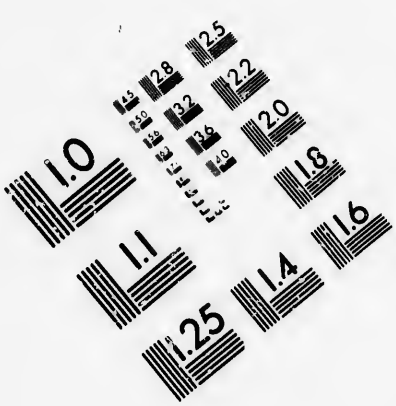

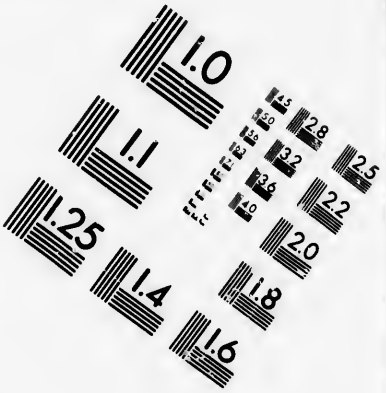

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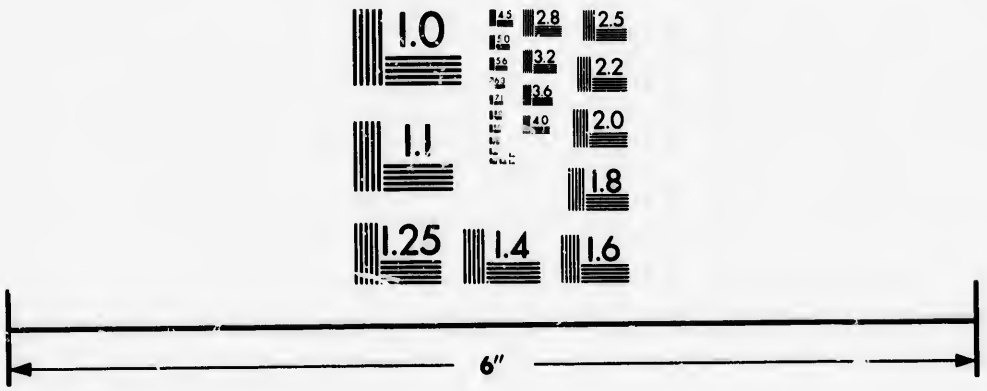

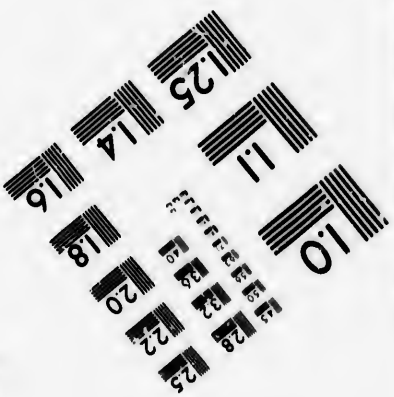

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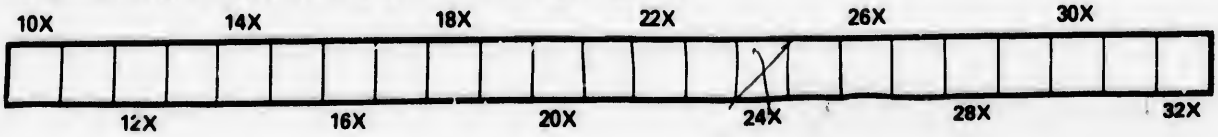

