth, a Manchester machinist, afforded the desired facilities for procuring and exporting the roller printing-machine. In this way England gained the advantage of the most ingenious scientific invention ever made in the cotton manufacture ; and America obtained the use of this important printing-machine for calico. Mr. Houldsworth patented this American invention in the year 1826, as allowed by English law. It proved a source of wealth and fame to him ; and both countries profited by the exchange.

In an historical address by Judge Staples, in 1860, he states : "The first print-works ever established in Providence was where the Franklin Foundry now is, and were occupied in 1794 by Schaul, Tissot and Dubesque, natives of Alsace." The extent and value of calico printing has since rapidly been developed, until it has now become of national importance.

The subject of our memoir had two brothers, Philip Allen and Crawford Allen, extensively engaged in the manufacture of cotton and calico printing. The former also entered into political life, and served as Governor of the State, and Senator in the Congress of the United States.

Being left an orphan at the early age of nine years, the subject of our memoir was placed at a school in Medford, Mass., and subsequently at Phillips' Exeter Academy, in New Hampshire ; whence he entered Brown University in 1809. After being regularly graduated in the year 1813, he passed two years in the study of law, in the office of James Burrill, Esq., in Providence, and was admitted to practice in the courts of the State in the year 1815. After a few years' practice of the law, and

engagements also in mercantile operations, he resumed his favorite study of physical science and civil engineering, which he sedulously pursued in after life.

Soon after entering on a business career, Mr. Allen was married to Eliza Harriet Arnold, daughter of Welcome Arnold, an eminent merchant of Providence, and a bridal tour extended across the Alleghany Mountains, to explore the new regions for enterprise then invitingly opened. At that time—1817—Illinois had not been admitted as one of the United States, and Indiana had been admitted only the previous year; Cincinnati then contained eight thousand inhabitants, and Louisville about five thousand. An extensive tour was made through Kentucky, part of Indiana and Ohio; and, returning by the way of Niagara Falls to his native place, Mr. Allen engaged in business and agricultural employments.

He early appreciated the advantage of improving unproductive pasture-lands, by planting them with acorns, chestnuts and locusts. Having inherited more than fifty acres of such land in the town of Smithfield, R. I., he planted chestnuts in furrows, like corn, where the plow could be used, and elsewhere irregularly, by spading and hoeing. This was deemed a work done for the benefit of posterity; but the planter has lived to cut off two crops of thrifty chestnut-trees; and some of the locusts, it appears, were sold to a contractor for supplying the United States Navy Yard at Charlestown, Mass. The recently awakened attention to arboriculture may receive encouragement from this early experiment, which has proved pecuniarily successful. Trees grow while the planter is sleeping. In the cultivation of teasels and madder, experiments were made; but, with the obstacle of unreliable laborers, little satisfaction was found.

Having been elected a member of the Town Council of Providence, Mr. Allen found occupation in the varied duties which were once required of the ancient Town Councilmen, including nearly all the functions of municipal government, such as the Police, Fire and Health Departments, the management of public schools, and many other incumbent labors.

The mechanical arrangements of the Fire Department first attracted the engineering attention of the newly-elected member. As a memorial of the imperfect state of the apparatus then in use in New England for extinguishing conflagrations, a brief recapitulation of the system is here given, that the contrast between the old and new system may be properly appreciated.

The old fire-engines were made in London, and were supplied with water by buckets passed by hand to the vicinity of the building on fire, where it was necessary to station them; for the leather hose, then made by sewing with waxed linen threads, were so speedily burst, that no dependence was placed on long lines of leading hose. A short section only was used; and in the old London-made engines first imported,

a platform was raised on top of the engine for the engineer to stand upon while holding the pipe. Each householder was required to provide a pair of leather buckets, ever ready for use, under penalty of a fine for neglect. Although the old fire-engines were furnished with suction-hose for a self-supply of water from rivers or wells, yet the leather was so pervious to the air, that a vacuum could be formed only sufficient to lift the water six or eight feet by suction. About that time Messrs. Sellers and Pennock, of Philadelphia, had made a very important improvement in the manufacture of leather hose, by using copper rivets instead of waxed linen threads. They had constructed large and powerful fire-engines requiring about thirty-six men to operate them. These were used in Philadelphia, with the copper-riveted hose, very advantageously from the city hydrants, but were incapable of drawing water by suction for self-supply where no hydrants were available. Correspondence between Mr. Allen and Sellers and Pennock shows that they were requested by him to make a metallic suction-pipe with folding joints, to render them flexible for use. This order was accordingly executed successfully, and a very powerful new fire-engine, then named a "Hydraulicon," was put in operation in Providence, capable of supplying itself automatically by suction from rivers or wells. After the introduction of the manufacture of India-rubber, the suction tubes were again made of leather, rendered tubular with coils of wire inside, and coated outside with this air-tight material. These improvements constituted an important era in the system of extinguishing fires in New England; and their success attracted the attention of Mayor Quincy, of Boston, who came to inspect the operations, and then first introduced this improved system into use in that city.

The town records show that the present perfect system of accurate surveys and platting of the streets of Providence, was originated under the direction of Mr. Allen, commencing with Atlas No. 1.

Manufacturing operations being then, as now, the principal pursuit of the people of Providence, and being congenial with engineering studies, to which much of his time had been devoted, a mill-site was purchased in the year 1822, on the river which flows through Providence, and a village was built, still known as "Allendale." While constructing the mill-dam, the scanty supply of water during the summer drought became so manifest on this stream, as well as on all others, that he proposed a system of forming reservoirs, for obviating the losses to manufacturers and their employees by suspension of labor from want of motive power. The State records show that in the year 1823, a charter was granted to incorporate "Zachariah Allen and others, mill-owners on the Wonasquatucket River, to construct reservoirs for retaining the flood-waters in winter, to equalize the flow of the river during the droughts of summer." This was the first act of incorporation for making reser-

voirs in New England, and originated a general system that has since been most beneficially extended.

The matter of economy of heat in warming dwelling-houses appears, by his journal, to have attracted the attention of Mr. Allen in the year 1820, when he introduced hot-air furnaces in the basements of houses, for transmitting heat, through conducting-pipes and registers, to various apartments above. Four or five years afterward, when the use of anthracite coal in New England, in the years 1825 and 1826, began to supersede wood as fuel, this original plan speedily became popular. After this the family-circles, instead of gathering around the social fireside, gathered around a "hole in the floor," as humorously described by Warner.

Soon after commencing the manufacture of wool, the rude state of the machinery and the lack of skill in workmen, induced Mr. Allen to make a voyage to Europe, in the year 1825, to visit the manufactories of Great Britain, France and Belgium. The scientific information there obtained he published in a work entitled, "The Science of Mechanics, as applied to recent improvements in the Useful Arts, in Europe and America;" which was received with popular favor, and is referred to as authority at the present day. Soon after this scientific work was published, two volumes for general readers were sent to the press, entitled, "Sketches of Travels in Great Britain, France and Holland, and of the State of the useful Arts, Society, Scenery, etc.," which were also highly popular.

These publications show that special attention was bestowed by Mr. Allen on the early history and improvements of the steam-engine. A visit to the works of Boulton and Watt, at Soho, revealed some facts which appear to be little known at the present day, in regard to the share of credit due to the celebrated inventor, James Watt, and to other more humble and less-known inventors. It will probably be new to most of our readers, that the original steam-engine, as improved and used by Boulton and Watt to operate their manufactory, made only a single downward effective stroke to lift a great pump-piston hung by a chain from the opposite end of the working-beam. This served to pump up water into a mill-pond, for use on a water-wheel, which was employed to obtain a rotary motion to turn the mill-shafting. The steam-engine invented and used by James Watt had neither a crank nor a balance-wheel. These were special inventions made by two other ingenious and poor engineers, who thereby rendered the steam-engine complete in itself, and capable of producing a *direct revolving motion*, without the cumbersome appendage to each engine of mill-pond and water-wheel, which are not available in common manufactories in towns. James Watt devoted his labors to obtain a direct rotary motion by the pressure of steam against the rims of steam-wheels revolving in steam-tight circular cases, now popularly denoted "rotary engines." This desideratum has been sought, also, by

successive generations of inventors ever since the days of Watt, but without a success equal to that obtainable by the tightly-adjustable packings of a piston, vibrating back and forth in a straight and smooth-bored cylinder. To improve the operation of the old original single-stroke condensing-engine to turn the machinery of mills, by directly converting the vibratory rectilinear movement of the piston into a regular revolving movement, Matthew Washborough is recorded to have obtained a patent right for the use of the balance-wheel; and two workmen, John Pickard and John Steed, in 1780, patented the additional improvement of a crank, as the most perfect mode of gradually arresting and reversing the vibrating rectilinear movements of the piston. A recent biographer of James Watt—Samuel Smiles—notices these facts in the following words: “The accomplishment of so important an improvement for regulating and perfecting the use of steam-power in so simple a way, excited the wrath of James Watt, when he first discovered that he had been *bolted out* (as he termed it) from the use of the crank and balance-wheel. At first, Mr. Watt accused the inventors of having obtained the idea from some of his own experiments. The inventors replied they ‘borrowed the idea from the simple potters-wheel and foot-lathes which they daily used for turning brass.’” Subsequently, in 1808, Mr. Watt wrote a letter to his son, as follows: “It certainly appears possible that John Steed might have invented the use of the crank, and Matthew Washborough the balance-wheel; which, as far as I know, was the first time they had been used for that purpose. I was desirous of producing a continuous equable revolving motion without either a crank or balance-wheel, of which I did not then appreciate the advantages. Finding the door closed to us by Washborough, Pickard and Steed, we decided to take patents for a contrivance on the same principle, denoted ‘the Sun and Planet wheel.’” Mr. Smiles, the biographer, adds: “A proposal was made to Boulton and Watt by Washborough and Pickard, to allow the use of the crank and balance-wheel in exchange for the use of Watt’s chief patent right of a separate condenser of steam and air-pump, to form a vacuum. To this proposal Watt replied, in a letter to his partner, Mr. Boulton: ‘I will never consent to hold a candle for Washborough. I have money enough to make their patent tremble, and shall leave no mechanical stone unturned to aggrive them.’” The biographer of Watt continues: “Washborough alleged he had been badly used; and the pecuniary losses thus incurred preyed so keenly upon his mind, that he was seized with a fever, which carried him off in 1781, when only twenty-seven years old.”

Thus miserably was crushed the workman who practically converted the steam-engine from a mere pumping-machine for raising water, into the useful motor now everywhere employed to turn the cranks and balance-wheels for operating machin-

ery, steamboats and locomotives on railways; while the whole glory of this great achievement in the useful arts is popularly ascribed to the genius of James Watt.

This testimony, authenticated by the biographers of Watt, does merited, though tardy, justice to the poor workmen who have hitherto been held up, as infringers, to obloquy and reproach, instead of being duly honored as benefactors of mankind, and allowed a share of the glory of the most important achievement in the useful arts.

In connection with this sketch of a visit to the original steam-engine used by Boulton and Watt for pumping water to turn a mill-wheel, it may be interesting to some of our readers to recur to a description contained in the *Tourist*,* of the vivid impressions excited by the first sight of a locomotive engine traveling on a colliery railroad, near Leeds, several years before the first use of steam for transportation of passengers on the Liverpool and Manchester Railroad. Mr. Allen then also enjoyed a locomotive engine ride probably earlier than any other American now living.

After devoting nearly a year to visiting the most interesting objects in nature and art in Europe, the subject of improvements of machinery and processes of manufacture of cotton and wool occupied the time and labors of the returned traveler. The first "lapper" for feeding cotton-cards, and *spiral rotating* shear-blades for shearing broadcloths, were introduced by his agency; and also improved machinery for raising the nap on the surface of felted cloths.

A patent was awarded to him for an extension-roller, for smoothly spreading woolen cloth in the process of teaseling, which proved both profitable and useful, and is the roller continued in use to the present day. Numerous other improvements were made by him in the then rude processes of woolen manufacture.

The incident of an invitation to deliver a lecture on the History of the Steam Engine, turned his especial attention to the waste of steam-power by regulating steam-engines with the ordinary throttle-valve, which reduces the effective pressure of the steam by choking its free passage from the boiler. Instead of reducing the pressure of steam from the boiler to the diminished resistance to be overcome, Mr. Allen devised a clearly preferable plan, to allow its full pressure to act on the piston during a longer or shorter portion of each stroke, by using *variable cut-off valves, placed under the control of the revolving ball-regulator*. This improved plan of regulating steam-engines was practically introduced into use in the works of the Wadsworth Steam Engine Company, in Providence, in the year 1833. The specification of the patents issued to Zachariah Allen, in March, 1834, is in the following descriptive words: "For a new and useful improvement in the mode of constructing steam-engines, by so arranging the steam-valves as to allow the steam to pass freely

* *Practical Tourist*, I, 220-222.

from the boiler to act upon the piston with its full pressure during a longer or shorter portion of each stroke, and to the extent which may be necessary to maintain the requisite equable movement of the engine, instead of ineffectively wasting its expansive force by choking its passage through the contracted aperture of a throttle-valve, etc."

This is claimed to be the original invention and introduction in the United States, of the system of working steam expansively by detachable and variable cut-off valves regulated automatically by the governor; and it is also claimed that there is abundant evidence that this method was brought into practical use as early as 1835, and before variable cut-off valves, under the control of the governor, were practically introduced either in England or France. So readily was this new method of regulating steam-engines applicable, that the very throttle-valve itself was, by Mr. Allen's invention, converted into a variable cut-off valve, adjustable at any point of cut-off, by the hand, in marine engines; and automatically by the governor in other engines, by means of cams fixed on the crank shaft. These were so arranged and combined with springs, as to throw the winged valve wide open at the commencement of the stroke, and to close it at such point of the stroke as might be required. Under the name of "Fly-Valve," this arrangement was used on some of the steam-engines in Great Britain.

In closing this abstract of inventions and improvements of the steam-engine, a few more extracts may be copied, relating to the first use of steam-power in the United States.

The earliest steam-engine made and operated in the United States appears to have been used in Rhode Island, at the Cranston iron-ore bed, for pumping water, at the commencement of the War of the Revolution. It was a Newcomen Engine, and the ore was smelted for making cannon for the Continental army; so that the first breath of a puff of steam in America was utilized in the cause of Independence. At an early date a steam-engine for the water-works in Philadelphia was made in New York; and Oliver Evans made the first high-pressure, non-condensing engine, with his original invention of long cylindrical boilers, of small diameter and great strength, which were early and deservedly popular in the United States, both for land-engines, and steamboats on the great rivers of the West; and which, for usefulness, economy and durability (where there is room for them) can hardly be surpassed.

In an address to the Rhode Island Historical Society, delivered by Judge Staples, in the year 1860, he notices that the first double-acting steam-engine in New England, was made in the year 1808, by Philip Allen. In the construction of this engine, his brother received rudimentary lessons in this branch of science.

After continuing the manufacture of woolen cloths, with varying success, for seventeen years, the fluctuations in the prices of the raw material—of which a large portion was imported under heavy duties—proved so discouraging, that a change was made to the manufacture of cotton, as having a more stable basis on the production of the raw material in this country. The machinery in a cotton-mill was purchased at Phenix, R. I., in 1837, in connection with Mr. David Whitman, a skillful practical manufacturer; and, soon after, the woolen machinery was sold by auction at Allendale, and replaced by the cotton machinery.

A somewhat similar experience of disappointment in raising wool appears to have been realized by John Randolph, who said, in one of his anti-tariff speeches in Congress, “he would go ten rods out of his way to kick a sheep.”

Recurring to the journals of Mr. Allen, we find notes of services in the cause of literature and science. The reports and catalogues of Brown University show that he has served as a life-long member of the board of trustees, until his name stands at the head of the list for veteran services as trustee during more than half a century. His exertions in connection with Dr. Wayland proved instrumental in introducing the new system of special instruction in Physical Science.

His labors in establishing and sustaining the Providence Athenæum, are testified to by the vote of directors on his resignation in the following words: “Mr. Allen was foremost among the founders of this institution in those early days when its progress was difficult and uncertain—as the records abundantly testify. A constant and unwearied promoter of its welfare, he has never ceased to extend to the institution his valuable counsel and assistance.”

In the establishment of a free Public Library in Providence, the records of this new institution now show the persistent exertions made by Mr. Allen in soliciting contributions, and the incorporation of a board of directors, who are actively engaged in accomplishing this useful object.

To afford facilities for early instruction to the youthful laboring population after their daily toil is over, the utility of free evening schools was advocated by him, in statements published in the *Providence Journal*, in the years 1839 and 1840. The school committee being averse to this innovation, the city council was induced to appoint Mr. Allen and Mr. Potter to organize two evening schools, which was speedily done. Soon after, the board of the school committee voted to concur in this new project; which has been very beneficently sustained to the present day, not only in the city of Providence, where this system was commenced, but also in many other principal cities and towns throughout New England, as stated in a recently-published report of the school committee of Providence: “Evening schools were in operation in Providence in 1840, as we are assured by Professor Samuel S.

Greene, who then visited one of the schools in company with Superintendent Bishop. This evening school was taught by Samuel Austin, under the auspices of Zachariah Allen, Owen Mason and other public-spirited citizens."

The numerous publications of researches and memorials, by the Rhode Island Historical Society, testify to the unwearied labors of their vice-president, Mr. Allen ; and many addresses and lectures on scientific subjects are also evidences of unceasing researches in physical science. Among the latter may be here noticed the first systematic engineering admeasurement of the volume of water and extent of water-power of the great cataract of Niagara, the details of which, with a map, were published in *Silliman's Journal*, in April, 1844. This task was accomplished by the personal labors of Mr. Allen, aided by an engineer whom he employed. By reference to that survey, the admeasurements show that more than 700,000 tons of water descend in one minute over the great fall of 160 feet, with the force, estimated in foot pounds, of nearly 7,000,000 horse-power ; being adequate for operating far more than all the machinery in Great Britain. The whole descent of this vast torrent of water from the level of Lake Erie to that of the ocean being about 565 feet, the extent of this water-power affords an impressive view of the sublime natural motive power derived from the solar excitation, which evaporates and lifts this water to form rivers of vapor aloft in the sky to supply the eternal flow of the rivers on earth.

In the original establishment of the Hospital for the Insane in Providence, the records of the annual Reports of Mr. Allen, as chairman of the building committee, show the extent of personal care and labor bestowed in carrying out that beneficent charity in its commencement.

The manufacturers throughout New England are now realizing the advantages of Mr. Allen's labors in establishing an improved system of mutual fire insurance, based on an inspection of each fire risk, and on a rigid limitation of the amounts insured below the actual values, to allow no temptation to carelessness, with requisitions of adequate apparatus for the extinguishment of fires and vigilance of watchmen. The costs of mutual insurance are thus reduced to about one-fourth of the price commonly paid for other modes of insurance.

The dangers of explosion of the newly-introduced coal oils, having been referred by insurance companies in Providence to Mr. Allen, for examination and report, were duly investigated, and the results subsequently published in the Annual Reports of the Smithsonian Institute, in Washington, in 1862. The mode of proving their inflammability then proposed by him, has ever since been practically adopted as a standard test for determining the safe use of the coal oils, which have been so liberally furnished to the children of men, as if mercifully to relieve the persecuted whales.

The very successful manufacturing and engineering operations of the subject of our memoir induced a gradual extension of them, as is too commonly the case in all prosperous enterprises; for few duly appreciate the prophetic warnings of the philosophical poet who wrote:—

“If fortune fills thy sail
With more than a propitious gale,
Take half thy canvas in.”

When the disastrous commercial crisis of 1857 swept over the land like a tornado, uprooting stable institutions, and suspending payments by banks and commercial firms, it proved equally overwhelming to manufacturing enterprises, verifying the financial aphorism, that “not one-tenth of the men embarked in business escape a final wreck.”

Undismayed by losses, persistent labors were recommenced with renewed energy, and bright prospects again opened before him. The management of extensive print-works and other affairs were committed to his tried scientific ability and practical skill.

In the process of madder dyeing he commenced and accomplished important improvements, by introducing a new plan for passing, in succession, in a continuous string through the dye-cisterns and washing apparatus, the connected pieces of cotton cloths; whereby, not only the labor of repeated handling is saved, but also the labor of repeatedly sewing together and tearing them apart, with the loss of a portion of the cloth. This continuous system of madder dyeing was patented in connection with Mr. Henry Burrows, of the Merrimac Print Works, and is now in general use, with very profitable and labor-saving results.

Another improvement, by the use of double-belted cones, was made for facilitating changes of speed of the calico printing-machines, and for avoiding the necessity and extra cost of a donkey steam-engine to each machine, with the annoyance of the heat of such a companion by a workman's side in a hot printing-room. Previous attempts to accomplish this useful improvement had always failed, from the lack of imparting to the belted cones a *swift velocity* of revolution; which very effectively ensures the transmission of power from motors to machines by leather bands without slipping. This principle of transmitting effective power from motors to machines, Mr. Allen was invited, by the president of the New England Cotton Manufacturers Association, Gov. Straw, of New Hampshire, to explain in an address to a meeting in Boston, in April, 1871. The information contained in that address gives an instructive idea of the progress gradually made in facilitating the transmission of power from motors to machines, in the mills of the United States.

In the year 1822, when Mr. Allen commenced his practical engineering operations at Allendale, American mills were modeled precisely after the English plans, with square shaftings, on which the cog-wheels were wedged fast, and on which the great wooden pulleys, denoted *drums* from their length, were clamped by two pieces of joist, fitted to come nearly together, and tightened by means of screw-bolts. Boards were nailed to the clamps on the shafts, and were then turned to the required diameter for receiving the staves of wood, which were nailed to the rounded heads, to form a barrel-shaped pulley. To obtain the requisite surface velocity, some of these drums were made four or five feet in diameter, and the mill-rooms were made thirteen or fourteen feet high to accommodate these huge drums without intercepting the light. Such unbalanced huge drums were incapable of revolving swiftly without shaking the mill floors, and becoming themselves shaken to pieces. After a time pulleys were made of cast-iron in halves, and clamped by screw-bolts to the mill shaftings. The introduction of round shafting by Fairbairn, in England, was next deemed a great improvement. Then the centres of the hubs of both cogwheels and pulleys were drilled with round holes, to fit them, and prevented from slipping around by grooves, or slots, and wedged by keys. With these improvements, the velocity of revolution of the mill shaftings was increased from thirty turns up to seventy or eighty turns per minute. By thus doubling the velocity of motion of the shafts and connecting bands, their efficiency for transmitting power was doubled, in accordance with the engineering rule for estimating power in *foot pounds*. The equivalent of one horse-power is estimated by the descent of a weight of 33,000 pounds, one foot in a minute, or of one pound 33,000 feet in a minute; so that an engineer may employ a swiftly-moving thread capable of lifting one pound, to do the work of a cable capable of lifting 33,000 pounds, with a manifest saving in the weight and cost of materials employed.

After realizing the advantage of increasing the velocity of shafting from 80 to 160 revolutions, and again to over 200 per minute, at the mill in Allendale, on subsequently building a new cotton-mill at Georgiaville, in Rhode Island, in 1853, this principle of increased velocity was further extended to more than six hundred revolutions per minute, with a corresponding reduction in the weight of the iron shafting, by substituting light, hollow gas-tubes. By this new system the additional weight and cost of heavy shaftings and driving-pulleys were dispensed with, by applying the leather bands used for operating each machine directly around the polished surface of the naked hollow tubes. By the great diminution of weight, and of the tension of tight bands on the pillow-bearings of the shafts thus obtained, the increased friction consequent on increased velocity was compensated for by the diminished pressure, and, consequently, diminished friction. Indeed, were it

practicable to employ in terrestrial mechanics the same velocity of motion, of 190,000 miles per second, as is employed in transmitting solar action to our planet, through an intervening space of 93,000,000 miles, the strength of a thread might transmit 1,824,000 horse-power, being more than sufficient to operate all the machinery in England.

In the elaborate and embellished work of Mr. Evan Leigh, C. E., on the Cotton Manufactures of Great Britain, recently published, the rules given in Mr. Allen's address before the New England Manufacturers Association, in Boston, are inserted at length, and many statements copied, to show the advantage of swift velocities in the use of leather belts; and it is stated that light hollow shafts may be advantageously used in all cotton-mills, if properly coupled, as described in the address, and may drive machines from the bare shafts in both a neat and simple manner. He adds, that with solid steel bearings, coupled by a right and left-hand screw against a shoulder, they are self-tightening, will run with very little friction, and require but little oil and power to drive them. In continuation, Mr. Leigh admits that "The time has now arrived for another innovation in the system of transmitting power from motors to machines. With our present knowledge of materials and the laws of motion, there is now room for a further change, as great, economical and complete, as that made by Fairbairn and Lillie, nearly half a century ago—which has had an undisturbed reign ever since. Their speed of shafting is certainly too slow."

These extracts and avowals from one of the most recent and valuable publications, illustrative of the modern improvements in the construction and operation of mills in Great Britain and in the United States, recognize the real advance Mr. Allen actually made in the science and practice of transmitting power from motors to machines.

To promote the industry, health and general prosperity of his native city, Mr. Allen early took an active part in introducing an abundant supply of pure water, and was mainly instrumental in bringing this subject before the citizens of Providence for adoption, at three successive periods. With prejudices in favor of old wells and against innovations, thrice they voted negatively; but after a lapse of a few more years, the discussions and investigations of the utility of aqueducts finally prevailed—but with a change to a far more costly plan of engineering than the original one proposed by him, as is now realized by experience.

The published writings of the subject of this memoir are numerous not only on scientific, but various popular topics, and include several historical addresses.*

* Among the latter, is a valuable "Memorial of Lafayette," giving his statements and explanations as to the apparently obstinate refusal of the Count D'Estaing with the French fleet, to co-operate with the

Leisure for investigations was secured by a systematic habit of early rising, whereby three or four morning hours were available before the ordinary routine of business labors commenced. His principal subjects of investigation in physical science have been the correlation of physical forces, and the primary source and modes of transmission of natural motive-power, as appears from his work published by Messrs. Appleton and Company, in 1851.

Similar original investigations have occupied the later years of his life; and, at the age of eighty-three he continues active and cheerful, and is engaged with unabated interest in completing a supplement to the work on "The Mechanics of Nature," as a key to open more fully the indicated sources of natural motive-power, in accordance with universal laws.

In this brief memorial, works accomplished by the labors of a prolonged life are recapitulated which appear worthy of remembrance; for the individual man is of little moment in social life, and the best eulogium is expressed in the verse of Bonar:—

"Needs there the praise of the love-written record—
The name and the epitaph graved on the stone?
The things we have lived for, let them be our story;
We shall be remembered for what we have done."

American army during the British occupation of Newport, and at the battle on Rhode Island, thereby causing the failure of Sullivan's expedition.

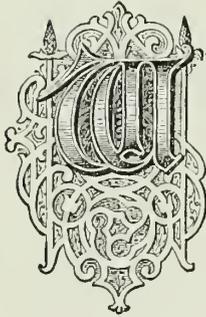
These explanations were given to Mr. Allen, while serving as the representative of the Town Council of Providence to meet Lafayette at the border of the State, in Connecticut. He then passed many hours with him in a traveling carriage between Plainfield and Providence.

On crossing the State line into Rhode Island, Lafayette remarked: "In this State I have experienced more sudden and extreme alternations of hopes and disappointments, than during all the vicissitudes of the American War." "When the French fleet arrived in Rhode Island, in 1778, I was assured of the certain capture of the British army in Newport, by an arranged plan for a combined attack by the American and French forces." "When I saw the French fleet sail out of the harbor, I felt the first great disappointment of my sanguine hopes. At their return, my fresh hopes were excited, only to be more greatly disappointed than before; for D'Estaing again held a council of his officers, who decided to depart immediately with the whole fleet for Boston for repairs. My most earnest entreaties for him to stay only a short time, to finish the conquest of the British army, were all in vain."

The true reasons which led to this unfortunate course were known personally to Lafayette, who attended the council of French officers; and his explanations given at length in the Memorial, led to the belief that the French admiral acted under the influence of a council of his officers, and not from any discordant feelings toward Gen. Sullivan or the American cause.

THE AMERICAN SCREW COMPANY.

WILLIAM G. ANGELL.



WHEN screws were first made and brought into use, it is not known. The early method of making them, however, was to forge the blanks, then to make the heads by pinching them while red-hot between dies, and then to form the threads by the process of filing. The first application of machinery to the making of screws, on record, was made in France, in 1569, by Besson, who contrived a screw-cutting guage to be used in a lathe. In 1841 this device was further improved by Hindley, a watch-maker of York, England; and for many years thereafter it was in general use amongst the watch-makers of that country in making the small screws used in their work. The first English patent was issued to Job and William Wyatt, May 14, 1760, for three machines: one for making the blanks, another for nicking the heads, and a third for cutting the threads. Between that date and 1840, some ten patents were issued in England. It is said that Sir Samuel Bentham, one of the great mechanical engineers of England, early in this century, devised a machine for cutting screw-threads with rotary cutters, which he did not patent. The only one of the ten patents mentioned worthy of notice—and that solely for the principle involved—was that of Miles Berry, dated Jan. 28, 1837, which was for a gimlet-pointed screw. This machine was of no practical value, because the space between the threads diminished towards the point, so that every revolution of the screw forced it into the wood more than the distance between the threads on the taper, making it as difficult to drive as one with a blunt point.

The first American patent was issued Dec. 14, 1798, to David Wilkinson, a celebrated mechanic of Rhode Island. The next American patent was dated March 23, 1813, and was issued to an equally distinguished mechanic of Massachusetts—Jacob Perkins, of Newburyport. On the fourth day of May, of the same year, a patent was granted to Jacob Sloat, of Ramapo, N. Y. At the extensive nail and

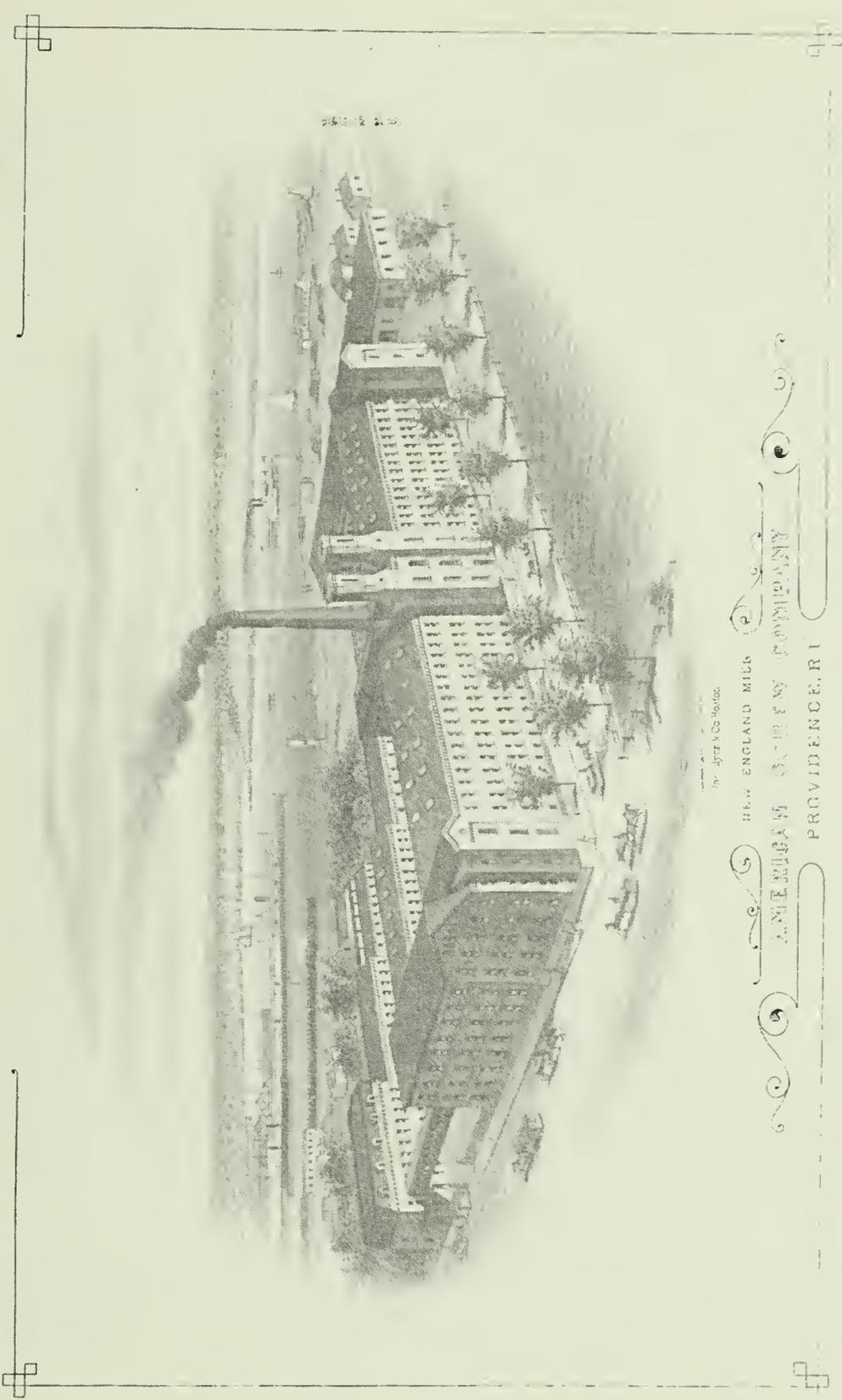


PLATE 2

By J. P. CO. Boston.

NEW ENGLAND MILLS
AMERICAN SPLY COMPANY
PROVIDENCE, R.I.



iron works of the Piersons, established in Ramapo, in 1798, Thomas W. Harvey, in 1831, applied the toggle-joint to the heading of screws, rivets and spikes. In 1834 Mr. Harvey entered into partnership with Frederick Goodell, a cotton manufacturer of Ramapo, and established a small screw manufactory at Poughkeepsie. Early in 1835 Mr. Harvey invented machines for heading, nicking and shaving-screws. These, and a thread-cutting machine which they had purchased from its inventors,—Jacob Sloat and Thomas Springsteen,—were built and successfully operated by them, producing a gimlet-pointed screw. In November, 1836, patents on thread-cutting machines were issued, respectively, to Henry Crum, of Clarkstown, N. Y., and to J. H. Pierson, of Ramapo. Pierson's machine was put into successful operation at the Ramapo Iron Works.

In 1837 the attention of some persons in Providence, R. I., was directed to the manufacture of screws. A company was organized, and in January, 1838, was chartered, with a capital of \$20,000, as the "Providence Screw Company." Its principal corporator and manager was Clement O. Read; and the machinery used by the Company was claimed as his invention. In the autumn of 1838 another company was formed and chartered as the "Eagle Screw Company." The corporators were John Gorham, James Humphreys, John Proctor, Pardon Miller, William G. Angell, Jabez Gorham and eleven others. The authorized capital was \$75,000. The subscribed capital, which at the beginning was \$30,000, was very soon raised to \$50,000. Some machinery, with the right to use it, was purchased from the Providence Screw Company. That Company continued in operation till 1840, when their mill was burnt, and the enterprise, having been unprofitable, was abandoned. William G. Angell was made agent of the Eagle Screw Company, and James Humphreys, whose previous occupation had been that of an iron-founder and machinist, was elected treasurer.

William G. Angell was the eldest son of Enos Angell, a house-carpenter by trade, and a descendant, in the sixth generation, of Thomas Angell, who came to this country in 1636, with Roger Williams, and was associated with him in founding the settlement of Providence. William was born in Providence, Nov. 11, 1811. He received some education in the common schools, and at an early age was instructed in his father's trade, at which he worked until about 1835, when, in company with his uncle, John Gorham, under the firm-name of Gorham and Angell, he engaged in the manufacture of loom-reeds. Mr. Angell had previously improved and rendered automatic a machine for making these reeds; and he built the first one used by them. After the organization of the Eagle Screw Company the business of this firm was continued under the management of Mr. Gorham, until 1840, when Mr. Angell retired from it.

The Eagle Screw Company had but fairly commenced operations, when a suit was brought against it for an infringement on the Pierson patent, in the machinery purchased from the Providence Screw Company. Mr. Angell had supposed that the Company's rights were secure under the terms of the purchase; but an adverse judgment was rendered, with damages to the amount of \$20,000. The payment of this sum, with costs of court, absorbed more than one-half of the whole working capital. With this serious check to their operations the business of the Company progressed but slowly, and was carried along until about 1850 only by the most strenuous effort of its manager. In 1849 a screw had been made by the New England Screw Company, of Providence, which proved so efficient that that Company began its manufacture, and the business soon sprang into activity. This screw, modeled on one of French manufacture, was tapered to a point. It had been made in France some twenty-five years before, and had been imported into this country; but the manufacture and importation had ceased for some time. Mr. Angell saw that the old style of blunt screws, for the making of which alone his machinery was adapted, would soon be supplanted by this new style of pointed screws. His Company was not in a pecuniary condition to change all the thread-cutting machines. The Cullen Whipple machine, by a simple change in the form of the cam which controlled the action of the thread-cutting tool, could be readily modified, so as to make a screw with any form at the point; and this was covered by a patent owned by the New England Screw Company.

At this juncture the machine of Thomas J. Sloan, of New York, was offered to Mr. Angell. This machine, though patented some four years before, had not yet found a purchaser. Mr. Angell found it defective, but saw that the principle of the machine could be made available. Mr. Sloan had also patented, Aug. 20, 1846, the form and construction of the pointed screw. This patent only covered a particular form of the point, and was of little value, since a slight change in the form would evade any infringement.

Mr. Angell now devoted his resources to conform his machines to the principle of Sloan's machine, and was soon ready to supply the screw in its new form. From this period dates the prosperity and rapid growth of the Company.

The Company was authorized by the legislature, in January, 1854, to increase its capital stock to \$500,000. The buildings, machinery and other facilities were gradually extended, until, in 1860, they included and occupied all the buildings now on the south side of Stevens Street. In 1856 an arrangement was made with its principal competitors, for a combination of sales, each company selling a proportion agreed upon, and at a fixed price. Four years later a consolidation of the two principal companies was effected, the company taking the name of the American

Screw Company, with a nominal capital of \$1,000,000. Its actual property, including real estate, machinery, stock and funds, was greater than this amount. The New England Screw Company was originally chartered in October, 1840, with a capital of \$20,000. Its incorporators were Cullen Whipple, Henry Hopkins, Hezekiah Willard and seven others. Cullen Whipple had been in the employ of the Providence Screw Company. He was a machinist and mechanic of skill and inventive genius. On leaving the Providence Company he had devised a machine for cutting the threads of screws, which he proposed that the new Company should use. Hezekiah Willard was appointed treasurer. A small shop was hired on Canal Street. In the autumn of 1841 a new charter was obtained, authorizing an increase of stock to \$50,000; additional subscribers were obtained, and the Company was placed under new management, Alexander Hodges, who had been superintendent of the Providence steam mill, being appointed treasurer and agent. A large wooden building on the corner of Eddy and Friendship Streets, formerly occupied as the stables of the old line of stages between Providence and Boston, was leased. Mr. Whipple's screw-cutting machine was patented Aug. 18, 1842; his machine for shaving the heads was patented April 6, 1843; and a device for removing the burs left in cutting the slots in the heads, on April 19, 1843. These three patents were assigned to the New England Screw Company. Afterward, in 1853, 1854 and 1856, Mr. Whipple invented and patented seven other machines or devices for improving the manufacture of screws, all of which were in like manner assigned to the New England Company. In October, 1844, authority was granted to increase the capital to \$200,000; and in October, 1845, to \$300,000.

In the spring of 1849, as has been stated, a new departure was made, by beginning the manufacture of pointed screws. This resulted in a complete revolution in the business. Additional facilities and larger and better buildings were soon needed; and in 1852 a large area adjoining the premises of the Providence Machine Company, on Eddy Street, measuring on that street two hundred feet, and extending about fifteen hundred feet to tide-water, was purchased. The buildings were finished and occupied in 1854, and included the main building on Atlantic (now Henderson) Street, and the ell on Eddy Street. Both of these structures were then one story less in height than now. On the consolidation of the Eagle and New England Companies, in 1860, as the American Screw Company, William G. Angell was appointed president, with the executive management; his brother, Albert G. Angell, who had been, since 1838, in the employ of the Eagle Company as clerk and salesman, was appointed agent, which post he still holds; Edwin G. Angell, son of William G., was elected treasurer; and William H. Henderson, who had been book-keeper in the New England Company, was appointed secretary. Edwin G. Angell resigned the

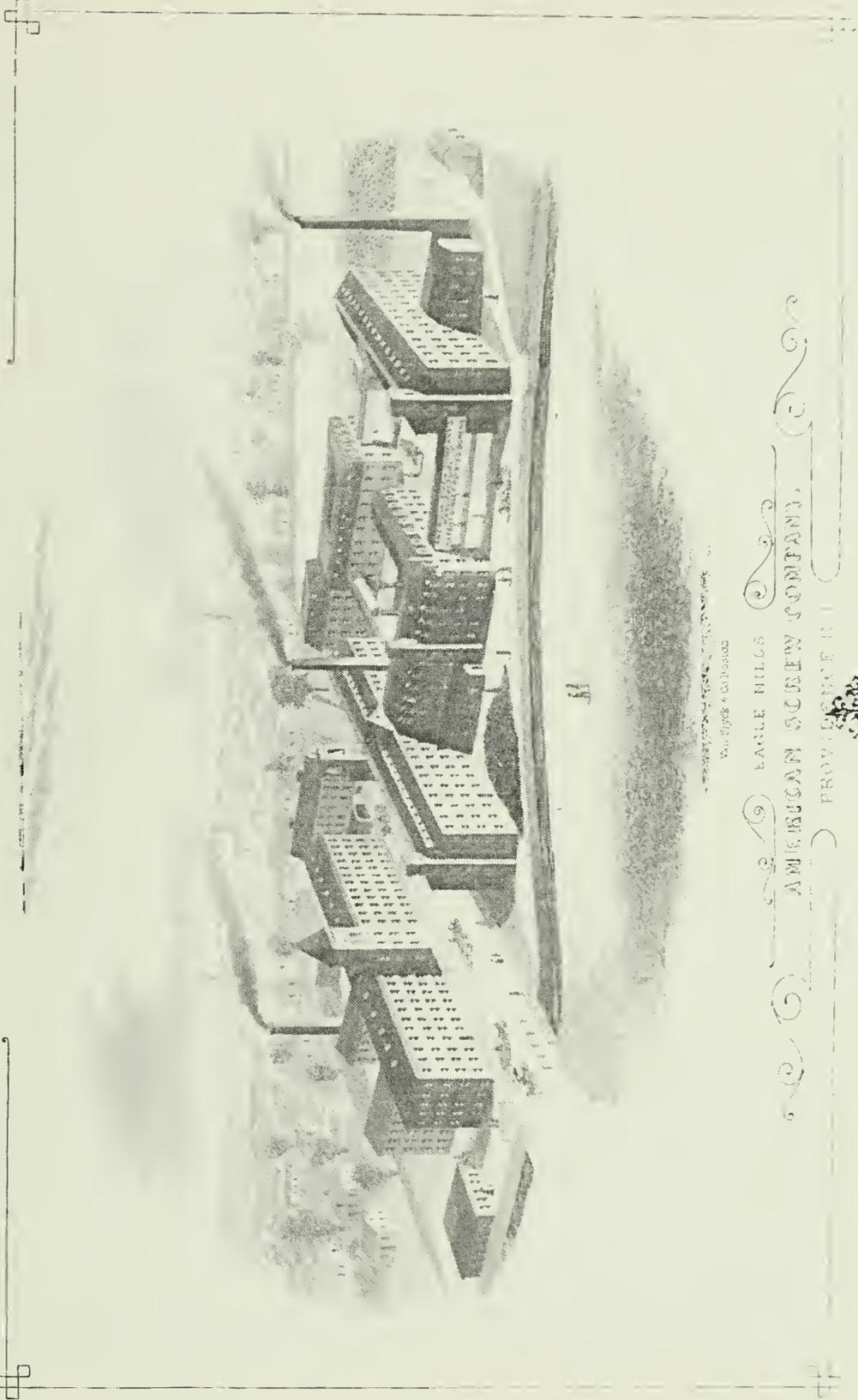
treasurership in 1864, and removed to New York, having accepted the office of treasurer of the Eagleton Manufacturing Company, engaged in the manufacture of iron wire. He was succeeded in his office in the American Screw Company by William H. Henderson, who is still its treasurer.

While negotiations for a union of the two companies were in progress, proceedings had been begun against the Eagle Company, by the heirs of Thomas W. Harvey, for infringements of his patents. These claims would have applied also to the New England Company. Both companies had made use of principles covered by the patent for automatic screw machinery, patented by Harvey, May 30, 1846. The claim against both companies was admitted and settled, after the organization of the American Screw Company, on terms fixed by arbitration.

In 1860 the American Screw Company bought up the property of the Utica Screw Company, of Utica, N. Y.; and the following year they also purchased the property of the Bay State Screw Company, at Taunton, Mass. The Bay State Company had been organized in 1852, and was chiefly engaged in the manufacture of rivets and machine screws, and screws for stoves, and for carriage and other iron-work; and it had attained some success in that class of work.

The progress of the American Screw Company during the remaining ten years of Mr. Angell's life was constant and rapid. It had, during this period, the advantage of the high price of gold, which was almost prohibitory of importation. While, however, the property and actual capital was rapidly increasing in value, no change was made in the nominal capital until 1876. In few lines of manufacture was there so small a percentage of successful concerns. Of more than seventy companies and firms engaged in the manufacture of screws, unconnected with other interests, besides the two companies comprising the American Screw Company, only two, the Bay State, at Taunton, and the National, at Hartford, were fairly successful. William G. Angell, President of the Company, died on May 13, 1870. He had married Ann R. Stewart, of Providence. Their children were Edwin G. and William H. The latter died in 1874.

Mr. Angell was the guiding spirit and "formative genius" of the enterprise; and to him, in a very large degree, it owed its final success. He took care to inform himself, not only on the details of machinery and mechanical construction, but on the complicated subject of the patent laws, which constantly entered into the affairs of the Company; and as he himself also took an active part in its mercantile relations, he also made himself familiar with the wants and means of supplying the market of the country. His policy, as regarded financial matters, was rather to distribute the earnings to the stockholders, than to create from them a reserve fund; and thus large dividends were paid regularly from year to year.



Wm. Sizer & Co. Boston

EAGLE HILLS
AMERICAN SCREW COMPANY,
PROVIDENCE, R. I.



He was succeeded as president and executive manager by his son, Edwin G. Angell, who still retains these positions, administering the affairs of the Company with vigor and ability. During the period since the elder Angell's death, depression in business, by diminishing building operations, has lessened the demand for the Company's products. Despite this, the works at Providence were enlarged, and arrangements were made in 1873 to transfer the business and machinery of the Bay State Company at Taunton to the former city.

The large and convenient building on the north side of Stevens Street was then erected and occupied, and received the name of the "Bay State Mill." Several important patents have been taken out; one of these, dated May 30, 1876, made a great change in the form of the screw. A defect in screws heretofore has been their liability to break, or to twist in two, at the point of the sudden diminutive of the wire, caused by cutting the thread. Under the patent referred to, the wire, while uniform in size, from the base of the head to the beginning of the thread, decreases in size, with a regular taper, for about one-half the length of the thread; and then, as in ordinary screws, continues of uniform size to the beginning of the taper near the point.

The cost of production has been lessened, so that the Company has sold screws at a reasonable profit, and at less price than ever before. To facilitate a foreign trade, the property of the Canada Screw Company, at Dundas, Ontario, was purchased in 1876, which enables them to compete on equal terms with English manufacturers.

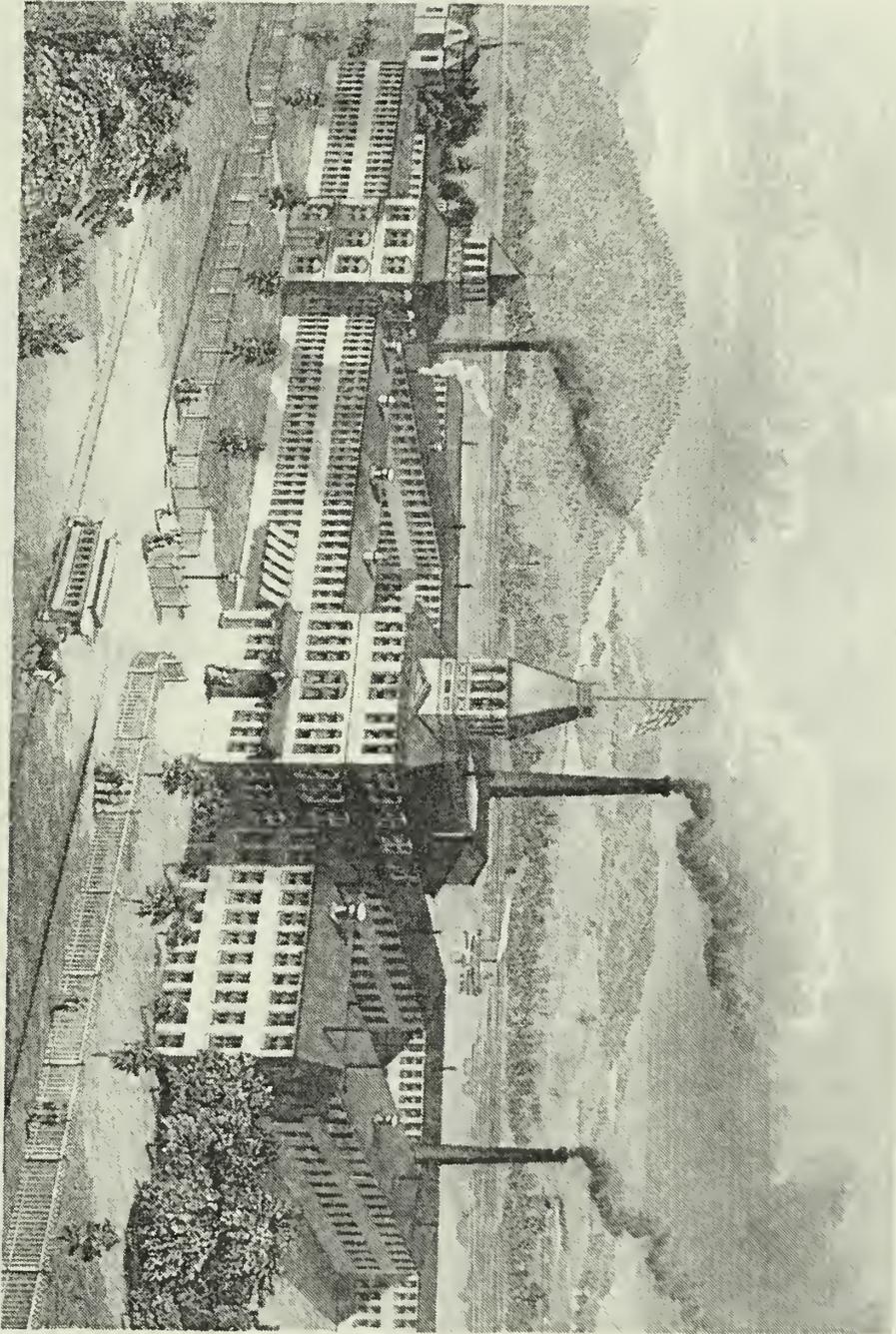
A brief description of the processes of manufacture as conducted by this Company will not be out of place here. The work begins with the drawing of the wire, both of iron and brass, in the different sizes needed for the great variety of screws. The machinery for the different processes is the result of the skill of many inventors, who have gradually produced a system of machines, mostly automatic, and accurate and beautiful in operation.

The screw-machine, indeed, exceeds the card-machine in its life-like working. The card-machine deals always with wire of the same size and quality, fed into its grasp and then carried forward to the completion of the work, under the most certain and invariable conditions; while in the American screw-machine there is the liability that, among the blanks of a given and uniform size furnished to a machine, there will have been dropped in, here and there, one of larger size or of greater length. The result to be expected, if this happened, would be a derangement or breakage of some part of the machine; but the machine at once adjusts itself to the emergency. It may be stopped violently—as, for example, by the interposition of a bar of iron between its driving-gears, or by some impediment elsewhere; and

when the impediment has been removed, the machine starts off again of its own accord. To provide fully against loss of time in running the machines, many duplicates of every piece of each variety of machines are at all times kept on hand for instant use, when necessary. The result is that but a small force of machinists, and but small provision of room, are needed for repairs.

The Company has a spacious room set apart as a museum, with an interesting collection of machines; beginning with those of the earlier American inventors, Sloat and Crum and Pierson, and including those of Harvey, Sloan and Whipple, and many others. These show the progress of invention in this line for nearly fifty years. This collection is not only unique, and of great interest to the curious mechanic, but is of great value as showing the rocks on which others have split, and the reasons of failure in devices. These machines, also (even those which, as a whole, may be crude and inoperative), often contain, in some device or peculiarity of adjustment, the germ or suggestion of valuable ideas to the experts in this class of machinery in the employ of the Company, and who are constantly at work to improve the old, or to construct new machines.

The present officers of the Company are: Edwin G. Angell, President; Albert G. Angell, Agent; William H. Henderson, Treasurer; and Charles T. Salisbury, Secretary. Mr. Salisbury having been for some years the treasurer of the Continental Screw Company, of Jersey City, N. J., removed, in 1871, to Providence, and entered into his present relation to the Company. The capital was increased, in 1876, to \$3,250,000; and, with its large factories, its improved machinery and its able management, it may reasonably hope, not only to continue to hold the position it has so long maintained among the manufactories of our own land, but to compete, at no distant day, with the great screw manufacturers of Birmingham, England, for the trade of the world.



*Shawmut Mule & Company
Waltham, Mass.*

THE AMERICAN WATCH COMPANY.



ORIGINALLY, the watch was moved by weights, and was, in reality, only a little clock. The case was made of iron; and, on account of the weights, it was suspended by a cord about the neck. It was but little more than three centuries ago, about 1555, that the spring was devised, superseding the weights, and thus rendering the watch easier to be carried. The springs were not coiled, as now, but were straight pieces, and occupied more space. The watch also had but one index, or hand, and must be wound two or three times a day. The faces were usually of brass, and the cases were without crystals, and shut over the face much like the hunting-watch case of the present day. The case was from five to six inches in diameter, and the watch itself cost about fifteen hundred dollars of our currency. The watch-makers of Europe finally produced watches of convenient size, and within the means of persons of moderate circumstances; while those of higher cost were of great beauty of finish, and very exact time-keepers.

In 1848 two ingenious mechanics of Boston, Aaron L. Dennison and Edward Howard,—the former a skillful repairer of watches, and the latter a clock-maker, who learned his trade with the Willards,—conceived the idea of making watches by machinery, with most of the parts interchangeable; they were convinced that they could thus make a more perfect watch, and compete with the skilled but low-priced foreign labor. They observed that foreign watch-makers worked without system and without machinery, except what was supplementary to hand labor; and they decided to undertake the enterprise. Mr. Dennison, closing up his business as jeweler and repairer of watches, entered the clock factory of Howard and Davis, in Roxbury, and, with Mr. Howard, began some experiments. They then associated with them Samuel Curtis, of Boston, who proposed to invest the requisite capital. A brick building of two stories, 100 feet long and 25 feet wide, was erected near the

clock factory of Howard and Davis. They assumed the firm-name of the Warren Manufacturing Company, and made at first fifty watches, to run eight days without re-winding. These, however, did not prove to be accurate; and they then made one hundred of the usual thirty-hour watch, as simple in all its parts as possible.

Soon after, they assumed the name of the Boston Watch Company; and the business was continued at Roxbury until 1854, when a large factory, in the form of a hollow square, one hundred feet on each side and two stories high, was erected at Waltham, Mass., whither the business was removed. An act of incorporation was obtained by Edward Howard and others, March 23, 1854, under the name of the Waltham Improvement Company, with a capital of \$300,000. The enterprise was continued there, under the superintendence of Mr. Howard, until the autumn of 1856, when the large expenses to which the Company had been subjected involved it in financial difficulty, which compelled it to make an assignment for the benefit of the creditors. The business was continued by the assignees, until the spring of 1857, when the property was purchased at auction by Royal E. Robbins, representing the firm of Appleton, Tracy & Co. The industry was carried on at first under the name of the Waltham Improvement Company, to all of whose interests and franchise Mr. Robbins and his associates had succeeded. By act of the legislature, in February, 1859, the name was changed to the American Watch Company. Mr. Robbins was elected treasurer and agent; and, under his administration, the new Company was soon placed on a prosperous basis. At the present time, from three hundred and fifty to four hundred watches are completed every ten hours of daily work-time; and the rate of production often exceeds the larger figure. These watches not only find a large sale in this country, but a market for them has been established in London, and foreign sales have now become a considerable part of its trade.

The capital stock of the Company has been increased, from time to time, until it now amounts to \$1,500,000. Its substantial buildings cover an area of about two acres, and are surrounded by a thriving village. The factory is conducted in twenty-four departments, each in charge of a foreman; and the whole is under the administration of Charles Van der Woerd, mechanical superintendent. The number of operatives is about one thousand, one-half of whom are women and girls, mostly of New England birth. A part of the business—the manufacture of the gold cases—is carried on in New York City, for account of the Company, by Robbins and Appleton, large owners in the Company, representing it there. The silver cases are made in the factory at Waltham. The American Watch Company has, from time to time, employed new machinery specially adapted to the work, not only to replace hand labor, but also to secure accuracy and perfection in the mechanism, and to duplicate

and multiply indefinitely any single piece. "By means of micrometric gauges, any deviation, to the ten-thousandth part of an inch, can be detected. No human hand, at its best, can rival this exactitude. It is this unerring, unfailing automatism that gives the uniform quality to the American watch."

European manufacturers are viewing with jealousy, not unmingled with alarm, the invention and employment of machinery in watch-making in this country. The dependence of the American people upon the English and Swiss for their time-keepers has ceased to exist, and exportations have largely taken the place of importations.

M. Edouard Favre Perret, who was a member of the jury on watches at the Philadelphia Exposition, one of the Swiss Commissioners, and himself a watch manufacturer, in an address delivered Nov. 14, 1876, before a gathering of Swiss watch manufacturers at La Chaux de Fonds, one of the principal seats of the industry in Switzerland, said: "For a long time we have heard of American competition, without believing it. The skeptics—and there were many of them—denied the possibility of a competition at once so rapid and so important. To-day we are forced to believe the proofs of it, and to acknowledge the existence of a formidable manufacture. . . . Up to this very day we have believed America to be dependent on Europe. We have been mistaken." His closing appeal was in these words: "Do not lose time. Labor to regain our lost position. Imitate the Americans, who, in twenty-five years, have overtaken, and passed us."

AMES MANUFACTURING COMPANY



THE Ames Manufacturing Company, of Chicopee, Mass., was formed by Nathan P. Ames, Sr., who, after having completed his apprenticeship at the blacksmith's trade, in 1791, engaged in business on his own account. His shop stood in Chelmsford, now Lowell. His trip-hammer and other machinery were operated by water-power, from a mill-privilege on the Concord River, which the Richmond paper-mill now occupies. He also manufactured edge-tools, and wrought in the iron parts of mill-work. About 1810 Mr. Ames's shop was burned; and he, with his family, removed to Dedham, Mass., where he started a factory for the production of nails by machinery. This was one of the earliest factories of the kind in New England. He remained in Dedham about a year, and then returned to Chelmsford, where he rebuilt his shop on the old site, and resumed his former business. Here his two sons, Nathan P., Jr., born at Chelmsford, Sept. 1, 1803, and James T., born at Dedham, May 13, 1810, were employed, from early boyhood, in their father's shop, during the intervals between the terms of the district school.

In 1829 Mr. Ames transferred the business to his son Nathan, who, with his father and brother, removed to Chicopee Falls, and established a shop at a privilege now occupied by the Lamb Knitting Company, on the Chicopee River. James T. Ames assisted his brother, and remained as an apprentice with him until 1834. The manufacture of swords for the United States Government was commenced in 1831. Three years later the brothers Ames, with James K. Mills and Edmund Dwight, prominent merchants of Boston, organized a joint-stock corporation, under the title of the Ames Manufacturing Company, and bought the privilege it occupies at Chicopee. The capital stock was \$30,000. Mr. Mills was made treasurer of the Company, and Nathan P. Ames its resident agent, with the general management of

the business, while James T. Ames became superintendent of the manufacturing department. Besides the immense quantity of regulation swords and sabres for the United States Army and Navy and for State militia, these works have produced a large proportion of the swords used by Masonic bodies, and dress-swords for military and other officers.

The Company began the manufacture of brass cannon in 1836, which it has since continued. The metal used for this purpose is an alloy of copper, being, properly, a bronze. Gun-metal is usually composed of about ninety parts of copper and ten parts of tin. About the same time the Company engaged in the manufacture of leather belting, military accouterments, artillery harnesses, and other leather work connected with their metal work of lathes, planers and other machinists tools, besides special tools for gun-makers. In 1840 N. P. Ames, in company with a commission from the United States Ordnance Department, went to Europe to examine the improved machines available for gun-making, with a view to the manufacture of new and better tools for the United States Armories. The capital of the Ames Manufacturing Company was increased, in 1840, to \$75,000, and the business of the Company was pushed with increased energy. In 1846 the capital was made \$200,000; and, in the same year, the declining health of N. P. Ames induced him to retire from active business. He died in 1847. His brother, James T. Ames, succeeded to the general management of the concern; and, in 1849, the capital was increased to its present amount of \$250,000. In the same year was commenced the manufacture of the Boyden Turbine Wheel, which had been invented and patented by Uriah A. Boyden, of Boston, about two years before. Its principle was first used with success by a Frenchman, named Fourncyrow, in 1824. The right to manufacture the Boyden wheels was conveyed to the Ames Company in 1859, and it was soon adopted by the large cotton-mills in the vicinity. Though it was the earliest of the American turbines, and though the ingenuity of many mechanics has been exerted to improve upon it, this wheel is still unsurpassed. A large number of turbines, varying from one hundred to five hundred horse-power, have been in use from ten to twenty-five years in the large cotton and other mills of New England and New York. Among the special machines produced in the Company were some made to the order of the United States, for use in the national armories; others, to the order of private companies and firms engaged in the manufacture of small arms. In 1853 the English government sent a commission to this country to investigate the American machines for gun-making, and contracted with the Ames Company to furnish gun-stocking and other machines, for the manufactory of small arms, at Enfield. A large demand was thus soon created for similar machines for foreign countries.

In 1853 the Company prepared its foundry for the production of statuary and other works of art in bronze. This enterprise involved both the investment of capital and peculiar risk. But the Ames Company achieved from it successful and gratifying results. Among their productions in this branch of industry are the equestrian statue of Washington, in Union Square, New York, and the statue of DeWitt Clinton, in Greenwood Cemetery, Brooklyn, after models by H. K. Browne; the equestrian statue of Washington, and the statue of Franklin, in Boston, both modeled by Thomas Ball; and the statue of Abraham Lincoln and the four groups, including several statues each, for the monument at Springfield, Ill., of colossal size, and modeled by Larkin G. Mead. The Company also cast the great bronze doors of the capitol at Washington, the models for which were made by the sculptor Crawford. Since the war, statues and bass-reliefs for soldiers monuments have afforded a large field for the enterprise of the Company. A smaller work of the same kind is a statuette of Daniel Webster, modeled by Thomas Ball. The colossal statue of Webster, in Central Park, New York, presented to that city by Gordon W. Burnham, is an enlarged copy of the statuette, and was modeled by the same artist. In 1858 Mr. Ames went to England, as agent of the United States, to examine machinery used there in rolling gun-barrels, and while there purchased, on behalf of the Government, some machines for the armories at Springfield, Mass., and at Harper's Ferry, Va.

Mr. Ames continued in the executive management until 1872, when he retired. He married, in 1838, Ellen Huse, of Newburyport, Mass. Their only surviving child, Sarah, is married to Albert C. Woodworth, who is now president and resident agent of the Company. He was born in Chicopee, Mass., June 5, 1841. When he was two years old his father's family moved to Ohio, and he spent the next fifteen years on a farm. In 1858, when seventeen years of age, he removed to Chicopee, and entered the employ of the Ames Manufacturing Company, as an apprentice, at the trade of sword-making. He continued to do mechanical work until 1865, in which year he went to New York, and became salesman for a large house engaged in the importation of bronzes and other art goods. He was admitted a member of this firm, which had become the agents of the Ames Manufacturing Company, in 1872. At the beginning of 1875 he returned to Chicopee, and was elected resident agent of the Company; and two years later he succeeded to its presidency.



O. AMES AND SONS.

OLIVER AMES—OAKES AMES—OLIVER AMES.



IN England, manufacturing establishments often remain in the same family to the third and fourth generations. In the United States, comparatively few industries are controlled even by the sons of their founders. A strikingly exceptional instance is found in one of the most prominent manufacturing establishments of New England, founded at Easton, Mass., by Oliver Ames.

Seventy-five years ago he began, on the premises still occupied by his grandsons, the manufacture of shovels and spades, which has developed to such proportions that more than one-half of these implements made in the world are the product of this firm.

Oliver Ames, Sr., was born at West Bridgewater, Mass., April 11, 1779. He was the youngest of eight children of John and Susannah Ames, and was descended in the sixth generation from William Ames, who came, in 1638, from Benton, Somersetshire, England, and settled in Braintree. His brother John came in 1643, settled in Duxbury, and was one of the fifty-four residents of Duxbury to whom, in 1645, a grant was made, by the colonial authorities at Plymouth, of the territory west of Duxbury, "twelve miles into the woods" and "four miles every way from the place where they should set up their center." Of the fifty-four were Capt. Miles Standish, Gov. William Bradford and John Alden. Though the land was granted by the Colony, the rights of the Indian proprietors were recognized, and a formal purchase was made from Massasoit, by a committee consisting of Capt. Standish and two others. The price paid was seven coats (one and a half yards), nine hatchets, eight hoes, twenty knives, four moose-skins and ten and a half yards of cotton cloth.

The first actual settlement was made in 1650, eighteen of the proprietors only removing to the new place. One of these was John Ames. The town was incorporated as Bridgewater, in 1656, the original center being the present West Bridgewater. The son of William Ames, of Braintree, also named John, followed his uncle John to Bridgewater in 1672. The senior, John Ames, having no children, gave the larger part of his estate in Bridgewater, in 1697, to his nephew John. The latter, born in 1651, had five sons. The second, Nathaniel, was the grandfather of Fisher Ames, distinguished for his eloquence as a lawyer and statesman in the early years of the Republic. The third son of John Ames was Thomas, great-grandfather of Oliver, the subject of this sketch. The father of Oliver, named, like his great-grandfather, John, was the blacksmith of Bridgewater; and in the latter years of his active labor engaged in the manufacture of shovels, on the site of one of the present shops of O. Ames and Sons. The business was, therefore, founded in the last century, nearly a hundred years ago, and continued in the same family through four generations.

Oliver's education was that afforded by the rural schools of New England in those days. The practical experience of his early home gave him the mechanical skill, the industry and the integrity which were characteristic of him in after life. When eighteen years of age he went to Springfield, Mass., to learn the trade of a gunsmith. His eldest brother, David, had gone thither in 1794, to establish the United States Armory, receiving his appointment from the administration of President Washington. The act authorizing the establishment of the Armory was passed by Congress in April, 1794. David Ames was the first superintendent, remaining in office till 1802. Oliver Ames continued to work in the Armory till the close of his brother's term, in 1802. He then returned to West Bridgewater, and engaged with his father in the manufacture of shovels.

In April, 1803, he married Susannah Angier, of West Bridgewater. By this marriage, two distinct branches of the English family of Ames were united, Susannah Angier being descended from Dr. William Ames, one of the most distinguished Puritan divines of his time; who, graduating at Cambridge in 1607, went, in 1612 to Holland, and became Professor of Theology at the University of Franquer. He was the author of "*Medulla Theologiæ*," and other theological works, and died in 1633. His daughter, Ruth, coming to this country with her brother William and her mother, in 1637, married, in 1640, Edmund Angier, of Cambridge. Their son Samuel, graduating at Harvard College in 1673, was installed as a minister at Rehoboth, in 1679, and at Watertown, in 1697. He married, in 1680, Hannah, daughter of Rev. Urian Oakes, who graduated at Harvard College in 1649, was elected its president in 1675, and held that office till his death, in 1681. The son of

Rev. Samuel and Hannah (Oakes) Angier, was John Angier, who graduated at Harvard College in 1720; was settled, in 1724, as the first minister of the church in East Bridgewater, and died in 1787, having been pastor of that church for sixty-three years. His son, Oakes Angier, graduated at Harvard College in 1764, studied law with the elder President Adams, settled in practice at West Bridgewater, and became eminent at the bar. His daughter, Susannah, became the wife of Oliver Ames.

The latter, soon after his marriage, removed to the northern part of the adjoining town of Easton, then mostly covered with forest, and very sparsely inhabited. He was attracted to the locality by an excellent water-privilege, of which he wished to avail himself in the manufacture in which he proposed to engage. In 1805 his father died, leaving his affairs in an embarrassed condition, in consequence of having rendered friendly aid to others. He at once undertook the task of trying to restore the previous prosperous condition of the business at West Bridgewater, in addition to the management of his own enterprise in Easton.

Soon afterward he contracted with a firm at Plymouth—Russell, Davis & Co., who had been engaged in the manufacture of shovels—to make their goods; and, in order to fulfill this contract to the best advantage, he removed with his family to Plymouth, in 1807, and there remained till 1813. The war with Great Britain being then in progress, business was much depressed, and the stock of goods on hand had so increased that it became necessary to suspend operations. Mr. Ames returned to Easton, and there, early in 1814, erected a factory in company with some others, and began the manufacture of cotton goods, and afterward, also, of cotton machinery. He had as a member of his family, and as foreman in the latter branch of his business, Warren Colburn, afterwards distinguished as an arithmetician and as superintendent of the Merrimac Mills, at Lowell. This factory was soon destroyed by fire. These various causes—the effort to restore his father's business, the disastrous effect of the war on his own business, the considerable outlay in the new enterprise at North Easton, and the loss of the cotton factory of which he was the principal owner—combined to seriously embarrass him, and they would have disheartened a man of less courage and persistency. At this time (1815) he became largely indebted to many of the farmers of his own and neighboring towns, especially for charcoal, then used in the manufacture, as anthracite coal is now used. But he was found to be both able and willing to pay his debts.

After the loss of the cotton-factory, he devoted himself exclusively to the manufacture of shovels and spades, at North Easton and at West Bridgewater. Being now nearly forty years of age, in the maturity of his powers, he brought to the business unusual physical and mental energy. To these he added large business capacity, a special mechanical training begun in early boyhood, and

experience in personal management. He at once began to increase his facilities, and to inaugurate that succession of improvements which have made the works at North Easton so prosperous. He allowed no defect in any implement which bore his name, and sought constantly to improve the quality of his work, whether in iron, steel or wood. In 1844 he associated with himself his sons Oakes and Oliver, under the firm-style of O. Ames and Sons.

Oakes Ames was born at Easton, Jan. 10, 1804. His boyhood and youth were mainly spent at his father's shop and farm. He attended the district school, and afterwards a short course, when he was sixteen years of age, at the Dighton Academy. Being, like his father, of large frame and great muscular power, he early evinced a capacity for athletic, mechanical and agricultural exertion, and became a valuable assistant to his father in the details of his manufacture, and of his land improvements. In those days of limited facilities for transportation, both the materials and the products of the manufacture were laboriously carted from or to Taunton, Providence or Boston; and Oakes often drove the one-horse wagon to and fro. In the work early begun by his father for the improvement and increase of the water-power at North Easton, his sturdy vigor also played no unimportant part.

On the 29th of November, 1824, he married Eveline O., daughter of Joshua Gilmore, of Easton. During the next twenty years the interests of the manufacture closely engaged his energies, and he remained the associate and assistant of his father, while his brothers directed their attention to other pursuits. These early years left their record in improved processes and enlarged results, while those business qualities were matured which served him well in after life. He became a member of the firm, formed in 1844, of O. Ames and Sons, and virtually its head, his father, then sixty-five years of age, transferring to his sons the active responsibility of the concern. In the new firm the junior partner was Oliver, the third son of Oliver and Susannah Ames.

Oliver Ames, Jr. was born at Plymouth, Nov. 5, 1807. Like his elder brothers, he passed his boyhood and youth in assisting his father in mechanical and agricultural work, sharing with them such labor as was adapted to his years; and very early he became expert in the use of tools, and a thorough workman in every branch of the shovel manufacture. When a lad, though one of the most athletic and cager in the sports and games of the day, his natural bent was for study and books. In a letter, written in later life, he said: "I had, very early, a great love for historical and philosophical reading, and ran through all the books of this class in our social library, and what were possessed by our family, and what I could get from a very good library of my uncle, Dr. Hector Orr, of East Bridgewater. Very few works of fiction were then published; but what were accessible I read with great interest, such as

“Thaddeus of Warsaw” and “the Scottish Chiefs,” of Jane Porter, and the “Waverley Novels.” In the common school he stood at the head of his class, and before attaining his majority became much interested in debating-clubs and lyceums, which were at that time very popular.

In 1828 he was temporarily withdrawn, by a severe fall, from his ordinary pursuits. While seeking recovery, his scholarly tastes inclined him to renew his studies; and, though twenty-one years of age, he entered the Franklin Academy in North Andover. Among his classmates were Amos A. Lawrence, of Boston, and Surgeon-General Wm. J. Dale. He intended to prepare for college, and then to study law; but upon his restoration to health he entered at once the office of Hon. William Baylies, at West Bridgewater. Mr. Baylies was eminent in his profession, and was for many years at the head of the Plymouth bar. Mr. Ames, however, pursued his legal studies but a short time; the increasing demands of his father’s business called for his aid, and he entered into a partnership with his brother Oakes, which was destined to continue for more than forty years. On June 11, 1833, he married Sarah, daughter of Hon. Howard Lathrop, of Easton.

Oliver Ames, Sr., on the formation of the firm of O. Ames and Sons, retired, as has been said, from active relations with the business, but lived nearly twenty years longer, passing away at the ripe old age of eighty-four years and five months, Sept. 1, 1863. His wife’s death had occurred sixteen years before. He appears most prominently as an organizer of labor, and as a successful leader in a useful branch of manufacture. In addition to valuable improvements in the processes of manufacture, and in the forms of different parts of the implements made by him, he was an inventor of many useful devices outside of his own specialty. The furnace water-back and the iron wheel-hub were of his invention. He was an enthusiastic agriculturist. In the many demands of his middle-life, he found time for the oversight of farm-work. Unassuming and just in all his relations, his *employés* felt that he was their friend. He retained his physical vigor by simple and temperate habits. Taking a deep interest in public affairs, he was elected as representative in the lower branch of the Massachusetts Legislature in 1828–29, and as senator in 1845. In his own town he refused all office except that of Surveyor of Highways. His diligent supervision of this department for years, and the expenditure of thousands of dollars of his own means, gave to Easton many good thoroughfares.

The development of the business, after the organization of the firm in 1844, was rapid. In twenty-five years, the increase in product was sixfold, the number of shovels, spades and scoops made having been, in 1845, 20,000 dozen, and in 1870, 120,000 dozen; or from less than 5,000 shovels and other utensils per week in 1845, to nearly 30,000 per week in 1870. To provide for this vast increase of

production, additional shops were established in North Easton and Braintree, in 1823, and at Canton, in 1844. In 1861 the firm came into possession of the property of Nourse, Mason & Co., manufacturers of plows and other agricultural implements at Worcester and Groton (now Ayer) Junction, that firm having become bankrupt, the Messrs. Ames being their largest creditors. In 1864 the business was reorganized as the Ames Plow Company, and has since been conducted under that name. A sketch of that industry under its previous and present organization, is given elsewhere.

On the death of the senior member of the firm, in 1863, two sons of Oakes Ames, Oakes Angier and Oliver, 2d, and one son of Oliver Ames, Jr., Frederick Lathrop, were received into the firm. Oakes Angier Ames was born at North Easton, April 15, 1829. Oliver Ames, 2d, was born at North Easton, Feb. 4, 1831. Both received a good common-school and academic education; and, on arriving at a suitable age, entered the works at North Easton. For some years prior to their admission to the firm, and to a still greater degree after that event, they had the virtual charge of the extensive operations at the central works at North Easton, as well as at West Bridgewater, Braintree and Canton. This relation to the business they still retain; the mercantile and financial departments, with the office business at Boston, being under the supervision of their cousin, Frederick L. Ames.

Frederick Lathrop Ames was born at North Easton, Jan. 8, 1835. He graduated at Harvard College in 1854, and soon afterward entered the office of O. Ames and Sons, receiving there the business training which fitted him, in connection with his cousins, to assume, ten years after, the principal charge of the industry which had been developed by the firm. Soon after the admission of their sons as partners, the time and energies of Oakes and Oliver Ames became, to a large extent, devoted to important interests outside of their enterprise; the development of which they at first proposed to aid only by the investment of capital not needed in their business, but to which they were subsequently induced to assume the relation of active promoters and agents. One of these new interests was the construction of the Union Pacific Railroad. This fact devolved upon the younger members of the firm, at an early period after their admission to it, the chief charge of its business.

In December, 1870, in consequence of a decision of the Secretary of the Treasury, afterward reversed, but which affected injuriously very large interests of the firm, the concurrence of very heavy losses by failures on the Pacific coast, and the general stringency of the money market, O. Ames and Sons were compelled to suspend payments. It was shown at the meeting of the creditors, that there were surplus assets, at a low estimate, of over \$8,000,000. The creditors promptly granted all the extension asked for, leaving the business wholly in the hands of the firm. In

two years, the whole seven millions of outstanding liabilities were paid, with interest, and the credit of the firm was restored to its former position.

Up to the close of 1860 the energies of both the brothers, Oakes and Oliver, were devoted to their personal business, the only public service of either being that of Oliver, in the Massachusetts Senate, in 1852 and 1857. In 1860 Oakes Ames was elected a member of the Governor's Council, and served in that capacity during 1861 and 1862.

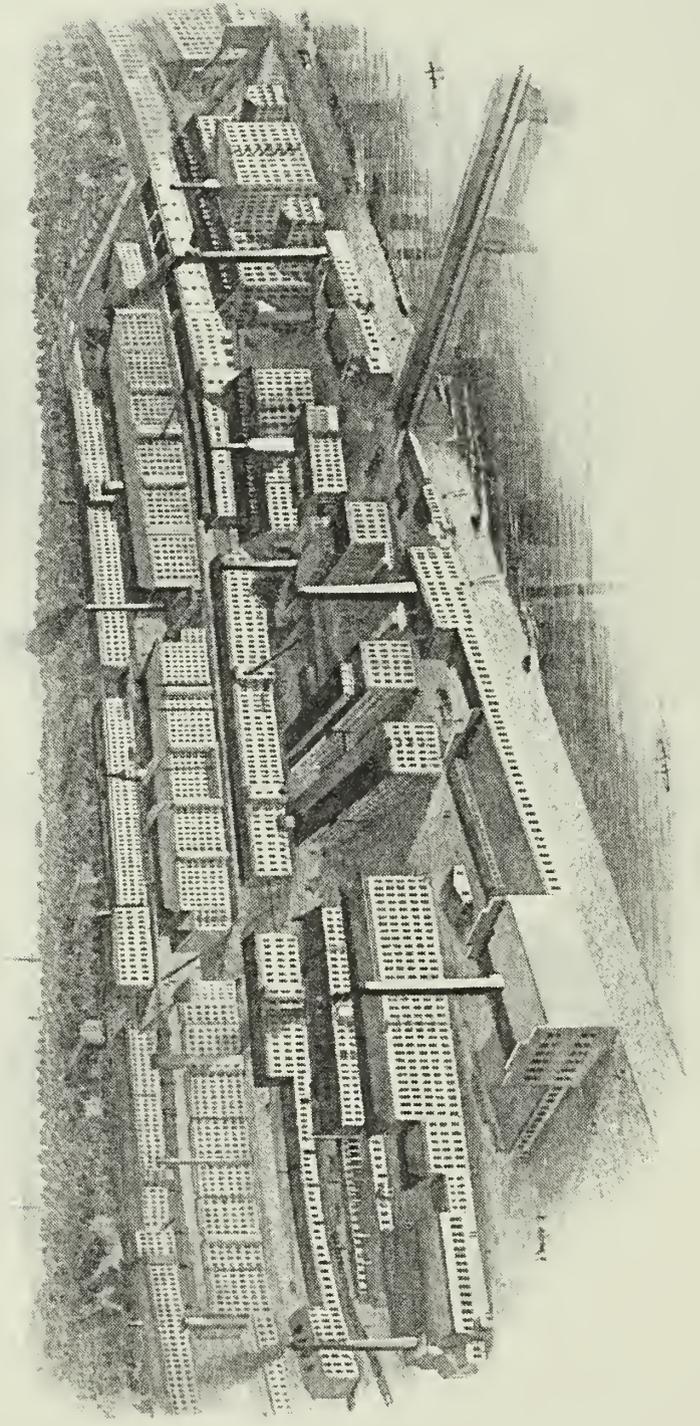
In 1863 Mr. Ames took his seat as a member of the Thirty-eighth Congress; and in 1864 he was appointed a member of the Committee on the Pacific Railroad. The bill relating to this road did not awaken sufficient interest in capitalists to insure their adequate co-operation; a few only subscribed about half a million dollars, and then became so discouraged that they preferred losing what they had paid rather than to make new investments. When the bill was passed, neither Oakes Ames nor any other member of Congress had an idea of engaging in the enterprise. More than a year afterward, however, Mr. Ames resolved to lift it out of its embarrassment and to carry it through. He and his brother, with their associates, proceeded to build the road and equip it, which they did in half the time allotted. The *Boston Advertiser* stated that "All the private means that Mr. Ames could command were diverted to the road, and a score or more of our wealthy merchants, who are now financially connected with the Company, were induced to embark in the enterprise solely through the solicitations and influence of Mr. Ames. Until the road was all but completed, neither the stock of the road nor of the construction-company was considered a safe investment by careful business men; and none knew better than those associated with Mr. Ames in this work, that if it had not been for his indomitable energy and perseverance, both companies would have been obliged, by bankruptcy, to have discontinued the construction of the road."

On the 4th of March, 1873, Mr. Ames closed his fifth Congressional term. On the 5th of May following, he suffered a stroke of paralysis. Three days later, on May 8, he quietly passed away, surrounded by his family and relatives. Although a man of the people, Oakes Ames was no common man. Fearless, frank, at times brusque and rugged in his manner, he was yet of a kindly and generous nature. Simple in tastes and habits, plain almost to homeliness in his address, he was a believer in the worth and dignity of work. In his native town and his home, he won and kept the respect, confidence and affection of neighbors, friends and kindred.

His brother Oliver, so long and so closely associated with him in private and public enterprises, survived him about a year. He was elected, in 1866, to succeed Gen. John A. Dix as president of the Union Pacific Railroad, and held that office during the construction of the road, and till March, 1871, through more than four

years of its severest trials and most difficult operations. With increasing familiarity with the needs of the enterprise, he brought order out of confusion. Inflexible, prompt and efficient, he overcame some of the greatest obstacles to the road, and was a director in it until his death. His capacity, sound sense and integrity caused him to be sought for in other positions of responsibility, as president or director in various financial institutions, in manufacturing corporations, and in railroad or steamboat companies. He was of the same massive physical mold with his father and brother, was of a calm and placid nature, of courteous manners, of simple yet cultivated tastes; and, in the pressing demands of business, he took time for mental culture, religious duty and social and domestic enjoyments. He was for many years first vice-president of the Massachusetts Total Abstinence Society. He contributed freely to the educational interests of Easton, and to the endowment of the higher institutions of learning of Massachusetts and other States. He was a member of the Unitarian religious society of North Easton, and built and presented to that society a costly church and parsonage, and laid out for it a cemetery. He also left a fund to keep the church and parsonage in repair, and another for the care of the cemetery. Besides these gifts to his own parish, he erected and gave to the Methodist Episcopal Church of North Easton their present church edifice, and devised a fund for a town library.