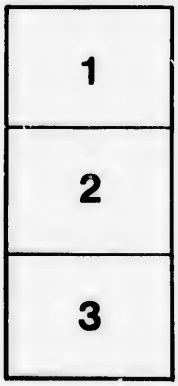

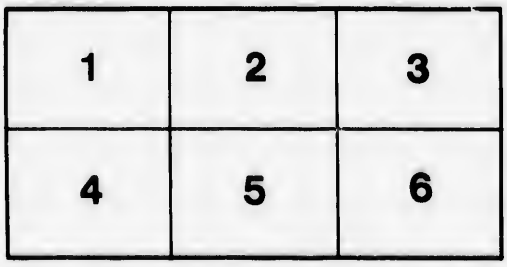

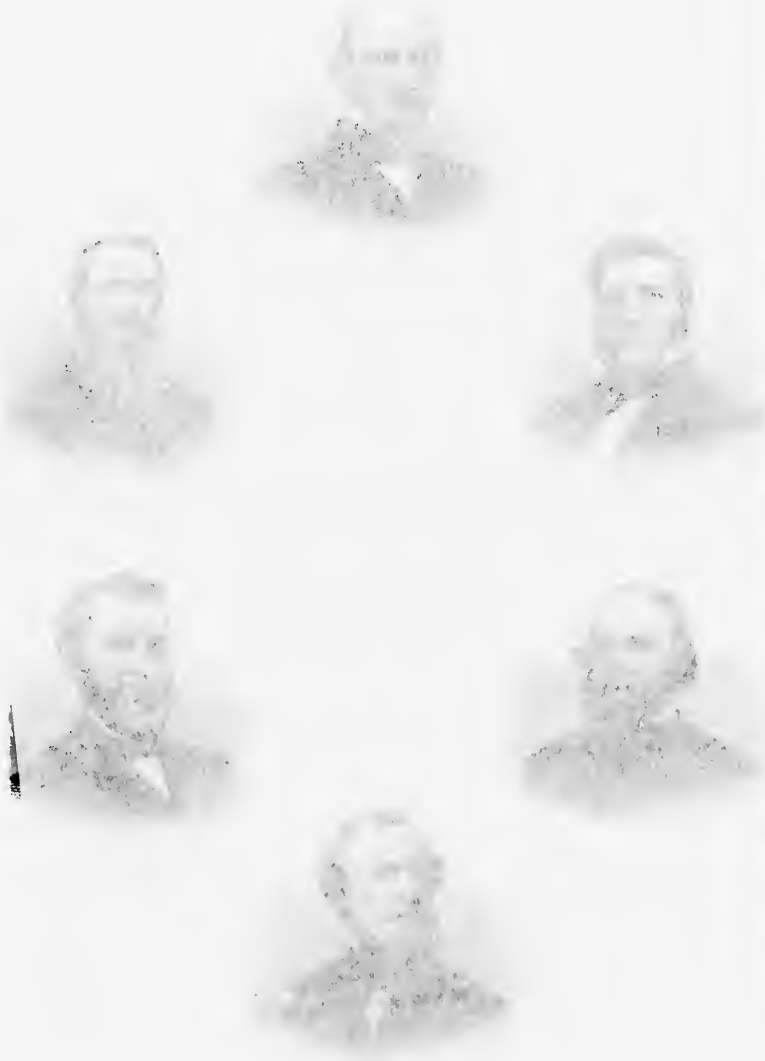

A HISTORY

OF

American Manufactures

FROM

1608 TO 1860:

EXHIBITING

THE ORIGIN AND GROWTH OF THE PRINCIPAL MECHANIC ARTS AND MANUFACTURES, FROM THE EARLIEST COLONIAL PERIOD TO THE ADOPTION OF THE CONSTITUTION;

AND COMPRISING

ANNALS OF THE INDUSTRY OF THE UNITED STATES IN MACHINERY, MANUFACTURES AND USEFUL ARTS,

WITH A NOTICE OF

The Important Inventions, Tariffs, and the Results of each Decennial Census.

By JOHN LEANDER BISHOP, A.M., M.D.

WITH AN APPENDIX, CONTAINING

STATISTICS OF THE PRINCIPAL MANUFACTURING CENTRES, AND DESCRIPTIONS OF REMARKABLE MANUFACTORIES AT THE PRESENT TIME.

IN THREE VOLUMES.

VOL. III.

THIRD EDITION, REVISED AND ENLARGED.

PHILADELPHIA:
EDWARD YOUNG & CO.,
No. 144 SOUTH SIXTH STREET.
LONDON:
SAMSON LOW, SON & CO., 47 LUDGATE HILL.
1868.

KING & BAIRD, STEREOTYPERS AND PRINTERS, 607 SANSOM STREET, PHILADELPHIA.

INTRODUCTION TO VOL. III.

In the two preceding volumes we have endeavored to trace, from such records as laborious research could discover, the leading facts in the history of the growth of the manufacturing industry of the United States, from the establishment of the first Glassworks at Jamestown, in 1608, to the close of the eighth Decennial Census. As France has a work on her "Great Manufactories," and England on her "Workshops," it would seem that our task would be incomplete without showing that the United States has also manufacturing establishments worthy of a permanent record. In offering this volume to the public, it is but just to acknowledge that it is almost wholly the result of the labor of other hands than those which prepared the previous ones. Having been drawn into the current of military life before the publication of the second volume, and afterward by the force of circumstances prevented from immediately prosecuting the work to its conclusion, its completion was intrusted to gentlemen whose industry, literary experience, and practical acquaintance with the subject gave assurance of judgment and fidelity in its execution. By far the larger and better portion of the volume is the work of Edwin T. Freedley, of Philadelphia, while the statistical portion has been principally contributed by Mr. Edward Young, late of the Census Office in Washington city.