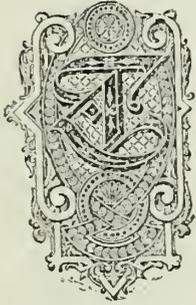
His health began to decline some years before his death. In 1874 he laid aside, to a large degree, the cares of business. On the 2d of March, 1877, he was attacked with pneumonia; and on the 9th of March he breathed his last.



ANDOVER PAPER MANUFACTURING COMPANY

MANCHESTER, N.H.

THE AMOSKEAG MFG. COMPANY.



HIS, the oldest and largest manufacturing corporation in the city of Manchester, N. H., is the outgrowth of a private enterprise, whose origin dates back to the year 1809. In that year Benjamin Pritchard, who had previously removed from New Ipswich, formed a partnership with the three brothers Stevens, for the purpose of manufacturing cotton and woolen goods. The firm erected a mill, forty feet square and two stories high, on the Merrimac River, at Amoskeag Village, then Goffstown. The following year a joint-stock company was formed, and, in June of that year, was incorporated as the Amoskeag Cotton and Woolen Manufacturing Company. Of this Company, James Parker was chosen president, and Jotham Gillis agent and clerk. There was then no other cotton-mill upon the territory now within the limits of the city of Manchester; and in this one there was neither picker nor loom, the sole operation performed being that of spinning. The cotton was picked, and the cloth woven, in the dwellings of the neighboring inhabitants.

The Company carried on operations in a small way until 1822, when Olney Robinson bought the property, and for a brief time carried on the business. His successors were Larned Pitcher and Samuel Slater, of Providence, R. I. In 1825 these two gentlemen associated with themselves Willard Sayles, Lyman Tiffany, Oliver Dean (better known as Dr. Dean) and Ira Gay, four Massachusetts capitalists, three of whom, at least, had a practical knowledge of the business. Dr. Dean was made the firm's agent, and the next year he removed his residence to Amoskeag Village. Under his management operations were carried on more vigorously. In 1826 the mill first built was enlarged, and two others were erected; one of them, upon an island in the river. The manufacture of sheetings, shirtings and tickings was now undertaken, and prosecuted with such success that the products of these

mills, especially the tickings made in the island mill, and sold under the name of "A. C. A." tickings, became celebrated for their good quality. The manufacture of these goods was carried on uninterruptedly by the firm for five years, during which time no material change in the business occurred.

But, at the close of this period, events transpired which marked a new era in the history of this industry. On the 1st of July, 1831, the legislature of New Hampshire granted to the six gentlemen named, as the owners of the mill property at Amoskeag Village, a charter of incorporation, as the Amoskeag Manufacturing Company, with an authorized capital of \$1,000,000. Twelve days subsequently these gentlemen, with the exception of Samuel Slater, who had authorized Mr. Tiffany to act as his attorney, met together in their counting-room, and duly organized the corporation by the choice of the proper officers. The new Company, having taken the property of the old firm in exchange for stock in the corporation, proceeded at once to lay the foundation for a material enlargement of the business. Land was bought on both sides of the Merrimac, but chiefly on the east side, which was found to be the more desirable for manufacturing purposes. The property and rights of other manufacturing and water-power companies in the vicinity were also purchased. These purchases were continued, until the Amoskeag Company became the owner of all the mill-sites and water-powers on the Merrimac River from Manchester to Concord, and also of large tracts of land lying adjacent to the river, on either side, and extending a considerable distance from it. All needful preliminary purchases having been made, the work of developing the immense manufacturing resources at the Company's command was now prosecuted with energy.

At this time the Company created a land and water-power department, which was placed under the management of a separate agent. It was in connection with the business of this department that, in 1837, the construction of a new stone dam, to supersede the original one of wood, was begun, and was completed in 1840. During the same period the guard-gates were built at the lower end of this dam, with openings that measure five hundred and ten square feet; and the two canals which now conduct the water from the river through these gates to the various mills were also built. The upper of these two canals, constructed at the lower end of the dam, has a total length of five thousand four hundred and eighty feet, and at the upper end, where it receives the water from the river, it is seventy-three feet in width, with an average depth of ten feet. The dimensions of this canal are substantially continued, until it reaches below the principal mills located upon it. It terminates at a wear at its lower end, that discharges any surplus water through a viaduct below it into the lower canal. This viaduct is connected with the lower canal at a point nearly opposite the Manchester Mills. The lower canal commences

near the upper end of the upper canal, and is connected with it by a set of stone locks. It extends southerly, parallel with the upper canal, and two hundred feet westerly from it, being built between the upper canal and the river. It has a total length of six thousand nine hundred feet, and is fifty feet in width, with an average depth of ten feet, passing the viaduct which connects it with the upper canal. The land lying between the two canals is occupied as mill-yards for the mills upon the upper level. The water used by these mills is discharged from the upper into the lower canal, with a fall of twenty feet. The lower canal is terminated by a wear that discharges its surplus water into the river, with a fall of thirty-four feet; and the land between this canal and the river is used as yards for the mills drawing water from the lower canal.

In 1838 a site and privileges for mills was sold to the Stark Corporation, a company then recently organized; and, during this and the following year, two large mills were erected for this corporation. These two mills were the first buildings erected for manufacturing purposes on the east side of the Merrimac, at Manchester.

While thus engaged in the work of construction, the Company also took measures to foster the growth of a city in the vicinity of their mills. The large tract of land, embracing about fifteen hundred acres, which had been purchased by the Company on the east side of the river, was surveyed, and such part as was unsuitable for mill-sites was laid out in lots, with reservations for public parks, and placed upon the market. A large part of this tract was sold by the Company to individuals who proposed to erect dwellings or buildings for business purposes. In many instances lots that were desired as sites for churches and school-houses and other public buildings were donated. Thus an influx of population began; and upon the territory thus disposed of stands, to-day, the most compact portion of the city of Manchester. In 1845 the Company made a sale of land to a corporation which had just been organized as the Manchester Mills, and the same year erected for this corporation mills and a printery.

The Amoskeag Company continued to operate the three mills which had originally been owned by the private company who built them at Amoskeag Village, until they were destroyed by fire. The "Island Mill" was burned in 1839, and the other two, known respectively as the Old and the Bell Mill, in 1848. It was deemed inexpedient to rebuild them. But soon after the destruction of the Island Mill, the Company established a district department of its business, known as the "Amoskeag New Mills," and began the erection of two new mills, for its own use, on the east side of the river, just south of the Stark Mills. These were completed in 1841; to them the Company added other mills, from time to time, as the needs of its increasing manufacturing business required.

At about the time the New Mills department was created, the machine-shop department was instituted. Its business embraced the building and operating of shops for the manufacture of machinery. The first of these shops was erected in 1840, and is 381 feet in length, and 36 feet in width. The second, 320 feet long, and 40 feet wide, was put up in 1848. Each is three stories in height. In connection with these a foundry was built in 1842, which was replaced, in 1848, by another 154 feet long, and 80 feet wide. The shops were originally constructed for the manufacture of such new machinery as the Company needed, and for the repairing of old. But the business done in them was gradually extended to the production of steam-boilers, turbine-wheels, heavy tools, locomotives and steam fire-engines. The first locomotive built in these shops was constructed in 1849, for the Northern Railway Company. Several hundred were subsequently built. During the Civil War, about forty thousand stands of arms were made here for the United States Government.

But the most extensive business carried on in these shops was the construction of the celebrated Amoskeag Steam Fire-engine, which was begun in 1859. The manufacture of these engines, and also of hose-carriages, was prosecuted for about eighteen years. About fifty steamers were annually made, and widely distributed. The United States Government, and nearly all the principal cities in the country, were large purchasers of them, while some were sent to England, others to Russia, and others still to China, New South Wales, Peru and Chili. During the continuance of the manufacture of fire-engines, about four hundred and fifty men were employed in the shops. In 1877 the Company sold its rights and interest in this branch of its business to the Manchester Locomotive Works. Since that date the machine-shops have been used only for making and repairing machinery needed by the Company, and have given employment to about one hundred and fifty men.

The Amoskeag Company adhered to its plan of conducting its business under three distinct departments until July, 1856, when the land and water-power and new mills departments were consolidated. Two years later, the machine-shop department was also merged in the other operations of the Company.

In 1860 the Company sold its mills at Hooksett, which came into its possession in 1836, to another corporation. But it still owns property in that town, as well as in those of Bedford, Merrimac, Pembroke, Bow, Goshen and Washington, and in the city of Concord, N. H., and in Newark, Vt. In 1875 the Company bought what was then known as the Namaske Mill, which stands at the south end of the lower canal, where it empties into the river, and is three stories high, 160 feet long, and 60 feet wide. Including this, the Amoskeag Company own eleven mills, two machine-shops and foundry, cotton-houses, store-houses, and other accessory buildings.

In 1871 the stone dam constructed in 1837, having become unsafe, was super-

seded by another, built after plans drawn by the Company's agent, and under his immediate supervision. This dam is located further down the river; and, instead of running directly across the stream, it is so curved as to give a wider entrance from the river. It has an average height of twelve feet, and a total length of six hundred and fifty feet. It is considered one of the best structures of its kind in New England.

The Company still own about one thousand acres of land on the east side of the Merrimac; but of this, a considerable portion is still unoccupied. They also continue to own land on the west side of the river. For a number of years they were engaged in making a new channel for the river, by straightening its course from the dam to the mill, so as to enlarge the mill-yard. This work, which involved a large outlay, has now been fully accomplished.

The mill-yard, which at present embraces about fifty acres, has a frontage on Canal Street of one thousand and eighty feet. It reaches back to the river, along which it extends a distance of about two thousand feet. The mills themselves, which are all of brick, are very extensive, and, in this respect, are surpassed, if at all, by those of only one or two other cotton manufacturing corporations in this country. The first building entered after crossing the canal bridge at the foot of Stark Street is the counting-house, 110 feet in length, 36 in width, and three stories high. In the upper story is a large hall, used for the meetings of stockholders. Reaching further down the canal, and virtually an extension of the counting-house, and of equal height, is the cloth-room, 360 feet in length, and 30 in width. Extending from the cloth-room to the southern limit of the mill-yard is a mill 504 feet in length, and 30 in width, used both for spinning and carding. In the rear of the line of buildings thus described are mills No. 1, 2, 3 and 6. The two first named are the first that were built by the Company for their own use, after the old one upon the island was burned, and are counterparts of each other. Each is 157 feet in length, 48 in width, and six stories high.

In 1859 and 1860 these two mills, which, as originally constructed in 1841, stood apart, were connected by what is known as Mill No. 6, 88 feet in length and 48 in width; so that the three, with the picker-houses built at either end of the structure, now constitute, virtually, one large mill. Directly south of this building stands Mill No. 3, 440 feet in length and five-stories high, with a picker-house 135 feet in length by 60 in width. It was built in 1844, and reconstructed in 1870. These mills all stand upon what is called "the upper level;" descending to "the lower level," one comes upon a third line of buildings, three and four stories in height. The most northerly building in this line is a gingham weaving-mill, 472 feet in length, and 30 in width; and southward from this mill is a store-house 500 feet in

length. In the rear of this store-house is Mill No. 4, constructed in 1846, 260 feet in length and 60 in width, and seven-stories high, to which was added, in 1872, a wing 100 feet in length and 60 in width. Connected with this mill are two picker-houses three-stories in height. To the northward from Mill No. 4 stands Mill No. 5, 258 feet in length and 60 in width, with a picker-house 62 feet long and 44 feet wide; and northward of the latter, and on a line with it, is a gingham-mill, the main portion of which, 120 feet in length, 67 in width, and three-stories high, is filled with machinery for dressing gingham. The building has two wings, one of which is a dye-house, while the other contains looms operated exclusively for weaving gingham. The mill nearest the northern limit of the yard in this line of buildings is also a gingham-mill, 260 feet long, 68 wide, and four-stories high, and was erected in 1874. In the rear of the gingham-mill first named is a building 110 feet in length and 36 in width, which contains the bleachery and napping-house, and near these stands the drying-house. On the west side of the river is located the store-house for cotton—a building of sufficient capacity to contain from fifteen thousand to twenty thousand bales of cotton. Near this store-house are the sheds for the storage of coal. With these sheds and cotton-houses, about twenty-five acres of land near by are to be considered as included in the mill-yard, making the total area of the mill-yard fifty acres—twenty-five acres on each side of the river. In the year 1872 the Company constructed a bridge across the Merrimac, to connect these two mill-yards. This bridge is chiefly used for the transportation of cotton and coal from the store-houses to the mills.

The eleven mills now owned and operated by the Company contain, in the aggregate, 150,000 spindles and 5,000 looms, upon which are produced an average per week of 700,000 yards of cloth. Cotton fabrics exclusively are here manufactured; but of these, various kinds are made, both white and colored. The white goods produced consist of drillings, sheetings and bags. The colored fabrics embrace tickings, fancy shirtings, denims and gingham. The machinery in all the mills is driven by water-power, communicated through fourteen water-wheels, seven on each level, having a combined force of thirty-five hundred horse-power. There is also a Corliss engine of eight hundred horse-power, located in mill No. 3, which is used only when there is a scarcity of water. The buildings are heated throughout by steam, and lighted by gas. They are also amply provided with apparatus for extinguishing fires. The water available for this purpose having first been raised by force-pumps from the river into the Company's reservoir, located in one of the squares in the city, and having a capacity of eleven million gallons, is thence conveyed to the mills. From the same source the supply for the Company's tenement-houses was formerly obtained, but is now furnished from the city water-works. The

total number of persons in the service of the Company is about four thousand, whose monthly wages aggregate nearly \$150,000. The capital of the corporation is now \$3,000,000.

The original corporators of the Amoskeag Manufacturing Company—Lyman Tiffany, Willard Sayles, Samuel Slater, Dr. Oliver Dean, Larned Pitcher and Ira Gay—rendered valuable service in the early development of the industrial resources of New England. Samuel Slater, Willard Sayles and Dr. Dean, especially, were known in their day as men of great enterprise and sagacity, and were largely concerned in manufacturing interests in Massachusetts and Rhode Island, as well as in New Hampshire. At their first corporate meeting, in Amoskeag village, held on the evening of July 13, 1831, Dr. Dean presided, and Ira Gay was chosen clerk. The next day the organization was perfected by the election of Lyman Tiffany as president, and Dr. Dean as treasurer and agent of the corporation. At the same time Lyman Tiffany, Willard Sayles and Ira Gay were chosen directors. Mr. Tiffany held the office of president until 1836, when he was succeeded by Joseph Tilden. Upon the death of Mr. Tilden, in 1853, Dr. Dean was chosen president, and retained the office until 1871, when he resigned. He was succeeded by Gardner Brewer, of Boston, who held the position until his death in 1874. Daniel Clark was chosen as Mr. Brewer's successor, and retained the office until 1876. He was succeeded by William Amory, who still retains the position.

Dr. Dean was the first agent of the corporation, and held that position until 1834, when he removed from Amoskeag Village. Soon after this the other departments were organized. The following year his successor, Harvey Hartshorn, was appointed, who held the position of agent of the old mills for two years, and was followed by William P. Newell, who had charge of the old mills at Amoskeag Village until 1846, when Phinchas Adams was appointed. The following year Mr. Adams resigned, that he might accept the position of agent of the Stark Corporation. C. W. Blanchard was chosen to fill the vacancy. He remained until 1848, when the mills at Amoskeag were burned.

During this time that the Company's business was divided into distinct departments, an agent was put in charge of each department. The first agent of the land and water-power department, was Robert Read, who served the Company in that capacity until 1852. Mr. Read was also a director of the corporation from 1841 to 1846. He was succeeded as agent by E. A. Straw, who had been in the service of the Company, as a civil engineer, from 1838. The first and only agent of the new mills department was David Gillis, who subsequently removed to Nashua. When, in 1856, the two departments above named were united, and placed in charge of one agent, Mr. Straw was appointed to fill the position. The first agent of the machine-

shop department was William A. Burke, now treasurer of the Lowell Machine-Shop. He served the Company as an agent from 1840 to 1847, when he resigned. O. W. Bayley, who for a number of years was president of the Manchester Locomotive Works, was selected to fill the vacancy. He resigned in 1855, and was succeeded by Cyrus W. Baldwin, who resigned in 1858. Then this department also ceased to be a distinct branch of the Company's business, and was placed in the charge of Mr. Straw, who has since been the Company's sole resident agent at Manchester. In 1874 his son, Herman F. Straw, was appointed assistant superintendent of the mills, and, in 1877, to the position of superintendent, which he now fills. During the time in which the Company owned and operated mills at Hooksett, it was needful that there should be an agent resident there. This position was successively filled by Hiram A. Daniels, Joshua Ballard (now treasurer of the Hamilton Woolen Company), Stephen Ballard, William L. Killey and T. W. Wattles.

During the forty-seven years of the corporate existence of the Amoskeag Manufacturing Company, there have been many changes in the directors of the Company. Of the men who have served the Company in this capacity, not a few have been widely known as among the most prominent and able business men of New England. Of these, in addition to the original directors already named, and Dr. Dean, who was a director from 1834 to 1871, special mention should be made of Patrick T. Jackson; William Appleton, who served twenty-five years; George Howe, who served thirty-two years; Francis C. Lowell, who served fifteen years; John A. Lowell; George W. Lyman, who served thirty-three years; Nathan Appleton, who served twenty-three years; James K. Mills, William Amory, Gardner Brewer, T. Jefferson Coolidge, John L. Gardner, William P. Mason and Charles Amory. The present directors are William Amory, Daniel Clark, T. Jefferson Coolidge, Thomas Wigglesworth, John L. Gardner, William P. Mason, John L. Bremer, E. A. Straw and George Dexter.

Prior to 1857 the annual meetings of the corporation were held in July. Since that date they have occurred in the month of October.

The by-laws adopted at the organization of the Amoskeag Manufacturing Company made the treasurer the factor of the corporation; and, as such, he had the whole responsibility of the manufacture and sale of the articles produced. Dr. Dean was the treasurer of the corporation for five years from its organization in July, 1831. His acquaintance with the details in the manufacture of cotton cloth, and his knowledge of the requirements of the trade, and of the difficulties at that time attending the disposal of the articles manufactured, made his service of great value. On his resignation, in 1836, Francis C. Lowell was elected to fill the vacancy. This was at the commencement of the extension of the works upon the east side of the river.

Mr. Lowell held the office for one year, when he resigned, and William Amory was chosen as his successor. It was during Mr. Amory's administration as treasurer, embracing a period of more than one-third of this century, that most of the mills were built, the works of improvement begun and completed, and the business of the corporation enlarged to its present proportions. Within this time changes in laws and in tariffs had rendered the business of the manufacturer uncertain and perilous, and both the raw material and the manufactured product had been subjected to great and sudden changes in value; but through all these difficulties the affairs of the Company had been safely guided by a firm hand and a sound judgment. With the growth and thrift of this great industry, a fair and prosperous city had also arisen about its works, containing a population greater than any other city in New Hampshire. In 1876, after nearly forty years of invaluable service, Mr. Amory sent in his resignation as treasurer. On its unwilling acceptance, he was unanimously elected president of the corporation, and T. Jefferson Coolidge was chosen treasurer in his stead, which position he still occupies.

DAVID ANTHONY.



DAVID ANTHONY was born in Somerset, Mass., Jan. 9, 1786. He was descended, in the sixth generation, from John Anthony, who came from England about 1646, and settled on the Island of Rhode Island. David's father was a ship-carpenter, then an important trade in Somerset. The most prominent merchant of the place was John Bowers, who, at his death, left his son, John Bowers, a fortune estimated at about \$100,000. David Anthony, at the age of fourteen, entered the employ of John Bowers. He had spent but three or four months each year, and less than thirty months in the aggregate, at school. In the employ of Mr. Bowers he soon became expert in accounts. Before he was eighteen years of age he had, to a large extent, the charge of the store. In September, 1804, Mr. Bowers failed; and in closing up the business, young Anthony, though not yet nineteen years of age, was employed to dispose of the stock on account of the creditors. The ensuing winter, the school committee asked him to take charge of a small school. He accepted the offer, and performed his new duties with such success that he was invited to take the school a second term.

Early in 1806 he went to Providence, and entered the store of John P. Hellen, a prominent crockery and China-ware merchant. With Mr. Hellen, who had a large trade with England, his knowledge of the method of wholesale trade increased, and his first engagement, for four months, was extended to two years. His wages were small, but, by economy, he was able to put a portion aside at interest.

In April, 1808, he went to Pawtucket, as clerk in the mill of Wilkinson, Greene & Co., the second mill in which Samuel Slater, the pioneer of American manufacturers, was interested. In this mill he remained four years. While at Pawtucket, he learned much about the manufacture of cotton, which proved of great value in his future career.

In April, 1812, he went into partnership with Dexter Wheeler, of Rehoboth, Mass., who had, since 1807, run a small yarn mill. Mr. Wheeler's mill was of one horse power, not only by measure, but actually furnished by a single horse. After Mr. Anthony had been at Rehoboth less than a year, he saw that the lack of water-power prevented an increase of business, and decided to erect a new mill in Troy, now Fall River. That village then numbered thirty houses, and about three hundred inhabitants. Associated with him were Dexter Wheeler and Abram Bowen; the capital being subscribed by residents of Tiverton, Newport, Warren, Rehoboth, Swansea and Somerset. The Company was formed in March, 1813, as the Fall River Manufacturing Company, and it was incorporated Feb. 5, 1820, with a capital of \$80,000. The Troy Cotton and Woolen Manufactory, organized in the same month, by Oliver Chace and others, was at the outlet of the lake. Between these two original mills, the Pocasset, the Quequechan (since merged in the Pocasset) and the Watuppa Mills have since been established.

The first building of the Fall River Manufacturing Company was 60 by 40 feet, and was designed for fifteen hundred spindles. It was of three stories, the lower story of stone and the upper two of wood; the reason for this being that "there was not enough stone in Fall River to finish it." This now seems a singular statement in the presence of the immense structures belonging to the various corporations, the stone for which has been mostly taken from their own premises. In October, 1813, Mr. Anthony removed to Troy; was at once appointed treasurer and resident agent; and continued to be the executive manager of the concern until 1836.

In 1814 Blair's picking-machine was started by the Company. This was the first machine used for the purpose in Fall River, and one of the first in the country. It greatly aided the process, performing its work at less than one-fourth the cost of hand-picking. For some years experiments had been made with power-looms; and, in 1817, the first looms of this kind were started in the Fall River Mill. The business of the mill, as of all the cotton-mills of New England nearly down to that period, had been the manufacture of yarn to supply the hand-looms, most of them in the homes of the people. These were built by John Orswell and Wheaton Bailey, and were heavy and clumsy. About 1820 they were superseded by Gilmour looms. In 1822 the Fall River Company built a small brick mill; and, in 1827, another of stone. Both of these have since been superseded by a fine mill of 25,000 spindles.

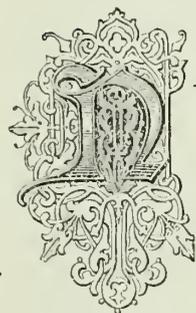
In 1825 Mr. Anthony, with others, organized the Fall River Bank, now the Fall River National Bank, the oldest in the city. He was its first president, and continued in office until 1865, when, at seventy-seven years of age, he retired from active business. In 1847 he was elected treasurer of the Fall River Railroad, and held

the office for seven years, during which period the corporation was relieved from its embarrassment, and placed on a substantial paying basis.

In 1859 he was induced to take the lead in a new enterprise—the organization of the Union Mill Company. Only six corporations had been formed before this time, and but two since 1825. The whole number of spindles in the town, in 1840, was 32,084. In 1847 the Metacomet Mill, now having 24,440 spindles, was established; and in 1852 the American Linen Company was started, but, in 1858, changed to a cotton-mill, and now has 82,500 spindles. It is one of the largest mills in the country. The Union Mill Company was incorporated with a capital of \$150,000. It had a capacity of 16,000 spindles, and the veteran David Anthony was its treasurer. Such was its success that its shares, of \$1,000 par value, have risen to \$4,000. In 1865 a new mill, of more than 28,000 spindles, was built from the profits, making an aggregate capacity of 44,684 spindles. An additional mill, of about 40,000 spindles, was begun in 1877. The success attending this latest undertaking of David Anthony gave a large impulse to the enterprise of Fall River; so that since the erection of the first Union, twenty-two mills have been built, almost wholly with Fall River capital, increasing the spindles from about 200,000 to over 1,300,000—or more than sixfold within fifteen years. The population of the city, stimulated by this increase of its industrial capacity, has, within the same time, increased from 14,026, to 45,340.

Mr. Anthony died July 6, 1867. He was married three times. Of his sons, the only one still in active business is John B. Anthony, who is at the head of one of the most extensive industries of Providence—the Providence Tool Company; he is also president of the Union Mill Company, of Fall River. David Anthony was educated as a Quaker; but he became a member of the first Congregational Church in Fall River, soon after its organization, in 1816. He survived his third wife, with whom he had lived more than forty years, by a little more than four years. When seventy years of age he wrote a brief review of his own career, and added some counsel to young men, in which he said, “Happiness and success in a business life is promoted by correct habits, systematic living in all matters, and great promptness in meeting engagements.”

NATHAN APPLETON.



NATHAN APPLETON was descended, in the sixth generation, from Samuel Appleton, who, in 1635, came from England, and settled in Ipswich, bringing with him his son Samuel, then a child about ten years of age. This Samuel, his son Isaac, born in 1664, and his grandson Isaac, born in 1704, were respectable yeomen of the old town of Ipswich. The latter was one of eighteen persons who, in 1735, received a grant of land lying on the southern border of the Colony of New Hampshire. Isaac Appleton received six of the forty-five shares into which the territory was divided. He soon removed to the new settlement, which received the name of New Ipswich. His son Isaac, the third of the name, was born at Ipswich, Mass., in 1732, was deacon of the church, and one of the most influential citizens of New Ipswich. Of his eight sons, the third was Samuel, born June 22, 1766, and the seventh was Nathan, the subject of this sketch, born on the 6th of October, 1779. He attended the district school of the village, and spent several terms at the New Ipswich Academy. In this institution Nathan pursued his studies preparatory to admission to Dartmouth College. He passed a creditable examination, and was admitted a member of the Freshman class, in 1795.

At this time his brother Samuel, who was his elder by thirteen years, who had been trained for a mercantile career, and who had been engaged in trade on his own account (at first for one year in a country store in Ashburnham, and then for three years in his native town), resolved to try his fortune in Boston. He had saved some money as a capital, and was ambitious to enter a wider field of effort than could be found in a remote village. He desired his brother Nathan, then a lad of sixteen years, to go with him to Boston, as his clerk and assistant. Nathan yielded to his persuasions, and did not enter on his college course. The modest enterprise of the brothers was begun in a small store on Cornhill, Boston—a name then applied to that

part of the present Washington Street which extended from Dock Square to School Street.

Samuel Appleton at first engaged in the jobbing of goods to retail dealers, in large part from the rural districts, the goods being purchased at auction. In 1799 with a view of opening trade as an importer of foreign dry-goods, he went to Europe, leaving the business in charge of his brother Nathan. The next year the elder brother having returned from abroad, and the younger having attained his majority, the latter was admitted to partnership, and the firm-style became S. and N. Appleton. It soon attained a leading position in the importation of foreign goods, and in the jobbing of foreign and domestic dry-goods, which it held until the retirement of Samuel Appleton, in 1820. In 1801, war at that time prevailing on the Continent, Nathan Appleton went to England to purchase goods. On landing in that country, he learned that peace had been declared. Uncertain as to the effect of this event on trade and prices, he refrained from making his purchases, and availed himself of the opportunity for an extended tour on the Continent.

The business of the firm, meanwhile, and after his return, continued to be profitable. In 1810 his wife's health being such as to render a sea voyage desirable, he again crossed the ocean. Visiting Scotland the next year, he met, at Edinburg, his friend Francis C. Lowell. Mr. Appleton had been considering how to invest his surplus capital; and, as a dealer in dry-goods, his thoughts naturally turned to the development of domestic manufacture, as a profitable deposit for capital, and as a means of more complete independence of English and other markets.

The manufacture of cotton, founded twenty years before by Slater, at Pawtucket, R. I., and having extended from that centre through a radius of some twenty or thirty miles, had been carried on in small factories, with a few hundred spindles, and had been solely engaged in spinning yarns for the supply of hand-loom. These had been established by persons who invested time and labor, as well as small amounts of money, in the enterprise. Mr. Appleton and Mr. Lowell discussed a plan for the establishment of a factory on a larger basis, by combining, in a single enterprise, a much larger amount of capital than had hitherto been used for this purpose, subscribed by stockholders who should form a corporation; the factory to be managed by salaried officers, and the interest of the stockholders to be dividends resulting from the profits. By the larger amount of capital invested, they believed that improved machinery, with increased scope, might be introduced; and that weaving and finishing the cloth, as well as spinning the yarns, might be effected by machinery.

Mr. Appleton came back to the United States, and again devoted himself to his mercantile business. Early in 1813, after the return of Mr. Lowell from Europe, the latter, in company with Patrick T. Jackson, on meeting Mr. Appleton, informed him

that they had resolved to establish a cotton-manufactory; that they had already purchased a mill-privilege at Waltham, and had obtained an act of incorporation; and that Mr. Jackson had decided to give up all other business, and to take upon himself the management of the concern. He was told that of the \$400,000 authorized by the charter, they proposed to raise and invest only \$100,000, until the experiment should be fairly tried; that of this sum they, with Mr. Jackson's brothers, had subscribed the greater part; and they proposed to Mr. Appleton that he should invest \$10,000. He agreed to take half that amount. The full details of the organization and progress of the Boston Manufacturing Company are given in the sketch of Francis C. Lowell.

After the conclusion of peace with Great Britain, in 1815, Mr. Appleton added to his business interests, by entering into partnership with Benjamin C. Ward, under the Style of B. C. Ward & Co. He invested capital, but did not propose to take any active part in the business, which was that of importing British goods. The store was at 36 Broad Street, the centre of the wholesale dry-goods trade being, at that time and for many years after, in that vicinity. When the Boston Manufacturing Company began to produce cloth, there was but one store in Boston at which domestic goods were sold. This was a dry-goods store on Washington Street (then Cornhill), kept by Isaac Bowers, or rather by Mrs. Bowers. There was at this time only one loom in operation in the mill; yet the goods accumulated. Mr. Lowell and Mr. Appleton went together to see Mrs. Bowers, who told them that everybody praised the goods, and did not object to the price, but still they did not buy. Mr. Appleton said that the next parcel of goods finished might be sent to the store of B. C. Ward & Co., and that he would see what could be done. The goods then made were precisely of the class of which a large portion of the cotton cloth manufactured throughout New England has continued to consist—a heavy unbleached cloth, thirty-seven inches wide, weighing somewhat less than a pound to three yards. Mr. Lowell said that he would be satisfied with twenty-five cents per yard, though the nominal price was somewhat higher. Mr. Appleton now gave close attention to effecting sales, and soon secured a regular demand for the goods through David Forsaith, an auctioneer in dry-goods, on Kilby Street, who sold them at auction, and obtained an average of somewhat more than thirty cents per yard. They were thus disposed of for some time, with but little variation in the price. B. C. Ward & Co., in this manner, became the selling agents of the goods. Mr. Appleton found an agreeable task in attending to the sales, and made up the first account with a charge of one per cent commission, which became the established rate. Mr. Appleton was thus the pioneer of the numerous commission-houses in domestic goods, which have contributed so largely to the volume of trade in our great cities.

The success of the Boston Manufacturing Company was so marked in its first seven or eight years, that Mr. Appleton was disposed to enlarge his interest in the cotton manufacture. The goods made at Waltham, and elsewhere in New England, were, as has been said, of a coarse and heavy texture; and the lighter printed goods, known as calicoes, were wholly imported from Europe. Mr. Appleton saw that the time had arrived when the manufacture and printing of these goods might be successfully introduced into this country. Mr. Jackson fully coincided with him. The available water-powers of Waltham, and of Watertown, had been secured for the Boston Manufacturing Company; and they were compelled to look elsewhere. With this view, in September, 1851, they went to Amherst, N. H., to look at a fall of the Souhegan River, about midway between Nashua and Manchester. The power afforded at that point, however, proved insufficient for their purpose. On returning, they passed the Nashua River, but were not aware of the existence of the fall which has since been the source of so much power. They saw only a grist-mill near the road, where there was a fall of some six or seven feet.

A project was now started of creating a large water-power at the Pawtucket Falls, on the Merrimac, in the town of Chelmsford. It was found that the stock and land of the Pawtucket Canal Company, needed for rendering the water-power available for the purpose of a manufactory, could be purchased at a reasonable rate. Mr. Kirk Boott was selected as the manager of the new enterprise; and thus was founded the great manufacturing interests at Lowell. The details of the early history of this enterprise have a place, more appropriately, in our sketch of Mr. Jackson.

On the resignation of Warren Dalton, the first president of the Merrimac Manufacturing Company, in 1825, Mr. Appleton was elected to that office. The firm of B. C. Ward & Co., of which he was a member, became the selling agents. This firm was dissolved in 1828, and a new firm was formed, by James W. Paige and Mr. Appleton, under the style of J. W. Paige & Co. This firm became the agents of the Merrimac Company, and afterward of other companies: Mr. Appleton retired from it at the close of 1852.

The second mill, built at Waltham, contained 3584 spindles, spinning No. 14 yarn with all other machinery necessary for converting cotton into cloth. This was taken as a standard of what has since been known as "a mill-power." This mill-power, according to John B. Francis, for many years the engineer in charge of the "Locks and Canals," amounted to about sixty horse-power, or the right to draw twenty-five cubic feet of water per second, on a fall of thirty feet. The price fixed was four dollars a spindle, or \$14,336 for a mill-power, and as much land as was proper for the establishment. Of this, \$5000 was to remain, subject to an annual rent of three hundred dollars.

Under these conditions, the first sale was made to the Hamilton Manufacturing Company, with a capital of \$600,000. Mr. Appleton was the chief promoter of this enterprise, and its largest stockholder.

The third company was organized, through the influence of Mr. Jackson, in 1828, and named the Appleton Mill, after his friend and coadjutor. Between 1828 and 1840 seven other companies went into operation in Lowell, in several of which Mr. Appleton was a stockholder and director, and exerted much influence in securing their success.

Having spent thirty-six years in mercantile and manufacturing pursuits, and with an experience of several sessions as a member of the Massachusetts Legislature, Mr. Appleton was elected to Congress in 1831, where he remained two years, and, in 1842, was chosen to complete the unexpired term of Robert C. Winthrop. His experience in industrial pursuits, and his practical knowledge of affairs, gained him attention, and gave his opinions weight in the national Legislature. His first speech in the House of Representatives was on the subject of the tariff, in which he demonstrated that a protective tariff was no longer necessary to the cotton industry, as a pound of cotton could be manufactured into common cloth more cheaply in America than in England, or any part of Europe.

Mr. Appleton died in Boston, on the 14th of July, 1861, at the age of eighty-two years. At the time of his decease he was a member of the American Academy of Science and Arts, and of the Massachusetts Historical Society. As a writer, he left behind him valuable essays on the currency, banking and tariff, an account of the introduction of the power-loom, and the origin of Lowell.

What he did in planting the cotton industry at Lowell, with his own hand, was the most useful feature of Mr. Appleton's industrious life. It is certain that, as a capitalist, he intended to pave the way for a Manchester at Lowell; and that during his lifetime he largely influenced that result.

Both he and his brother Samuel were remarkable for their philanthropy, distributing large sums of money annually in charities.

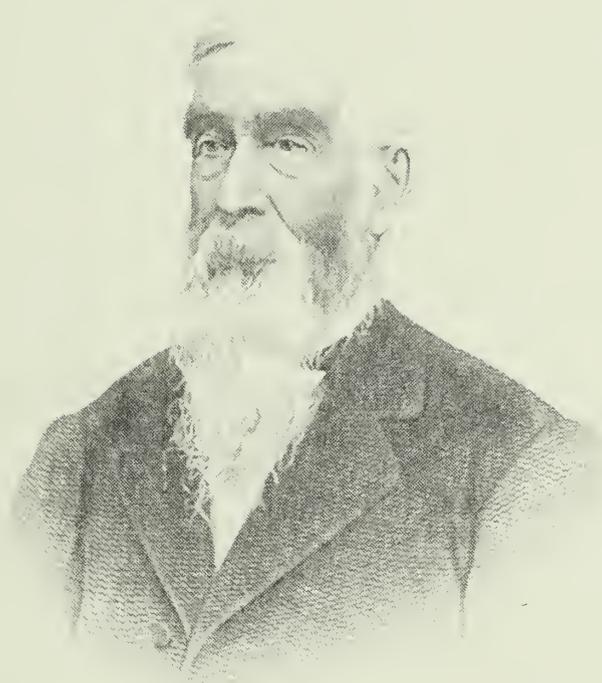


OLIVER ARNOLD.



PROMINENT among those cotton manufacturers in Berkshire County, Mass., who have risen from modest beginnings, have been the brothers Oliver and Harvey Arnold. Their grandfather, John Arnold, in early life a farmer in Natick, and in Warwick, R. I., removed, in 1802, with his three sons, Harris, Daniel and John, to North Adams. There he purchased four hundred acres of land, which was afterward divided into three farms, the father occupying the middle one, and selling one on each side of him to his sons Harris and Daniel. His youngest son, John, remained with him, and, at his death, succeeded him in the ownership and occupancy of the middle farm.

Harris Arnold had married before the removal of the family from Rhode Island ; and, having acquired the portion of land mentioned, he occupied it until 1830, when he removed to the vicinity of his son's factory, in North Adams. By his first wife, Freelove Holden, his sons were Oliver, Harvey and Andrew ; and John F. was his only son by his second wife, Lydia Nash. Harris Arnold died June 9, 1845, at the age of seventy-four. His sons, Oliver, Harvey and John F., waived their claims to any portion of his property in favor of their sisters, and of their brother Andrew, who had become incapacitated for hard labor. Oliver, the eldest son of Harris Arnold, was born in Natick, R. I., on Oct. 18, 1801. During his childhood and youth he worked on the farm, attending occasionally the district school. His father, who had been a ship-wright and house-carpenter, as well as farmer, had in his house the tools used in the different branches of his mechanical work ; and with these Oliver soon became a mechanical expert. He worked for two or three years in the manufacture of cheese-casks, of cider and pork-barrels, and of tubs. When he was twenty years of age he entered, as a worker of wood, into the employment of Alvan Sanford, who made cotton and wool-machinery for Giles Tinker, then a manufacturer



Van Slyke & Postco



Oliver Arnold

of this class of machinery. Mr. Sanford's shop was on the site of the present brick factory, on Main Street, North Adams. Here Mr. Arnold remained about two years, and then entered into partnership with Isaac Hodges and Alvan Sanford, for the manufacture of cotton goods. The former was a successful physician in North Adams, and only invested capital.

The style of the firm was Hodges, Sanford & Co. They hired a part of the factory on the Union privilege, and put in fourteen looms and the requisite machinery for carding and spinning. Here they continued about five years. Mr. Arnold next formed a partnership with his brother Harvey and Nathaniel Blinn, under the style of Arnold, Blinn & Co. The new firm bought out the machinery and business of Hodges, Sanford & Co., and occupied the same premises for three and a half years. In 1831 they purchased the mill-privilege immediately above them, and erected a stone factory 72 by 38 feet, with two main stories, attic and basement. This mill, which, with alterations and additions, has become the Eclipse Mill, was occupied in 1832, and their machinery was increased to twenty-one looms. At the same time Edmund Burke put in an equal amount of machinery, but did not himself engage in the manufacturing. He received one-half of the profits of the production, and was charged with the same proportion of the rent and all other running expenses, including the pay of the working partners. Mr. Blinn sold his interest in the firm Feb. 28, 1835, and the business was continued by the brothers Arnold, under the firm-style of O. and H. Arnold. During the same year they purchased the machinery in their mill belonging to Mr. Burke.

In 1831 Isaac Hodges and Alvan Sanford had erected, at the privilege above them, the Slater Mill, of about the same capacity as that erected, the same year, by Arnold, Blinn & Co.; and O. and H. Arnold, in 1836, bought the Slater Mill, its owners having failed. They had, for some years, sold their whole production to Turner and Laffin, who were carrying on the Union Print Works, now owned and occupied by the Freeman Manufacturing Company. In the financial crisis of 1837, Turner and Laffin also failed. They were largely indebted to O. and H. Arnold, and the latter firm was compelled to go into liquidation. The business was, however, soon started again by their younger brother, John F. Arnold, who had had charge of their accounts, and had become a skillful accountant and financier. He purchased the property at a low price, and conducted the enterprise, under the style of John F. Arnold, until 1846.

A new partnership was formed Aug. 10, 1846, by the three brothers, under the style of O. Arnold & Co. After the failure of Turner and Laffin, the Union Print Works were purchased by Joseph Marshall, the brother of Benjamin Marshall, a wealthy New York merchant, and afterward largely engaged in manufacturing in

Troy, at the New York Mills, and at Middlebury, Vt. The print-works were afterward given by Mr. Marshall to his nephew, James E. Marshall. They lay idle until 1844, when the Arnolds hired them. Messrs. Jerome B. Jackson and Johnson D. Stuart were in partnership, so far as the printing department was concerned, the business in which was carried on under the style of Arnolds, Jackson & Co. They not only printed cloths manufactured by O. Arnold & Co., but purchased largely from other manufacturers. In 1848 O. Arnold & Co. bought the Arnoldville Mill, in South Adams, with one hundred looms, since increased to one hundred and eighteen. The Messrs. Arnold, in 1855, raised their upper dam, so as to secure a fall of thirty-six feet; and, by conducting the water through a wooden cylinder five feet in diameter and three hundred and thirty feet in length, they greatly increased the power at their lower mill. An addition was made to the building; all the machinery was removed from the upper mill to the lower, and new machinery was added; making the whole number of looms one hundred and fifty, and bringing the work of the two mills into one.

In 1856 A. W. Richardson & Co., who were engaged in manufacturing print-cloths at the privilege below the Union Print Works, bought the latter establishment from James E. Marshall, and entered into a contract for five years with O. Arnold & Co., under which they, in connection with Richardson & Co., were to supply the print-works with cloths, each firm to share in the profits *pro rata* of the cloths supplied by them, and equally as to cloths purchased from outside firms. In June, 1856, Abiel P. Butler purchased, from the assignees of Joseph L. White, the property just north of the lower part of Maine Street, in North Adams, known as the Marshall property, including land now covered by the Flour Mill, Harvey Arnold & Co.'s print-works, and C. T. Sampson's shoe-factory. He soon after sold an interest of one-half to O. Arnold & Co., and they, on the 5th of August, sold one-half of their interest to Willard L. Ray. A partnership was formed, under the firm-style of A. P. Butler & Co., and a factory was erected, and furnished with one hundred looms and the subsidiary machinery. Mr. Butler sold his interest to Jerome B. Jackson, Aug. 23, 1858, and the firm-style was changed to Jerome B. Jackson & Co. On May 1, 1860, Mr. Jackson sold his interest to O. Arnold & Co., the style of the firm being changed to Arnolds and Ray. On Feb. 5, 1866, Mr. Ray having died, his brother, Addison J. Ray, purchased the interest of the heirs. In 1860 the Messrs. Arnold erected, on the northern part of the property, buildings for print-work, to be under their own sole ownership and control. These were finished and ready to start up at the expiration of their contract with the Messrs. Richardson & Co.; and the business at these print-works, since their completion, has been conducted under the style of Harvey Arnold & Co.

In 1864 O. Arnold & Co., with parties in the adjoining town of Williamstown, organized a corporation, under the name of the Williamstown Manufacturing Company, with a capital of \$300,000; the members of the firm owning, as individuals, in proportion to their interest in the firm, two thousand five hundred shares out of three thousand. A large factory was erected, and furnished with three hundred and nineteen looms.

With Nathan Day, husband of the adopted daughter of Oliver Arnold, the firm established, in 1865, a store at Nos. 167 and 169 Church Street, New York, for the sale of their own goods, together with those of other manufacturers, taken on commission; there, a large business was transacted until 1872. On the 27th of December of that year the print-works of Harvey Arnold & Co. were burned, and the store was discontinued. In 1871 Oliver Arnold sold his interest in the firm to his brother Harvey, and retired from active business. The firm-style of O. Arnold & Co. was, however, retained.

On May 28, 1873, the factory building of Arnolds and Ray, which had been known as the Phoenix Mill, was sold to M. D. and A. W. Hodges, and has since been used as a flouring mill. The firm of Arnolds and Ray was at this time dissolved. On the 28th of July, in the same year, John F. Arnold sold to Edward H. Arnold, adopted son of Harvey Arnold, his interest of one-fourth in the print-works; and on July 1, 1864, Harvey Arnold sold to Albert C. Houghton one-third of his interest of three-fourths in the print-works, the business being continued under the same style of Harvey Arnold & Co. On the 11th of December of the same year, John F. Arnold sold his interest of one-fourth in the property of O. Arnold & Co., consisting of the Eclipse Mill (on the site of the stone mill, erected in 1831), and the Arnoldville Mill, at South Adams, to Edward H. Arnold; and the business of these two mills has since been conducted under the firm-style of E. H. Arnold & Co.

Oliver Arnold was married, Jan. 28, 1830, to Prudy M. Upton, of North Adams, who died June 21, 1873. He married again, April 13, 1874, S. Elizabeth Briggs. He has had no children.

Mr. Arnold, throughout his connection with the enterprise, had charge of the manufacturing department; and for this he was fitted by his mechanical skill and his close attention to details. He has had the entire supervision of the repairs of the machinery, doing personally, in the early years of the business, the work both in wood and in iron, and afterward retaining the management of this department. In the introduction of new or additional machinery, and in the erection of new mills, including that erected at Williamstown, in 1864, he supervised the selection, purchase and putting up of all of it; and a large share of the success of the concern has been due to his skill, experience and labor.

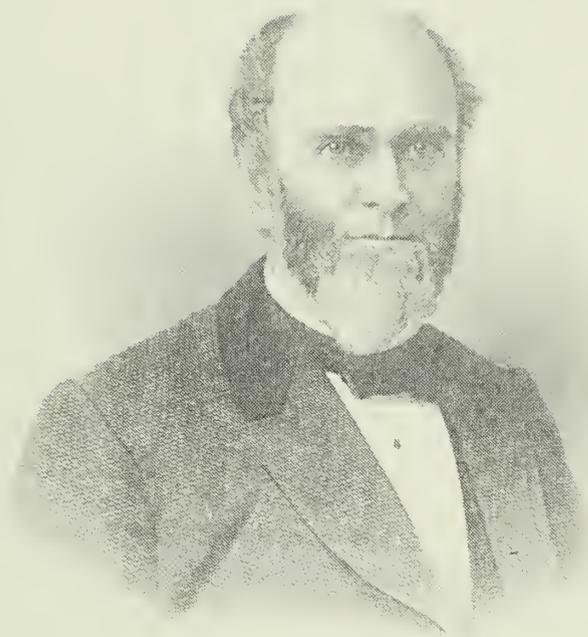
JOSHUA BALLARD.



JOSHUA BALLARD, of Boston, treasurer of the Hamilton Woolen Company, was born in Andover, Mass., on January 28, 1813. His father, for many years a farmer, employed the winter months in cutting ship-timber. Until of age, the son lived at home, assisting his father on the farm and in the forest. He received such an education as the town schools afforded, and studied for a few months at Phillips Academy, Andover. The first year after attaining his majority, he was employed in a saw and grist-mill at Ballardvale, receiving for wages one dollar a day. The following year he resumed, on his own account, his former occupation of cutting ship-timber; his father assisting him by a small loan, which he afterward repaid. This business he pursued for several years, at times employing a large number of men; the profits, however, were moderate.

In the year 1839, Mr. John Marland, then a prominent woolen manufacturer at Ballardvale, invited Mr. Ballard to give up the ship-timber business, and become his assistant in the Ballardvale Fannel Factory, of which Mr. Marland was then the agent and principal owner. It was agreed that Mr. Ballard, purchasing only a small amount of stock in the mill, should enter it as a common laborer, and receive pay according to his service, until, on acquiring a mastery of the various processes, he became a practical manufacturer. Mr. Ballard was now twenty-six years of age. He addressed himself diligently to the task of becoming familiar with the details of the business. He spent the first ten days of his mill-life in picking woolen waste, and advanced from this to higher positions, as fast as he was qualified to fill them.

During the second year of Mr. Ballard's connection with this factory, the proprietors began the experiment of making worsted yarns, and for this purpose sent to England for machinery. On its arrival, it was found that no one in the mill understood setting up the machinery. Mr. Ballard's mechanical ingenuity now displayed itself; he succeeded in putting this new machinery into working order.



Wm. L. Rice, 1850



Joshua T. Hubbard

In the following year, the Amoskeag Company, of Manchester, N. H., began to manufacture muslin-delaines, and to use for this purpose their mill at Hookset. Desiring to engage a man who understood the working of machinery adapted to such goods, the Company proposed to Mr. Ballard, whose reputation as a machinist was now well established, to go to Hookset, and convert their cotton-mill into a woolen-mill, changing, so far as he could, the machinery already there, and doing whatever else might be needful to fit the mill for its new use. Mr. Ballard accepted the offer, and, in 1843, went to Hookset, and set about the labor imposed upon him. He accomplished it to the entire satisfaction of the Amoskeag Company, who soon saw their Hookset mill successfully producing worsted goods. It was thus that Mr. Ballard started the first muslin-delaine mill ever operated in the United States.

Mr. Ballard remained at Hookset until 1846, when he was appointed resident agent of the Hamilton Woolen Company, whose mills are located at Globe Village, in the town of Southbridge, to which place he at once removed. This company is the successor of the Wolcott Woolen Manufacturing Company, and the latter of the Globe Manufacturing Company, which was incorporated in 1814, and from which Globe Village takes its name. The Globe Company was organized for the purpose of manufacturing cotton and woolen yarn, with an authorized capital not to exceed \$30,000 in real and \$50,000 in personal estate. The same year in which it was incorporated, this company erected a large mill on the Quinebaug River, but did not continue operations more than two or three years. In 1816, a portion of the corporators formed a new company for the manufacture of woolen goods. This was the first attempt to produce such goods in Globe Village, which was, at this time, a part of the town of Sturbridge. The new company began business in an old oil mill; but in the year 1819, it bought a mill, with machinery, which had been built by the Globe Company. In this building the manufacture was carried on until the close of the year 1823, when the company, which had then been incorporated under the name of the Wolcott Manufacturing Company, and which had increased its capital to \$200,000, erected another mill, afterwards known as the Wolcott Brick Mill. The company introduced into their factories, during the following year, the power-loom—an innovation which excited great opposition among the weavers, who had hitherto operated only the hand-loom. In 1827, with a view to augment their water-power, the company built what was known as the "Big Dam;" but in the next spring this dam was carried away by a freshet in the Quinebaug River, causing a heavy loss to the Wolcott Company. From this disaster, occurring at a time when their affairs were in a depressed state, the company never fully recovered, although the dam was rebuilt, and manufacturing was carried on for a time. But in 1831 the property of the Company passed into the hands of the Hamilton Woolen Company, which was

organized June 29, of the same year, with a corporate capital of \$200,000. Samuel A. Hitchcock and Willard Sayles, of Boston, were elected president and clerk, respectively; and they, with Lorin Norcross, constituted the directors. Mr. Hitchcock removed to Globe Village, and assumed the general management of the Company's affairs. At the outset the Company operated five sets of machinery, with the necessary dyeing and finishing apparatus, and twenty-eight power-looms. The first year's production was 40,778 1-2 yards of broadcloth.

In 1836 Mr. Hitchcock withdrew from active connection with the business, and Mr. Samuel L. Fiske became the resident agent. The Company, during the same year, began the erection of a large, six-story, brick mill, and raised and strengthened the dam. The new mill was soon afterward filled with machinery, doubling the productive power of the manufactory. The year 1844 witnessed the beginning of the manufacture of muslin-delaines by this Company; and a small mill for making cotton warps was then built. The next year the capital was increased to \$500,000, and the Company was re-organized, with Oliver Dean as President; Charles Merriam, Clerk; Addison Gilman, Treasurer; and Oliver Dean, Josiah Stickney, William J. Walker, Willard Sayles and Gardner Brewer, Directors. In 1846 the Company increased its capital to \$1,000,000; and Mr. Samuel L. Fiske having resigned the position of resident agent, which he had held for ten years, Mr. Joshua Ballard succeeded him. Since Mr. Ballard's connection with the corporation, the same wise management and success which always marked its affairs have attended it. During the thirty years which have since elapsed, the mills of the Company have not stopped for a single week-day, except in cases of accident. In 1849 new stock to the amount of \$100,000 was issued, making the present paid-in capital \$600,000. The same year, in order to increase the facilities for making cotton warp for delaines, another mill was built. In 1850 the large mill completed in 1837 was burned, but was rebuilt in 1851, with the addition of a two-story wing. At the same time a change of machinery, from the board-loom for the production of broadcloths, to looms for making fancy cassimeres, was effected, and gas for lighting the buildings was introduced.

About 1856, at Mr. Ballard's suggestion, the Company bought a tract of land adjacent to their mill property, in order both to give constant employment to a class of laborers whose services are only occasionally required, and to make use of certain fertilizers constantly produced by the processes of manufacture. The agricultural operations thus begun proved advantageous to the Company, and have since been extended; and the corporation now owns a large farm stocked with blooded animals, and on which a fine barn has been built.

Another large mill was erected in 1860, and supplied with machinery for making

print-cloth ; but, owing to the outbreak of the war, the manufacture was not undertaken, and in 1874 a portion of the machinery was replaced by that suitable for the production of delaines. Mr. John R. Brewer, who, since the retirement of Mr. John Gardner, in 1851, had been the treasurer of the Company, resigned his office in 1861, and Mr. Ballard was chosen in his place. His brother, Gayton Ballard, succeeded him as resident agent. During 1876 the Company greatly enlarged their reservoir in the town of Holland, and thus provided a constant and abundant supply of water. Since that time the Company has increased its productive power, and in the mills may now be seen the latest inventions and the most skillful apparatus for producing the fabrics they manufacture. In 1872 they purchased what are known as the Westville Mills, about one mile from Globe Village ; and on that site they purpose to erect extensive factories. They commenced, in 1875, printing cotton goods purchased for the purpose of other manufactories. This is now an important branch of their operations ; and about eighteen million yards of cotton prints and cambrics are annually sent forth from their print-works. In the entire manufactory about twelve hundred hands are now employed. The annual production of manufactured goods is about six and a half million yards of delaines, three hundred and fifty thousand yards of cassimeres, and eight thousand double shawls.

The Hamilton Company has ever manifested a commendable desire to promote the welfare of those in their employ. In 1860 they established a free library in Globe Village, which now numbers 4,037 bound volumes ; and additions are made every year. In 1867 and 1868 they erected, at their own expense, a commodious and substantial church, costing \$20,000, the free use of which they give for religious services.

DEXTER BALLOU.



THE waters of the Blackstone River and its tributaries vie with those of the Merrimac, in supplying power for the cotton and woolen manufactures. Of the flourishing towns and cities which have grown up within the last century on the banks of that river, next to, perhaps equal with, Pawtucket, where American cotton manufacture had its birth, is Woonsocket, which signifies, according to different authorities, "Pond on the hill," "Thunder-mist," or "The place where the water comes down." It is situated on both sides of the Blackstone River: the part on the west formerly belonged to Smithfield; and that on the east, including the greater part of the territory and population, was, until 1867, within the limits of Cumberland. The latter town was originally a part of Rehoboth, having been conveyed to that town, in 1661, by Wamsutta, the son of Massasoit, and brother of King Philip, and was known as Rehoboth, North Purchase. In 1694 it was incorporated as a township, and called Attleboro. A part of this territory, extending to the Blackstone River, was called the "Gore." This was, for half a century, disputed territory between Massachusetts and Rhode Island. At last, in 1746, it was detached from Attleboro, made a town, and called Cumberland, after the Duke of Cumberland, and was annexed to the county of Providence, in Rhode Island. The northerly portion of this new town was the present Woonsocket.

Two hundred acres of this tract were granted, by the General Court at Boston, to Samuel Chapin, of Springfield, in 1669. About three years before, the first settlement had been made by Richard Arnold and Samuel Comstock. The former was a grandson of William Arnold, one of the thirteen original proprietors of Providence, and the ancestor of Benedict Arnold. Samuel Chapin, whose grant included a large portion of the town in the vicinity of the Falls, never became a resident. The land afterward passed into the hands of John Arnold, son of Richard, and others.

Up to the beginning of the present century, the growth of the village was very slow, the splendid water-power being utilized only for saw-mills and grist-mills. The first wheel turned by the waters of the Blackstone at Woonsocket Falls was that of a saw-mill erected by the first settler, Richard Arnold, in 1666, and was on the Cumberland side of the falls. The next was that of a grist and fulling-mill, erected in 1712, by John Arnold. It was on "the island," above the present bridge at the falls. The next concern to which the waters of the river were diverted was the "Old Forge," spoken of in ancient documents as the "Winsokett Iron-mill." Iron was made there, from ore obtained in Gloucester, R. I. This mill was built between 1712 and 1720, and stood on the Cumberland side of the river, on land now occupied by the boiler-house of the Ballou Manufacturing Company. During the Revolution, its business was very lucrative, and its proprietors made what were then regarded as large fortunes. At the close of the war, the business declined, and, at the beginning of the present century, had ceased altogether. There was also a small scythe-factory, which stood on the island below the grist-mill and the bridge. The grist-mill, iron-mill and scythe-works were all either swept away by the great freshet of 1807,—the greatest ever known in Rhode Island,—or were so disabled that business was never resumed in them. Early in this century, Woonsocket felt the impulse of the manufacturing enterprise which, started by Samuel Slater, had established the card and the spinning-frame at Pawtucket, Warwick and Slatersville, and began a new era of industry. In the next decade two men, Welcome Farnum and Dexter Ballou, and, about the close of the third decade, two others, Edward Harris and George C. Ballou, came to Woonsocket, and began operations, two in the woolen and two in the cotton manufacture.

Dexter Ballou was born in Cumberland, R. I., Jan. 28, 1789. His father, Oliver Ballou, was a house-carpenter, but was, in middle life, engaged with his sons in manufacturing. Of his four sons, Dexter, Harvey, Hosea and George, three were prominent in the early mill operations at Woonsocket, Harvey alone remaining at the old home, and not engaging in the same industry. Dexter, having enjoyed but limited school privileges, early learned his father's trade. He then engaged in spinning cotton at a place in Cumberland known early in the century as "Sinking Fund," and at the present time as Ashton. The name "Sinking Fund" was given to it because two or three dams had been built there, and, successively, within a very short time after their erection, had been swept away, thereby "sinking" a large amount of "funds." The machinery, which he himself made, consisted of five cards and three spinning-frames, of eighty-four spindles each. His father was in partnership with him, the firm being Oliver Ballou and Son. They removed to Woonsocket, in 1817, and hired a building of James Arnold, who was at that time the proprietor

of the water-power of the Blackstone, at Woonsocket, and of the surrounding estates. Mr. Arnold was the great man of the place, in more than one sense, being more than six feet high. Oliver Ballou and Son occupied the first and second stories of the building, and Gilbert Brewster and Samuel Shove, the upper story. Gilbert Brewster was the inventor of a self-acting mule, which was used for some time in spinning wool; it antedated, by many years, the self-acting mule of Sharpe and Roberts. On the 8th of October, 1821, the building was sold to Daniel Lyman, of Providence, and was the nucleus of the Lyman Mills, which, on Aug. 6, 1864, became the property of J. P. and J. G. Ray. In 1775, while a student at Yale College, Daniel Lyman became the captain of a company of students, and on the reception of the news of the battle of Lexington marched with his command to Cambridge. He joined the expedition under Montgomery and Arnold, and was at the capture of Ticonderoga, Crown Point and St. Johns. He was afterward commissioned as colonel in the Continental Army, and distinguished himself in the battle of White Plains. Graduating at Yale College in 1776, he practiced law at Newport, R. I., and became judge, and afterward chief-justice. About 1812 he resigned his office, and removed to North Providence, where he engaged in manufacturing. He was the first manufacturer in Rhode Island who introduced the power-loom. William Gilmour had come to this country, from Scotland, some two years before, and had brought with him a knowledge of the looms for weaving by power, which had then been recently introduced into that country. In 1816 Judge Lyman engaged Gilmour to build for him twelve looms on the Scotch pattern. These, when completed, worked so well, that the manufacturers in the vicinity soon introduced them into their own mills. In recognition of the benefit conferred on the industry by Mr. Gilmour, they presented to him fifteen hundred dollars. Judge Lyman was interested in manufacturing until his death, in 1830.

The sale of Arnold's building compelled its occupants to seek a new location for their business; and, on the 1st of May, 1822, Oliver Ballou and Son leased from Mr. Arnold the old "Saw-mill Lot." This was very near the Falls, and is now covered by a part of the Ballou Mill, owned by the Ballou Manufacturing Company. A saw-mill was erected upon it by Richard Arnold, probably about 1666. The dimensions of the lot leased by the Messrs. Ballou was 33 by 70 feet; and one of the conditions of the lease was, that the mill should cover the ground. The basement was of stone, and the two stories above, of wood. The first story was occupied by its lessees, Oliver Ballou and Son; the basement was hired and occupied by W. and D. D. Farnum; and the second story, by Samuel Shove, a manufacturer of satinets. The business of the Messrs. Ballou at this time was accommodated by a room 33 by 70 feet. On the 2d of April, 1827, Oliver Ballou sold his

interest to his two sons, Dexter and Hosea, who formed a partnership as Dexter Ballou & Co., Dexter owning three-quarters and Hosea one-quarter. Hosea had been, like his brothers, trained to mechanical pursuits, and, like them, early engaged in the cotton manufacture. He was at first in partnership with the younger brother, George C. Ballou, at Waterford, two miles north of Woonsocket, in the manufacture of cotton warps for satinets. This partnership had been dissolved in the spring of 1827. Having sold his interest in the firm to his brother Dexter, in February, 1828, Hosea began manufacturing cotton goods on his own account, in a brick mill, which he had erected, in 1827, on leased land, and which is now a part of the buildings of the Lippitt Woolen Company. Their business had now increased so that they occupied the whole building. Dexter, from the time of purchasing his brother's interest, transacted the business in his own name.

On the 25th of March, 1829, the mill took fire, and, with its machinery, was totally destroyed. This was a severe disaster to Mr. Ballou. Daniel Lyman had purchased the machinery, as well as the building, in 1821; and Mr. Ballou had purchased, or made, new machinery throughout for his new establishment, which went into operation in 1822. His loss largely exceeded the insurance, which was \$10,000. A subscription was started and signed by his friends; Welcome Farnum headed the list. Nearly \$2,000 was raised; but Mr. Ballou declined the gift, and set himself vigorously to repair his own loss. His brother Hosea was obliged to suspend payments in 1829; and his brick mill now passed into the hands of Dexter, who at once resumed the business which had been stopped by the fire. This he continued till April, 1835. Hosea Ballou, immediately after his suspension in 1829, resumed manufacturing in a wooden building which he had erected soon after the erection of the brick mill, and a little to the south of it.

In April, 1835, another fire occurred, which destroyed Hosea Ballou's wooden mill; another wooden building on the same lot, occupied by Willis and Lyman A. Cook, as a machine-shop; and a third building on an adjoining lot. The next year Dexter Ballou erected a stone mill on the site of Cook's machine-shop, and a few years later extended it, so as to connect it with the brick mill. The whole establishment was named the Harrison Mill, in honor of William Henry Harrison, the whig candidate for President. This name it retained until 1865, when it was changed to a woolen manufactory, and received the name of the Lippitt Woolen Mill. Hosea Ballou, soon after the loss of his mill, leased a lot of land which had been sold by W. and D. D. Farnum to Seagrave and Harris, and built a new cotton-mill. This is now the cotton-mill of the Harris Woolen Company. He continued in this establishment until 1846, when he sold the mill to Edward Harris, formerly of Seagrave and Harris, on whose lot the mill stood, and removed to Putnam, Conn., where he erected a

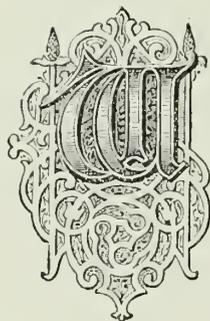
cotton-mill, and resumed business. The mill is now the property of the Putnam Manufacturing Company.

Dexter Ballou became proprietor of the Social Mill, in 1841. The originator of that enterprise was Joseph Arnold, who inherited from his grandfather, Daniel Arnold, a strip of land, extending from the river at Cold Spring across the country to the river again at the Social, which had been conveyed to him by the original Mendon proprietors. Mr. Arnold, having caught the spirit of enterprise which the success of Samuel Slater, at Pawtucket, had awakened in so many minds, and, having an excellent water-power on the Mill River, determined, in 1810, to undertake, at that point, the cotton manufacture. He induced some others to share in the enterprise; and a meeting was called on Oct. 24, 1810, consisting of the following persons: Ariel Ballou, Abner Ballou, Nathan Ballou, Eber Bartlett, Job Jenckes, Luke Jenckes, Oliver Leland and Joseph Arnold. At this meeting a covenant of agreement was signed, and by-laws were enacted. The capital stock was \$16,000, divided into sixteen shares, of which each stockholder owned two. The original real estate contained four acres and twenty-five rods, sold to the company by Mr. Arnold. The mill was to contain 2,000 spindles. It was a small wooden structure, and now forms a part of the boarding-house. In its early years, probably from its size, it received the name of the "Pistareen." In 1814, the stock had changed hands: Nathan Ballou, Eber Bartlett and Oliver Leland had sold out their shares, and Moses Jenckes had bought one share, Luke Jenckes two shares, and Job Jenckes three shares. The three Jenckes proprietors held their ten shares, a controlling interest, till 1822, when they disposed of them wholly, and commenced operations on Peters River, laying the foundation of the present village of Jenckesville. Their first mill was built in 1822, and was the first stone mill erected in Woonsocket. They built a second mill in 1828. Ariel and Abner Ballou sold their stock in 1823, and the property was owned by Smith Arnold,—son of Joseph,—nine parts, and Arnold and Earle, seven parts. In 1827, the second wooden mill was erected. The speeders for this mill were built by Joseph Ray, of East Blackstone, father of the well-known manufacturers J. P. and J. G. Ray. It is now a tenement-house, and is known as "The Castle." Arnold and Earle became tenants in common of the estate, in March, 1839, and soon afterward failed. Mr. Ballou then run the mill for the assignees of Arnold and Earle; and on the 12th of November, 1841, he bought the property, with Tyler and Daniels, for \$25,000. The next year, he began the erection of a stone mill, which was afterwards improved and enlarged. Both the Harrison and the Social Mills, after becoming the property of Dexter Ballou, were managed with ability and success. Like his brother George, Dexter Ballou was unostentatious, and expert in every department. He was the first president of the

Woonsocket Falls Bank, and held the office until his death, which occurred July 17, 1849.

He had four sons,—Oren A., Hosea, Ezra and Francis; and two daughters, Nancy and Elizabeth. Of them all, Elizabeth alone survives. She is the wife of Christopher T. Keith, one of the assessors of Providence. Nancy married the late Judge David Daniels, of Woonsocket. Oren, the eldest son, was employed, when but a child, in feeding cotton upon the cards. In the infancy of the cotton manufacture, before the introduction of the “lapper,” children from seven or eight to twelve years were engaged in this work; and many prominent cotton manufacturers of the present day began work in the mills, in childhood. In 1828, when fifteen years of age, Oren was admitted to Brown University, and, though one of the youngest members of his class, took a high rank in scholarship, and graduated first in the class. After graduation he went into business with his father, and was, also, engaged in the cotton business in Providence, in partnership with Sterry Smith, under the firm of Smith and Ballou. On the death of his father, in 1849, he continued, with his brother Hosea, the business of the firm of Dexter Ballou & Co., under the same style, managing the Social and Harrison Mills. They built a large addition to the Social Mill, with new machinery. After the death of Hosea Ballou, in 1854, a portion of the estate in both mills was sold to H. and R. Lippitt, of Providence. In May, 1855, the Social Manufacturing Company, of which Mr. Ballou and the Messrs. Lippitt were the incorporators, was chartered. Mr. Ballou continued to be its president until about a year before his death, which occurred on Feb. 21, 1877.

GEORGE C. BALLOU.



WHILE Dexter Ballou may be regarded as the pioneer in the cotton manufacture of Woonsocket, his younger brother, George C. Ballou, had even a greater interest in its progress, because it was exerted for a much longer period. George C. Ballou went to Woonsocket two years before Edward Harris, and survived him by a little more than three years; and Ballou and Harris must be regarded, each as the leading representative of his special industry in that town—Edward Harris as a woolen, and George C. Ballou as a cotton manufacturer.

George C. Ballou was born in Cumberland, R. I., Feb. 2, 1798. He was descended, in the sixth generation, from Maturin Ballou, a Huguenot who found a refuge in Rhode Island. George Ballou's childhood and youth were spent partly at the public school, but in larger part at manual labor. Learning the trade of a house-carpenter, which was that of his father and brothers, he worked at it until he was somewhat over twenty-one. His father and older brother, Dexter, had begun, before 1817, the manufacture of cotton yarns, and had been modestly successful; and when about twenty-eight years of age, George, also, began to try his fortune in a similar enterprise. Entering into partnership with his brother Hosea, he removed to Waterford, Mass., and began to make satinets warps. The partnership continued till the spring of 1827, when Hosea Ballou bought his father's right in the business of Oliver Ballou and Son, and removed to Woonsocket. George C. Ballou continued the manufacture of satinets warps at Waterford till 1829, when he hired the shop which had been made by roofing over the stone basement of Dexter Ballou's factory at Woonsocket, after the destruction of the upper stories by fire. Here he began a business which has been continued ever since, on the same spot, by himself, and after his retirement by his son, representing his father's heirs. Mr. Ballou brought

with him from Waterford, as his savings there, a capital of \$1500. His business included, besides the manufacture of satinets warps, that of spinning cotton yarns for hand-weaving—an industry which was still carried on in many farm-houses; although the introduction of power-looms into cotton factories had greatly diminished the demand for home weaving when Mr. Ballou began operations, and in the course of a few years entirely superseded it.

His business rapidly increased, and, in a few months, he was obliged to devote all his room to spinning the cotton and the processes preparatory to it. For the making of his warps, he hired a room in his brother Hosea's wooden mill, on the land now owned by the Lippitt Woolen Company. He remained in the basement of the stone mill on the "saw-mill lot," which he purchased, till 1839. He then built up and extended the mill, and continued it in successful operation till Jan. 23, 1846, when it was wholly destroyed by fire. His loss was estimated at \$24,000, the insurance being only \$14,000. Not discouraged by this disaster, he immediately began the erection of the still larger stone mill which now occupies that site.

Before this loss occurred, Mr. Ballou had become one of the proprietors of the Clinton Mill. The land on which this mill was erected, in 1830, was purchased on March 31, 1827, from the heirs of Daniel Lyman, by Benjamin and Thomas C. Hoppin. They sold it, in 1830, to Edward Carrington. In 1832 John H. Clark became a partner with Mr. Carrington, and, in 1845, became sole proprietor. On the 3d of April of that year, he sold the property to George C. Ballou, associated with whom in the purchase was Oren A. Ballou, a son of his brother, Dexter, and James T. and Peleg A. Rhodes. An act of incorporation was granted in May, 1854, to the same parties, with a capital of \$75,000, and the right to increase it to \$200,000. Mr. Ballou became the president, and retained his interest and office in the company until his death. The mill was considerably enlarged; the capital raised to \$120,000; and the number of spindles increased to 15,000; and it was a well-managed and successful concern. Its name was chosen in honor of De Witt Clinton, governor of New York.

In 1864 Mr. Ballou became the owner of the Globe Mill. The land, which was included in what has been more recently known as the Globe Estate, was conveyed to Thomas Arnold, Thomas A. Paine and Marvel Shove, by James Arnold, who owned, at the beginning of the century, three hundred and sixty acres of land on both sides of the river at the falls. This included what is now the business center of the town. He sold the Globe Estate on June 1, 1827. The purchasers formed a company for the manufacture of cotton goods, to which they gave the name of the Globe Manufacturing Company, and erected a mill. This was the first cotton-mill in Woonsocket, and was built on the Smithfield side of the river. This company

shared in the general disaster and bankruptcy of the Rhode Island Cotton Manufacturers, in 1829, and the property passed into the hands of Samuel Shove, a successful woolen manufacturer, who had gained a high reputation for his satinets. Five years later the mill passed into the hands of Thomas Sprague and Sons, one of whom, Edward H. Sprague, in 1846, bought out his partners, and became the sole owner. In 1854 he sold the estate to Benjamin R. Vaughn and George C. Ballou. They operated the mill together until 1864, when Mr. Ballou became sole owner of the property.

In 1868 Mr. Ballou invested some capital in a company which was incorporated that year under the name of the American Worsted Company. This enterprise was originated by William H. S. Smith, a young man then in the employ of John Currier, a dry-goods merchant. With Reuben G. Randall he began, in 1866, the manufacture of worsted braids, in a wooden building then standing on the "Island." They were successful enough during the next two years to induce Mr. Ballou to aid them in the enlargement of their business; and this resulted in the organization of the American Worsted Company, and the erection of its stone mill. It was incorporated in May, 1868, with a capital of \$50,000. Mr. Ballou was chosen president of the Company. He was also a large stockholder in the Peabody Mills, at Newburyport, Mass. These mills were originally owned by the Globe Steam Mills Company, incorporated May 22, 1845, with a capital of \$200,000. The Company became embarrassed in 1868, and its principal creditors were Denny, Poor & Co., of Boston. At the request of this firm, Messrs. George C. Ballou and Son united with the firm in the re-organization of the Company, taking an interest of one-half. The machinery, the greater part of which was old, was almost wholly replaced by new, and a considerable addition was made to the mill, increasing its capacity from 14,000, to about 22,000 spindles.

In 1873 the Ballou Manufacturing Company was organized and incorporated with a capital of \$500,000. Mr. Ballou was the principal stockholder; and the rest of the stock was held mostly by his children, by blood or marriage. He remained president, from the organization of the company until his death: his son, David Ballou, was treasurer and agent. In the summer of 1873 the new mill on the Globe estate was completed. This mill, built of stone, with a capacity of about 40,000 spindles, was supervised by Mr. Ballou himself. His experience of nearly fifty years, the recent improvements in machinery and equipment, and the expenditure of capital, rendered the mill a most effective one. On the 4th of August, 1873, Mr. Ballou himself performed the first operation of the manufacture in this mill, by feeding the first cotton on the moving apron of the lapper.

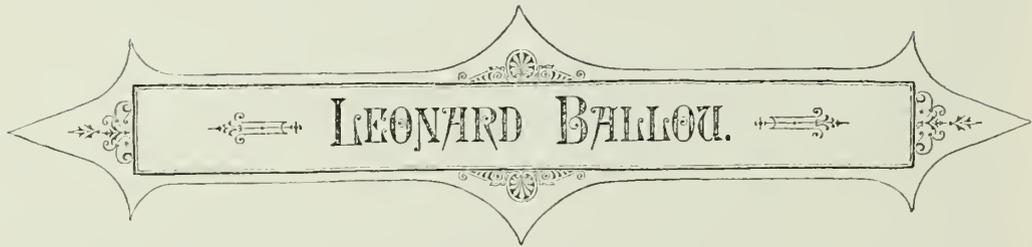
Mr. Ballou retained his official relations with his several business interests until

his death ; but six or seven years since, he relinquished the active superintendence to his son, who had been, since 1864, associated with him in the firm of George C. Ballou and Son. His habits of industry and activity, cultivated from early childhood, still found scope, and a taste for agricultural pursuits found gratification in the cultivation of his farms, including several hundred acres of land.

Mr. Ballou married Ruth Eliza Aldrich, daughter of Caleb Aldrich, of Smithfield, who was the son of Judge Caleb Aldrich, and grandson of Moses Aldrich, the celebrated Quaker preacher of the middle of the last century. Mrs. Ballou was a descendant, also, of the first settler of Woonsocket, her grandmother Aldrich, whose maiden name was Mary Arnold, having been the great granddaughter of Richard Arnold. Their children were Celia Ann, married to Cyrus Arnold, in early manhood a merchant in Woonsocket, but, since 1846, interested with his father-in-law in manufacture (who was a lineal descendant of Richard Arnold, in the sixth generation); Alpha, who married Peter H. Brown, of Providence, agent of the American Worsted Company; Abby, who married Hon. Charles D. Robinson, of Green Bay, Wis., publisher and editor of the Green Bay *Advocate*, and an influential citizen of Wisconsin, having been secretary of State; and David Ballou, who was educated as a manufacturer, under his father's eye, and was received into partnership in 1852, the firm taking the style of George C. Ballou and Son. On the organization of the Ballou Manufacturing Company, David was elected treasurer and agent.

Mr. G. C. Ballou died, after a long and painful illness, on March 5, 1876. He was at one time a representative to the General Assembly, for a single year, and a State senator for the same period. He had belonged to the Masonic Order for more than fifty years, and was, at the time of his death, one of its oldest members in the State.

The high estimation in which he was held, alike in his business, public, social and religious relations, was strongly attested, upon his death, by the terms in which he was spoken of in the local, Boston, and New York press.



LEONARD BALLOU.



WORTHY representative of what may be called "the old school" of New England manufacturers is Leonard Ballou, formerly of Killingly, now of Norwich, Conn. His ancestor, the earliest of that name in this country, was Maturin Ballou, a French Huguenot, who came to Providence, R. I., in the latter part of the seventeenth century. His son purchased and cultivated a large tract in Cumberland, R. I.; and his eldest son, in turn, inherited the whole of his father's landed estate. He, however, gave out of that estate a farm to each of his brothers. Of these, Noah, the grandfather of Leonard Ballou, had ten children: Absalom, David, Noah, Oliver, Ziba, Amariah, Eliel, Mercy, Keziah and Abigail. Oliver was the father of the well-known manufacturer of Woonsocket, R. I. Noah Ballou, the father of Leonard, was brought up as a farmer; but, having some mechanical taste, he became, also, a boat-builder, and in connection with his farming, carried on that business throughout his whole active life. He was in the Revolution, entering it at or near the commencement, when only sixteen years of age, and serving through several campaigns. He died in Cumberland, at the age of eighty-four years.

Leonard Ballou was born in Cumberland, R. I., Feb. 23, 1794. In his boyhood he worked on his father's farm, attending school in the winter terms. When sixteen, he taught school in his own district, and, some years later, a larger school in another part of the town. He also worked a part of the time in his father's shop, thereby acquiring skill in the use of tools. His father's business was almost destroyed by the embargo which preceded the War of 1812. Leonard, accordingly, on giving up school-teaching, was employed as a house-carpenter by Samuel Ray, uncle of the cotton and woolen manufacturers of that name, of Woonsocket, R. I., and Franklin, Mass. He worked at Slatersville on a machine-shop and tenement-houses built in that village, by Mr. Ray, for Almy, Brown and Slater.



Van Slyke & Co Boston



Leonard Bullou,

In 1816, his father's business as a boat-builder having improved, he worked in the shop for two years. He was then employed as a journeyman-carpenter until 1819, when he entered the employment of Jason Tower, a mill-wright. Soon afterward Mr. Tower was engaged by William Harris and Crawford Titus to put in a water-wheel, and to do other mill-wright's work in a mill they built that year at Abbott Run, just above the entrance of that stream into the Blackstone River. Mr. Harris was the uncle of Edward Harris, the woolen manufacturer of Woonsocket, who was then in his employ. Mr. Tower not being able to devote himself entirely to his business, the charge both of the construction and putting in of the wheel and of putting up the shafting, with the gearing, drums and pulleys, devolved mainly on Mr. Ballou. He succeeded in his task; and soon afterward was employed by Messrs. Watson, Tingley and Rathbun, of Providence, R. I., who were erecting a mill at Willimantic, Conn., to build and put in the wheel, put up the shafting, and start the mill. His success decided him to continue in the business. Returning to Rhode Island, he erected some tenement-houses for Mr. Harris, and built and put in a wheel in a new mill on the Abbott Run, above the Harris Mill, belonging to Bennet Whipple, of Cumberland.

Early in 1824 he and Elisha Newell were employed to put a wheel into the Yellow Mill, at Pawtucket; and Mr. Ballou was afterward employed as a mill-wright in manufactories at Plainfield, Abbott Run, Central Village and Valley Falls.

In November, 1825, Mr. Ballou purchased a mill-privilege on the Five Mile River, in Killingly, Conn., just above the Blashfield Factory, then owned by the heirs of Gen. James B. Mason, of Providence. On the privilege was a mill which had been built for grinding rye, to make gin—a business then very common in that part of the State. In making this purchase his father-in-law, Jabez Amsbury, who was a machinist in the employ of Walcott and Harris, at Valley Falls, was associated with him, under the firm-name of Amsbury and Ballou.

During the winter they built a part of the necessary machinery for the mill; and in the spring of 1826 they removed to Killingly, being accompanied by George Weatherhead, another son-in-law of Mr. Amsbury, and Mowry Amsbury, his son. They each received an eighth interest. Both Mr. Amsbury and Mr. Ballou put in \$2,500, and Mr. Weatherhead and Mowry Amsbury \$500, making their aggregate capital \$6,000. Their limited means compelled them to use the old gin-mill, which was of only one story. The roof was removed, the rest of the building raised, the foundation strengthened, a story built under the former structure and another over it, and the roof replaced; and a factory was thus provided, three stories high, 50 feet long and 32 wide. The building was finished, and the mill started, in the autumn, with Mr. Ballou as manager. After running the factory a year, he found that they

were in debt more than three thousand dollars, and that their facilities were not sufficient to earn a support for their families. On the same stream, above them, there was a factory, known as the Howe Factory, then owned by the Killingly Manufacturing Company, the agent of which was Col. John Andrews, of Providence. Colonel Andrews advised Mr. Ballou to double his machinery, and offered his own credit for the use of the firm; and, thus encouraged, Mr. Ballou at once acted on Colonel Andrews's advice. The firm was able to meet its payments without resorting to Colonel Andrews's aid, and this was the turning-point in the tide of its fortunes.

Having secured these additional facilities Mr. Ballou made a contract with Robert Rhodes, son of William Rhodes, then a well-known merchant in Providence, by which Amsbury, Ballou & Co. were to receive cotton from Mr. Rhodes, and manufacture at a fixed price per yard. This guaranteed to the firm a constant business, to the full capacity of their machinery, without the investment of money in materials, or the uncertainty and delay of sales and possible loss. This contract was for a year, and proved profitable. Mr. Ballou then entered into a similar contract with Low and Fenner, of Providence. The next year, 1829, a financial crisis occurred, and Low and Fenner succumbed to it. Amsbury, Ballou & Co. would have also been involved in bankruptcy, but for the prompt action of Mr. Ballou. The indebtedness of Low and Fenner to the firm had been settled, from time to time, by their notes, which the Company had procured to be discounted, the avails being used in their business. A large amount of this paper had not matured; but, coming on the firm, in case of the failure of Low and Fenner, they would not have been able to meet it. On hearing of Low and Fenner's embarrassment, Mr. Ballou attached all the cotton, with the cloth finished and in process, at his mill; and the result was that he recovered seventy-five per cent of the debt.