It has been the object in these pages to present, as clearly and graphically as possible, the results of American enterprise and ingenuity in organizing skilled labor, and subordinating the forces of nature and the mechanical powers to his service, in building up systematic establishments and manufacturing towns and villages; thus bringing into view numerous remarkable examples and peculiar phases of the many-sided, practical American character, as displayed in individual or associate undertakings. The United States, according to the last Census, contains not less than one hundred towns and cities, with populations of ten thousand and upward, engaged more or less in manufactures. The constant tendency is toward the concentration of labor and capital in large towns where skilled workmen, banking privileges, transportation, and other facilities are most easily commanded. As these focal points of industry extend and increase in size, the methods of business are more and more assimilated to the factory systems of older and more densely populated countries, with their divisions of labor and handicraft perfection, so far as the more general use of machinery in this country permits. In many of these manufacturing communities we see the operation of these laws and affinities of trade, which tend to concentrate certain branches of manufacture in particular localities. Hence many of these busy hives of labor are noted for special kinds of production, which are there fabricated to a greater extent or in greater perfection than elsewhere. The economy of several branches of American industry has been so modified by the genius and character of certain inventors or prominent producers as to differ materially from the methods employed in other countries. Other branches have been almost or entirely created by the mechanical improvements of men

who are still on the stage of action or have recently left it. These and many other interesting features of our industrial economy, with many details of particular manufactures, omitted in the preceding historical annals, will be found in this volume. While it contains much matter of a personal and local character, we believe no less regard has been paid to strict accuracy of statement than in the previous volumes, and the truth of history has in no case been knowingly sacrificed to gratify the subjects of the sketches. Some of the descriptions have been made from sources deemed authentic and reliable, without the knowledge of the proprietors of the works noticed; though generally the accounts are derived from direct personal inquiry, and have received the corrections of the parties interested. It is believed that this volume, with the Appendix of the preceding volume, contains some account of nearly all the really extensive and noteworthy manufacturing establishments of the United States, yet it could with propriety have been greatly extended if time had been afforded, and a future revision will enable us to remedy the omissions and defects of the present.

With these explanations the volume is committed to the indulgence of the public, in the belief that it will be found of great practical value to manufacturers in showing the interior management of large establishments, and to posterity in furnishing a landmark and criterion by which they may measure their progress in the magnificent future now opening to the Nation's Industry.

STATISTICS

OF THE PRINCIPAL

MANUFACTURING CITIES AND TOWNS IN THE UNITED STATES.

COMPILED FROM THE

CENSUS RETURNS FOR THE YEAR ENDING JUNE 1, 1860.

WITH

DESCRIPTIONS OF REMARKABLE MANUFACTORIES.

In 1860, the agents employed in taking the Eighth Census reported there were in Philadelphia six thousand two hundred and ninety-eight manufacturing establishments, with a capital of $73,318,885, employing sixty-eight thousand three hundred and fifty males, thirty thousand six hundred and thirty-three females, who produced a value of $135,979,777. Believing that the original returns were erroneous, Lorin Blodget, Secretary of the Board of Trade, was appointed to revise them, who reported as follows:

MANUFACTURES OF PHILADELPHIA.

Manufactures.	No. of Establishments.	Capital.	Cost of raw material.	Male hands.	Female hands.	Value of Products
Agricultural implements	7	$67,800	$46,542	83	....	$142,940
Alcohol and camphene	9	190,900	444,275	76	....	662,418
Artificial limbs	7	42,000	11,000	38	9	52,000
Artificial teeth	12	284,800	176,831	89	71	323,908
Bakers' bread and crackers	346	755,605	1,314,537	878	34	2,214,856
Blacking and ink	9	184,000	109,665	60	86	265,380
Bolts and rivets, wrought iron	7	170,500	159,390	318	....	410,000
Bone black	3	111,000	106,156	32	....	192,000
Bookbinding and blank books	54	505,100	336,742	596	594	949,778
Book publishing	42	1,914,500	741,000	603	241	2,260,400
Boots and shoes	701	1,730,815	2,912,657	6,497	1,937	5,323,887
Brass founders	31	350,150	274,024	310	10	571,800
Breweries	68	2,122,600	1,102,733	593	3	2,223,425
Britannia ware	3	50,600	28,620	68	....	76,900
Bricks, common and pressed	49	1,208,500	70,625	1,870	....	1,212,100
Bricks, fire	5	50,600	24,975	89	....	77,900
Brooms, corn	7	51,850	58,461	88	....	132,809
Brushes	31	206,400	203,208	384	75	415,624
Caps, men's and boys'	10	111,550	84,505	53	320	258,150
Cards, playing, printers', etc.	4	44,000	80,555	33	59	134,000
Carpets	124	882,625	1,393,771	1,925	755	2,915,618
Carriages and coaches	52	610,600	326,321	1,038	....	1,051,371
Cars, for railroads	4	358,500	188,507	421	....	494,375
Car wheels and axles	2	540,000	235,300	120	....	393,000
Chemicals	35	1,861,000	1,544,316	702	35	2,769,254
Clothing	352	4,360,575	5,147,414	6,309	8,078	9,084,497
Coffee, roasted and ground	6	33,500	417,200	27	....	528,600
Combs, tortoise-shell and other	9	17,700	18,673	51	....	66,900
Confectioners	89	234,400	312,663	250	58	551,250