Mr. Ballou now made a contract with Josiah Chapin, then a large wholesale grocer in Providence, who agreed to purchase cotton, and to sell the goods on a commission of two and a half per cent. This contract continued two years, and was the beginning of the cotton business of Chapin & Co., who finally became large cotton-dealers in Rhode Island. Mr. Ballou next entered into negotiations with Mott & Co., a New York commission house; but, on Mr. Chapin agreeing to do the business without commission, he continued his relations with him for nearly three years longer. Meanwhile, having gained confidence, Mr. Ballou began, in 1833, to buy material and sell goods directly. He had, on his own account, in 1831, purchased an unoccupied privilege next above that belonging to himself and partners, and soon after sold it to George Weatherhead and Mowry Amsbury, who had, at the same time, sold their interest in the firm of Amsbury, Ballou & Co. to the senior partners. Receiving into partnership Abel Williams, who had married another daughter of

Jabez Amsbury, they built a factory, and commenced business under the firm-name of Amsbury, Weatherhead & Co. This firm was dissolved in 1836, Mr. Williams purchasing the Howe Factory, for which Colonel Andrews had formerly been agent, and Mr. Weatherhead buying the Blashfield Factory, on the same stream, and formerly owned by the Masons. The firm of Amsbury and Ballou was also dissolved, Mr. Ballou buying his father-in-law's interest. The elder Amsbury formed a partnership with his son, under the name of J. Amsbury and Son, and purchased the factory of Amsbury, Weatherhead & Co. From that time Mr. Ballou was alone in his business. In 1834 an addition had been made to the factory of sixty feet in length, making its entire length 110 feet, and the width 36 feet, and more than doubling its capacity.

Mr. Ballou's agents, Hoyt and Bogart (afterward Hoyt, Sprague & Co.) and Nesmith & Co., passed through the crisis of 1837 without embarrassment. In 1843 J. Amsbury and Son, George Weatherhead and A. B. Williams, all failed, Mr. Ballou's business alone of those which had grown out of the original firm being successful. He had been from the outset the active and responsible manager, and his capacity for the business was proved by his success.

He purchased, and rebuilt, in 1845, the dwelling-house on Washington Street, Norwich, Conn., now occupied by General Aiken, and has since resided in that city. In 1854 he made another addition of fifty-eight feet to his factory. Mr. Ballou retired from active business in February, 1864, and sold his factory, and the real estate in Killingly connected with it, to the Attawaugan Company. Since then he has confined himself to the discharge of financial trusts in connection with corporations in which a portion of his capital has been invested. He is a director in the First National Bank of Norwich, and a trustee of the Norwich Savings Society, of which, until recently, he was a director. He is also a director in the Norwich Bleaching and Calendering Company and the Norwich City Gas Company, and is president of the Occum Water Power Company. He was at one time president of the Norwich Water Power Company, and is still a director in it. In 1837 he was a member of the Connecticut Legislature.

Mr. Ballou married, in 1822, Ann Eliza Amsbury, of Cumberland, R. I. Their eldest daughter, Lydia, married John B. Young, late of the firm of Tiffany and Young, now Tiffany & Co., of New York. Their second daughter, Amelia, married Albert H. Almy, of Norwich.

Mr. Ballou retains, in his eighty-sixth year, his mental and physical powers, and is still enjoying the fruits of a long life of active and well-directed industry.

A decorative horizontal banner with a pointed left and right end. Inside the banner, the name "CYRUS I. BARKER." is written in a serif font. The banner is adorned with intricate floral and scrollwork patterns.

CYRUS I. BARKER.



CYRUS I. BARKER was born on the 27th of November, 1827, at what is now Bridgeton, Me., on the homestead granted to his grandfather, for his services as a Revolutionary soldier, by the State of Massachusetts. When quite young he went to Watertown, and then to Brunswick, Me.; where, on a farm, the first summer, he earned eighty dollars in silver. His tastes were rather mechanical than agricultural; and, in 1845, when he was eighteen, he repaired to Saco, and entered the services of the York corporation. He continued with them fourteen years, beginning at the foot of the ladder, which was tending what is called a lap-alley—a piece of work often parceled out to a new comer in the carding-room. In the early part of this period he went through various stages of promotion, until he was appointed an overseer. The duties of this post excited his ambition, and he applied himself diligently to them for seven years. There was a break of one year during this time, when he took charge of a card-room at Springvale; but, finding the pay irregular, and but little opportunity to rise, he returned to the first scene of his labors.

On leaving the York Company he engaged with Samuel Batchelder, to start a cotton carding-room in the Everett Mill, at Lawrence, Mass. Eight sets of woolen machinery were newly set up there, and the starting and oversight of these also were intrusted to Mr. Barker. He soon became familiar with the details of the woolen manufacture; and, in the spring of 1866, he was appointed general manager for A. Campbell & Co., who had begun the manufacture of both woolen and cotton in Philadelphia. He remained in that establishment three years, during which he planned and erected a substantial mill, half stone, half brick, six hundred feet long, seven stories high, and containing 40,000 spindles.

Early in 1868 Mr. Benjamin E. Bates, who was then making cotton cloth at Lewiston, Me., with a large capital, and who knew Mr. Barker's reputation as a



Van Slyke & Co Boston



C. A. Barker

manufacturer, engaged him to take charge of the Bates Mills ; and in this position he still remains.

In 1848 the Bates Mills consisted of two factories of 34,000 spindles ; now, after various enlargements, it has a capacity of 56,000 spindles. Woolen manufacture has blended here with that of cotton, in the use of eight set of woolen machinery, capable of producing anything in woolen demanded by the market. Of late, however, the mills have been, for the most part, devoted to Moscow beavers. At the commencement of Mr. Barker's service, plain white cotton cloth was the principal product of the Bates Mills, and about 18,000,000 yards annually were placed upon the market ; now, not a yard of such cloth is made there, having been found to be unprofitable. In its stead, cottonades, gingham, dress-goods, fancy shirtings, chevots, satin jeans, towelings, and varied spreads and quilts, are manufactured. The establishment includes 2,208 machines, each for some kind of active work, employs sixteen hundred hands, and uses a motor of eleven hundred horse-power.

A radical change has been made in passing from white to colored work, which has been done in Mill No. 1. This required an enlargement of the dye-house, an acquaintance with many kinds of chemicals, and a study of the various modes of dyeing. The coloring is done in the cotton, and often when this is in the bale ; but other kinds are also practiced, such as lap dyeing, short-skein dyeing, and chain dyeing, in chains of cotton, upwards of a thousand yards in length. This is a very rare process in that part of the country, but is done in this way for the economy of its after preparation for the loom. The advantage of the processes in the Bates Mills appears, when it is considered that these colors enter as constituents into dress-goods, the beauty of which depends as much upon the color as the figure. Within ten years, the manufacture of crochet, honey-comb and Marseilles quilts has been undertaken, excellent in design and quality, and has proved the most profitable of the whole work. Formerly, the "Jacquard loom," an intricate affair, had been set up in western Massachusetts, with the intention of making these goods, and of thus securing handsome profits ; but the attempt was a complete failure. Mr. Barker persuaded his corporation to purchase them ; and, after a while, desirable results were obtained. One hundred and forty of these Jacquard looms are at work at present weaving seventeen patterns of Marseilles quilts, ten of the crochet, and two of the honey-comb variety. France, in the former history of industries, enjoyed a monopoly in the Marseilles quilt ; but now she has a competitor in the Bates Mills. For a time this project was threatened by the distortions of the figure, in the processes essential to the bleaching of the quilts. It was not until a bleachery was established in these Mills, and special machinery was invented and patented by Mr. Barker, for the bleaching of the quilts, that the

figures and patterns could be preserved in their natural state, and, when finished give an effect of grace and beauty to the eye.

Dress-goods of many patterns are made at the Bates Mills ; and dress-goods with silk noils, formerly only done in Europe, are now produced there. Many looms, once employed on plain cotton cloth, now produce a Damask, blue and brown, for carriage linings. All colors and sizes of tidy and knitting cotton, including Turkey red, made only on a small scale in one other American Mill, are extensively spun here. A system of polishing cotton threads, so as to give them a silk finish, is extensively practiced, and is seldom done in other mills. A machine for printing white cotton in the yarn, so as to give it a mottled appearance, has been recently added. These Mills occupy twenty-four floors, comprising a superficial area of about eight acres ; use yearly 1,800,000 pounds of cotton, 400,900 pounds of wool ; and ship about three hundred cases or bales per week of finished goods. They have eleven hundred and twenty looms, a capital stock of \$1,500,000, a monthly pay-roll of \$60,000, and an annual product valued at about \$1,500,000. One hundred and eighty-three patterns of cotton goods alone was in process of manufacture, on the day that this account was written.

Besides his relation to the Bates Mills, Mr. Barker holds important relations with the Barker Mill, near Lewiston. The Little Androscoggin Water Power Company, formed in 1871, resolved to devote a part of its property to manufacturing purposes. Mr. Barker was chosen president, and at once drew plans, and issued stock, for what is now the mill that bears his name. The capital of \$500,000 was soon subscribed ; a dam, twenty-seven feet high, was built across the river, and a canal blown through the solid rock, at the terminus of which the first mill was built, in 1873. This is a brick structure, 300 by 50 feet, four stories high, with a basement ; and to it are added a gas-house, a fire-proof store-house, and other auxiliary buildings. Three hundred and fifty horse-powers are supplied by a Leffel turbine wheel, forty-eight inches in diameter, with a fall of water of thirty-six feet, from the Company's canal. This mill was started in December, 1873, with an ample supply of new and improved machinery throughout, and was soon in successful operation. The product is a sheeting forty inches wide, and the yearly production is 3,000,000 yards, into which are worked 850,000 pounds of raw cotton. A second mill is designed to be built at right angles with that described, with double the capacity of spindles. The Company has an abundance of space at its disposal for increasing its works at will, besides plenty of water-power—there being twenty-three ponds tributary to the Little Androscoggin, with sufficient water to run over 100,000 spindles.

SAMUEL BATCHELDER.



SAMUEL BATCHELDER, the eldest child of Samuel and Elizabeth Woodbury Batchelder, was born in Jaffrey, New Hampshire, June 8, 1784. His parents moved to New Ipswich, in 1785, where he obtained his education in the common schools and the academy of that town—the latter then taught by Mr. Hubbard, afterwards a professor in Dartmouth College. He early evinced a taste for literature, which has continued through a long and active life; and his hours of relaxation from business were engaged with his books and pen, instead of with what are generally called amusements.

At the age of sixteen, Mr. Batchelder had the care of a country store at New Ipswich, which belonged to his father; riding on horseback to Boston, a distance of fifty miles, to purchase goods. Before the age of twenty he commenced the same business for himself at Peterborough, N. H., and, after about two years, removed to Exeter, where he remained until 1807, when he returned to New Ipswich, continuing the same business.

His first connection with the manufacturing of cotton was in 1808. A mill for the spinning of cotton yarn had been put in operation at New Ipswich in 1804,—the first cotton mill in New Hampshire,—and four years later Mr. Batchelder, with two other proprietors, built a second mill on the same stream. It is worthy of remark, as showing the condition of manufactures at that time, that the erection of this factory was regarded with dislike by the owners of the first one, lest the business should be overdone, neither party having more than five hundred spindles. This was before the introduction of the power-loom, and the manufacture was confined to the spinning of cotton yarn, which was sold to families about the country for weaving. At that time almost every farm-house was furnished with spinning-wheels and a loom, and the ordinary clothing of the family was spun and wove by the women of every household.

Mr. Batchelder contracted with the two other owners for the whole product of the mill for several years; and, to dispose of this material, he undertook to have the yarn woven by hand into shirtings, checks and twilled goods. The women of the neighboring towns came a distance of six or eight miles for the yarn, which they wove at home, and then returned the finished webs. In this way he employed, at times, a hundred women—not constantly at work, but as they had leisure from other household occupations. When the power-loom was introduced at Waltham, in 1815, it was confined to the manufacture of plain shirtings and sheetings, while the goods which Mr. Batchelder made were checks, twills and tickings—some of them of dyed yarn of blue and other colors, which were still only made by hand. He paid a Scotchman who understood dyeing by what was called the *cold vat*, then scarcely practiced in this country, fifty cents per pound for coloring a *fast indigo blue*, such as would now cost only seven or eight cents. Pickings that are now worth from fifteen to twenty cents, then sold for seventy-five cents, and a better article at a dollar a yard.

In this domestic manner Mr. Batchelder manufactured over fifty tons of cloth by hand-loom. When, before 1812, he offered his goods for sale in Boston, and proposed to consign them to some merchants, he was told that it would be discreditable to them to undertake the sale of American goods; and he was obliged to send them to retail stores in Salem and other towns at a limited price, paying a commission of ten per cent. At one time during the war of 1812, such was the demand for cotton goods, that speculators came from Boston and cleared out all these fabrics at retail prices. After commission houses were established in Boston for the sale of American cottons, Mr. Batchelder's goods were sold in that city. He continued this business until 1824, when he was induced by Mr. Nathan Appleton and other capitalists, who were interested in manufacturing operations at East Chelmsford, now Lowell, to remove thither and undertake the establishment of a second company, only one of the Merrimac Mills having then been built. To that embryo city, then containing a few hundred inhabitants, he removed his family in January, 1825; and on the 20th of October following, an act was passed incorporating himself and his associates as the Hamilton Manufacturing Company. In these mills, the building of which he superintended from the laying of the foundations, he introduced by his mechanical skill such a construction of the power-loom, as to adapt it to the weaving of twills and such articles as before had only been done by hand-loom. One of these fabrics, the power-loom drilling, has become an important article both for exports and home consumption; nothing of the kind had been previously manufactured even in England. It was first put upon the market in August, 1827, at the New England Society's semi-annual sale, and brought over nineteen cents per yard by the bale. At this price

the article afforded a profit so much better than that upon shirtings, sheetings and printing-cloths, that a plan was immediately formed for building two mills for its manufacture. The Suffolk Company was incorporated for this purpose, and the stock subscribed for in a few weeks. This drilling proved to be so serviceable and so well adapted to the wants of the people both at home and abroad, that other factories for its production were soon built at Springfield, Nashua, Fall River and other places to supply the demand; and it became such an article for export, that more than two-thirds of what are called *domestics* exported to China, were estimated to consist of this article, amounting in 1855, to 7,700,000 yards; in 1856, to 16,593,000 yards; in 1857, to 15,538,200 yards; in 1858, to 28,661,400 yards; in 1859, to 31,108,800 yards; in 1860, to 31,576,600 yards.

The demand for the article became so important in various foreign markets, that British manufacturers soon began to make an imitation of it with inferior cotton, copying the American marks. With all the extension of the manufacture in this country, the fabric of this article has continued the same, with little variation—the same number of yarn, the same number of threads in the warp and filling, the same average weight, 2 3-4 yards to the pound.

Besides originating this drilling in the Hamilton Mills, Mr. Batchelder there commenced the manufacture of Canton flannel, a fabric unknown at that time in this country or England. A small sample was obtained from a sea captain engaged in the China trade, from a garment purchased in Canton—hence its name; and Mr. B., seeing how it could be made, immediately put in operation the machinery for making it, and it has now become a very important article of manufacture. Another curiosity in weaving which must be attributed to him is the seamless bags, first made by a Miss Spaulding, one of the women he employed on the hand-loom in 1823, and adapted by him to the power-loom at Saco, in 1832; since which time patents have been taken out for the invention by different parties.

During Mr. Batchelder's residence at Lowell, for about six years, his management of the concerns of the Hamilton Company was admitted to be successful; but his situation was such as to render him unable to derive much benefit from his own skill. Some changes had been made in the organization of the corporation which were unpleasant to him, as he was left to perform the labor and take the responsibility, while the control was in other hands. He therefore concluded to give up his connection with the concern, and sent in his resignation. After it was known that his engagements with the Hamilton Company were terminated, he immediately had offers from Boston capitalists to undertake the establishment of new manufacturing companies in various places, and finally made arrangements with the owners of the Falls on the Saco at the head of tide-water, to rebuild the mills that had been destroyed by fire.

In 1831 he went to Saco, Maine, and built the York Mills. There he invented the stop-motion for the drawing-frame, which was put in operation before any patent was taken out for it in this country; but it proved so important that it was afterwards patented by him in England, and few drawing-frames are now operated without it. In 1834 he put in successful operation his invention now known as the "Balance Dynamometer," which has received several medals, and been described in various foreign scientific journals as preferable to any known apparatus for ascertaining the power used in driving machinery. After this was exhibited at the Mechanics Fair in Boston, the following notice of it appeared in the *North American Review* of January, 1840, written by the Hon. Nathan Hale: "Among the inventions deserving of particular notice, was a dynamometer for the measuring of steam or water-power, by S. Batchelder, Esq., of Saco. This is an instrument which has long been a desideratum in practical mechanics. It is on a principle entirely novel, yet so simple, that it is no sooner seen than it is acknowledged to be fully adapted to its object. It may be made of any dimensions or strength suited to the degree of power to be measured; and by placing in the line of communication, by means of a band or gearing between the water-wheel, or drum of the steam-engine, and the machinery to be moved, the power exerted on the machinery may be exactly measured by means of a steelyard and weight, which form a part of the machine. There is also connected with it an index, to show the number of revolutions of the drum in a given time, which, being observed, together with the weight, the data are obtained for computing the number of pounds which would be raised one foot per minute, by the degree of power exerted at the time upon the machine, transmitted through it to the working machinery. Whether we regard the utility, the ingenuity or the simplicity of the machine, it must be ranked in a high class of inventions, as rendering that easy of attainment which was before impracticable by any process universally applicable; and we are a little surprised that, in the liberal number of premiums awarded, no higher testimonial of approbation has been bestowed upon it than the award of a silver medal."

Mr. Batchelder also made an improvement in the dressing-frame, by applying steam cylinders in drying the yarn in the process of sizing, which was patented, and has since come into general use.

In 1842 he purchased an estate in Cambridge, to which he removed his family for the education of his sons at Harvard University; but he still continued his business at Saco until 1846, when he decided to retire from active life. But in less than a year he was solicited to take the treasurership of the Portsmouth Mills—a company formed for the manufacture of lawns, an article much finer than anything that had hitherto been attempted in this country, and the success of which then

appeared very doubtful. After putting this mill in operation so as to pay moderate dividends for five or six years, he again retired from business. He next purchased an interest in the Exeter Mill, which had made no dividends for several years. Reorganizing this mill, and putting it in successful operation for a few years, he again sought the retirement of his library. In 1856 the York Company, of Saco, had become so depressed that the stock was sold for about half the price it brought when he left it ten years before, and he was persuaded to take the treasurership, in order to bring it up to its former condition; and from that time to 1868 the stock, besides paying good dividends, advanced from over \$600. to over \$1200. per share. During this time he undertook, for the Everett Company, to convert the machine-shop at Lawrence into a cotton-mill, which went into operation in 1861, and during the war continued to be very profitable, when cotton and cotton goods, as well as gold, was constantly advancing in price until 1865. But at the close of the war, with a large stock of goods and cotton on hand, and the decline in value of all kinds of property, the future prospects of the business appeared very discouraging. In 1869, at the age of eighty-five, Mr. Batchelder thought it time for him to rest from active business. For several years he had acted in the responsible capacity of treasurer or president of several corporations, representing a capital of over five million dollars. In 1863 he published a little volume on the introduction of cotton manufactures into this country, containing such particulars as he had gathered up, from time to time, in regard to the progress of the business here, and the condition of cotton manufactures in Great Britain, when the power-loom was introduced into New England.

“The manufacture of cotton by machinery in this country,” says Mr. Batchelder, made an important change in all our operations of trade and financial and social condition. Previous to that time, we imported large quantities of inferior cotton goods from England and from India. Those from the latter country were paid for by the exportation of silver dollars; and those from England, by all the means that could be made available for the purpose. Now, we are able to supply ourselves at half the cost, with goods of a better quality made at home. And, besides, the employment of capital in building mills and machinery, has occasioned such a demand for labor, that the rate of wages has advanced more than fifty per cent, as the examination of the pay-rolls of the mills will prove.”

Mr. Batchelder died at Cambridge, on Feb. 5, 1879, at the advanced age of ninety-four, leaving two sons and a daughter.

The life of this venerable manufacturer, beginning with the establishment of American Independence, covers the whole period of our existence as a nation; and he saw the cotton manufacture, from its very humble beginning, become one of the most important interests of the country, both in relation to labor and capital.

JARED BEEBE.



JARED BEEBE was born at Wilbraham, Mass., March 28, 1815. His father was a farmer, and Jared, in his early years, worked in the fields, varying his labors with attendance at the village school.

In 1835 he obtained employment in the woolen mills at Fitchburg, remaining there three years. This mill manufactured fine broadcloths. He went thence to work as a spinner in the Hampden Mills, in Monson, belonging to H. S. C. Reynolds. These mills were originally devoted to the cotton manufacture, by the Hampden Cotton Manufacturing Company, which had been incorporated Jan. 20, 1814. It was afterward converted into a woolen factory. Monson was one of the first towns in that part of the State to engage in manufacture, preceding by several years the enterprise of the capitalists of Boston and the eastern part of the State. The Monson Woolen Company was incorporated in 1812; and, some years before that time, the Union Manufacturing Company, of Monson, and the Brimfield Manufacturing Company, in the adjoining town of Brimfield, were organized, and, in 1815, chartered as one company, under the name of the Monson and Brimfield Manufacturing Company.

Young Beebe remained in these mills fourteen years, in various capacities, on a salary ranging from nineteen to fifty dollars a month. He thus became expert in the details of the woolen manufacture, and in 1852 he joined the firm of Holmes, Reynolds & Co., then organized. He contributed \$2,000 to the capital stock; and the firm purchased the Somersville Woolen Mills, at Somers, Conn., and at once began the manufacture of woolens. The management was assigned to Mr. Beebe. In 1858 he disposed of his interest in this firm, and purchased the Phelps Woolen Mill, at Willimansett, Mass., which he conducted successfully until 1862, when he sold it, and built a woolen mill at Holyoke, in company with Ezekiel Blake, of Chicopee Falls, Jerome Wells, of Chicopee, and J. Sanford Webber. Mr. Webber is a



VALLEY & BROS. CO.



Jared Beebe

native of Cazenovia, N. Y., and had been an overseer in the Somersville Woolen Mills since 1852. In 1863 Messrs. Beebe and Webber sold their interest; and, forming a partnership, under the style of Beebe and Webber, the firm built a new mill at Holyoke, and engaged in the manufacture of fancy doeskins and cassimeres. Mr. Webber has since been the manager of this mill. Under his administration the business has been very prosperous, the production of the mill gradually increasing until it has reached four hundred and fifty thousand yards of cloth a year, the wholesale value of which is equal to \$400,000.

In 1872 Mr. Beebe sold one-half of his interest in this mill to his son Frank, and the other half to Mr. Webber, who thus became owner of an interest of three-fourths. Franklin Beebe has since been an active partner with Mr. Webber, the style of the firm being now Webber and Beebe.

The opportunity for the creation of an immense water-power at Holyoke had been unimproved until 1847,—a single small cotton-mill at South Hadley, on the eastern side of the river, having been the only one to use it. In that year the Hadley Falls Company was organized, with a capital of \$400,000. Thomas H. Perkins, George W. Lyman and Edmund Dwight, all of Boston, were the incorporators. Mr. Perkins was a retired merchant, and earlier in the century had been an enterprising and successful Boston merchant, engaged in foreign trade. He was the principal patron of the institution known as the "Perkins Institution for the Blind," founded by Dr. Samuel G. Howe. Messrs. Lyman and Dwight had both been actively engaged in the cotton manufacture, with large interests in, and the financial management of, important corporations sustained by Boston capital.

In 1848 the great dam across the river was completed; but, shortly after the closing of the gates, the whole structure was swept away. A new dam, one thousand and seventeen feet long, was built in the summer of the same year, which has since endured the severest tests.

In 1870 Mr. Beebe bought a woolen-mill at North Monson, Mass., which he enlarged and equipped throughout with new machinery. He placed his son, J. H. Beebe, in charge of it, and conducted the business under a partnership having the style of J. Beebe and Son. This partnership continued until his death, the business being afterward conducted by J. H. Beebe and J. Sanford Webber, as administrators for the benefit of his heirs.

Mr. Beebe leased and put in operation a woolen-mill at Belchertown, Mass., in 1871, in which he was interested about two years. In 1872 he purchased the Hampden Paper Mill, in Holyoke, and organized the Beebe and Holbrook Paper Company, which was placed under the management of his son-in-law, G. B. Holbrook. Besides these enterprises, in the growth and success of which the efforts

of Mr. Beebe greatly aided, he was connected with other and equally important interests. When the Oceanic Woolen Company, at Mystic, Conn., was organized, he took one-third of the stock, and was made president of the corporation. He invested in the Farr Alpaca Company, of Holyoke, organized Nov. 13, 1873, and was its president also. The first meeting of the promoters of this enterprise was held just before the financial crisis in 1873. The general depression of business that followed, and the prostration of the trade at Bradford, England, the chief seat of the worsted industry, rendered the success of the new company doubtful. They erected a brick factory, however, and, six months afterward, were able to show in New York a full line of goods. They did not fully equip the mill at the outset; but, after this favorable reception, the mill was filled to its entire capacity. Its fabrics obtained an award at the Centennial Exhibition, and its alpacas, cashmeres and serges were especially commended. Mr. Beebe also united with others in the organization, in 1853, of the Massasoit Paper Company, with a capital of \$300,000, and was one of its directors. He also subscribed to the stock of, and was a director in, the Holyoke and Westfield Railroad Company, which not only gave railroad facilities to the villages between the two termini of the road, but shortened the route between Holyoke and the West, and opened a new avenue of travel and transportation between Holyoke and New York, by way of New Haven. He was special partner in the large commission-house of C. H. and F. D. Blake, of New York; and, residing during the latter years of his life in Springfield, he invested a portion of his capital in the Agawam National Bank, and was one of its directors at the time of his death. The various industries with which he was connected gave employment to about five hundred persons, and the aggregate value of their annual products reached \$2,000,000; while the business of the commission-house in which he was interested amounted to \$2,000,000 more.

Mr. Beebe died July 31, 1876, at the age of sixty-one. He married Mary Stacey, of Monson, Oct. 10, 1838, by whom he had seven children. He was a man of integrity, enterprise and industry, and was noted for his quiet kindness toward all who were brought into relations with him.



Van Slyck & Co.

BENEDICT & BURNHAM MANUFACTURING CO.

WATERBURY, CONN.

BENEDICT AND BURNHAM MFG. CO

AARON BENEDICT—GORDON W. BURNHAM.



THE early method of casting brass metal into sheets was superseded in this country by Aaron Benedict, at Waterbury, Conn., in 1824. He imported from England such rolling-machines as were in use there, and began the process of rolling brass for the purposes of its manufacture.

Aaron Benedict was descended, in the sixth generation, from Thomas Benedict, who was born in 1617, came from Nottinghamshire, England, and settled in Boston in 1638. Soon after his arrival he was married to Mary Bridgum, a fellow-passenger in the same vessel. They settled first "in the Bay parts,"—that is, in Boston or vicinity,—but soon removed to Southold, L. I., which was settled in 1640. Thomas Benedict was a man of some note; he was appointed, by the Commissioners of the United Colonies of New England, with the famous Captain John Mason, of Hartford, to adjust a difficulty between Uncas, the Sachem of the Mohegans, and Mohansick, Sachem of Long Island. In 1665 he removed, with his wife and their five sons and four daughters, to Norwalk, Conn. His youngest son, Daniel, was a lieutenant in the Connecticut troops during King Philip's War, and was in the expedition which resulted in destroying the power of the Narragansetts, and at the storming of the swamp fort, in South Kingston, Dec. 19, 1676. For these services he received a grant of twelve acres of land. In 1690 he removed to Danbury, Conn. His grandson, also named Daniel, was the father of six sons and three daughters. Of these, the second son, Lemuel, was a lieutenant in the American Revolution. The third son, Rev. Noah Benedict, graduated at Princeton, in 1757, and was pastor of the First Congregational Church, in Woodbury, Conn., for fifty-three years. Aaron, the fifth son, was also a lieutenant in the Revolution, and served with Arnold and Montgomery before Quebec. Amos, the sixth son, graduated at Yale College, in 1774, and joined the army of the

Revolution, became *aide-de-camp* of General Washington, and died in the service, on Feb. 18, 1777. Lieut. Aaron Benedict removed to Waterbury, and settled in that part of the town which, in 1807, was incorporated as the town of Middlebury. He represented the town in the Constitutional Convention of 1818, and for several terms in the legislature; and he died Dec. 16, 1841, aged nearly ninety-seven years. He was the father of four sons and four daughters. Two of the sons died young. His second son, Amos, born July 7, 1780, graduated at Yale College, in 1800, studied law, and was admitted to the bar in 1806. Removing to Watertown, N. Y., he entered an active professional career, and soon attained a high rank. He was appointed district attorney in 1810, and died in 1816.

The third son of Lieut. Aaron Benedict was Aaron, the subject of this sketch, born Aug. 9, 1785. He entered Yale in the middle of his Sophomore year, but ill health compelled him to leave college. A sea voyage and a summer's labor on the farm somewhat restored his health, but he did not resume his studies. In 1804 he went to Waterbury, and formed a mercantile partnership with Joseph Burton. This lasted until 1812. He then engaged in the manufacture of bone and ivory buttons, which he continued until 1823. In that year James Croft, who had learned in England the manufacture of gilt-brass buttons, and who for two years had been employed by Leavenworth, Hayden and Scovill, and had informed them of the better and cheaper processes of manufacture practiced in England, and, having left their employ, induced Mr. Benedict to engage in the same manufacture. His business of nearly twenty years had not furnished him sufficient capital for the new enterprise, and he secured, as a special partner, Bennet Bronson. Bronson graduated at Yale, in 1797, and studied law at Woodbury, with Hon. Noah B. Benedict. In 1802 he began the practice of law in his native town, and, in 1812, he was appointed judge of the county court. In 1814 he entered into partnership with Mark Leavenworth, in the manufacture of wooden clocks. On forming his business connection with Mr. Benedict, in 1823, he invested two thousand dollars, and induced his personal friends, Hon. Nathan Smith, afterward United States Senator, William Bristol and David C. De Forest, of New Haven, to invest one thousand dollars each. Mr. Benedict's mill was put in at \$1500, making the whole capital \$6500. Mr. Benedict was the general partner, and had the exclusive management of the business. The firm-style was "A. Benedict." James Croft and Samuel Forest, an expert maker of the special tools used in the manufacture of brass buttons, who had also been in the employ of Leavenworth, Hayden and Scovill, received a small interest in the business. Soon afterward Benjamin De Forest, of Watertown, and Alfred Platt, of Waterbury, invested capital, and became special partners. Judge Bronson loaned additional capital and his credit, as they were needed. He was one of the original stockholders



Van S. P. & Co. Boston



Aaron Benedict

of the Waterbury Bank, and its first president. He retained his interest in the business of "A. Benedict," and of the firms and company which succeeded the original firm, down to his death in 1850.

The new enterprise was soon reasonably successful. The method which had been adopted by Abel Porter & Co., and Leavenworth, Hayden and Scovill, of having the brass ingots partially rolled at Bradleyville, and then reduced to the requisite thinness with small rolls at their own mill, was at first adopted by Mr. Benedict; but he soon made a more effective arrangement. In July, 1824, Mr. Croft was sent to England to purchase such machinery for brass-rolling. He brought back with him a set of rolls thirty inches in length, and eleven in diameter. At that time these rolls were regarded as of wonderful size. They were at once set up; and Mr. Benedict was not only able to prepare, in his own mill, the brass needed for his button manufacture, but to furnish sheet-brass to other manufacturers, as early as 1825.

The partnership was renewed in 1827, and the capital increased to \$30,000. This second partnership expired Feb. 2, 1829, and a new one was formed by Aaron Benedict, Israel Coe, Bennet Bronson, Benjamin De Forest, Alfred Platt and James Croft, under the style of Benedict and Coe, with a capital of \$20,000, Messrs. Benedict and Coe being the general partners. Mr. Coe came to Waterbury, in 1821, and kept a hotel. In 1826 he entered the employment of "A. Benedict," as book-keeper. He was an expert accountant, and, although he had lost his right arm, he was an excellent penman. On Jan. 1, 1829, he purchased Nathan Smith's interest, and on Feb. 10, 1834, the firm dissolved. Mr. Coe went to Wolcottville, where, with Israel Holmes and others, he established a new brass-mill. This, after some changes, became the property of his son, Lyman W. Coe, and others, who had been, since 1863, successfully engaged in brass-manufacture, under the style of the "Coe Brass Manufacturing Company." Benjamin De Forest and James Croft now retired from the firm, and Gordon W. Burnham, Henry Bronson, Samuel S. De Forest and John De Forest entered it, the style becoming Benedict and Burnham, with the capital increased to \$40,000. Messrs. Benedict and Burnham were the general partners, the former superintending the manufacture, and the latter the sales.

In 1835 the concern began the rolling of German silver. This alloy of copper, zinc and nickel was first made from an ore found at Hildburghausen, in Germany, the proportions being—of copper, 40.4; of nickel, 31.6; of zinc, 25.4, and of iron, 2.6. This ore, being smelted, produced the metal which, from its partial resemblance to silver, and from the country where the ore was discovered, received the name of German silver. As the iron was not an essential ingredient, and as various proportions of the other metals were desired by different manufactures, the practice was soon adopted of melting together the pure metals, copper, nickel and

zinc, and various names, as *German silver*, *white metal*, *nickel silver*, *albata* and *argentine*, have been applied to the several compounds. The first composition of this kind rolled by Benedict and Burnham, was for Joseph Curtiss, of Hartford. He furnished the nickel, which was then, and for several years, of inferior quality. They mixed it with copper and zinc, and rolled it into sheets, which Mr. Curtiss manufactured into spoons, forks and various articles for which pewter and britannia had been previously used. The introduction of electro silver-plating, which soon followed, and the manufacture of silver-plated ware, at Meriden, Taunton and other places, produced an increased demand for nickel-silver, the highest grades of plated-ware having this as their basis. Nickel-silver is rolled in sheets like brass, and Benedict and Burnham have been among its largest manufacturers. The first three years of the firm of Benedict and Burnham were successful. The business was, however, seriously affected by the financial crisis of 1837, and the general depression which followed. In March, 1838, the partnership was renewed, and the capital was increased to \$71,000, and, in 1840, to \$100,000. Previous to the last date, a second financial revulsion occurred, followed, also, by a general stagnation in business. The firm survived both these periods without dishonor or serious loss. On Jan. 14, 1843, the firm was re-organized as a joint-stock company (the first formed in Waterbury), under the name of the Benedict and Burnham Manufacturing Company, with a capital of \$100,000. Mr. Benedict was elected president, which office he held until his death. In 1848 the capital stock was increased to \$200,000, and, in 1856, to \$400,000. New specialties in brass manufacture have been from time to time introduced. Whenever one of these could be carried on better by itself, property has been detached and distributed as a dividend among the stockholders, in the form of stock for a new company. In this way originated the Waterbury Button Company, in 1849, with a capital of \$30,000, since increased to \$100,000; and the Waterbury Clock Company, in 1857, with a capital of \$60,000, since increased to \$100,000.

In 1846 the American Pin Company was organized, gentlemen connected with the Benedict and Burnham Company taking one-half the stock. This Company was the successor of Slocum, Jillson & Co., of Poughkeepsic, N. Y., and M. Fowler and Sons, of Northford, Conn. The whole interest of the latter concern, and one-third of that of the former, had been previously purchased by Brown and Elton, of Waterbury, who, on the organization of the American Pin Company, took the other half of the stock. Mr. Benedict was also a stockholder and a director in other manufacturing companies in Waterbury and in the State, and was, from its organization, a director in the Waterbury Bank.

Aaron Benedict was married, in 1808, to Charlotte, daughter of Abel Porter, the

senior partner of the firm, who, in 1802, laid the foundation of the brass industries of the State. Their children were—Charlotte, born March 27, 1810, who married Scovill M. Buckingham, president of the Scovill Manufacturing Company from 1857 to 1861; Frances Jennette, born Nov. 12, 1812, who died Feb. 13, 1830; George W., born Nov. 26, 1814, who died April 12, 1862; Charles, born Sept. 23, 1817; and Mary Lyman, born Sept. 24, 1819, who married John S. Mitchell. George W. Benedict died at the age of forty-eight years, in the midst of his activity and usefulness. From early manhood he was engaged in the manufacturing department of his father's business, and was, at the time of his death, a director of the Company. He was active in local public affairs, was a selectman of the town, a member of the City Council, and, in 1847, a representative in the legislature. John S. Mitchell, who married Mary, was the son of John S. Mitchell, of New Haven, Conn. Before attaining his majority he had engaged in business on his own account. On his marriage, in 1841, he removed to Waterbury, and, entering the employment of Benedict and Burnham, soon became prominent in their business. On the organization of the Company, in 1843, he was appointed secretary, and became the active business manager of the home department. Mr. Mitchell was compelled by illness, in 1846, to retire for a while from active affairs. Nine years later he became the founder and head of the house of Mitchell, Vance & Co., prominent manufacturers of gas-fixtures and ornamental bronze goods. Having removed to New York City, in 1859, he transferred his residence to Tarrytown, N. Y., in 1863, and died in that town in 1875.

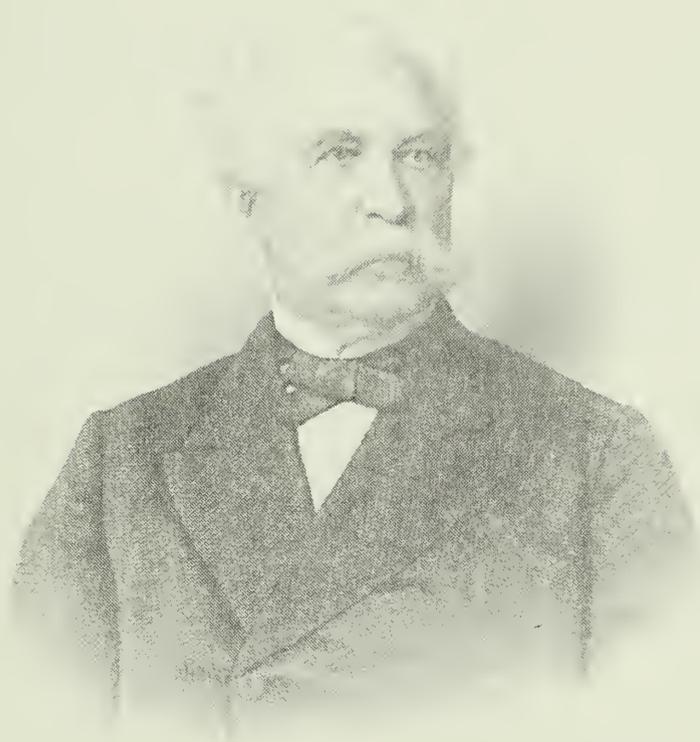
Mr. Benedict died Feb. 9, 1873, at the age of eighty-seven. He took a deep interest in civil affairs, and repeatedly represented the town in both branches of the legislature. Among other benefactions, he gave \$10,000 toward the erection of Divinity Hall, at Yale College; an equal amount toward the endowment of the Benedict Professorship of Latin, in Iowa College; and \$30,000 toward the erection of the edifice of the First Congregational Church, in Waterbury.

Gordon W. Burnham was descended, in the sixth generation, from John Burnham, of Ipswich, Mass., who was the eldest of three young men who came to America early in 1635. He was born in Norwich, Norfolk County, England; and, with his brothers, Thomas and Robert, emigrated, in charge of their uncle, Captain Andrews, master of the ship "Angel Gabriel," which was wrecked on the coast of Maine. Captain Andrews, with his three nephews, settled at Chebacco, afterward called Ipswich. The numerous families in both Old and New England bearing this surname are descended from Walter de Ventre, who came to England, from Normandy, with William the Conqueror, and was cousin-german to Earl Warren. The latter received from the Conqueror large estates which had belonged to Saxon

nobles, among which was the manor of Burnham, including several villages in the county of Norfolk. This manor was enfeoffed by Earl Warren to his kinsman, Walter de Ventre, who, from that fact, was afterward called Walter de Burnham.

In 1637, before he was of age, John Burnham joined the expedition against the Pequots, and for his services received a grant of land. He was a deacon of the Church, a large land-holder, and a man of influence. His grandson, Ebenezer, removed, in 1733, to Hampton, Conn., with his five sons and one daughter, all of whom lived to be married. Ebenezer's grandson, Jedediah, was the father of thirteen children, eight of whom attained maturity. Of these the ninth child and sixth son was Gordon, who was born at Hampton, March 20, 1803. His father was a well-to-do farmer; and Gordon, in his youth, worked on the farm. Before attaining his majority he resolved to earn his own living, and went into the employ of a neighboring farmer. He afterward engaged in mercantile business. In 1828 he entered into partnership with Mason Cleveland, a brother of Gov. Chauncey F. Cleveland, afterwards Comptroller of the State. Hampton was too limited a sphere for Mr. Burnham's aspirations; he, therefore, proposed to sell his interest to Mr. Cleveland, who agreed to purchase it if Mr. Burnham would dispose of the stock on hand. For this purpose he visited New York, Boston and other large cities. His success exceeded his expectations, and indicated his special talent as a salesman. Having fulfilled his contract with Mr. Cleveland, he devoted himself at once to the sale of articles of American manufacture, chiefly hardware, in the large markets. In about five years he acquired such a reputation, that, on the dissolution of the firm of Benedict and Coe, in February, 1834, he was invited to become an active partner, in place of Mr. Coe, to take charge of sales. The articles then manufactured consisted chiefly of sheet-brass, brass and copper wire, and gilt-brass buttons. Becoming a partner, he applied all his energies to the business; and, aided by the senior partner in the home department, developed the trade, so that, within a year, the sales were threefold.

Early in 1836 Mr. Burnham decided that it was important to establish, at New York, a sort of mercantile head-quarters of the firm. For this purpose he entered into partnership with John C. and Moses H. Baldwin, under the style of Baldwin, Burnham & Co. Besides the goods of Benedict and Burnham, they sold, on commission, the goods of other manufacturers. Five years after Mr. Burnham bought the interest of the senior partner, and continued, with Moses H. Baldwin, under the firm of Burnham and Baldwin; and, in 1837, he removed to New York, where he has since resided. The business at Waterbury was organized, in 1843, as a joint-stock company, and the Benedict and Burnham Manufacturing Company was among the first joint-stock concerns established in Connecticut.



Van Slyck & Co. Boston



Gordon W. Burkhani

Burnham and Baldwin established a commission-house in Boston in 1844, Arad W. Welton, of Waterbury, uniting with them, under the firm of Baldwin, Burnham and Welton. The next year James M. Plumb, who had, for several years, been a clerk in the New York house, was admitted to the firm, the style of which became Burnham, Baldwin & Co. Mr. Baldwin sold his interest in both firms to Mr. Burnham, in 1846, and the style of the New York house became Burnham and Plumb, and afterward Burnham, Plumb & Co., while that of the Boston house became Burnham and Welton. In 1848 Charles Scott, who had been a clerk in the house of Burnham and Welton, was admitted a partner, and the name was changed to Burnham, Welton & Co. In 1852 Willard Welton, Jr., was admitted to the firm, and the next year, Arad W. Welton retiring, the style was again changed to Burnham, Scott and Co. Willard Welton, Jr., retired in 1858, and the firm was then Burnham and Scott. In 1863 the firm of Burnham, Plumb & Co., and in 1867, that of Burnham and Scott, were dissolved. Since that date Mr. Burnham has had no active connection with business.

In addition to his interest in the Benedict and Burnham Manufacturing Company, Mr. Burnham invested largely in other companies in Waterbury. Though not one of the projectors of the enterprise known as Holmes, Booth and Haydens, he made a large subscription to its stock early in its existence. This, with his subsequent active interest in its affairs, contributed largely to place it on a substantial basis, as one of the great brass industries of Waterbury. Early in its history, he purchased stock in the Waterbury Brass Company. In both of these companies, and in other concerns, he is a director and a stockholder.

Mr. Burnham married, in 1831, Ann Griswold Ives, of Meriden, Conn. Their only surviving child is Douglass W., born Oct. 11, 1843. He lives at Fishkill, N. Y., on the estate formerly owned by Chancellor Livingston, but now belonging to his father, and devotes himself to agricultural pursuits. Mrs. Burnham died in 1847. Mr. Burnham married a second time, in 1851, Maria Louisa, daughter of Rt. Rev. Bishop Brownell, of Hartford, Conn. Their eldest child, Charlotte Brownell, died in 1857, aged five years. Their second and only living child is Thomas Brownell, born Jan. 20, 1866.

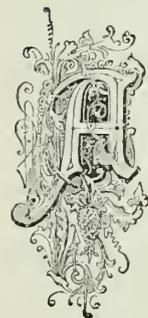
Mr. Burnham has contributed several notable works of art to the public. Chief of these are the monument to Bishop Brownell, in Cedar Hill Cemetery, at Hartford, Conn.; a bronze statue of the Bishop, at Trinity College; and a bronze statue of Daniel Webster, in Central Park, New York, which was inaugurated Nov. 25, 1876. This statue was by Thomas Ball.

Charles Benedict, the second son of Aaron, is now president, treasurer and executive manager of the Benedict and Burnham Manufacturing Company. He

attended, in his youth, the academy at Wilton, Conn., and the Berkshire Gymnasium, at Pittsfield, Mass. When seventeen he went to New York, and became assistant book-keeper in a dry-goods jobbing-house. By the great fire of December, 1835, the store was burned, and its business interrupted. Early in the next year he became book-keeper in the office of Baldwin, Burnham & Co., the commission-house representing Benedict and Burnham in New York. Here he remained for several years; but, in 1844, having had some connection with the India-rubber business, and being offered by Mr. Goodyear a share in the profits of his enterprise, and its agency in New York, in connection with George Beecher, he entered into a copartnership with Mr. Beecher, under the firm of Beecher and Benedict, and established the agency at No. 100 Broadway. The difficulty, however, of arranging definite terms with the parties interested, and the discouragement resulting from the imperfect quality of the goods, induced Mr. Benedict to retire from the firm; and, in 1845, he formed a connection with William Ball, of Chicopee, and furnished means to build some pin-machinery invented by Mr. Ball. This machinery proved too complicated to compete with the machinery already in successful operation; and about this time Mr. Ball turned his attention, with success, to the invention and construction of stamping-machinery, for reducing ores and quartz. Mr. Benedict then returned to Waterbury, and took the place of his brother-in-law, Mr. Mitchell, as secretary of the Benedict and Burnham Manufacturing Company. He was elected treasurer in 1854, and president on the decease of his father. He has had the general management of the affairs of the company for about twenty-five years. Within that period the nominal capital has increased from \$200,000 to \$400,000, with a large surplus; and with investments in several other companies. He was one of the projectors of, and is still connected with, Mitchell, Vance & Co., of New York, of which, as a joint-stock company, he is president. He took an active part in the organization of, and is a director in, the Detroit and Lake Superior Copper Company — an enterprise inaugurated by the Waterbury brass manufacturers. Mr. Benedict was one of the Presidential electors in 1872, and gave his vote for General Grant. He has served in both branches of the city council of Waterbury, and was mayor of the city in 1860.

A decorative horizontal banner with a pointed left and right end, containing the name "ERASTUS B. BIGELOW." in a serif font. The banner is adorned with intricate floral and scrollwork patterns.

ERASTUS B. BIGELOW.



AMONG the many inventors who, during the present century, have aided the progress of the industrial arts and sciences, it is difficult to say who has achieved the greatest benefit to mankind. Prominent in this sphere of labor, however, may fairly be placed the subject of this memoir. Erastus Brigham Bigelow was born April 2, 1814, in West Boylston, Mass. At the age of ten he began to earn his own living on a farm, where he worked for three summers. When he was thirteen, his father began to manufacture cotton yarns, and he went into the spinning-room as an operative. Before he had completed his fourteenth year he had invented two machines—the first, a hand-loom, of peculiar construction, for weaving narrow webbing; and the second, a machine for making piping-cord. The loom was effective; but the demand for its product would not then justify the employment of an operator, and it was laid aside, having earned for him only a few dollars. The other machine proved to be of more value. Piping-cord had been previously twisted by hand. By his machine, this could be done with much greater speed and uniformity. It earned for him in the course of the year about one hundred dollars. At sixteen, he had earned enough money to pay his own tuition at a neighboring academy which he attended for several terms; after which he went to Boston, and found employment with S. F. Morse & Co., wholesale and retail dry-goods merchants. Dealing in dry-goods, however, not proving to his taste, he remained with Messrs. Morse & Co. but little more than one year. While with them he became interested in the study of stenography, and afterward wrote a small book upon the subject, entitled, “The Self-Taught Stenographer.”

His father had now taken a partner, and removed to a new mill, leaving the old one unoccupied. Erastus, forming a partnership with John Munroe, occupied the old mill, and began to make cotton twine. On the failure of his

father, soon after, Bigelow and Munroe moved to Wareham, Mass., and hired a small cotton-mill; but this enterprise was not successful.

Young Bigelow now went to New York, took lessons in penmanship from Professor Bristow, and supported himself for some time by giving lessons in this art in Newark, N. J., and other places near New York. But this desultory, aimless life did not satisfy him. He soon returned home, and began the study of medicine, which he prosecuted eighteen months. To pursue his studies further, he must have pecuniary means; and this thought was again the stimulus to invention. His attention had been attracted by a counterpane on a bed in which he slept. It was a heavy cotton fabric, knotted over its whole surface. The goods were generally known as "knotted counterpanes." He asked himself why a power-loom could not be made to weave them at less cost. Suspending for the time his medical studies, and procuring some pecuniary aid, he succeeded in constructing, early in 1836, a loom for this purpose. He showed a sample of the fabric to Freeman, Cobb & Co., of Boston, who were importers of the goods. They at once entered into a contract with him to pay the expense already incurred, and that of securing patents in the United States and in England, and to erect and equip a mill to meet the probable demand for the article. The inventor was to receive one-fourth of the profits. But before the preparation for engaging in the manufacture of the goods had made much progress, Freeman, Cobb & Co. failed; and, in the general depression for the ensuing months, capital for the enterprise could not be raised; nor could the loom itself otherwise have been at once put to work, as the contract for its use was a part of the assets of the firm. Mr. Bigelow's father had been unsuccessful in business, and was now in declining health. He was, therefore, forced to postpone his projects, and provide for the needs of the present.

While selling his book on stenography, Mr. Bigelow had happened to witness the operation of weaving coach-lace by hand looms. The idea of a power-loom for this purpose now occurred to him. He visited the carriage-builders of Worcester and several other towns, who referred him to Fairbanks, Loring & Co., of Boston, as the firm from which they purchased the article. The latter firm assured him that, if such a loom could be made to work, it would be profitable, and expressed a desire to join him in the enterprise. In six weeks from the time of its first conception, his coach-lace power-loom was in operation. This invention involved some of the essential principles of the Brussels carpet-loom; and the success of the loom was immediate and complete. An association was formed consisting of Mr. Bigelow, his brother, Horatio N. Bigelow, Fairbanks, Loring & Co., of Boston, John Wright, of Worcester, and Israel Longley, of Shirley, to build and run the looms. They received a charter, as the Clinton Company, March 8, 1838, and purchased for their

use a mill on a small stream in the eastern part of Lancaster. A patent was granted April 20, 1837. This was the first of the long list of patents issued to Mr. Bigelow during the ensuing forty years, for looms and other textile machinery.

Although the knotted counterpane loom was invented before the coach-lace loom, and was the first of Mr. Bigelow's power-looms, the patent for it was not granted until Jan. 6, 1838. He soon after entered into an arrangement with Charles L. Roberts, previously a member of Freeman, Cobb & Co., to build, and put in operation for him, a number of these looms. Before proceeding to build the looms, however, he saw in New York an imported counterpane of a better fabric, which could be made at a less cost than the knotted counterpanes. A loom of different construction would be needed; and, in six months, a loom for this purpose was invented by him, and put in operation. The patent for it was granted May 30, 1842, and was succeeded by two other patents, granted for the same purpose, July 28 and Aug. 2, 1842. Under his direction, a mill for the manufacture of counterpanes was put into operation in the same part of the town with the coach-lace mill, the village having taken the name of Clintonville, from that of the coach-lace company. Although the price of counterpanes fell, within a few years, from nine to three dollars, the business was a profitable one.

In 1840 he turned his attention to the manufacture of ingrain carpeting by power-looms; and, having decided that he could devise and construct effective looms for the purpose, he proposed it to the Lowell Manufacturing Company, at Lowell, Mass., and the Thompsonville Carpet Company, at Thompsonville, Conn. Up to that time ingrain carpets were universally woven by hand-looms; and to weave them by a power-loom was deemed an impossibility. There were peculiar difficulties to be overcome. The complicated interweaving of warp and woof, to form the figure and to bind together the plies of the fabric, must be accomplished; and this must be so done that a perfect selvedge and a smooth, even face should be produced, and that the figures should be of such uniform length as to perfectly match with each other. The latter condition was fulfilled in the hand-loom only by constant attention on the part of the weaver. To fulfill all these conditions by machinery, as well as by the most expert hand-weaver, and with such increase of production as would warrant the additional expense, was a serious problem. Mr. Bigelow had not constructed a model, or had drawings made.

After some hesitation, the Lowell Manufacturing Company decided to engage in the enterprise, and agreed to pay the expense of building trial looms and obtaining patents, and pay him a royalty on their manufacture; he retaining the exclusive use of his inventions for all other purposes than that of weaving ingrain carpets. Mr. Bigelow went to Lowell, and in less than a year had built two automatic looms

—one to make two-ply, and the other three-ply carpets. Each of these looms was successful, meeting the required conditions, surpassing in the perfection of the fabric the best work of hand-loom, and exceeding it in product by at least fifty per cent. He had thus shown the practicability of weaving on power-loom all the varieties of ingrain carpets. Mr. Bigelow now commenced the construction of a second two-ply loom, with various modifications, suggested by the working of the first. This loom, when completed, made eighteen, instead of twelve yards. He next began a third loom, with essential changes, which, when finished, made thirty yards a day, the ordinary work of an expert hand-weaver being eight yards per day. Similar improvements were made in the three-ply loom in the summer of 1841. Patents for the two and three-ply ingrain carpet-loom were granted May 16 and May 26, 1842.

In the autumn of 1841 Mr. Bigelow went to England, to learn the methods of manufacture in that country. His observations satisfied him that, in some important respects, the English methods were superior to those of our manufactures. On his return he expressed this opinion, which led to the sending out of a special agent, Ex-Governor Steel, of New Hampshire, to England, that the opinion of Mr. Bigelow might be confirmed or refuted. His report fully sustained Mr. Bigelow's statements; and early in 1842 the several great corporations in Lowell united in the creation of an office, the duties of which were those of a general adviser of the several companies; and Mr. Bigelow was appointed to it. He made numerous improvements; but, finding the duties of his position advisory rather than executive, he resigned at the end of eighteen months, and resumed his mechanical enterprises.

He had, meanwhile, superintended the construction of fifty power-loom for making ingrain carpets under his patents, and the erection of a mill to receive them. This was finished and started in 1843. On leaving Lowell, he at once proceeded to organize a company for the manufacture of gingham and plaids by the power-loom. The Company was incorporated under the name of the Lancaster Mills, Feb. 5, 1844, with an authorized capital of \$500,000. Messrs. Erastus B. Bigelow, Stephen Fairbanks and Henry Timmins were the corporators named in the act. The required capital was subscribed, and Mr. Bigelow planned and equipped the mill. At the same time the Lowell Manufacturing Company decided to erect another large mill, sufficient for two hundred carpet-power looms, and contracted with Mr. Bigelow to design it, and to direct its construction and equipment. He carried on these two enterprises simultaneously, taking the whole charge of the plans, contracts and general supervision. While erecting these mills, Mr. Bigelow also directed the enlargements then made of both the coach-lace mill and the counterpane-works.

The Lancaster Mills were located in what was then Clintonville, which, in 1849,

was incorporated as a town, under the name of Clinton. Here Mr. Bigelow established, respectively, the *first power-loom* factory known in the history of industrial art, for weaving coach-lace, for weaving counterpanes, for weaving Brussels and Wilton carpets, for weaving wire-cloth, and also the first *power-loom* gingham factory organized on the "factory system," and thus became the founder of Clinton. When he began business there, what is now Clinton contained less than two hundred inhabitants. It has now a population of over seven thousand, six churches, excellent schools, and a free library of over six thousand volumes.

The patent for Mr. Bigelows's gingham power-loom was granted April 10, 1845. In the same year he received three additional patents, one for his revolving tentering mechanism for drying and finishing ginghams; one for an improved jaw-temple, and one for improved mechanism for regulating the tension of warps. On the 18th of August, 1846, the third patent for a power-loom to make two and three-ply ingrain carpets was granted; and on the 20th of March, 1847, his first patent for a Brussels carpet power-loom was issued. The essential principles of the coach-lace loom were embodied in this loom; but so many new devices were required to adapt it to making a fabric of so much greater width and of precise uniformity in length of figure, that it was properly the subject of a new patent.

During the ten or eleven years after the invention of the counterpane and coach-lace looms, his labors had been such as to seriously impair his health. He laid aside all business cares, and made a tour in Europe, finding the relief and restoration which he needed. On his return, in 1848, he devoted himself anew to his mechanical pursuits, especially to the improvement and development of his Brussels carpet-loom; and in 1849 he received two patents for looms of this special character, dated respectively March 10 and March 13. On the 23d of October of the same year, he received a patent for a Jacquard power-loom, having a general application to the making of any figured goods. In 1849 Mr. Bigelow, with his brother, Horatio N. Bigelow, and Henry P. Fairbanks formed a copartnership, under the style of H. N. and E. B. Bigelow, and began the manufacture of Brussels carpets at Clinton.

Mr. Bigelow received, on Sept. 24, 1850, a patent for a power-loom to weave tapestry Brussels carpeting; and, on the 7th of January, one for a loom to operate parti-colored warps. A patent for a loom to weave pile-carpeting was granted him the following year, and also one for a loom for cut pile-carpeting on the 18th of March of the same year. Other looms for the same purposes were patented in the next six years—for pile-carpeting, Nov. 15, 1853, Dec. 18, 1855, and May 5, 1857; and for cut-pile, Oct. 17, 1854. A loom for making double-pile goods was patented Jan. 13, 1857. Two power-looms for general weaving were patented Feb. 12 and April 8, 1856.

In September, 1851, Mr. Bigelow visited England, to attend the Great Exhibition at London, taking with him specimens of Brussels carpetings made at Clinton. They arrived too late to receive any award, but added materially to the interest of the American department, and were the subject of a supplemental report by the jurors. Their merits were also recognized by John Crossley and Sons, the carpet manufacturers of Europe, who then made arrangements for putting the Bigelow carpet-loom into their great mills at Halifax, England, and subsequently purchased the patent rights in them for Great Britain. In March, 1854, the firm of H. N. and E. B. Bigelow, before mentioned, organized the Bigelow Carpet Company as a joint-stock company, under an act of incorporation granted by the State in that year. The capital was fixed at \$500,000, and the incorporators were Erastus B. Bigelow, Horatio N. Bigelow and Stephen Fairbanks. On the 6th of February, 1866, the capital was increased to \$1,000,000, its present amount.

In 1856-7 Mr. Bigelow turned his attention to the weaving of wire cloth on power-loom. The intractable character of the material makes the weaving of it by hand a slow and imperfect process; and this was remedied by Mr. Bigelow in the power-loom he then devised, for which a patent was granted Oct. 6, 1857. Wire of every size and metal is woven by this loom with scarcely less facility than cotton or woolen yarn; and the woven wire fabrics are firmer, more uniform and of much better appearance than any ever made by hand. The Clinton Wire Cloth Company was organized in 1855, and a small mill erected. To this mill, as the uses to which wire cloth is applied have been increased, additions have been made from time to time, until it has become a large establishment. Its present capital is \$500,000.

During the next ten years Mr. Bigelow was engaged less in invention and industrial affairs, than in those of a more general and public character. In the autumn of 1860 he was a candidate for Congress in the fourth district of Massachusetts, but lacked a few votes of an election.

In 1862 he issued, in a large quarto volume of one hundred pages of text and two hundred pages of statistical tables entitled, "The Tariff Question considered in regard to the policy of England and the interests of the United States." It was an argument in favor of protecting home-industry. Mr. Bigelow had, before, published some works on economic subjects. In 1851 appeared his "Statement of Facts, addressed to the Proprietors of the Lancaster Mills;" and in 1858 he published a pamphlet entitled, "Remarks on the Depressed Condition of Manufactures in Massachusetts, with Suggestions as to its Cause and Remedy."

During the Civil War our wool manufacture attained a high degree of prosperity. To secure co-operation, a meeting of gentlemen interested in this industry met at Springfield, Mass., and organized the National Association of Woolen Manufacturers,

of which Mr. Bigelow was elected the first president. He soon after prepared and issued an address to the wool manufacturers of the country, defining the objects of the association, and suggesting a similar organization of the wool-growers. The result was, that, in December, 1865, the "National Association of Wool-growers" was organized, and a reconciliation of the two great interests was secured. The fruit of this was the present tariff, as far as it relates to the wool industry.

In 1866 he again visited Europe; and while there he took up and worked out new problems in textile and automatic machinery. He entered in the British Patent Office both drawings and specifications of the improvements he devised. On his return he made applications to our Patent Office, resulting in the issue to him of five patents during 1869. The first, dated Feb. 9, 1869, was for a new ingrain carpet-loom, differing from his former inventions and superior to them in efficiency, simplicity and cheapness. Some of its improvements have been applied to looms before in use, adding twenty per cent to their production. On the 20th of April two patents were granted—one for a Jacquard loom; the other for a loom stop-motion, combined with a friction-clutch. Two patents were also granted Aug. 17—one for a loom-harness operating mechanism; the other for a pile-weaving power-loom.

On Oct. 5, 1869, he delivered at the Exhibition of the American Institute in New York, an address on the Wool Industry of the United States. He has more recently published two works—one in 1877, on "The Tariff Policy of England and the United States Contrasted;" and the other, an article in the *Atlantic Monthly* for October, 1878, on "The Relations of Labor and Capital."

Since Jan. 1, 1870, Mr. Bigelow has received nine patents. Three were in 1870—one, March 22, for a loom for general purposes; May 24, for let-off mechanism; Dec. 13, for warp tension and let-off mechanism. On April 4, 1871, a third patent was granted for let-off mechanism.

A ninth patent was granted to him, for a power-loom to weave pile-carpetings, on Aug. 31, 1875; and on the 18th of January and the 30th of May, 1876, his sixth and seventh patents for looms to weave Brussels carpetings were secured. Both of these looms were also adapted to weave other fabrics.

Forty of the fifty patents which Mr. Bigelow has obtained are for improvements in looms. They have wrought a complete revolution in carpet-weaving, both in this country and in England, and in all grades, from the cheapest ingrains to the highest-priced Brussels and Wilton. Mr. Bigelow has, besides, received patents in other fields. One of these was for a machine to crush the ramie, and other fibrous plants. This plant may yet occupy an important place in our textile industries; and this ramie-crusher, patented March 22, 1870, will then come into valuable use.

On the 2d of May, 1876, a patent was granted to Mr. Bigelow for a hay-cart, which may be changed to a box-cart, and which, as a hay-cart, has a large holding capacity without the usual top-rails, which obstruct the loading and unloading of the hay.

Mr. Bigelow has been twice married: first, to Susan Wilson King, of West Boylston, who died in 1841, leaving an infant son, who died when six years old; secondly, to Eliza Frances Means, of Amherst, N. H., by whom he has one daughter, still living, and married to Rev. Daniel Merriman, of Worcester. Mr. Bigelow's elder and only brother, Horatio N., who aided him in patenting his first looms, and in building all the works at Clinton, died in 1868. The evidences of Mr. Bigelow's marked genius for invention, his persistent labors for many years, his business ability and practical capacity are shown by the preceding record.

He has received honorary degrees from five New England colleges—that of M. A. from Harvard, Yale, Dartmouth and Williams, and of LL. D. from Amherst. He was one of the original corporators of the Massachusetts Institute of Technology, and was chosen as one of its representatives in the Board of Trustees of the Massachusetts Museum of Fine Arts. He is a member of the Boston Society of Natural History, of the Massachusetts Historical Society, and of the American Academy of Arts and Sciences, and a life member of the London Society for the encouragement of Arts, Manufactures and Commerce.



W. H. B. & CO. BOSTON



L. Blackstone
En

LORENZO BLACKSTONE.



ON. LORENZO BLACKSTONE, of Norwich, Conn., is a lineal descendant, in the seventh generation, from William Blackstone, the first settler of Boston. The name, spelled variously, Blackstone, Blakestone, Blackston and Blaxton, is not a common one, either here or in England. There is little doubt that all the families of the name in this country were descended from "the primitive man of Boston;" and that Sir William Blackstone, the great English legal commentator of the last century, was of the same stock. In Woods' "Athenæ," one Marmaduke Blaxton is spoken of as a student of Queen's College, Cambridge, as having received the degree of A. M. in 1583, and as a dignitary of the church in the diocese of Durham in 1625. He was probably the father of William Blackstone, who always spelled his name Blaxton. He was undoubtedly born before 1600, and, like Marmaduke, was a graduate of Cambridge, and a clergyman of the Church of England. William Blackstone graduated at Emanuel College, as A. B., in 1617, and as A. M. in 1621. When he came to this country is not certain. He had built a cottage, and improved some land, before the coming of Winthrop and his company to Charlestown, in 1628. He sold his land in 1634, and removed to his new home in Boston, early in 1635. His house, garden and orchard were probably a little northwest of the junction of the present Beacon and Charles Streets. Governor Winthrop, on the first of April, 1633, set off fifty acres of land to Mr. Blackstone, of which he sold, early in 1634, forty-four acres to the inhabitants of Boston, for £30; and, later in the same year, the remaining six acres, including his house, garden and orchard, to Richard Pepys. He married, in Boston, on the 4th of July, 1659, Mrs. Sarah Stevenson, and by her had one son, John Blackstone. On leaving Boston, Blackstone went into the wilderness, and settled on the banks of the river which after-

ward received his name, at a point in what is now the southern part of the town of Cumberland. Here Mr. Blackstone lived until his death, May 26, 1675.

Of William Blackstone's real estate, consisting of two hundred and sixty acres of land, besides various tracts of meadow, the Plymouth court decreed that fifty acres of land and five acres of meadow should be given to John Stevenson, a son of Mrs. Blackstone by her previous marriage, in consideration of "his good services" to his step-father and his mother. The rest of the estate, coming at his majority to John, only son of William Blackstone, who was dissolute and unthrifty, was sold by him, Sept. 10, 1692, to David Whipple. John Blackstone then removed to Providence, where he worked at shoe-making, and where, it is supposed, he married his wife, Katharine. In 1713 he again removed to the vicinity of New Haven. His son, also named John, born Jan. 19, 1699, went to Branford, Conn., in early manhood, in a condition of poverty. But his grandfather's thrift, prudence and industry were revived in him. Soon after his arrival at Branford, he went to sea, which he followed for a number of years, becoming master and owner of a vessel trading to the West India Islands. In time he found himself the owner of several vessels, some of which were lost in the French war. He afterward turned his attention to farming, and at his death, which occurred Jan. 3, 1785, when he was nearly eighty-six years old, he had acquired a large landed estate. This has been handed down, from father to son, to the present generation. John Blackstone left two sons, John and Timothy, and two daughters. Of the sons, John died in Branford, Aug. 10, 1818, aged eighty-seven years. The eldest son of Timothy was James, who still survives. He has been for many years an honored and useful citizen of his native town, and has been repeatedly a member of both houses of the General Assembly of Connecticut.

The second son of Hon. James Blackstone is Lorenzo, the subject of this sketch. He was born at Branford, Conn., June 21, 1819. He remained at home during childhood and early youth, going to the district school, and afterward to the academy. At sixteen he went to the neighboring city of New Haven, to learn the trade of carriage-making, in which he was employed about three years. He then occupied four years in acquiring a knowledge of accounts, and of general mercantile business. He resolved, in 1842, to start in business on his own account; to leave his home and native land, and to establish an agency and commission-house, for the sale of American merchandise, in Liverpool, England. He soon established an enterprise on a sound basis, and gradually extended it until he had branches in Manchester and in London. His transactions reached every part of Great Britain, and many parts of the Continent and Australia. One branch of his business, which finally became extensive and profitable, was, in some degree, the result of accident.

On his return from one of his visits to America, Mr. Blackstone carried with

him, for his personal use, a pair of overshoes of vulcanized rubber, then recently introduced, but now universally used. No such thing had then been seen in England. Even the ill-shapen, but thoroughly waterproof shoes of native rubber had been for many years in general use in this country, but were hardly known in England. The overshoe, or *galoche*, then in vogue there was of leather, and a very clumsy affair. Mr. Blackstone's overshoes at once attracted attention, by their neatness and adaptation to their purpose. It was suggested that he should import an invoice of them. He did so, and found so ready a sale for them that he ordered other and larger invoices, and soon had a large trade in them. He was, however, ere long, interrupted by a notice from the great manufacturers of India-rubber goods, Charles Mackintosh & Co., of Manchester, that he was infringing on their rights as owners of the patents of Thomas Hancock. There were, at that time, unsettled claims in litigation between Charles Goodyear, under whose patent Mr. Blackstone's goods were made, and Thomas Hancock and his representatives. Mr. Blackstone deemed it wise to pay Charles Mackintosh & Co. a royalty, for which they gave him the exclusive right to sell rubber boots and shoes in every part of Great Britain. He also thus secured himself against the competition of American manufacturers, and such merchants in England as might become their agents. For a time he purchased goods indiscriminately of different American companies; but in 1846 he began to sell the goods of the Hayward Rubber Company, of Colchester, Conn., exclusively, receiving a special discount. He also invested in the stock of the Hayward Company, and has continued a stockholder in it down to the present time. His sales of rubber boots and shoes soon amounted to several hundred thousand dollars per year; and in this trade, with that in other lines of merchandise, he continued until 1855, in which year he returned to Branford, continuing, meanwhile, the business of his house, with its branches in England.

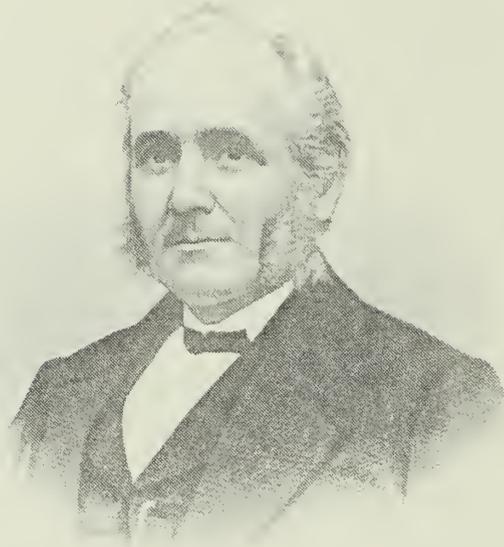
His intimate relations with his brothers-in-law, the Messrs. Norton, who had been, for several years, prominent merchants of Norwich, Conn., with W. A. Buckingham (afterward Governor of the State), and other officers of the Hayward Rubber Company, resident in Norwich, decided him to make that thriving city his permanent home, and he removed thither in 1857. Finding it difficult to transact his business in England while residing at home, he closed it up, to invest his now considerable capital in enterprises in this country.

In 1859 he made his first investment in the cotton manufacture, and to this new line of business he gave his most active, personal energies. He purchased the mill property which had been known early in the century as the Blashfield Factory, and as one of the earliest enterprises of the kind in the State, in 1859. The mill had been burned prior to the purchase of the privilege by Mr. Blackstone; and a new

and substantial brick mill was at once built, supplied with the latest machinery, with a capacity of 10,000 spindles. It received the name of the Attawaugan Mill, the name being of local Indian origin. Additional machinery to the capacity of 8,000 spindles was soon after added, making 18,000 spindles in all. In 1865 Leonard Ballou's mill, on the privilege next above that of the Attawaugan Mill, was purchased, and a new mill, with a capacity of 18,000 spindles, was erected opposite the old Ballou Mill. The Amesbury Mill, on the privilege next above the Ballou, had been burned several years previously. This privilege was now purchased, and a mill was erected for weaving, subsidiary to the Ballou Mill. With Mr. Blackstone have been associated in these enterprises his brothers-in-law, Henry B., Timothy P., and William T. Norton. The company was incorporated under the name of the Attawaugan Manufacturing Company, owning and operating the Attawaugan and Ballou Mills. In 1870 Mr. Blackstone and the Messrs. Norton purchased the Totokett Mill (built in 1868 for a woolen-mill), in the northern part of the township of Norwich. The building is of stone, and the machinery is of about 14,000 spindles.

Mr. Blackstone has also large investments in many other corporations,— manufacturing, financial and railroad. He is a director and one of the executive committee of the Ponemah Manufacturing Company, the largest cotton manufacturing company in Connecticut, and one of the largest in New England; is president of the Chelsea Savings Bank, and director of the Thames National Bank of Norwich; is a director in the Continental National Bank, of New York City, and in the Chicago and Alton Railroad Company, of Illinois; and has large interests in other railroads, mostly in the West. He was for four years mayor of Norwich, and has represented the city in the legislature of the State.

He married, on Oct. 17, 1842, Emily, daughter of Asa Norton, of Branford, Conn. Their children are James De Trafford, born in Manchester, England, June 6, 1847, who has an interest of one-third in the Totokett Mills, and is its agent; Harriet Belle, born in Manchester, England, Nov. 17, 1849, and married to Frederick S. Camp, of Norwich, who is a stockholder in the Ponemah Mills, and has charge of its office business; Ella Frances, born in Manchester, England, Nov. 13, 1851; William Norton, born in Norwich, Sept. 1, 1853, who is associated with his father in the management of his manufacturing business; and Louis Lorenzo, born in Norwich, March 17, 1861.



Gen. F. Blake

GEORGE FORDYCE BLAKE.



GEORGE FORDYCE BLAKE was descended, in the seventh generation, from William Blake, who came, with his wife Agnes and their five children, from Little Baddow, Essex Co., England, in 1630, and settled in Dorchester, Mass. Early in 1636 he accompanied William Pynchon, of Roxbury, and others, to the settlement at Springfield, Mass. His son James was selectman, member of the General Court, deacon of the church fourteen years, and ruling elder for the same period. His son, also named James, was selectman of the town and deacon of the church. The latter's youngest son, Increase, was, like his father, grandfather and great-grandfather, a substantial yeoman of Dorchester. His son, also named Increase, lived in Boston and manufactured tin-plate ware. His residence was on King (now State) Street, near the scene of the Boston massacre, March 5, 1770; and he supplied the provincial troops with canteens and tin cans.

In consequence of his refusal to supply the British troops with the same articles, his shop and other property were destroyed. Thomas Dawes had married his sister Hannah, and was a mason and architect; the Massachusetts State House was erected, in 1779, from his plans. The son of Colonel Dawes, also named Thomas, graduated at Harvard College in 1777, was appointed judge of the Massachusetts Supreme Court in 1792, and died, in 1825, "full of honors; a small man in stature, but very eloquent."

Increase Blake, after the destruction of his property, removed, after the battle of Bunker Hill, to Worcester, Mass., where he spent the rest of his life. His son, Thomas Dawes Blake, was born in Boston in 1768. Removing with his parents, at the age of seven, to Worcester, he spent his youth there, attending school in that town. On attaining his majority, he was for three years usher in the school of Master Payson. He was afterward a teacher for some years in Lancaster, Mass., and in Salem and Claremont, N. H. Meanwhile, he studied medicine; and, after

ceasing to teach he engaged in practice with Dr. Joseph Goldthwait, of Petersham, Mass. In 1799 he removed to Bangor, then a small village; but soon changed his residence to Farmington, where he died, Nov. 20, 1849.

His son, George Fordyce Blake, was born in Farmington, May 20, 1819. After attending the common schools, he engaged as an apprentice, at fourteen, to a house-carpenter. When twenty years of age he went to South Danvers, now Peabody, Mass., and remained there seven years working at this trade. At the end of that period he engaged with Peter Hubbell, the brick manufacturer of Cambridge, to take the general charge of his works, as mechanical engineer. Mr. Hubbell purchased, in 1860, a large area of land in Medford, for a new brick-yard; and Mr. Blake removed thither to take charge of laying out the yard, erecting the buildings, and starting the business. Finding that the clay there was not fitted for the purpose, with the machinery then used, Mr. Blake applied his inventive power to devise a machine that should meet the difficulty; and the result was the construction of a machine which was better adapted than any other for pulverizing, not only the peculiar Medford clay, but any other clay for bricks. This he patented, Nov. 26, 1861.

About the same time Mr. Blake invented a water-meter, successive patents for which were granted to him April 1, 1852, March 23, 1865 and Sept. 12, 1865. In 1864 the business of the brick-yards, both at Cambridge and at Medford, having passed into the hands of the Bay State Brick Company (organized in that year), Mr. Blake, though retained as directing engineer, engaged with Peter Hubbell and Job A. Turner, under the firm of George F. Blake & Co., in the manufacture of water-meters and steam-pumps; and for this purpose they purchased a building on Province Street, Boston. The steam-pumps were manufactured under Mr. Blake's patent, granted April 12, 1864. This pump had been in operation for some years at the brick-yard at Medford, for which it was at first designed, under his charge. In 1867, the building on Province Street not being adapted to the work, large rooms in the building of Messrs. Bowker and Torrey, having on its three sides Bowker, Chardon and Portland Streets, were hired. The interest of Mr. Hubbell was soon after bought by Messrs. Blake and Turner; and their sons, Thomas D. Blake and Edward C. Turner, were admitted to the firm. These premises soon proved insufficient for their increased business; and, in 1873, the large building on the corner of Friend and Causeway Streets was bought from the American Steam Company. It had been constructed for the manufacture of heavy iron-work, and was therefore well adapted to the business of George F. Blake & Co.

The business of the firm was finally organized as a joint-stock company, under the style of the George F. Blake Manufacturing Company. Its officers are: George F. Blake, President; Job A. Turner, Treasurer; and William E. L. Dillaway, Clerk.

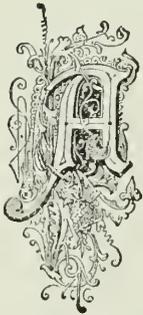
Its directors, besides Messrs. Blake and Turner, are : Ebenezer N. Blake, George H. Storer, Edward C. Turner and Thomas D. Blake. Since the issue of Mr. Blake's first patent on a steam-pump, his attention has been directed to further improvements, for which numerous patents have been granted to him. His aim has been to adapt the various pumps built by him to the special work which each has to perform, including the pumping of liquids, from those of the lightest specific gravity to those of the heaviest. It has been Mr. Blake's custom to submit every improvement to a series of long experiments. These pumps are used largely in the United States Navy, in the merchant-marine, for water-works in cities and large towns, for mining and fire purposes, and as oil-line pumps, boiler-feed pumps, and for other similar purposes.

In the construction of the Buffalo Water Works, six Blake pumps were submerged in a tunnel to the depth of forty-five feet ; and, after the steam was turned on, they had worked themselves free, and pumped all the water from the tunnel.

To meet the English and colonial demand, a manufactory of these pumps has been established in London. It has been found necessary to adopt the plan of making the parts interchangeable ; and this has been carried out in the minutest details.

While the details of the manufacture are looked after by his younger associates, and by men of special training, Mr. Blake himself personally supervises the daily business of the Company ; and the final decision of all important questions rests with him. He has also had, virtually, the general oversight, as consulting engineer, of the immense business of the Bay State Brick Company, of which he is still a director and large stockholder.

KIRK BOOTT.



ALL the great corporations of Lowell, excepting the Massachusetts Mills, chartered in 1839, and the Lowell Machine Shop, chartered in 1845, were put in operation within the first fifteen years of the history of that place ; and one of their most prominent promoters was the subject of this memoir.

Kirk Boott's father was an Englishman, who came to Boston soon after the Revolution, and established himself in the dry-goods trade. He lived in an imposing house at the corner of Cambridge Street and Bowdoin Square, which was first known as the "Boott House," but is now the "Revere House."

His son, Kirk Boott, was born in Boston, Oct. 20, 1790, and entered his father's store, when quite young, as a clerk. He was then fitted for Harvard College, and was admitted to the Sophomore class Feb. 14, 1807. His name appears among the Juniors in the catalogue published in the autumn of 1807, and among the Seniors in the catalogue of 1808. He did not, however, complete the course. In the latter part of 1808 he was sent by his father to England, where he entered Rugby School, and devoted himself especially to surveying and engineering. He then obtained a commission, as lieutenant of engineers, in the English army, and served in the Peninsular War, under Wellington. In July, 1813, he commanded a detachment in the memorable seige of San Sebastian. His regiment was afterward ordered to this country, to serve in the war between the United States and Great Britain ; and it was engaged in the battle of New Orleans. But before the embarkation of his regiment for America, Mr. Boott, being unwilling to fight against his native country, obtained his discharge from the army, and returned to England, where he allied himself in marriage with a family of high social standing.

On his father's death, in 1817, Mr. Boott returned to Boston, and engaged with his brothers in the business in which his father had been so long and successfully

employed. The style of the firm had been Kirk Boott and Sons, the junior partners being John W. and James Boott, with whom he was now associated. He only remained in the firm a short time, however, not finding mercantile business congenial to his taste.

In 1821, by the advice of Patrick T. Jackson, he was offered a partnership in the new manufacturing interest at East Chelmsford, in which Mr. Jackson and Nathan Appleton had become interested. Mr. Boott entered into the project, drew up the articles of association of the Merrimac Manufacturing Company, and was appointed, on Jan. 1, 1822, its treasurer and agent for five years, at a salary of \$3,000 a year. He purchased, at a par value of \$1,000, ninety out of the six hundred shares.

The act of incorporation was granted Feb. 5, 1822; and in the following spring Mr. Boott, to whom was committed the details of preparing for operations, removed to Lowell, then East Chelmsford, where he resided until his death.

The work of enlarging the canal to a width of sixty feet and a depth of eight feet, which, it was estimated, would furnish fifty mill-powers, was pushed with vigor; but it was soon found that it could not be accomplished in a single season, and the mills were then located so as to use the whole fall of thirty feet. Mr. Moody, the consulting engineer, favored the use of wheels of large diameter. While the old canal was being enlarged, a new canal was constructed; and factory buildings, a house for Mr. Boott, and boarding-houses for the operatives, were erected. A contract was made with the Boston Manufacturing Company, for machinery for two mills, \$75,000 being paid by the Merrimac Company to the Boston Company for their patterns and patent rights, and for a release of Mr. Moody from his contract, his services being desired at Lowell.

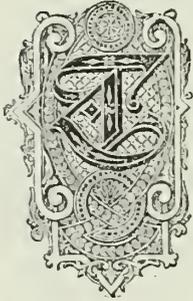
The first wheel of the Merrimac Company was set in motion Sept. 1, 1823. Print-goods was a new business in America, and the principal part of the design in undertaking the new cotton manufactory was to print calicoes. But the works at East Chelmsford were on so large a scale, and so much time was consumed in their construction, that two small establishments, one at Dover, N. H., the other at Taunton, Mass., anticipated the Merrimac Company in the production of American prints.

On the re-organization of the "Proprietors of Locks and Canals on Merrimac River," in 1825, Mr. Boott was appointed to the agency of that Company. The duties of this office, together with those of his position as treasurer and agent of the Merrimac Company, required versatility and industry, which conditions he ably fulfilled.

Mr. Boott died very suddenly, on the morning of April 11, 1837. He had prompt business habits, much tact in managing men, and rare ability to grasp and master complicated details; and his services in aiding to establish a great enterprise were of the highest value to his coadjutors and to American industry.

THE BORDENS, OF FALL RIVER.

RICHARD BORDEN — JEFFERSON BORDEN — HOLDER BORDEN.



THE family bearing this name has been associated with the history of Fall River from its first settlement, and closely connected with nearly all the enterprises which have made that city what it is. John Borden, the first person of this name in America, and believed to be the ancestor of all the Bordens in the United States, lived in Portsmouth, R. I., early in the seventeenth century. He had nine children, two of whom — Richard and Joseph — settled in Fall River. Richard's sons, Thomas and Joseph, inherited the land and water-power on the south side of the river; and their cousin Stephen, the son of Joseph Borden, the land and water-power on the north side. Much of this land afterward passed into the hands of others; but for many years the Borden family held a large portion of the land and water-power in Fall River, and are still among the largest landholders there. When Fall River became a town, in 1803, it contained eighteen families; and nine of these were Bordens. The river was then a small stream, two miles long, and one rod wide; but, by the raising of the water in Watuppa Pond, of which it forms the outlet, by means of a dam at the beginning of the falls, it has been much widened in the upper part, and is now from ten to eighty rods wide for four-fifths of its length. The fall begins about twenty-five hundred feet from the bay, the river descending one hundred and thirty-two feet in that distance. Nothing can now be seen of the falls, on account of the mills that cover them from bank to bank. The river runs over a bed of hard granite, and the mill-wheels are placed directly in the stream. The water-shed of the country around is but small, and the supply of water very steady, coming mostly from living springs in the ponds.

The Bordens early set up saw and grist-mills along the river. On May 25, 1778, one hundred and fifty British troops invaded the place, and burned the dwelling,



Richard Borden

grist-mill and saw-mill of Thomas Borden, the father of Col. Richard and Jefferson Borden; and, on their retreat, set fire to the house of Richard Borden, whom they carried off with them. They were fired upon by the Americans as they were passing Bristol Ferry; and, while two of the British soldiers were trying to raise Mr. Borden from the bottom of the boat, they were shot and killed. Mr. Borden was soon set free on parole.

To the two brothers, Col. Richard and Jefferson Borden, sons of Thomas and Mary Borden, belongs a large share of the credit for the great progress of the Fall River industries. Their father was born on Oct. 26, 1749, and their mother on Nov. 25, 1757; and they were in the sixth generation from John Borden.

Col. Richard Borden was born on April 12, 1795, and was the ninth of thirteen children, all of whom grew up and had families of their own. Thomas Borden, the father, was a farmer, whose lands are now occupied by the Richard Borden, Chace and other mills. The son Richard spent his early years, after leaving school, working on the farm. From 1812 to 1820 he ran a grist-mill at the last fall near the mouth of the stream. To the occupation of miller he joined that of mariner and ship-builder. He was owner of a small sloop, the "Irene and Betsey;" and, accompanied by his brother Jefferson, he used to sail down Narraganset Bay to Prudence and Conanicut Islands, take in a load of corn, and return to Fall River. Although his mill was at the edge of a large fresh-water fall, it also bordered on tide-water, so that the sloop could be moored at a little wharf, and discharge directly into the mill. This ground the corn of the entire region roundabout. The "Irene and Betsey" had a capacity of two hundred and fifty bushels. She was also used as a packet between Fall River and the neighboring ports, going to Warren, Bristol and Providence with the surplus meal, which was sold in those places, and returning with a freight of groceries, provisions, cotton and other goods.

In the War of 1812, Richard Borden joined the local militia company as a private, and was afterward promoted to the rank of colonel. After the war, Colonel Borden engaged, with Bradford Durfee, in the construction of small coasting vessels. After their day's labor on these, they worked in a neighboring blacksmith's shop, getting out the iron work for the vessels. From their ship-yard they launched about one vessel a year, of from twenty to seventy-five tons burden. The work of the blacksmith's shop gradually increased, and a good business in the manufacture of spikes, bars, rods and other articles for building was established.

This was the beginning of the Fall River Iron Works, which has been the source of the capital for the development of many of the most important industries of Fall River. It was the demand for the products of their shop that suggested to them the establishment of the Iron Works. With Holder Borden and David Anthony, of

Fall River, William Valentine and Joseph Butler, of Providence, and Abraham and Isaac Wilkinson, of Pawtucket, they formed an association with a capital of \$24,000, each contributing \$3,000. But the two Wilkinsons soon withdrew, which reduced the capital to \$18,000. The first shops were erected where the Metacomet Mill now stands. At first hoop-iron was the principal production, and was sold to the New Bedford trade, for the binding of oil-casks. The manufacture of bar-iron of various sizes was soon commenced; and two nail-making machines were also set up. The heading of the best quality of nails was at that time done by hand. When a sufficient quantity had accumulated, Colonel Borden would take a sloop load and sail for New York and up the Hudson, seeking a market. At one time a small lot was shipped to Mobile, as a venture; and they were found to be so much better than the soft-iron Pittsburg nail, that a large cargo was ordered. The business of the works grew rapidly; and the shops were enlarged as new branches of production were added.

The Fall River Iron Works Company was organized, as has been stated, in 1821; and it was incorporated in 1825, with a capital of \$200,000. In 1845 this was increased to \$960,000, the present nominal capital. There are now invested in the works \$1,500,000, and there have been dividends to the amount of \$3,500,000. The whole amount of \$5,000,000 has been accumulated from the profits of the business, not a dollar having been added by subscription to the original investment of \$18,000. In 1840 the works had outgrown the limits of their original site, and were removed to their present location near High Hill, where they had the advantage of large buildings, and a good water-front with wharves. The rolling-mill was burned on the morning of June 2, 1843; but in six weeks it had been rebuilt, and the manufacture of iron was resumed. The mill was again burned on Nov. 11, 1859, and was at once restored. The works now comprise a rolling-mill, a nail-mill and a foundry, in three separate buildings. These use forty tons of scrap and pig-iron a day; and thirty-two thousand tons are used each year in the manufacture of nails, hoops, rods, castings and other articles. Steam is now the sole motive-power; six hundred men are employed, and the monthly pay-roll averages \$25,000.

One of the first steps taken by the Iron Works Company, after its organization, was to purchase, for \$10,000, the large lot bordering on the shore to the south and west of the creek; and afterward another large section was bought. The resources of the Company were largely used for making this property available for its purposes, and for founding and promoting other enterprises which rapidly increased the wealth and importance of Fall River. The city is indebted to this Company for many of its largest mills, steamboats, and wharves, and various prominent institutions.

During the first ten years of the Iron Works, their productions were sent in sailing vessels to Providence, New Bedford, Nantucket, New London, New Haven, New York, Poughkeepsie, Albany and Troy. Several unsuccessful attempts had been made to establish steamboat communication with Providence; and, in 1827, the Company built the steamboat "Hancock," and placed it on the route. In 1832 this was succeeded by the "King Philip," which, in 1845, was replaced by the "Bradford Durfee." In 1847 the "Canonicus" was built, and was run to Providence and Newport; the "Metacomet" in 1849; and the large and handsome steamer, "Richard Borden," in 1873. The "Canonicus" was sold to the National Government in 1862, and was used as a transport; but, at the close of the war, it was bought back, and is now used mainly as an excursion steamer. Before 1840 there were but three wharves of any importance in Fall River, and two of those had been built, and were owned, by the Borden Company. In that year wharves were built for the new Iron Works; in 1846 the New York Steamboat wharf was built; and in 1848 the wharf now used by the Clyde Line to Philadelphia, was constructed. The Company at present owns about one mile of wharf frontage, making it the principal wharf-proprietor in Fall River.

Before 1849 the Company had obtained its bituminous coal, of which it was a large consumer, from Pictou, N. S.; but that year a mine at Frostburg, Md., was purchased by Richard and Jefferson Borden and others, and the Borden Mining Company was organized, which has since taken out from 150,000 to 200,000 tons of coal a year, the coal for the Iron Works being derived entirely from that source.

In 1834, when the American Print Works Company was organized, its buildings were erected by the Iron Works Company, and leased to the Print Works Company until bought by the latter. In 1840 the Company erected large machine works, which were leased to Hawes, Marvel and Davol for the building of cotton-machinery. The Metacomet Mill, then regarded as a model of its kind, was built in 1846, by the Company, which still owns and runs it, for the manufacture of print-cloths. In 1847 the Company built the Fall River Gas Works, primarily to light the Metacomet Mill; but they now furnish gas for almost the entire city, and are still owned and run by the original builders. A large interest in the Troy Cotton and Woolen Manufactory was bought in 1851, and a similar investment was soon after made in the Fall River Manufactory; the Company thus gaining an ownership in the two pioneer mills of Fall River. In a like manner it became interested in other mills and institutions, and erected various buildings, which were leased for business and manufacturing purposes. The growth of all this large and varied business from its small beginnings is largely due to Colonel Borden, who was treasurer from the time of the organization of the Company until his death, — a period of more than fifty years, — and agent, after the death of Major Durfee in 1843.

The Old Colony Railroad Company, which was originally chartered to run between Boston and Plymouth, owes its extension in the direction of Fall River and south-eastern Massachusetts chiefly to Colonel Borden. In 1846 he projected the railroad from Fall River to Myrick's; and to his active exertions its speedy construction was due, opening thereby railroad communication with Boston by way of the New Bedford and Taunton and the Boston and Providence Railroads. This route, however, was too circuitous; and the Fall River Railroad was soon extended from Myrick's to South Braintree, where it connected with the Old Colony Railroad. To create a feeder for his railroad, and make it self-sustaining, he then organized the Cape Cod Railroad Company, with a line from Middleboro down the Cape. Of both of these enterprises he was the projector and financier. The Fall River line was soon consolidated with the Old Colony, which now includes the Cape Cod and a number of other railroads.

In 1847 the success of the Stonington and the Norwich steamboat lines to New York induced Colonel Borden to start a similar line from Fall River; and, with his brother Jefferson, he established the Fall River Steamboat line, with a capital of \$300,000. The steamer "Bay State" was built for the route, and the "Massachusetts" was chartered. In 1848 the "Empire State" was built; and in 1854 the "Metropolis," then regarded as a very marvel of a floating palace. The line was so successful that both these boats were paid for from the earnings, and, for ten successive months in 1850, six per cent monthly dividends were declared. Colonel Borden set a movement on foot in 1864, for the building of a new line to Boston, starting on the west side of the bay opposite Fall River. The charter was at length bought by the Old Colony Railroad, which at the same time secured control of the steamboat line.

Colonel Borden was officially connected with many corporations, both in and outside of Fall River. He was president and director of the American Print Works, the American Linen Company, the Troy Cotton and Woolen Manufactory, and the Richard Borden Manufacturing Company, and was a director in the Annawan Manufactory. He was president and a director of the Fall River National Bank, director, treasurer, agent and corporation clerk, of the Fall River Iron Works Company, and president of the Watuppa Reservoir Company. Of outside corporations, he was president of the Bay State Steamboat Company, the Providence Tool Company, the Cape Cod Railroad Company, and the Borden Mining Company, and a director of the Old Colony Railroad Company. In Fall River he once served as assessor and surveyor of highways, and was elected to the State legislature as representative and as senator. In 1864, at the second election of Abraham Lincoln, he was chosen presidential elector.

On May 27, 1872, he had a stroke of paralysis; and he died Feb. 25, 1874, in his seventy-ninth year, leaving four sons and two daughters. He was robust, energetic, self-reliant, and an honest and industrious business man. He had the faculty of leaving his business cares at the office, and at home was free for domestic pleasures. During the Civil War he was patriotic; and he gave the Soldier's Monument and lot at the entrance of Oak Grove Cemetery. The Richard Borden Post of the Grand Army of the Republic was named in his honor. He became a member of the first Congregational Church of Fall River in 1826, and afterward of the Central Congregational Church. He was a corporate member of the American Board of Commissioners for Foreign Missions, and gave liberally to charitable and educational objects.

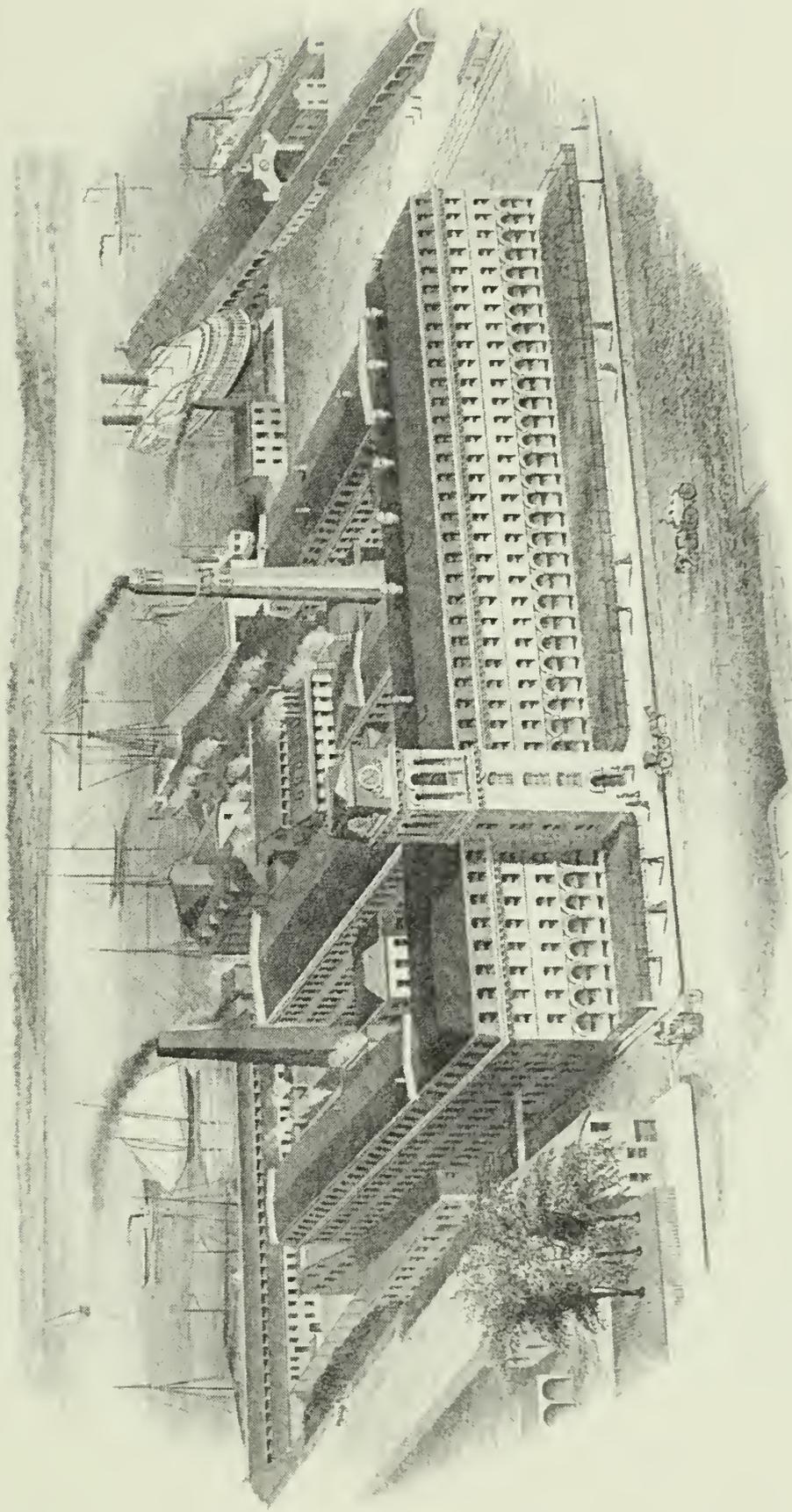
Jefferson Borden was a younger brother of Richard, and was born Feb. 28, 1801. He attended school, and worked on his father's farm in the intervals between the terms, until September, 1816, when he became clerk in the provision store of William Valentine, at Providence. Mr. Valentine subsequently was associated with him in the organization of the Fall River Iron Works. He remained in Providence until 1819, when he returned to Fall River, with a thorough mercantile training. In the ensuing year he accompanied his brother Richard on his trading trips in the "Irene and Betsey," when not needed on the farm. In 1820 the two brothers bought out Holder Borden's store, of which Jefferson was put in charge. When, in 1821, the Iron Works were established, he was appointed clerk of the concern.

In September, 1822, the Company established a warehouse and salesroom in Providence, and he was intrusted with its care. He was then but a few months over twenty-one years of age. By his capable management at Providence he really directed the home productions, and rapidly widened the market for the wares of the Iron Works, until it embraced nearly the entire country. He remained as agent in Providence for fifteen years, after which he was chosen executive officer and managing agent of the American Print Works, which had been held by his cousin, Holder Borden. He assumed this trust in the midst of the great crisis of 1837, which was most critical for American manufacturing interests; but his superior ability carried the Company safely through; and his wise management, during the thirty-nine years in which he held the position, kept the American Print Works in the front rank of enterprises of its class. He resigned the management in the spring of 1876. He was largely interested in most of the important Fall River enterprises, and was partner in many of his brother Richard's great undertakings, for the success of which he is entitled to an equal share of the credit. Among these were the old Bay State Steamboat Company, in which he at one time owned three-fifths of the stock, the Fall River Railroad, and the Borden Mining Company. He is still president of the American Print Works Company, the Fall River Iron

Works Company, the Fall River Bleachery, the American Linen Company, the Troy Cotton and Woolen Manufactory, the Borden Mining Company, and the Metacomet National Bank, and is also an officer in many other moneyed institutions.

On the left of the wharf of the Fall River Line to New York stands a large building, the handsome architecture and massive appearance of which at once attracts the eye. This is the principal building of the American Print Works—an establishment with which, from its foundation to the present day, the Borden family has been closely identified. The organizer of the Print Works Company was Holder Borden, a man of remarkable boldness and energy. He was born on June 17, 1799. At eighteen or nineteen he entered the employment of David Anthony, then at the head of the Fall River Manufactory. He remained in this service about two years, and then went to Pawtucket, where he at first acted as clerk to the Wilkinsons, and soon became agent for the Blackstone Mills. An incident occurred here which shows his energetic, self-confident character. Having been intrusted with the investment of a large sum of money belonging to the Company, he bought up all the cotton he could find, and thus gained entire control of the market. His employers were surprised and alarmed; but he offered to assume all responsibility for the operation, and made the bargain in his own name, and at his own risk. It resulted in his selling a portion of the cotton to the Company at an advanced price. In 1827 he joined his principals at the Blackstone Mills, Brown and Ives, in the establishment of the Massasoit Mill, in Fall River, which was erected at a cost of about \$100,000. After a time Brown and Ives proposed to remove the machinery to Lonsdale, R. I., on account of some trouble from low water; but Holder Borden bought them out, and ran the mill himself. He afterwards became interested in several other Fall River enterprises. He owned shares in the Troy Cotton and Woolen Manufactory, the Annawan Manufactory, the Fall River Manufactory, and the Fall River Iron Works; and for a year was agent of the print works of the Globe Mill, afterward the Bay State Print Works.

When he had fully conceived the idea of the American Print Works, and the plans were matured, he quietly hired all the men and teams he could obtain, staked out the lines, and set the men at work on the foundation; after which he drove off to Providence, to his business in connection with the Blackstone Company, the agency of which he still held. The American Print Works began running in January, 1835, with four machines, and a capacity for an average production of between two thousand and two thousand five hundred pieces a week. The works continued under the management of Holder Borden for two years, when ill-health demanded his withdrawal from business. This took place in February, 1837, and he died on the twelfth of the following September, at the age of thirty-eight. His



MANUFACTURING COMPANY

NEW YORK



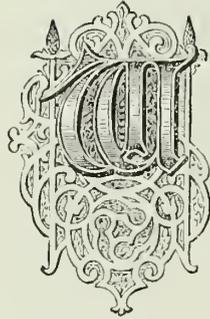
business life had a length of only fifteen years; but it was a brilliant one, and was productive of important results. He was succeeded by Jefferson Borden, as already stated, who continued at the head of the works until February, 1876, when he was succeeded by his nephew, Thomas J. Borden.

In the establishment of the American Print Works, several Fall River manufacturers had combined, to secure a market for their goods. There was a large and growing demand for calicoes, while their mills were for the most part devoted to the manufacture of plain cotton cloth. The Company was successful from the start, and its prosperity still continues, although it has met with severe reverses.

In 1840 the works were enlarged by adding a new machine-building, dye-house and other improvements, and the production was about doubled. The Company was incorporated in 1857 and Colonel Richard Borden was elected president, which office he held until his death in 1874. In 1858 the Bay State Print Works, at Globe Village, were bought by the corporation; and, in 1867, a portion of the American Print Works was removed, to give way to a new building of Fall River granite. On Dec. 15, of the same year, when the new part was nearly ready for work, the whole of the new and about one-half of the old parts were burned. About a week before, a serious fire had damaged the Bay State Print Works. The loss by these two fires was estimated at \$2,000,000; but, in one year and ten months, the present edifice was finished. Including the basement and the Mansard roof, it is five stories high. It has a front of 406 feet, is 60 feet deep, and has a tower 110 feet high, with a bell and clock. Large arched windows, each separated by a granite pillar, give the first story a light and graceful look. In the main room, on the lower floor, there are operated twenty printing-machines, with a capacity of 80,000,000 yards of cloth a year. Together with the cills and other smaller buildings, the works have an entire length of 2055 feet of solid stone masonry, and an area of 816 1-2 square rods. Across the way, not delineated in the accompanying steel engraving, are two additional brick buildings, connected with the main works by a tunnel under the street. The entire force employed is nearly one thousand operatives; and the monthly pay-roll amounts to about \$30,000. The works are run by steam and water-power combined, fifty-eight boilers being available for the former. The precautions against fire are such that as many as one hundred and thirty-nine streams of water can be brought into play at once. The printing-machines require six large mills to supply them with cloth. The Bay State Print Works, which date from 1829, now employ two hundred and fifty persons, and turn out twenty millions of yards of prints a year, from five machines.

BOSTON RUBBER SHOE COMPANY.

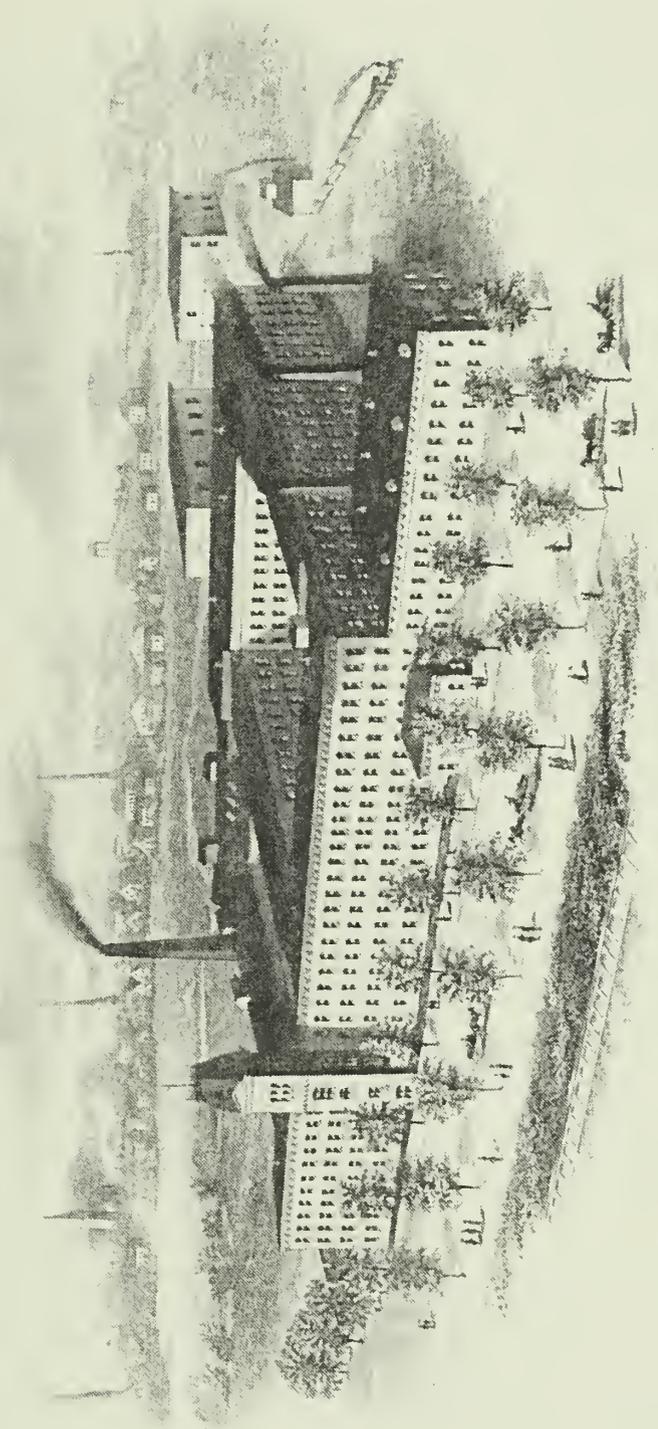
ELISHA S. CONVERSE.



WE give in our sketch of Thomas C. Wales, a full and authentic history of the introduction of native India-rubber into this country, particularly in the form of rude overshoes. In our record of Nathaniel Hayward, we give an equally authentic account, taken from his autobiography, of the early experiments made by himself, Charles Goodyear and others, to ascertain the nature of those peculiarities of India-rubber which limited its uses, and to discover processes which would enlarge its utility and widen the range of its adaptation to the purposes of manufacture, without interfering with its great essential characteristic as a repellent of moisture; and how these experiments were finally successful, by combining sulphur with a metallic salt. In our sketch of Leverett Candee, we record the success of the first effort to make, by this new process, that most important and generally used article in the almost endless variety of India-rubber manufactures—overshoes. The three gentlemen named have been widely known by their connection with three great rubber shoe companies, known as L. Candee & Co., the Goodyear Metallic Rubber Shoe Company, and the Hayward Rubber Company. Younger than any of these by several years, yet worthy to be classed as an equal with them, is the Boston Rubber Shoe Company, whose factories are located at Malden, Mass.

Before entering into the details of the origin, development and present condition of this company, it will be of interest to give an account of the remarkable substance, caoutchouc, or India-rubber, as it is found in tropical regions, and gathered by the natives to be sent to the great markets of the United States and Europe.

India-rubber is imported into the United States from Borneo, Java, Penang, west coast of Africa, Madagascar, Pará, Carthage, Guayaquil, Panama, Honduras and Mexico; the tree growing, generally, on a belt about one hundred miles wide, on



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both sides of the Equator. The chief source of supply for the rubber boot and shoe manufacturers of New England and New Jersey is Pará and the Central American States; and as the Pará rubber is, in quality, superior to all other for the above-mentioned purpose, to that, our description will particularly refer. There are, however, even in the Pará region of the Amazon, shrubs other than the India-rubber tree which produce rubber; but the product is, so far as it relates to the manufactures mentioned, comparatively valueless. The *Siphonia Braziliensis*—the *Seringa* of the Portuguese, and the *Cahuchu* of the Indians—is a member of the Euphorbiaceous order, and belongs to a group of plants quite different from that which furnishes the gutta-percha of India, or the rubber of the African Coast. In bark and foliage it is not unlike the European ash; but the trunk, like that of all forest trees, shoots up to an immense height before throwing out branches. It grows only on a soil annually inundated by the overflow of the Amazon, and hence is found on the lowlands—the latest deposit of the river. Hitherto the rubber has been collected from the islands and swampy parts of the mainland within one hundred miles of Pará; and, as a consequence, the trees are quite destroyed within this radius, particularly as, when the rubber became of importance as an export, the natives had the habit of cutting down the trees, as the most expeditious, or least laborious method of collecting the sap. All the rubber exported is still obtained from trees of natural growth, so that the Seringueiros (rubber-gatherers) constantly look in unexplored valleys for new trees. There are untapped trees in abundance growing in the wilds of the Tapajós, Madeira, Juruá and the Janari, as far as eighteen hundred miles from the Atlantic coast; but no Seringueiro dares penetrate into the lateral valleys of these rivers, from fear of the wild Indians, who attack those who attempt to explore their domains, and roast and eat such as have the misfortune to fall into their hands. The planting of the *Seringa* in the vicinity of Pará would, therefore, be a profitable investment, as the tree yields its precious milk in the comparatively short time of twenty years. This measure, from the indolence of the natives and the general truth of the maxim, “What is everyone’s business is no one’s,” should be undertaken by the Government, and entered upon before the rubber exportation shall become diminished by the destruction of the trees.

The inundation commences to subside in August, and then the Seringueiro takes his family and utensils in a canoe, searches out a locality where the *Seringa* abounds, and rears his hut, thatched with palm-branches, in one end of which, raised three or four feet from the ground, on account of the floods, is a floor of laths, to support his bed, while the other end is a harbor for his canoe. As soon as the ground is sufficiently dry, narrow paths are cut from the hut, through the dense undergrowth, to each tree, or from tree to tree; and with a hatchet little gashes are cut in the

bark, from which the milk-white sap exudes into pieces of bamboo, which conduct it into little clay cups, or shells of *ampullaria* (a species of shell-fish), stuck beneath the wounds. Each person to whom a certain number of trees is allotted, goes the round daily with a yoke on his shoulders, from each extremity of which dangles a calabash in its straps of liana, into which the contents of the cups or shells is poured. On his return to camp, these calabashes are emptied into one of those immense turtle-shells so auxiliary to housekeeping in these regions. While his family are making these collections, the chief is preparing for the smoking process. Near the turtle-shell receptacle is placed an earthen jar without bottom, and with a narrow neck, by way of chimney; beneath this jar is kindled a fire of dry urucury-palm nuts, the smoke of which has the effect of instantly coagulating the sap. This artificial coagulation is necessary, as the curdling, if left to nature, separates the resinous portion, and the quality deteriorates. The workman now seats himself beside his chimney, which is pouring out dense clouds of smoke, and pours a cupful of sap over a light wooden paddle, distributing it evenly over the surface; this he thrusts into the smoke, turning it several times with rapidity, when the milk is seen to consolidate, and take a yellow tinge. Thus he puts layer upon layer, until the rubber on each side is an inch or two in thickness, when he cuts it through on one edge, withdraws the paddle, and hangs the bottle in the sun, to evaporate whatever water may remain between the layers. A good workman can thus prepare five or six pounds in an hour. The drippings which collect at the foot of the tree, and the scrapings of the utensils, form an inferior quality called *Negro-head*, or coarse *Pará*.

The harvest commences in August, and ends with January; or corresponds with the dry season. The average production of a family is fifty *arrobas*, or sixteen hundred pounds, and brings the chief about three hundred and fifty dollars; but his outfit and provisions come largely from the storehouses of his employer, and hence, the balance due him at the end of the season is oftentimes woefully small. The huts of the gatherers have been described. For subsistence, they have the huge turtles of the Amazon, with their eggs; fish from the river; the large bundles of yellow fruit from the indigenous banana; and, largely, dried fish, from the storehouses of *Pará*.

The rubber-tree and the cacao-shrub are essential to the commercial prosperity of Brazil. The latter is also fast disappearing, from the same causes; and it would be wise for the Brazilian government to follow the example of the English government, which has, it is said, with some success, introduced the *Pará* tree into the Indian Empire, and re-establish plantations of the trees and shrubs in those places in the vicinity of *Pará* which are favorable for their maturity.

As will be remembered by many of the present time, the shoes and other articles

of India-rubber imported into this country fifty years ago, had the very inconvenient quality of becoming so rigid in cold weather, that, before they could be used, they must be subjected to heat. Daniel Webster was accustomed to relate a pleasant story, to the effect that one of his rubber clients presented him with a water-proof suit, which, on a frosty morning, he sometimes *stood up* on his porch and surmounted with a hat, so that passers-by supposed they were saluting the "Marshfield Farmer."

The first attempt to utilize the product in New England, was in the year 1828, when Dr. Comstock, of Hartford, Conn., obtained a patent for a process by which he dissolved the gum in turpentine, so as to adapt it for being spread upon cloth. The crude shape of the imported shoes was modified by subjecting them to a similar softening process, and remolding them on the lasts in common use. The solvent was then evaporated by solar heat, and the goods boxed up for sale. They were without binding, lining or inner-sole, unless the wearer found they were stretching too much,—as after frequent pulling on and off they were inclined to,—and fitted an inner-sole himself. Subsequently, the rubber was imported in a crude state, washed in tanks of hot water, rolled by means of hollow iron cylinders, heated by the introduction of steam into thin sheets, the parts of shoes of various sizes and styles cut after patterns and formed on a last with the aid of rubber cement, the solvent evaporated by artificial heat, and the last then withdrawn. It was found, however, that the shoes retained their shape but a short time; and several factories in 1834-5-6, operated in the method above described, by 1838 had failed, or had virtually abandoned the business. Many inventors, learned and unlearned, tried numerous experiments to overcome the difficulty, so that the goods would not be affected by change of temperature, but without success. At length, however, Nathaniel Hayward and Charles Goodyear succeeded in perfecting the process known as the *vulcanization* of rubber, which, celebrated as the "Goodyear patent," gave a substantial basis to the manufacturer of boots, shoes and other articles from rubber. Besides the Goodyear Metallic Shoe Co., of Naugatuck, Conn., and Onderdonk and Letson, of New Brunswick, N. J., the right to manufacture vulcanized rubber boots and shoes, was held under purchase from Charles Goodyear in 1847, by four companies: L. Candee & Co., of New Haven, Conn.; the Hayward Rubber Co., of Colchester, Conn.; Ford & Co., of New Brunswick, N. J.; and the Newark Rubber Co., of Newark, N. J. Under the conditions of purchase, these six companies organized as "The Associates," with an agreement that no other parties should be licensed to manufacture except by consent of all concerned, intending thereby to monopolize the business.

In 1850, a company called the "Edgeworth Rubber Company," was organized, and a factory established in Malden, Mass. It was the purpose and hope of this company to successfully compete with "The Associates;" but the business of

manufacturing by the new process was yet largely experimental, and although no royalty was paid to Mr. Goodyear or to "The Associates," it failed of success.

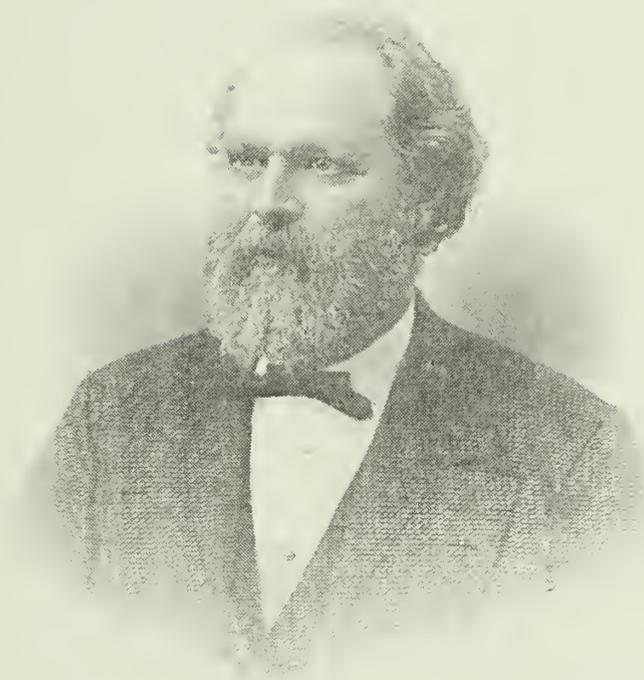
Another company was organized in 1853, called the "Malden Manufacturing Company," which succeeded by purchase to the buildings, machinery and business of the Edgeworth Rubber Company. This company received a charter from the Legislature, with an authorized capital of \$200,000. The first directors were all men of mark. Among them were Gardiner G. Hubbard, then a prominent lawyer of Boston, and since that time more widely known for his successful efforts in effecting a reform in the telegraph business of the country; William Judson, the friend and legal adviser of Mr. Goodyear, through whose efforts and advice was secured to the latter the reward of his years of toil and privation; T. C. Wales, the pioneer in the sale of native rubber shoes, and, at a later period, the patentee of the indispensable Arctic overshoe; John Bertram, a merchant of Salem, and one of the earliest and largest importers of rubber; Joshua Sylvester, whose mercantile connection with England was expected to open a lucrative foreign trade for the productions of the factory; and Nathaniel Hayward, who was entitled to equal credit with Mr. Goodyear for the discoveries which have made rubber and rubber goods of such importance in the commerce of the world.

One of the first moves made by the directors was to negotiate with "The Associates" for a license, in order to avoid the expensive litigation that might result from the attempt of any party to gain a footing in the rubber market. Under the management of their counsel, Mr. Hubbard, who was president of the company for several years, a license was granted, on the surrender to "The Associates" of one-half the stock, valued at one hundred thousand dollars.

The company at first met with many discouraging obstacles to success, the principal one being insufficient capital. "The Associates" finally relinquished their stock; and some others who declined to pay further assessments, either surrendered their shares or sold them to such persons as were willing to contribute new capital.

In September, 1853, a meeting of the directors was held in New York, at which it became necessary to fill a vacancy in the treasurership. An election was held, and the result was telegraphed by the president of the company to Elisha S. Converse, a shoe and leather dealer in Boston, informing him of his election. Mr. Converse accepted the office, and at once entered upon its duties. Since that time he has been the executive manager of the business of the company, and a brief sketch of his earlier history may very properly be given.

Elisha S. Converse was born at Needham, Mass., July 28, 1820. When he was four years of age his parents removed to Thompson, Conn. Spending his childhood there, under the wholesome restraints and kindly influences of New England rural



Van Hook & Co Boston



W. S. Converse
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life, he was trained in habits of industry and integrity, and in the essentials of an English education. In his thirteenth year he was sent to Boston, that he might have the advantage of its superior schools. He remained there until he was sixteen years of age, when he returned home. During the next three years he learned the trade of a clothier; and when nineteen years old he engaged in that business, on his own account, in the village of Thompson, continuing there five years. In 1844 he went again to Boston, where his elder brother, James W., had been since 1831, engaged as a wholesale dealer in hides and leather, being a member of the house of Field and Converse. Through the influence of his brother an offer was made, and accepted, of a partnership with Benjamin Poland, in the wholesale trade in boots and shoes, on North Market Street—a street which then held a similar relation to the shoe and leather business, which Pearl, Congress and High Streets have since attained. The business was new to him; but he soon familiarized himself with its details, and during his connection with it, the business and reputation of the firm became well established. In 1853, as before stated, he accepted the office of treasurer of the Malden Manufacturing Company, but did not relinquish his existing business relations.

Early in 1855 the company was reorganized; an addition of \$175,000 was made to its capital; and its corporate name was changed to that of the "Boston Rubber Shoe Company." The act of the Legislature to that effect was approved May 30, 1855. At that time, by the earnest solicitation of the directors, Mr. Converse was induced to relinquish his previous business, and, in addition to the office of treasurer, to assume that of buying and selling agent. These offices he has held to the present time, and the direction and control of all operations, both at the factory and the store, have been unreservedly intrusted to his care. In 1856 the balance-sheet for the first time showed an actual profit earned by the business. The capital of the company has been increased at various times, until its present amount is \$500,000. The production has increased in a corresponding ratio—from two hundred and sixty thousand pairs in 1857, to the maximum of eighteen hundred thousand pairs in 1874, and the present capacity is fifteen thousand pairs per day. The sales have been increased in nearly the same ratio—from \$270,000, to the maximum amount, in 1874, of \$1,600,000.

The original factory was of wood, three stories high, and seventy feet long. Additions were made: first, a building seventy feet long, built of wood, corresponding to the original structure; then one of brick, on the same line; then wings, also of brick, until the whole frontage of brick was eight hundred and fifty feet in length; which, with the wooden structure, made a whole frontage of nearly one thousand feet, of a uniform height, of three stories. There were also structures for boiler and

engine-rooms. The flooring covered nearly four acres. The power, originally an engine of fifty horse-power, is now communicated from a Corliss, a Harris-Corliss and three small engines, aggregating about eight hundred and fifty horse-power.

The variety of articles used in the manufacture of boots and shoes will surprise one not familiar with it; consisting of rubber, litharge, sulphur, whiting, benzine, cotton and woolen cloth of various kinds, dye-stuffs, linseed and native oil, rivets, eyelets, buckles, webbing, goring, packing-paper and boxes, and a multitude of items of lesser account, amounting in value in a single year to upwards of a million of dollars for supplies. There are about eight hundred workmen and workwomen ordinarily employed to turn this vast amount of raw material into articles which are no longer the luxuries, but the necessaries of daily life.

In 1873, an appropriation of \$1000 was voted by the directors for the foundation of a library, which should be free to the employees. A selection of standard works on History, Biography, Travels, Science, Poetry and Fiction was made; and the experiment was attended with such good results, that successive annual appropriations and private donations from the stockholders have increased the number of volumes to over one thousand. A Relief Society was established in 1873, "for the purpose of aiding the sick and those who might meet with accidents while employed by the Company;" governed by a code of by-laws, administered through a Board selected by and from the operatives. The funds are raised by stated weekly donations by the operatives and the company. The amount disbursed in a single year, 1874-5, was \$945.81. As an encouragement to industry and thrift, the Company has adopted a system similar to that of savings' banks, and operatives wishing to deposit a portion of their wages with the Company receive interest thereon.

On the morning of the 29th of November, 1875, every building, save one, of the extensive manufactory of this Company was laid in ashes. The buildings were in the general form of a hollow square. The fire caught in the second story of the rear or eastern section, and made its way rapidly by the elevator-well to the attics; thence by the connections, both right and left, to the front, or main building. The fire companies of Malden, Medford and Chelsea, with their steam engines and appliances, were speedily present, heroically fighting the fire in these connections and elsewhere, but found their efforts baffled and their own safety greatly imperiled by the fire eating its way overhead and dropping down behind them. After an hour and a half of constant struggle and defeat, the firemen confined their efforts to the oven, or heater-building—an extension of the front, one hundred and seventy-five feet in length, but only two stories high, and with a flat roof, covered with asbestos. Upon this roof the hot bricks and slate, the burning rafters and blazing fragments from the adjoining and connecting buildings, had no effect. Separated from them by

a thick wall of brick and by iron doors, the men had here a chance to fight the fire without the danger of being surrounded by it. Upon the first alarm, Mr. Converse ordered these doors to be shut and guarded. They soon became white, from the intense heat, and water reached them only to be instantly repelled in clouds of steam. This section of the buildings, upon which the insurance companies refused to take risks, was the only structure saved.

The early trains on the Boston and Maine Railroad had carried the alarm to Boston; and the wise and kind foresight of the superintendent of the road, Mr. Furber, immediately ran out some box-cars on the track which led into the factory yard, which were loaded with goods, and withdrawn to a place of safety. In two hours, or by eight o'clock, the principal walls were flat, the magnificent engines a wreck, and the labor and the plans of years brought to naught. By the morning of the next day, the place which only a few hours before presented a scene of busy industry, exhibited, instead, a conglomerate of bricks and mortar, bent and twisted iron rods and pipes, burnt and charred timbers, fragments of machinery and masses of ice. From the interstices of several huge heaps of *débris*, smoke was lazily rising in the frosty air. Next to the disappearance of a lad thirteen or fourteen years of age, who has been missing since the fire, and who is supposed to have fallen into the hollow square and become utterly consumed, by the intensity of the heat, the throwing out of employment, as winter was fast approaching, of nearly eight hundred work-people, was the saddest feature of the calamity. The sudden withdrawal from circulation of the company's pay-roll, amounting to between \$25,000 and \$30,000 per month, the greater portion of which was distributed amongst the traders in the town, added to the general depression.

Mr. Converse at once telegraphed to other rubber companies, and in this manner a portion of the help found employment. The town gave work to some, the mild weather allowing working on roads; some were employed at the factory clearing away the *débris*; some sought refuge with their friends, and others were aided in other ways. The necessity for an Aid Society was immediately apparent, and was forthwith organized; its officers working in harmony with the town officers in furnishing supplies of food and clothing to the destitute. The different religious societies aided in the good work, and the directors and stockholders of the rubber companies contributed to the funds of the Aid Society, or to the Relief Fund of the factory. To this latter fund was added donations from some of the rubber shoe companies, and from dealers in rubber.

Offers of the use of buildings and factories for the resumption of work poured upon the treasurer by every mail; but, upon mature reflection, the directors decided that as the heater-building, a large and expensive structure, was still unharmed, and

the foundations of the walls, calenders and grinding machines, costing thousands of dollars, were available, they could not afford to move elsewhere; and, accordingly, the treasurer was instructed to proceed to make contracts for rebuilding, and for restoring and replacing the machinery. The open winter was favorable for the work, and it rapidly progressed. The plan adopted for rebuilding contemplated, instead of three-story buildings and a pitched roof, four-story walls and a flat roof, and intersecting walls of brick extending above the roof. Being erected on the old foundations, the group of new buildings retains the general appearance of that which it has replaced; but many changes and improvements in the interior have been made. The structure is wholly of brick, built in the most substantial manner, with especial reference to protection against a recurrence of fire from any cause, and with such increased facilities for greater economy and for an improved product, as the experience of more than twenty years has suggested. As appears from the fine view which accompanies this sketch, the architectural style of the buildings is tasteful, symmetrical, and sufficiently ornate for the purpose to which the buildings are devoted. The plans adopted and the contracts made, contemplated the resumption of operations by the first day of July, 1876. With a promptness and punctuality not often realized in an enterprise involving so much expense and liability to adverse contingencies, some of the machinery was put in operation on the 29th day of May, 1876; and on the first day of July following, the first lot of shoes came out of the heaters finished for the market.

Although the Company has twice within ten years suffered severe loss by fire—first, by the burning of its store, and the stock of goods contained in it, in the “Great Boston Fire,” of 1872; and, second, by the burning of its factory, in 1875—the loss in the former case being about \$100,000, and in the latter \$250,000, aggregating a loss of \$350,000—it has its capital intact, and a surplus of nearly \$300,000.

Its officers are James W. Converse, President; Elisha S. Converse, Treasurer and Agent; and Thomas Lang, Secretary. The Directors, in addition to the President, Treasurer and Secretary, are Charles Osgood and Ephraim L. Corning.

THE BOSTON TYPE FOUNDRY.



THE discovery of the art of printing was one of the most beneficent ever made ; but, important as was Guttenberg's invention, its value has been much increased by the permanent industries which it has created. Among the new industries to which the invention of printing has given rise, and which has been brought to a high degree of perfection, is that of type-founding. Peter Schœffer, Guttenberg's assistant, may be said to have been the first type-founder ; for he substituted type cast from metal for the carved type used by Guttenberg, and first used metallic punches for the more perfect construction of matrices.

For a long time printers made their own type ; but the rapid adoption of the new invention soon made a division of labor necessary, and the manufacture of type became a distinct industry. It is said that the Star Chamber, in 1637, issued a decree declaring type-founding to be an art distinct from that of printing, and appointed four founders to make all the type required by the printers in the British realm.

Until 1720 the English printers imported most of their type from Holland. Then William Caxton, an engraver, began to make type in London ; and so great was his success that he entirely reversed the current of trade in this article : the importation of Dutch type ceased, and those of Caxton's manufacture were largely exported to the Continent. His foundry still exists. Among the most celebrated of the early continental type-founders, were Breitkopf, of Germany, the Didots, of France, and Bodoni, an Italian.

But long after type-making had become a distinct industry, the typography of printed works was but rudely executed. From Schœffer's decease until about the

middle of the eighteenth century, this art made but little progress. Before Guttenberg's time, manuscript works, in many cases, had been superbly illustrated by block printing and by the hand-work of illuminators. But as the illustrations could not be easily reproduced in type, they ceased to appear in printed volumes. The first marked improvement in the making of type was about 1750, when John Baskerville, an Englishman, through his skill in cutting punches for type, succeeded in producing them so well, that, in this respect, they compared favorably with any that have been made since. Subsequently, Bulmer showed great skill in the typographic art, and his Shakespeare and Milton were famed for their finely-executed typography.

The pioneer type-maker in America is said to have been Christopher Sauer. A printer by trade, he cast the type used by himself in printing a German Bible, at Germantown, Penn., in 1735. But it was not till 1796 that the first type-foundry was established in the United States. In that year Messrs. Binney and Sargent began the manufacture in Philadelphia. The establishment is still in existence, and is now one of the largest in the world.

The oldest type-foundry in New England is that whose name appears at the head of this sketch. It was established in Charlestown, Mass., in 1817, by Mr. Elihu White, as a branch of his New York foundry; but it was in the same year removed to Boston. Its beginnings were modest: Mr. David Manley, its first superintendent, employed but two casters. But it afterwards became, and long continued to be, as extensive as any similar concern in the United States, and is now the principal establishment of the kind in New England.

In 1818 Messrs. Charles Ewer and Timothy Bedlington purchased the foundry, appointed Mr. Edward Haskel superintendent, and conducted the business in the rear of Samuel T. Armstrong's bookstore, on Washington Street. T. H. Carter became the proprietor in 1822, and soon after removed the foundry to a building erected for the purpose in Harvard Place. The next year the establishment was enlarged by the addition of a department for stereotyping, the apparatus for which was brought from New York and set up in the foundry by Mr. John Howe. Mr. Howe spent a few years on the premises, giving instruction in reference to stereotyping; and then this department was intrusted to the management of Mr. Lyman Thurston, a printer by trade, who thenceforward managed the business. Among the first works stereotyped in this department were Scott's Bible, and *Collectanea Majorca and Minorca*. At this time the stereotype foundry was under the superintendence of Mr. James Conner, who was afterwards connected with the United States Type Foundry, at New York.

Soon after, Mr. Charles Carter was appointed general superintendent of the entire establishment, having for his assistant Mr. N. Lyman, who was afterward

proprietor of the Buffalo Foundry. Mr. Lyman's successor was Mr. Edwin Starr, who eventually gained a reputation for great skill in his art. During his connection with the foundry, about 1825 or 1826, the first attempt was made to use machines for casting type. These were the joint invention of Messrs. Starr and Sturtevant; and their use was continued for about five years. Not proving wholly successful, they were finally discarded. This is said to have been the first instance of the actual use of type-casting machines in this country, or the world.

In the year 1823, the accommodations in Harvard Place having become too small for the foundry, it was removed to a more commodious structure on Salem Street. Two years after, this building was partially consumed by fire; the loss to the foundry was about \$30,000. The building was speedily refitted, and business was resumed. The proprietors were incorporated in 1829, under the name of the Boston Type and Stereotype Foundry. An organization was perfected by the choice of Nathan Hale—afterwards widely known as the editor and proprietor of the *Daily Advertiser*—as president; of John Gorham Rogers—then superintendent of a printing establishment—as agent and treasurer; and of a board of directors. Mr. Rogers proved to be a successful manager, and the concern at the commencement of his trusteeship was extensive enough to employ twenty-five casters, and fifty or sixty persons in the stereotype department. In 1843 Mr. Rogers retired, on account of ill health.

The same year in which the act of incorporation was secured, the proprietors, in order to obtain a more central location, removed the foundry from Salem to Congress Street. Here it remained until 1841, when it was removed to Minot's building, on the corner of Spring Lane and Devonshire Street.

On Mr. Roger's retirement, Mr. James M. Shute—for several years previously an *employé* at the foundry—was chosen agent and treasurer. A second trial of type-casting machines was now made—this time with success. The machine introduced was the invention of Mr. David Bruce, of New York, who obtained his first patent in 1838. In 1843 and 1845, he obtained patents for improvements; and his machine, as thus perfected, has since been used in this and all other American type-foundries. The machine consists of two principal parts—a melting-pot and a mold. The former, containing the melted metal, is provided with a small force-pump, which is so contrived that, when the mold is brought into the proper position, a portion of the metal is forced through a small orifice into it, where the metal instantly cools. The mold, which is constructed in halves, then recedes, opens, and throws out the type. These successive operations are rapidly executed by the rotary motion of a crank. By the use of this machine, the type are not only cast with much greater rapidity than by the old hand-mold, whose successful operation depended greatly

upon the dexterity of the workman, but with a finish and regularity which could not otherwise be attained.

In 1848 Messrs. Sewell Phelps and Michael Dalton — the former of whom had been connected with the stereotype department, and the latter with the foundry proper — retired, and purchased a foundry which had previously been established by Mr. S. N. Dickinson. This foundry, still known as the Dickinson Foundry, is carried on by successors of Messrs. Phelps and Dalton, and maintains an excellent position in the business.

The stereotype department was disconnected from the foundry proper, and purchased by some of the workmen, who formed a company, bought the apparatus, and have since carried on the business as a separate concern. They were afterward incorporated as the Boston Stereotype Foundry. Since the separation, the original Foundry has been (what it was at the outset) a type-foundry alone.

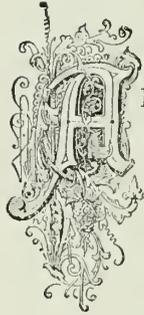
Mr. Shute retained his position as manager of the foundry till 1852, when the establishment was sold to Mr. John K. Rogers (a nephew of John G. Rogers) and Mr. David Watson, both of whom had previously been connected with it. Soon after making this purchase they associated with them Mr. Edward Pelouze, of New York. The new proprietors, under the name of John K. Rogers & Co., enlarged the foundry, increased its facilities for manufacture, and prosecuted the business with energy. In 1862 Mr. Pelouze dissolved his connection with the Company, and the remaining partners continued the business under the former name. In June, 1865, a joint-stock company was formed and incorporated, under the name of the Boston Type Foundry. This company became the proprietors of the establishment. Meanwhile, it had been removed to Water Street. The new company was organized by the choice of David Watson as president, and John K. Rogers as treasurer and superintendent. These gentlemen have since had the direction of the business of the foundry, and under their management it has continued to be the leading establishment of the kind in New England.

The foundry was removed, in 1870, to its present location, on the corner of Milk and Kilby Streets. The following year a branch was established at St. Louis; but, in 1874, the connection of this branch with the Boston Foundry was severed, and since that time the former has been maintained as a separate establishment, and known as the Central Type Foundry. It is now the leading foundry in the West.

By the great fire of 1872, the proprietors of the Boston Foundry were driven from their location on the corner of Milk and Kilby Streets, suffering the loss of all their stock, but saving the greater part of their valuable matrices and machines. They temporarily removed to Travers Street, but returned to their old site on the completion of the present building. The establishment now occupies three stories,

and the basement of the building. In the fourth story are twenty-five type-machines, varying in size according to the size of the type they are designed to cast. Steam-power has been applied to the smaller machines, and is found to be a great saving of manual labor, as it enables one caster to attend upon two machines. The finishing-room is in the third story; here the type, as they come from the machines, are subjected to a process of smoothing and dressing, after which they are carefully examined through a magnifying-glass. The second story is occupied partly as a counting-room, and partly for the storage of type. The basement contains the apparatus used in the preparation of the type-metal, all that is used being made in the foundry. This is in order that the metal may invariably be of the best quality. Each story is provided with a spacious fire-proof vault, in which matrices, moulds, specimens of type and other valuable articles are deposited. The entire business is systematically conducted by men of experience and skill, and the product of the establishment is probably not excelled in quality by that of any other type-foundry in the United States.

IRA G. BRIGGS AND COMPANY.



AMONG the early factories of cotton yarn in New England was that of the Industry Manufacturing Company, of Voluntown, Conn., which was formed March 12, 1814, by James Treat, of Preston, and others. Mr. Treat was one of the most enterprising business men of that vicinity. He was largely engaged in trade, and invested in several manufacturing interests, among which was the Jewett City Cotton Manufacturing Company, organized in 1811—the germ of the present manufacturing enterprises at that place. In the Industry Manufacturing Company, he owned, at first, five of the twenty shares; and, by successive purchases from the other owners, increased his interest until Nov. 4, 1823, when he became sole owner. On Aug. 9, 1824, he conveyed an interest of one-third to his son-in-law, Joseph H. Doane, and on April 18, 1828, an additional one-sixth. Mr. Doane sold his interest to James S. Treat, son of James Treat, Dec. 29, 1832. The latter also sold his interest to his son, Sept. 18, 1843. James S. Treat operated the mill until Feb. 12, 1855, when he made an assignment. On the 18th of April, of the following year, the property was sold to a company, one of whom was Ira G. Briggs.

Ira G. Briggs was born in Coventry, R. I., April 29, 1820. His father, Warton Briggs, was a farmer and a justice of the peace. He was the father of eight sons and four daughters. Of the sons, Ira was the eldest, except one who died in infancy. He worked on the farm until he was twelve years of age, when his father removed to the village since known as Harrisville, where he was employed by Elisha Harris, the well-known manufacturer, and afterward governor of the State. Ira entered Mr. Harris's factory, beginning in the picker-room, where he remained four years. He then worked about two years in the other parts of the factory, and became expert in all the processes of cotton manufacturing. At eighteen he entered the machine-shop of Lavalley, Lamphear & Co., in the adjoining village of Phenix, that firm being then



Van Slyke & Co Boston



Ira G. Briggs

engaged, as its successor, the Lamphear Machine Company, is now engaged, in the manufacture of cotton-machinery. He worked here three years, becoming familiar with the building of cotton-machinery. Having attained his majority, he again entered the employment of Mr. Harris, and remained in it for seven years, having charge of the repairs of the machinery. At the end of that period the factory of Brown and Ives, at Hope Village, two miles above Harrisville, on the same stream, was being built under the supervision of David Whitman; and Mr. Briggs was hired to superintend the putting up of the shafting and setting the machinery in order for running.

Having finished this task, he was engaged by Brown and Ives, to take charge of the machinery and repairs, and remained in that capacity at the Hope Factory until 1852. He was then appointed superintendent of the Rockville Mills, in Hopkinton, R. I. These mills, built in 1845, were then owned by John C. Harris, Oliver D. Wells and Harris Lamphear; the latter, a brother-in-law of Mr. Briggs, had been superintendent. The business had not been successful, and the Company was embarrassed in its finances. In the four years of Mr. Briggs's agency, by his able administration, the indebtedness was materially reduced, and the affairs of the Company became more prosperous.

Early in 1856, with other gentlemen, he purchased, from the insolvent estate of James S. Treat, the mill and adjacent real estate formerly belonging to the Industry Manufacturing Company, and at once commenced business, as the Beachdale Manufacturing Company, in the manufacture of cotton cloth. In the same year changes in the ownership occurred; such that, at its end, Mr. Briggs owned two-fifths, and Jonathan R. Wells and Thomas R. Wells three-fifths, of the whole interest; and in this proportion it was held by the same persons until Nov. 20, 1857, when the Messrs. Wells sold their interest to John L. Ross, of North Providence, R. I. This partnership continued for three years. It was then dissolved, Mr. Briggs purchasing the interest of his partners, and becoming sole proprietor, Nov. 17, 1860. On the 12th of December ensuing, he sold an interest of two-fifths to his brother-in-law, Jonathan L. Spencer, of Hopkinton, R. I., forming, with him, the firm of Briggs and Spencer. On Feb. 15, 1861, Briggs and Spencer bought a mill and privilege,—half a mile below the Beachdale Mill, on the same stream,—from Samuel Gates. Mr. Gates had, several years before, built the mill and a temporary dam, but had not operated the mill. Briggs and Spencer did not occupy it, but leased it to Hiram Jenckes, for four years, as a twine-mill. The partnership continued until Oct. 1, 1863, when Mr. Spencer sold his interest to John L. Ross, the style of the firm being changed to Ross and Briggs.

On July 1, 1865, Mr. Briggs conveyed to his youngest living brother, Ezra, one-

sixth of his interest, amounting to one-tenth of the whole interest, the business being afterward conducted under the style of Ross, Briggs & Co. On Aug. 21, 1868, Ira G. Briggs purchased John L. Ross's interest, and conveyed to his brother Ezra an additional one-tenth of the whole business and mill property, forming, with him, the firm of Ira G. Briggs & Co. Their interests in it were respectively four-fifths and one-fifth. The firm-style and the relative interests remain the same to this day. During both of the periods of the partnership of Ira G. Briggs and John L. Ross, the latter had no active connection with any part of the business, his capital only being invested. On Sept. 21, 1870, Ira G. Briggs & Co. purchased, for further uses, the mill-privilege below the Gates Mill, formerly belonging to Alice Branch, having a fall of twenty-four feet, and a capacity nearly double that of either of the privileges owned by them, which had been leased to supply power for a saw-mill, a grist-mill and a shoddy-mill. The next year, 1871, they purchased the Doane Mill, on the same stream, below the Branch privilege. This property had passed from the ownership of Joseph H. Doane, by the foreclosure of a mortgage, Dec. 7, 1852. During the period between that date and its purchase by the Messrs. Briggs, it had been owned by different firms, neither of whom had been successful in operating it. Since it has come into the hands of its present proprietors, it has been profitably used for the manufacture of yarns and warps.

Since Mr. Briggs acquired, in 1860, the controlling interest in the Beachdale Mills, he has expended large amounts out of his profits in increasing the capacity and facilities of his mills, by erecting new buildings, introducing improved machinery, and providing a larger and more continuous supply of water-power. He has purchased the rights of persons controlling the outlet and flowage of Beach Pond, a principal means of supply of water-power to the mills in Voluntown, and below on the Pachaug River,—and has erected a new dam at the outlet of the pond, and raised the highway for half a mile. These works have enlarged the area of this natural reservoir to some twelve hundred acres, and increased the depth of the water by ten feet, thus enabling the Messrs. Briggs to run their mills throughout the year, instead of nine months. The work was done under the personal supervision of Ira G. Briggs, and, mainly, at the expense of the firm.

In 1873 Mr. Briggs became a stockholder, and the next year a director, in the Rockville Mills, at Hopkinton, R. I., in which, from 1852 to 1856, he had his first experience in mill management. He has been the general manager and agent since 1874, with the personal supervision of the purchase of material and the manufacture and sale of the goods. There are three of these mills, situated on successive privileges of the same stream, like the mills of the Messrs. Briggs, at Voluntown. The Rockville Mills have been ably managed, and, in a period of general depression,

have been kept in constant operation, paying their current expenses, together with the interest on a large debt, and heavy expenditures in improvements in mills and machinery. In the same year, 1873, Ira G. Briggs & Co. bought an interest of one-fifth in the Stillman Manufacturing Company, at Westerly, R. I. This mill, engaged in the manufacture of cassimeres, has been in operation about six years, and operates eight sets of machinery. Ira G. Briggs has been president since October, 1876, and has devoted much personal attention to its affairs. The result is seen in the marked improvement of its condition and prospects.

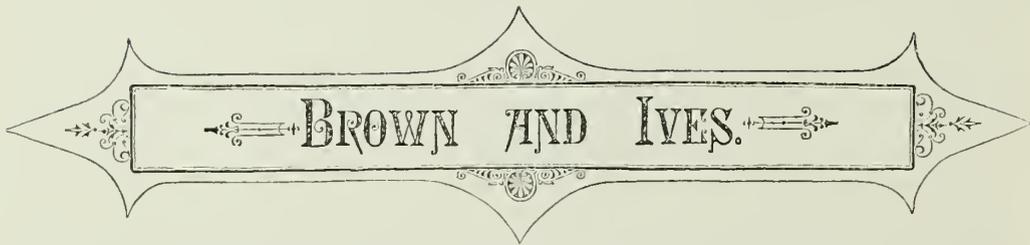
While Mr. Briggs has been engaged in these enterprises, he has occupied many public positions of honor and trust. He was first-selectman of the town nine years in succession; a member of the lower branch of the General Assembly, in 1864, 1866 and 1868; and of the senate, in 1870. In the senate he was chairman of the Joint Committee on Banks and Banking.

The junior partner of the firm, Ezra Briggs, is the youngest son but one of Warton Briggs, and was born in Coventry, R. I., Oct. 9, 1830. He attended the district school until he was about nine years old, when he was placed at work in the factory. He was employed there—except a brief interval of labor on a farm, and about six months at school—until the spring of 1846, when his father's family removed to Phenix, R. I. There Ezra went to work in the Phenix Cotton Mill, continuing in it until the spring of 1849. He next obtained employment in the machine-shop of Lavalley, Lamphear & Co., and worked at building machinery about two years. He then went to school, and engaged in teaching for three years.

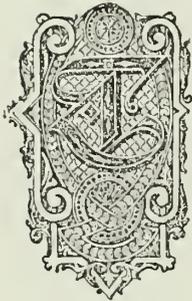
In the spring of 1854 he became book-keeper in the Harris Lime Rock Company, in Smithfield, R. I.; and, in the summer of 1856, engaged in the same capacity with James H. Read & Co., wholesale dealers in woolens, in Providence, R. I. In the autumn of the same year he engaged with Brown and Ives, as book-keeper in their factory at Hopeville, R. I. Here he remained nearly nine years, removing, in June, 1865, at the invitation of his brother Ira, to Voluntown, Conn. On July 1, 1865, he became a member of the firm of Ross and Briggs, as above stated, the style being changed to Ross, Briggs & Co.; and on Aug. 21, 1868, Mr. Ross retiring, the firm-style was changed to its present form of Ira G. Briggs & Co.

The senior member of the firm has, since that date, retained the general management, while to his brother has been committed the details of business at the mills, with special charge of the books, accounts and correspondence. Ezra Briggs is a man of large public spirit and influence in the community, and served the town, in 1872, as its representative in the General Assembly of Connecticut.

Both of the members of the firm are in the prime of mental and physical vigor, with ripe experience and ample capital, and with mills well supplied with machinery, and of a high industrial reputation.



NICHOLSON BROWN — THOMAS P. IVES.



THE firm-name of Brown and Ives is the oldest in New England, and, perhaps, in the country. It is the only one that has come down unchanged from the last century, having been established by Nicholas Brown and his brother-in-law, Thomas P. Ives, in 1791. They inherited the business established a half century before, by Mr. Brown's grandfather. Of the remote history of the Brown family, but little, definitely, is known. The ancestor of Nicholas Brown, was Rev. Chad Brown, or Browne, who came from England in 1638. Sympathizing with Roger Williams in his religious views, and on the question of liberty of conscience, he, with his wife Elizabeth and their children, sought a permanent home at Providence. He became, and continued until his death, to be the first minister of the oldest Baptist church in America. He died in 1665. His eldest son, John, was a man of influence in the community; and James, the second son of John, was, like his grandfather, minister of the First Baptist Church. Two of James's sons, James and Obediah, acquired large fortunes as merchants.

James Brown was the father of the men who were known in their day as the "four brothers." His eldest son, James, was master of a vessel, and died at the age of twenty-six years. The others, Nicholas, Joseph, John and Moses, were, like their father, successful merchants, and were at first associated in business. Nicholas added largely to the property inherited from his father, and bequeathed to his son Nicholas, and to his daughter Hope, the large fortune which was the basis of the immense business developed by the house of Brown and Ives. Joseph, besides his mercantile pursuits, engaged in manufacturing, and acquired a property, so that in the middle of life he retired from business. Having a natural taste for science, he became an adept in philosophy and astronomy, and especially in mechanics. In 1784 he was elected Professor of Natural Philosophy in Rhode Island College; and

on account of its impoverished condition, resulting from the war, then just closed, he gave his services without a salary. John, third of the "four brothers," was the most active and enterprising of them, and was the first Rhode Island merchant who engaged in trade with China and the East Indies. He was an ardent patriot, and served three terms as a member of Congress. The youngest brother, Moses, was an infant when his father died, and was brought up by his uncle, Obediah, whose daughter he married. With her he inherited a considerable fortune. Adding to this by successful commerce for a period of ten years, he retired from active business in 1773. About the same time he became a member of the Society of Friends, and for sixty years exerted a great influence in that sect. He was the founder and liberal patron of the "Friends Boarding School," of Providence. He freed his slaves in 1773, and became an active member of the Abolition Society, of Rhode Island, and of the Rhode Island Peace and Bible Societies. He is chiefly known as the first wealthy New Englander who invested largely in manufactures, and as the patron of Samuel Slater. His daughter, Sarah, married William Almy, who, with Obediah, the son of Moses Brown, formed, with Mr. Slater, the firm of Almy, Brown and Slater, Moses Brown furnishing the capital. This firm was the pioneer in the cotton manufacture of New England, and for about forty years at the head of that interest in Rhode Island.

Nicholas Brown, Sr., died in 1791, leaving his large fortune, as has been stated, to his son Nicholas and his daughter Hope. Nicholas Brown, Jr., was born April 4, 1769, and graduated at Rhode Island College, in 1786. He always retained a deep interest in his *alma mater*, and, in after years, contributed to its library and to the endowment of a professorship. He also erected Hope College, named from his sister, and Manning Hall, named after President Manning. The whole amount of his gifts to the college was about \$160,000; and, in recognition of these, the name of the institution was changed, in 1804, to Brown University. On his father's death he entered, at twenty-two, into partnership with his brother-in-law, Thomas P. Ives.

Thomas Poynton Ives was born in Beverly, Mass., April 9, 1769, and was but five days younger than his partner in business. When he was four years old his father died; and, soon after, he was also deprived of his mother. He was then placed in the charge of relatives in Boston, with whom he lived until he was thirteen. He attended the public schools; and, in 1782, was sent to Providence, R. I., where he entered the counting-room of Nicholas Brown. Here he was assigned important trusts, his uncle, before his death, giving him the almost exclusive direction of his mercantile affairs. At the age of twenty-two, Mr. Ives married Hope, the daughter of Nicholas Brown, and became a partner in the business.

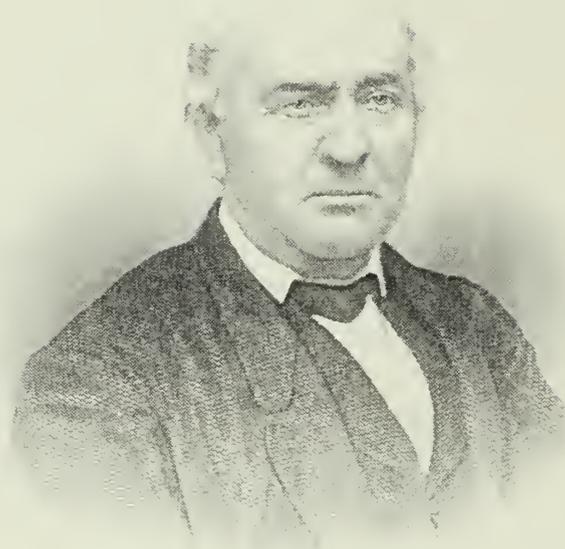
The young firm enjoyed the advantage both of the wealth and the prestige of the old concern. The first twenty-five years of their business history were, at times, very favorable to foreign commerce; at other times the course of events was depressing to it. During this period the transactions of the firm extended to every clime; and after the return of peace, in 1815, they shared in the rapid growth of American commerce. Mr. Ives died in the spring of 1836; his partner survived him more than five years, dying Sept. 27, 1841, having been actively engaged in business for half a century. The firm-style was continued by John Carter Brown, son of Nicholas Brown, and by the two sons of Thomas P. Ives, Moses Brown Ives and Robert Hale Ives. Mr. Brown, however, devoted but little attention to the business, which was mainly in the charge of the Messrs. Ives.

Besides his two sons, Thomas P. Ives left a daughter, Charlotte, who married William G. Goddard, afterward a professor in Brown University. Their sons, Thomas P. Ives, William, Moses B. Ives and Robert H. Ives, became successively members of the firm of Brown and Ives. Moses B. Ives died in 1857, John C. Brown in 1874, and Robert H. Ives in 1875. The daughter of the latter married Prof. William Gammell, of Brown University; and their son, Robert I. Gammell, is now a member of the firm of Brown and Ives.

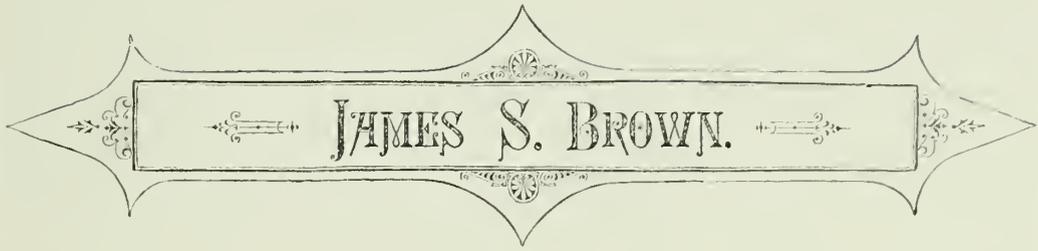
In 1827 Brown and Ives started a cotton-mill on the site where the village of Lonsdale has since grown up, which was the germ of the Lonsdale Company. Wilbur Kelley, and Gen. Edward Carrington of Providence, were associated with them in the enterprise. A charter was granted to them in 1834, the capital being \$500,000, which, in January, 1865, was increased to \$1,000,000. The Lonsdale Mills have been for many years under the management of George Kilburn, as agent; and he, with his three sons,—John, formerly agent of the Naumkeag Mills at Salem, and now of the Lawrence Mills at Lowell; Edward, agent of the Wamsutta Mills at New Bedford; and Hiram, agent of the Potomska Mill also at New Bedford,—have won high reputations as mill-managers.

In January, 1847, the Hope Company was chartered, with a capital of \$500,000, the firm of Brown and Ives, and Stephen G. Allen, agent of the company, being the incorporators. In January, 1856, the firm bought a controlling interest in the Blackstone Manufacturing Company. The mills of this company are at Blackstone, Mass., the business having been started in 1808.

The manufacturing interests of this firm have been in charge of the Goddard Brothers since 1850, a firm formed in that year by Thomas P. I. and William Goddard. Robert H. I. Goddard and Robert I. Gammell have since been admitted to the latter firm.



James S. Brown



JAMES S. BROWN.



EARLY in the history of Rhode Island, four brothers bearing the name of Brown emigrated from Wales, and settled in what is now Cumberland. There they engaged in mining coal and iron-ore, using both in the manufacture of iron. Their furnace was situated at Valley Falls, on the Abbott Run. It was operated ten weeks in each year; and the rest of the time was employed in the mining of ore and coal. This business was inherited by Philip, the grandfather of James S. Brown, and carried on by him until his death. After that event only one blast was made, and the working of the furnace was given up. Philip's son, Sylvanus, the father of James S., was only ten years old at his father's death, and was placed under the care of his great-uncle, a millwright. This trade he learned, and he worked at it until he was twenty-one years of age. He then engaged in business on his own account, until the Revolution. He then enlisted in the Colonial navy, the first commander-in-chief of which was Ezekiel Hopkins, of North Providence, R. I. Sylvanus Brown served on board his flag-ship, the "Alfred," as master-of-arms, the ship being commanded by William Jones, afterward prominent in the civil affairs of Rhode Island, and from 1810 to 1817 governor of the State. On closing his naval career, Sylvanus Brown went to Providence, and worked at stocking guns, in a shop operated by the State. He was next engaged by the Governor of Nova Scotia and New Brunswick, to superintend the making and putting up of sets of machinery for seven saw-mills, and machinery for two grist-mills; and he employed on the iron-work all the men connected with Stephen Jencks and Sons' shop. After remaining in this occupation in St. John, N. B., a year and a half, he went to Europe, and soon returned to Pawtucket, where he built a house and a shop.

Early in 1790 Almy and Brown, having entered into a contract with Samuel Slater to engage in the cotton-manufacture, employed Sylvanus Brown to construct

the machinery, under Mr. Slater's superintendence. Mr. Brown worked in his own shop, and agreed not to furnish patterns or knowledge of the machinery to any others. He constructed the cards and other parts of the machinery according to Mr. Slater's directions. The cards, however, when completed, would not work. In this perplexity he happened to take up a pair of hand-cards, and observed a peculiar bend or crook in the teeth. Hastening to his shop, he made a similar bend in the teeth of his machine-cards, and started the machine; and the experiment proved successful. This achievement encouraged the partners to build the old Slater Mill, in Pawtucket.* In 1792 Mr. Brown invented and used the first slide-lathes for turning rolls, by which they were made straight and of uniform size. He also built machines for fluting rolls, which were of great advantage to the business, enabling one man to do the work before requiring the labor of six men. He continued in the superintendence of this establishment until 1796. He was next employed by John Brown, a manufacturer of cannon, to superintend furnaces and boring-mills at Scituate, R. I., and at Easton, Mass. In 1801 he engaged again in his own business, as millwright, and continued in it until his death in 1824.

James S. Brown was born in Pawtucket, Dec. 23, 1802. He attended school until his fifteenth year, when he was employed by David Wilkinson, a manufacturer of cotton-machinery at Pawtucket, in pattern-making, having, during his school vacations of the previous year, assisted his father in this department of his business. In 1819 he went to work in the shop of Pitcher and Gay, which was started in 1813, on Main Street, and was, when Mr. Brown entered it, the largest manufactory of machinery in Pawtucket. Mr. Gay retired in 1824; and Mr. Brown took his place in the firm, the style of which was changed to Pitcher and Brown. They did a large and successful business in the manufacture of cotton-machinery; and, in 1842, Mr. Brown bought his partner's interest. He continued the business on the same premises until 1850.

In 1846 Mr. Brown bought the site of his present establishment, three and a half acres in area, and put up a furnace and foundry for making his own castings. In 1849 he erected his present shops, including the main building, 400 feet long, 60 wide, and two and a half stories high, with a large wing, in which is placed the steam-engine furnishing power to all the works. He has since erected a large pattern-shop, and other buildings. Nearly all the machines used in the establishment were built by Mr. Brown, many of them embracing improvements of his own invention, and secured to him by letters patent. In 1820, when he was only eighteen years of age, he invented the slide-rest used in turning-lathes, by which the height of the tool can be adjusted while the lathe is in motion. His gear-cutter, for

* See note to sketch of Samuel Slater.

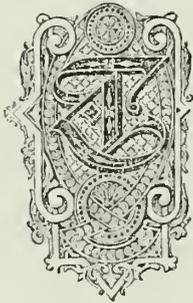
cutting bevel-gears, was invented in 1830; in 1838 he patented a machine for boring the passage for the roving through the arm of the long flyer roving-machine; and his lathe for longitudinally turning bodies of irregular forms was patented in 1842. He also devised an improvement in planing-machines, so that sixteen rolls, instead of four, may be used. He applied the turning-lathe to the cutting of large screws, six to eight inches long, for clothing; and, in 1874, he patented a new machine for spindle-grinding. These inventions and improvements were designed to aid his own business. He has also made improvements in various machines used in other manufactures in which he has been engaged.

Sharpe and Robert's self-acting mule was introduced into this country in 1839, by Bradford Durfee, of Fall River, who imported six of the mule head-stocks. From Fall River they were sent to Pitcher and Brown, to be put into running order. Mr. Brown applied himself to simplifying and perfecting the work in these machines. Among his improvements in them was the substitution of a catch-box in the middle of the carriage, under the head, in place of a set of changing-gears, which had a large share in securing the success of the mule in this country. He then engaged in the manufacture of these mules, devoting to this and to the manufacture of the American speeder, the greater portion of the force of his establishment. The English fly-frame was then being introduced; but Mr. Brown insisted that the American speeder could be made superior to the English machine, and took out a patent for his improvements in January, 1857. The result was that the demands on him for these machines compelled him to devote the whole force of his shop to them; and also to employ for the same purpose nearly the whole force of another large machine-shop in the vicinity.

In 1862 Mr. Brown was employed by some capitalists of Baltimore, who had bought the right for the United States for making and using M. Bennet's machine for cutting files, to build some of the machines. He built nine, with some modifications, and put them into successful operation. He also invented a machine for grinding file-blanks, and a furnace for hardening files. During the Civil War, his improved turning-lathe, originally designed for the turning of rolls for cotton-machinery, was employed in turning gun-barrels; this, for a time, to a large extent, superseded all other work in his shops. Mr. Brown, in 1864, associated his son, James Brown, and his son-in-law, Charles A. Warland, with him, and the firm became James S. Brown and Sons.

Mr. Brown has been engaged in these various enterprises and inventions for nearly sixty years; and his improvements in machinery have been of great value to the industries to which they have been applied.

PHILO BROWN.



THE town of Waterbury received its name from its site at a point where the Naugatuck River and its tributaries, by their large fall of water, afford numerous mill privileges. These began to be used for manufacturing purposes early in this century. In the progress of manufacture, however, before 1850, the limit of water-power had been nearly reached, and further enlargement could only be secured by the use of steam-power. The first introduction of steam at Waterbury was due to the enterprise of Philo Brown, the founder of the firm of Brown and Brothers, who, depending solely on steam-power, and with the universal prediction of failure at the outset, used it with success.

Philo Brown is descended, in the seventh generation, from Francis and Mary Brown, who, on the 26th of June, 1637, left England with Rev. John Davenport and others, and came to Boston. Mr. Davenport had been a popular preacher in London, and the families who came with him included many men of character and substance. They were urged to remain in the Colony of Massachusetts Bay, but decided to establish a new colony, and sent a few of their number, one of whom was Francis Brown, to make a tour of exploration. In the fall of 1637, the party proceeded about one hundred and fifty miles along the shores of Long Island Sound, until they came to Quinnipiac, now New Haven. Here they built a log hut, where now is the corner of George and Church Streets, and there they spent the winter. On the 25th of March, the rest of the company, including their pastor, sailed from Boston, and after a voyage of two weeks, reached Quinnipiac, and began the permanent settlement. Francis Brown received an allotment of land on the east side of the harbor, afterward within the limits of Fair Haven, which remained in the family for several generations, and which was known, within the memory of persons now living, as the Brown Farm.



Van Slyck & Co. Boston



Philo Broun

From Francis Brown was descended, in the fifth generation, Stephen Brown, who removed to Windsor, and carried on there the trade of a blacksmith. His son James, learning the same trade, worked with his father until his majority, when he went to Canton, where he remained one year. At twenty-two years of age he removed to Waterbury, and was employed as a journeyman by Lieut. Ard Welton, who manufactured brass cannon and brass muskets. His shop was in the Saw-mill Plain District, two miles east of the center of the town. Having worked with Welton two years, James Brown removed to the center of the town, and married Lavinia Welton, a distant relative of his employer. He established himself in his trade, and attained a competence. He took much interest in military affairs, and became colonel of a regiment composed of companies in that part of the State. He was for thirty years a deacon of the Congregational Church in Waterbury, and sustained, through his long life, a high reputation for integrity, industry and exemplary conduct.

His eldest son, Philo, was born Jan. 26, 1803. He received his education at the village school, and when eighteen entered his father's shop, and became an adept in the trade of a blacksmith. He worked there until 1827, and then engaged in trade on his own account. In 1830, with James P. Sommers, a millwright and machinist by trade, he conceived the idea of starting a mill for the manufacture of sheet-brass for the market, the two manufactories then in operation being devoted to the specialty of making brass buttons. They associated with them Horace Hotchkiss and Israel Holmes, for the purpose of securing additional capital, and the assistance of the persons named. Hotchkiss had been engaged in business, and was competent to attend to the mercantile department; while Holmes had been for some years in the employ of J. M. L. and W. H. Scovill, and, therefore, had the special knowledge and experience that were needed. Mr. Holmes proceeded to England to obtain machinery for rolling brass. Meanwhile, a mill was erected on the privilege now occupied by the Rogers and Brothers Manufacturing Company, a mile and a half east of the center of the town. Mr. Holmes having returned from England, with the rolling-machines, the business was started, in November, 1831, under the firm-name of Holmes and Hotchkiss. Col. James Brown, Dr. Edward Field, Preserved W. Carter and Solomon B. Minor, were special partners. Each of the partners, active and special, furnished one thousand dollars, and thus a capital stock of \$8,000 was raised. The business was soon in successful operation. The firm was the first to engage in the regular business of manufacturing sheet-brass for the market. The Messrs. Scovill and A. Benedict had for several years prepared small sheets for their own use in making buttons; and the latter firm had, to some extent, as early as 1825, rolled sheets for other manufacturers of buttons, and other small articles of

brass, in the vicinity. But the making of sheet-brass as an article of merchandise for the metal warehouses of the large cities, in competition with that imported from abroad, was started by the firm of Holmes and Hotchkiss; and this was, during the first year, its sole business. The demand for sheet-brass was at that time small; but the Company's trade soon surpassed their capacity of supply, and demanded an increase of machinery and capital; and on the 12th of March, 1832, John P. Elton became a partner, and invested one thousand dollars in the concern. The mill was burned in September, 1832; but the Company received a loan from Dr. Samuel Elton (father of John P. Elton), and at once proceeded to rebuild it. They now resolved to add to their business the manufacture of brass wire. Machinery and operatives skilled in this industry were obtained from England, and on the 1st of January, 1833, the first brass wire ever made in this country, by machines adapted to draw out the wire by a continuous motion, was produced. A small business was done early in this century, and even in the last century, in drawing brass, as well as iron wire, by the method in use from early times, namely, by pineers, with which the workmen drew the wire in short lengths through suitable apertures. The first sale was made on Jan. 12, 1833; and the firm thus became the pioneer in this leading industry of Waterbury and its vicinity.