Manufactures.	No. of Establishments.	Capital.	Cost of raw material.	Male hands.	Female hands.	Value of Products.
Coopers' work	75	$215,832	$201,725	460		$483,681
Copper work	9	84,500	77,240	75		148,000
Cordage, hemp and flax	7	187,800	131,339	183	3	252,850
Cotton goods, cloths, with power	51	2,191,000	2,053,740	1,991	2,802	4,347,645
Cotton goods, hand looms	18	69,000	84,048	161	400	258,743
Cotton and woolen goods, power	51	1,059,600	2,021,813	1,704	1,554	3,593,326
Cotton and woolen goods, hand looms	5	31,500	42,100	78	22	98,000
Cotton webbing, tape, braid, &c.	7	157,800	131,616	74	152	262,960
Cotton and woolen machinery	6	273,700	120,954	337		490,000
Cured meats	23	1,145,500	3,510,415	238		4,575,807
Cutlery, steel tools, files, &c.	22	56,600	40,895	88	1	119,425
Distillers and rectifiers	39	712,400	1,171,516	136		1,499,031
Dyers, wool and cotton	35	174,191	200,396	214	26	801,588
Earthenware	14	59,000	23,922	102		109,010
Fertilizers	12	106,400	107,570	62		207,450
Fire engines	2	40,000	16,500	45		43,000
Flour mills	30	614,860	2,648,645	198		3,098,328
Furniture, cabinet or household	161	1,008,550	638,623	1,613	14	1,854,436
Fur manufactures	29	312,000	177,504	80	165	371,650
Gas works	3	3,956,248	586,200	863		1,837,500
Gas fixtu's, chandeliers, etc.	15	1,131,900	533,420	1,000	32	1,680,150
Glass, window, bottles, etc.	8	635,000	341,750	825		1,069,000
Gloves, of buckskin	5	20,600	23,996	19	36	50,800
Glue, curled hair, etc.	4	570,000	370,000	493		560,006
Gold leaf and foil	8	91,500	146,250	73	50	224,000
Gold watch cases & chains	23	741,500	1,103,856	578	46	1,714,880
Guns and pistols	25	110,000	82,382	223	2	251,150
Haircloth	3	65,500	51,100	25	85	102,040
Hats; wool, silk, and fur.	61	355,300	546,866	627	371	1,164,222
Hatters' trimmings	2	7,000	8,500	6		14,500
Hosiery, woolen	71	822,200	740,684	785	1,500	1,738,335
Hosiery, cotton	31	25,760	43,763	72	76	104,470
Ink, printers'	4	72,000	34,100	26		88,000
Iron castings:						
Building foundries	3	175,000	74,150	194		247,000
Gas and water pipe	2	155,000	150,000	160		250,000
General foundries	14	232,250	158,597	233		295,583
Stoves and hollow ware	8	905,000	508,800	956		1,306,700
Iron railings	13	297,400	118,904	192		283,520
Iron rolling-mills, bar, sheet, and plate	5	535,000	668,790	605		1,110,000
Iron rolled tubes, flues, &c.	3	258,000	378,879	293		539,247
Iron wire and ornamental work	17	54,900	47,848	101	3	115,794
Jewelers and watchmakers	71	567,600	247,830	414	18	691,430
Lampblack	4	41,800	22,380	34	2	62,792
Lead pipe, shot, and lead-smelters	4	275,000	414,700	48		638,500
Leather, in all forms	84	1,948,450	2,661,304	1,170	156	4,022,558
Locomotives	2	1,650,000	696,500	1,255		1,429,000
Machinery, general, of iron	61	1,244,800	737,727	1,613		1,862,000
Machinists' tool manufac's	2	450,000	70,274	370		403,000
Mahogany mills	2	240,000	134,200	125		265 000