Mr. Holmes retired from the firm on Jan. 30, 1834; but the style remained unchanged till Jan. 1, 1837, when his name was dropped, and the firm became Hotchkiss, Brown and Elton. On the 1st of January, 1838, Mr. Hotchkiss also retired, and the firm-style was changed to Brown and Elton. Mr. Sommers had retired from the firm on the 30th of January, 1833. In 1836 the Company began the manufacture of brass and copper tubing, which, though attended at first by some difficulty, soon became an important and profitable branch of business.

On the 18th of April, 1842, Brown and Elton purchased an interest of one-third in the pin manufacture of Slocum, Jillson & Co., at Poughkeepsie, N. Y. Pins were introduced into England from France, in 1483, and were first made there in 1626. Before the former period English ladies had used clasps and skewers of brass, silver, gold, ivory, bone or wood. Very early in the history of the New England colonies, the manufacture of pins was suggested; and in 1666, on petition of Joseph Jenks, of Lynne, the General Court of Massachusetts passed the following order: "Being informed that there are in this town (Lynn), a sett of tooles for wyer-drawing, and that there be some in the place that are able and skillful in that employ, this Court doth order the treasurer of the county to disburse out of the public treasury, such a sume of money as will be necessary for the purchase of said instruments and tooles, not exceeding 15 pounds; also to disburse 40 shillings for the encouragement of those that shall, of the said wyer, make cards and pins."

In 1775 Leonard Chester, of Wethersfield, proposed to erect a pin-factory there, and Dr. Apollos Kinsley invented a machine for making pins; but the plan was abandoned. The price of pins rose to a dollar a pack in 1812, and some Englishmen, who had brought the necessary implements from England, began to work, with the assistance of convicts in the old State Prison, at Greenwich, now included in New York City. The business was given up on the return of peace. It was resumed, in 1820, by Richard Furman, who employed inmates of the Bellevue Alms-house; but after carrying it on at a loss for a year or two, he, also, abandoned it. Brown and Elton, as has been stated, purchased, in 1842, an interest of one-third in Slocum, Jillson & Co.'s pin-manufactory, which has been fully described in our sketch of John P. Elton. A year afterward, the business of Maltby, Fowler and Sons, who had been engaged for two or three years in making pins at Northford, Conn., was united with that of Slocum, Jillson & Co. and Brown and Elton, and removed with the machinery and tools to the mills of the latter firm, at Waterbury, Conn.

The American Pin Company was organized, in 1846, by the members of the firm of Brown and Elton, with gentlemen connected with the Benedict and Burnham Manufacturing Company; one-half of the stock was held in the interest of each concern, and the capital was placed at \$50,000. Philo Brown was made president and treasurer, and Norton J. Buel, secretary. Factory buildings were erected, and on their completion, the machinery and tools were removed from Poughkeepsie, and from the mills of Brown and Elton, to the new factory. At the annual meeting, held in January, 1847, Nelson Hall was elected secretary and treasurer, offices which he held till Dec. 24, 1866, when he was succeeded by Theodore I. Driggs, the present incumbent and executive manager of the business. In February, 1848, the American Pin Company and the Howe Manufacturing Company, which were the leading concerns in the business, and between which there had been a sharp competition, entered into a contract to combine their sales under one general agency. This arrangement continues to the present time. At the annual meeting, held Jan. 29, 1850, the capital stock was increased to \$100,000.

Mr. Elton retired from active participation in the business on April 8, 1851, but it was continued under the same style and on the same premises until July 1, 1856. In 1851 Mr. Brown undertook a new enterprise. The limits of the brass manufacture in Waterbury by water-power had been reached, and he decided to obviate the difficulty by the use of steam-power. He utilized the heat from the casting furnaces, by passing it under the boilers; and, having purchased several acres of land well adapted for the purpose of a large manufactory, with a large area of level surface, and being in proximity to the railway stations, he built a mill, with subsidiary buildings, to carry out his project. He associated with him his three brothers,

William, Augustus and James, and organized the firm under the style of Brown and Brothers. William and Augustus had been merchants, and James was a physician. Philo Brown personally superintended the erection of the buildings, and, after their completion, took the general management, in addition to his charge of the mills of Brown and Elton. On the 28th of December, 1853, the business of Brown and Brothers was organized as a joint-stock company, but still retained the firm-name.

The business of Brown and Elton was closed up in 1866; and Mr. Brown has since devoted his whole time to the interest of Brown and Brothers, in which he has always owned a controlling interest. A mill was built in 1875 for the special business of manufacturing silver-plated flat ware; and this new departure proved an immediate success. It is under the charge of LeRoy S. White, a skillful mechanic, with a thorough knowledge of metallurgy, chemistry and electro-galvanism.

The Company manufactures not only brass and copper sheet, wire, tubing and other supplies and material for the manufacturers of brass or plated goods, but a large variety of small wares for the regular trade, and to meet special demands.

Its capital at the organization, in 1853, was fixed at \$200,000, and represented actual property in land, buildings, machinery and cash. It still remains at the same nominal figure, though large purchases of land have been made, new buildings have been erected, and new machinery, to meet increased demands, has been put in. The expenditure for these purposes has more than exceeded the original capital, and has been made wholly out of the profits of the business.

Mr. Brown married, in 1824, Esther Ives. Their children are: William Henry, born April 6, 1827, and married to Ellen Ives, of Hartford; and Cornelia A., born April 10, 1834, and married, in 1854, to Theodore S. Buel, of Waterbury. W. H. Brown received his mercantile training in the office of Brown and Elton, and, since the organization of the company, has been actively connected with it as the manager of its New York store. He is also a director and the secretary of the Company. Theodore S. Buel, having been educated for the law, was admitted to the bar in 1845, and attained a respectable rank and practice in his profession. He entered, some years ago, the office of Brown and Brothers, taking the general charge of the books and of the business at the mill, under Philo Brown, who, as president and treasurer, retained the general supervision. Mr. Buel performed his duties faithfully and ably until his death in March, 1872.

Philo Brown still has the general direction of his extensive business. Earning with his own hands, at the anvil, the first thousand dollars which he invested as his proportion of the capital of the original firm, he brought to it also his mechanical aptitude and experience, his personal labors as a trained mechanic, and a useful knowledge of metallurgy.



Van Slyck & Co Boston.



Joseph R Brown

BROWN & SHARPE MFG. CO.

JOSEPH R. BROWN.



JOSEPH R. BROWN, in conjunction with his father, David Brown laid the foundation of the Brown and Sharpe Manufacturing Company, of Providence, R. I., nearly half a century ago.

David Brown was born in Attleboro, R. I., in 1781. His educational advantages were but slight; and he left home, at the age of fourteen, to become a tavern-boy at Seekonk, Mass. He remained in this humble position a year or two, and then entered the store of Nehemiah Dodge, in Providence, to learn the trade of a jeweler. After serving a full term of apprenticeship, his natural taste for mechanics led him to transfer his services to Payton Dana, under whom he mastered the trade of watch and clock-making. Here he remained until about 1802, when he was employed by Obed Robinson to organize and put in operation an establishment for the manufacture of plated jewelry at Attleboro. Two years later he went to Warren, R. I., where he established himself modestly as a manufacturer and dealer in clocks, watches, jewelry, and, especially, silver-ware.

In 1809, having prospered in trade, he married Miss Patience Rogers. After his marriage, however, his business became depressed, and his home was mortgaged. He had invented a grinding-machine propelled by the foot; this he now put on wheels, packed his silver-ware upon it, and went through the valley of the Connecticut, grinding razors and other fine cutlery, and selling his goods. Finding this venture successful, he extended his trips further south, and continued to follow it two or three years, not only clearing himself of all debt, but laying by something. He finally again settled down to the regular pursuit of his trade. In 1828 he sold his property in Warren, and removed to Pawtucket, where he continued the same line of business.

In 1833 he formed a copartnership with his son, Joseph R. Brown, and they

soon founded, in Providence, the enterprise now known as the Brown and Sharpe Manufacturing Company. This, when first started, was mainly devoted to the manufacture of watches and clocks, and surveying and mathematical instruments. David Brown retired in 1841, when he removed to Bureau County, Ill., to establish a younger son on a large tract of land which he had there purchased. In 1856, however, he returned to Pawtucket, where he built a residence for his daughter. In the rear of this house he fitted up a shop, in which he worked until his death, in 1868, at the advanced age of eighty-seven years and five months. In the course of his long and laborious career he made several useful inventions, among which were improvements on the mechanism of clocks, and a machine for winding twine-balls.

Joseph R. Brown was born in Warren, R. I., on the 26th of January, 1810. He went to the district school; and, out of school hours and during his vacations, he assisted his father in the labors of the shop. With a natural bent for being a machinist, he went, in the spring of 1827, to learn this trade of Walcott and Harris, at Valley Falls. At first he was put upon coarse work; but his experience in his father's shop soon enabled him to leave this for finer work, and for three months he was employed on the parts of cotton-machinery that required accuracy and skill. Failing, however, to receive the wages he claimed, he entered the service of William Field, at Central Falls, where he turned throstle-spindles, being paid eighty-seven and a half cents a day. In the following spring he returned home to assist his father, who had removed to Pawtucket, in constructing a tower clock for a church in that town, and others for Taunton and New Bedford. These labors kept him employed until he attained his majority, in 1831.

He now set up a small shop of his own, for the manufacture of small tools for machinists and the building of lathes. Two years later he again joined his father, and they resumed business together, at No. 60 South Main Street, Providence, as has been stated. In the winter of 1837 their shop and its contents were burned, and they lost heavily, the amount of the insurance being only \$2,000, and all that was left to them. While awaiting the re-creation of their building, they rented a small shop for temporary use. When the new shop was completed, however, they had no forge with which to work; and in 1839 they rented a portion of the premises at No. 69 South Main Street, where the business was continued until 1848, Joseph R. Brown carrying it on alone after 1841. In order to secure more room and the benefit of steam-power, he removed to No. 115 on the same street; and here his industry prospered. From the beginning up to 1853, Mr. Brown had carried on, with the rest of his business, a general jobbing department, which he then closed up, and after that date confined himself to his manufacturing interests.

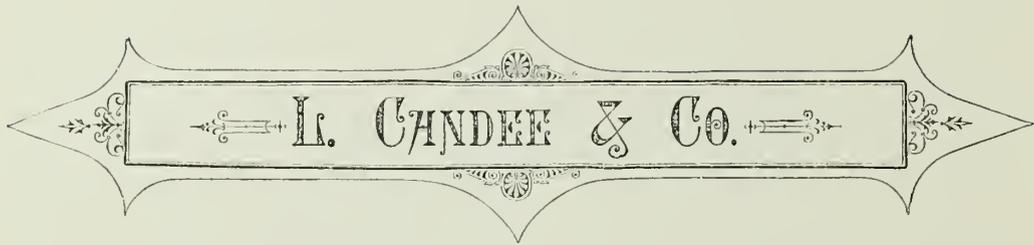
Lucian Sharpe, who had been for five years his apprentice, was now offered, at

a nominal figure, a half interest in the business, which he accepted; and the firm of Brown and Sharpe was organized. The new firm occupied a ground floor, 60 by 30 feet, and employed in their business about fourteen workmen. From time to time they gained possession of other portions of the building; and, in 1858, they entered into a contract with the Willcox and Gibbs Sewing Machine Company, to manufacture all their machines. This they have done ever since, amounting, in the aggregate, to nearly three hundred thousand machines. Four years later they not only occupied the entire three floors of the building and the building adjoining, but had built an addition in the rear; and, by 1865, the number of their workmen was nearly three hundred. They obtained a charter, under the corporate name of the Brown and Sharpe Manufacturing Company, in 1868. The building they then occupied was of wood, and they were crowded in their operations for want of room. To meet these necessities they purchased, in 1870, a large space of ground on Promenade Street, near Park Street, and built their present factory buildings. These consist of a large main building, with east and west wings, all having an elevation of three stories above the basement. Attached to them are a boiler-house, a blacksmith-shop and stables. The total floor area is nearly sixty thousand square feet. On each floor, for the convenience of *employés*, there is a store-room, from which small tools for especial use are furnished to them; and there is a library of interesting and instructive books free to all workmen in their employ. The buildings are fire-proof, and brick, with iron beams and columns.

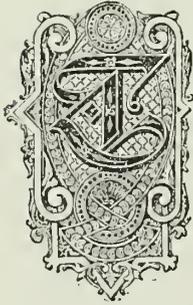
The tools and machinery employed in the factory are, to a large extent, the products of Mr. Brown's inventive skill. In 1852 he invented the linear dividing-engine, for graduated divisions in scales of measurement — the first automatic machine of the kind put in use on this side of the Atlantic. Since that time the firm has entered largely into the manufacture of graduated steel rules for nice measurement, according to the United States, English and French standards, gauges, calipers, protractors, and a variety of tools for accurate measurements. Samuel Darling acquired an interest in this particular branch of the industry in 1866, and it was made a separate business. It is now conducted in the same building, but under the name of Darling, Brown and Sharpe.

In 1865 Mr. Brown invented the universal milling-machine, with gear-cutting attachment; and among his other inventions were a revolving head-screw machine, a universal grinding-machine, a tapping-machine, and a screw-slotting machine.

Mr. Brown died at the Isles of Shoals, N. H., July 23, 1876, of rupture of the left ventricle of the heart, leaving a widow and one daughter, the wife of Edward I. Nickerson, of Providence, R. I.

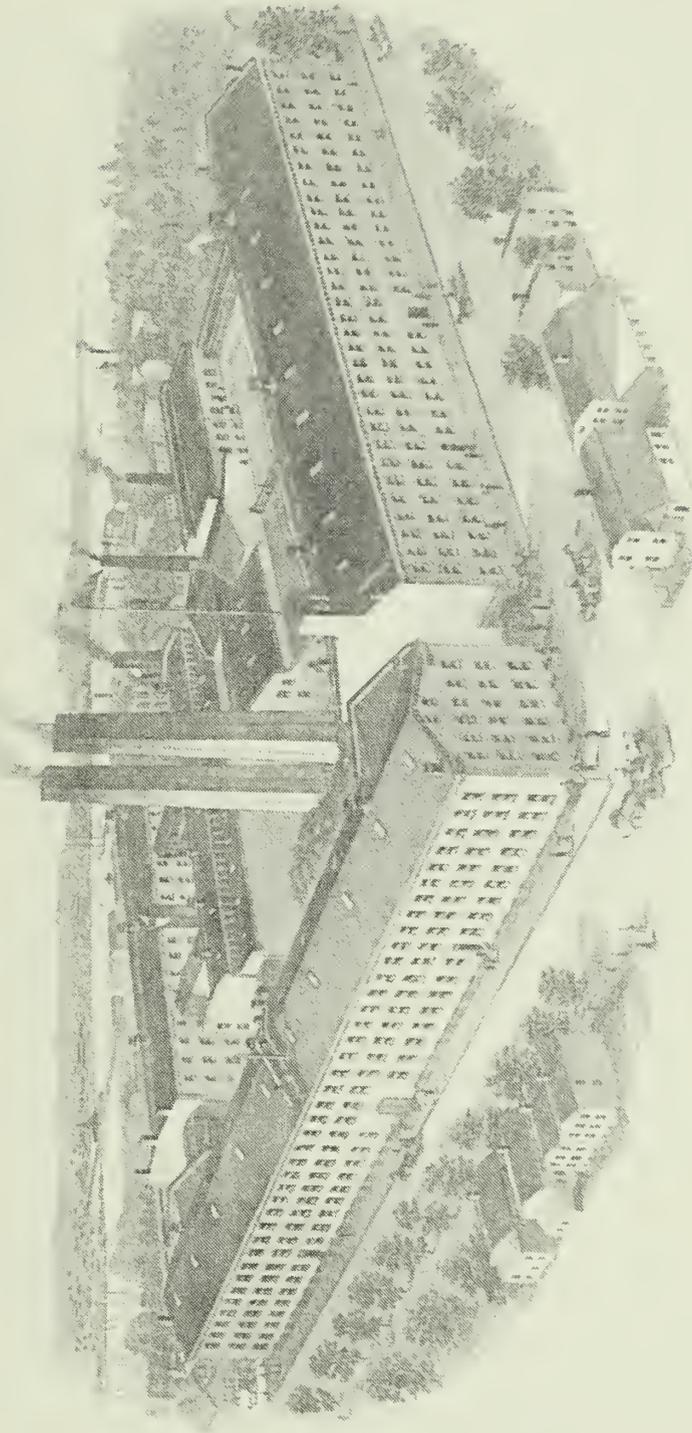


LEVERETT CANDEE — HENRY HOTCHKISS.



HE discoveries of Nathaniel Hayward and Charles Goodyear, which brought to light the effect of sulphur and intense heat upon India-rubber, in better adapting it to practical purposes and greatly multiplying its uses, have given rise, within the past forty years, to an important industry in the manufacture of overshoes and boots. Among the earlier uses of native rubber, was the making of overshoes, by the natives of Brazil, where the caoutchouc trees were discovered, in 1735. The introduction of, and trade in, these overshoes, made from the pure gum, during the next fifteen years, are narrated in the sketch of Thomas C. Wales; and the experiments with sulphur and other substances, which resulted in the process of vulcanization, are described in the sketch of Nathaniel Hayward. The first to apply this process successfully to the manufacture of boots and shoes, was the firm of Leverett Candee, organized on the 5th of September, 1843, the members of which were Leverett Candee, general partner, and Henry and Lucius Hotchkiss, special partners.

Leverett Candee was born in Oxford, Conn., June 20, 1795. He received his education at the district school; and when about fifteen he went to New Haven, and obtained a position in a store. He soon entered into the employment of Capt. Gad Peck, at that time a prominent merchant in foreign trade; and, soon after, became a clerk with Root and Atwater, dealers in dry-goods, in which position he remained until the dissolution of that firm. With his fellow-clerks, James E. P. Dean and William Cutler, he then formed the copartnership of Candee, Dean and Cutler, which succeeded their former employers. Their business, that of retail dry-goods, was a successful one. In 1833 Mr. Candee retired from the firm; and, removing to New York, entered into partnership with Leonard Bradley and John C. Taylor, under the firm of Bradley, Candee and Taylor, their business being that of jobbers



THE NEW YORK RUBBER CO.

L. CALDWELL & CO'S RUBBER BOOT & SHOE WORKS.

(Incorporated in N.Y.)

NEW HAVEN, CONN.



and commission merchants in dry-goods. He returned to New Haven in 1835, and entered into partnership with Timothy Lester and Abraham Murdock, in a general merchandise and commission business, under the style of Candee, Lester and Murdock. This firm was afterward dissolved, and a new firm was formed by Messrs. Candee, Lester and John G. Page, under the style of Candee, Page and Lester, who engaged in the manufacture of book-paper. In 1840 Mr. Page retired, and Messrs. Candee and Lester, under the firm of Candee and Lester, continued the same manufacture at Westville. In 1842 they became involved, by several failures, and the business was closed up and the firm dissolved.

Mr. Candee, who had now lost the savings of twenty-five years of active business, began to make elastic suspenders,—a manufacture which was then carried on in several towns in Connecticut,—the elasticity being secured by the use of threads of native rubber. But the business was not profitable. The application of India-rubber to various purposes had been the subject of much experiment since 1830, by Haskins, Chaffer, Hayward, Goodyear and others; and tolerably good results in coating cotton cloth with a solution of rubber and sulphur, had been obtained. Mr. Candee resolved to attempt to make overshoes of India-rubber. He received a loan from Messrs. H. and L. Hotchkiss, who were at that time engaged in the sale of lumber; and while he was at work, late in 1842, in the attempt to produce a merchantable article of overshoes, a rubber shoe was shown to him by Charles Goodyear, who had then recently discovered his method of vulcanizing rubber, and was engaged in perfecting the process. This shoe was of vulcanized rubber; and, though rude in form, and of a dull lead color, seemed still to promise so much, that Mr. Candee agreed with Mr. Goodyear to undertake the manufacture, receiving from him a temporary license to use the process, to be renewed and confirmed when a patent should be granted. He thus became the first licensee in the manufacture of India-rubber shoes by the Goodyear process. He at once began some experiments in a small factory which had been occupied for the manufacture of carpets, at Hamden, six miles from New Haven. In these experiments he was aided both by the capital and the advice and co-operation of the Messrs. Hotchkiss, who then became identified with the enterprise.

The brothers, Henry and Lucius Hotchkiss, were sons of Justus Hotchkiss, who was engaged for many years at New Haven, Conn., in the lumber trade. Justus Hotchkiss died in 1812, leaving his two sons, still in their minority, to the guardianship of their maternal uncle, Russell Hotchkiss. Henry Hotchkiss was born at New Haven, April 9, 1801. He attended the common schools of New Haven, and Fairfield Academy. On leaving school he entered the office of his uncles, Russell and Elias, who had succeeded to the business of Justus Hotchkiss; and on attaining

his majority, was admitted as a partner, the firm style being Hotchkiss & Co. Lucius Hotchkiss was born in New Haven, March 1, 1803. He also entered the office of his uncles, and learned the lumber-business. He was admitted to partnership with his uncle Elias and his brother Henry, in 1824; Russell Hotchkiss having retired from the concern. The style of the new firm was also Hotchkiss & Co., and to distinguish its business and accounts from those of the old firm, was designated as Hotchkiss and Co., *new*. In 1828 Elias Hotchkiss retired, and the brothers formed a new firm, under the style of H. and L. Hotchkiss, which survived until 1850. In that year, their capital having been invested largely in other interests, which demanded their care and time, especially in the manufacture of rubber shoes, as members of the firm of L. Candee & Co., their business as dealers in lumber was closed.

On the organization of the firm of Leverett Candee, the business was pushed with energy; and whenever pecuniary facilities were needed, they were supplied from the ample capital of the Messrs. Hotchkiss, as they were called for, when the original capital was exhausted. The factory was under the immediate charge of Mr. Candee. One of the main difficulties at the outset, was the obtaining of a good color in the rubber. The tendency of the surface of the shoes was to assume the appearance called "bloom." A large sum of money was offered by the firm for the discovery of some method to obviate this difficulty, so as to secure an uniform and permanent black color. The result was the preparation of a varnish, which gave the shoes a very handsome finish, and a permanent black polish. This was at first of much value to the firm; but the secret of the composition was soon found out by other companies. Having succeeded in making articles sufficiently good to encourage them to try the market, the firm sent out agents to dispose of the shoes in small lots to retail dealers. These agents, however, were met everywhere with distrust and doubt. Lots were left with dealers to be disposed of, and payment made after they should be sold. In some instances, when they had been sold and delivered to the dealer, they would spoil on his hands. To avoid the tendency to "bloom," the amount of sulphur used in the process was diminished, the result of which was, that the rubber was not sufficiently "cured," and the shoes in a little while softened and stuck together; and if they increased the sulphur again, the "bloom" would reappear. The agents, therefore, on visiting a customer a second time, were often presented with a lot of spoiled goods. The firm from the outset guaranteed their goods, and instructed their agents, wherever dissatisfaction was expressed, to replace the old articles by new ones, without cost to the customer. Thus it secured the confidence of the trade, and acquired the high standing which it has since retained.

The manufacture was carried on exclusively at Hamden, until Feb. 11, 1850. In



Von Siedel & Co Boston



Samuel Comden

1849 a large lot of land in New Haven, in Green, East and Wallace Streets, was purchased, together with a factory which had been occupied by a New Haven company in the manufacture of screws. Here a branch factory was established, the business being also still carried on at the old factory, in Hamden. Additional buildings having been erected in 1859, the whole business was then concentrated at New Haven.

In 1848 Leverett Candee, the Hayward Rubber Company, at Colchester, Conn., Ford and Company, of New Brunswick, N. J., and the Newark Rubber Manufacturing Company, of Newark, N. J., entered into a combination to purchase the exclusive right, under the Goodyear patent, to manufacture boots and shoes. The other two concerns, then engaged in this manufacture, the Goodyear Metallic Rubber Shoe Company, of Naugatuck, Conn., and Onderdonk and Letson, of New Brunswick, N. J., did not join them, but worked under licenses granted by the new owners. It was in consequence of this combination that the great legal contest was sustained, which resulted in establishing the validity of the Goodyear patent; and in which Daniel Webster, as one of the counsel for the combination, made his celebrated plea.

On the 7th of June, 1852, the business of the firm was organized, under the State law, as a joint-stock company, under the style of L. Candee & Co., with a capital of \$200,000. Besides Mr. Candee and the Messrs. Hotchkiss, Timothy Lester, the early partner of Mr. Candee in his paper manufacture, who had been, after the organization of the rubber business, superintendent of the manufacture, became a stockholder. The first officers of the company were Leverett Candee, President and Treasurer, and Charles T. Candee, Secretary. With the exception of one year, 1859, when Dr. Isaac Hartshorn, of Providence, R. I., was president, and Leverett Candee was treasurer, there was no change in the officers till 1863. In that year Mr. Candee resigned, and disposed of his stock in the company. Henry Hotchkiss was elected president and treasurer, and Henry L. Hotchkiss secretary. These officers continued until 1869, when Henry Hotchkiss resigned the office of treasurer, being succeeded by Henry L. Hotchkiss, who continued also as secretary. On the death of his father, in 1871, the latter was elected president, continuing as treasurer, and was succeeded as secretary by Pierrepont B. Foster. Mr. Foster held the office until 1874, when he was succeeded by the present secretary, Charles L. Johnson.

Leverett Candee died March 23, 1865. On his resignation, in 1863, of the office of president of L. Candee & Co., he was elected president of the New Haven County Bank, and of the Goodyear Metallic Rubber Shoe Company, of Naugatuck, Conn.

Henry Hotchkiss died Dec. 15, 1871. His business career covered a period of more than half a century, and was identified with the growth and prosperity of his native city. Besides his large interest in L. Candee & Co., in the business of which he was, for several years, the executive head and manager, he was connected, by the investment of capital or official relations, with many manufacturing and financial interests. He was one of the five original corporators, and a director in Holmes, Booth and Haydens, of Waterbury, one of the large brass manufactories of the Naugatuck Valley; and a director in, and at one time president of, the United States Pin Company, at Seymour, Conn., the first manufacturers of the "Adamantine" pin. He was also largely interested in railroad enterprises, having been one of the first corporators, and afterward a trustee, of the Shore Line Railroad; and in banks, having been for twenty-one years president of the New Haven County Bank, and the first president of the Union Trust Company, of New Haven; in which latter office he was succeeded by his son, Henry L. Hotchkiss.

Lucius Hotchkiss, who was associated in early manhood with his elder brother in their personal business, was in this, as well as in the early career of L. Candee & Co., an efficient partner and coadjutor. He is now a director in the Second National Bank, of New Haven.

As with other companies engaged in the manufacture of rubber boots and shoes under the Goodyear patent, very soon after the issue of that patent, and especially after the decision in favor of its validity, in 1848, L. Candee & Co. rapidly progressed in business, capital, facilities and resources. The original capital of \$6000 dollars, furnished wholly by the Messrs. Hotchkiss, was increased, at the organization of the joint-stock company, in 1852, to \$200,000, and in 1869, to \$300,000, to which has since been added a large surplus. Substantial brick buildings have been erected, at different times, covering the extensive area purchased in 1849; and a force of operatives, averaging for several years six hundred persons, has been employed. In the fall of 1877, though there had been a financial depression for five years, the Company had gained so good a reputation, that there was a demand and ready sale for all its products. But on the 19th of November, 1877, while in full operation, the works were destroyed by fire. The officers of the Company at once took measures for resuming business, and hired the factory of the late Odorless Rubber Company, at Middletown, Conn., and arranged with the Boston and New York Railway to run two special trains a day between New Haven and Middletown, for the accommodation of the operatives. The hired factory was put in order, lasts were made, patterns cut, tools and machinery purchased and set up, and goods produced and delivered on orders, within three weeks after the fire. Meanwhile, the insurance was adjusted and paid, additional land was purchased,



Van Slyck & Co Boston



Henry Hotchkiss

and contracts were made for the erection of buildings and the construction of new and improved machinery. The contracts were punctually fulfilled; and early in August, the works were started up, and were soon in full running order.

There are six brick buildings in which the manufacture is carried on. That on Wallace Street, is 393 feet long by 58 feet wide, of three stories, and has an ell. The first floor is devoted to the grinders and calenders. These are placed over four parallel lines of shafting, six inches in diameter, running the whole length of the building, and connected with the engines, in another building, by immense bevel-gears and underground shafting, sixteen inches in diameter next to the engines, and nine inches at the other ends. This arrangement for driving the one hundred grinders, and the calenders, is a very effective one. It was made at the machine-shop of the Corliss Steam Engine Company, at Providence. As the grinders and calenders are arranged in two duplicate divisions, each driven by its own engine of seven hundred horse-power, a stoppage of even a whole division, for a day, or longer, can be made at any time; and, running the other divisions during extra hours, the full amount of work can be accomplished at all times. The second floor of this building contains the heel-presses, the cloth-cutting presses and tables for cutters. The third floor is wholly devoted to cutters. At each end of this building are wide fire-proof stair-cases.

At a right-angle with this building is one on Green Street, 304 feet long and 55 feet wide; and, including the basement, which is used for certain processes of the manufacture, is four stories high. In the basement, the crude rubber is received, weighed, cut and cleansed by being passed through heavy rolls, a stream of water pouring on the mass as it passes through the rolls. The rolls are driven by an independent engine of one hundred and fifty horse-power. These machines are called masticators, for they fairly chew or masticate the gum; which, having been thus freed from bark, earthy matters and other impurities, is placed in drying-rooms, where it remains three months or more, until the moisture is thoroughly evaporated, which involves a shrinkage of from fifteen to thirty per cent. It is then ready for the grinders. The first main-floor of the building, except a portion reserved at the east end for the offices of the Company, is devoted to making Arctics, and contains three hundred tables. The second floor contains two hundred and fifty tables, and is used by the boot-makers. The third floor has five hundred tables for the shoe-makers. The building will thus accommodate a thousand and fifty operatives engaged in making up the stock, which has been prepared and cut in the Wallace Street building. The building on Green Street also contains two wide, fire-proof stair-cases—one at the Wallace Street end, and one in the middle of the building.

At a right-angle with the building just described is another of three stories on

East Street, 170 feet by 40 feet, the first floor of which is devoted to shipping, and the second and third to packing. These three buildings are separated from each other by a space of twenty-five feet ; the walls and gable ends, which face each other, are without windows and of extra thickness, and the communication between the upper stories is by iron bridges, guarded by iron doors. The quadrangular space, three sides of which are made by the three buildings, is occupied by three other buildings, with road-ways twenty-five feet wide between them. Next the Wallace Street building is the engine-house, 110 feet by 20 feet, containing two Corliss Steam Engines, each of seven hundred horse-power. East of the engine-house is the boiler-house, 90 feet by 75 feet, containing twenty boilers, with an aggregate of seventeen hundred horse-power. Adjoining the boiler-house is a coal-yard, with a capacity of fifteen hundred tons. Between this and the East Street building is the heater-building. There are six heaters, covering a space of 150 feet by 50 feet, and capable of vulcanizing twenty-four thousand pairs of shoes at one time. In addition to these six main buildings, are the benzine-house and the cement-house, placed at a safe distance from each other, and from the larger buildings. These edifices were constructed on a plan arranged especially for the uses to which they are put.

The Company sells its goods directly from the factory, without the intervention of agencies. This department is under the management of George Watkinson, who, before 1871, was a member of the firm of Henry Elliot & Co., of New York, agents of the Candee and other rubber-shoe companies. In 1871 he was invited to take charge of the sales of L. Candee & Co.; and he took up his residence at New Haven, and made the office of the Company the headquarters for the sales. The experience of several years has proved this method of disposing of the goods, and of bringing the buyer in immediate contact with the Company, to be a wise and profitable one.



Van Slyke & Co Boston



Henry Chan

HARVEY CHACE.



HARVEY CHACE, of Valley Falls, R. I., has been, for more than seventy consecutive years, connected personally with the cotton manufacture. His ancestor in the sixth generation was William Chace, who came to America in 1630, and settled in Roxbury, Mass., where he remained till 1637, when he removed to Yarmouth, Mass. His son William, who came with him from England, and settled, in 1637, in that part of Yarmouth which is now included in Harwich, was a Quaker, as have been his descendants to the present day. His son Joseph removed to the part of Swansea which is now included in Somerset, where the subject of this sketch was born, Aug. 30, 1797.

He was the eldest of seven children. His father, Oliver Chace, a carpenter and mill-wright, removed to Swansea in 1805, and, early in 1806, contracted to build a small cotton-factory for three gentlemen, only one of whom had any practical knowledge of the cotton manufacture. He had been employed in a factory at Pawtucket, R. I. Before the factory was finished he left the concern. The spinning-frames were constructed, according to information which he furnished, on the model of those first introduced into this country by Samuel Slater, and then used at Pawtucket. The others, Dexter and Nathaniel Wheeler, were machinists. They had not the means to pay Mr. Chace for his work, and proposed that he should enter into the enterprise with them; and he started up the mill, and managed it until 1813. He at once put his little son, Harvey, then nine years old, into the mill, his work being that of a bobbin-boy, and of spreading the cotton on the breakers. He thus early learned the working of a cotton-mill, as it was carried on at that time. Weaving was done on hand-looms, and mostly at the homes of the people, the business of the factories being to prepare cotton yarns for warps and filling.

Young Harvey early became proficient; and, in his fifteenth year, he was sent to

Burrillville, R. I., to superintend the putting in of machinery, and to start up the factory known as the Tar-Kiln Factory, of about 500 spindles, for his father and others. There he remained until the mill was in successful operation—a period of about a year. In the spring of 1813 his father went to Troy, now known as Fall River, invested some capital, and, with others, organized the Troy Cotton and Woolen Manufactory, the first corporation formed in the town. The power for these two mills, as for many others since started, was furnished by a stream having a fall of one hundred and thirty-six feet within the distance of a little more than half a mile. A dam had been in existence at this outlet, and a saw-mill had here obtained its water-power, for many years; but the dam had become very much out of repair. It was at this time replaced by a new and substantial dam; and the Troy Mill was built of stone in immediate proximity to it, the Fall River Mill being of wood, and situated lower down the stream. Oliver Chace superintended the construction, and was the first managing agent, of the Troy Mill; and his son Harvey, returning from Burrillville, in 1813, entered the employ of the Company. He at once developed practical qualities; and, before he was twenty years of age, he was often sent to Boston to sell yarns, and to purchase cotton for the supply of the mill. He remained in the employ of the Troy Cotton and Woolen Manufactory until 1843, becoming a stockholder, and being for fifteen years its agent and treasurer.

Oliver Chace, with others, organized the Pocasset Manufacturing Company, in 1822, and became its first agent. In 1839 that part of the present real estate of the Valley Falls Company then situated on the Cumberland side of the Blackstone River was bought by Oliver Chace, who leased it to his sons, Harvey and Samuel B. They formed a partnership, under the style of H. and S. B. Chace; Samuel removed to Valley Falls, and took charge of the work there, while Harvey remained at Fall River until 1843, and then also removed to Valley Falls.

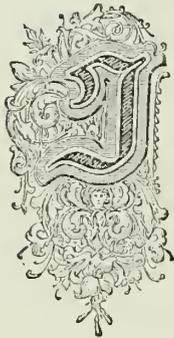
Oliver Chace continued engaged in manufacturing till he was seventy-five years of age, when he retired from active business, and died, in 1852, at eighty-three years of age. After this event his real estate at Valley Falls, by the terms of his will, became the property of his sons, Harvey, Samuel B. and Oliver, Jr. H. and S. B. Chace, who owned the machinery, continued to run the mills. They purchased the neighboring mill property, across the river, in 1852. The next year the Valley Falls Manufacturing Company was chartered, the three brothers being the co-corporators. The firm purchased the Albion Mill property, about five miles above Valley Falls, on the same river, in 1854; and, in 1856, they became proprietors of the Moodus Cotton Factory, at East Haddam, Conn. In 1868 the business interests were divided, Harvey receiving the Albion Mills and the Moodus Mills, and certain property in Fall River; and Samuel B., the property at Valley Falls. At the same time James

H. and Jonathan, sons of Harvey, became co-corporators with him in both the Albion and the Moodus companies, of which, under the firm of J. H. and J. Chace, they are treasurers and agents, Harvey Chace being president of both corporations.

The two sons of Harvey Chace, James II., born Nov. 12, 1827, and Jonathan, born July 22, 1829, were educated at the Friends Boarding School, in Providence, R. I., and were trained for business chiefly in the office of H. and S. B. Chace. Harvey Chace was one of the corporators and active promoters of the Reservoir Company, at Fall River, from 1825 to 1843, the object of which was the increase of the water-power, by raising the dam three feet, so as to collect a much greater supply of water, and thus meet the demands of the mills in dry seasons. He early became interested in the development of railroads at the time of their first introduction into this country; and he has contributed largely, by his own investments, and by his influence in securing the subscriptions of other capitalists, to the construction of various lines of railroads in his own vicinity.

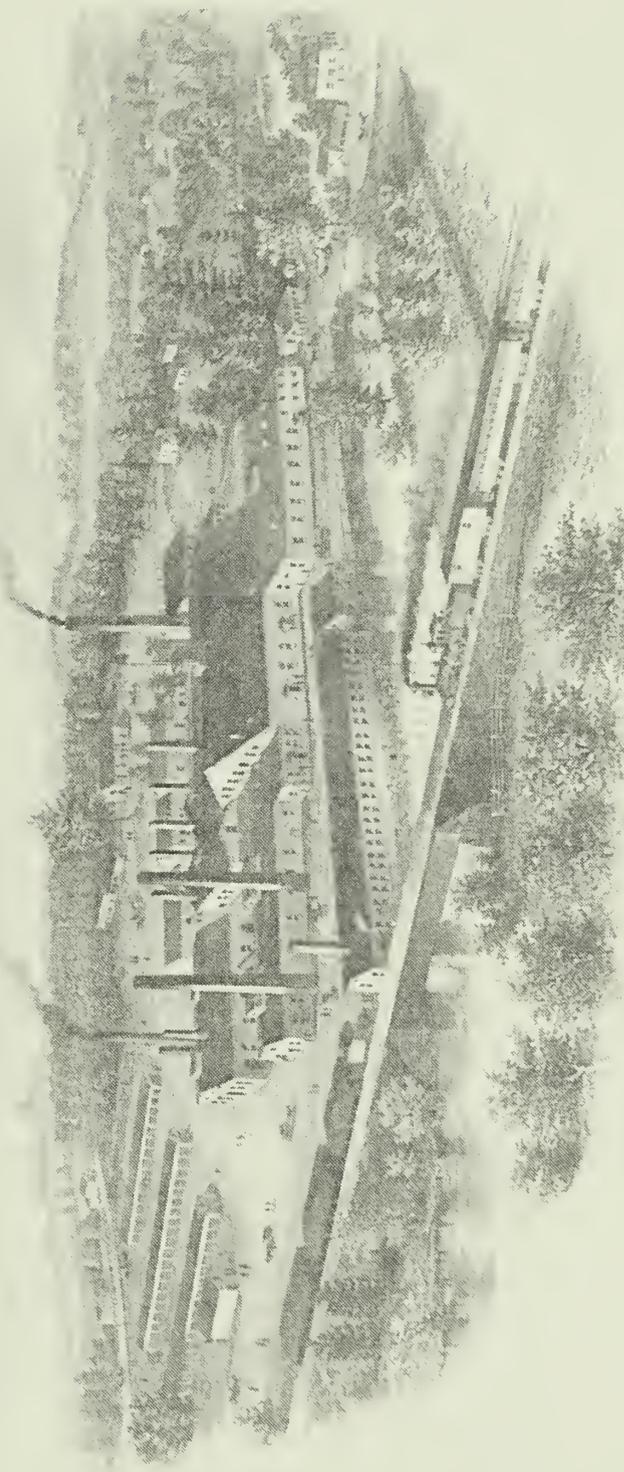


ISRAEL COE—LYMAN W. COE.



ISRAEL COE is descended, in the eighth generation, from Robert Coe, who was born in Suffolkshire, England, in 1596, came to this country in 1634, and settled first in Watertown, Mass. In 1636 he settled with a colony on the banks of the Connecticut River, which named its new sojourning-place Watertown. This name was changed to Wethersfield in 1639. Thence, with twenty others, he removed, in 1640, to a site on Long Island Sound, forty miles west of New Haven, and founded the town of Stamford. His descendant in the fifth generation was Jonathan Coe, who was born in Durham, Conn., in 1710, and removed to Torrington, and afterward to Winchester, Conn. His grandson, Abijah, returned to Torrington, but lived for some time in Goshen, where his son Israel was born, Dec. 14, 1794. At the age of thirteen Israel went to Winsted, where he attended the district school and Winsted Academy. He then became a school-teacher, and, soon after, an accountant.

In 1813 Israel entered the employ of the Torrington Cotton Factory as book-keeper. The business was afterward carried on by the firm of Wadhams and Thompson, Mr. Coe being the resident or managing agent. In 1821 he removed to Waterbury, Conn., where he kept a public house until 1825, when he entered the employ of A. Benedict, as book-keeper. On the 1st of January, 1829, he purchased the interest of Nathan Smith, in the firm of "A. Benedict," thus becoming a special partner. A new firm was formed, in 1829, by Aaron Benedict, Israel Coe, Bennet Bronson, Benjamin De Forest, Alfred Platt and James Croft, under the style of Benedict and Coe, with a capital of \$20,000. Messrs. Benedict and Coe were the general partners, the former having charge of the manufacturing, and the latter of the accounts, sales and outside business. In this connection he continued until February, 1834, when the partnership expired by limitation, and Mr. Coe retired. Israel Holmes now



THE STEEL MILL

THE STEEL MILL OF THE GREAT LAKES REGION

1910

proposed to him to engage in the manufacture of brass kettles, and this proposal he accepted. Mr. Holmes sold his interest in the firm of Holmes and Hotchkiss, at Waterbury, and went to England to obtain men skilled in the battery method of making kettles, and returned, after some delay, with seven of these artisans. Mr. Coe had, meanwhile, purchased a mill-privilege and erected a mill at Wolcottville, Conn., and now engaged in the business of kettle-making, under the name of Israel Coe, but had as special partners Anson G. Phelps, of Phelps, Dodge and Co., of New York, and John Hungerford, who had been engaged in the woolen manufacture at Wolcottville. Mr. Holmes was employed on a salary, and had a share of the profits. The method of making the kettles was by subjecting a flat disc of sheet brass to the blows of small, rapidly-moving trip-hammers, the disc, as it was gradually shaped into a kettle, being held by the workmen on a small anvil directly under the hammer, and guided only by his eye and hand.

The business was profitable; and, in 1841, it was organized as a joint-stock company, under the style of the Wolcottville Brass Company. Israel Coe, Anson G. Phelps and John Hungerford continued, and Israel Holmes and Lyman W. Coe became stockholders. The capital was fixed at \$56,000. Israel Coe was president, and Lyman W. Coe was secretary and treasurer.

Mr. Coe sold his stock in July, 1843, and engaged with Samuel Coit, formerly of Hartford, in business as bankers, continuing about three years. He was afterward engaged in the lumber business, residing in New York City, Brooklyn, and now at Bloomfield, N. J., where he is a Justice of the Peace. He represented Waterbury in the Connecticut House of Representatives in 1824 and 1825, and the district, including Wolcottville, in the Senate in 1843.

Lyman W. Coe, Israel's eldest son, was born at Torrington, Conn., Jan. 20, 1820. He was engaged, in 1837-8, as clerk and book-keeper, by Lewis McKee and Co., lock-makers, at Terryville, Conn. He then held the same relation to his father's business at Wolcottville for a year, at the end of that period returning to his old place at Terryville. On attaining his majority, in 1841, he became a stockholder in the Wolcottville Brass Company, and was appointed secretary and treasurer. In 1843 he sold his stock in the company, but remained in his official capacity, on a salary, for two years. The Waterbury Brass Company was organized April 1, 1845; and at first Solomon B. Miner was appointed secretary and Timothy Porter treasurer. Mr. Coe, having completed his term of service in the Wolcottville Company, removed to Waterbury in the fall of 1845, and at once gave his energies to the forwarding of the erection and equipment of the mill for the Waterbury Company. This mill was completed so that the first sheet brass was rolled Feb. 9, 1846. At the annual meeting, held early in 1846, he was elected secretary and treasurer, Israel Holmes

being the president. Mr. Holmes and Mr. Coe were the only practical brass-manufacturers in the Company, except Messrs. Brown and Elton, both of whom were engaged in their own business, and only invested capital. Mr. Holmes, though officially at the head of the Company, really superintended the internal operations of the mill and took charge of the men. The executive business devolved on Mr. Coe; and this continued to be his task throughout the period of his connection with the Company. At the annual meeting in 1846 the stock, which had been fixed at the beginning at \$40,000 was increased, by additional subscriptions, to \$50,000. Two years later it was increased to \$78,000; in 1852, to \$208,000, and in 1853 to \$250,000.

At the annual meeting in 1853 Mr. Holmes resigned his office as president, and Mr. Coe was elected in his place; and his brother, Russell A. Coe, was chosen secretary and treasurer. On the 31st of October, 1855, Mr. Coe resigned his office as president, being succeeded in it by John P. Elton, and was again elected secretary and treasurer in place of his brother, who had resigned. At the annual meeting in 1857 the capital stock was increased to \$300,000.

In 1862 Mr. Coe resigned the office of secretary, and on May 1, 1863, that of treasurer, at the same time disposing of his stock in the Company. For some time the Wolcottville Brass Company had not been prosperous; and the heirs of John Hungerford, who died in 1858, wished to dispose of the property, in which they held the largest interest. Mr. Coe purchased it; and he at once organized a company, with a capital of \$100,000, and associated with him several gentlemen prominent in the brass and kindred industries. To this Company, to which Mr. Coe gave his own name, he devoted his best energies and experience. The nominal capital has been increased to \$325,000, and the Coe Brass Manufacturing Company has taken position as one of the large brass industries of New England. The mill was at first devoted to the manufacture of brass sheet and wire, and of German silver. With diminished profits in it, and a demand for more profitable specialties, Mr. Coe has, for the last few years, withdrawn wholly from the manufacture of the latter article. His attention was early drawn to foreign markets, and he has opened a large trade, especially with Russia and Spain. His manufacture of brass for metallic cartridges has progressed rapidly within the past few years. For the saving of waste metal, and diminishing the cost of freight, he has recently put the metal through the first stage of the cartridge manufacture, the striking of the blanks or cups. Under his management the production of the mills has steadily increased, and they have been worked to their full capacity.



Van Slyck & Co Boston



Respy Yours

J. Van Slyck



Wm. Lloyd Garrison



L. W. Coe.

SAMUEL COLT.



HE name of Samuel Colt is naturally associated with the invention and introduction of the revolver; although there is to be seen in the United Service Museum, in London, a revolving fire-arm of the time of Charles I., called, in the phrase of the period, "a snap-haunce, self-loading petronel."

Samuel Colt was born in Hartford, Conn., July 19, 1814. His father was Christopher Colt, a manufacturer of cotton and woolen fabrics. In his eleventh year Samuel was sent to his father's factory, at Ware, Mass., where he spent most of his time for three years; occasionally, however, attending school and working on the farm. At the end of the third year he returned to his studies for a while at the academy at Amherst, Mass. But, while he learned rapidly whatever he chose to study, his bent proved not to be in this direction: and his father sent him to sea, as a sailor before the mast. After his return home, he again went to the factory at Ware, and devoted himself particularly to the dyeing department, the manager of which was a practical chemist. Here he acquired a knowledge of chemistry, which he afterwards reduced to practical use. In the spring of 1832 he again left home to seek his fortune; and one of his projects was the construction of a new pistol. A love for fire-arms had been one of his boyish passions. When but seven years of age he had been discovered one day taking a small pistol apart and putting it together again. He made the wooden pattern of his first idea of a revolver on his voyage to Calcutta, in his seventeenth year. This was a combination of long barrels, rotating on a spindle. A similar combination, manufactured after Colt's revolver had become popular, was known as the "pepper-box" pistol. Another project, conceived while making experiments in chemical mixtures at Ware, was the use of electricity for submarine purposes.

It was the development of these two ideas that he now, at eighteen years of age,

decided to attempt. To secure the needed money, he delivered some lectures, for which he had been fitted by his chemical course at Ware, and succeeded in thus raising some funds. About this time he deposited a description of his revolver in the United States Patent Office. The next year he ceased lecturing for a time, and, while at Baltimore, made both a pistol and a rifle on the revolving principle. In 1835 he went to Europe, and obtained his first patents for a revolver in England and in France. Returning home in January, 1836, he obtained his patent in the United States on the 25th of February, 1836. He had already enlisted the interests of New York capitalists. A company, styled the "Patent Arms Manufacturing Company," was chartered by New Jersey, with a capital of \$250,000; and a manufactory was established at Paterson, in that State. The patents were conditionally assigned by Mr. Colt to the company, for a fixed royalty of from one to two dollars on each arm produced, and a nominal salary for superintendence. His next step was to secure the adoption of the arm by the United States. A resolution was passed by the United States Senate, on Jan. 21, 1837, authorizing the Secretary of War to appoint a board of officers to try several new inventions in fire-arms, among them Colt's revolver. The board consisted of eight army officers. It reported in the following September unanimously on the Colt's revolver, that, "from its complicated character, its liability to accident, and other reasons, this arm is entirely unsuited for the general purposes of the service."

Soon after the breaking out of the Seminole War, in 1838, Mr. Colt went South with samples both of his rifles and pistols, to obtain, if possible, an actual trial. He interested Colonel Harney in his inventions; and that officer applied to his brigade commander, Colonel Twiggs, to procure the appointment of a board to report on the efficiency of Colt's rifles. Their report was favorable, and fifty rifles were purchased. The arms slowly pushed their way into use. Meanwhile, Mr. Colt's necessities compelled him to sell his patents to the Patent Arms Manufacturing Company; and in 1842, finding the sale very limited, the Company was compelled to wind up its affairs. The production of the arms now wholly ceased, and was not resumed until 1847.

During these five years Mr. Colt applied his energies and inventive talents to a new purpose, viz., the use of electricity for submarine purposes, especially for the explosion of a submarine battery. In order to test the practicability of his invention for igniting explosives under water, he applied to the Government to lend him condemned vessels to be blown up, and, in the event of his success, to refund him the cost of his experiments, to the amount of \$20,000, and pay him a royalty for his secret. After some delay he was employed by the War Department, in Mareh, 1842, in experiments for this purpose. On July 4, 1842, an exhibition was publicly made in New York Bay. The old gun-boat "Boxer" was blown up by a torpedo,

ignited by an electrical battery on the deck of a man-of-war stationed at a suitable distance ; and, on Aug. 20, he completely destroyed a vessel five miles off, in the presence of the President and officers of the Departments of War and Navy. The result of these experiments was, that Congress, within a week, passed a bill appropriating \$15,000 for further trials of this submarine battery. Mr. Colt made further exhibitions of his defensive submarine system. In his last one, April 13, 1844, the destroying agency was applied to a vessel not anchored, but under sail at five knots an hour. It is claimed that Mr. Colt also originated submarine telegraphy. Telegraphy by land was first effected in 1837, and the first submarine cable successfully and continuously worked was that under the English Channel, in 1850 ; but, five years or more before, Mr. Colt had both established electrical communication between a battery on land and torpedoes under water five miles or more away, and had laid a regular telegraphic cable between the Merchants Exchange in New York and Coney Island.

Down to the breaking out of the Mexican War, Mr. Colt's labors had not brought him any adequate return. But in 1847 he received an order from the Government for one thousand pistols ; and from that time the tide of fortune ran in his favor. The stock of pistols at Paterson was soon exhausted, and he engaged a shop at Whitneyville, near New Haven. The facilities at this place becoming too restricted, he removed, in 1848, to Hartford, where he hired a three-story shop on Pearl Street. In 1849 he again went to Europe. Returning home, he found it necessary to obtain still larger premises for his increasing business. He purchased, in 1852, two hundred acres of unimproved land within the limits of Hartford, less than a mile from the State House, railroad stations and business center, and conveniently on the borders of the river. Mr. Colt built a dyke at an expense of \$125,000, with an embankment one hundred feet thick at the base, forty feet at the top, thirty-two feet in height from low water-mark, and two miles long. This was soon set thickly with willows, the roots of which, becoming matted together year by year, increases its strength. Having thus prepared his land, Mr. Colt began his armory in 1854. The buildings are of brick, ornamented with Portland freestone, and consist of two parallel structures, four stories high, five hundred feet long and sixty wide, connected at their central parts by a third structure, of the same height, and fifty feet wide. Between the main buildings, and parallel to them, extending in either direction from the cross buildings, and at equal distance with the main building, are two structures fifty feet wide. The motive power is supplied by six steam-engines of four hundred and fifty aggregate horse-power. On Feb. 4, 1864, the east building was destroyed by fire ; but it was rebuilt in 1866-7.

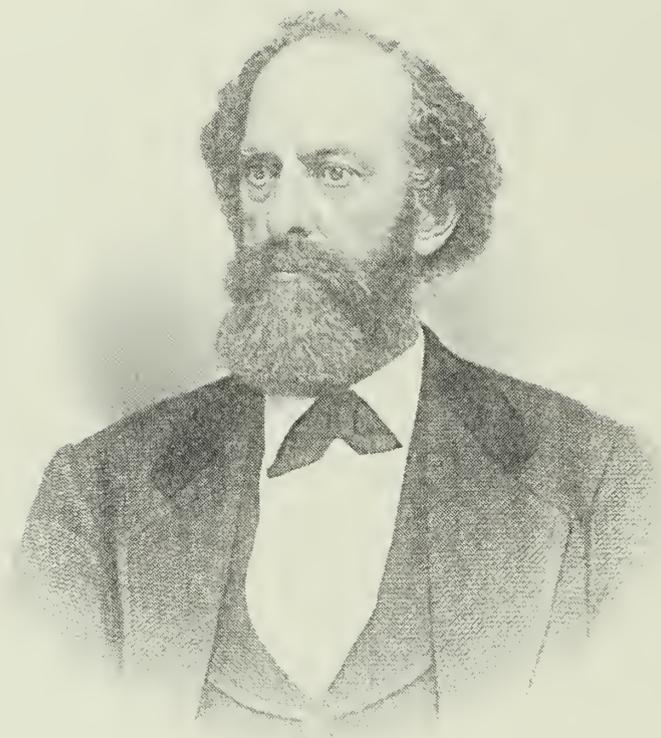
The different armory buildings contain fifteen hundred machines, most of them

invented and constructed in the establishment. These machines make all the parts of the arms, which are worked to gauge, so as to be interchangeable. Besides the exactness and uniformity thus secured, they are submitted to a rigid inspection.

The business was incorporated in 1854, as Colt's Patent Fire Arms Manufacturing Company, with a capital of \$1,000,000; and, with the establishment of the armory and the organization of the company on a corporate basis, Mr. Colt's labors in the establishment of the home industry virtually ceased. In the spring of 1854 he visited England, and was invited by a committee of the House of Commons on small arms to testify as an expert. The next year he visited Russia, and was received with honor by the Imperial family.

Mr. Colt married, in June, 1856, the daughter of Rev. William Jarvis, D. D., of Middletown, Conn. Of his four children, but one survives. In 1857 he erected, in the suburbs of Hartford, a fine mansion, and laid out an extensive estate known as "Armsmead." In the winter of 1860-61 he spent some time in Cuba, in consequence of a severe attack of illness. This proved of a temporary benefit; but the ensuing Christmas he was again attacked more violently, and he died on Jan. 10, 1862. At the time of his death he was in his forty-eighth year.

Down to the close of the War of the Rebellion, the business of the armory was exclusively the manufacture of arms. Mr. Colt's patents having expired, a competition had grown up; and, under the stimulus of the war, the demand had become enormous. On the return of peace it became necessary to devote the facilities and resources of the armory, in part, to other departments of manufacture. Among its present productions are the Gattling battery-guns, which, since 1867, have been exclusively manufactured there. The large metallic cartridges used in this gun are also made at the armory in large quantities. In 1870 the manufacture of the Baxter steam-engine was commenced; in 1873, the Universal printing-press; and, later, the "bell-punch," now generally adopted on all street railroads throughout the country.



1854

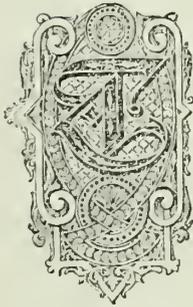
Van S. & Co. Boston



P. Corbin



PHILIP CORBIN.



THE manufacture of builders hardware and similar articles has, within the past twenty-five years, become an important specialty of industry in western Connecticut. The ingenuity of manufacturers has been incited, by competition, to arrange new devices, to secure greater convenience or safety, and to invent more artistic ornamentation. The result has been the substitution for plain articles, others that are equally or even more useful, and, at the same time, are the means of adornment. In this class of builders hardware, a prominent position has been attained by P. and F. Corbin, of New Britain, Conn.

Philip Corbin, the founder of the business of this firm, was born at Willington, Conn., Oct. 26, 1824, and is descended from James Corbin, one of the forty men who settled Woodstock, Conn., in 1686. Most of the settlers were from Roxbury, Mass., but James Corbin was from Muddy Brook, now Brookline. Thirteen of the forty left Roxbury, April 1, 1686, and are referred to in the first Book of Records of Roxbury, as "the men who went to spy out Woodstock." James Corbin and his son Jabez were the first traders of the infant settlement; and "James Corbin's cart," which made periodical trips to Boston, carrying furs and turpentine, and bringing back groceries and other domestic articles, is often referred to in the early records of the town. On the occasion of an apprehended attack of the town by the Indians, who had nearly destroyed the adjoining town of Oxford, Mass., the return of "the cart," with a supply of ammunition, was anxiously looked for, and its safe arrival was hailed with joy.

Philip Corbin's father, whose name also was Philip, was a farmer of small means, and his six boys, during the long intervals between the short school terms, aided in the farm work. This training developed in them vigorous physical frames, industrious habits, self-reliance and enterprise, which largely counterbalanced the disadvantages of their limited education.

When Philip was seven years of age, his father removed to West Hartford, Conn., where he had purchased a farm, on which he still resides. Besides attendance on the district school, Philip was a student, for three terms, at the West Hartford Academy.

From the age of fifteen to that of nineteen years, he was employed in farm-labor away from home, performing the full work of a man, and earning a man's wages, which were, however, received by his father. At nineteen, he resolved on a change of employment. He had a decided mechanical taste; and, in March, 1844, he went to New Britain, already a thriving center of mechanical industries. He first obtained work in the factory of Russell and Erwin, where he remained three months, and then entered the lock-shop of North and Stanley, in which he obtained employment from one of the contractors, working as a boy wherever his labor could be made available. There was in the shop, at this time, a workman who had learned the trade of a lock-smith in England, and who was skilled in the best and most intricate work. Young Corbin was ambitious to obtain a thorough knowledge of the business, and so engaged with this man on job-work, out of the regular hours of labor, to be paid or not, according to the value of his work. He soon became quite expert; and in January, 1845, when he was a little more than twenty, and though he had only been at work ten months, he felt competent to undertake a contract on his own account. He made his bid, obtained the contract, and fulfilled it to the satisfaction of the firm. The next year he got a second contract. At this time his brother Frank, who was born at Willington, in 1828, and who was now seventeen years of age, came to New Britain, and Philip at once received him into a partnership in the contract. They thus realized more than they could have done by working on wages. Each of them, until attaining his majority, retained, for his own use, only enough to defray his personal expenses, giving the balance to their father. Their work by contract for North and Stanley, continued till Jan. 1, 1849.

The brothers now entered into partnership with Edward Doen, under the style of Doen, Corbin & Co., and built a small shop at the east end of the town. They fitted this up with machinery, run by horse-power, steam-power having been introduced only to a limited extent. Their joint capital was nine hundred dollars. At the end of six months, Mr. Doen's interest in the firm was purchased by Henry W. Whiting, father-in-law of Philip Corbin, and the firm-style was changed to Corbin, Whiting & Co. This partnership continued one year, when Mr. Whiting retired, and the firm-style was once more changed to P. and F. Corbin. By 1853 the business had rapidly increased; and in that year it was organized as a joint-stock company, retaining the name of the firm. Besides the brothers Corbin, Frederic H. North, Oliver Stanley and John M. Spring were the stockholders of the

new corporation. The first officers were Frederic H. North, President; Philip Corbin, Secretary; and Frank Corbin, Treasurer. Philip Corbin was elected treasurer in 1856, in place of his brother, who went to New York to establish an agency of the Company; and Charles Peck purchased stock and was elected secretary, which position he still fills. He was a member of the Peck and Walter Manufacturing Company, of New Britain, which was one of the old Builders Hardware Manufacturing Companies, having succeeded to the firm of Peck and Walter, of which firm the father of Charles Peck was the senior partner. The Peck and Walter Manufacturing Company discontinued business at this period.

The same fraternal interest which led Philip Corbin to associate his brother Frank with him in his early contracts brought the younger brothers, each in turn, gradually into a share in the business. In 1853 Waldo Corbin, then thirty-one years of age, who had been working for his brothers, became a stockholder. He died in February, 1874. In 1852 William, then sixteen years old, entered the shop as an apprentice, and made such rapid progress that, in two years, he was appointed superintendent of the factory, which position he held until his death, in 1860. John M. Spring, who entered the employ of P. and F. Corbin as a common workman in 1851, and became a stockholder at the organization of the Company, was appointed superintendent, as the successor of William Corbin, and has held the office till the present time.

Frank Corbin having, in 1854, established the agency of the Company in New York, continued in its charge till 1860, when he sold his interest, and engaged in other business till 1868. He then returned to New Britain, and resumed active relations with the Company, taking general charge of the sales-department. He was succeeded in the agency by Andrew Corbin, who had been engaged in the manufacture of jewelry from 1854 to 1858, when he joined his brother Frank in New York. He remained in charge of the agency until 1872, when he became the general manager of the manufactory at New Britain. The youngest brother of the family, George S. Corbin, entered the packing-room at the factory as a boy, in 1852; and, in 1854, he went with Frank, to the agency at New York, where he still remains, having succeeded his brother Andrew in 1872.

The business of Doen, Corbin & Co., succeeded by Whiting, Corbin & Co., and then, in 1850, by P. and F. Corbin, as has been stated, was started in a small shop at the eastern part of the town; and their small amount of machinery was operated by a wheel turned by a horse. In 1851 the firm hired a room in what was then known as the Hook and Eye Shop, of North and Stanley, which stood on the site of the present west wing of the main factory of P. and F. Corbin, and nearly on the site of the original shop of Seth J. North, to whose enterprise the town owed much

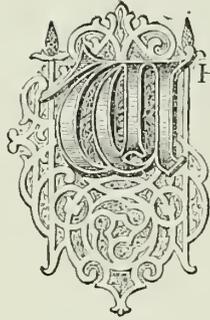
of its early development. The site is now included within the area owned and occupied by P. and F. Corbin. The whole building was soon needed by the increasing business; and, in 1855, they hired a part of the adjoining factory, known as the "Knitting-mill,"—a substantial brick building, 100 by 45 feet, and five stories high. It now constitutes the middle portion of the front factory. The business gradually absorbed the whole of the building; and, in 1864, the Company purchased this building, with a considerable area of land, from North and Stanley, and a building immediately east of the Knitting-mill, known as the Burritt House.

A substantial brick iron-foundry, 112 by 40 feet, was built in 1865. Three years later the Burritt House was moved off, and the main factory was extended seventy feet eastward. A similar extension westward was made by North and Stanley, and was occupied by them. This western extension was purchased by P. and F. Corbin, in November, 1876. The front building, thus completed, is tasteful, and appropriate to its purpose. Additional buildings have since been erected. The iron-foundry has been extended to nearly three times its original size, its present length being about three hundred feet. In 1875, in place of the old brass-foundry, a new brick building, 140 by 60 feet, was erected, in which were introduced all the modern improvements. The Eames Patent Molding Machines have been introduced into both foundries, adding more than one-third to their productive capacity with the same number of men. Improvements in machinery, with the enlargement of the old, and the erection of new buildings, have increased the capacity of the establishment from seventy-five men at the organization of the company, in 1853, and from two hundred men in 1865, to eight hundred men at the present time, when in full operation.

It was the aim of the Messrs. Corbin to engage in a line of business distinct from that of any of the manufacturers around them, and in competition only with foreign imported goods. The first articles made were ox-balls, for tipping the horns of cattle, window-springs, lamp-hooks, and similar articles; and in these they soon attained a profitable business. They adhered to their proposed line of manufacture, until others in the vicinity engaged in the same lines of manufacture. They determined, then, to enter the fields they had previously avoided, and began the manufacture of hinges, latches, bolts, locks and miscellaneous hardware for building purposes. They at first contented themselves with making the plainer and cheaper goods, in which other concerns had for years been plodding along; but, in 1868, they struck into a new path, and began to make more ornamental and more expensive goods than had before been in the market. These included hinges, knobs, escutcheons, and other door-trimmings, mostly bronzed. The Corbins were the first to use, in this speciality of manufacture, the bronzing process, patented by Hiram

Tucker, of Boston, which soon became popular in the lamps, gas-fixtures and other ornamental goods of the Tucker Manufacturing Company. They have supplied not only private purchasers, but many public and government buildings, including all the bronze hardware for the new State, War and Navy Department buildings at Washington; for the Post-Office and Sub-Treasury building at Boston; and for other buildings erected in Boston since the great fire, and in New York and other large cities, for mercantile, banking and insurance purposes. To them was awarded the contract for supplying hardware for the new capitol of Connecticut. To meet this demand, a large corps of the best workmen, of inventors, designers and pattern-makers, is employed in the production of articles novel in device, and artistic in design. All the stockholders of the Company, except the members of the firm of North and Stanley, who invested capital at the outset, and have never had any active relations with its business, are employed in some capacity, and, with the exception of Messrs. Peck and Spring, the former the secretary, and the latter the superintendent of the factory, are brothers. They combine the enterprise, energy and mechanical skill which marked Philip Corbin.

GEORGE H. CORLISS.



WHEREVER manufacturing industries are pursued the name of Corliss is known. Those features which give the "Corliss Engine" its distinctive character form the greatest improvements in steam motive-power since the days of Watt. George H. Corliss, the inventor of this engine, was born on June 2, 1817, in the town of Easton, Washington County, N. Y. His father, a native of the same town, was born in 1793, and died September, 1877. He was a physician, active in the practice of his profession at the age of fourscore years; and so well were his physical and mental powers preserved that, even at that advanced age, he performed successfully the most difficult surgical operations.

In 1825 Dr. Corliss removed to Greenwich, in the same county — a town on the Battenkill, about thirty-five miles from Albany. Young Corliss attended school here until he was about fourteen years old. He then entered the factory store of William Mowry & Co., whose cotton-factory was the first built in the State of New York. In the store young Corliss was a sort of general clerk, book-keeper, salesman, and inspector of the cloth manufactured in the mill. After some years of this service, a strong desire for a more liberal education took such thorough possession of him that his father yielded to his persuasions, and allowed him to enter an academy at Castleton, Vt., which he attended for about three years. At intervals during this time he was employed in the Mowry store, and at the end of his academic days he opened a country store in Greenwich. This was in 1838, when he was scarcely twenty-one years old. In the following year he was married. Though moderately successful, he became tired of the monotony and limited scope of his business, and sold his stock, with the intention of following the same avocation at one of the commercial centers.

It is remarkable, considering Mr. Corliss's subsequent career, that up to this

time he had never seen the inside of a machine-shop, and had shown no propensities for invention. He seems, however, to have had the intuitive perceptions necessary to a successful adaptation of means to an end, which needed only the stimulus of an emergency to develop and bring into full play. Such an emergency arose at Greenwich, when he was eighteen years old.

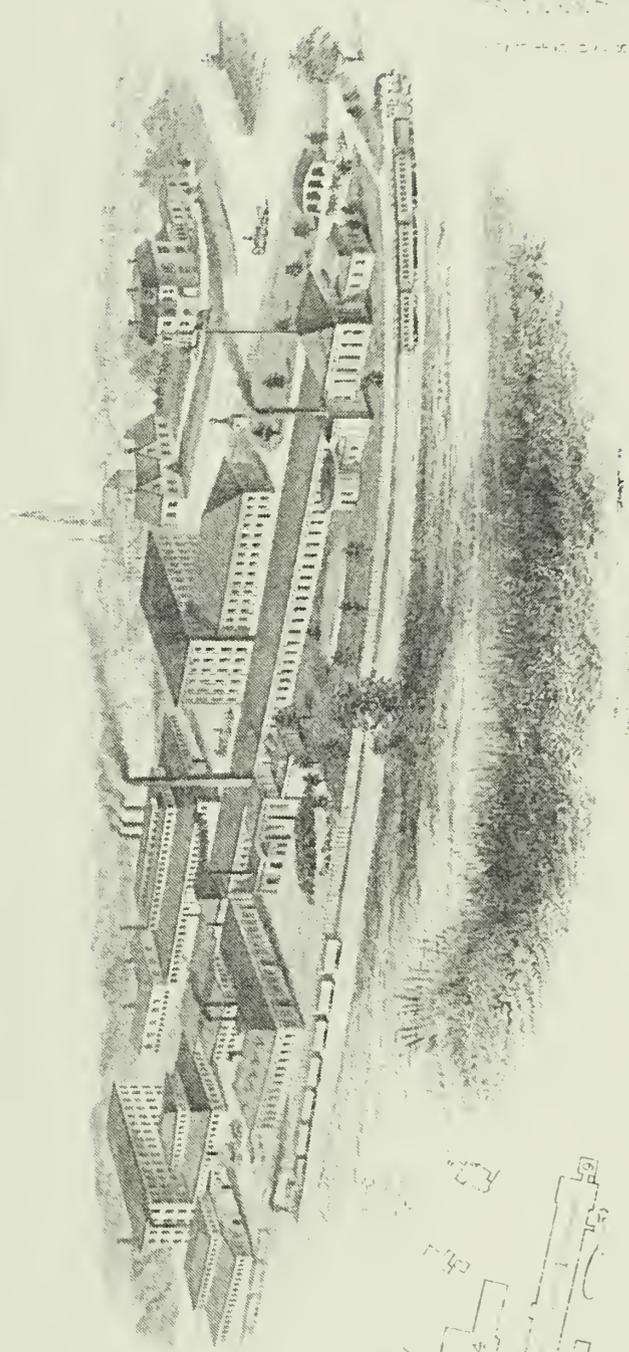
Greenwich was divided into two sections by the Battenkill, and the ice brought down by a spring freshet carried away the only bridge that united the town. There were no means of communication left, and the loss of the bridge was a serious inconvenience to the entire town. At a meeting of the prominent citizens they decided that a temporary bridge was impracticable, and adopted a plan for building a scow, to ferry passengers and teams across the stream. Young Corliss, regarding this project as falling short of the demands of the occasion, devised a plan for a bridge, drew up a subscription, raised fifty-five dollars, and with the volunteer services of the farmers and working-men, who were his enthusiastic supporters, in ten days the bridge was built which stood for six months and carried with perfect safety everything that had occasion to pass over it. The structure was nearly eight rods long, and was erected during the high water over a rapid stream. This unselfish public deed gave him his first experience of what it was to have personal enemies. The leading men of the town, who had publicly declared the impracticability of building a temporary bridge, could never forgive him for his presumption in differing from them on that question.

Among the various kinds of merchandise which Mr. Corliss kept in his country store, boots and shoes became an important item; and it was this circumstance which eventually gave shape to his course in life. The complaints of his customers about the workmanship of the ready-made shoes impressed Mr. Corliss with the idea that machinery might be used in their manufacture which would prove a public benefit, yet with no thought then of giving it concrete form. But the leisure which the closing up of his business gave Mr. Corliss led him to embody in a working machine the various intuitive conceptions which had before carelessly engaged his mind. At an expense of about one hundred dollars, Mr. Corliss constructed a machine which would make twenty stitches a minute in heavy leather; and this was before the invention of the original "Howe machine." Even then the subject of this memoir had no serious intention of devoting himself to mechanical pursuits, but looked upon his machine as the fruit of a recreation rather than of legitimate business. However, as time went on, Mr. Corliss found himself applying his inventive powers to the development of the sewing-machine; and the manufacture of his machinery, when it took the form of iron and steel, introduced him to the machine-shop; and thus he found his way into the steam-engine business.

In 1844 Mr. Corliss became a resident of Providence, R. I., where he has continued to reside. In February, 1848, being then associated with John Barstow and E. J. Nightingale, and doing business under the firm-name of Corliss, Nightingale & Co., he completed and started a steam-engine which embodied the essential features of his unequalled improvements in steam-engines. This engine made the first practical exhibition of the value of these improvements while driving two hundred and sixty horse-powers. During the following month land was purchased for the site of the present works of the Corliss Steam Engine Company. Mr. Corliss was his own architect and engineer in designing and constructing the buildings, and secured so convenient an arrangement of the several departments that it has stood the test of thirty years' experience. The works and grounds present a neat and well-ordered appearance rarely seen in establishments of the kind. The grounds have an extent of over nine acres, about one-half of which is covered with buildings, while the rest of the space is devoted to lawns and drives, ornamented with shade-trees.

Although the works have a capacity of employing one thousand men, this fact fails to show the magnitude of the establishment or business, so ingenious and practical are the labor-saving appliances. The works have turned out single castings which demanded 72,000 pounds of molten iron in pouring them; a bronze casting has been made here, the pouring of which required in one molten mass 43,000 pounds of copper, 5000 pounds of tin and 1000 pounds of zinc; and shafts twenty inches in diameter, weighing over 22,000 pounds each, have been forged from scrap-iron. On the other hand, the smallest pins and bolts are manufactured on the premises, and, indeed, everything entering into the construction of a steam-engine. In the different departments there are eleven foremen, whose average time of service in the establishment is about eighteen years.

Mr. Corliss began the development of his inventions in 1846, at about the time he became a partner in the business. His letters-patent were granted on March 10, 1849. Before that time the response of an engine to an increase or diminution of the resisting force, as of the machinery whose movements it governed, had been imperfect. The result was a great loss of power, and also a serious inconvenience; absolute uniformity of speed being demanded for many kinds of mechanical work, and important for all. This desired result is so perfectly accomplished by the Corliss Engine that, if there be one hundred looms in operation in a factory, and all but one of these be suddenly stopped, the motive-power will respond as instantly as the hand does to the will of the brain, and the one loom will keep on working at the same uniform rate as when its ninety and nine sisters were clattering in company.



CORLISS STEAM ENGINE CO.

PROVIDENCE, R. I.



THE CORLISS STEAM ENGINE CO.
 PROVIDENCE, R. I.
 1880

Previously, an approach to uniformity was made by connecting the governor with the throttle-valve. But this connection, by imposing upon the governor the work of moving the valve, greatly impaired the efficiency of the former, through reducing the sensitiveness which makes it, as it were, the nerve of the engine; but the most obvious drawback of the old system lay in the fact that the steam, in passing through the appliance for regulating the speed, was deprived of more than one-half of its available force: in other words, it took about twice as much steam to do the same work as is now required with this improved method of regulation.

Mr. Corliss made a radical change in the application of steam for manufacturing purposes. He abolished the throttle-valve altogether, and adopted a method of automatic adjustment through the action of the governor on the valves controlling the point where the steam was shut off from the cylinder. This adjustment occurs twice at every revolution; so that in large engines, making thirty revolutions a minute, the quantity of steam admitted to the cylinder (that is, the degree of power imparted) is regulated sixty times a minute; while in smaller engines, making sixty revolutions, the adjustment takes place one hundred and twenty times a minute. The extreme nicety of this regulation may easily be perceived; and, although the governor regulates, it does no work itself, but simply indicates to the levers moving the valves the work to be done, the only force which it exerts being simply that which is needful to move a small cam or stop. There is the least possible amount of friction in this action, the cam or stop presenting no resistance to the governor excepting at the moment when it touches the lever which forms its fulcrum.

In all previous engines there had been a great waste of steam, and, consequently, of fuel. This waste was caused by admitting the steam into the cylinder at a diminished degree of pressure, in consequence of the partial opening of the throttle-valves. The reduction in the expansive force of the steam thus brought about is technically called "wire-drawing." But in the Corliss engine, the throttle-valve being dispensed with altogether, the steam-valves are caused to open and close suddenly at the proper instant, thus biting off the steam in the same condition in which it leaves the boiler, admitting it into the cylinder at substantially the same tension as when generated, in this way saving and using its entire expansive force. Thus two important results were obtained by a single stroke of engineering skill. As Hon. William H. Seward said in his argument in the United States Circuit Court, at Cooperstown, New York, on Aug. 3, 1853: "To sum up the matter, the regulation of the engine is made perfect by the peculiar way of combining the governor with the cut-off, and the cut-off is made perfect by the automatic adjustability secured by that connection."

Setting aside the great advantage of the marvelous uniformity of speed which it has obtained, the saving in fuel made by the Corliss Engine since its introduction

amounts to millions of dollars. Its leading features have been adopted by engine-builders in all parts of the world. In 1870 the petition of Mr. Corliss for a renewal of his patents was supported by manufacturers using his engines in the aggregate amount of over forty-five thousand horse-powers.

His engines had been substituted for the best engines of previous construction, and in no instance had the result in the saving of fuel been less than thirty per cent. In 1870 the value of the invention to the users of his engines in the United States was over two million of dollars a year. Upon the basis of results secured, Mr. Corliss proved, in his petition for a renewal of patents, that the introduction of his improvement in a single cotton mill of 40,000 spindles, requiring four hundred and fifty horse-powers, effected an annual saving in fuel amounting to more than what his annual receipts from the invention had been ; and the cotton-machinery operated in this country by engines embodying his improvements was more than equal to seventy such mills. An instance is recorded of one corporation which had, from 1848 to 1870, profited \$228,480 by the use of his engine, which was more than he had ever received from his patents. Another corporation had actually saved, during fourteen years and four months, in the item of coal alone, \$190,705.

Mr. Corliss had much to contend with in the introduction of his engine. His efforts, generally, at first only stimulated an attempt to accomplish the results that he proposed to secure by his improvements, by the owners and builders of the old style of engines repairing and readjusting them, and in some instances changing their boilers. A Philadelphia mill, turning out three hundred and fifty barrels of flour a day, after spending about two years in this way, was furnished by him with a new engine at the regular market price, stipulating, under forfeiture, to manufacture with this engine one hundred and forty-five barrels of flour with the same amount of fuel, which, with all the improvements they could bring to bear, had been required for producing one hundred barrels. Within thirty days one hundred and forty-seven and one-half barrels were reported as the actual result. In another case, that which he promised in order to secure the adoption of his invention was equivalent to the gift of the entire engine of two hundred and fifty horse-powers, for less than two years' saving in fuel alone ; and what was actually realized in increased work and improved regulation was, in about fifteen months' service, equivalent to the entire cost of the engine.

Besides the difficulties which grew out of competition, and a conflict of interests and deep-seated prejudices, another obstacle was that the Corliss engine had a new vitality and effectiveness which demanded new forms of construction, whereby adequate strength would be secured. In the nature of things, the machine could not evolve the new power and efficiency put into it without a correspondingly large

increase in its powers of endurance. To have put these improvements into an engine as then ordinarily constructed would have been like putting a Flemish draft-horse into a harness adapted to a Shetland pony. Hence, the necessity for an entire reconstruction of the steam-engine. To this task Mr. Corliss applied himself—with what result is shown in the fact that leading engine-builders throughout the world seek to associate his name with the products of their works.

Still another obstacle in the way of the introduction of the new engine was the long-continued and harassing litigations which were forced upon Mr. Corliss, beginning in 1850 and ending in 1865, involving an outlay on his part of over one hundred thousand dollars, and monopolizing at least one-third of his energy and time during a period of fifteen years. The final result of all this was a full vindication of his claims by the highest judicial tribunals in the land. Among his counsel were the Hon. William H. Seward, Ex-Judge B. R. Curtis, Judge Blatchford, Hon. E. W. Stoughton, Hon. Thomas A. Jencks, and the late Chief-Justice Ames. None of these being mechanical experts, they had to rely upon Mr. Corliss to instruct them in that department.

Nothing in the general conduct of his business is more to his honor than the steady persistency with which Mr. Corliss has refused to countenance anything looking like corruption and bribery in attaining his ends. The custom has prevailed among engine-builders to give commissions to engine-drivers and others in consideration of their influence in securing contracts; but Mr. Corliss has allowed contracts amounting to hundreds of thousands of dollars to go to other parties rather than secure them to himself by such means. And in his Government contracts, he has preferred to lose one hundred thousand dollars in interest by waiting patiently for the judgment of the Court of Claims in his favor, and its affirmation by the Supreme Court of the United States, rather than “retain” the doubtful persons who in Washington claim to have “influence.”

That the great service which Mr. Corliss has rendered the world through his invention is generally recognized is proven by the awards made to him at the Paris Exhibition of 1867, and at that of Vienna in 1873, as well as in the bestowal of the Rumford Medal by the American Academy of Arts and Sciences. At the Paris Exhibition he carried away the highest competitive prize, although there were in competition more than one hundred engines, the master-pieces of builders in all parts of the world. Mr. J. Scott Russell, a distinguished English engineer, and the builder of the steamship “Great Eastern,” was one of the British commissioners to this exhibition. In a report to his government, he gave his impressions of the Corliss engine in the following terms: “A mechanism as beautiful as the human hand releases or retains its grasp of the feeding-valve, and gives a greater or less dose of

steam in nice proportion to each varying want. The American engine of Corliss everywhere tells of wise forethought, judicious proportion, sound execution and exquisite contrivance."

The Rumford Medals were awarded to Mr. Corliss at a meeting of the American Academy of Arts and Sciences in Boston, on Jan. 11, 1870. In a letter dated July 12, 1796, addressed to John Adams, Count Rumford requested the Academy to accept five thousand dollars in United States stock, the interest to be applied to premiums to be given to the authors of the most important discoveries or useful improvements which shall be made in any part of the American continent, or in any of the American islands, on heat and light, the preference always to be given to such discoveries as shall, in the opinion of the Academy, tend most to promote the good of mankind; the premiums to be given in two medals, one of gold and one of silver, together of the intrinsic value of three hundred dollars.

In the speech of presentation, Dr. Asa Gray, the president of the Academy, said: "As this is only the fifth occasion since the foundation of the trust upon which this premium has been given, it may well be inferred that the Academy has in no case bestowed it inconsiderately. It has required the discovery or invention to be real, original and important. It is not restricted to considerations of direct practical benefit; but it may, as it did in the first instance, in the case of the oxyhydrogen blow-pipe, honor a discovery of much scientific interest, the uses of which are limited. It would not hesitate to crown any successful, however recondite or theoretical, investigation within the assigned domain, being confident that no considerable increase of our knowledge of the laws and forces of nature is likely to remain unfruitful. But the Academy rejoices when, as now, it can signalize an invention which unequivocally tends to promote that which the founder had most at heart, and commended to our particular regard—the material good of mankind."

Dr. Gray then went on to rehearse the grounds upon which the award had been made, saying that, in making such an entire change in the structure of the engine, Mr. Corliss had shown conspicuously his mastery of the resources of mechanism. "It appears," he said, "that, within the twenty years since the machinery was perfected, more than one thousand engines of the kind have been built in the United States, and several hundreds in other countries, giving an aggregate of not less than 250,000 horse-powers. . . . It is worth noting that, when these medals were voted to you, Mr. Corliss, just a century had passed since James Watt first patented his improvements of the steam-engine. The vast results of these improvements—the difference between the engine when Watt found it and when he left it—make one of the most important chapters in the history of applied science. It is a great thing to say, but I may not withhold the statement, that, in the opinion of those who have

officially investigated the matter, no one invention since Watt's time has so enhanced the efficiency of the steam-engine, as this for which the Rumford Medal is now presented to you. If Watt, or his partner, Bolton, could boast that they held the supply of that which almost everybody longed to have, power, you may justly felicitate yourself, and permit us to felicitate you, upon your ability to supply a greater amount of steam-power for the expenditure, and an exacter nicety in its governance, than any of your predecessors. In acknowledgement of this benefit, the American Academy, administering Count Rumford's trust, now, by the hands of its presiding officer, presents to you these honorable testimonials of its high appreciation of what you have done. And the Fellows here assembled join with me, I am sure, in most sincere and hearty wishes that you may long enjoy this and similar distinctions, along with more material rewards of your genius and skill—hoping, also, that these may still be fruitful in yet other inventions redounding to your honor and advantage, and to the promotion of the good of mankind."

In accepting the medals, Mr. Corliss made the following reply: "Competitive honors are the reward of effort stimulated by rivalry and ambition. But *this honor* comes from gentlemen who scan the whole field of science and art, and in deliberate council make their awards in the discharge of a sacred trust. To this consideration I add the historical associations connected with the American Academy of Arts and Sciences, and the scientific fame of its members; and I receive this testimonial with grateful acknowledgement of a distinguished honor."

The award of the Grand Diploma of Honor from the Vienna Exhibition of 1873 was a distinction exceptionally noteworthy, from the fact that Mr. Corliss sent neither engine nor machinery of any kind to Vienna, nor did he have anyone to represent him there. Foreign builders had sent engines claimed to be built on his system, they having adopted his ideas and placed his name on their productions, since his mode of construction was demanded by their customers. The international jurors, among their instructions regarding the highest honors at their disposal, received the following: "The Diploma of Honor is to be considered as a particular distinction for eminent merits in the domain of science, its application to the education of the people, and its conducement to the advancement of the intellectual, moral and material welfare of man." Mr. Corliss was the only person who received a Diploma of Honor without being an actual exhibitor.

In February, 1872, under the Act of Congress providing for a celebration of the one hundredth anniversary of American Independence by an International Exhibition at Philadelphia, Mr. Corliss was duly appointed Commissioner for the State of Rhode Island, and was chosen one of the Executive Committee of seven to whom the Centennial Commission intrusted the responsibility of the preliminary work. In

less than thirty days the Executive Committee, on the suggestion of Mr. Corliss, adopted a scheme of an auxiliary body, to be known as the "Centennial Board of Finance." The original draft for an Act of Congress creating that Board is in Mr. Corliss's handwriting. This measure is generally recognized as the turning-point in the fortunes of this great enterprise, and is so characterized in the addresses made at the closing ceremonies of the Exhibition.

In January, 1875, the subject of providing motive-power for the Machinery Hall came before the Executive Committee for consideration. Mr. Corliss submitted plans for a GRAND CENTRAL STEAM ENGINE of fourteen hundred horse-powers, proposing that it should be so arranged as to form an attractive feature of the Exhibition, while it was to be utilized as the moving-power of this department.

The Executive Committee were unanimously in favor of its adoption; and Mr. Corliss offered to furnish such an engine, but with the distinct understanding that no machinery embraced in the plan, or put on exhibition by him in any form, should become the subject of a competitive award. He also made it a condition that the plan should receive the concurrent approval of the Board of Finance. It was soon made apparent that the Board was not favorable to the plan. Engineers of high repute had impressed them with the idea that it was not safe to trust the work to any one engine; that the gearing would be noisy, troublesome, and liable to breakage; and that the expense would be largely in excess of the means available for such a purpose.

Mr. Corliss immediately withdrew his proposals; and, on his suggestion, circulars were issued to builders of steam-engines, boilers and shafting throughout the country, inviting proposals for furnishing the machinery in sections.

After months of waiting, it was found that the combined power of all the machinery offered fell short of the requisite amount; the Commission had no money to purchase additions; and the shortness of the time that remained, and the incomplete plans for Machinery Hall, increased the perplexities of the situation.

At the urgent solicitation of friends, and in compliance with a unanimous vote of the Commission, Mr. Corliss, in this emergency, sharing the anxieties, and feeling the responsibilities of the Commission, of which he was a member, came forward and assumed the burden of this great work with the entire responsibility for its successful working.

The cost of this undertaking over and above all the aid furnished by the Commission, or any other source, amounted to over \$100,000, making it the most princely contribution ever made by any one individual to an International Exhibition. It included not only the furnishing of the engine of fourteen hundred horse-powers, but also all boilers, pipes, shafting and gearing, foundations and trenches for acres of space, all transportation expenses, the setting up and operation of the machinery,

together with the superintendence and care of the work, from the commencement of manufacture to the close of the Exhibition.

No better evidence of the superior resources of the Corliss Works could be given, than is furnished by the construction of this engine, which, with the boilers, shafting and appurtenances, made from new designs and from crude materials, was, in nine months and twenty-six days, manufactured, transported about three hundred miles, and set up ready for use. The first pencil sketch of the machinery was made by Mr. Corliss, June 14, 1875, and the last piece was shipped to Philadelphia, March 22, 1876; nineteen days from which date, and exactly at the time promised (thirty days before the opening of the Exhibition), the engine was started, in the presence of a large concourse of spectators; and the fact was telegraphed throughout the world that motive-power was ready for all who were intending to exhibit in the Machinery Hall. This prompt initiatory movement had much to do with the unprecedented advanced state of the preparations for the opening day of our International Exhibition.

The fact was scarcely realized that more personal labor, careful planning and special adaptation for new conditions were bestowed upon those things which were excluded from sight, than were involved in all the conspicuous things which were in view. Over two thousand tons of masonry and building-material had been carefully laid beneath the aisles and avenues of the great hall, to hold in secure position the several bearings upon which were continually revolved not less than 365,000 pounds of shafts, gears and pulleys. Mr. Corliss was well aware that the whole work was to be subject to the criticisms of the engineering world, without a chance for previous trial or opportunity for reconstruction, on account of the limited time allowed for the work; and every detail, however seemingly insignificant in itself, had to be arranged as carefully as though the question of success or failure depended wholly on its fully meeting its purpose. So immense were the distances, in Machinery Hall and its adjuncts, to be traversed by the connected appurtenances of this engine, that special arrangements, not called for in ordinary practice, were demanded to meet the expansion and contraction of the metals entering into their construction. The pipes connecting the engine and boilers were elongated *five inches*, by the introduction of steam and the increased temperature incident thereto; and so great were the distances between the connections of the shafting that the ordinary atmospheric changes would have thrown the gears so much out from their original proper setting as to make smooth running an impossibility. All these contingencies were thought of, and so provided against by Mr. Corliss, that observations made at regular periods failed to detect the slightest change in the position of the various parts.

The general plan involved the use of numerous heavy cog-wheels. The art of constructing such wheels was in such state that, throughout the Old World and the New, the judgment of constructing engineers was against their employment as a means of transmitting power where any other means could be made available. Indeed, there was no machine in existence, when this work was begun, equal to the demands of the occasion. It had to be invented, constructed, and its products turned out, within a limited time, for a public demonstration on a gigantic scale. With what success this effort was attended is already a matter of history.

All this vast and complicated system was the result of Mr. Corliss's personal labor. He originated, and gave definite lines to, every design, and fixed the proportions of every detail.

It was, indeed, a tribute to the genius of Mr. Corliss, that neither the treasures of the Art Galleries, nor the brilliant display of gorgeous color, rich material and unique design which the whole world had poured in upon the twenty acres of the Main Exhibition Building, in the least overshadowed or obscured the artistic elements which he embodied in a practical motor of fourteen hundred horse-powers, free as it was of all meretricious ornamentation. Besides the universal interest manifested in the presence of this exhibit, it received marks of the highest appreciation from men of science and the representatives of art, prominent among whom was M. Bartholdi, commissioned on account of his pre-eminence in his profession. In his report to the French Government on the arts in America, he spoke of the great Corliss Engine of the Exhibition, as truly belonging to the category of works of art, by the general beauty of its effect and its perfect balance to the eye; that "the lines were so grand and beautiful, the play of the movements was so skillfully and simply arranged, and the whole machine was so harmoniously constructed, that it had the beauty, and almost the grace, of the human form."

Hon. Robert C. Winthrop, in his great oration at the unveiling of the statue of Webster, in Central Park, New York, said, alluding to Webster: "That great brain of his, as I have seen it working, whether in public debate or in private converse, seemed to me often like some mighty machine—always ready for action, and almost always in action, . . . producing and reproducing the richest fabrics with the ease and certainty, the precision and the condensing energy, of a perfect Corliss engine—such an one as many of us have just seen presiding so magically and so majestically over the Exposition at Philadelphia."

Prof. Radinger, of the Polytechnic school at Vienna, Austria, in an extended work on the Machinery Department of the Centennial Exhibition at Philadelphia, places Mr. Corliss at the head of American mechanics; and in speaking of the Corliss Centennial Engine, characterizes it as one of the greatest works of the

present day: "Although colossal, it was symmetrical in greatness, beautiful in form, and without fault, . . . its every detail a masterpiece." We see in this tribute from a foreigner a recognition of the fact that in every line and feature of this mammoth and complex exhibit could be seen the peculiar impress of Mr. Corliss's handiwork.

Referring to the closing day of the Exhibition, and the stopping of the engine, Prof. Radinger further says: "The people wanted to cheer, as they had done on other occasions; but, instead of bursting out with joy, they were choked with emotion,—the hurrah stuck in their throats,—and some were so overcome that they shed tears." Although a German, his enthusiasm finds vent at the close of a chapter in these words: "Ehre dem jungen Lande! Ehre dem grossen *Corliss!*" Literally translated: "Honor to the young Land! Honor to the great Corliss!"

In the imposing ceremonies attending the closing of the Exhibition, the chairman of the Executive Committee of the Centennial Commission, Hon. D. J. Morrell, concluded his address in the following words: "The Exhibition was opened by starting in motion the Corliss engine—that giant of wonder to all, which for six months, with equal pulse, without haste, without rest, has propelled an endless system of belts and wheels. Silent and irresistible, it affects the imagination as realizing the fabled powers of genii and afrite in Arabian tales; and, like them, it is subject to subtle control. When these our ceremonies here are ended, the President of the United States, by the motion of his hand, will make the lightning his messenger to stop the revolution of its wheels, and, at the same instant, to tell the world that the International Exhibition, which marked the Centennial of American national life, is closed."

The latest efforts of Mr. Corliss have been directed toward the embodiment in one complete machine of every feature of improvement, utility or convenience developed by him during a thirty years' experience in the manufacture and installation of steam-engines, which is being applied, not only to manufactures, but also to the pumping-machinery of WATER WORKS. In this new field of effort Mr. Corliss's success has already been as conspicuous and marked as it was thirty years ago, when he introduced what is now known the world over as the "Corliss Engine."

Mr. Corliss, yielding to the wishes of his townsmen, for the years 1868, 1869 and 1870, represented North Providence in the Senate of the General Assembly of Rhode Island,—during this period serving as chairman of the Committee on Finance. He was also chosen a Presidential elector, in 1876, on the Hayes and Wheeler ticket. Within the past eight years, Mr. Corliss has been frequently urged to consent to a nomination for governor, which he has uniformly met with discouragement, seeming to prefer to serve the interests of the people less publicly,—but with the zeal, fidelity and liberality which have always been his marked characteristics as a private citizen.

GEORGE CROMPTON.



THE establishment of George Crompton, of Worcester, Mass., in the specialty of looms for weaving fancy cotton and woolen goods, occupies the first position not only in New England, but in this country. The foundation of its business was laid more than forty years since, in the invention of William Crompton, the father of the present proprietor of the Crompton Loom Works.

William Crompton was born in 1806, in Preston, a large cotton manufacturing town in Lancashire, England. He was brought up as a hand-loom cotton-weaver. At an early age he learned the trade of a machinist. He was a superintendent of a cotton-mill in Ramsbottom, near Berry, and made many experiments on cotton-looms, with reference to increasing the scope of their production, especially in the style of the fabrics. In 1836, he came to Taunton, Mass., and entered the employ of Crocker and Richmond, then largely engaged in the manufacture of cotton machinery at that place. At the suggestion of the junior member of the firm, Mr. Crompton undertook to devise and build a loom for the manufacture of fancy cotton goods. In this he succeeded, and built twelve looms for the manufacture of cottonades and similar fabrics. In 1837 Crocker and Richmond failed. A patent was issued Nov. 23, 1837, to Mr. Crompton for a fancy loom, which contained the germ of the loom which has since been brought to so high a state of perfection by his son. An important feature of this loom was the manner of opening the shed, one part of the warp being depressed while the remainder was lifted, instead of the old method of lifting a part, the remainder retaining its position. The principal advantage secured by his invention was a larger space for the passage of the shuttle, and less strain on the warp-threads. Another feature, which remains substantially to the present time in the fancy woolen-looms of this country, is the chain, which, with its peculiar apparatus, operated the warp. The claim was for the

combination of an endless pattern chain, composed of bars and pins, or spindles, tubes and rollers with double-hooked jacks, and a lifter and depressor, whereby any of the numerous harnesses through which the warp was drawn could be elevated or depressed, *from a central line* to form a shed, for the passage of the shuttle.

In 1838 Mr. Crompton returned to England, and entered into business relations with John Rostron, a manufacturer of cotton goods at Edenfield, and obtained a patent on his loom for England, in the name of Mr. Rostron. He remained there till December, 1839, when he returned to the United States, bringing his family with him, and again located himself in Taunton. Shortly after his arrival he went to Lowell, taking with him samples of cotton fabrics manufactured on his looms, and endeavored to interest the managers of the mills there in them, but without success. Among the gentlemen with whom he became acquainted in Lowell was Samuel Lawrence, the agent of the Middlesex Mills, at that time devoted to the manufacture of broad-cloths. Mr. Lawrence was informed of what Mr. Crompton claimed for his loom; but their goods being a plain woolen fabric, the looms then in use answered their purpose. A few days after Mr. Crompton's visit to Lowell, a friend of Mr. Lawrence called on him at his residence in Boston. The gentleman had just returned from Europe, and wore an overcoat purchased in Paris, made of a woolen fabric, woven with a diamond figure, giving it a unique and beautiful appearance. It had been woven by Bonjean, of Sedan. Mons. Bonjean was the first to introduce the manufacture of this class of goods, having adopted the Jacquard Loom for weaving the goods, to which he gave the name of "fancy cassimeres," as he could make them of such style or figure as his *fancy* might dictate. It at once occurred to Mr. Lawrence, that if his mills could engage in the manufacture of these "fancy woolens," they would be a new and profitable article of production. It also occurred to him, that Mr. Crompton might be able to adapt his loom to the weaving of the goods. Obtaining from his friend a bit of the cloth, cut from the inside of the coat-collar, he at once sent a message to Taunton, to obtain the services of Mr. Crompton. The latter went immediately to Lowell, taking with him one of his cotton-looms. With this he experimented, and soon demonstrated its capacity for weaving the goods called for. This was the beginning of the manufacture of a class of woolen goods which, to a considerable extent, have superseded the plain goods formerly in universal use for men's garments. At least three-fourths of all the woolen cloths manufactured in this country at the present time are fancy woolens, and are woven on the Crompton Loom, or on looms based on the same general principles. A considerable portion of the looms at the Middlesex Mills were at once altered, and others were built by Mr. Crompton, who remained in the employ of the company about two years. In 1841 he sold to Phelps

and Bickford, of Worcester, the right to build the looms, under a royalty. Mr. Crompton removed his family to Worcester, and until 1844 was engaged in visiting various woolen manufactories in New England, introducing his looms, and instructing operatives in their use.

In 1849 his health became impaired, and since that time he has not been engaged in active business. Although his invention was one of great value in connection with the manufacture of textile fabrics, he realized from his personal manufacture of the looms, and afterwards from the royalties, and the devotion of his personal labor and time in introducing them, but little more than a comfortable support for his family.

With this invention as the basis, George Crompton, inheriting his father's mechanical genius, and possessing business abilities of a high order, though not engaging personally in the manufacture of the looms until about the time of the first expiration of the patent, has built up a large and important industry.

George Crompton was born March 23, 1829, at Ramsbottom, in Lancashire, England, and was ten years of age when brought to America. His childhood and youth were largely spent in and about foundries, machine-shops and woolen-mills, which influenced the development of his natural taste for machines. He also had such mercantile training, in connection with the keeping of books and accounts, as to be of great value to him in his later business career. Before he had attained his majority, by the failure of his father's health he was called to the management of the business, and to the general support of the family.

In 1851 he entered into partnership with M. A. Furbush, under the style of Furbush and Crompton, and, obtaining an extension of his father's patent, engaged in the manufacture of fancy looms. The first location of the factory was in Merrifield's Block, in Worcester, Mass., where it was continued until the great fire of June 14, 1854, in which they lost all their machinery and other property, and were compelled to start anew. They then purchased the site of the Crompton Loom Works, and erected the first of the present shops. Very soon after commencing business, Mr. Crompton turned his attention to making improvements in his father's loom. On the 14th of November, 1854, he received the first of the long list of patents granted to him. It was for the substitution of a single cylinder-chain for two or more different patterns, greatly simplifying the operation of the loom for different kinds of weaving. In 1858, on the 27th of April, he received his second patent; which was for a mechanism by which the warp-threads, which are required to be in the same position during two or more throws of the shuttle, are retained in their position, whereas the heddles controlling those threads had previously been brought, each pick, to a central line.

In 1859 the firm was dissolved by the retirement of Mr. Furbush, and Mr. Crompton became, and has remained, proprietor and manager. Mr. Furbush was a practical machinist, and by his skillful labors he had rendered valuable aid in the development of the business. During the continuance of the copartnership, Mr. Crompton found that the inventions of his father had been pirated by some leading loom manufacturers. After considerable litigation, which drew heavily on his means, he succeeded in establishing the validity of his father's patents, as well as his own.

On the breaking out of the war of 1861, there came a depression in the loom business, and Mr. Crompton devoted a part of his works to making gun-machinery for the United States, and for private armories. In 1863 the demand for woolen machinery having greatly increased, he again devoted his whole attention to the manufacture of his looms, and increased the capacity of his works. From that time to the present, he has been constantly employed in supplying manufacturers with looms for weaving fancy woolen and cotton fabrics, in all their varieties and widths; and has made many improvements in them, simplifying their operation, increasing their speed, and securing other most important advantages.

Mr. Crompton preserved the configuration of the loom as built by his father, until 1865, when he adopted vertical levers and other devices for operating the harnesses, receiving a patent for their improvements Jan. 9, 1866. In 1867 he exhibited his loom at the Paris Exposition. Although it was in competition with seven looms, all of European manufacture, from England, France, Saxony, Belgium and Prussia, it alone received recognition of special merits, a silver medal being the award. In 1868 he produced a new and perfectly unique harness motion, styled the horizontal harness motion. It was patented Jan. 31, 1871. There is but little choice between the loom having this movement and its predecessors, weavers being about equally divided in opinion as to their comparative merits. In 1877 he received a patent for the "Chain Tappet Loom,"—a new departure in the way of harness motion, which, within the limits of the loom's capacity, promises to rival, in simplicity, durability, speed and cheapness, anything yet devised. Including these important patents to which we have made especial reference, Mr. Crompton has taken out about fifty patents for his own inventions since 1854. Among these patents are the harness mechanism, picker movement, let-off and stop-motions, shuttle and shuttle-boxes, drop-boxes, shipping mechanism, rocking-plate, a device for finding the pick when broken or exhausted; also improvements in the form of certain parts of looms designed to give a more ornamental and tasteful appearance. Besides these patents having to do with mechanical construction, he has received eight patents for textile fabrics, including tapestry carpeting and pile-woven goods. Since the beginning of 1874, Horace Wyman, the superin-

tendent of the works, has been associated with him in the invention and issue of patents—some seven patents having been jointly taken out by them. Mr. Crompton has also, by purchase and assignment, the control of more than fifty other patents having immediate relation to the manufacture of looms.

“Crompton’s fancy woolen loom marked an era in the history of that industry. In 1850 it threw the shuttle fifty times per minute; to-day, the shuttle is thrown one hundred and eighty times per minute. The improved loom of 1876 produces sixty per cent more than the loom of 1850, with a saving of fifty per cent in labor, and more than that in repairs.” At the Centennial Exposition of 1876, his exhibit of four looms, comprising this broad fancy loom, a broad woolen loom, a narrow loom with new box motion, a pick-finder operated by power, and his gingham loom, which, at the present time, is the standard gingham loom of the country, the united Centennial Commission announced as the basis of an award to Mr. Crompton, as follows: “For the best looms for fancy weaving on shawls, cassimeres and satinets, embracing original invention, ingenious construction and excellent workmanship.”



WATERBURY, N. H.



Francis Dane

FRANCIS DANE.



FRANCIS DANE, at the time of his decease a prominent citizen and shoe manufacturer of Boston, was born in Hamilton, Mass., on the 6th of August, 1819. His father, John Dane, a lineal descendant in the seventh generation of John Dane, who was born in England, about 1587, and emigrated to America in 1636, was a farmer in Hamilton, and died in 1829. Francis spent his boyhood at Hamilton; and, after passing through the public schools of that town, he was allowed to make choice of an avocation in life. At first he tried farm work, and then labored as a mason; but as neither of these pursuits were congenial to his tastes, he began to work for a shoe-manufacturer in Hamilton, and remained in his service for several months. He was now fifteen years old, strong and active in body and mind, and willing to work. At this time he received from his mother a gift of twenty dollars, with the instruction to go to the neighboring town of Danvers (now Peabody), and purchase leather, with which to make shoes for sale.

This was the turning-point in his life, and the beginning of his career as a manufacturer. At first he found a market for his shoes in New Hampshire; but he soon formed the acquaintance of John Osborn, now of Boston, then a leather-dealer in Danvers, and with him he made an arrangement for obtaining leather in exchange for shoes. This arrangement continued for some time, during which Mr. Dane was in the habit of going regularly, once a week, in a one-horse wagon, to Mr. Osborn's place of business, carrying the shoes he had made, and receiving more stock.

In 1840, in accordance with Mr. Osborn's advice, Mr. Dane removed to South Danvers, and began the manufacture of shoes on a somewhat larger scale.

In these labors, however, Mr. Dane's pecuniary success did not give promise of the wealth he ultimately attained. The net profits of the first four years amounted

to not more than five hundred dollars. But he made many and warm friends, and his honesty procured the needful credit. He himself clearly foresaw the possibilities in the path of his chosen pursuit, and persevered. At first he confined himself to making children's shoes, to which he afterwards added misses' and women's shoes, and, later still, he began the manufacture of brogans. He introduced a new kind of brogan, chiefly for the Southern trade; and "Dane's brogans," though coarse, heavy and uncomely in shape, were received with much favor by the Southern planters, and in a few years were sold throughout the South, to be worn by the colored people. With the overthrow of slavery, the demand for these goods ceased.

In 1857 Mr. Dane, whose resources had then become ample, and in whose factories at South Danvers, Rowley, Upton and Stoughton, Mass., and Dover, N. H., a large variety of goods were made, opened a wholesale store on Kilby Street, Boston, taking into partnership Mr. D. A. Varney, now the head of the firm of Varney, Henderson & Co., Mr. Dane's successors. At this time he was also a stockholder in, and the agent of, the Hayward Rubber Company. His sales of boots and shoes were large for that time, aggregating from \$700,000 to \$800,000 yearly. He numbered among his customers leading merchants at the West and South, and his care in the selection of customers was such that he was seldom deceived.

At the outbreak of the Civil War, the unpaid obligations of Mr. Dane's Southern customers were immense. It was a critical time in his business career. But he met the emergency with energy, and passed safely through it, though with a heavy loss.

During the war Mr. Dane turned his attention especially to the manufacture of wax-brogans, which were introduced into the army. Large orders for these goods were received; his factories were kept running to their utmost capacity; and his sales averaged from \$1,000,000 to \$1,200,000 annually.

On the 1st of January, 1872, Mr. Dane retired from the personal direction of his business, still retaining, however, a pecuniary interest in that of his successors, Varney, Henderson & Co., and in that of Dane, Grinnell & Co., the senior partner in the latter firm being his youngest brother.

During all the years of his busy life, Mr. Dane never forgot his early home. Before retiring from the shoe business, he had begun to make improvements in the old Dane homestead, which he had inherited from his mother, and additions to the estate by purchases of land; and these he continued, until the modest homestead became an elegant mansion, which he used for his country residence. In the care and culture of his estate Mr. Dane found recreation, as well as in the society of the

numerous friends whom he entertained both there and at his city residence in Chester Square.

Mr. Dane was generous and sympathetic, lenient with his debtors, and ready to give unasked assistance to those whom he employed when this could wisely be done. He contributed to the advancement of education and religion, and was one of the trustees of Dummer Academy, at Byfield, Mass., and gave freely in aid both of the religious society in Boston, of which he was a member, and of the church in his native town. When the news of the great fire in Chicago reached Boston, he was one of the first to subscribe for the relief of the sufferers; and when a similar disaster overtook Boston, though he was himself a loser, he subscribed \$1000 in aid of the destitute.

Mr. Dane's ability as a financier led to his appointment to various positions of trust in moneyed circles. He was a director of the National Exchange Bank, the Shoe and Leather Insurance Company, the Boston Safe Deposit and Trust Company, and other mercantile institutions. In all of these relations he was prompt, sagacious and accurate. He identified himself with the interests of his native town; and the city of Boston is largely indebted to his public spirit.

Mr. Dane's vigorous constitution gave promise of a length of life which was not fulfilled. He died, after a brief but severe illness, at his country residence in Hamilton, on the 30th of July, 1875, in his fifty-sixth year. He left a widow, but no children.

BENJAMIN DOUGLAS.



ON. BENJAMIN DOUGLAS, of Middletown, Conn., was born in Northford, in that State, on April 3, 1816. His surname indicates his descent from the famous Scottish clan of Douglas. An ancestor of the family, as shown by the early records of Boston, resided there as early as 1646. The grandfather of our present subject, William Douglas, of Northford, was a colonel in the Revolutionary army. Born at Plainfield, Conn., Jan. 17, 1742, he enlisted, at sixteen, in the troops furnished by the Colony of Connecticut to serve in the French war. He was in the army of Gen. Wolfe, and was present at the taking of Quebec. By the close of the Canadian war, in 1763, he had attained the rank of sergeant. He removed to New Haven, became a sailor, and in the course of a few years had risen to be the master of a merchant vessel in the West India trade. Before the beginning of the Revolution, he had amassed a comfortable fortune, his property being, to a large extent, in vessels. When the news came of the battles of Lexington and Concord, he raised a company, of which he was commissioned captain, and marched to Albany, N. Y., where he joined the expedition under General Montgomery, against Canada. On reaching Lake Champlain, he took command of the flotilla, and did good service at the capture of St. Johns and Chamblee. On the failure of the expedition, he returned to New Haven, and was appointed major of one of the eight regiments raised, early in 1776, by Connecticut. In June of that year, he was commissioned as colonel in the Continental army, and was in the disastrous campaign which ended in the evacuation of New York, and the retreat of the American army to the vicinity of Philadelphia. In the battle of Long Island, Aug. 27, he was placed in an important command by General Putnam; and, of the five hundred men of his regiment who went into the battle, but three hundred survived. He was also in the battle of Harlem Plains, on Sept. 16,



Van. & Co. N. York.



Benjamin Douglass

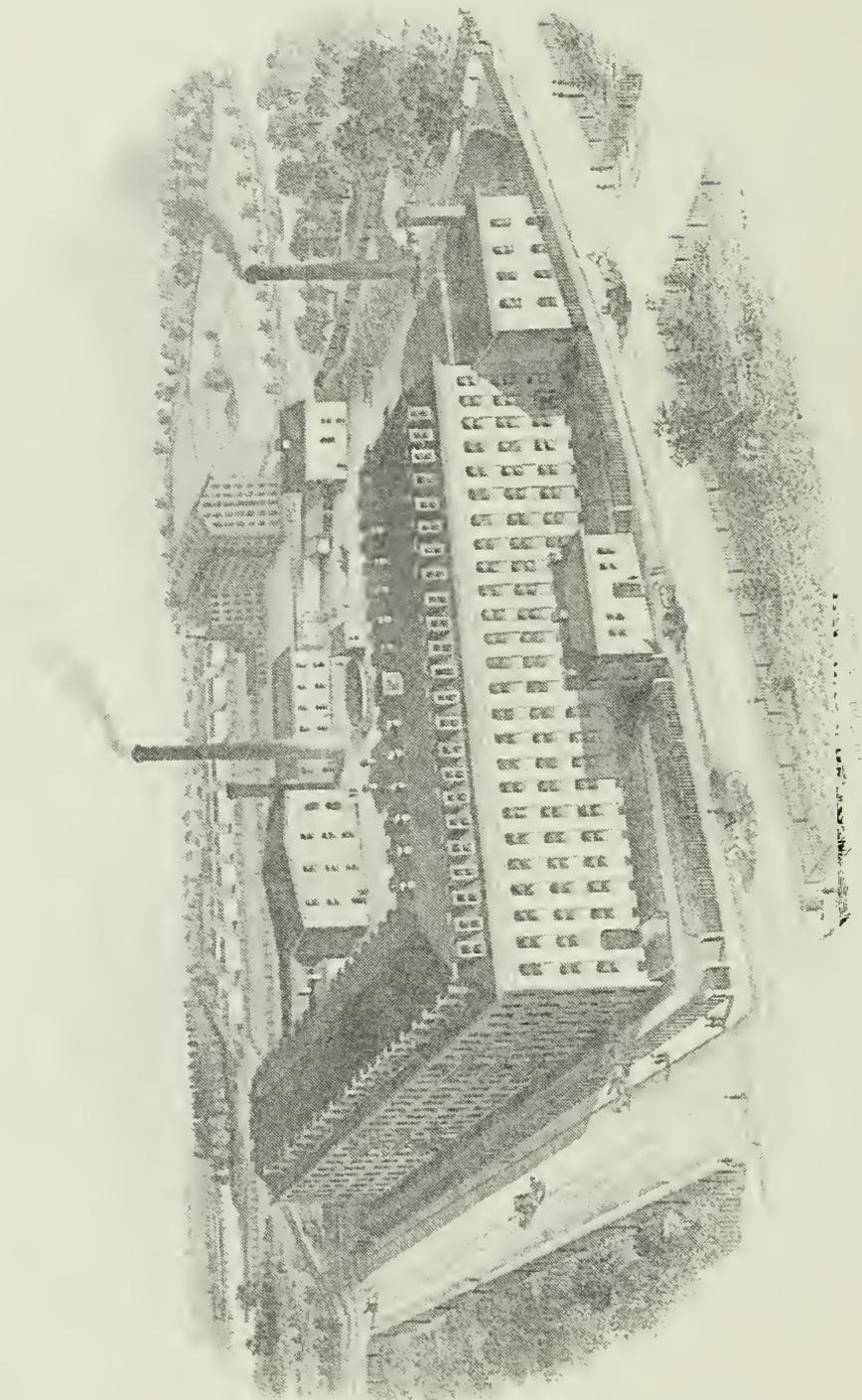
where his horse was shot under him, his clothes were riddled with bullets, and he became so exhausted that he lost his voice, and was compelled to resign his commission. He died on the 28th of the following May, at Northford, Conn., whither he had removed and purchased a farm. On raising his regiment, he had contributed generously to the expenses of its enlistment and equipment; and, after his death, his widow paid the debts thus made, out of the estate, for which she was reimbursed by the Government. His brother John was also commissioned, early in the war, first as lieutenant-colonel, then as colonel; was finally promoted to the rank of general, and served with distinction through the war.

The son of Colonel Douglas, born in 1771, when eleven years old, was sent thirty miles by his uncle, Gen. John Douglas, with important despatches on the eve of a battle, and returned safely, after having swum a river on the route. He served as captain of militia in the War of 1812, and was a farmer. His son Benjamin, the subject of this sketch, worked through the months usually devoted to farm-labor, and attended school during the winter months, until he was sixteen years of age. In 1832 his elder brother, William, commenced business, in a small way, at Middletown, Conn., as a machinist, his special branch being the manufacture of iron pumps. Benjamin engaged that year as an apprentice with him. They formed a partnership in 1839; and, in 1842, they invented their revolving cistern stand-pump. Since the issue of their first patent, improvements and new styles have been constantly introduced; and more than a hundred new patents have been granted to the brothers, or the company, in the United States, as well as several in Europe. They met with a serious obstacle in the introduction of their first patented pump, in the prejudice against novel inventions. Benjamin traveled from store to store, carrying a pump under his arm, explaining its merits and showing its good points. Even with this effort, the sales did not amount to three hundred pumps the first year. Their perseverance, and the excellence of their pumps, however, soon achieved success, which increased, from year to year, until 1858, when the senior partner, William, died. His relation to the business had been chiefly in the manufacturing department, where his ingenuity and skill as a mechanic greatly aided in the progress of the concern; while the mercantile department, which each year became more and more important, devolved upon Benjamin, the junior partner.

A special charter was granted to the firm in 1859, by which the business was re-organized, under the form of an incorporated company. The old firm name, W. and B. Douglas, which had now become well known, was retained. Benjamin Douglas is president; his son, John M. Douglas, is secretary and treasurer; and Joseph W., a son of Wm. Douglas, is superintendent of the manufacturing department. The enterprise, since its incorporation, has constantly grown; and, in

its special department of manufacture, has established a wide and honorable reputation. The Company's works embrace a number of buildings; the little wooden shop, 60 by 40 feet and one story high, originally used and still occupied, presents, in contrast with the many larger and more imposing structures, a vivid picture of the rapid growth of the business within forty years. These works are furnished with every convenience of mechanical appliances. The foundry is the largest in the State; the furnace is of the latest and best construction; and the castings are noticeable for their finish. There are about twelve hundred styles and sizes of pumps made; among them are many descriptions of hydraulic apparatus for household use and for artesian wells; force-pumps, for boilers and manufacturing requirements; chain-pumps; garden and fire engines; rotary pumps for elevating liquors; air and gas-pumps; and every other variety of pump, of iron, brass, copper or composition, of all sizes and capacities, and adapted to every purpose. Special mention may be made of the improved tube, or drive-well. A single hour will suffice to sink a pipe in the earth, in almost any locality, to attach the pump to it, and thus to procure water. This apparatus has been much used by Western settlers, exploring expeditions, and troops on the March. They were also utilized by the English army during the late war in Abyssinia. The pumps of this concern were awarded the highest medal at the Paris Exposition, in 1867, and the Grand Medal of Progress (the highest award) at the World's Fair at Vienna, in 1873. They are sold, not only in the United States, but in the British Provinces, the principal countries of Europe, Mexico, Central and South America, Australia, the Sandwich Islands, China and Japan.

Benjamin Douglas was for several years mayor of Middletown. He was chosen, in 1860, one of the presidential electors of Connecticut, and cast one of the six electoral votes of the State for Abraham Lincoln. The next year he was Lieutenant-Governor of the State. He has been president of the First National Bank of Middletown since 1864, when it was organized. For some ten years he was president of the Farmers and Mechanics Savings Bank, and he has been a trustee of the Wesleyan University. In early life he became a member of the Congregational Church, and has contributed generously to the support of the South Church, at Middletown. He married Mary A. Parker, of Middletown. Of their children, John M., Benjamin, Jr., and Edward, are employed by the company. John M. Douglas is the capable manager of the business, in its financial and mercantile branches.



THE DAY OF MILLS.

FALL RIVER, MASS.

DAVOL MILLS.

WILLIAM C. DAVOL.



THE aggregate number of spindles in all the mills of Fall River in 1858 was less than 150,000; in 1875 it was more than 1,250,000. The number of mills had increased from six to thirty-three, and the capital stock from \$2,460,000 to \$14,745,000. This rapid progress was not due, as in the case of other centers of the New England cotton manufacture, to the investment of capital from outside the immediate locality, but to the energy and enterprise of the residents of Fall River itself. Ever since the foundation of the Troy Mill and the Fall River Mill, in 1813, excepting a relatively small investment of two or three capitalists of New Bedford, the whole capital used in Fall River, amounting now to about \$15,000,000, has been raised and invested there by men born and raised within its limits, or in its vicinity.

Among the manufacturers to whom Fall River owes its enterprise is William C. Davol, who was born in Fall River (then known as Troy), Mass., Jan. 5, 1806. His father and grandfather had been residents of Freetown, from which Fall River was set off in 1800; and both of them were shoe-makers. William attended the free school of the town, and, when nine years old, began to work in the Troy Mill, which had then been in operation less than two years. He continued in this mill until it was burned, in 1821, and, during the period of its rebuilding, worked in the Pocasset Mill, which began its operations in 1822. On the starting up of the new Troy Mill, he returned to it, remaining in it as an operative until his twentieth year. Beginning in the carding-room, he worked in the various departments of the mill, and acquired much skill in all the processes of manufacture. In 1825, more than a year before attaining his majority, he was appointed superintendent of the mill, which position he held until the close of 1838. In December of that year his uncle, Major Bradford Durfee, then manager of the Fall River Iron Works, and also interested in the

cotton manufactures of the town, went to England, to obtain information about the improvements in the machinery and processes both of the iron and the cotton manufactures; and young Davol accompanied him. While Major Durfee was visiting the Continent, his nephew devoted himself to practical observation, and spent much of his time at Manchester. The difference in the cost of production in England and America attracted his attention. He learned that a hank of cotton yarn, of a given number, that would cost eleven cents at home, could be produced in England for three and one-half cents, which was chiefly due to the better methods and machinery of the latter.

Among the machines recently brought into use in the English factories was the Roberts and Sharp self-acting mule, for which patents had been granted in 1830 and 1835. This machine was a great improvement on the Crompton mule, and revolutionized the whole process of mule-spinning. Mr. Davol determined to secure this machine for introduction into his own country, and finally succeeded in arranging with Messrs. Roberts and Sharp for the purchase of a machine, and for taking out a patent for it in the United States, with a royalty to be paid them. But in consequence of an English law which forbade the exportation of machinery, it was only after a year's delay, and with much difficulty and trouble, that Mr. Davol succeeded in finally getting the self-acting mule to Fall River.

On his return from England Mr. Davol again entered the employ of the Troy Manufacturing Company; and in July, 1840, he went into partnership with the firm of Hawes and Marvel, machinists, with the purpose of manufacturing the Roberts and Sharp mules, and other cotton-machinery. This firm, originally Harris, Hawes & Co., had been established in 1822. Mr. Harris had retired in 1824; and, in 1825, the firm took the style of O. S. Dawes & Co. On the entrance of Mr. Davol, it became Hawes, Marvel & Davol. Mr. Hawes retired in 1857, and the style was changed to Marvel, Davol & Co. Mr. Marvel sold out his interest, in July, 1876, to Mr. Davol, who has since that time been sole proprietor, under the old firm name. Immediately on entering this firm, Mr. Davol gave his attention to the construction and introduction of the new mule into the mills of Fall River and other places, from the patterns made under his supervision. Within six years the firm had built mules with an aggregate capacity of 180,000 spindles. In 1847 a new set of patterns, with improvements, was made, and mules of a capacity of 100,000 spindles were built. New mules were perfected in 1852 and 1854, including new principles, and adapted to spinning very fine yarns.

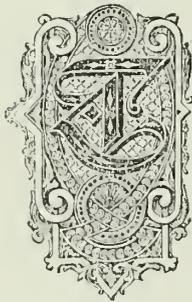
Mr. Davol did not confine himself to the making of mules, but gave his attention also to the construction of other cotton-machinery,—including carding-machines, speeders and drawing-frames,—with success, so that the firm soon supplied

nearly all of the machinery of the mills in Fall River. Mr. Davol patented his double-speeder in 1843, and successfully maintained his patent in the courts against infringements upon it. Besides his personal supervision over the manufacture of machinery, Mr. Davol has aided, by the investment of capital, in the development of other financial and manufacturing interests of Fall River. He has been, for several years, a director in the Metacomet National Bank, and, from its organization, in 1866, of the Stafford Manufacturing Company, which runs mills with 35,000 spindles in the manufacture of print-cloths.

On Dec. 1, 1866, Mr. Davol united with eighteen other gentlemen in the organization of the company which received his name, and of which he has since continued president, the capital stock of which was \$270,000. The ground was broken for laying the foundation of the mill on April 1, 1867; and, on March 11, 1868, the first yard of cloth was woven. This mill is different in design and material from most of the Fall River factories, which are long ranges of granite. The Davol Mill proper is of brick, four stories high (exclusive of the attic), and covers two sides of a quadrangle, the rest of which is occupied by the picker, engine and boiler-houses. The motive power is steam. The Company also differs from most of the other Fall River corporations in the character of its goods; the Davol Mill making shirtings, sheetings, silecias, and fancy cotton fabrics, while eighty-eight per cent of all the spindles in the city are running for the manufacture of print-cloths. The Company has been prosperous from the first. The original number of spindles was 13,312; but, in 1871, the capacity of the mill was increased to its present number of 30,600 spindles. The exhibit of the Company's goods at the Centennial Exposition received an award for the superior quality of their serge-twill lined fabric, fine honey-comb cloakings, sateens and striped piqué.

The general management of the business has been, from the outset, in the hands of its treasurer and agent, William C. Davol, Jr., only son of the president. He was born in Fall River, in 1840, and attended school in his native town, and at Phillips Academy, at Andover. During his vacations, and for a period after leaving school, he was employed in the office of a prominent architect and mechanical engineer, in Fall River, where he perfected himself in the art of architectural and mechanical draughting. He was then engaged for a year in the office of Marvel and Davol, in making detailed drawings of the most complicated machines. On the organization of the Davol Mills Company, he was elected one of the directors, and its treasurer and agent. He has served the city for several years as chief of its fire department.

THE DOUGLAS AXE MFG. CO.



THE origin of the Douglas Axe Manufacturing Company is of quite ancient date. Early in this century Oliver Hunt, a mechanic, went to the village of Douglas. He had learned the trade of blacksmithing, and now set up a rude forge. His purpose was to supply the farmers with axes, and to do other jobs in his line. Meanwhile, he studied how to make good axes, and in time accumulated a barrel of these implements, which he held as a modest stock in trade. When his son Warren grew up, he taught him how to make axes; but Warren's ambition was not satisfied with confining himself to his father's local trade. He accordingly started for Providence, one leisure day, with a team loaded with the full stock of axes, in search of customers, and afterward visited Boston on the same errand. There he met Charles Scudder, a hardware dealer, who bought his entire stock, and promised to continue his custom. This piece of good fortune gave rise to the firm of Oliver Hunt and Son. New forges were placed by the side of the others, and new hands were set to work at them; and the Hunts thus began the axe industry, which has since grown to large proportions. They provided themselves with a larger shop; but soon the utmost production that the premises could afford did not satisfy the demand.

As the business increased, Warren Hunt desired to enlarge their facilities by purchasing a mill that was for sale in the vicinity, and converting it into a tool-factory. As his father would not consent to this, the firm was dissolved; and Warren, raising the sum of \$5000 by aid of his Boston customers, made the purchase, fitted up his new factory, and continued the business. The shop was soon after burned; but a stone shop was at once erected on the same spot, and Mr. Hunt's enterprise grew rapidly. Its increase finally demanded the addition of a new partner to the firm; and Mr. Hunt associated with him Alexander Scudder, a sea captain, the brother



Howe Factory.



New Shops.

Lovett Works.



Upper Works.



Gilboa.

*Douglas, Jr. Manufacturing Co.
East Douglas, Mass.*

of his first Boston customer. This partnership lasted two years, and was then dissolved.

The Douglas Axe Manufacturing Company was formed in 1834; and, in 1836, it was incorporated, with a capital of \$80,000. Its first officers were: William T. Eustis, President; Charles Scudder, Treasurer; and Warren Hunt, Superintending Agent. The works were enlarged, and machinery of improved patterns was introduced into them. The financial disasters of 1837 forced a reduction of the capital stock to \$40,000; but, in 1850, it was increased to \$130,000. The Company has since done business to the full capacity of its works, and its capital stock is now \$400,000. It has bought mill-privileges on the stream where the enterprise was first established, from time to time, and erected new shops, until there are now five buildings, provided with thirty-four trip-hammers and sixty-five forges. The machinery is turned solely by water-power, except in cases of emergency, when a steam-engine is used. Three hundred hands are employed in the works, the pay-roll amounting to \$200,000 a year. They produce not only axes, but many varieties of hatchets, adzes, picks and mattocks. The rough material, consisting of refined iron and cast-steel, goes through the several operations of cutting, shaping, forging, tempering and finishing, before the product is ready for the market. The Company annually use 1200 tons of iron, 250 tons of English steel, 1200 tons of grind-stones, 2400 tons of Anthracite coal, 400,000 feet of lumber, for packing purposes, and \$30,000 worth of handles.

The tools of this Company were awarded the highest prizes at three International Expositions: a bronze medal at London, in 1862; a silver medal at Paris, in 1867; and a bronze medal at Vienna, in 1873.

Some changes have taken place in the management of the concern since its incorporation. Wm. S. Eustis, one of the earliest purchasers of Hunt's axes, retained the presidency of the Company for forty years, until his death, in May, 1874. Charles Scudder was succeeded as treasurer by George Rogers, who continued in office until 1860. Warren Hunt remained as the superintendent of the manufactures at Douglas until 1865, only two years before his death. The present officers of the Douglas Axe Manufacturing Company are: Samuel W. Swett, President; D. D. Dana, Treasurer; and Edwin Moore, Superintending Agent.

SAMUEL DOWNER.



SAMUEL DOWNER was born in Dorchester, Mass., on the 8th day of March, 1807. He attended the public schools of his native town until he was fourteen years of age. He then entered a shipping and commission house in Boston, and was employed there for six years, acquiring, in this position, a good mercantile education. At the age of twenty-one he was received into partnership with his father, who was then a merchant on Central Wharf. The style of the new firm was Samuel Downer and Son, and it continued until 1830. During the next three years he was engaged, with Mr. S. P. Merriam, in the wholesale West India goods trade, the style of the firm being Merriam and Downer. He next entered into a copartnership with his father and Mr. W. R. Austin, under the style of Downer, Austin & Co., for the manufacture and sale of sperm and whale oils and candles. The business of this firm was conducted so successfully that it became known as one of the largest houses in the trade. Toward the end of 1844, Messrs. Downer, Sr., and Austin retired from the firm, and its business was conducted by its junior partner, Samuel Downer, until 1854.

At this time his attention had been called to the hydro-carbon oils. For many years the attention and efforts of scientific men and of others had been directed to the obtaining of some article which should generally take the place of sperm oil, then the only known lubricator for fine machinery, the sources of the supply of which were rapidly diminishing,—this fact, in connection with the large increase in the demand, causing a constant increase in the price.

During the twenty years previous to 1854, various burning fluids had been introduced into public use. All of these were, however, either dangerous, expensive, or of such a nature as to need complicated and inconvenient arrangements for lighting and burning, so that none gave satisfaction. A series of experiments were made, in

1854, under the direction of Mr. Downer, in various substances, which, by distillation, produced hydro-carbon oils. These experiments were expensive, nor were their results fully satisfactory. Enough, however, was ascertained to encourage Mr. Downer to continue them in a kind of bituminous coal obtained in Albert County, New Brunswick, and known as the Albertite mineral. This proved to be very rich in the desired properties, and from it was obtained the hydro-carbon oil now known as kerosene. The demand for this oil was at once established, and increased so rapidly, that more extensive works were built, and within four years two million of gallons were made and consumed.

The manufacture of kerosene oil from the Albertite mineral continued till 1861, when the petroleum of Pennsylvania and the adjoining States was discovered. The quantity in which this crude native oil was very soon produced, and its form, as a liquid, being such that the apparatus used for the distillation of its several products was less complicated and less expensive, enabled it to supplant the manufacture of kerosene from the Albertite mineral, and the latter was very soon abandoned. From 1861 to the present time, petroleum has been used exclusively as the material of manufacture. The business thus started by Mr. Downer's enterprise rapidly grew to such proportions that he organized the company, which is now well known as **THE DOWNER KEROSENE OIL COMPANY**.

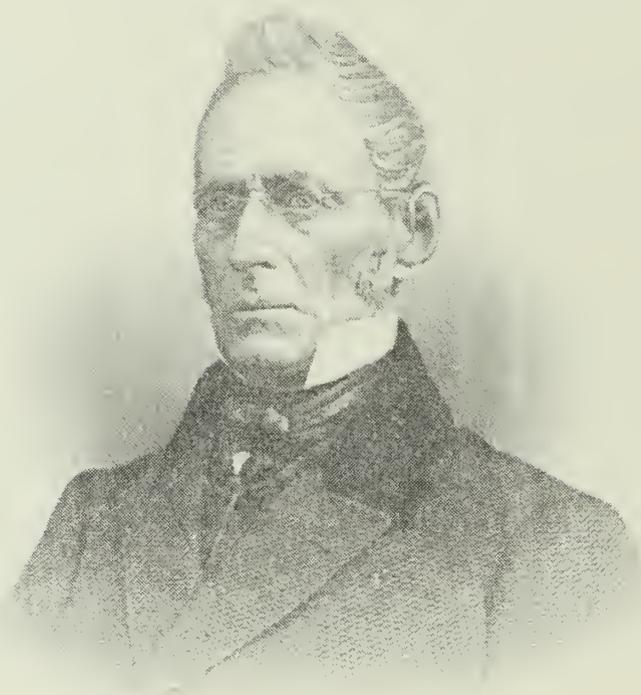
Of this enterprise Joshua Merrill is the superintendent, and has managed the department of manufacture from the beginning. Mr. Downer became acquainted with him about 1853, while he was engaged with his brother Rufus in selling a lubricating oil, known as coup oil, manufactured from coal tar by the United States Chemical Manufacturing Company, of Boston. Mr. Merrill had spent much time in the study of manufacturing-chemistry, and had made many experiments for obtaining substitutes for the expensive lubricating and illuminating oils then in use.

In 1856, under Mr. Downer's auspices, Mr. Merrill and Luther Atwood went to Scotland, to superintend the erection and starting of oil-works for James Miller & Co., of Glasgow, designed to manufacture the coup oil. While thus engaged their attention was called to a peculiar oil, or spirit, called "brown Bathgate naphtha." James Young had commenced, in 1849, the manufacture of a lubricating oil from petroleum, a small deposit of which had been discovered in an abandoned coal-mine in Derbyshire, England. This supply was soon exhausted; and, in 1850, Mr. Young turned his attention to the Scotch cannel coal, obtaining from it an oil well adapted for lighting purposes, and for which, under the name of paraffine oil, he secured a patent. He also obtained the naphtha just referred to. This article Mr. Merrill and his associate refined into an illuminating oil, similar to kerosene, and adapted a lamp to burn it. This was the origin of the manufacture of kerosene oil.

In 1857 Mr. Merrill returned to the United States, and Mr. Downer at once employed him to make experiments, and to arrange for the manufacture of hydrocarbon oils. Besides the Downer kerosene oil, a later result of Mr. Merrill's investigation and experiment was obtained in 1869, in the mineral sperm oil, having for its "fire test" about 300° Fahrenheit, while that of the Downer kerosene oil is about 140°. This has come into general use in factories, on railroads, and in ocean steamships and steamers.

The works of this company are in South Boston, and occupy an area of nearly four acres, covered, for the most part, with substantial brick, fire-proof buildings, erected at an expense of about \$500,000. These buildings were constructed, and much of the machinery and apparatus was put up, from the designs and under the immediate supervision of Mr. Merrill. Many of the processes used, and much of the apparatus employed, have been patented, both in this country and in Europe, and are used in no other manufactory of oils in the country. The products of distillation from petroleum, as it is effected at the works of this Company, are naphthas of different grades, the various kinds of lubricating oils, kerosene, mineral sperm oils, and paraffine, which has almost wholly taken the place of spermaceti in the manufacture of candles. All of these products are standard and of the best quality. The annual product of oils for the past ten years has been from fifty thousand to sixty thousand barrels, and of paraffine, about four hundred thousand pounds.

Mr. Downer is known in the vicinity of Boston as the projector and proprietor of "Downer's Landing," a pleasant harbor resort, which has become very popular during the summer months.



Van Slyke & Co Boston



Lewis Downing



ABBOT-DOWNING COMPANY.



CARRIAGE building has been continuously followed in the Downing family for nearly a century, and in the Abbot family for about fifty years. It was begun by the elder Downing at Lexington, Mass., in 1780, who taught it to his son Samuel. A second son, Lewis, who was born in Lexington, Mass., in 1792, chose the same occupation, and learned the trade from his brother Samuel, in his father's work-shop.

In June, 1813, at the age of twenty-one, Lewis Downing went to Concord, N. H., and began his career as a carriage-builder. The first carriage constructed in the United States had been built in Dorchester, Mass., in 1805; and carriage-making seemed likely to be a profitable field for the application of mechanical skill and enterprise. Mr. Downing first directed his attention to the construction of private carriages in which durability was the chief requisite. In the following November he completed his vehicle known as the Concord wagon. It at once attracted attention, and gave him a good start in business. In 1825 he purchased land, and built some shops on the site now occupied by the Abbot-Downing Company, procured more workmen, and otherwise provided to meet the growing demand for the manufacture of the "wagon."

In 1826 he added the making of chaises to that of wagons. These were then popular in New England, especially among professional men, on account of its easy movement. He sold his first chaise to Rev. Dr. Bonter, the parish minister of Concord.

Mr. Downing now began to consider the wants of public travel, and how to provide for them. Hitherto it had mostly been performed in imported coaches, of either English or French make, which were better adapted to the older countries, with their harder roads, than to our own rougher region. English coaches were also too heavy with iron for the wants of this country. Mr. Downing sent for J. Stephens

Abbot, a journeyman coach-body maker at Salem, Mass.; and, late in 1826, they set to work together, to meet this pressing want of American travel. The "Concord Stage Coach" (a happy hit, both for the builders and for travelers) was soon produced from their workshops. In design, the structure was a wide departure from any coach hitherto seen in America. It was hung upon leather braces, instead of metallic springs, to prevent the breakage incident to steel, from age, cold or jolting; it was made of rather light draft, to favor the team when heavily loaded, to assist in mounting steep hills, and to permit of fast traveling in safety over uneven roads. In strength of wood, leather and iron, this coach was a fine achievement of planning and workmanship. It was very solid and substantial, while it provided greatly increased comfort in traveling.

On Jan. 1, 1828, the original firm of Downing and Abbot was established in Concord, N. H., especially for the production of their vehicles of private and public carriage.

After nineteen years of partnership, the firm was dissolved in September, 1847. Mr. Downing built new shops in the central part of the town, and admitted his two sons into partnership, under the name of L. Downing and Sons. Mr. Abbot remained and prosecuted the business on the old spot, still owned by Mr. Downing; but in 1849 the original work-shops were burned. They were rebuilt on a larger and more substantial scale; and in 1852 Mr. Abbot formed a partnership with his son, the firm becoming J. S. and E. A. Abbot.

On Jan. 1, 1865, a dissolution of each of the former partnerships took place. Mr. Lewis Downing, Sr., permanently retired from business; and the remaining resources of the concerns, in capital and reputation, were joined together, under the name of Abbot, Downing & Co. It comprised Mr. Abbot and his two sons, Edward A. and Joseph H., and the two sons of Lewis Downing, Lewis Downing, Jr., and Alonzo. The shops erected by Mr. Downing were now abandoned and put to other uses, while the different branches of carriage-building were carried forward on the old site.

At the time of the formation of this new firm, some mechanics planted another carriage interest in Concord, under the name of Harvey Morgan & Co. They progressed rapidly in the business, and did a thriving trade for some years.

On Jan. 1, 1873, the last two firms were dissolved, and the present concern was incorporated as the Abbot-Downing Company. The capital stock is \$400,000. The officers are: Lewis Downing, Jr., President; Edward A. Abbot, Treasurer; Frank L. Abbot, Secretary; Lewis Downing, Jr., Rufus M. Morgan and George P. Harvey, Board of Control.

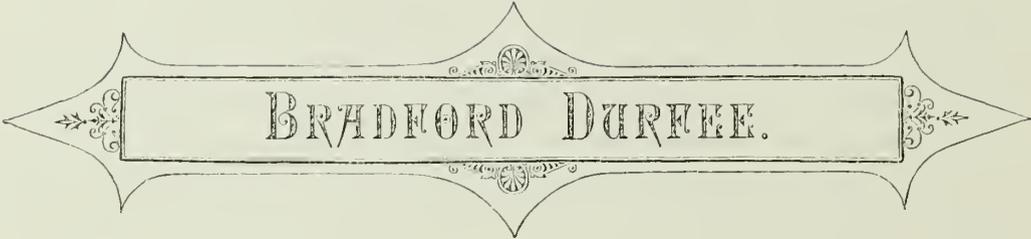
Inheriting the experience of nearly a century in carriage-building, this concern

is still diligently pursuing the enterprise. The "Concord wagon" and "Concord coach" have been greatly improved in the progress of time, and yet each still remains in the market. This Company continue the making of the large team-wagons introduced by Downing and Abbot, intended for drawing over rough roads, with a peculiar set of the axles, whereby the loads are moved more easily; and among their products are to be found every description of vehicle required either for business or pleasure. About one-quarter of the annual manufactures of the Company are sent to foreign countries, including Canada, Mexico, South America, Austria and other parts of Europe.

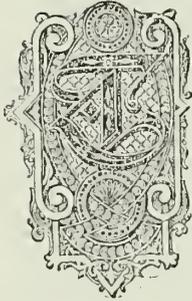
The premises of the Abbot-Downing Company now cover about five acres, and are provided with large work-shops, heated with steam, lighted with gas, and are well arranged for convenience and health. The Company give employment to about three hundred mechanics, who generally own the houses in which they live; and every part of the carriage-building is done on the premises, including the making of the axles and springs, and the turning of the spokes and hubs. Besides the works at Concord, the Company has offices in New York and Boston, and agencies in Chicago, San Francisco, Australia and South America.

Mr. Abbot continued actively in business until his death, which occurred, after a brief illness, in March, 1871; and his death was followed by that of Mr. Downing, the founder of this industry, in 1873.

Both earned and maintained a high reputation for skill, sagacity and integrity; and both bent their energies, as well to the promotion of the prosperity and growth of Concord, as to the pursuit of their important enterprise.



BRADFORD DURFEE.



HE name of Durfee, like those of Borden, Chace and Anthony, has been associated with the manufacturing interests of Fall River from their first inception. As early as 1811, Col. Joseph Durfee had established a small cotton-factory within the present limits of the city; and Major Bradford Durfee, his nephew, was associated with the Bordens in many of their great undertakings. Col. Joseph Durfee's mill was a small building of wood, located on the corner of the present Globe and South Main Streets, and was occupied for spinning cotton until 1829, when it was changed to print-works, and so employed until its destruction by fire in 1831. Colonel Durfee was a man of considerable local importance. In the War of the Revolution, he served as captain in command of a company at the battle of White Plains; and was afterward promoted to the command of a regiment, which rendered efficient service against the British in their campaigns of 1777 and 1778 in Rhode Island.

Major Bradford Durfee was born in Fall River, Oct. 22, 1788. In his youth he learned the trade of a ship-carpenter, and worked at it in New Bedford until 1812, when he engaged with Col. Richard Borden, at Fall River, in the building of small vessels. Into the great work of establishing and developing the Fall River Iron Works, started in 1821 (which was an outgrowth of the ship-building enterprise), Major Durfee entered and pursued with energy and zeal, as its superintendent. The erection of the original and the succeeding buildings of the Iron Works; the construction of the Iron Works' wharves; the establishment of the Anawan Mill in 1825, and the erection of its building; the construction of the canal to the pond of the print-works; and the dam of the Watuppa Reservoir Company—all these were under his personal direction; and when, in 1827, the steamboat line between Fall River and Providence was established, he took charge of that also, and for years,

with rare exceptions, he was regularly on the wharf on the arrival and departure of the boats. The projectors of the Anawan Mill, named after King Philips' most famous captain, were the original stockholders of the Fall River Iron Works. Its capital was \$160,000, and Major Durfee was its first agent.

In 1838, in company with William C. Davol, Major Durfee visited Europe, to examine improved machinery both for the iron and cotton manufacture; and, as one of the results of the trip, one of Sharp and Roberts' self-acting mules was imported, and it served as a model for the manufacture of numerous other machines which were introduced into the mills of Fall River.

Major Bradford Durfee died on the 23d of July, 1843, from the effects, it is supposed, of over-exertion and exposure during the great fire of the second day of that month and year, when an area of about twenty acres in the center of the village was burned over, and one hundred and ninety-six buildings were destroyed. Major Durfee accumulated a large estate, which was inherited by his widow and his son. As a monument, in part, to his memory, the Durfee Mills were erected—Mill No. 1 in 1866, and Mill No. 2 in 1871—by a corporation organized in 1866, with a capital of \$500,000. Its principal stockholder and first resident agent was the son of Major Durfee, Bradford M. C. Durfee, since deceased. These mills are two large parallel granite structures, in which are operated 87,424 spindles.



PLINY EARLE.



AND-CARDS were, to a considerable extent, manufactured in New England and other colonies before the American Revolution. It seemed to be a necessary industry, owing to the practice of manufacturing cloth in the homes of the people. Machines were devised for making hand-cards—adapted, however, only to be worked by hand. The ingenuity of several skillful mechanics was directed, late in the last century, to the invention of these machines. Among them were Jeremiah Wilkinson, who constructed a card-making machine at Cumberland, R. I., in 1776; Oliver Evans, at Philadelphia, in 1777; and Amos Whittemore, at Boston, in 1796. The invention of the latter was the germ of the automatic card-making machinery of later times, operated by power. The manufacture of hand-cards in Leicester, Mass., was begun by Edmond Drew, in 1785. He first did this work by hand, and afterward by such improved machinery as was, from time to time, invented.

Among those who at an early period engaged in the manufacture was Pliny Earle, who was born in Leicester, Dec. 17, 1762. He was, by descent and profession, a Quaker. His great-grandfather, Ralph Earle, went thither from Rhode Island in 1717, and was probably either a grandson or great-grandson of Ralph Earle, who came to Rhode Island in 1638. Pliny Earle began the manufacture of hand-cards in 1786, using about a dozen calf-skins the first year. Early in 1790 Samuel Slater went from Pawtucket to Leicester, to obtain card-clothing for the machines which he was building under the patronage of Moses Brown; and Mr. Earle undertook to furnish the desired article. To do this, he had to prick the holes in the leather with two needles fitted into a handle; and, in a week, he had made a hundred thousand perforations. He then sent the leather strips, or fillets, to be set with the wire teeth by expert fingers in the neighborhood. These fillets were forwarded to Mr.

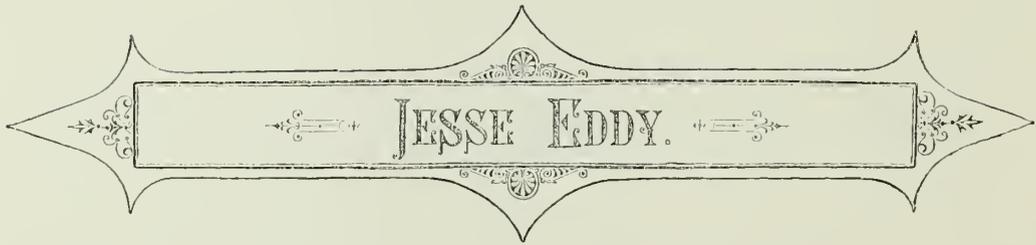
Slater, and adjusted to the carding-machines ; but they became clogged, and would not work. Mr. Earle then went to Pawtucket, examined the teeth, and found that the pitch, or angle, of the teeth, was not what it should be to cause them to properly engage with, and give off, the fibers of cotton. He soon succeeded in remedying the difficulty, and thus made an important contribution to the successful introduction of the Arkwright system of cotton-machinery into America.* The first cards made in this crude way by Mr. Earle proved to last much longer than those on English machines.

Mr. Earle's work on these machine-cards led to his invention of the machine long in use in Leicester, for pricking "twilled" cards. These cards were produced, in some years, to the value of \$200,000 ; and in their manufacture every operation, from giving motion to the comparatively simple machines which pricked the leather and cut the teeth, to the setting of these, tooth by tooth, into the card, was performed by hand. All these operations are now performed by automatic machinery, and driven by power, either of water or steam.

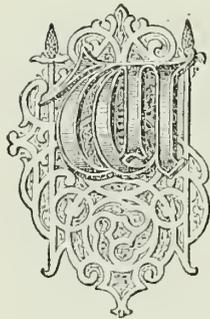
A few years later, in 1796, Elizur Smith, of Walpole, Mass., an ingenious mechanic, conceived the idea of combining various operations of perforating the leather,—bending and cutting of the wire, to form the teeth,—and inserting them in one machine. Amos Whittemore, a hand card-maker of Boston, advanced him money, to enable him to complete the machine. Soon afterward, in 1797, Mr. Whittemore received a patent for a machine like that of Elizur Smith. He claimed, however, that, in the machine as finished by Mr. Smith, there was a serious defect, which he himself had overcome. But Whittemore's machine failed to make the best card clothing ; and, in 1838, William B. Earle, the son and successor of Pliny Earle, made improvements upon it, which, after being modified at different times until 1843, produced the machine now generally in use.

In 1791 Mr. Earle united with his brothers, Jonah and Silas, in the firm of Pliny Earle and Brothers. Silas Earle withdrew from the firm in 1815, and carried on the business in his own name until 1842. His second daughter, Anna, married Harvey Chace, the well-known cotton manufacturer of Rhode Island. Pliny and Jonah Earle, meanwhile, continued successfully the business of the old firm, almost down to the former's death, which occurred in 1832, in the seventieth year of his age. Mr. Earle was an intelligent man, and an ingenious mechanic. His eldest son, John Milton Earle, was for many years editor of the *Worcester Spy*.

* See note to sketch of Samuel Slater.



JESSE EDDY.



WHILE Fall River is one of the principal seats of the cotton industry in the United States, it has also grown, within a little more than half a century, to be an important centre of the woolen manufactures. It owes this added branch of enterprise, in a large degree, to the subject of this article, who for nearly half a century was prominently identified with that industry.

Jesse Eddy was born in Northbridge, Mass, in 1801, and was connected by descent with the Quakers. He received his first lessons in manufacturing in the Northbridge Cotton Manufactory; and at sixteen years of age entered a woolen mill at Billingham, Mass., where he was employed about four years in the dyeing and finishing department. He then went to Plainfield, Conn., and was employed for three years in the machine-shop of the cotton-mill at Central Village, in that town. In 1824 he went to Woonsocket, and entered the employment of Samuel Shove, then manufacturing satinets in the second story of a mill owned by Dexter Ballou, the lower story of which was occupied by Mr. Ballou, in the manufacture of cotton goods. This mill was within the present limits of the Lippitt Woolen Company's premises.

Having formed a copartnership with his employer and his elder brother, John, under the firm of Samuel Shove & Co., Mr. Eddy came with them, in 1825, to Fall River. Their business was at first carried on in a part of a stone-mill still owned by the Pocasset Company, the rest of the building being occupied by Hawes, Marvel & Co., manufacturers of machinery. The firm continued until 1834, when, on the withdrawal of Mr. Shove, it took the style of J. and J. Eddy. The firm had from the first manufactured satinets—a kind of cloth with a cotton warp and woolen filling. In the division of their labor, Jesse Eddy undertook the mercantile department, while his brother managed the manufactory. He traveled extensively



Van Dine & Co. Boston



Jesse Condy

in various parts of New England and of the West, to buy wool, and made frequent trips to Boston and New York, for the sale of his goods. There being no public conveyance between Fall River and Boston, he made his trips to Boston, a distance of fifty miles, in his own carriage.

In 1843 the firm began the manufacture of fancy cassimeres—a class of goods, the introduction of which into this country, in 1839, is referred to in our sketch of the Middlesex Mills. The firm vacated the premises they occupied in 1845, as the Pocasset Company was about to replace the mill by a larger one for their own business, and removed to what was known as the Eagle Mill, in Tiverton, R. I., near Fall River. Shortly afterward John Eddy retired from the firm, and Jesse Eddy continued the business in the same place, until 1848, when the mill was burned. Mr. Eddy had previously, with Joseph Durfee, purchased and located a mill for the manufacture of fancy cassimeres, on Mosquito Island, near the outlet of Watuppa Pond. Before they were ready to begin operations, however, Mr. Durfee died, and Mr. Eddy became the sole proprietor.

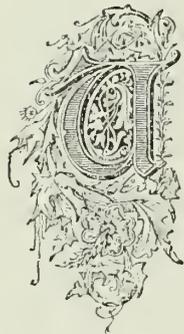
In the manufacture of his cassimeres Mr. Eddy used only the highest grades of wool, introduced improved machinery, and maintained the most careful supervision of all the details of the manufactory. At first he copied the best styles of foreign goods as they were brought to this country; but he soon learned to rely on his own taste, and made his own designs, competing successfully with the best manufacturers, both foreign and domestic.

Manufacturing was started in the new establishment in January, 1849, and was continued about three years by Mr. Eddy alone. He then received his son, Thomas F. Eddy, into partnership, under the firm-style of Jesse Eddy and Son. The business steadily prospered for about twenty-one years, until the death of Mr. Eddy, which occurred in 1873. His younger son, James C. Eddy, then joined the firm, when it took the name of Jesse Eddy's Sons, who still continue the enterprise on its old basis.

Aside from his relations to the woolen industry, Jesse Eddy took an active part in other business interests. In 1828 he was chosen one of the original board of trustees of the Fall River Savings Bank, and was for many years its vice-president. Some years after, he was elected president of the National Union Bank. In character, he was noted for the best business qualities, which were fully justified by his success.



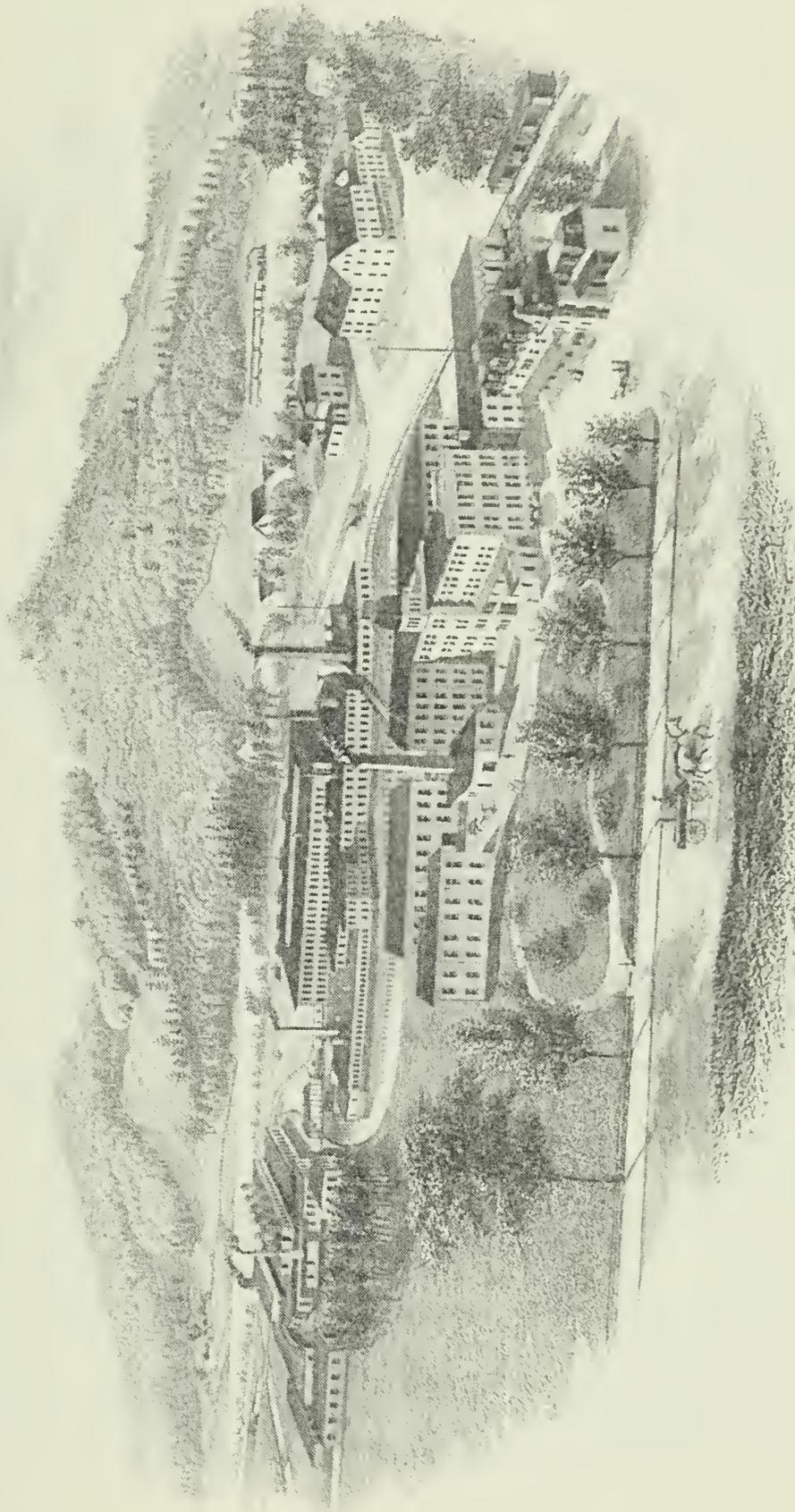
ERASTUS FAIRBANKS—THADDEUS FAIRBANKS.



UNTIL about 1831, when Thaddeus Fairbanks devised the platform-scale now in general use, the contrivances for weighing quantities were comparatively crude and unreliable; and the want of accurate appliances had been deeply felt, through many preceeding years, in all civilized countries. This want had been vexatiously manifest in the commonest affairs of domestic traffic, and had greatly impeded the larger transactions of commerce between nations; it had immeasurably hindered the pursuit of scientific investigation, and narrowed the field of philosophical experiments. "Chemistry owes its scientific character to the advance made by mankind in their ability to weigh and measure accurately; and the atomic theory of equivalent proportions, to which the scientific character of chemistry is due, is one of the most brilliant and useful results obtained by the knowledge of modern times. The vague conjecture and experiment of the old alchemists have been replaced by the accurate knowledge of the chemists, and the processes of industry can be carried on with the definiteness of scientific precision. No department of the knowledge gained by experience and experiment can become scientific, until its results have been so accurately tested by measures and by weight as to be expressible in figures; and it is really to our ability to thus measure and weigh that our modern progress is due."

The scale invented by Thaddeus Fairbanks, in the perfection to which it has been brought, and in the wide scope of its adaptation, has been an important agent in the wonderful progress made within the last quarter of a century or more. Its service to commerce has been great; it has done much toward correcting the standard, and securing uniformity and accuracy; and has exerted a large influence in bringing all commercial nations to the adoption of a uniform system of weights.

The works of E. and T. Fairbanks & Co., where this scale in great variety is



THE
EDWARD T. FAIRBANKS COMPANY
SCALE WORKS.
ST. JOHNSBURGH, VERMONT.

manufactured, are in the town of St. Johnsbury, Vt. Few towns in the United States owe their progress in population and prosperity to the enterprise of a single firm more fully than this. The firm originally consisted of two, and afterward of the three, brothers Fairbanks. They were descended, in the seventh generation, from Jonathan Fairbanks, who came, before 1641, from Somerby, in Yorkshire, England, and settled at Dedham, Mass. His second son, George, became one of the first settlers of Sherborne, and was one of the five first selectmen in that town, in 1678. His son and grandson, both named Eliezur, spent their lives in Sherborne. The son of the second Eliezur, named Ebenezer, moved to Brimfield, Mass., in 1783. His son Joseph lived until 1815 in Brimfield, where were born his three sons: Erastus, born Oct. 28, 1792; Thaddeus, born Jan. 17, 1796; and Joseph P., born Nov. 26, 1806. In 1815, having sold his farm in Brimfield, Joseph moved to St. Johnsbury, Vt., where he purchased a small mill-privilege on Sleeper's River, a tributary of the Passumpsic, which itself is a tributary of the Connecticut. On this privilege he built a small saw and grist-mill. His elder son, Erastus, had gone to St. Johnsbury some years before, and entered the law office of his maternal uncle, Judge Paddock, afterward a Judge of the Supreme Court of Vermont. But Erastus, owing to an affection of the eyes, was compelled to give up the law; and he engaged in trade successively in Wheelock, East St. Johnsbury, Barnet, and, finally, at St. Johnsbury. Thaddeus remained with his father on the farm at Brimfield, until 1815, when he removed, with the rest of the family, to St. Johnsbury. He was then in his twentieth year, and had a marked aptitude for mechanics. He at once united to the business of the mill that of carriage-making.

In 1824 Erastus Fairbanks gave up his mercantile business, and entered into partnership with his brother Thaddeus, under the style of E. and T. Fairbanks. The new firm did not continue the carriage manufacture, but, having erected a small foundry, began to make cast-iron plows, then of recent introduction, and castings for stoves.

In 1829 many of the farmers in that part of Vermont turned aside from their ordinary farm-crops, and devoted their land and labor to growing hemp. A machine for dressing hemp had been patented, Aug. 12, 1826, by J. Haines, of New York; and applications had been made to E. and T. Fairbanks to build machines for persons who had bought the rights for Hardwick and Barton, Vt. The firm built the machines, and, with three or four others, purchased the right for the use of the machine in St. Johnsbury, forming the St. Johnsbury Hemp Dressing Company. A location was secured on Moose River, a tributary of the Passumpsic, on the opposite side from Sleeper's River, and two miles from the works of E. and T. Fairbanks, with ample grounds; and large buildings were erected for the storage of

hemp. In receiving the hemp-straw from the farmers, it was necessary to weigh it. This was done at first by the ordinary method of weighing hay, which had been in use for generations, the apparatus being a large beam, from the short arm of which hung heavy chains, which, passing over the load, were attached to the end of the axles, while from the other arm was hung a platform, of sufficient size to hold any number of weights. The beam, with the cart and its load, was then raised by a windlass, so that the cart rose clear from the ground, enough weights being placed on the platform to balance the cart and load. This apparatus did not secure even tolerable accuracy, a variation of fifty pounds in two thousand being not uncommon.

The attention of Thaddeus Fairbanks, a mechanic by nature and training, was drawn to the rudeness of this method; and he soon contrived, and had built, a satisfactory platform-scale. His brother and he now determined to engage in its manufacture. They built one for the use of their own Company, and one or two for others. Encouraged by their first success, they began to build and introduce them into general use. While preparing to do so, Thaddeus Fairbanks devised the arrangement and combination of levers supporting the platform, which were essentially those of the platform-scale as it has continued to the present day. For this he received a patent, June 21, 1831. The firm now relinquished their other business, and devoted all their energies to the scale manufacture. In undertaking this enterprise, Erastus took charge of the mercantile and financial departments, and Thaddeus of the mechanical and manufacturing branches.

In 1834 their younger brother, Joseph Paddock Fairbanks, who had studied law, but had not practiced, became a member of the firm, and took charge of introducing the scales into general use. This was an important department, agents being sent through the country to secure orders, and to superintend the erection of the scales, the first effort being to supply the towns and villages with public scales, for weighing hay.

In 1833 they began the manufacture of fixed and movable platform-scales, constructed on the same principle, for use in stores and factories. These, too, supplied a great need; and a brisk demand for them soon sprang up. Other additions to the products of the firm have been made from time to time, until the varieties and styles now number four hundred. In all of them, from the most delicate instruments for the use of jewelers and chemists, and those for retail traffic, to those which can weigh from one to five hundred tons, the greatest accuracy is secured. Their largest scales could weigh the heaviest of the Egyptian obelisks, with the superadded weight of four ordinary locomotives. Some of their railroad-track scales, for weighing freight trains while in motion, have platforms one hundred and fifty feet in length. Two hundred and eighteen of these track scales have been built in a single



Ernest Hartmann

year. It is estimated that these scales weigh — taking the repetitions into the account — a million million pounds a week. One of them, built in June, 1872, for the Lehigh Valley Railroad Company, weighed, on an average, twenty thousand tons a day ; and, in a single day, had been known to weigh sixty thousand tons.

In Chicago there are two hundred hopper-scales, which, in the last ten years, have weighed thirty thousand million pounds of grain. In the stock-yards of the same city, the Fairbanks scales have, within nine years, weighed nearly ten thousand million pounds of live-stock — about thirty million animals, of an estimated value of more than \$500,000,000. Whole droves of cattle and flocks of sheep are driven upon these scales at once.

An immense bell had been cast for the Saviour's Cathedral, at Moscow, by H. Finlandski, a founder of that city. It was intended that the bell should weigh at least eighteen hundred poods, or sixty-four thousand eight hundred pounds ; and, to secure this weight, seventy-two thousand pounds of metal were to be used. When the bell was finished, the founder claimed that it exceeded the proposed weight by at least two poods, or seventy-two pounds. Application was made to the agent of E. and T. Fairbanks & Co., at Moscow, who furnished a scale to weigh the bell. This was placed upon it with great difficulty. Its weight was immediately shown to be only fifty-nine thousand five hundred and sixty-four pounds — a difference against the founder of more than five thousand pounds. This was submitted to conclusive tests, by experts selected by the bell-founder himself, and was, in each of the tests, found to be absolutely correct. The pecuniary gain to the building commissioners was about \$2,240.

The Fairbanks scales are sent to every country, and are to be found in the stores and offices, shops and factories, on the wharves, and along the railroads of the nations of Europe ; they are the standard in India, China and Japan, in the East and the West Indies, Australia, Africa and South America. The Company has warehouses in all the principal cities of the United States, as well as in London and Montreal.

The consumption of raw material is very large. The following figures indicate the average annual amounts used. Of pig-iron, three thousand tons ; of bar-iron, three hundred and fifty tons ; of steel, fifty tons ; of coal, four thousand tons ; of lumber, two and a half million feet ; of nuts, bolts and washers, twenty tons ; of sheet-copper and sheet-brass, ten tons ; of paint, twenty-four thousand pounds ; of oil and varnish, two hundred barrels ; of screws, four thousand gross ; of nails, fifteen hundred kegs ; and other materials in like proportions. The original shop of 1830, which was factory, warehouse and salesroom, was of wood, 60 feet long and 25 wide, having a ground area of 1500 feet. The present shops are ten in number,

of brick, having an aggregate ground area of more than 160,000 feet, and a total floor area of more than 280,000 feet. The Company has also ninety-three tenement houses, its own saw-mill, a lumber-yard of ten acres, and six thousand acres of timber land. The capital invested in 1830 was \$4,600; it is now more than \$2,000,000. The number of men employed then was ten; more than nine hundred men are now at work in the factories and warehouses.

Improvements, both in the scales themselves, in their details, in the variety of style and adaptation, and in the methods and appliances of manufacture, have been made by Thaddeus Fairbanks and others of the family, and by persons employed in the works. These are covered by patents, forty-two of which are still in force.

Gold and silver medals were awarded to the Fairbanks scales at the exhibitions at London, 1851; New York, 1853; Paris, 1867; Vienna, 1873; Santiago (Chili), 1875; Philadelphia, 1876; Sydney (Australia), 1877; Paris, 1878; and at numerous exhibitions of industrial associations and agricultural fairs in this country. At the Centennial Exhibition the Company received four medals and four diplomas; and, at the recent exposition at Paris, they received seven medals, one of which was for "precision in scales." The Emperor of Austria conferred on Thaddeus Fairbanks, in 1873, the Cross of the order of Francis Joseph. Many of their instruments are provided with two beams: one marked with the numeral characters usual in the countries in which they are used, say, — China, Arabia, Austria or Peru, — and the other with the divisions of the metric system.