Manufactures.	No. of Establishments.	Capital.	Cost of raw material.	Male hands.	Female hands.	Value of Products.
Mantillas (ladies' cloaks)..	30	237,850	369,880	15	523	689,880
Marble cutters	59	521,900	376,585	744	.....	1,019,125
Matches	5	26,150	32,374	54	79	70,700
Mathematical and optical instruments	30	104,700	36,651	113	.....	164,886
Medicines	34	422,800	191,250	170	53	752,650
Millinery, laces, straw goods, etc.	233	355,800	413,103	53	1,085	995,171
Mineral water, mead, etc..	9	116,600	82,875	140	1	259,600
Mirrors and gilt frames	51	289,150	283,146	330	.....	630,000
Morocco leather	31	843,660	1,043,743	784	155	1,727,846
Nails, cut	1	65,000	83,200	130	.....	173,060
Newspapers	30	948,300	660,875	932	12	1,741,100
Nets, fish and fly	3	5,800	3,926	9	24	13,100
Oils, animal	6	103,000	151,800	41	.....	246,186
Oils, linseed and nut	5	450,000	715,400	96	.....	906,020
Oils of rosin	3	40,000	103,800	15	.....	178,500
Oils, mineral, coal and petroleum	3	120,000	147,381	13	.....	209,200
Oil cloths	4	200,000	250,988	142	19	379,200
Organ builders	5	33,500	5,224	24	.....	28,000
Paints and colors	6	601,000	534,600	148	.....	1,109,724
Paper mills	6	400,000	482,675	146	87	682,000
Paper hangings	4	310,000	201,100	270	23	435,000
Perfumery and fancy soaps	17	483,500	206,310	193	38	712,500
Pianos and melodeons	15	200,500	83,100	272	.....	410,000
Planed lumber	11	208,200	228,680	146	.....	372,880
Plumbers and gas fitters	91	227,850	213,430	399	2	555,987
Pocketbooks and morocco cases	11	20,300	22,000	73	14	86,721
Printers, job and card	73	712,100	541,349	757	96	1,435,425
Printers, steel and copperplate	4	24,500	9,436	25	.....	26,700
Print works	12	967,250	2,848,396	773	152	4,048,888
Provision curers and packers	23	1,145,500	3,510,415	238	.....	4,575,807
Roofs of felt and composition	4	40,000	76,470	71	.....	134,800
Roofs, iron	3	155,000	133,000	145	.....	300,000
Saddles and harness	79	351,700	417,535	652	66	950,783
Safes and bank locks	7	120,000	60,548	138	.....	210,500
Sail and awning makers	18	33,350	67,739	71	11	144,000
Sash and blind makers	25	194,070	131,800	262	.....	330,840
Saws: hand and mill saws	6	182,500	126,468	229	.....	258,600
Sawed lumber	7	158,000	114,430	34	.....	183,620
Segars	229	462,700	511,240	1,120	170	1,228,220
Sewing machines	11	212,000	52,258	248	20	247,555
Ship-builders, iron	3	400,000	245,000	350	.....	448,500
Ship-builders, wood	13	1,350,000	297,855	608	.....	804,500
Shirts, collars, etc	72	664,650	650,787	104	3,186	1,334,064
Shovels, spades, etc	6	113,000	88,100	108	.....	169,000
Silk-spinning mills	3	170,000	276,000	47	217	450,000
Silk fringes and trimmings	31	748,800	611,968	369	850	1,260,725
Silk dyers	8	33,000	29,050	34	17	63,000
Silverware (solid)	9	368,000	308,803	145	13	516,000
Silver-plated ware	26	200,800	123,471	322	99	483,550
Snuff and cut tobacco	2	36,500	41,500	20	5	640,180
Soap and candles	45	974,333	1,421,123	343	31	2,076,590

Manufactures.	No. of Establishments.	Capital.	Cost of raw material.	Male hands.	Female hands.	Value of Products.
Spices, ground	14	191,800	453,905	93	35	668 [illegible]
Starch	4	177,030	136,975	63	6	210,975
Steel makers	2	175,000	231,750	50	.....	368,200
Steel springs	6	65,300	75,560	99	.....	130,052
Stoves and ranges	45	453,100	264,543	335	.....	664,074
Sugar refiners	8	1,546,000	5,472,700	478	.....	6,356,700
Surgical and dental instruments	17	152,350	51,614	155	13	190,021
Tallow refiners	10	68,000	285,278	35	.....	407,920
Tanners and curriers	46	1,035,250	1,443,720	339	1	2,037,040
Tin and sheet-iron	142	284,650	269,040	486	16	620,335
Trunks and carpet-bags	20	70,570	67,650	168	7	213,750
Type foundries and stereotypers	11	605,200	85,350	383	12	420,800
Umbrellas and parasols, &c	21	602,952	741,945	429	665	1,207,300
Varnish	13	215,700	305,833	69	.....	423,980
Venetian blinds	28	37,300	31,184	75	25	101,000
Vinegar	14	130,800	86,344	62	2	183,252
Wagon makers and wheelwrights	89	774,450	414,883	825	.....	997,191
Wagon-hubs, spokes, etc	7	62,200	39,027	50	.....	84,230
White lead	4	925,000	586,500	123	.....	850,500
Whips and canes	7	68,541	43,815	59	13	68,700
Willow ware, cedar ware, baskets, etc	29	46,750	32,213	166	.....	123,516
Woolens (all wool)	7	330,000	497,281	428	245	1,062,800
Yarns, cotton	15	612,000	499,478	318	450	849,233
" woolen	15	211,000	565,991	186	94	930,425
" worsted	2	30,500	21,775	23	25	34,200
" mixed	3	17,000	18,850	25	3	34,550
Totals in the City of Philadelphia,—including miscellaneous manufactures, not above specified,—*	6,314	$73,087,852	$72,333,805	69,388	20,009	$141,045,658
In the immediate vicinity of the city;—Cotton and woolen goods	100	5,038,049	3,226,869	3,504	3,309	6,777,349
Iron, and manufactures of Iron	31	3,044,610	1,603,003	2,420	.....	3,888,151
Paper	13	438,000	Est. 250,000	153	78	641,160
	6,467	$81,608,502	$77,473,677	75,535	32,390	$152,355,318

Total number of persons employed	107,931
Total number of establishments	6,467
Average production of each person	$1,411.60
Average production to each establishment	$23,558.88

* In 1858, Edward Young & Co. published a work entitled "Philadelphia and it Manufactures," by Edwin T. Freedley, which was the first comprehensive account that her citizens ever had of the importance of Philadelphia as a manufacturing centre. The able Secretary of the Philadelphia Board of Trade, Lorin Blodgett, Esq., who was appointed to revise the official statistics for the Census of 1860, remarks in his Report: "It is also but justice to say that the publication of the Statistics of manufactures prepared by Mr Young and Mr. Freedley, in 1858, proves to have been remarkably accurate in many of the classes, and generally to be very well sustained." In 1867, Mr. FREEDLEY published an enlarged edition of his Work, and estimated the value of the articles made in Philadelphia in 1866, at $225,130,014.

REMARKABLE MANUFACTURING ESTABLISHMENTS IN PHILADELPHIA.

The Bridesburg Manufacturing Company.

BARTON H. JENKS, PRESIDENT.

In the first volume of this history we referred more than once to the important part performed by the Hon. Joseph Jenks, Governor of Rhode Island, in the early fabrication of Iron in this country. A lineal descendant of his, Mr. Barton H. Jenks, is now proprietor of one of the most complete works for the manufacture of Cotton and Woolen Machinery, and of Fire-arms, in operation in the United States,—the Bridesburg Machine Works.

The founder of this establishment, Mr. Alfred Jenks, was a pupil and colaborer for many years with the celebrated Samuel Slater, who erected the first cotton-mill in Pawtucket, R.I. In 1810, Mr. Jenks removed to Holmesburg, Pa., taking with him drawings of every variety of cotton machinery, as far as it had then advanced in the line of improvement, and commenced its manufacture. The first mill started in this portion of the State of Pennsylvania was supplied by machinery constructed by him, and was situated in Lagrange Place, near Holmesburg. In 1816, he built a number of looms for weaving cottonades for Joseph Ripka. Under the universal impetus given to home manufactures during the last war, Mr. Jenks greatly extended his business operations, and in 1819 or 1820 removed to his present desirable location in Bridesburg, the increased growth of which is owing in no small degree to the personal efforts and enterprise of himself and the importance of his establishment. Here, where he possessed the necessary facilities for shipping to his more distant patrons, he conveyed his old frame building from Holmesburg on rollers, which yet stands amid the more substantial and excellent structures beside it. When the demand first arose for woolen machinery in Pennsylvania, Mr. Jenks answered it, and at once commenced its manufacture, and furnished the first woolen mill started in the State, by Bethuel Moore, at Conshohocken, with all the machinery necessary for this manufacture.

In 1830, he invented a power-loom for weaving checks, and introduced it into the Kempton Mill at Manayunk, where its success produced such excitement among hand-weavers and others opposed to labor-saving machinery as to cause a large number of them to go to the mill with the

avowed purpose of destroying it, from doing which they were only prevented by the presence of an armed force. This and other improved machinery made by Mr. Jenks soon acquired an extended reputation, and induced the erection of larger buildings; and now the establishment is one of the most extensive and important in this country. Since the decease of Mr. Alfred Jenks, and for several years previously, the business has been conducted by his son, Mr. Barton H. Jenks, to whom, if eulogy were admissible, we might refer as the type of a model manufacturer,—fertile in invention, skilful in mechanism, liberal, just and public spirited,—one, indeed, who throws around the pursuit of manufacturing something of the lustre and glory which the mercantile profession borrowed from the genius of Giovanni de Medici.

To attempt a recital of the various inventions and improvements which this firm have made for the benefit of cotton and woolen manufacturers, would carry us too far beyond our limits. Of Looms they manufacture a large number of different styles, ranging from the single shuttle or ordinary loom, through the more intricate forms of two-shuttle looms for weaving checks, three and four shuttle looms for weaving ginghams and other fabrics requiring a corresponding number of colors in the weft, to the more enlarged carpet loom; and all of these embrace in a greater or less degree improvements and advantages not possessed by looms manufactured elsewhere. The several improvements in the looms are covered by seven distinct patents; and the main features accomplished by these inventions, so far as they relate to the two, three, and four shuttle looms, may be said to consist in the expeditious manner of moving the shuttle boxes to change the picks of weft, and, by certain new constructions, combinations, and arrangement of parts essential to this operation, and to others of an important character, by which almost as many picks of weft can be made by these two, three, and four shuttle looms as by the single shuttle loom. As an exemplification of this it may be stated that so perfect is the arrangement of the various parts of these latter description of looms, and the principle upon which they work, that they make 130 picks of weft per minute where the same class of ordinary looms only make 110.

The looms for weaving the more elaborate and fancy character of goods are also perfect in their operations, particularly the loom for weaving damask table-cloths, napkins, and articles of a like character, and the carpet-loom. This latter has thirty-two shuttles, and is capable of laying sixteen different colors in the figure, and an equal number of colors in the ground of the carpet.