St. Johnsbury has derived great benefit from this important industry. The Academy was founded, and has been mainly supported, by Thaddeus Fairbanks; and the Athenæum, with a library of several thousand volumes, reading-room and art-gallery, containing, among other paintings, Bierstadt's "Yosemite," which was a gift to the town from Horace Fairbanks. Many of the workmen own the houses in which they live, which are often surrounded by considerable areas of land. Promotions in the factory are invariably made on the ground of merit.

Of the three brothers who composed the firm in its early history, Joseph P. died May 15, 1855. He was a man of methodical habits; and his close attention to the details, and supervision of the sales and the agents, was of marked advantage to the business. He left two sons: Edward T., born May 12, 1836, graduated at Yale College in 1859, and is now pastor of the South Congregational Church at St. Johnsbury; and William P., born July 27, 1840, is the present secretary and treasurer of the Company. Erastus Fairbanks died Nov. 24, 1864. His early mercantile experience, and his native ability, fitted him for his position at the head of the industry. He was elected Governor of Vermont in 1851 and 1860, his second



Thaddeus Fairbanks

term of service beginning early in 1861. He rendered efficient aid to the Government in the early period of the Civil War.

He left three sons and three daughters. Of the sons, two have been, from early manhood, actively connected with the firm, having been trained in its practical details under their father and uncles. Horace, born March 21, 1820, is president of the Company, having succeeded his father as the executive manager, and in the general supervision of its mercantile interests. Like his father, he has been chosen to public office: first, as State senator, and, in 1877 and 1878, as governor. Franklin, born June 18, 1828, succeeded his uncle Thaddeus in charge of the mechanical and manufacturing departments. He has also contributed to the interest of the business several inventions, for which he has received patents; some of them having reference to improvements in the scales, and others to the special machinery and tools used in the manufacture. Elected, in 1871 and 1872, to represent his town in the legislature, he was chosen speaker of the house of representatives.

Thaddeus Fairbanks is yet living. In his eighty-third year, he retains, in a good degree, his physical and mental faculties. In 1876 and 1878 he received three patents each year for recent and valuable inventions. He has been engaged actively in business for sixty years; and in the last few years, though giving up the direction of affairs to the younger members of the firm, he has retained his interest in them. His only son, Henry, born May 6, 1830, graduated at Dartmouth College in 1853, and at Andover Theological Seminary in 1857, and was ordained as a clergyman of the Congregational Church. He preached in Vermont from 1851 to 1859; and, from 1859 to 1868, was professor of natural philosophy and of natural history in Dartmouth College. Since 1868 he has resided at St. Johnsbury, devoting much of his time to mechanical experiments. He has perfected several inventions, for which he has received patents; some of them pertaining to the scale manufacture, and others to matters or products of other industries.

The business was organized as a corporation, Nov. 24, 1874, with a capital of \$2,000,000. Its officers are: Horace Fairbanks, President; and William P. Fairbanks, Secretary and Treasurer.

FALES AND JENKS MACHINE CO.

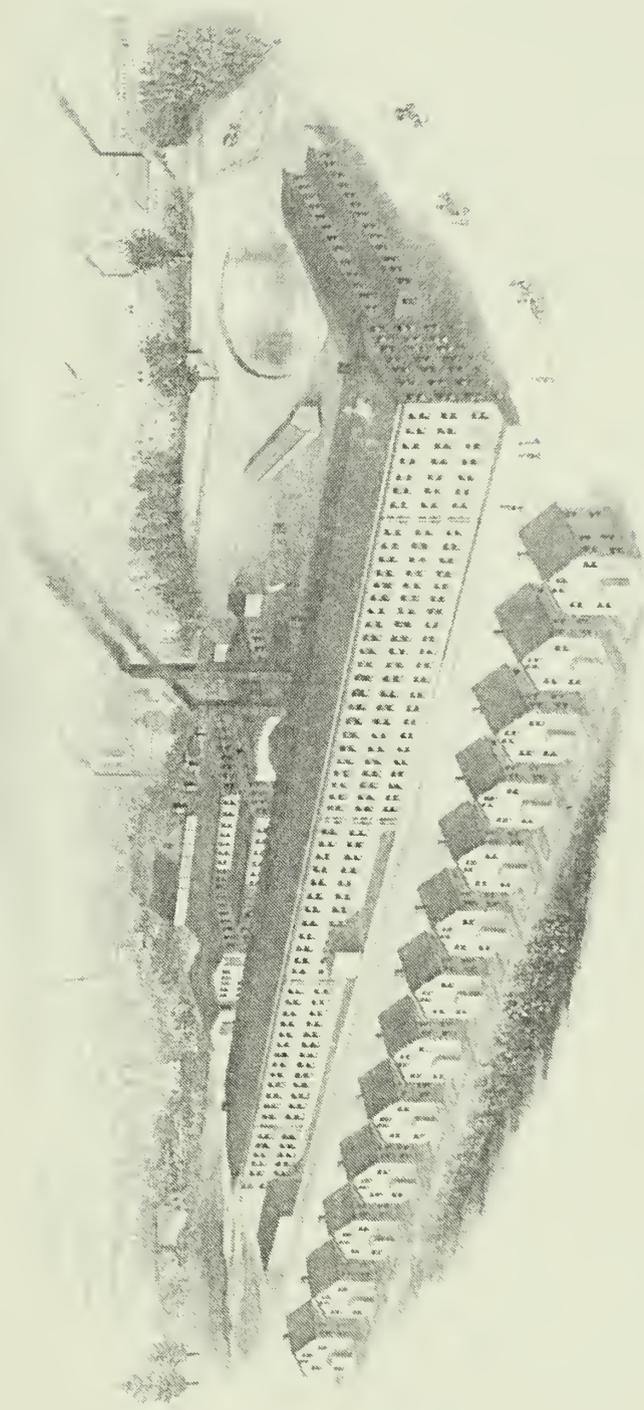
DAVID FALES—ALVIN JENKS.



THE works of this Company constitute one of the oldest and largest industrial establishments in Pawtucket, R. I. The manufactory was founded by David G. Fales and Alvin Jenks in 1830. Mr. Fales had previously served an apprenticeship in the works of David Jenks and Company, of which his partner, Alvin Jenks, was, during that period, one of the proprietors. They began business under the firm-name of Fales and Jenks, in a shop owned by Ruel Richards and Company, at Central Falls, R. I. Their business was at first the manufacture of cotton-machinery; and the first product of their manufactory was a spooler, made for Cunningham and Anderson, of Richmond, Va., for which they received sixty dollars. The operations of the firm, down to the year 1833, were confined to the manufacture of machinery for cotton-spinning and thread-making. In that year they added the manufacture of rotary pumps, having purchased the right to make, in Rhode Island, and sell in New England, a machine known as Hubbard's patent rotary pump. They improved this machine from time to time, and its manufacture formed an important part of their business for many years.

They began the manufacture of ring spinning-frames in 1845, and in the next year ring-twisters, the firm being among the first to build these machines.

Alvin F. Jenks and John R. Fales, sons of the founders of the manufactory, were admitted to membership in the firm in 1854, the name of which was changed to Fales, Jenks and Sons. Two years after, the elder Mr. Jenks died; and another of his sons, Stephen A. Jenks, was taken into partnership. Thenceforward there was but little change in the products of the manufactory until the outbreak of the Civil War, when a great demand arose for milling-machines, to be used in the manufacture of guns. The firm built many of these machines, while still continuing the manufacture of rotary-pumps and cotton-machinery. At length the extent of



Yours truly,
The Board of Trustees

LEWIS & CLARK COLLEGE

PAINT TUBS

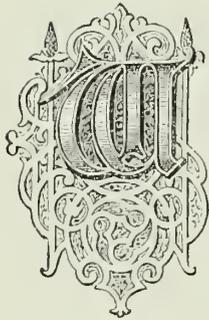


their business required them to enlarge their accommodations, and to increase their productive facilities. They therefore bought, in 1865, a tract of wild land, embracing over fifty acres, in Pawtucket, about a quarter of a mile from the railway station. Upon this they erected buildings, into which they removed their manufactory. These buildings occupy an inclosed area of about eight acres. The main building is the machine-shop, 550 by 63 feet, two stories high, with a basement 200 feet long. There are also two foundries, one for brass and one for iron castings—the former 42 by 35 feet, the latter 156 by 125 feet; a fire-proof pattern-shop, 100 by 40 feet; a blacksmith shop, 80 by 63 feet; a furnace building, 100 by 60 feet, containing four annealing furnaces and several large lumber-sheds.

Having thus largely increased the productive capacity of their manufactory, the firm now extended their operations to the manufacture of plunge-pumps, turbine water-wheels, dynamometers, safety-valves, double and single valve hydrants, pipe connections, shafting and all kinds of foundry work. Still more recently, they have added the manufacture of supplies for water-works. Among others, they furnished the supplies used in the Providence Water Works. An important feature of this manufactory is the large pond, inclosed with the buildings, and fed by springs, which provides the establishment with water, both for manufacturing purposes and for protection against fire. The large engines which drive the machinery are fed from this pond, and from it water is conveyed over the whole premises.

The works are arranged with a view to the perfect harmony of the various departments, and the entire factory is complete in its appointments. The business is now conducted exclusively by the sons of the founders, David G. Fales having retired in 1865. In 1876 the proprietors were incorporated under the name of the Fales and Jenks Machine Company.

W. AND D. D. FARNUM.



WELCOME and Darius D. Farnum were the sons of Moses Farnum, a substantial farmer of Uxbridge, Mass. They were descended, in the seventh generation, from Ralph Farnum, who came, in 1635, from London, England, to Boston. One of his descendants, probably the grandfather of Moses, settled in Uxbridge, about 1700. Moses was the father of three sons, Welcome, Darius D., and Jonathan. The latter never engaged in manufacturing, but remained as a farmer on the homestead. His son, named for his uncle, Darius D., is now the treasurer of the Harris Woolen Company, of Woonsocket.

Welcome Farnum was born Dec. 18, 1796, and was engaged, through his childhood and youth, on the farm. He was also employed occasionally in weaving cotton cloth on a hand-loom, then a common article in farm-houses. The yarn was obtained at the factory of the Slaters, three or four miles distant. He intended to study law; but a weakness of the eyes rendered this impracticable. In his nineteenth year he obtained a situation in the Whiting Mill, at Wrentham, Mass., employed in carding wool by hand—"custom-carding," as it was then called. Being at home on the day when he attained his majority, Dec. 18, 1817, he ventured on his first speculation on that day. Having no money, he bought on credit five hundred pounds of wool from one of the neighbors, Eastman Taft. He sold part of this, at a profit, to a hat manufacturer; the rest he carded and spun himself at Eddy's Mill in Northbridge, Mass. During the ensuing winter he wove the yarn thus prepared in a hand-loom, in his father's house, making about two hundred and fifty yards of cloth. His father, with others, had engaged, just before this time, in an attempt to start a mill at the neighboring village of Ironstone; but this was unsuccessful, and the family were reduced to straitened circumstances. Welcome, in the ensuing spring (1818), was invited by Mr. Stafford, the superintendent of the Belfont Mill, at Pawtuxet, R. I., to take charge

of the one set of cards in that mill. He thereupon walked to Pawtuxet, a distance of twenty-seven miles. He put the cloth which he had woven the previous winter into the hands of Christopher Rhodes, of Providence, the owner of the Belfont Mill, to sell for him, receiving for it one dollar a yard. With this capital, and the aid of his father's credit, he commenced, in 1819, the manufacture of satinets, in company with his brother Darius, under the style of W. and D. D. Farnum.

Darius Daniels Farnum was born at Uxbridge, Oct. 19, 1798. He, too, worked on a farm in early life, and then learned the shoe-maker's trade. He next joined his elder brother in starting a woolen-mill, at Woonsocket. They hired a small wooden building, now occupied by John Kendrick, of Providence, for the manufacture of loom-reeds and harnesses. They began with one set of cards, run by power, and a number of hand-looms. Although the mill was small, their looms exceeded in number those of any other woolen mill at that time on the Blackstone River, with the exception, perhaps, of the mill of Ezekiel Pitts, at Millville, Mass. Both the brothers often worked on the looms during hours outside the regular time for work. On one occasion, in order to fulfill a contract, they worked several days and nights successively.

In 1822 they hired one story of the new cotton-mill started in that year by Dexter Ballou, and which now forms a part of the mills of the Lippitt Woolen Company. Here they put into operation two sets of cards, with two looms, all their machinery being now run by power; and they continued the manufacture of satinets with such success that in two years they had accumulated \$16,000, and then resolved to seek a wider field of enterprise. They bought, in 1854, a large area of land, including a water-privilege, in the adjoining town of Mendon, naming the village which, in a few years, grew up under their patronage, Waterford. That region was then very sparsely inhabited. The mills of the Blackstone Manufacturing Company were about three-quarters of a mile to the west, its first mill having been erected in 1808; and about two miles eastward was the village of Woonsocket. They at once began preparations for building. The few residents in the vicinity were opposed to the enterprise, and placed all the obstacles which they could in its way. The first mill, known as the "Old Red Mill," afterward enlarged, and known as Mill No. 3, was finished, and put into operation in the manufacture of satinets, in 1826. It was of wood, 80 feet long by 40 wide, and four and a half stories high. It contained at first four sets of machinery—afterward, five.

Their business for the next six years was prosperous; and, in 1832, the foundations of a new brick mill were laid, its extreme length being 400 feet, its width 51 feet, and its height four stories above the basement. Three breast-wheels of the best construction furnished the motive power. The mill contained all the machinery

necessary for making woolen fabrics, broadcloths, doeskins, Oxford mixtures and cassimeres. This mill, put in operation in 1837, was then the largest woolen mill in the country, and was called "The Mammoth Mill." It contained twenty-two sets of machinery. Their facilities being so greatly increased, it was not an easy matter to obtain labor. This want, however, was soon supplied by the efforts of Darius Farnum.

The financial crisis of 1837, occurring at the same time with the enlargement of the mill, severely taxed the resources of the firm; and only their good credit enabled them to continue without compromise or suspension. From 1837 to 1841 the firm was scarcely solvent. Their manufactured goods, however, were of the best quality, and received awards at the industrial fairs in Boston, New York and elsewhere. They were the first in this country to make the finest grades of broadcloth. Some of these goods were sold by the houses of David S. Brown, of Philadelphia, and Fearing and Hall, of New York, at ten dollars per yard, the purchasing value of money being then much more than it is now. A suit of clothes made from their broadcloth was presented by the firm to Daniel Webster, and was worn by that statesman in the United States Senate on the occasion of his great speech advocating "Protection of Home Industry."

Welcome Farnum had the general management of the financial affairs, the purchase of material and the sale of goods; while Darius superintended the interior operations of the mills and the details of the manufacture, with the special direction of the operatives. Of a delicate constitution from childhood, Darius overtaxed his strength for years; and, in 1832, when the erection of the large mill was suggested, he proposed to retire from business on his share of the \$50,000; but, on his brother's solicitation, he consented to continue a while longer. In the autumn of 1840 his health again failed. He went to Cuba, intending to spend the winter in the West Indies, and died there on the 23d of November, leaving a widow and three children.

After his brother's death, Welcome Farnum continued the business, taking the whole burden of it on his own shoulders. When there was no direct railroad communication between that part of the Blackstone Valley and Boston, Mr. Farnum used to ride the whole distance each way—eighty miles—in one day, with two relays of horses. At the time of his brother's death the firm was scarcely solvent: but, on the revival of business, its resources increased rapidly; and the surviving partner divided to the heirs of his brother a considerable surplus. Continuing the business on his own account, he still retained the old style of W. and D. D. Farnum.

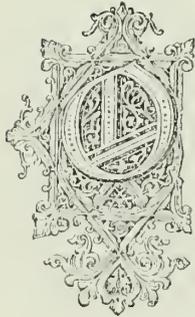
About 1845, with a view of increasing his resources, he bought all the water-power, the woolen, grist and saw-mills, and the scythe-factory, at Millville, about three miles above Waterford, on the Blackstone River. Raising the dam, and setting

the water back about five miles, he doubled the power, so that, besides the other work carried on there, he was able to run thirteen sets of woolen machinery in one mill, and two sets in another. In 1848 Mr. Farnum became interested in the project of an air-line railroad to New York. It was proposed to run through Woonsocket, Slatersville and Paseoag, to Putnam, and thence, by way of Middletown, to New Haven. Mr. Farnum first secured the construction of the Norfolk County Railroad from Boston to Waterford. He then leased his factories, and devoted himself exclusively to the extension of the railroad, with the idea of reaching the Hudson River, and of thereby opening a direct route from the manufacturing districts of Eastern New England to the coal regions of Pennsylvania, as well as a new route from Boston to the West; but this project did not succeed. He next resolved to continue the line of the road independently of Woonsocket, and to make a detour, by way of East Thompson, to Putnam; but, having exhausted his property in this attempt, he was reduced to complete bankruptcy. As president of the Providence and Worcester Railroad for several years, Mr. Farnum introduced, for the first time in this country, the practical and economical use of coal, in place of wood, as fuel for locomotives. Experiments to gain this object had been tried for many years, on the Boston and Worcester, the Boston and Providence, and other railroads, but with no favorable results. Mr. Farnum spent a large part of his time for several months, in trying to effect the object, acting himself as fireman on both passenger and freight trains. These experiments were finally successful.

At the close of his business operations, Mr. Farnum owned, without encumbrance, and had in successful operation, sixty-three sets of woolen machinery, and employed fifteen hundred hands.

FARREL FOUNDRY AND MACHINE CO.

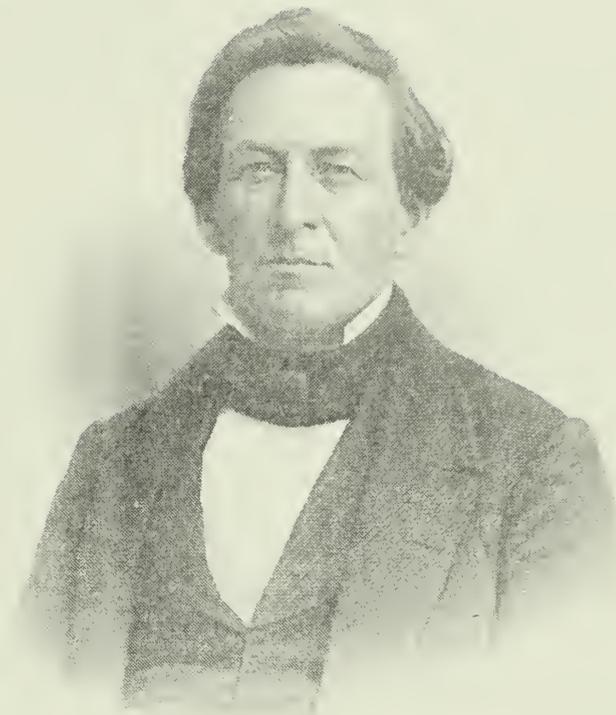
ALMON FARREL.



ONE of the men who were identified with the rise of manufacturing industries in the Naugatuck Valley was Almon Farrel, of Waterbury, Conn. His father, Zebah Farrel, born Oct. 7, 1776, was a millwright, who died in 1862, at Prospect, Conn. His son Almon was born at Oakville (in the town of Waterbury), Oct. 12, 1800, and early learned his father's trade. At eighteen years of age he bought his time, and from that period was engaged in business on his own account. One of his first pieces of work was the construction and putting-in of a small breast-wheel in the woolen-mill of Austin Steele, at Waterbury; and he also built power-looms for Mr. Steele.

Mr. Farrel began his business career at a time when there was a rapid development, in western Connecticut, of manufacturing enterprises; and he soon acquired a reputation for his special capacity in laying out, constructing and putting into operation, mills and their appliances, from dams and water-wheels to the smallest details of the machinery. His first work, outside of Waterbury, was at Barkhamstead, Conn., where he built a chair-factory. He was then employed, until 1845, in the erection of mills, either for new enterprises, or to take the places of old mills. These were mostly in the Naugatuck Valley, or in its vicinity.

In 1845 Phelps, Dodge & Co., of New York, started a new enterprise at Derby, Conn., in a village called "Ansonia," from Anson G. Phelps, the senior partner. Mr. Farrel was engineer of the dam, and of the first mills erected by this firm. The whole fall of the Naugatuck River at this point was used, the dam being two hundred and fifty feet long, with a fall of thirty-two feet. A canal two miles long was built, affording several mill-privileges. On this canal the following establishments have since been erected: Slade's Woolen Mill, Wallace and Sons' Brass Mills, Union Brass Foundry, the works of the Farrel Foundry and Machine Company, the manufactory of Osborn and Cheesman, and the Ansonia Brass and Copper Company's factory.



Wm. Glynn & Co. Boston.



Amos Fernald

In 1848 Mr. Farrel engaged in establishing the Farrel Foundry at Ansonia. It was fairly in operation in 1849, his object being to manufacture shafting and other heavy machinery called for in the mills, in the erection of which he was then actively engaged. In 1851 he was interested with others in the organization of the Waterbury Foundry Company; and, during the remaining six years of his life, he was constantly employed in similar labors. He died in June, 1857. Mr. Farrel was energetic, skillful, and conspicuous for the thoroughness of his work. Fertile in resources, and effective and accurate in mechanical construction, by his unaided strength, he reared monuments to his genius and skill which exist in every part of his native valley.

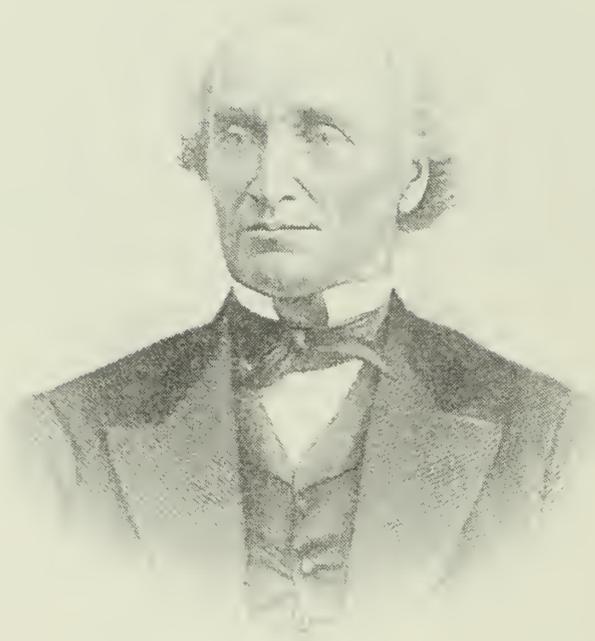
On his death his son Franklin, who had been, since 1845, associated with him in most of his enterprises, assumed the management. Franklin Farrel was born at Waterbury, Feb. 17, 1828. He attended the academy, and Mackenzie's School, at West Point, making a special study of mathematics and draughting. At fifteen he learned the trade of a mill-wright; and, two years later, he began to assist his father at Ansonia. From that period until 1848, he was employed in surveying and engineering; and on the starting of the Farrel Foundry, in 1849, he took charge of it. The business of this establishment and that of the Waterbury Foundry Company were kept distinct until after the death of the elder Farrel in 1857.

The two interests were then combined; the shares in the Waterbury Foundry Company owned by outside persons being purchased, the Farrel Foundry and Machine Company was organized. The work of mill-building having now, to a large extent, ceased, the Company devoted itself almost exclusively to the manufacture of machinery, both at Ansonia and at Waterbury, the machinery at the latter place being generally lighter than that made at Ansonia. Among specialties made are chilled rolls; iron, brass, copper and rubber mill-machinery; railroad cranes, some with a capacity to raise twenty tons; also sugar-mills, and steam-engines to run them. Within the last ten years, a good foreign trade has been secured.

Franklin Farrel is president and executive manager of the Company. Associated with him in the Farrel Foundry and Machine Company is Edward C. Lewis, its agent and treasurer, who was born in Wales, Sept. 23, 1826, and came to this country when he was five years old. His father was the master-spinner in the woolen-factory of Thatcher and Bunnell, at Bridgeport, Conn. When eighteen years of age he went into the machine-shop of Wheeler, Whitney and Young, at Bridgeport, as an apprentice. Having learned the trade, he repaired, in 1847, to Birmingham, Conn., and obtained employment with Colburn and Bassett, machinists. In 1848 he began to work for Almon Farrel, and superintended the starting of the foundry at Ansonia.

The year after, he returned to Bridgeport, and went to work for his first employers, remaining there until 1850, when he took charge of the Birmingham Iron Foundry. In 1852 he removed to Waterbury, and took charge of the foundry of the Waterbury Foundry Company. On the union of that concern with the Farrel Foundry, at Ansonia, and the organization of the Farrel Foundry and Machine Company, he was appointed treasurer and agent, with the management of the foundry and machine-shops in Waterbury. He is an able business man, and a public-spirited citizen.

The secretary of the Farrel Foundry and Machine Company is Alton Farrel, son of Franklin Farrel, who was born, March 9, 1851, and had a good business training in the office of the Company at Ansonia. To him is committed the oversight of the business there, especially in the absence of his father, much of whose time is devoted to visits to different places in making and completing contracts for machinery.



Wm. H. Stone, Boston



W. W. Farwell



NATHANIEL W. FARWELL.



NATHANIEL W. FARWELL has been prominently connected with the cotton bleaching and dyeing industries of New England, for the past thirty-six years. He was born in a log house, at Plymouth, Chenango County, N. Y., on the 9th of March, 1818. His mother died four days after his birth, leaving two sons and a daughter. When he was about a year old, his father removed to Peterboro, N. H., intrusting his children to the care of their maternal grandfather, Nathaniel Whittemore.

At the age of nine, the subject of this sketch was forced to seek his fortune in the world; and he spent his early years at Peterboro, N. H., and at Waltham, Mass. At twenty-one he went to work on a milk-farm, at Waltham, on which he labored eighteen hours a day. Then he became the watchman—half the time at day, and half the time at night—of the Boston Manufacturing Company, a cotton establishment at Waltham. Three years later he went into the bleachery of this Company as second hand, and he took charge of this bleachery the next year. In this post he remained eight years, at the end of which period his health broke down, and he was forced to transfer his labors to another sphere. He entered the employment of the Fitchburg Railroad, at Waltham, in which he continued two years. He was then engaged by the Great Falls Manufacturing Company to arrange a bleachery, in conjunction with their extensive works in New Hampshire; and he planned and erected a building for this purpose, of which, in 1852, he became the manager. He has operated this bleachery ever since, partly on contract, and partly as agent, leasing the premises at various times.

Meanwhile, he has not confined himself to this work. He arranged the bleachery at Passaic, N. J., known as the "Boiling Spring Bleachery," and also the Lewiston Bleachery, in Maine, at the request of the late David Whitman, who was

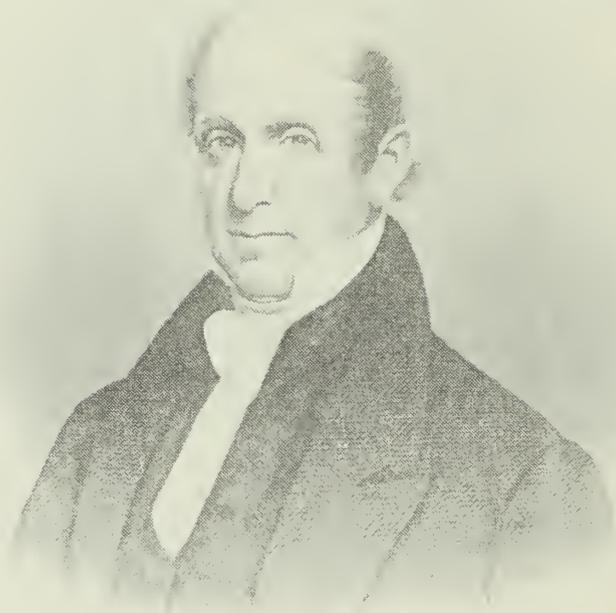
the agent of the Franklin Company at that place. The latter building he afterward leased, with its machinery, for ten years, operating on his own account, and introducing dye-works, which were combined with the bleachery. On the expiration of his lease, Mr. Farwell advised that the enterprise should be changed into a corporation, and that the stock should be issued to, and owned by, the different cotton corporations in Lewiston and Biddeford.

The present capacity of the Great Falls Bleachery, with which Mr. Farwell is still connected, is from five to six tons of cloth a day, and it employs forty hands. For some years past John W. Farwell, son of N. W. Farwell, has had an equal interest in this establishment.

The cotton interest proper was not entered into by Mr. Farwell until 1868. In that year he went to Lisbon, Me., six miles from Lewiston, and bought three mill privileges on the Sabbathus River, which were known respectively as the Corbett, the Lisbon Center Falls and the Bryant privileges. He reconstructed the old Corbett Mill, formerly devoted to woolen manufacture, and enlarged it for a cotton-mill, with a capacity of 3,000 spindles. Several years ago he built his present cotton-mill, on the Lisbon Center Falls. It is of brick, 500 feet long, 52 feet wide, three stories high, with basement, and is equipped with about 20,000 spindles. It manufactures bleached sheetings, thirty-six inches wide when finished, and is ticketed Farwell Mills. The annual product is about 3,600,000 yards. In the structure of this mill, the brick came from a yard near by, belonging to Mr. Farwell, and the lumber from a saw-mill, also owned by him, which saws about 600,000 feet annually. About three hundred hands are employed in the cotton-mill, and forty more in his other smaller interests.

After leaving the bleachery at Lewiston, Mr. Farwell succeeded A. D. Lockwood, as agent for the Franklin Company, which owns the large privilege on the Androscoggin River at that place.

In the spring of 1877 Mr. Farwell and his son started a new bleachery at Lawrence, Mass., on the south side of the river, which was completed and put in operation the first of January following. The present capacity of these works is six tons of fine bleached work per day. They are provided with dye-works, and buildings in which its capacity may easily be doubled. Mr. Farwell was a member of the Massachusetts Legislature for two terms, and mayor of Lawrence one year.



Van Slyck & Co Boston



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THE FAULKNER MILLS.

FRANCIS FAULKNER—JAMES R. FAULKNER.



THE Faulkner Mills are situated on the Concord River, at North Billerica, Mass., about four miles from Lowell, and on the direct line of the Boston, Lowell and Nashua Railroad. The business was established here by Francis Faulkner, whose ancestry were English, and who was born in Acton, Mass., Jan. 31, 1760. His father was a colonel in the Continental Army, and was conspicuous for his zeal and patriotism. When Mr. Faulkner attained his majority, he entered into business as a silk-dyer, and in finishing woolen goods, at Watertown. In 1811 he began to manufacture satinets in North Billerica.

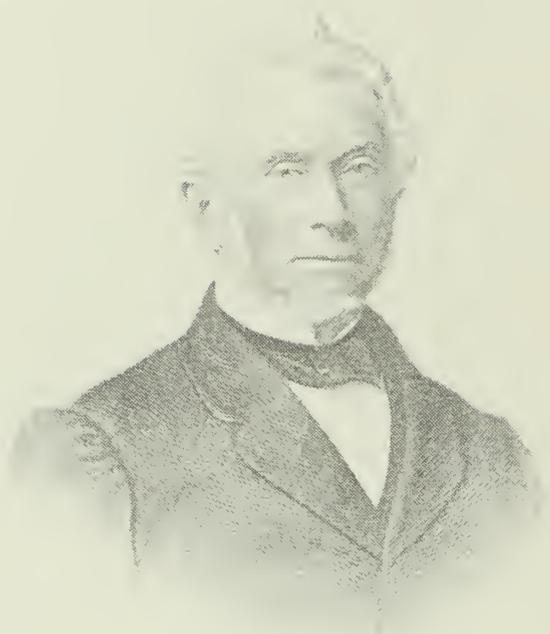
The site on which the factory now stands was then owned by the Middlesex Canal Company, on which was a long, one-story frame building, which Mr. Faulkner rented for the purpose of his manufacture. At this time there were but fifteen woolen mills in the United States, and none in this section of Massachusetts. The great obstacle to this industry had been the scarcity and high price of wool, and woolen goods were then mainly made in private families.

But Mr. Faulkner prospered in his undertaking. Three years later he erected an additional building, and introduced machinery for the carding of wool. In 1818 the buildings were totally destroyed by fire, when he purchased the site, including twenty acres of land, and erected a new brick mill, two stories in height, with an area of 50 by 42 feet. His son, James R. Faulkner, the present representative of the business, was admitted as a partner in 1824, the firm-style being Francis Faulkner and Son; and, at about the same time, they began the manufacture of flannels—an industry which Abraham Marland had previously established in Andover, Mass. On coming to this country from England, Mr. Marland had inquired for a woolen manufacturer, and was directed to Francis Faulkner, at Watertown. The acquaintance thus formed led to a life-long friendship; and probably gave, in part, the new direction to Mr. Faulkner's labor.

In 1836 the mill erected in 1818 was also burned, and the smaller of the two buildings now comprising the factory, having an area of 72 by 42 feet, and three stories in height, was erected. Seven years later—Feb. 12, 1843—Francis Faulkner died, at the age of eighty-three. He was a man of intense activity and of steadfast integrity.

James R. Faulkner, his son, was born in Watertown, Mass., on the 14th of April, 1801. At an early age he entered his father's factory, where he soon acquired a practical knowledge of the process of manufacture. On his father's death he associated with himself his younger brother, Charles, in the conduct of the business, the interest of the heirs remaining in it, and the firm-style being unchanged. The immediate management continued in the hands of James R. Faulkner. In 1846 the two brothers acquired the whole property,—James owning two-thirds and Charles one-third,—and formed a new firm, as J. R. Faulkner & Co., which style has continued until the present time. Charles Faulkner having come to Boston in his youth, to receive a mercantile training, was received, in 1834, as junior partner of the house of Thomas Tarbell, importer of European and India goods. In 1850 Mr. Tarbell retired from business; and Mr. Faulkner became the head of the new firm, Faulkner, Kimball & Co., which, in 1872, became Faulkner, Page & Co. They represented the mills of J. R. Faulkner & Co., and other mills in the same line of manufacture.

In 1865 J. R. Faulkner & Co. erected what is now the main factory-building, with an area of 81 by 54 feet, and, including basement, is four stories in height. Since the first purchase, twenty acres more have been added to the grounds. The product of the factory is heavy twilled flannels; of these goods, two thousand six hundred yards are manufactured daily. Thirty-eight looms, seven sets of cards and three thousand spindles are used, employing seventy hands, of whom twenty-seven are women and girls. James R. Faulkner died at North Billerica, Mass., Jan. 7, 1877.



WILLIAMS & CO BOSTON

Merrill Field





ALBERT FIELD.



UNTIL late in the last century, the manufacture of nails, tacks and brads was wholly by hand. It was not until the time of the Revolution that the first attempt was made to produce cut nails and tacks. About 1775 Jeremiah Wilkinson, of Cumberland, R. I., who was then engaged in making hand-cards, adopted the expedient of cutting tacks with shears from iron hoops, or other thin metal, and afterward heading them in a vice. He then applied the same method to the manufacture of small nails, producing, probably, the first cut nails ever made. Between that time and the end of the century, several early American inventors, among them Jacob Perkins, Amos Whittemore, Ezekiel Reed, all of eastern Massachusetts, and Josiah G. Pierson, of Ramapo, N. Y., employed their skill in devising and constructing nail-making machines, based on the same principle as that involved in Wilkinson's method. One of the most valuable of these machines was that of Ezekiel Reed, of Bridgewater, Mass. The nail-cutting machinery of Jacob Perkins, though invented as early as 1790, was not patented until January, 1795. It cut and headed nails at one operation, and was an advance upon anything before used. Mr. Perkins first established a factory at Byfield, Mass., in which Paul Moody, afterward the machinist of Waltham and Lowell, was employed. In the *American Gazetteer*, published in 1797, a machine is described, invented by Caleb Leach, of Plymouth, which would cut and head five thousand nails in a day, with the aid of one boy or girl. There was also a machine at Newburyport, which would turn out two hundred thousand nails in a day. In 1810 Mr. Perkins took out another patent for cutting nails and brads, and during the same year the nail-cutting machine of Massachusetts was patented in England. This machinery was soon after put in operation at the Britannia Nail Works, in Birmingham, which was the first manufacture of cold cut nails by machinery in that country.

Its features were powerful rotary presses, or hammers, for squeezing metal rods into the forms of nail-shanks, and soon cutters for separating the proper lengths and dies, operated by revolving cams, or cranks, for forming the heads. It was the type of many later inventions, securing greater simplicity of parts and increased speed.

The invention of Ezekiel Reed was improved by his son, Jesse Reed, who took out a patent June 9, 1801, for nails milled out of heated rods, and who afterward, between 1807 and 1825, received ten patents, chiefly for cutting and heading nails and tacks. Other patents early in the century were those of Jonathan Ellis, in 1807; of Seth Boyden, of Sharon, Mass.; and, most valuable of all, the brad and tack machine of Thomas Blanchard, of Middleboro, Mass., invented when he was eighteen, and remodeled and perfected through six years. This could make five hundred tacks a minute. These machines, especially those of Reed and Blanchard, were the means of starting several important establishments for the manufacture of nails and tacks, both in New England and in the Middle States; those in New England being mainly situated in Plymouth and Bristol Counties.

A very prominent establishment in the tack manufacture is that of A. Field and Sons, at Taunton, Mass. The founder, Albert Field, was born in Norton, Mass., July 4, 1795. His first mechanical labor was undertaken in his seventeenth year, when he entered the file factory of Seth Boyden, at Sharon. Mr. Boyden's attention had been directed to the invention of a machine for cutting brads and small nails; and young Field, soon after attaining his majority, went to New York, and attempted to manufacture tacks by horse-power. He then repaired to Taunton, and was employed by Crocker and Richmond, who were engaged in the manufacture of nails and machinery. He remained with this firm until 1827; in which year he began, in a small building on the site of the present works of A. Field and Sons, to make brads with a single machine, built by himself. The business gradually increased; and, in 1830, he bought one of Reed's tack-machines, and employed Elijah S. Caswell to run it. The next year he employed Otis Allen to take charge of the packing and shipping departments. One machine after another was built, both of the Reed and the Blanchard patterns; the buildings were from time to time enlarged; and improvements in methods were invented in the establishment, or adopted from without.

The principle of the manufacture of tacks, brads and ordinary nails was, as has been stated, that devised by Wilkinson, viz.: to cut them from sheets or strips of uniform thickness, in such shape that they would need no hammering to form the body of the nail or tack. In this machine there is a main shaft, driven by a belt supplied with cams, and provided with a metal tube, through which passes the plate from which the brad or tack passes, this plate being held in its position by pinchers. To give the brad or tack its wedge shape, the cutter is set obliquely to the direction

of the plate, which is reversed after every cut, and a uniform taper is obtained. A rocking shaft effects the turning of the plate, which is fed to the cutter by means of a weight, the nail-rod, with its attach-plate, vibrating freely within the guide-tube. The cutter, being as long as the plate is wide, is adjusted by screws to the cutting-block, on which, between guides, rests the nail-plate. The vibratory motion of the cutter is effected by a crooked lever, worked by an eccentric on the main shaft. The lever of the heading-die is worked by a crank-pin and rod, attached to a wheel on the main shaft. The working of the machine is as follows: The nail-plate rests against the frame of the cutter, the lever resting on the point of the cam or eccentric. As the lathe revolves the lever falls, lifting the edge of the cutter above the cutting-block, and also above the nail-plate, which, by the action of the weight, is thrown forward under the cutter, to a stop the width of the required nail or tack. At this point, by the revolution of the eccentric, the lever is raised, lowering the edge of the cutter and shearing off a wedge-shaped piece of metal, which is at once seized by nippers below the cutter, and subjected to the action of the heading-die; and the nail or tack is completed at a stroke. In the factory of A. Field and Sons, in making shoe-nails, which are a speciality, the machines are provided with an ingenious self-feeding apparatus, the invention of William H. Field, of Taunton.

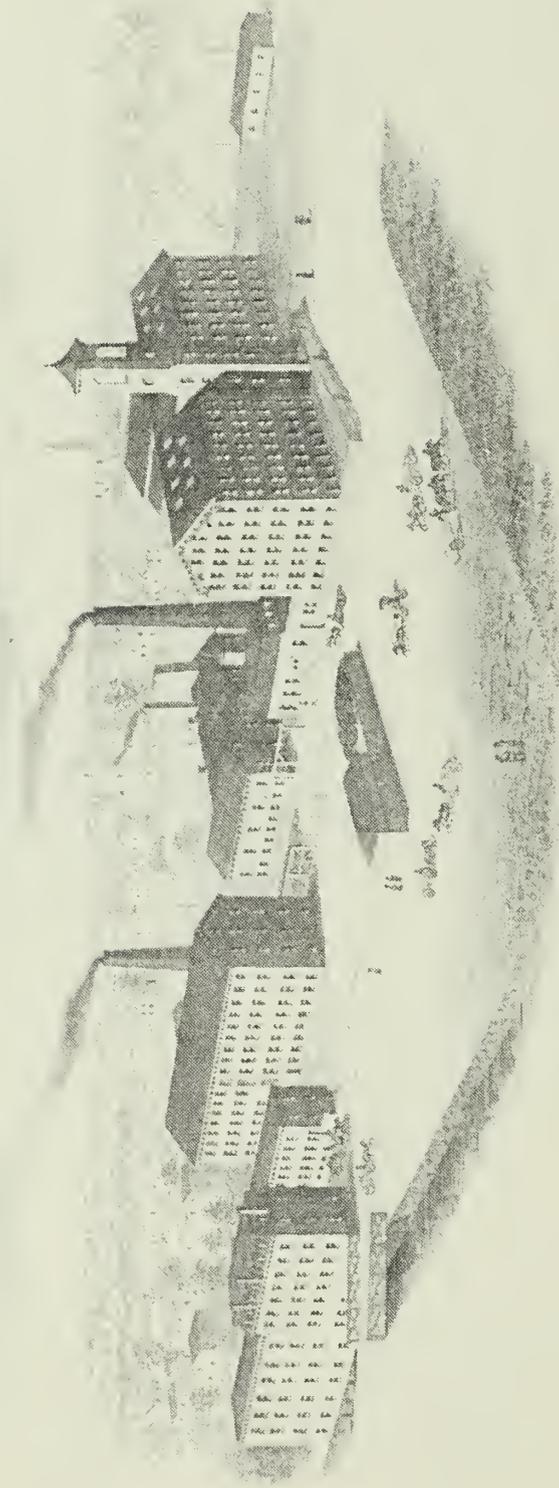
Nails and tacks, having been cut, must be annealed, making them more tough and malleable, and imparting to them their rich blue color. This is done by heating them in iron boxes in an oven, and leaving them to cool slowly. A complete department is devoted to the leathered carpet-tacks. Scraps of leather from shoe manufactories are fashioned by machinery into the caps for tacks, which are at the same time driven through them. A girl operating one of these machines can leather one hundred and twenty thousand tacks in a day. Mr. Field designed, and was the first manufacturer of, the gimp-tack used on carriages and furniture. He drove out of the American market the English clout-nail, by producing a better nail for the same purpose and at a less price.

Mr. Field continued in active connection with the business for more than forty years, and died April 25, 1869, aged seventy-three. The success attained by him was a proof of his business capacity, and his talent for industrial organization; and, as an employer, he was considerate of his workmen. He was one of the projectors of the gas works of Taunton, and was president of the company. He also established the Taunton Foundry and Machine Company, and the Mount Hope Iron Company, at Somerset, Mass.

In 1869 the business was organized as a corporation, retaining the previous firm-name. The president, George A. Field, eldest son of Albert Field, entered his father's factory in early youth, and has been connected with the concern for about

forty years. Associated with him in the general management is N. Bradford Dean, who is treasurer, and who for the past twenty-five years has been identified with the business. Charles H. Field, another son of the original proprietor, is one of the directors. The superintendent of the works is Leander Soule, a practical tack-maker. In charge of the cutting-room is Elijah S. Caswell, who has been in the establishment nearly half a century, and has made important improvements in both the Reed and the Blanchard machines. Otis Allen has been in the service of the Company only one year less than Mr. Caswell. He took charge of the packing and shipping departments in 1831, and is still in the same position.

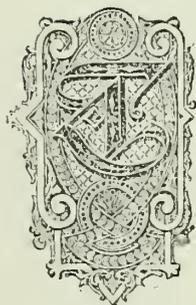
The buildings are over seven hundred feet long, and the machinery is mostly manufactured by the Company, from their own patterns and under their own inspection. The range of manufacture includes over two thousand varieties of small nails and tacks, which are made of iron, zinc, copper, steel, and every kind of material used for this purpose. Each machine cuts and heads fifteen thousand nails or tacks an hour. Shoe-nails are cut at the rate of fifteen hundred to three thousand a minute. Here are made, also, the chisel-pointed nails used in boat-building. Early in 1877 the Company began to make French wire-nails, sending to France for the necessary machinery and labor; they also now make shoe-eyelets, glaziers points, and tufting-buttons. The daily capacity, including all articles, is fifty millions of pieces; and, on an average, about two hundred boxes, or other packages of nails and tacks, weighing, in the aggregate, between nine and ten tons, are every day sent out from this establishment. These products are exported to the West Indies, South America, Australia, Germany, China and Africa.



THE UNIVERSITY OF CALIFORNIA, BERKELEY

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FLETCHER MANUFACTURING Co.



THE business of the Fletcher Manufacturing Company was commenced in Boston in 1793, by Thomas Fletcher, a poor cotton-weaver, who came from Manchester, England, in 1791. The branch of weaving to which Mr. Fletcher had been trained was that of narrow goods, such as lamp-wicks, tapes, webbing and fringes; and, two years after reaching America, availing himself of the supply of cotton yarn which, at that time, was appearing in the market, he began to weave the class of goods referred to, in a small room on Cornhill, in Boston. Soon after, the Argand Lamp was introduced into this country from France; and he was the first person here to meet the demand for the style of wicks used in them.

Mr. Fletcher carried on his business in Boston until 1808, when he removed to Providence, R. I. His first location was on South Main Street, near the present site of the Providence Institute for Savings. The next year he removed to a small room in a house on Charles Street. In 1820 he removed to a house on the corner of Davis and Cross Streets, on Smith's Hill, Providence, where he continued until his death in 1824.

His sons, Thomas, William and Joseph, had learned the trade of their father. On his decease the two elder sons, Thomas and William, entered into partnership, under the firm-style of T. and W. Fletcher, and gave employment to Joseph, who had not attained his majority. In 1826 they put up some braiding-machines, and began the manufacture of boot and shoe-laces. In 1837 Joseph Fletcher was received into partnership, and the firm-name became Fletcher Brothers. Three years later they removed, for water-power, to the mill on Charles Street, which had long been known as the Town Grist Mill, and is now Snow's Dye-wood Mill. Here they began to spin their own yarn, operating 300 spindles. They purchased the

premises on South Main Street, now occupied by their factories, in 1844, and erected Mill No. 1. In 1860 the firm was enlarged by the admission of John S. Ormsbee, son-in-law of Thomas Fletcher; William B., son of William Fletcher; Henry, son of Joseph Fletcher; and Samuel G. Tripp. The style of the firm was changed to Fletcher Brothers and Company. Five years later it was incorporated, under a special charter, with a capital of \$300,000. The first officers of the Company were: Thomas Fletcher, President; William Fletcher, Vice-President; John S. Ormsbee, Treasurer; Henry Fletcher, Secretary and Agent.

The manufacture of kerosene oil from the Alberti mineral, commenced in 1859, and from the petroleum wells of Pennsylvania, in 1861, opened a new field in the manufacture of wicks, which has become one of their most important specialties.

Thomas Fletcher died in September, 1867. He had been at the head of the business since 1824, and may justly be regarded as the founder of the present establishment. At his death, William Fletcher became president, and Joseph Fletcher vice-president, of the company. William Fletcher died in 1869, and was succeeded as president by Joseph Fletcher, whose place as vice-president was filled by the election of William B. Fletcher. Henry Fletcher, who had been since 1865 secretary and agent of the company, died May 6, 1875. As agent, he had been in charge of the manufacturing department, both before and after the organization of the company. The offices vacated by his death were filled by the election of William Ames, who had been educated to the practice of law, and had been United States Commissioner of Internal Revenue for the district of Rhode Island.

The buildings of the Fletcher Manufacturing Company consist of Mill No. 1, erected in 1842, 144 feet long, 47 feet wide, and five stories high; and attached to it a store-house and finishing-shop 110 feet long, 35 feet wide and two stories high. Mill No. 2, erected in 1862, 184 feet long, 64 feet wide, five stories high, with a bleaching and dye-house of the same width, and 123 feet long. Steam-engines of 150 and 350 horse-power are used respectively in these buildings, which contain machinery of a capacity of 40,000 spindles. Much of the machinery employed is intricate and novel, and is kept from public inspection. A large three-story brick building, for offices and store-rooms, was erected in 1872. In addition to the manufacture of the yarns used in its own manufactures, the Company spins a large amount for other concerns, for weaving, braiding and various other purposes.

The selling agencies of the Company are in New York and Boston; the former is under the management of the vice-president, William B. Fletcher; and the latter, of Samuel G. Tripp, who entered into the employ of the Fletcher Brothers when a youth, became a partner in 1860, and held his present relation to the business before the incorporation of the Company.

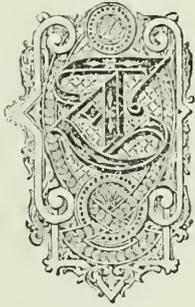


Van Stryck & Co. Boston.



George H. Gilbert

THE GEORGE H. GILBERT MFG. CO.



HIS Company, the immediate successors of the firm of George H. Gilbert & Co., received their charter of incorporation on May 27, 1867. The authorized capital was \$600,000. On the 1st of April, 1868, the Company was organized with a capital stock of \$250,000. Mr. George H. Gilbert was chosen president, and Mr. Lewis N. Gilbert, treasurer. On the 15th of November, 1869, Mr. Lewis N. Gilbert was elected president, to fill the vacancy occasioned by the death of the first president; and Mr. Charles D. Gilbert was elected treasurer. Mr. J. H. Grenville Gilbert was chosen secretary in December, 1872, since which date there have been no changes in the officers of the corporation.

The Company own and operate five mills. Of these, one built of granite, 85 by 55 feet, and five stories high, is situated in Ware, Mass., where is also the principal office of the Company. The other four, of brick, are in Gilbertville, a village about four miles from Ware, in the town of Hardwick. They are numbered in the order of their erection; No. 1, being 130 by 56 feet, and five stories in height; No. 2, 125 by 60 feet, and three stories high; No. 3, 84 by 60 feet, and four stories in height; and No. 4, 230 by 68 feet, and five stories high. Connected with them are smaller buildings, used for various purposes. In the vicinity of their Gilbertville Mills, the Company own also about three hundred and twenty-five acres of land, upon which nearly two hundred tenements for operatives have been erected. All the mills of this Company were built, and have been exclusively used, for the manufacture of woolen goods, principally fine flannels. Together, they constitute the largest manufactory of such flannels in the United States.

The growth of this manufactory has been noteworthy. In 1851 Mr. George H. Gilbert, then the sole proprietor, was operating the Ware Mill, with four sets of machinery. Within three years three more sets had been started in that mill. At

the time of Mr. Gilbert's death, in 1869, the four mills at Gilbertville had been erected, and the machinery in the entire manufactory had been increased to twenty-four sets. Before the close of that year, four sets were added; in 1870, four; and three in 1871; making a total of thirty-five, or an increase of nearly 900 per cent during twenty years. The productive capacity of the five mills is now about 10,000 yards per day. Their product embraces almost every variety of fine flannels; plain white opera (of which about one hundred different colors are produced), silk-warp, and French plaid, as well as dress-goods and blankets.

George H. Gilbert, the founder of this industry, was among the men whose energy and capacity have advanced the business interests of New England. He was born in Brooklyn, Conn., Feb. 15, 1806. His early education was limited. At the age of twelve, he left home to make his way alone in the world, going first to Pomfret, Conn., where he lived until 1824. He next removed to Sutton, Mass., where he learned the carpenter's trade. Leaving Sutton in 1827, he went to Worcester, and there resided until 1832, working as a machinist, and gaining a thorough knowledge of the business. In May, of the same year, he removed to North Andover, where, for a short time, he worked as a journeyman in a machine-shop; and then, having formed a copartnership with two other gentlemen, under the firm-name of Barnes, Gilbert and Richardson, commenced building woolen machinery. Of this firm, of which Messrs. Davis and Furber are the successors, Mr. Gilbert continued a member until 1846. The knowledge and experience acquired during this period were a preparation for the success which, in after years, he achieved as a manufacturer of woolen fabrics.

In August, 1841, Mr. Gilbert, while still engaged in building woolen machinery at North Andover, removed his residence to Ware, with a view to establish a manufactory of woollens. He there formed a copartnership with Mr. Charles A. Stevens, of North Andover, under the name of Gilbert and Stevens. The firm bought of the assignees of the Hampshire Manufacturing Company, all the property formerly owned by that company on the south side of the Ware River. The purchase included the water-power with the adjoining land, and a woolen-mill with the machinery, for which the sum of \$35,000 was paid. This was the beginning of the enterprise to which Mr. Gilbert devoted his life, and which grew into the extensive industrial establishment that now bears his name.

Messrs. Gilbert and Stevens at once began the manufacture of broadcloths and cloakings, running five sets of machinery. Two years later they ceased the manufacture of these goods, and began to make fine flannels. The extent of their business having steadily increased, the firm erected a mill, in 1846, on the water-privilege next below the one they then occupied, and set it in operation with four

sets of machinery. Messrs. Gilbert and Stevens carried on this manufacture until 1851, when the firm was dissolved. The mill property was divided between the partners, Mr. Gilbert taking the stone mill, which had been built in 1846.

For six years after the dissolution of his partnership with Mr. Stevens, Mr. Gilbert conducted his manufacturing operations alone. During this period he confined himself exclusively to the manufacture of white flannels, which he had first undertaken in 1844. He took the first prize for these goods at many of the industrial fairs.

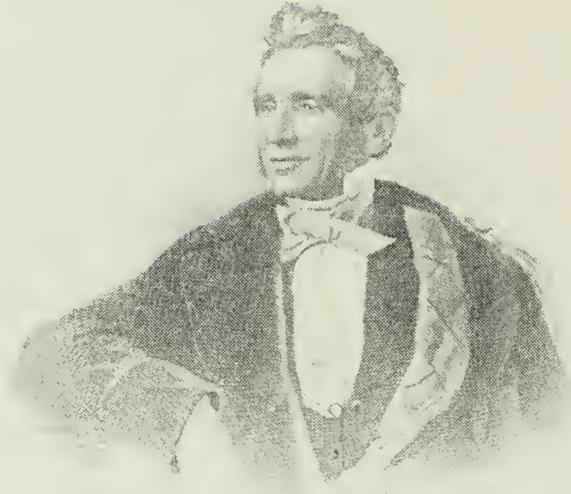
On the 1st of July, 1857, Mr. Gilbert formed a copartnership with his nephew, Lewis N. Gilbert, under the name of George H. Gilbert & Co. The junior partner was a native of Pomfret, Conn., and had entered his uncle's office in 1851, at the age of fifteen, in the capacity of office-boy. He had afterward been employed as clerk; and then, with a view of gaining a practical knowledge of the manufacture, had entered the mill, where he had been employed in various positions. On reaching his majority, he was offered a partnership in the business. In the early part of 1858, the Messrs. Gilbert began the manufacture of opera flannels. So rapid was the growth of this new enterprise, that within three or four years the importation of opera flannels into this country ceased. During this time the Messrs. Gilbert continued the manufacture of fine white flannels; and the demand for these had also become greater than their mills could supply. The firm accordingly determined to increase their facilities. Additional water-power was not available in Ware; but in the adjoining town, Hardwick, on the Ware River, a manufacturing property consisting of a water-privilege, and a small shop in which spokes were made, with about twenty acres of land adjoining, with several dwellings, was for sale. The shop was built near the spot where a paper-mill had once stood, which was still designated as the "Old Paper Mill." Messrs. Gilbert purchased this property in May, 1860. They removed the shop, and erected a brick mill upon the site. By this purchase was laid the foundation of the now flourishing village named Gilbertville, in honor of its founders. Before the close of the year, this mill, with wheel, picker and boiler-house attached, was completed, and a second purchase, of twenty acres of land adjoining the first, was effected. In January, 1862, this mill was put in operation, with six sets of machinery, for the manufacture of balmoral skirts.

A second mill, connected with the first, was erected in 1863, and started with two sets of machinery; and, in the following year, a third mill was built. Three additional sets of machinery were placed in the Gilbertville Mills early in 1865, making eleven sets that were then used for the production of skirts. When the manufacture of these skirts was first undertaken by the Messrs. Gilbert, they produced about four hundred per day. But these goods were soon in such demand, that,

while the production increased to one thousand per day, the supply did not equal the demand. At length, however, the demand for balmorals began to decline; and then the Messrs. Gilbert devised plans for an increased production of fine flannels. In 1867 they erected a fourth mill at Gilbertville, much larger than either of the three previously built. This mill was not put in operation, however, until the autumn of the following year. While they were thus enlarging their manufacturing facilities at Gilbertville, they also erected a large number of dwellings for their operatives, as well as a hall for religious worship.

Their operations had now become extensive; and, as there was a prospect of a further enlargement, they procured an act of incorporation. In the spring of 1868 a company with the corporate title of the George H. Gilbert Manufacturing Company was organized. Charles D. Gilbert, son of George H. Gilbert, now became a stockholder. He was born in Ware, in 1846; and, after completing his education, entered his father's mill, and fitted himself to be a manufacturer. Mr. George H. Gilbert was chosen the first president of the Company. A few months after the organization of the Company, the mill, which had been built the previous year by the Messrs. Gilbert, was put in successful operation, with six sets of machinery. This was the last step toward enlarging the manufactory which Mr. Gilbert was destined to witness. He had not yet achieved all that he had contemplated. He had matured plans for the still further expansion of the business; but he was compelled to leave them unaccomplished. Failing health obliged him to retire from his labors; and he died May 6, 1869, in the sixty-third year of his age.

Mr. Gilbert left not only a large fortune, but a reputation for integrity and fidelity. He was elected a member of the Massachusetts House of Representatives in 1857, and was twice a member of the State Senate, in which body he served as the chairman of the Committee on Manufactures.



Chas Goodyear



CHARLES GOODYEAR.



CHARLES GOODYEAR was born in New Haven, Conn., Dec. 29, 1800. He was descended from Stephen Goodyear, the successor of Governor Eaton, who founded the Colony of New Haven in 1638. Charles's father, Amasa Goodyear, was at first a merchant in the West India trade. While his son was quite young, he bought an interest in a patent for the manufacture of buttons, and removed to Naugatuck, to avail himself of the water-power there. In 1807 he manufactured the first pearl buttons made in America. He was an ingenious man, and made several valuable improvements in the manufacture of agricultural implements.

Much of Charles's time in early years was taken up by work in the factory and on the farm, and he had but little schooling.

In 1816, in his seventeenth year, he went to Philadelphia, and became an apprentice to the firm of Rogers and Brothers, to learn the hardware business. Remaining there until nearly his majority, he returned home, and entered into partnership with his father, in 1820, under the firm-name of A. Goodyear and Son. In 1825 his younger brother, Henry B., was admitted to the firm. Charles went to Philadelphia in 1826, and opened a store for the sale of hardware. Its stock largely comprised articles manufactured by the firm. In the winter of 1829-30, Charles Goodyear's health broke down; and to this misfortune were added losses in business. The transactions of the firm had been extensive, especially in the South. The failure of many houses to meet their payments involved the firm in difficulty. They obtained an extension of their payments, and struggled on for a year or two, but finally failed; and the business, with their inventions, was given up to the creditors.

Young Goodyear was so beset by pecuniary difficulties that he was now led into an entirely new field of effort. The substance India-rubber had been known as a curiosity for about a century, and as an article of practical use for about sixty years.

It was soon afterward used, to a limited extent, in chemical apparatus, and thus some of its remarkable qualities were observed. About 1820 it had found its way into the commerce of the world, and was frequently brought as ballast. It was then made an ingredient in blacking and varnish. The French cut it into threads, which they used in the manufacture of suspenders; and Charles Mackintosh discovered a method of dissolving it into a thin paste, with which he made two layers of cloth to adhere, thereby producing a water-proof fabric, which, for many years, bore his name. About 1825 India-rubber shoes were introduced into the United States; and, in 1830, large quantities of the native gum were brought here, and sold as low as five cents per pound. In that year Edwin M. Chaffee, the foreman of a manufactory of patent-leather, at Roxbury, Mass., conceived the idea of spreading India-rubber on cloth. At last, by dissolving India-rubber in spirits of turpentine, and adding lamp-black, he produced a successful result. He did not patent his solution, however, but deposited the formula under seal, in a bank in Boston, for the benefit of his heirs. He proposed to make the solution himself, keeping the method a secret. The final result was the formation of the Roxbury India-rubber Company, chartered in February, 1833, with a capital of \$30,000. Apparent success at once attended the manufacture. The shoes, coats, caps and carriage-covers made at the factory were sold more rapidly than they could be produced. The factory was enlarged, and others were established in several places in Massachusetts, and at Troy and Staten Island, N. Y., with capitals varying from \$100,000 to \$500,000; and all of them appeared to prosper. Large stores for the goods were opened in the principal cities, and much was said of the new manufacture in the journals of the day.

These accounts awakened Charles Goodyear's curiosity. Being in New York in 1834, on business, he observed the sign of the agency of the Roxbury Rubber Company. He entered it, purchased a life-preserver, and took it home with him. On examining it, an improvement in the inflating tube occurred to him. On his next visit to New York, he carried his new contrivance to the agent of the Roxbury Company, and offered to sell it. The agent, impressed with the ingenuity of the device, took Mr. Goodyear into his confidence. The Company, it seems, had manufactured large quantities of shoes and fabrics, in 1833 and 1834, which had been readily sold at a great profit; but the greater part of them had softened, and become worthless. Their capital was so low that, unless a method of making the goods permanent could be devised, the business must fail. The agent suggested to Mr. Goodyear that he should give his whole energies to finding out the secret of successfully working the material itself.

Mr. Goodyear had little technical knowledge of chemistry. He was without money, and so heavily weighted with the debts of his old firm that, during the next

six years, he was seldom out of jail for a whole year, and always under danger of arrest. Before the close of 1836 all the rubber companies had ceased to work, and the whole subject of India-rubber had fallen into odium. This placed another obstacle in his way; at the same time it placed an abundance of the native gum within his reach at a very low price.

In a small house in New Haven, Conn., in the winter of 1834-5, Mr. Goodyear began his experiments. He melted the gum by the domestic fire, kneaded it with his own hands, spread it on a marble slab, and rolled it with a rolling-pin. He soon produced sheets of India-rubber which appeared firm, and a friend advanced him enough money to enable him to make several hundred pairs of shoes. He embossed these in various patterns, giving them a novel and elegant appearance. Mindful, however, of the experience of the Roxbury Company, he took the precaution to store them until summer. The hot days reduced them all to a sticky paste. It now occurred to him that it was the spirits of turpentine used in dissolving, or the lamp-black used in coloring, the gum, that spoiled the product, and accordingly procured some barrels of the sap not smoked and still liquid. Testing this, he discovered that the handsome white cloth made with it was affected by heat equally with the sheets which he had previously made. He now saw that a compound of some substance with the India-rubber could alone render the gum available. He tried every substance that he could think of; but, for a long time, he met only with failure. His slender means became exhausted; but, keeping up his spirits, he went to New York, in quest of some one who had still a little faith in India-rubber. He found there two old friends, one of whom lent him a room for a laboratory, and the other, a druggist, supplied him with material on credit. He now boiled a compound of gum and magnesia in quick-lime and water, and produced an article which seemed all that could be desired. Sheets made by this process received an award at the Fair of the American Institute in 1835. He obtained a patent for the process, made a large quantity, and sold the product readily. But his hopes were soon destroyed. A drop of weak acid would neutralize the lime, and the beautiful surface of the cloth would become sticky. After trying several further experiments, he at last accomplished a valuable result, almost by accident. He was trying to decorate some drapery which he had prepared of one of his compounds of India-rubber, and had used bronze. For some reason he desired to remove the bronze from a portion of it. For this purpose he applied some nitric acid, which had the wished-for effect; but this discolored, and seemed to spoil, the surface. Thinking the piece to be of no value, he threw it aside. Several days afterward, on looking at this piece, he saw that a remarkable change had been produced. The India-rubber cloth, cured by the nitric acid, was much superior to any previously made; it would bear a degree of heat which rendered it good for many purposes.

Mr. Goodyear now entered into partnership with William Ballard, a man of ample capital, and proposed to engage in the manufacture on a large scale. He received a patent for the process June 17, 1837, hired the rubber-works on Staten Island, and took a store on Broadway, New York, for the sale of his goods. But before he had completed his arrangements, the commercial crisis of 1836-7 swept away his partner's entire property, put a stop to their operations, and reduced Mr. Goodyear again to penury. A timely loan of a hundred dollars enabled him to remove his family to Staten Island, where, having free access to the abandoned rubber-factory, he and his wife contrived to make a few articles of his improved cloth. While thus at work he met John Haskins, one of the three original founders of the Roxbury Rubber Company, who examined his samples, invited him to go to Boston, and promised all the aid in his power. On his arrival at Roxbury Mr. Chaffee, the pioneer in the rubber manufacture of America, and Mr. Haskins, gave him the use of the machinery standing idle in their factory; and he once more entered into the manufacture of goods, with efforts for further improvements. He now made piano-covers, table-cloths and carriage-cloths, with such success, as to cause a temporary revival of the business, and to enable him to sell rights to manufacturers under his patent. His profits during the year amounted to more than \$4000. About this time he devised a method of putting together rubber shoes, for which a patent was granted to him, July 24, 1838. The right to make shoes under this patent and his previous acid patent, he sold to a company organized at Providence, R. I., by Gov. Charles Jackson, Dr. Isaac Hartshorn and others. This Company was in successful operation for many years, working at first under the patents just named, and afterward under the patent for the vulcanizing process.

In the spring of 1838, Mr. Goodyear made a contract with the United States Post Office Department for one hundred and fifty mail-bags. They were finished in the summer, and proved smooth, firm and water-proof. He was absent for a month, and left them hanging in the factory; and, on his return, he found them softening and dropping from their handles. The nitric acid cured only the surface of his India-rubber, and, for any fabric except that which was very thin, it was really valueless. The failure of the bags, and the imperfection of all his products except the thinnest fabrics, suddenly destroyed all his business. Everything belonging to him was sold by auction, to pay his debts, and he was again penniless.

Mr. Goodyear had now been four years engaged in experiments, and he still persevered. About the time of his failure he met Nathaniel Hayward, an account of whose experiments with sulphur and rubber is given elsewhere. Mr. Hayward was then at work in a small factory at Woburn, Mass., and had succeeded in partially curing India-rubber, by mixing a small quantity of sulphur with it, or by sprinkling

sulphur on it, and drying it in the sunlight. Mr. Goodyear observed that this process produced the same effect on the surface of the goods as did his own acid process. Mr. Goodyear was now certain that he was very close to the secret. He saw that sulphur had a mysterious power over India-rubber. The problem before him was to produce the same result in a mass of rubber, however thick, that could easily be produced on the surface. For a small sum, and an agreement to buy out Mr. Hayward's factory, and employ him for a year, he secured an assignment of the sulphur process, which was patented by Mr. Hayward, and assigned to Mr. Goodyear Feb. 24, 1839. Mr. Goodyear now entered upon many experiments. He mixed with the gum large quantities of sulphur, then small quantities; he exposed his compound to the sun, then to fire heat: but for months the secret eluded him; and, after all, an accident revealed it. One day, in the winter of 1839, he was standing, with his brother and others, near a very hot stove, holding a mass of compound of gum and sulphur, when he brought the mass in contact with the stove, which was hot enough to have melted pure rubber instantly. On looking at it, a moment after, he perceived that his compound had not melted in the least. It had charred, but there was no sticky place on it. Eagerly he showed the charred India-rubber to his friends. He nailed the piece of gum outside the door in the cold, which was intense. In the morning it was perfectly flexible.

Mr. Goodyear eagerly followed his clue. The first test he made was whether the compound should be heated so as not to char, and thus fully preserve its elasticity, without, at the same time, becoming sticky in hot weather, or stiff in cold weather. Subjecting a flat piece of compound to the heat of a fire, he noticed that the part exposed to the intensest heat was charred, while there was a rim around the charred portion which had been rendered more elastic than native rubber, and which would endure the heat of two hundred and seventy-eight degrees without melting, and, when placed for any length of time between blocks of ice, would not stiffen. That rim, in short, was perfectly "vulcanized"—to use the term now so well understood. He had now proved that a compound of India-rubber and sulphur, in the right proportions and conditions, and subjected to heat of a certain degree, and for a certain length of time, undergoes a change, rendering it available for a great variety of uses in the arts and manufactures. It remained for him to ascertain what were those proportions and conditions, what was the degree of heat and the length of time, and the best method of applying it. For two years he worked on the problem, employing only domestic utensils, and without suitable heating apparatus; while, now and then, he produced a sample piece of perfectly vulcanized rubber, other pieces would be blistered or charred. In the autumn of 1839 he received an offer from a house in Paris, for the right of his nitric-acid process for

France. He replied that he was perfecting a new process, which would render the other valueless; and that, when he had developed it, he would close with their offers. During the ensuing winter, being reduced to great want, a sum of money was loaned him by an acquaintance, which enabled him to continue his experiments on a small scale. In the ensuing April he was again thrown into prison, in Boston, for debt; and during the rest of the year, and a part of the next, he was in the deepest poverty.

He now removed to New York, where he submitted his specimens to William Rider, an enterprising merchant, who agreed to furnish sufficient capital to develop his invention. Associated with him in this agreement was his brother, Emory Rider, a skillful manufacturer. Mr. Goodyear now had ample facilities for completing his invention; but, before he had fairly overcome the difficulties in his way, Mr. Rider failed, and Mr. Goodyear lost his capital. His brother-in-law, however, William De Forest, then a successful woolen manufacturer, took Mr. Rider's place in supplying capital. The difficulties, yet to be overcome, were such that Mr. Goodyear did not take out a patent until 1844. The patent was granted him in June of that year. In 1841 he had started a factory at Springfield, Mass., under the charge of his brothers, Nelson and Henry, the work in which was general experiments in shirred goods, clothing, hose, and so on. In 1842 he was trying at Naugatuck, Conn., to apply his process to various articles of manufacture. Among these, the first vulcanized rubber shoe was made, under his direction, by his daughter, now the wife of Charles T. De Forest, of New York. Late in the same year, he visited, at New Haven, the late Leverett Candee, who was then trying to make overshoes from cloth coated with rubber, and induced him to adopt the vulcanizing method. Mr. Candee contracted with him for the right to make shoes under the patent which Mr. Goodyear proposed to obtain, and thus became the first shoe licensee under the vulcanizing process. In 1843 a factory, under the charge of Henry Goodyear, was started at Naugatuck, for the manufacture of clothing.

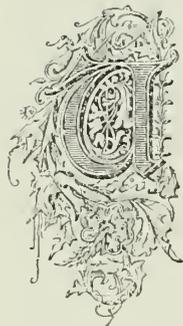
On the 9th of March, 1844, Mr. Goodyear received a patent for the goods afterward known as "shirred" or "corrugated" goods, and for a machine for making them. At the time of the granting of the patent for vulcanization, the distrust of the process had become so fully overcome, that capitalists were ready to invest in its various industries. It was after such labors and such difficulties that Mr. Goodyear at last triumphed. Before his death, in 1860, the new material had been applied to nearly five hundred uses, giving employment to sixty thousand persons, with an annual product of \$8,000,000; and there has been a vast increase since in both of these items. To himself and his family, however, the pecuniary result was comparatively small. Nearly all the valuable applications of vulcanized rubber that have

been made were made during his lifetime; and, though the manufacture has much increased in extent, it has not taken many new directions, and some of the ideas which he most valued have remained undeveloped.

Having seen the manufacture of shoes and other articles well established in the United States, and his rights placed beyond dispute by the decision at Trenton, N. J., in 1852, being still oppressed with debt, Mr. Goodyear went to Europe, to introduce his material to the notice of foreign capitalists. The great manufactories of vulcanized rubber in England, Scotland and on the Continent are the result of his labors. He returned to the United States in May, 1858, thoroughly broken down, but still devoted to his work. He lingered and labored until July 1, 1860, when he died in New York, in the sixtieth year of his age. He had spent twenty-seven years of intense labor under the most unfavorable circumstances, had founded a new and great branch of industry, or group of industries, and died insolvent.

THE GORHAM MANUFACTURING CO.

JABEZ GORHAM—JOHN GORHAM.



UNTIL late in the first half of the present century, the manufacture of silver-wares was not begun in this country, except in a limited way, in the making of spoons and other small articles. From the foundation laid by Jabez Gorham, in Providence, R. I., John Gorham, his son, and Gorham Thurber, his nephew, twenty years after inaugurated the new era in this business; and in twenty years more they had established a large and representative industry.

Jabez Gorham was born at Providence, R. I., Feb. 18, 1792, and was descended from John Gorham, who came from Northamptonshire, England, in 1643, and settled in Plymouth, where he married Desire Howland, daughter of John Howland, one of the Pilgrims, born a short time after the landing on Plymouth Rock. The father of Jabez was a saddler, and died when Jabez was about fourteen years of age. The latter attended the free schools in his early years; and soon after his father's death was apprenticed to Nehemiah Dodge, who had begun business as a manufacturing jeweler in Providence, in 1795. Here young Gorham served seven years. Soon after attaining his majority, he entered into partnership with Christopher Burr, William Hadwen, George G. Clark and Henry G. Mumford. Their business was fairly successful for five years, when they dissolved partnership, the several members forming other connections. Mr. Gorham continued the business alone, and took the premises previously occupied by the firm, at the corner of North Main and Steeple Streets, Providence. A year or two later he removed to a shop which he had purchased on Steeple Street; and this was the nucleus of the range of buildings now occupied by the Gorham Manufacturing Company. Here Mr. Gorham pursued the manufacture of jewelry until 1831, making gold beads, earrings, breastpins and finger-rings, and a peculiar kind of gold-chain which gained some reputation as the "Gorham chain." He disposed of his goods in part to peddlers; and twice a year he visited Boston, to supply his customers in the trade there.

In 1831 Mr. Gorham's attention was turned to the manufacture of silver spoons. These had been made for many years by silversmiths; but the demand had been limited. It was only a short time before the Revolution (about 1760), that, even in England, silver tablespoons had begun to take the place of spoons of wood, horn and pewter on the tables of the wealthy; and silver teaspoons were rare before the time of Queen Anne (1691-1713); but, in the first quarter of this century, families in comfortable circumstances were accustomed to have a set of teaspoons, and, perhaps, half a dozen tablespoons, of silver. The silversmiths mostly confined themselves to orders from dealers in jewelry, who rarely purchased more than one or two dozen at a time, and for special orders; but about 1825 they began to manufacture light spoons for general sale through the cheap jewelry peddlers. Mr. Gorham now engaged a young man, Henry L. Webster, who could make silver spoons, to go to Providence, and start the business in partnership; and a firm was formed, under the name of Gorham and Webster. The business began modestly, Mr. Gorham's jewelry manufacture being continued as a distinct interest; and the process was extremely crude. A bar of silver was heated in a common blacksmith's fire, rolled to the proper thickness by rolls operated by a windlass, and then hammered into shape. Each spoon had to be made hot nine times before it was finished. By hard work, two men could make in a day two dozen teaspoons — no two, however, alike, in shape or weight. For nine years nothing was made but spoons, thimbles and silver combs, and an occasional napkin-ring or fork. At fifty Mr. Gorham retired from the business, being succeeded by his son John. He had often been called to positions of financial or political responsibility by his fellow-citizens; but, during the last twenty years of his life, his retirement from public, as well as mercantile, interests was complete. He died suddenly on March 24, 1869, at the age of seventy-seven.

John Gorham was born in Providence, Nov. 18, 1820. He attended the city schools, and, when seventeen, went into his father's shop to learn the trade of a manufacturing jeweler. Early in 1837 he determined to try his fortunes elsewhere. He first went to Smithfield, R. I., where he remained the rest of that year, working on a farm; and the next three years he spent in Providence, New York and Boston, as clerk in different branches of trade. At the end of that period he returned to his father's shop as partner, with the superintendence of the work. The firm was re-organized as Jabez Gorham and Son, Mr. Webster retiring, and returning to Boston, and his interest in the tools, shops and business being purchased by the new firm; and John Gorham assumed charge of the concern. The business steadily increased; the senior gradually withdrew from active participation in it; and, in 1847, John Gorham found himself its sole proprietor.

He now purchased a steam-engine and set it up, and erected an additional building in the rear of the old shop. In 1850, believing that there was a profitable field in silver manufacture not yet occupied, John Gorham determined to enter it. This was the manufacture of silver hollow-ware (the technical name by which all goods of the general form of pitchers, teapots, etc., are designated, the term flat-ware being applied to forks, spoons, and other similar articles) on a large scale; and also of every article of silver for which a demand arose, whether for ornament or utility.

Mr. Gorham now invited his cousin, Gorham Thurber, to become a partner with him; and a copartnership was formed Feb. 1, 1850, under the style of Gorham and Thurber. Gorham Thurber was the son of Dexter and Hannah (Gorham) Thurber, his mother being the sister of Jabez Gorham; and he was born in Providence, R. I. on April 9, 1825. He went, in 1841, into the office of the Franklin Foundry and Machine Company, which had been established, in 1836, by Isaac Thurber and others, and of which Isaac was the manager. Here he became book-keeper, and this position he occupied until he became a partner in the firm of Gorham and Thurber.

The arrangements for the extension of the business having been effected, Mr. Gorham hired an artisan skilled in the working of hollow-ware, procured tools, and soon had this new branch of manufacture in progress. In order to avail himself of every appliance to improve his work, or to economize labor, he first visited various establishments in this country—among them the United States Arsenal, at Springfield, and the Mint, at Philadelphia; and then in May, 1852, made a trip to Europe, to observe machinery and methods. Meanwhile, Lewis Dexter, also a cousin of Mr. Gorham, was taken into the firm; and its name was changed to Gorham and Company.

Mr. Gorham visited the great shops of Elkington & Co., of Birmingham, the shops of Dixon and Sons, of Sheffield, the Government Arsenal, at Woolwich, the Mint, at London, and shops in Paris and Brussels. The result of his observations satisfied him that he had nothing to fear from English or European competition in the use of machinery; as, in this respect, they were not only far behind our manufacturers, but very much that was done by them by hand was more effectively done in this country by machinery. He was also satisfied that, in manipulation, and in all processes which depended on expertness and care in hand-labor, they were much in advance of us. This was especially true of molding metals for fine work. That he might become an adept in this difficult branch of metallurgy, he entered an establishment in London where work of this kind was done, and paid for the privilege of working by the side of a skillful molder; and for three weeks he wrought like any operative, until he had mastered the art. He also hired and sent to Providence as skillful a molder as could be obtained, and several other thorough artisans in various

branches of metal-working. On his return home, in 1852, the business received a new impulse; and, until the beginning of the Civil War, it rapidly increased, the goods manufactured being distributed to every part of the country and in Canada; and, during the latter part of this period, a large trade was established with California. In 1854 George Wilkinson, who had learned his trade as a die-cutter in Birmingham, England, and had also given his attention to designing and modeling, was hired as a die-cutter. He soon became an accomplished designer and modeler, and at the present time he is the superintendent of the designing-rooms, in which a large corps of assistants is employed. Early in 1861 about two hundred hands were employed in the establishment. In that year Mr. Dexter retired from the firm; and business was continued by the other partners, the name of the firm remaining unchanged.

During the early months of the war, the market for the firm's goods was greatly curtailed, at the same time that the cost of the goods manufactured was nearly doubled, by the increased premium on silver and the great advance in wages. The firm then turned its attention at first to the manufacture of bronzes; but in 1863 it applied its resources, machinery and patterns to the production of plated-ware of the highest grade, and now known as "Gorham plate." Its base is nickel, which now rivals silver for so many purposes, with only sufficient alloy to reduce its refractory temper to the necessary malleability.

The process which, in the hands of the Elkingtons in England, and of Gorham and Company and others in America, has brought silver-plated ware within the reach even of persons of moderate means, was developed, in 1840, from a discovery made about 1800. Joseph Shore, of Birmingham, England, was the first to bring about a practical result, and a patent was issued to him March 3, 1840, the claim for which is as follows: "This invention relates to a mode of obtaining or applying a permanent covering of copper, or nickel, on articles manufactured of wrought or cast-iron, tin, lead and copper, and of alloys of such metals, such covering acting as a preservative to some of those metals and alloys of metals, and, in other cases, as a superior surface." On the 25th of March, 1840, a patent was granted to George R. and Henry Elkington, of the firm of Elkington and Company, of Birmingham, England, the second claim of which was for "coating certain metals with silver by the use of a silver solution only, also by means of a solution of silver in connection with a galvanic current. The solution consists of oxide of silver dissolved in a solution of prussiate of potash (cyanide of potassium). This solution is used boiling. The same solution may be used cold when electric force is applied." The third claim of the patent was for similar processes of coating with gold. This process was substantially the same as that now in general use. The silver-platers of Birmingham and

Sheffield, who used the old processes, by soldering and filming, ridiculed the new Elkington process, and prophesied its failure, their opinion being that this new method was only a kind of washing, and that the plating would soon wear off. This opinion has been demonstrated to be erroneous. The advantages of the new process were, that the metal being plated after, instead of before, manufacturing, all restrictions in taste and design are removed; and that the different parts of the article, which have been already electro-plated, can be united, if desired, by hard silver-solder (two parts of silver and one of brass), which is not affected by any degree of heat that would not be fatal to the metal contained in the article itself. In the old method, soft solder being used, the silver film on spoons, and the ornaments which had been affixed, would often, in ordinary use, become detached. Any pattern, moreover, which can be executed in silver can be as readily made in the metal which is to be plated; and old goods, in which from long use the plating has been partially or wholly worn off, can be restored at a small expense.

The first American manufacturer who engaged in making electro-plated goods was Asa Rogers, a silversmith in Hartford, Conn. He established, in 1842, a small factory at East Granby, Conn., and began to make electro-plated spoons and forks, and other flat-ware, the base being britannia-metal. He had thoroughly established himself in 1847, when he formed a partnership with his brothers, and produced goods of such excellence that the trade-mark, "Rogers Bros., 1847," was imitated extensively, and was afterward purchased, at a high price, by the Meriden Britannia Company, then engaged in the manufacture of electro-plated hollow-ware, with a base of britannia-metal. The first manufacturer of electro-plated hollow-ware in this country was Samuel Simpson, of Wallingford, Conn. He began the manufacture in 1848, also using the britannia-metal for the base. Gorham and Company, at the outset of their business in electro-plating, used, as has been stated, the nickel silver as their base.

In January, 1865, the Company was organized as a corporation, the two members of the firm being the principal incorporators. John Gorham was chosen President, Gorham Thurber, Treasurer, and J. F. P. Lawton, Secretary. The capital stock was at first fixed at \$300,000, with a limit of \$600,000; and in May, 1872, was increased to \$600,000, with a limit of \$1,200,000. During the ten years following the incorporation of the Company the business steadily increased. In 1872 the number of hands employed was four hundred and fifty, and the shops and rooms for the various purposes of the business had been multiplied so that they covered the whole area bounded by North Main, Steeple, Canal and Friend Streets, except a small building, 60 feet by 40, on the corner of North Main and Friend Streets. In January, 1878, Mr. Gorham retired from the office of president, and was succeeded

by William Henry Crins. Mr. Thurber still holds the office of treasurer, and Mr. Lawton that of secretary.

The first lesson learned by Messrs. Gorham and Thurber in their enterprise, was, not only that machinery might be introduced with advantage, but that silver-ware could not be made with jewelers' tools. There must be special adaptations of machinery used by other metal-workers. They established a shop, 80 feet by 40, for repairs and the building of new machines; and this was amply furnished with tools, and an auxiliary steam-engine; so that, if necessary, the shop could be run independently of the rest of the works. Many machines have here been devised, patterns made, and machines built. Every apparatus and arrangement for the convenience and economy of labor have also been furnished. Steam-engines drive almost innumerable lines of shafting. Steam-elevators and pipes throughout afford communication, for heating or lighting, conduct gas, air-blast, live and exhaust steam, and hot, cold, hard and soft water. There is a great variety of machines for rolling, shearing, milling, punching, shaping and embossing; ponderous die-stamping machines, lathes, drills and planing-machines for wood or metal; foundries for casting iron, brass, silver, gold and other metals; a blacksmiths' shop; large rooms devoted to melting and refining furnaces, electro-plating and gilding, photography, and metal spinning; apartments occupied by artists and draughtsmen, by engravers, chasers, embossers, die-cutters and die-hardeners, tool-makers, weighers and packers, and fancy case-makers in wood, morocco and velvet.

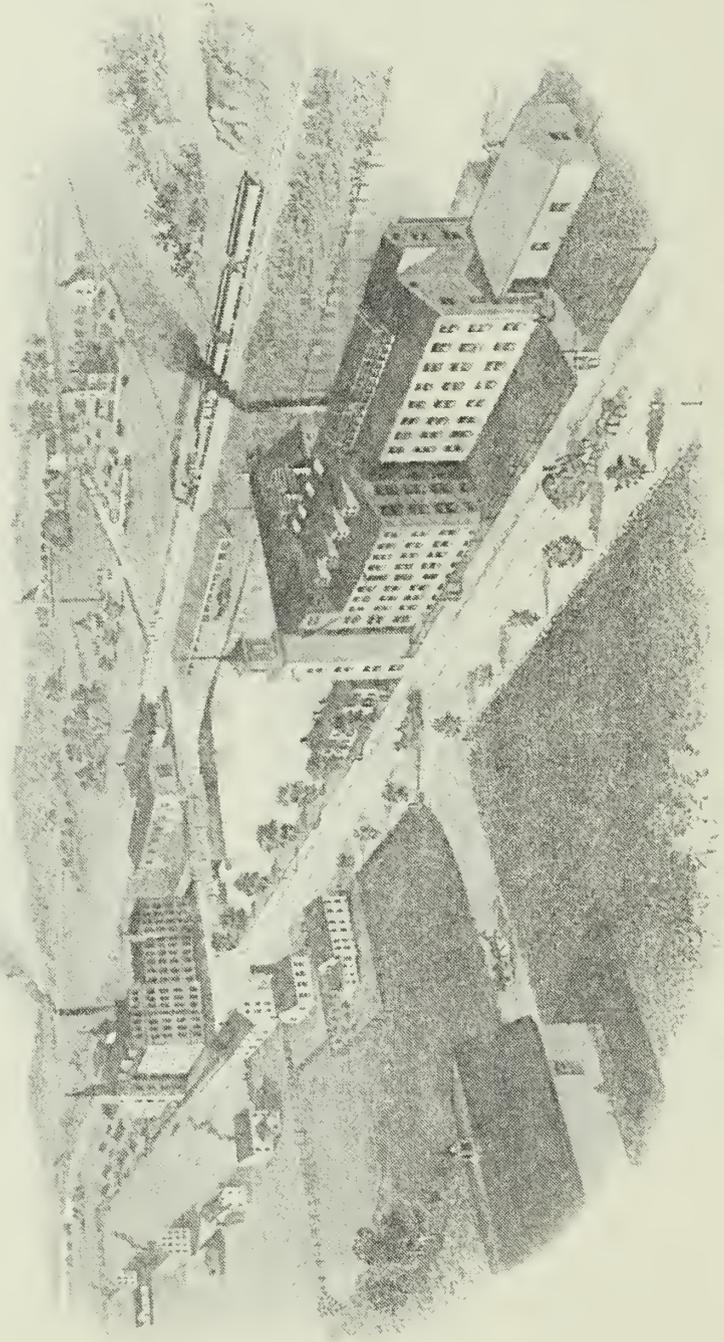
Excepting a few workmen and artists of special training, the Company employ intelligent American youths, and, in many cases, men who had been educated to other work. In the establishment at least twelve distinct trades are carried on, to each of which boys are regularly apprenticed. It is a trade to make spoons, forks and other flat-ware; and designing, die-cutting, pattern-making, stamping, molding, embossing, engraving, chasing, plating, burnishing and polishing are all separate trades.

In every country it is the rule that the standard for silver-plate shall be the same as that of the silver coin of the country. The coin of the United States and of France being nine hundred parts of silver and one hundred parts of copper, the genuine plate of those countries has conformed to that standard. English coin is nine hundred and twenty-five parts silver to seventy-five parts copper; and English plate, when honestly made, is of that degree of purity. To this standard has been applied for nearly seven hundred years the word now so familiar, *sterling*. Sterling plate is really no better for the purposes to which it is applied, except in pecuniary value, than American coin plate. The Gorham Company, however, adopted the sterling standard. When silver is received at the factory, its exact weight and purity are

recorded. But the character of no silver is taken on trust. Coin was, at one time, the form in which silver was bought for manufacturing purposes. The first thing done at the factory was to pick out counterfeit coin. In American coin there have usually been four or five counterfeit pieces in the thousand; in that which comes directly from the mints of Mexico and Peru, a counterfeit is seldom found. Every coin was subjected to a process which twisted it asunder, and then dropped it on the heap below. If it was false, the fact was discovered by the manner in which it tore apart, and by the ring as it struck the mass of silver. When the broken coins were placed in the crucible to be melted, enough pure metal was added to bring the mass a little above the sterling standard. Thus the Company was also obliged to buy a certain quantity of pure silver, to raise the standard to sterling. For ten years bullion has mostly been used. This is usually brought to New York in small, rough, silver bricks, each one assayed and worked by the assayer at the mint 998 or 999, and very rarely 999½. Perfectly pure silver is scarcely ever sold in the market. The stamp of the Gorham Company is as good guaranty of sterling purity as the "Hall mark;" which must, in England, be affixed, after an assay, by an officer of the government before the wares can be sold as silver.

The same course has been taken in the manufacture of the plated-ware. Only the best base is used, and the largest quantity of silver is deposited on it. The Gorham Company lays a silver surface upon the ware, and thus produces ware with the splendor of the best plate, at about one-fourth the cost. Its patterns, ornaments and workmanship are similar to those of the Gorham Sterling Silver. Its surface is a thick coating of pure silver. The policy of the Company has been to make, not only pure, but artistic, goods. The designing-room of the Company is stored with books, including many costly works, illustrative of designs and patterns of plate and silver-ware.

In their earlier history, the Company did not venture to abandon the forms approved by habit and protected by fashion. They modified, or laid aside, a fine design, because it was too simple, or too violent a departure from established patterns. But now the public taste has greatly advanced, and demands a higher grade of design and of workmanship than European silversmiths usually produce; and with this progress the Company has kept apace.



GROSVENOR-DALE CO.

Mill No. 2, No. 4

GROSVENOR-DALE, CONN.

GROSVENOR-DALE COMPANY.

WILLIAM GROSVENOR—LUCIUS BRIGGE.



SMITH WILKINSON, the brother-in-law of Samuel Slater, was the first to introduce water-power cotton-machinery, on the model of Slater's, into the State of Connecticut. He had learned cotton manufacturing at Slater's factory, in Pawtucket; and, going to Pomfret, Conn., he purchased, in 1806, the privilege now occupied by the woolen-factory of Moriarty and Sayles, whereon he erected a factory, and started up early in 1807. This was known, for many years, as the Pomfret factory, and had a profitable career. Similar enterprises were soon established in various other places in eastern Connecticut.

The power-loom had not then been invented; and the business of cotton-factories was only to make yarns and warps for the hand-loom, mostly in the farm-houses, though, in a few instances, hand-loom were set up in the factories. For running these factories the region afforded ample facilities in the numerous streams, having often a large fall of water within brief distances. With the water-wheels then in use, and only the natural supply of water, without the reservoirs since constructed, these factories were small when compared with the Grosvenor-Dale, Ponemah or Wauregan factories, now situated in the same valley.

Among the earliest of these factories in Connecticut was one started in Thompson, by John Mason. His father, also named John, was born in Swansea, Mass., and was descended from Sampson Mason, who came to this country, and settled in Dorchester, Mass., about 1651. Sampson Mason had been a dragoon in Cromwell's army. He moved to Rehoboth about 1657; and, in 1667, with Rev. John Myles, transferred his residence a few miles southward, where a settlement was made called Swansea, which was incorporated Oct. 30, 1667. Sampson Mason was the father of thirteen children, of whom the eleventh was Pelatiah, born at Swansea, April 1, 1669. Of Pelatiah's eleven children, the youngest was John, born Oct. 3, 1716. He,

as well as two elder brothers, Job and Russell, was a clergyman. Rev. John Mason was father of the John Mason named above, who was also a native of Swansea.

In his early manhood he moved to Thompson, Conn., where he engaged in business with Daniel Larned, under the firm-style of Larned and Mason. They built up a large trade, chiefly in the purchase of cattle and the packing of beef for the European market. In this business Mr. Mason acquired wealth. He moved to Providence, with his sons James B., Amasa and William H., and there engaged with them successfully as a merchant, mainly in foreign trade. His eldest son, John, to whom, in 1802, he deeded the farm on which he had lived in Thompson, became ambitious, ten years later, to undertake a more lucrative business. At this time Stephen Crosby owned the privilege now occupied by the upper factory in Grosvenor-Dale, and was running a saw-mill, grist-mill and clothier's-mill for fulling and dressing cloth. Mr. Mason at first proposed to build a factory just below Mr. Crosby's mills; but, failing to obtain the necessary supply of water, he associated with himself his townsmen, John Nichols, Jr., Theodore Dwight, Rufus Coburn and Nathaniel Crosby, for the purpose of establishing a new water-privilege and factory, and obtained pecuniary aid from his brother, Gen. James B. Mason, of Providence.

The Company was organized under the name of the Thompson Manufacturing Company; James B. Mason holding twelve twenty-fifths of the stock, John Mason three twenty-fifths, and the other partners the remainder. They purchased land about one hundred rods below Crosby's dam, from Willard Whittemore, in March, 1812, and erected a dam, and a wooden factory of 60 feet long, 36 feet wide and three stories high, with a capacity of 1600 spindles. This factory went into operation early the following year.

In the spring of 1813, General Mason purchased the interests of all his partners; and on the 11th of May he sold to his brother Amasa an interest of six thirty-seconds, and to his brother William H. ten thirty-seconds, retaining himself one-half of the whole property. The three brothers, now owning the factory, being merchants in Providence, Col. William Foster, of Providence, who had been sheriff of the county, was appointed resident agent. Colonel Foster became owner of two thirty-seconds interest by deeds from William H. Mason and James B. Mason, of Dec. 17, 1814, and Feb. 16, 1815, respectively. Early in the next year Colonel Foster hired the mill from the Messrs. Mason, on a lease of five years, from April 1, 1816, for three hundred dollars a year. General Mason died Aug. 31, 1819. He graduated at Brown University, then Rhode Island College, in 1791; and he was for many years a member of the town council of Providence, and represented that town in the legislature during several sessions, being the speaker of the house of representatives from February, 1812, to May, 1814. In the latter year he was elected a member of Congress from

Rhode Island, and was re-elected in 1816. His wife was Alice, daughter of Hon. John Brown, one of the most prominent citizens of Providence, who had also served as a representative in Congress from Rhode Island.

General Mason left three children. The eldest, Abby, married Nicholas Brown, of Providence, and died without issue. The second, Sarah B., married, first, George B. Ruggles, of Newport, and after his death Levi C. Eaton, of North Providence. The third, Rosa Anne, married Hon. William Grosvenor, now agent and principal owner in the Grosvenor-Dale Company. In the division of General Mason's estate, made after the death of his widow, his property in the factory at Killingly, known as the Blashfield Factory, was set off to his eldest surviving daughter, Sarah B. (his daughter Mrs. Brown, having died), and his interest of fifteen thirty-seconds in the Thompsonville Manufacturing Company was set off to his daughter Rosa Anne. On Feb. 24, 1821, Amasa Mason leased for three years, from Alice, widow of General Mason, and from William H. Mason, their shares respectively, paying them \$1,000 a year. This lease began April 1, 1821, and, at its termination, was renewed for two years, at \$960 year. On May 3, 1822, Colonel Foster having removed to Sturbridge, Mass., sold his interest of two thirty-seconds to Amasa Mason.

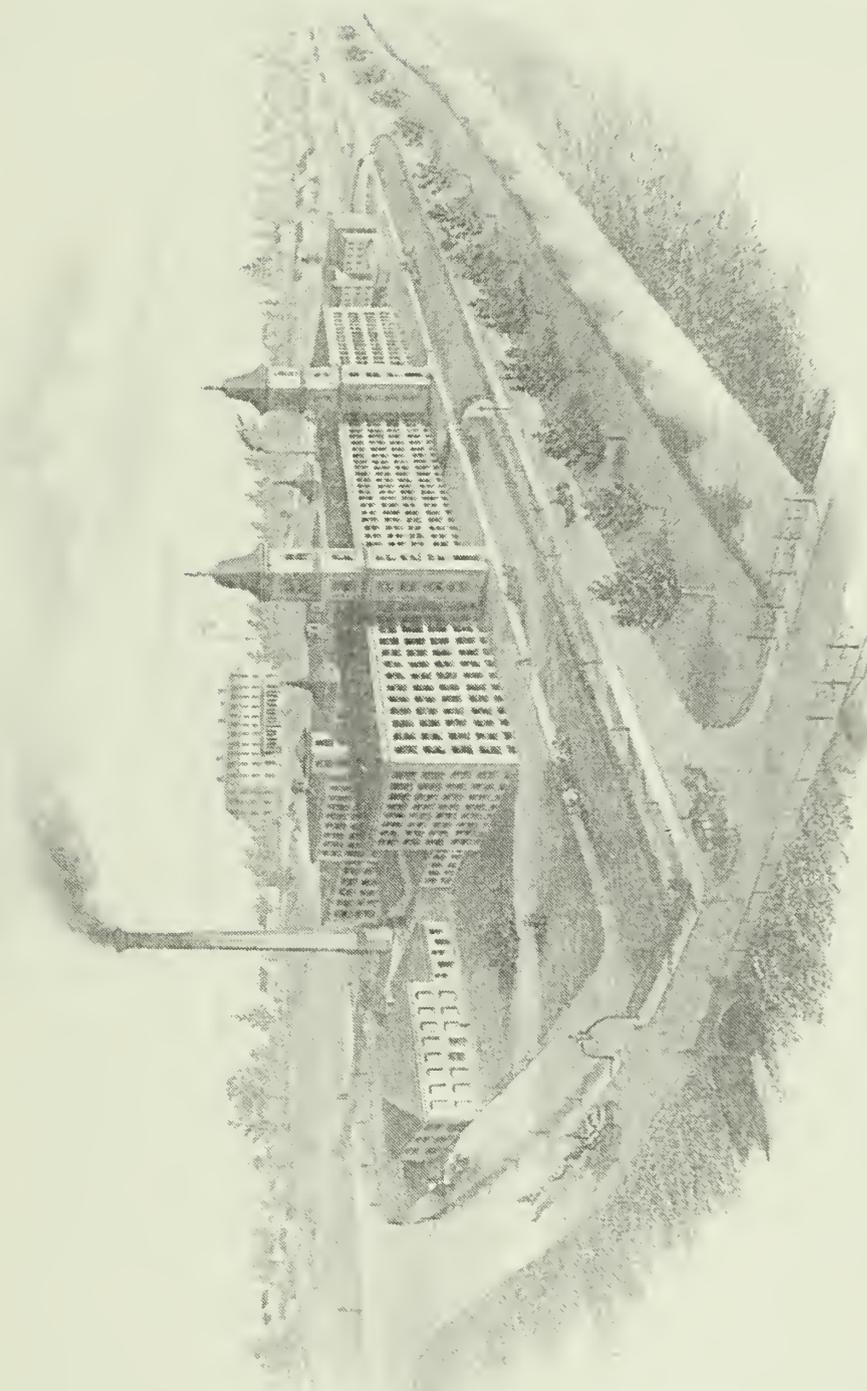
On Jan. 27, 1826, Amasa and William H. Mason bought from Stephen Crosby his property, consisting of a dwelling-house, saw-mill, grist-mill and a mill for fulling and dressing cloth, with eighty acres of land; and, on March 13, William H. Mason sold to Thomas Thatcher, of Thompson, one-eighth of his interest, being one-sixteenth of the whole property. The Company took the name of the Masonville Company. A stone factory was erected, 80 feet long, 40 feet wide and four stories high, with a capacity of 2500 spindles. This now forms the northern portion of the upper group of buildings at Grosvenor-Dale. Mr. Thatcher, a skillful manufacturer, was appointed resident agent. On Aug. 23, 1827, William H. Mason sold two shares (sixteenths) to his brother Amasa. The aim of the Masonville Company, from the first, was to manufacture goods of the best quality; and to this end Sea Island Cotton was used, and the Masonville sheeting soon stood high in the market. The business was successful, earning profits during the first five years of about \$100,000. The brick factory, now forming the southern portion of the same group, was built in 1831. It is 92 feet long, 40 feet wide and four stories high, with a capacity of 2500 spindles.

Early in 1833, the Messrs. Mason leased the Swamp factory to Samuel Stafford, of Providence, and Stephen Kendrick, of Thompson, under the firm-style of Stafford and Kendrick, for the term of two years. They carried on the business about eighteen months, at the end of which time they surrendered the lease. The factory remained idle until February, 1835, when it was leased to the Masonville Company

for four years, from April 1, 1835, at \$1,500 a year. It was then leased to Seth Mowry, Jr., and Gilbert Read, of Cumberland, R. I., for five years from April 1, 1839, at \$1,600 a year. On the tenth of the following September, Mowry and Read surrendered the lease, and bought the property, for \$24,000, giving a mortgage for \$11,000. Their business was not successful; and on May 13, 1840, Messrs. Richmond and Carr, of Providence, had set off to them on an execution, the equity of Mowry and Read in the property. This equity they sold, June 2, to William H. Mason. He had received, by conveyance, from Amasa Mason and from William and Rosa A. Grosvenor, their interest in the mortgage, and thus became sole owner of the property. He then gave it the name of the Thompson factory. In the same year he built an addition of forty feet in length to the factory, making it one hundred feet in length, and increasing its capacity to 2700 spindles, and replaced the old machinery by new. On Nov. 16, 1841, he sold the whole establishment to the Masonville Company; and, at the same time, Amasa Mason sold ten shares of this Company to William H. Mason, and one share to William S. Arnold, of Thompson. The Company now consisted of Amasa Mason, owning seven shares, William H. Mason, seven shares, Thomas Thateher, one share, and William S. Arnold, one share, and owned all the factory property then within the limits of what is now Grosvenor-Dale. In 1845 Amasa and William H. Mason purchased the share of Thomas Thatcher, who had died, from his heirs.

Amasa Mason died Nov. 13, 1852, without children; and his seven and one-half shares were divided—one-half, or three and three-fourths shares going to his only surviving brother, William H., and the other half to the two daughters of Gen. James B. Mason, each of them receiving one and seven-eighths shares. Mr. Mason was engaged actively, as a merchant, from early manhood until the failure of his health, in 1848; and, from the organization of the Masonville Company, in 1826, was its agent. On his retirement from business, Dr. William Grosvenor, of Providence, assumed the agency, and, on the death of Amasa Mason, being appointed administrator of his estate, continued in the same office. On June 30, 1854, Mr. Grosvenor purchased from William H. Mason his interest of eleven and one-fourth shares, and conveyed an interest of one-sixteenth to Lucius Briggs, the superintendent. On the 12th of February, 1855, Mr. Grosvenor bought the interest of Sarah B. Eaton, and in 1865, the one share of William S. Arnold.

Messrs. Grosvenor and Briggs purchased the factory property a mile and a half north of Masonville, known as Fisherville, on March 31, 1864. This factory was erected in 1828, on land before owned by Calvin Randall, who, Jan. 5, 1828, sold one hundred and eighty acres, for \$4,250, to John Nichols, Jr., Darius Dwight, of Thompson, and William Fisher, of Killingly. On the 19th of April they sold the



GROSVENOR-DALE CO.

Mills No. 1 & No. 2

NORTH GROSVENOR-DALE, CONN.



land to Simon Davis, of Thompson, who, in turn, sold it to John Nichols, Jr., William Fisher and Darius Dwight, and Cornelius G. Fenner and Thomas B. Fenner, of Providence, R. I. These persons formed themselves into a company, under the name of The Thompson Village Company, the stock being divided into forty shares, of which Cornelius G. Fenner held sixteen, Messrs. Nichols and Fisher eight each, and Messrs. Dwight and Thomas B. Fenner four each. They erected a dam and factory, which were completed and put into operation early the following year.

On March 24, 1829, C. G. Fenner purchased the interest of Darius Dwight, and, on the 29th of June, that of his brother. He then, on the 28th of August, sold his whole interest of twenty-four shares to John Nichols and William Fisher.

The business was carried on by Messrs. Nichols and Fisher until December, 1830, when Mr. Fisher bought his partner's share, and gave his name to the factory and village, which was known as Fisherville until 1868. In 1831 Mr. Fisher sold one-half of his interest to John Andrews, of Providence. They continued in partnership until May 9, 1836, when Mr. Andrews sold back his interest to Mr. Fisher.

The number of spindles in the factory at this time was 2488; and the business was carried on by Mr. Fisher until 1855, his two sons, William Fisher, Jr. and Joel E. Fisher, having had, during a part of the time, an interest of two shares each. An assignment of the property was made on the 21st of April, 1855, to Preston Bennett, of Providence, and Erastus Knight, of Thompson; and Messrs. David Goddard and Jeremiah Pritchard, of Boston, commission merchants in that city, under the firm-name of Goddard and Pritchard, purchased it Jan. 1, 1856. This firm operated the factory successfully for five years; at the end of which time Mr. Pritchard sold one-third of his share to Charles Albro, of Taunton, Mass. In 1863 he purchased from Mary C., widow of David Goddard, her interest of one-half; and on the 31st of March, 1864, Messrs. William Grosvenor and Lucius Briggs purchased the property from Pritchard and Albro, Mr. Grosvenor taking three-fourths; and Mr. Briggs, on the same date, conveyed an interest of one-sixteenth each to William Grosvenor, Jr., and James B. M. Grosvenor, sons of the senior proprietor.

The Fisherville and Masonville properties were consolidated in 1868, in one company, William Grosvenor owning an interest of three-fourths; Lucius Briggs, of one-sixteenth; William Grosvenor, Jr., of one-eighth; and James B. M. Grosvenor, of one-sixteenth. The Company acquired additional territory, including a water-privilege, capable of furnishing as much power as either of the privileges before owned by them. To this privilege the name of Grosvenor was properly given. There were then four properties, covering a territory about four miles in length, extending from Wilsonville to Mechanicsville; and, although under the same ownership, they had four different names: Fisherville, Masonville, the Swamp factory

and Grosvenor's. It was now thought best to unite the common property under a common name, and that of the Grosvenor-Dale Company was decided upon.

Since the business has been under the control of Mr. Grosvenor, as financial and mercantile manager, and Mr. Briggs, as resident agent and practical manufacturer, it has been continuously successful. In 1859 a structure was erected uniting the original Mason factory of 1826, with the brick factory of 1831, and more than doubling the capacity, increasing it from 5000 to 11,000 spindles. At the same time a Jonvel turbine-wheel, of one hundred and eighty horse-powers, was substituted for the two breast-wheels before used. In 1862 the wooden mill at the lower privilege was moved across the road, and, afterward, the erection of the present structure of brick, 160 feet long, 66 feet wide and five stories high (with ell 80 feet by 40), was commenced. It was not completed and put in operation until 1865. Its power is furnished by a Jonvel wheel of one hundred and forty horse-powers, and a Leffel wheel of forty horse-powers. The last and most important work was begun in 1868, and was so far completed in 1872 as to be in effective operation, including the erection of the long range of buildings at North Grosvenor-Dale, together with provision for a greater head and a more permanent supply of water. The dam was rebuilt, and raised eleven feet and six inches. It had been raised two feet, a few years before, by Goddard and Pritchard, making, in the two alterations, an addition to the height of the original Fisherville dam of thirteen and a half feet. The level of the railroad, at this point, being but little above that of the old dam, a heavy additional expenditure was rendered necessary in the construction, above the new dam, of a dyke or embankment, parallel with the railroad. This was built of stones and gravel, securing both strength and permanency.

A large reservoir was thus made, its level, when at its full height, extending back to the dam at Wilsonville, a mile and a quarter above North Grosvenor-Dale. The new dam, one hundred feet long and nineteen feet high, is a very strong one, and well adapted to its purpose. A second dam, or rolling-way, designed to relieve the extreme pressure in time of freshets, was built at an angle with the former, of the same length and of similar construction. Another dyke, half a mile long, leading from the factory to the dam, and separating the canal from the river, was built at a considerable expense.

This dyke is one hundred feet wide at the bottom, and twenty feet at the top. The buildings were finished in 1872. The main building is 464 feet long, 73 feet wide, of four stories, with an attic—the latter being well-lighted, and filled with machinery. There is an ell of 128 by 67 feet, of equal height with the factory; a continuation of it, and at right angles with it, of 157 by 50 feet, with separate buildings for steam-engine, boiler and gas-works. The capacity is 65,000 spindles. The



Lucius Briggs

power is furnished by three Jonvel turbines, of two hundred and seventy horse-powers each. Subsidiary to these, to be used at low stages of water, is a Corliss steam-engine, of four hundred and fifty horse-powers. This group of buildings is symmetrical in proportion, and well adapted to the purpose of its construction.

The same good taste and liberal expenditure is noticeable in the village, which, with the exception of some half-dozen houses, has been built up by, and is the property of, the Company. The Company also operate the old stone mill, erected in 1828, having renewed its machinery, which now has a capacity of 5800 spindles driven by a Jonvel turbine of one hundred and twenty horse-powers.

The Grosvenor-Dale Company now operates machinery to the aggregate capacity of about 102,000 spindles. Its principal owner, William Grosvenor, was born in Killingly, April 30, 1810. He was descended, in the fifth generation, from John Grosvenor, who, with his wife, Esther, and four sons,—William, John, Leicester and Joseph,—came from Cheshire, England, in 1680, and settled in Roxbury, Mass. Three children, Susanna, Ebenezer and Thomas, were born in Roxbury. In 1686 Samuel Ruggles, John Chandler, Benjamin Sabin, John Grosvenor, Samuel Ruggles, Jr., and Joseph Griffin, for £30, purchased 15,100 acres of wilderness land in the Wabbaquasset Country, from Major James Fitch, of Norwich. The region thus purchased was called Mosamoquet. This tract included the territory afterward occupied by the towns of Pomfret, Killingly, Woodstock and Thompson, and was given by Uncas, Sachem of the Mohegans, to his son, Owenecco, who sold it to Major Fitch.

The purchasers of Mosamoquet, mostly residents of Roxbury, Mass., did not at once form a settlement, and John Grosvenor died at Roxbury, Sept. 26, 1691. His widow, with her children, except the eldest son, moved with the party of settlers to Mosamoquet, in 1692. William, the eldest son, was then a student at Harvard College. He graduated in 1693, and afterward resided at Charlestown, Mass. He was the ancestor of the Grosvenors of eastern Massachusetts. Mrs. Grosvenor had set-off to her five hundred and forty acres near the center of the new settlement. Among her descendants have been several men who have distinguished themselves in the colony and State; one of whom was the Col. Grosvenor who commanded a portion of the Connecticut troops at the battle of Bunker Hill.

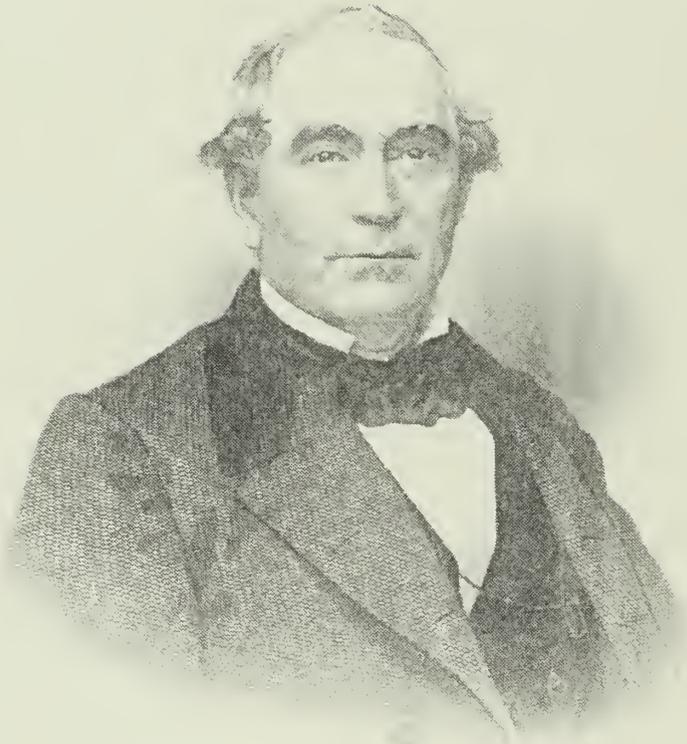
The youngest son of John and Esther Grosvenor, was Col. Thomas Grosvenor, born at Roxbury, in 1685. His name frequently appears in the annals of the time. He had four sons, of whom the youngest was Joshua. The last named also had four sons, of whom the youngest was Robert, who obtained a wide reputation as a skillful physician. His son, William, the subject of this sketch, was educated to the same profession; and having graduated at the Jefferson Medical College, of Philadelphia, he practiced medicine for some years in partnership with his father. On

his marriage, however, he moved to Providence, and began business in that city as a wholesale merchant in drugs and dye-stuffs. There he was successfully engaged for five years. He then entered upon calico printing, and continued in this industry until 1860. In 1848 he accepted the agency of the Masonville Company.

Mr. Grosvenor has been a member of the senate of Rhode Island, and in that body was chairman of the Committee on Finance. His children are William, Jr., James B. M., Robert, Alice and Rosa Anne. Mrs. Grosvenor died April 11, 1872.

Lucius Briggs, resident agent of the Company, was born in Coventry, R. I., Dec. 21, 1825. He was the son of a farmer, and was educated in the schools of his native town, and in the academy at Smithville, R. I. In order to become a machinist, he entered, at the age of nineteen years, the shop of Nicholas Potter, in Coventry. Mr. Briggs remained with him about three years, becoming expert in his trade. He then worked for two years as repairer of machinery for Governor Harris, in his mill at Harrisville, in Coventry, thereby becoming familiar with cotton-machinery. He then went to California, where he remained two years, engaged, most of the time, in trading. In June, 1851, he went to Thompson, Conn., and entered the employment of the Masonville Company; at first as repairer of the machinery in the lower mill, taking charge, the next year, of the repairs in the upper factories. In 1853 he was appointed superintendent of both the lower and upper factories; and in 1854, as before stated, at the time of the purchase of the Masonville property, by Mr. Grosvenor, he became a partner. The improvements and enlargements, by which an aggregate capacity of less than 8000 spindles has been increased to 100,000, while owing their origin and development to the energy and liberal outlay of Mr. Grosvenor, have been due, as to plans, arrangements and execution, to Mr. Briggs. He has represented the town of Thompson in the house of representatives, and the district in the senate of Connecticut.

The younger members of the Company, William Grosvenor, Jr., born at Providence, Aug. 4, 1838, and James B. M. Grosvenor, born at the same place, Feb. 12, 1840, were trained in their father's office, and are now the active managers of the mercantile department of the business; the senior partner retaining only a general supervision. Wm. Grosvenor, Jr., is the purchasing agent and manager of the business at the home-office, in Providence; and James B. M. Grosvenor, a member of the commission house of Grosvenor & Co., New York, is the selling agent in that city. The third son of Mr. Grosvenor, Robert, was born in Providence, Nov. 2, 1847, and has been for some years associated with his brother William in the home-office.



Van Slyck & Co Boston



Edward Harris

EDWARD HARRIS.



EDWARD HARRIS, of Woonsocket, R. I., woolen manufacturer, was born at Lime Rock, in the town of Smithfield, R. I., Oct. 3, 1801. In his childhood, his parents removed to Dutchess County, N. Y., and in 1818, to Ashtabula County, Ohio. As a boy, he worked on a farm in summer and attended school in the winter. On arriving at manhood he took charge of a school, spending the intervals between the school, as before, in farm labor. In 1823 he returned to Smithfield, and became a clerk in one of the factories of his uncle, William Harris, then a prominent manufacturer of cotton goods. This factory was at Valley Falls, on the site of the present stone mill on the Cumberland side of the river. His wages were meager; and, having attracted the attention of Abraham and Isaac Wilkinson, who ran the mill on the other side of the river, in Smithfield, he was offered employment by them at one dollar a day. His uncle, however, was unwilling to release him, and offered him the position of clerk in a mill at the Albion Village, in which the elder Harris owned an interest. He was soon appointed superintendent of this mill, and remained in that capacity until November, 1828. He then assumed the agency of the Harris Lime Rock Company—lime manufacturers—in his native village, where he remained two years. Early in 1831 he determined to engage in business on his own account. Since coming from the West, he had managed to save twenty-five hundred dollars. With that amount, and one thousand dollars borrowed from his father, he went to Woonsocket, R. I., and purchased a small woolen-mill, with one set of machinery. He entered into partnership with Edward Seagrave, of Providence, R. I., under the firm style of Seagrave and Harris, and engaged in the manufacture of satinets. The business was not at first profitable, and Mr. Harris's share of the capital was reduced to a thousand dollars. He now returned to his old position with his uncle, retaining his interest in the business at Woonsocket, which was carried on

by his partner. The next year there was a great advance in satinets, and a handsome profit was realized. He now returned to Woonsocket, and again devoted himself personally to the business. In 1836 the stone mill, known as Mill No. 2, was built. The next year Mr. Seagrave retired from the firm. From that date until his death, Mr. Harris was alone in the proprietorship of his mills and business. About this time he began, in Mill No. 2, the manufacture of what was then known as "merino cassimeres." These goods, like satinets, were made with cotton warps and wool-fillings; and, in December, 1842, he superseded these by making all-wool fancy cassimeres, since known as the "Harris cassimeres." In 1844 he built Mill No. 3, and the next year Mill No. 4. These four mills, with the additions which have been made to them, are known as the "Old Mills." They are located near the center of Woonsocket, and contain, in the aggregate, twenty-five sets of machinery. Adjoining Mill No. 4 is a cotton-factory, with 7000 spindles, devoted to the manufacture of sheetings.

Mr. Harris laid the foundation of a new range of factory buildings, in 1860, at a privilege owned by him, about three-quarters of a mile north of the "Old Works," which were finished and occupied in 1865. The main structure is in the form of an ell, which, if extended on a single line, would have a front of 440 feet, with a width of 60 feet, and is five stories in height. There are also smaller wings, together with a large dye-house and picker-house. The whole group of buildings is of brick. In this new factory are twenty-five sets of machinery, the motive power of which is derived from a breast water-wheel, forty feet in diameter and twenty-eight feet across the face. There is also an auxiliary steam-engine, built by Corliss, of one hundred and seventy-five horse-power. With these increased facilities Mr. Harris continued in business until his death, which occurred, Nov. 24, 1872. Prior to 1855 his goods were sold chiefly through commission-houses; and, when they had gained a footing, a mercantile house in New York solicited the exclusive agency for that city. Mr. Harris consented, on condition that the firm would agree that all notes received for the Harris goods should be placed by themselves, that they should not be negotiated without his consent, and that no notes whatever should be taken from parties holding or dealing in slaves. In that year he opened a store in New York; and, when it was customary for other houses to give eight months' credit, he allowed a limit of only six months, with two and one-half per cent discount; and when they adopted his limit of six months, he reduced it to four months, with five per cent discount. On the other hand, when the war broke out, he allowed a credit of three months; as he believed that some credit would be requisite for a large and successful trade, and that the time was favorable to the establishment of a system of short credits, in place of the extended credits which had obtained in many parts of the country. Mr. Harris

served both as a senator and representative in the legislature of Rhode Island. He held advanced views on the questions of anti-slavery and temperance, and was personally interested in many philanthropic movements. In habits and tastes he was simple and democratic; with his great wealth, he lived plainly and without ostentation, and was courteous to the humblest citizen.

The high school, district school and a church in Woonsocket were indebted to him for eligible sites; and the Harris Block, with its free library of four thousand volumes, and Lyceum Hall, erected at an expense of \$75,000, is a permanent monument of his generosity. He married, Dec. 2, 1835, Rachel Farnum, daughter of Moses Farnum, of Uxbridge, Mass., and sister of Welcome and Darius D. Farnum, the founders of the extensive woolen manufactories at Blackstone and Waterford, Mass. Their children were David F. and Rachel. The latter married Oscar J. Rathburn. Mrs. Harris died Feb. 7, 1846. Mr. Harris married again, April 19, 1848, Abby P. Metcalf, daughter of Joseph Metcalf, of Cumberland, R. I., by whom he had four children, three of whom survive him. The Harris Woolen Company, organized in 1867, has continued the policy inaugurated by Mr. Harris, his family owning nearly all the stock in the Company.

HAYWARD RUBBER COMPANY.

NATHANIEL HAYWARD—W. A. BUCKINGHAM.



ONE of the great achievements of this century was the discovery of the processes by which the vulcanization of India-rubber was accomplished. It has led to the production of a large variety of useful articles, among which many have contributed vastly to the health and comfort of mankind. While heat is a chief agent in effecting the change, sulphur is always present; and carbon, also, has a large influence, when the best results are obtained. In Good-year's process, a carbonate of lead or of zinc is used in connection with sulphur, the metal being a carrier only of the carbon. The discovery of the agency of sulphur in producing the result was a most important one, and was made in the summer of 1835, by Nathaniel Hayward, one of the founders of the Hayward Rubber Company.

Nathaniel Hayward was born in Easton, Mass., Jan. 19, 1808. He was one of a family of ten children. His interest in the manufacture of India-rubber, which became the business of his life, was first awakened in 1834, at which time he kept a livery-stable in Boston. A company had been organized at Roxbury, Mass., a year or two before, by John Haskins, Edwin M. Chaffee and Luke Baldwin, for the manufacture of cloth coated with India-rubber dissolved in spirits of turpentine. They soon sold their interest to the Roxbury Rubber Company, which made extensive arrangements for the manufacture of India-rubber goods, especially of cloth for carriage-tops, overcoats and other water-proof articles. The stock soon rose from one hundred to five or six hundred dollars a share. Mr. Hayward, on purchasing at the factory some rubber-cloth for a carriage-top, noticed that when two surfaces of the cloth came together they adhered, through the softening of the gum. This led him, in August, 1834, to make some experiments with a view to the remedy of this difficulty. Among other mixtures he made one of India-rubber, sulphur and lamp-



Van Alstede & Co. 1881-1882



Nathaniel „Hayward

black, which, as it proved afterward, contained the germ of his future success; but it did not then result in anything valuable. He continued his experiments, however; gave up his business for this purpose, and in April, 1835, sold out his livery-stable.

With five hundred dollars as the basis of his operations, Mr. Hayward removed to his native town, and hired a shop not far from the shovel-works of Oliver Ames. There he shut himself up and entered on a course of experiments. After two months of labor he one day poured all the chemicals with which he had been working—which were mainly white vitriol, blue vitriol, sugar of lead and sulphur—into a still of the capacity of about fifteen gallons, with spirits of turpentine, and drew off about four gallons. Into this mixture he put four pounds of rubber-gum, to be dissolved; and with this solution he made twelve yards of rubber cloth, three-quarters of a yard wide, which looked well, and which endured the changes of weather perfectly. Purchasing a new supply of chemicals, he repeated the experiment which had been previously successful; but, in this second trial, he failed. He then examined his chemicals separately, to ascertain their purity. He found impurities, especially in the spirits of turpentine and the lamp-black. These he purified—the former, by agitating it thoroughly with water, and the latter, by exposing it to heat. He found that the spirits of turpentine, thus purified, would dissolve the rubber; and having added the lamp-black (which is pure carbon), and applied the solution to cloth, he produced an article so satisfactory that he engaged to work for the Eagle India Rubber Company, then recently organized in Boston. This Company at once started a factory at Easton, where it carried on business for about seven months, employing six men and twenty girls in the manufacture of ladies aprons, carriage-covers and similar articles. A more convenient factory was then procured at Woburn, Mass.; and work was begun there in April, 1836, the business being carried on by the Company about eighteen months. Mr. Hayward was employed the whole time. During the summer of 1836 the Company asked him to make some white aprons. This he attempted to do by using a compound of white lead, magnesia and whiting, with an equal part of virgin or white rubber dissolved in spirits of turpentine. The aprons, however, softened when warmed, and were not white enough. He then exposed them to the fumes of sulphur, taking the hint from the method of bleaching straw, which he had seen. The aprons not only became very white, but they did not soften, or adhere, when exposed to the heat. This gave him the first intimation of the power of sulphur to prevent rubber from softening when warmed. After his success in treating the aprons, and during the whole of his engagement with the Eagle Company, he continued to make experiments with sulphur; and, among other discoveries, he found that if cloth coated with rubber prepared without sulphur was sprinkled with powdered sulphur, exposed to the sun, and afterward washed clean, this process fixed the gum and prevented it from melting.

In the autumn of 1837 the rubber business was completely prostrated; the goods made at the factories did not give satisfaction, and most of the companies were wound up with the loss of their capital. Mr. Hayward, with William F. Humphrey of Boston, purchased the stock and machinery of the Eagle India Rubber Company, and they continued the business together until the following spring, when the partnership was dissolved, Mr. Hayward continuing the business on his own account. In July, 1838, Charles Goodyear, who then had a store at No. 12 Water Street, Boston, sent him an order to make thirty yards of rubber cloth a yard wide. Fearing Mr. Goodyear would detect the presence of sulphur, Mr. Hayward attempted to make the cloth without it; but the result was a failure. He then made another piece, using sulphur, which Mr. Goodyear pronounced excellent. This was finished Aug. 11, 1838; and he afterward made other pieces for Mr. Goodyear.

On the 17th of September, 1838, Mr. Hayward sold out his establishment to Mr. Goodyear, and engaged to work for him a year. Early in October they signed a contract, that Mr. Hayward should make an application for the patent in his own name, and assign it to Mr. Goodyear, who agreed to bear the expense of obtaining the patent, to pay Mr. Hayward one hundred dollars cash, to give him his note for nine hundred dollars, payable in six months, and to allow Mr. Hayward the right to make, on his own account, three hundred yards of rubber cloth per day, until Mr. Goodyear should pay him the further sum of \$2000. The patent was issued Feb. 24, 1839, to Mr. Goodyear, as assignee of Nathaniel Hayward. During the year of his employment by Mr. Goodyear, Mr. Hayward made rubber cloths of various colors.

Early in 1839 Mr. Hayward learned that Mr. Goodyear had discovered a method by which rubber could be made to stand a high degree of heat; and on testing this, by placing a piece of rubber on the top of a hot cylinder stove, he found that it soon began to change color, becoming darker, and finally turning to a slate color. It underwent no further change, and was no longer affected by heat or cold. Mr. Goodyear afterward told him that he made the discovery by putting a piece of the sulphurized rubber cloth on a hot cylinder stove.

From September, 1839, to April, 1841, Mr. Hayward carried on business for himself. During this period Mr. Goodyear was in no regular business, but was trying to interest parties to invest capital for the development of his invention. On the third day of April, 1841, Mr. Hayward again entered into a contract to work for Mr. Goodyear for a year, at the end of which time he once more took the factory at Woburn into his own hands, and continued business there until Aug. 22, 1843. During this time Mr. Goodyear carried on the rubber business in different places, trying to perfect the heating process so as to use it for various purposes. Mr. Hayward also applied himself with much diligence to similar efforts, and so far

succeeded that he was able to heat, at one operation, a sheet of rubber cloth thirty yards long. He made several hundred pounds of vulcanized sheet-rubber for Mr. Goodyear, which was to be cut into threads for making suspenders. His furnace and apparatus were invented by himself, and kept secret. Having become embarrassed in money matters, however, he finally divulged to Mr. Goodyear the exact proportions of his compounds; for which the latter promised Mr. Hayward all the capital he needed, as well as the remainder of the money which Mr. Goodyear owed him.

During 1842 Leverett Candee had begun, at New Haven, Conn., the manufacture of rubber overshoes. At first he proposed to make the shoes of cloth, coated with rubber, just as clothing had been made for several years. Later in the same year Mr. Goodyear agreed to convey to Mr. Candee the right of making rubber shoes under his process. Mr. Candee, however, ascertained that the cloth shown him by Goodyear was really made by Mr. Hayward; and in April, 1843, he agreed with the latter that, if he could make a shoe out of the fire-proof gum, his firm would buy him out and employ him at good wages. Mr. Hayward spent three months in perfecting his apparatus, and in further experiments, and made the required article. He put into his heater thirty pairs of shoes, and they came out perfect. Of these he sent five pairs to Mr. Candee; and he at once bought out Mr. Hayward's business and factory, and engaged his services for one year. The latter repaired to Mr. Candee's factory, at Hamden, Conn., and began to make rubber shoes. They were satisfactory, except that, after a short period, the whitish appearance, which has received the name "bloom," appeared. Mr. Hayward obviated this, however, by using a smaller proportion of sulphur.

Having completed his contract with Mr. Candee, he determined to engage in business on his own account. The patent for the vulcanizing process was issued to Mr. Goodyear on June 9, 1844. The right to use it in the manufacture of shoes, and for other purposes, was then conveyed to Mr. Hayward. On leaving Hamden, Mr. Hayward went to Lisbon, Conn., and formed a partnership with Henry Burr, under the style of N. Hayward & Co. The business made rapid progress until April, 1847. Very soon after beginning at Lisbon, Mr. Hayward discovered a method of giving the shoes a lustrous black polish. This was kept secret for about two years, and gave a great advantage to the firm over other parties.

The joint-stock company was organized in 1847, under the style of the Hayward Rubber Company; and to this the business and interest of N. Hayward & Co. were transferred. The members of the firm united with William A. Buckingham, James S. Carew, Israel M. Buckingham, all of Norwich, Conn., and others, in the organization of the Company. William A. Buckingham was born at Lebanon, Conn., May 28, 1804. He was descended from Thomas Buckingham, one of the founders

of New Haven, and afterward one of the first settlers of Milford. W. A. Buckingham passed his childhood and youth in Lebanon, working on his father's farm, and attending the district school, the local academy, and the Bacon Academy at Colchester, then having an excellent reputation as an institution of a high order. When eighteen years of age he taught a district school at Lyme during its winter term. Two years later, he entered a dry-goods store in Norwich, as clerk, remaining in it for two years, and then spent some months in a wholesale dry-goods house in New York. He returned to Norwich, and opened a dry-goods store on his own account in that place. In 1830 he engaged in the manufacture of ingrain carpets, his factory being at Greenville (a part of Norwich), Conn. In 1845 William A. Buckingham, his brother, Israel M. Buckingham, and James S. Carew, formed a copartnership, under the style of I. M. Buckingham & Co., as dry-goods merchants, in Norwich.

On the organization of the Hayward Rubber Company, in April, 1847, the business both of W. A. Buckingham, in the manufacture of carpets, and of I. M. Buckingham & Co., in dry-goods, was closed up, and their resources were united with those of N. Hayward & Co., in the organization of a concern which soon took the prominent position since maintained by it, both in its specialty of manufacture, and among the industrial establishments of the vicinity and State. The capital stock was at the outset \$70,000. Land was bought at Colchester, and buildings were begun, the business being continued at Lisbon until 1847, when it was removed to Colchester. The power at the latter place is supplied by a steam-engine. In 1850 the woolen-mill at Lebanon, six miles from Colchester, was bought, there being a good water-power there, and was devoted to grinding and compounding the India-rubber. The machinery for this part of the work was the heaviest used in the rubber manufacture, and required great power. At the main factory, at Colchester, are the calenders for reducing the compound to thin sheets, other machinery for finishing and joining together the different parts of the boots and shoes, and the heaters for vulcanizing; and here, by far, the greater number of the operatives are employed. This Company at first worked under the right held previously by Mr. Hayward, under contracts made before the patent was granted.

In 1848 the Hayward Rubber Company, with L. Candee & Co., of New Haven, Ford & Co., of New Brunswick, N. J., and the Newark Manufacturing Company, of Newark, N. J., purchased the exclusive right to manufacture boots and shoes under the Goodyear patent. The two other concerns then working under licenses from Goodyear—namely, the Goodyear Metallic Rubber Shoe Company, of Naugatuck, Conn., and Onderdonk and Letson, New Brunswick, N. J.—declined to become parties to the purchase, but became licensees of the combination. The patent being infringed, the right of the combination was established by law, in the famous Goodyear case, in which Daniel Webster was counsel.



Wm W Buckingham

The first officers of the company were: Henry Burr, President, and W. A. Buckingham, Secretary and Treasurer. Mr. Burr resigned in 1855, and was succeeded by Mr. Hayward, who held the office until his death, in 1865. From the beginning, the Company's business rapidly advanced, and soon extended not only to every part of the United States, but to Great Britain, where, through its agent, Lorenzo Blackstone, then a merchant in Manchester, Liverpool and London, and now a successful manufacturer of cotton goods in eastern Connecticut, it had for several years nearly a monopoly in its line. Mr. Hayward was, until 1854, the active manager of the mills. After that year, although he remained president and a member of the board of directors until his death, the management of all the departments of its business devolved on others. Its financial interests were from the beginning under the care of Mr. Buckingham. In 1855 Mr. Hayward purchased the interests of the principal stockholders of the Malden Rubber Shoe Company, near Boston, and, with Elisha S. Converse, of Malden, Capt. John Bertram, of Salem, and others, organized the Boston Rubber Shoe Company.

Mr. Hayward died on the 18th of July, 1865, after a long illness. He had much force of character, and persistency in the pursuit of his objects; and to him, in a large degree, was due the success of the concerns with which he was connected.

William A. Buckingham continued as secretary and treasurer of the Company until his death. He was mayor of Norwich in 1849, 1850, 1856 and 1857. In 1858 he was elected governor of Connecticut, and was re-elected annually until 1866, when he declined further service. In May, 1868, he was chosen a Senator of the United States, his term beginning March 4, 1869. He died on Feb. 4, 1875, just one month before his term would have ended. As a man of business, Governor Buckingham was industrious, upright and prompt.

Mr. Hayward was succeeded as president by James S. Carew. On the death of Governor Buckingham, in 1875, his brother, Israel M. Buckingham, was elected secretary and treasurer, and held the former office until the ensuing June, when Charles J. Carew was elected his successor. Mr. Buckingham held the office of treasurer until his death, in May, 1876, when James S. Carew was elected to succeed him. At the same time Mr. Carew resigned the presidency, and was succeeded by William A., son of Isaac M. Buckingham. As the treasurer of the company, Mr. Carew is its executive head.

HEYWOOD BROS. AND COMPANY.

LEVI HEYWOOD.



THE various families of the name of Heywood, widely scattered through Middlesex and Worcester counties, in Massachusetts, are all probably descended from John Heywood, who, before 1650, came from England, and settled at Concord, Mass. His son, Deacon John Heywood, was prominent alike in civil and in ecclesiastical affairs. One of his sons, Phineas, born in Concord, in 1707, removed in 1739 to Shrewsbury, Mass. He was a selectman, a representative in the Provincial Congress, a member of the Committee of Correspondence in 1774-5, and an ardent patriot. His son, Benjamin, born in 1746, was commissioned in 1776 as a captain and paymaster in the army, and served through the war. He was present at the surrender of General Burgoyne, at Saratoga. From 1802 to 1811 he was one of the judges of the Court of Common Pleas. His elder brother, Seth, born in Concord, in 1738, went with his father's family to Shrewsbury, and, in 1762, married Martha Temple, of that town. He soon after removed to Sterling, and served as lieutenant in the army of the Revolution. Purchasing a farm in what is now Gardner, he was living there at the time of the incorporation of that town, in 1785, and, with John Glazier, was one of the petitioners and chief promoters of that act. He was the first town clerk. He was a blacksmith, and also carried on the large farm which he owned in the center of the town, his house being on the site of the present Town Hall, and the farm embracing within its limits the common, the burial-ground, and the lands occupied by the church, the hotel, and by many of the residences in the vicinity of the Town Hall. He died in 1827, aged 89 years.

His son Benjamin was born in Gardner, in 1773, and married Mary Whitney, sister of Phineas and Amasa Whitney, of Winchendon, Mass. He inherited his father's farm, and was for many years the town treasurer. He died in 1849, in his



Van Nostrand & Co. Engravers



Levi Heywood

77th year. His children were Levi, Benjamin F., Walter, William, Seth and Charles. Of these, Charles died at the age of six years; Benjamin F. died in 1844, having been a trader and a manufacturer of chairs; William died, in 1873, in Boston, where he had resided since 1830. He was engaged in business in Boston and Charlestown until 1855, in which year he retired from business. Levi, Walter and Seth survive, and are all engaged in the manufacture of chairs.

Levi Heywood was born in Gardner, Dec. 10, 1800. He received his education at the rural schools, and spent two terms at the academy in New Salem, Mass. He then became a school-teacher in his native town, and in the adjoining town of Winchendon, during the winters 1820, 1821 and 1822. In the spring of the latter year he went to Rochester, N. Y., and was employed there about a year in stonework by contract. Returning, in 1823, to Gardner, he entered into partnership with his brother Benjamin, in the miscellaneous business of a country store. This relation he continued until 1829. In 1826 he began, in Gardner, the manufacture of wood-seated chairs. Five years later he went to Boston, and opened a store for the sale of chairs, in which business he continued until 1836. Besides this occupation, he started, with William R. Carnes and his brother William, under the firm-style of Heywood and Carnes, a mill in Charlestown for sawing veneers from mahogany. This mill was burned in 1835. Mr. Heywood then returned to Gardner, and entered into partnership with his brother Walter, who, with others, had been for some years engaged in the manufacture of chairs, on a portion of the premises now occupied by Heywood Brothers and Company. The veneer-mill in Charlestown was rebuilt, and Levi Heywood retained his interest in it until 1849. The business of the new firm in Gardner proved profitable. The chairs were mainly made by hand, the only machinery used being the ordinary turning-lathe and circular saws, which were operated by water-power obtained from the pond now known as Crystal Lake.

In 1841 Levi Heywood purchased his brother's interest in the business, and at once gave his thoughts and labor to the construction and introduction of special machinery adapted to the various processes of their manufacture. He thus inaugurated a new era in the chair manufacture, and from time to time added new features, both in methods of manufacture and in the style of his products.

On the first day of July, 1844, he received into partnership Gen. Moses Wood, then of Providence, and afterward president of the Rollstone Bank, of Fitchburg, and his brother Seth; and the style of the firm became Heywood and Wood. This partnership continued until July 1, 1849. General Wood then retired from the firm, and Calvin Heywood and Henry C. Hill were admitted, the firm being changed to L. Heywood & Co. In 1852 Charles Heywood was admitted to the firm, and, in 1853, Calvin Heywood retired from it. In the same year a stock company, composed

mainly of the members of the firm, was formed under the style of the Heywood Chair Manufacturing Company. The business, which in 1849 amounted to \$100,000 a year, steadily increased, until it became, in 1861, \$300,000 a year. The manufacture of varnish had now become an important branch of industry with the Company. It had attained such a reputation, that, of the fifty thousand gallons made in 1860, five-sixths were sold to other persons. On the 5th of January, 1861, the factory buildings were burned, and the business was suspended for nearly a year, until the buildings could be restored. During this period the organization as a stock company ceased, and a new firm was formed under the style of Heywood Brothers & Co., composed of Levi Heywood, Seth Heywood, Charles Heywood and Henry C. Hill. In this first year of the war, the firm suffered severely from the loss of trade, and of debts due from the South and West, in which sections the business had been very large. But in the remaining years of the war, and in the years of the exorbitant premium on gold that followed, they were rewarded by large profits, arising alike from the regular margins on their business, and from the exchange on the gold in which their foreign claims were paid.

In 1868 Charles Heywood and Henry C. Hill retired from the firm, and Henry Heywood and George Heywood, sons of Seth Heywood, were admitted. Alvin M. Greenwood, son-in-law of Levi Heywood, was also admitted into the firm in 1873. Their sales, which, in 1860, amounted to \$300,000, had, at the time of the panic of September, 1873, reached the amount of more than \$1,000,000 a year.

The Company began to engage in the manufacture of rattan furniture in 1876. Mr. Heywood was among the first to make experiments in shaving and splitting cane, and was one of the original stockholders of the American Rattan Company. Like other chair manufacturers, Heywood Brothers & Co. depended, until 1875, on the American Rattan Company for their supply of strips for cane-seating. Since 1875 they have prepared their own cane. In order to use the cane to the best advantage, they began to make rattan chairs and furniture, and have thus added about twenty-five per cent to the aggregate of their business. In 1876 a foundry was started by Mr. Heywood, to secure castings for the chair business, and is also used on stove, range and other job work.

Besides his business relations as the head of the firm of Heywood Brothers & Co., Mr. Heywood, since 1847, has been a partner with Hon. W. B. Washburn, of Greenfield, Mass., in the manufacture of chairs and wooden-ware, at Erving, Mass., the firm being Washburn and Heywood. They are also engaged in the manufacture and sale of lumber, owning about three hundred acres of woodland in Erving, Northfield and New Salem.

Mr. Heywood has made many useful inventions. Among them may be named

one for a wood chair-seat, one for tilting-chairs, three for machines for splitting shaving, and otherwise manipulating rattan, and four for machinery for bending wood. He has, also, invented a valuable process for injecting rattan with India-rubber, or other suitable material, making of it an excellent substitute for whalebone. The Heywood patents have been combined with those of John C. Morris, of Cincinnati, on which the patents of Blanchard have, after long litigation, been decided to be infringements. The patents owned by the Morris and Heywood Wood-bending Company combine, it is thought, the really effective methods for bending wood. The firm has supplemented the inventive skill of their senior member by that of Mr. G. A. Watkins, an ingenious mechanic, who was for several years engaged in Springfield, and in Proctorsville, Vt., in the manufacture of surgical instruments and other machine work, and of chairs. His patents are for splicing cane, for groove and spline, for continuous spline, for grooving-machines, for pressing-machines and for embossing-machines. These aid in the weaving rattan strips like cloth, and using it for chair-seats, and is original with Mr. Watkins. By owning these patents, the Company has the monopoly of this improvement in chair-seating. Mr. Watkins also has patents for a machine for rolling cane, supplementary to Mr. Heywood's patent for injecting cane, and for a sawing-machine.

Mr. Heywood has been active in public affairs, as well as in the pursuit of his wide business interests. He represented Gardner in the convention for revising the Constitution of the State, in 1853, and in the lower branch of the legislature in 1871. He has been a director in the Gardner National Bank, and a trustee of the Gardner Savings Bank, from the organization of those institutions. He was an original stockholder and an active promoter of the Vermont and Massachusetts Railroad, and of the Boston, Barre and Gardner Railroad. The latter road not only confers large railroad facilities on Gardner, but is an important link of communication between Worcester, Providence and south-eastern Massachusetts, on the one hand, and, on the other, the regions reached, or to be reached, by the Hoosac Tunnel route.

Mr. Heywood married, on Dec. 29, 1825, Martha, daughter of Joseph Wright, of Gardner. Their children were Calvin, Mary Whitney, Charles, Solon and Helen. Mary Whitney, born Aug. 27, 1829, died Jan. 4, 1852. Calvin, born Sept. 11, 1826, was admitted to the firm of L. Heywood & Co., on July 1, 1849, and continued an active and useful member till 1833, when he retired. In that year he went to San Francisco, where he took charge, as its agent, of the firm's business at that point. He remained in San Francisco until 1868, when ill health compelled him to retire from active business. He has, since that time, resided at Gardner, and is unmarried. Charles, born Nov. 12, 1831, entered, at nineteen years of age, the office of L. Hey-

wood & Co. In 1851 he was admitted to the firm, and the next year took charge of the business in Boston. Removing his residence to the town of Winchester, he represented the district, composed of that town and West Cambridge, in the Massachusetts Legislature in 1861. He remained a member of the Heywood Chair Manufacturing Company, and then of Heywood Brothers & Co., until 1868, in which year, on account of ill health, he retired from the firm. He was elected president of the Gardner National Bank in 1871, having already been, for some years, one of its directors. He has been president of the Gardner Savings Bank since its establishment, and represented the town in the Massachusetts Legislature in 1868. He has been vice-president of the Boston, Barre and Gardner Railroad Company since the completion of the road. He married, in 1852, Miss Fanny Green, of Gardner. Solon, born Nov. 10, 1834, is a civil-engineer, and was employed in that capacity in the construction of the Boston, Barre and Gardner Railroad. He now has charge of his father's landed interests. Helen, born March 7, 1837, married Alvin M. Greenwood, the junior member of the firm of Heywood Brothers & Co.

Seth Heywood, brother of Levi, was born in Gardner, Nov. 12, 1812. Like his elder brothers, he was employed, in early life, on his father's farm, and, on attaining his majority, engaged in working on chairs. On the formation of the partnership of his brothers Levi and Walter, in 1835, he entered their service, and continued with Levi, after the purchase by the latter of Walter's interest, in 1841, until July 1, 1844, when, as has been stated, he entered into partnership with Levi and Gen. Moses Wood. He has continued in business with his brother Levi, through all the changes of the firm, until the present time. His special department has been, and still is, the selection, purchase and care of the material and stock. He married, in 1835, Emily Wright, a younger sister of Levi Heywood's wife. Their children are Henry, George, Frances and Mary. He represented Gardner in the Massachusetts Legislature in 1860. His eldest son, Henry, born June 25, 1836, was admitted to the firm in 1868, and took charge of its outside business, especially the contracts and sales. George, born Jan. 3, 1839, and admitted to the firm at the same time with his brother, has charge of the books, accounts, and, in general, of the finances. Alvin M. Greenwood, son-in-law of Levi Heywood, and son of James H. and Eveline C. Greenwood, of Gardner, was born Dec. 1, 1832, and was employed for some years by the firm. He was admitted to partnership in 1873, and has the charge of the orders and the shipping department.



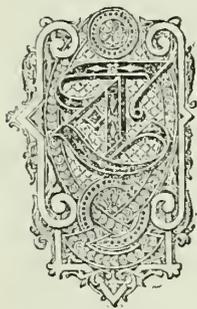
Van Slyke & Co Boston

Walter Hayward



WALTER HEYWOOD CHAIR CO.

WALTER HEYWOOD.



HE making of chairs as a branch of cabinet or furniture manufacture has been pursued in the United States from Colonial times. A shop devoted to cabinet-making was started in Gardner, Mass., by James M. Comee in 1805; and that place has since become a center of this industry. There were, also, early in the century, several small shops at Sterling, in which wood-seated and flag-bottomed chairs were made. The chair manufacture has since become so extensive an interest in the northern and north-western part of Worcester County that that region is called "the chair district." Walter Heywood, now of Fitchburg, was the pioneer in this branch of mechanical enterprise.

Walter Heywood was born in Gardner, Mass., Feb. 13, 1804. He attended the free schools, and worked on his father's farm, until he was nearly twenty years of age. He then entered Mr. Comee's shop, in order to learn to make flag-bottom chairs; and, after devoting a month to this purpose, he was employed by Mr. Comee a short time, on small wages. Resolving, in the latter part of 1824, to engage in business on his own account, he made up enough chairs for a one-horse load, drove to Boston, sold them, received his money and returned homeward. He was soon able to employ an additional workman; and, in 1827, his brother William engaged in work with him. In 1830 he entered into partnership with his brother Benjamin F., who had been a merchant in Gardner, and with Moses Wood and James W. Gates. The firm opened a store for the sale of dry-goods and groceries in Gardner, and at the same time, carried on the chair-factory. They established a store in Boston, for the sale of chairs, in charge of Mr. Gates. The business in both branches continued successfully until about 1835, when Messrs. Wood and Gates retired from the firm, and Mr. Heywood's relation to the business in Boston ceased. His brother Levi, who, with his brother William, and W. R. Carnes, had been selling chairs and making

veneers in Boston and Charlestown, about this time entered into partnership with Walter and Benjamin. Purchasing land now occupied by the factories of Heywood Brothers & Co., they erected new buildings, and entered more extensively into the manufacture of chairs. Walter Heywood sold his interest in the business and real estate, in 1841, and removed to Fitchburg, Mass., where, in company with Leander P. Comee, son of his old employer, he kept a miscellaneous store, embracing groceries, dry-goods, hardware and other merchandise. Not content, however, with this enterprise, he resolved to add the manufacture of chairs to it.

In the fall of 1844 Mr. Heywood hired a part of what is now the cotton-factory of H. W. Pitts, on West Street, Fitchburg, and resumed his former vocation. His premises soon proved too small for his purpose; and, when Alvah Crocker erected his building on the spot afterward covered by the factory of the Haskins Machine Company, the chair business of Heywood and Comee was removed to its upper story, which was 130 feet long by 40 feet wide. This building was burned Dec. 7, 1849. The firm of Heywood and Comee was then dissolved, and the store was given up. Mr. Heywood now devoted all his energies and capital to the manufacture of chairs. He secured a temporary shop on Newton Lane; and, on the completion of Mr. Crocker's new building, erected the next year, Mr. Heywood hired the whole of it. The main building was of the same dimensions as before, and three stories high; and an ell of the same height, 40 feet by 50, was built soon after by Mr. Crocker. In 1852 he received into partnership Alton Blodgett, Lovell Williams and George E. Towne, giving them an interest in the business, with the opportunity to repay him out of their share of the profits.

Alton Blodgett was born in Marlboro, N. H., April 1, 1812, and was brought up on a farm, remaining at home until Jan. 1, 1833, when he went to Gardner, and entered Mr. Heywood's service. He remained with Levi Heywood, at Gardner, for about a year after the latter had purchased his brother's interest. He then returned to Marlboro, where he remained about three years. Mr. Heywood, having, in the meantime, engaged in the manufacture of chairs, sent for Mr. Blodgett, who removed to Fitchburg, where he has remained till the present time. Lovell Williams was born in Shirley, May 10, 1815. In 1833, when eighteen years of age, he entered the machinery repair-shop of Walter Heywood, at Gardner, where he learned the trade of a machinist, and was employed in various departments of the factory. He continued in his employ, and afterwards in that of Levi Heywood, until December, 1844, when Messrs. Heywood and Comee sent for him to put up the shafting and machinery in their shop on West Street, in Fitchburg. From that time until the present, he has been with Mr. Heywood, as *employé* or partner. Messrs. Blodgett and Williams are both stockholders and directors in the Walter Heywood Chair Company, and are actively employed in charge of departments of its operations.

Mr. Towne, the son of Abiel F. Towne, for many years the head of the firm of Town and Willis, successful woolen manufacturers in Fitchburg, having entered when a youth the store of Heywood and Comee, continued in Mr. Heywood's office, and devoted himself exclusively to the manufacture of chairs. After being admitted to the firm, he had charge of the accounts and office business until 1867, when he was succeeded by George H. Spencer. In 1874 he sold his interest in the Company to Hiram A. Blood.

Soon after receiving Messrs. Blodgett, Williams and Towne into the firm, Mr. Heywood leased some land adjoining his factory from Mr. Crocker, and erected two factory buildings, one 80 feet by 40, four stories high, and the other 140 by 30 feet, two stories high. In 1864 he received into partnership George H. Spencer, who had entered the office of the company, as a boy, in 1857. He is now superintendent and business manager of the Company.

On the 31st of May, 1869, under a special act of incorporation, the firm was organized as the Walter Heywood Chair Company, with a capital of \$240,000. The buildings on Water Street, occupied by the Company, were burned in July, 1870; and a lot on River Street, having an area of nine acres, was purchased, and the erection of the present factory buildings was begun. During the time occupied in this work, the regular business was suspended; but the operatives were, to a large extent, employed in the reconstruction. The buildings now erected were three main factories, two of which were 300 feet by 50, and one 300 feet by 40; each factory was two stories high, with an attic. There was also a building for office and store-rooms, 100 by 50 feet; an engine and boiler-house; and five sheds, 300 by 20 feet, of one story, for stock and material. A railroad track belonging to the Company, a quarter of a mile long, connects the grounds with the main track of the Fitchburg Railroad; and subsidiary tracks also run over the grounds and through the buildings.

In 1856 the firm, whose operations had hitherto been confined to the United States, opened a direct foreign trade, which now extends to Great Britain, the Continent of Europe, the West Indies, South America, Australia, New Zealand, Africa, East India, China and Japan. A large trade is also carried on with California. In addition to their factory at Fitchburg, the Company owns a large tract of timber-land in Barton, Vt., with a mill, in which about forty men are constantly employed in getting out chair-stock.

Mr. Heywood is also the senior partner of the firm of Heywood, Wilson & Co., which carries on an iron-foundry, started in 1868, and is the largest individual stockholder in the Putnam Machine Company. He owns stock and is a director in the Fitchburg Machine Company, in the Burleigh Rock Drill Company, and in the

Burleigh Mining and Tunneling Company, and was for thirty-four years a director in the old Fitchburg Bank. In addition to these varied business connections, he gratifies his taste for agriculture on his farm of two hundred acres.

Mr. Heywood married, in 1828, Nancy Foster, of Fitzwilliam, N. H., who died Aug. 1, 1861. He married again, Aug. 4, 1864, Lydia R. Buttrick, of Troy, N. H. Her father's uncle was Major John Buttrick, of Concord, Mass., who commanded the patriots at the opening battle of the Revolution. His children, both by his first wife, are Rosa, born in 1834, who married William O. Brown, in 1871; and Nellie, born in 1841, who married D. A. Corey, a successful merchant of Fitchburg.

William O. Brown, now treasurer of the Heywood Chair Company, was born in Royalston, Mass., March 30, 1816. He worked, in early manhood, in his native town and its vicinity, as a carpenter and in the manufacture of chairs, and went to Fitchburg in 1851, where he became a coal, flour and grain dealer. He was for several years a member of the board of selectmen of Fitchburg, and part of the time its chairman. On the organization of the Twenty-fifth Regiment of Massachusetts Volunteers, in 1861, he was commissioned as its quartermaster, and served in this capacity during the three years of the regiment's service. He was then appointed port-commissary, at Newbern, N. C., where he remained six months. On his return home, he was appointed, by Governor Bullock, purchasing agent for the State, in its operations at the Hoosac Tunnel, in which post he continued for two years and a half. He was elected, in 1868, one of the County Commissioners, and has held that office, by successive re-elections, to the present time. He became a stockholder of the Walter Heywood Chair Company in 1872, and was elected its treasurer in 1874. The officers of the Walter Heywood Chair Company are: Walter Heywood, President; W. O. Brown, Treasurer; and George H. Speneer, Clerk and Superintendent.



Van Lippa & Co Boston



Thos. J. Hill

THOMAS J. HILL.



THE development of great industries, in many branches of manufacture, has been due to the monopoly secured by a patent for a term of years ; during which, the individual or company possessing it, has acquired so much capital and prestige as to retain a marked advantage over rivals, soon after the patent has expired. Others, without such a monopoly, and having at the outset of their enterprise no capital except mechanical skill, industry and perseverance, have attained equal success, both in fortune and industrial reputation.

In the latter class may be placed Thomas J. Hill, of the Providence Machine Company.

He was born March 4, 1805, at Pawtucket, R. I. His father, Cromwell Hill, who was a blacksmith, was born, and lived till his marriage, at Rehoboth, Mass., from which place he removed to Pawtucket, about the year 1800. There he worked at his trade, being dependent for much of his custom on the cotton factories already established in Pawtucket and its vicinity. He did not, however, succeed in accumulating much property ; and his son, in childhood, suffered the privations of poverty. He was not even able to avail himself of the limited opportunities for education furnished by his native village. One incident of his boyhood, illustrating a marked trait of the "Father of the American Cotton Manufactures." Samuel Slater, occurred when young Hill was about ten years of age. Mr. Slater felt a warm interest in children, especially in boys who betrayed intelligence and energy. It was his habit to stop in the streets, to speak to the boys who took his fancy, and invite them to his house, and there hold long conversations with them. On more than one occasion young Hill was thus favored, and Mr. Slater took pleasure in showing him how to draught forms of cams, and other mechanical devices. This incident, probably, had much influence in shaping his future career.

At the age of fourteen he went to work in his father's shop, where he remained for nearly two years, taking there his first lessons in iron-working. In his sixteenth year, on the 28th of February, he entered, as an apprentice, the machine-shop of Pitcher and Gay, at that time one of the largest establishments of the kind in the country. It was devoted to the manufacture of cotton machinery, all of the varieties of which, then in use, including cards, dressers, speeders, mules and looms, were made there.

These machines were made, to a large degree, from the models of the machinery first constructed by Samuel Slater, after the English patterns, with which he had been familiar before leaving his native land. The looms made by the firm were known as the Rhode Island looms, from the fact that they were first in general use in the Rhode Island factories, and those of the adjoining parts of Massachusetts and Connecticut. They were introduced into this country from Scotland, by William Gilmour, who first visited Slaterville, and urged its proprietors to have some looms constructed and put into operation in their mill. The idea was not approved by the firm. Mr. Gilmour was, however, employed by them as a machinist for the next two years. During this period he introduced the hydrostatic press of Bramah, for pressing cloth, which proved very useful in the mill.

The power-loom of Francis C. Lowell had in the meantime been successfully introduced at Waltham, Mass. Mr. Lowell, who had been residing in Europe, returned in 1812; and in the autumn of that year he produced a working model of a power-loom, which he afterwards patented, Feb. 23, 1815. The principal movement was a cam, which raised a weighted lever, and thus gave motion to the lathe. The loom subsequently introduced by Mr. Gilmour used a crank for the same purpose. Mr. Gilmour succeeded in interesting Judge Daniel Lyman and others in this loom, and was employed to construct twelve looms, which, on their completion, were put into operation in the Lyman Mill, at North Providence.

They at once attracted attention. Manufacturers came from a distance to inspect their operation, and they soon entirely supplanted the hand-looms, which had been previously in universal use. In recognition of his service in introducing this power-loom, fifteen hundred dollars was presented to Mr. Gilmour by the manufacturers of the vicinity.

About the time that young Hill became an apprentice of Pitcher and Brown, that firm also began the manufacture of the geared speeder, a machine patented in England in 1813, and improved by Paul Moody and other American mechanics. Hill continued with them until April 16, 1830; and during the four years after he attained his majority, he took contracts from them, and himself employed, in addition to his own labor, that of several workmen.

On leaving the employment of Pitcher and Brown, he went to Providence, and was engaged by Samuel Slater to take charge of the machine-shop connected with the Providence Steam Mill, of which Mr. Slater was at that time the owner. In the spring of 1834, the business of the machine-shop was organized as a separate interest, and Mr. Hill became a partner in it, under the firm style of the Providence Machine Company. Mr. Slater owned three-fifths of the stock, and Mr. Hill two-fifths. A profitable business soon grew up, both in repairs and jobbing, and in the manufacture of new cotton machinery.

After Mr. Slater's death, in 1835, other parties purchased from his heirs a part of his interest in the Providence Steam Mills and in the Providence Machine Company, Mr. Hill still retaining his interest in the latter.

In 1837 Mr. Hill purchased the Lee Mill, at Willimantic, Conn. This had been occupied as a cotton-mill; but the machinery had been removed, the dam was worthless, and the whole property was out of repair. Mr. Hill rebuilt the dam, repaired the buildings, and put in improved machinery for the manufacture of spool cotton thread. He also began to manufacture cotton machinery, intending to remove from Providence, and take up his permanent residence at Willimantic. He decided finally, however, to remain at Providence; and in the fall of 1845, sold the property to A. D. and J. Y. Smith, who organized the business since known as the Smithville Manufacturing Company.

On the 29th of July, 1845, Mr. Hill purchased from the Stonington Railroad Company, the land now occupied by the works of the Providence Machine Company, and began to build a new machine-shop in the following August. He had, nearly a year previously, entered into negotiations with his partners for the purchase of their interest in the business, with the machinery and tools. Meanwhile, he conducted his new concern under the style of Thomas J. Hill. On the 26th of August, 1846, he completed the purchase; and removing the machines and tools to his new premises, he assumed the old firm name of the Providence Machine Company.

In 1847, under a contract with Francis Skinner, of Boston, he made, for the Naumkeag Mill, at Salem, Mass., his first fly-frames. This variety of roving-machine was first made in England, about 1840, and was introduced into extensive use in that country. Several firms in the United States, including some of the most prominent builders of cotton machinery, engaged to a limited extent, during the next ten years in their manufacture; but from lack of experience, or some other reason, they did not find sufficient profit in the enterprise, and abandoned it. Mr. Hill, however, gave his personal attention to the details of their manufacture, and, working both material and men to the best advantage, soon made it a profitable speciality of his business. His competition in this branch has been largely with English manufact-

urers ; but it is proved, contrary to the common opinion as to the relative thoroughness of workmanship of machinery of foreign, as compared with that of domestic manufacture, that the English fly-frames sooner and more frequently needed repairs than those of the Providence Machine Company. The purpose of this machine is similar to that of the geared speeder, but it is adapted to the preparation of roving for much finer yarns, and occupies less space for the same amount of production. As an illustration of its capacity, it may be stated that, in its most improved form, machines have been made by the Providence Machine Company producing roving for yarns of No. 300, the roving itself being almost of the fineness of, and having but little more tenacity than, a spider's thread.

In 1850 Mr. Hill became associated with Francis Skinner, Benjamin E. Bates and other Boston capitalists, in the development and application to manufacturing purposes of the water-power of the Androscoggin River, at Lewiston, Me. In 1850 the Bates Mill No. 1 in that town was built, and the next year Bates Mill No. 2 and Hill Mill No. 1 was erected. In 1850 Mr. Hill built a foundry, and hired a machine-shop at Lewiston, the business of the former being conducted under the name of the Lewiston Foundry. He closed up the business of the machine-shop in 1856.

In 1854 he purchased a cotton-factory at East Greenwich, R. I., which had been run for a considerable number of years by different firms, but was then known as the Peckham Mills, being owned by Joseph Peckham. Mr. Hill purchased only the mill and the land, Mr. Peckham removing the machinery to Olneyville. Mr. Hill stocked the mill with new machinery, to the capacity of about six thousand spindles ; and, on account of its situation on East Greenwich Bay, gave it the name of Bay Mill. On the first of January, 1864, he gave one-third of this mill to his son William, and on the 30th of April, 1867, he gave the remaining interest of two-thirds to his two sons, William and Albert. In December, 1864, he sold his property in the Lewiston Foundry to Amos D. Lockwood. The business of that establishment has since been conducted under the style of the Lewiston Machine Shop.

Mr. Hill purchased in November, 1863, a tract of land in the town of Warwick, R. I., on the line of the Stonington Railroad, about seven miles from Providence. He has increased this tract, by subsequent purchases, to nearly six hundred acres. In 1867, with Smith Quimby and Samuel W. Kilvert, he organized a company at the May session of the Legislature, under the name of the Rhode Island Malleable Iron Works. A fine edifice of brick was erected, 247 feet long by 60 feet wide, with an ell, for molding purposes, 165 feet by 60 feet. These works are used for the manufacture of malleable iron castings. Its officers have been from the beginning : Thomas J. Hill, President and Treasurer ; Smith Quimby, Superintendent ; and Samuel W. Kilvert, Agent.

A large variety of different articles are made in the lines of ship-chandlery, agricultural tools for domestic purposes, and various pieces of machinery. The business is wholly for other companies or mercantile houses, none of the products being put directly on the market on account of the company. A short time after the works were started, a railway depot was erected, the expense being borne equally by the railroad company and Mr. Hill. The station received the name of Hill's Grove. Mr. Hill also erected and furnished, solely at his own expense, for the benefit of the operatives and their families, a school-house of two stories, the upper story being also fitted up as a hall for religious services.

Mr. Hill continued sole proprietor of the establishment and business of the Providence Machine Company till Jan. 1, 1874, when it was organized as a joint-stock company, with a capital of \$350,000. Associated with him in its organization were his son Albert, his son-in-law, Charles M. Pierce, Jr., and George J. Hazard, who had been in the employ of Mr. Hill since 1860. The officers of the Company are: Thomas J. Hill, President and Treasurer; Albert Hill, Secretary; and George J. Hazard, Agent. The latter also has the immediate superintendence of the works.

In 1875 Mr. Hill commenced the erection of a cotton-mill at Hill's Grove, in the immediate vicinity of the Rhode Island Malleable Iron Works. A range of substantial brick buildings has been completed, and a large portion of the machinery has been already set up. The mill will have a capacity of twenty thousand spindles, and will be devoted to the manufacture of cotton yarns. Mr. Hill has given it the name of the "Elizabeth Mill," after his wife.

The principal enterprises in which Mr. Hill has been engaged, and to which he has vigorously devoted himself, have been described. He has also been associated, by the investment of capital, and as an adviser, in various interests connected with the town and city in which he has been a resident for nearly half a century. He organized, in 1866, the Providence Dredging Company, which, while profitable to its projectors, has been useful to the city in preserving and increasing the facilities for navigation. He has been for twenty-three years the president of the Lime Rock National Bank, and a director in other financial institutions. He has also served for several years in the Common Council of Providence.

Mr. Hill married, on the 12th of October, 1825, Betsey, daughter of Sylvanus Brown, of Pawtucket. Mr. Brown was a millwright, and was employed by Moses Brown to assist Samuel Slater in the construction of his first spinning machinery; and by his mechanical skill gave valuable aid to Mr. Slater, and contributed much to his success in laying the foundations of the cotton manufacture in this country. Of Mr. Hill's children, three attained adult years: William W., born July 5, 1830; Albert, born March 3, 1834; and Amanda E., born Aug. 7,

1836. William was engaged in the manufacture of cotton goods at East Greenwich, R. I., till his death, Dec. 22, 1871. Albert is agent and manager of the Bay Mill, owned by himself and the widow of his brother William. Amanda married, Nov. 28, 1860, Charles M. Pierce, Jr., of New Bedford, Mass., who was connected with the Providence Machine Company as a stockholder, and was also a merchant in New Bedford. He died Sept. 15, 1875. Mrs. Hill died May 9, 1859. Mr. Hill married again, Dec. 9, 1861, Olive L. Farnum, of Canterbury, Conn. She died Nov. 16, 1866. He married his third wife, Elizabeth C. Kenyon, of Warwick, R. I., Aug. 9, 1869.

Mr. Hill is now in his seventy-fourth year, and still retains his physical and mental vigor. His appearance is more youthful than his years; and this is largely due to the fact that his hair has retained the color and abundance of his youth. Over six feet in height, and well-proportioned, he had, in his prime, great muscular strength; and this, with his mechanical bent, and his skill in the use of tools, enabled him in his early manhood, and even before attaining his majority, to accomplish in a given time an extraordinary amount of good work. Both in the work he has done with his own hands for others, and in that afterwards done by others for him, he has never been satisfied with any except the best.

It is said of him, that on one occasion a pattern was submitted to him for inspection. In reply to his criticism of it, the workman said that he thought that "it would do." "It will not do," was Mr. Hill's reply. "That is not my standard;" and throwing it upon the floor, he trampled it in pieces. On another occasion, examining a lot of cast-iron pulleys, he saw that they were not turned or bored accurately; and dashed these heavy pieces, one after another, on the floor, reducing them to a condition fit only for the scrap-heap.

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