The self-stripping cotton and woolen carding engines manufactured

at this establishment, are different from the carding machines generally used. Instead of delivering the cotton or wool to the main cylinder as heretofore, it is, after being fed to the machine by rollers, passed to the "licker-in" cylinder, by which it is delivered to the main cylinder, whence it is successively retaken with its dirt, redelivered to the main cylinder by additional cylinders, arranged in the same relation to the periphery of the main cylinder as the first-mentioned "licker-in" cylinder, and driven by stripper heads at the ends of the cards, at variable speeds, so as to enable the dirt to detach itself from the cotton or wool during its increased speed with the additional card cylinders, and drop into a receptacle below. In this manner these cylinders are made to act as self-acting cleaners to the cotton and main cylinder card, and this avoids the necessity of the usual and constant hand-stripping to effect this object, and the consequent loss of time, besides enabling the cotton or wool to be more regularly laid and thoroughly cleaned. This effective method of cleaning the cotton and main card cylinder by delivering the former on to the latter successively at two and three different points, was originally projected and patented by Messrs. Gambrill & Burgy, in 1855, and subsequently improved and brought to its present perfect state by Mr. Barton H. Jenks in 1857; and in consequence he became interested with them under a reissued patent. He also added doffing rollers, to take the place of the usual comb for delivering the cotton or wool. For these he has also obtained a patent. By this system of delivering, an increased speed can be given the card, without danger of injury to the staple, over that attained where the comb is employed.

For several years Mr. Jenks has been experimenting upon and constructing the necessary machinery to complete a cylinder *Cotton-gin*, which gives promise of producing one of the most extraordinary improvements in the process of ginning the raw material that has been devised since the advent of Whitney's Saw Gin. It is well known that in ginning cotton with the ordinary gin the violent action of their teeth in dragging it between the bars tears the staple and injures it in a corresponding degree. The injury thus done the cotton has been variously estimated at from three quarters to one cent per pound,—a loss that swells the sum total to several millions of dollars on a full crop in this country. Now, the object of this new form of Gin is to do away with the usual shaft of saws, and substitute for them a peculiarly constructed cylinder, its outer periphery consisting of numerous and regularly set angular steel wire teeth, imbedded in Babbitt metal, in positions inclined to the direction of the cylinder's motion, so that after the cylinder, or rather the outer ends of the teeth are ground down and finished, each tooth will present

a separate, sharp, and smooth point, tangential to the periphery of the cylinder. These teeth are so close together that nothing but cotton can be secreted between them.

This leads us to notice a most ingenious and extraordinary machine, made at this manufactory, for puncturing the cylinders of thick paper and preparing and setting therein the angular teeth preparatory to casting around their inner ends the cylinder of Babbitt's metal, in which they are imbedded to form the alloyed cylinder of the cotton-gin. While witnessing its operation, and its parts performing functions requiring the greatest nicety and regularity of movement, to grasp the wire and successively carry it through a variety of intricate operations that would seem impossible except to the manipulation by hand of the most skillful person, one cannot but pay homage to the genius, skill, and patience of its author. Its complex character will prevent us, of course, from giving a minute description of it; but we will endeavor to state, in the regular order in which they take place, the several operations necessary to finally set these angular wire teeth in their alloyed base on the periphery of the cylinder.

The paper cylinder in which the teeth are first set is the same or a little greater length than the alloyed base of the cylinder, and is designed to receive 95,000 teeth. This paper cylinder is placed on circular heads, through which a main shaft moves loosely,—one of these heads, on part of the periphery of which a screw is formed, so as to actually make it a screw nut, has a cog or tongue on it, which enters a longitudinal groove in the hollow shaft, so as to cause it to revolve with the shaft and yet move freely over its surface longitudinally. This screw nut meshes in gear with the nicks on two parallel partially flattened screw shafts, arranged on either side of the main shaft and parallel thereto, which screw shafts can be turned on their axis to disengage their screw nicks from gear with the screw nuts, and bring blank flattened surfaces next it, so as to be run back quickly after it has performed the necessary forward movement, through the agency of a ratchet and gearing, with the accompanying paper cylinder, to set all the teeth designed for it therein. The wires, previously brought to the angular edge desired, are wound on two reels, hung on journals above the machine, and are passed between movable nippers or pincers, which are caused to move back and forth at intervals by a lever or cam, clamping or griping the wires, in their movement from the front, and releasing their hold in returning. Thence the wires continue under clamps, by which they are held during the return movement of the nippers, and from which they are released during the opposite movement, to allow the free passage of the said wires between guides, into corresponding openings in a peculiarly formed

oscillating arm termed a carryer, whose oscillating movement is constant over the extent of a quarter of a circle, except a slight rest or stoppage at the termini of each stroke, sufficient to receive the wires, and allow them to be cut off at the proper lengths by cutting snips in the guides immediately next it, and the punches to force the cut teeth out of it into the previously made punctures in the paper cylinder. This peculiar oscillating movement of the carrier, with its stoppages, is produced by means of a series of scroll cams, operating on a toothed or partially-cogged wheel on the front end of the carrier-shaft. Simultaneous with the inward movement of the nippers with the wires grasped between them, two horizontal punches are pushed inward and entirely through the paper cylinder, on lines tangential with its periphery, in order to make the necessary holes or punctures for the reception of the teeth, the paper cylinder being clamped, during this operation, as well as during the subsequent operation of setting the teeth therein, between the end of a back rest and a stationary head, to prevent it from turning, from whose grasp it is released after the two objects of puncturing the cylinders and setting the teeth have been accomplished. As the carrier descends, the crop-head containing the punches is raised so as to take the puncturing punches out of range of the paper cylinders, and the reciprocating bar by which they are moved, and bring the other punches on the same horizontal plane they previously occupied, so as to force the teeth from the carrier into the punctures previously made for them. In this manner the several parts of the machine are made to act in concert from a regular motion, the paper cylinder being turned and moved forward at proper intervals by the before-mentioned ratchet and suitable gearing, and the several operations of moving the wires into the carrier the proper distance to form the teeth, cutting them off, puncturing the paper cylinder with suitable holes for their reception, carrying them opposite these holes, setting them therein, and the intermediate duties of the various parts being performed at the proper intervals of time, and in the regular order, to enable the machine to set the extraordinary number of two hundred and forty teeth in the cylinder per minute. After this paper cylinder is set or studded with 95,000 teeth, it is removed from the machine and placed concentric with a metallic cylinder, the inner ends of the teeth which project inward equally from the inner periphery of the paper cylinder, while their outer ends are flush with the outer one, serving to keep it in its proper relation to the metallic cylinder, during the pouring of the Babbitt metal around the same and between it and the paper cylinder and ends of the teeth, to which it forms a base or bed. In pouring the metal the channel through which it passes is such as to cause it to first descend to the bottom of the me-

tallic cylinder, and then rise outside the same through and between the ends of the teeth, so as to allow the escape of the air before it. When the metal is cooled and set, the paper cylinder is wet and softened, and turned off, and the outer ends of the teeth are ground to give them the peculiar sharp form and uniform length before mentioned.

There are numbers of other new machines and improvements in this establishment for assisting in the work intended for the machinery they manufacture, but we must limit our notice to two of them. The first of these is an attachment of additional tools to the mandrils of drills, and is so very simple and effective as to astonish the beholder. The design of this improvement is to finish the hubs of cog-wheels, pulleys, etc., and the mandril is so formed as to admit of the attachment of a frame or stock containing a facing tool, a chamfering tool, and a tool for turning the outside of the hub, arranged in such relation to each other as to enable the entire operations named to be performed simultaneously, and by one descent of the mandril. The boring and reaming tools can also be added, and the drill made to perform these additional functions at the same time, one man being able, under this process, to attend to two drills. This is not only a decided labor-saving improvement, but is advantageous in this respect, that the combined work performed through it is more accurate than if the tools were set separately, and each part of the work done singly, as heretofore.

The other machine referred to is an automatic cutting engine for cutting either plain or bevel cog-wheels and pinions. This machine can be adjusted to cut any sized cog, on any sized wheel, by simply detaching a segment cogged plate or curb, which acts to turn the platen and hub with the wheels to be cut, the proper distance to correspond with the distance apart of the intended cogs, and substituting another of the requisite size,—the feature of turning the platen and hub and wheels to be cut the required distance being effected and regulated by the cogged segment or curb. The extent of the up-and-down travel of the platen and hub is also adjusted to correspond with the thickness and number of wheels to be cut, by means of a sliding box, to which the raising chain is attached, and which is secured and capable of being moved in a slot or groove in the oscillating arm through which the platen and hub receive their movement. Any number of cog-wheels, whose combined thicknesses are not greater than the movement of the platen, can be placed and secured on the hub, and after the machine is adjusted, it can be started and left to automatically cut, without any attendance whatever, the entire cogs of the wheels in the most accurate and beautiful manner. In case it is desired, the parts can be modified and the machine adjusted to the cutting of bevel cog-wheels.

The Port Richmond Iron Works. I. P. Morris, Towne & Co., Proprietors.

This is one of the establishments to which Philadelphia is indebted for her reputation for ability to construct heavy machinery. Its existence may be said to cover the whole period of the manufacture of machinery by modern methods. In 1828, when Levi Morris & Co., the predecessors of the present firm, commenced business, many of the tools which are now deemed indispensable in every machine shop, even those of the most moderate pretensions, were scarcely known. At that time slide lathes and power drill presses were not in general use, and the only representative of the planing-machine in this country, it is believed, was to be found at the Allaire Works, in New York, originally built for fluting rollers. It was not until 1838 that a planer was purchased and fitted up in the Richmond works. In the Foundry department, the operations were also conducted with very imperfect and inefficient machinery compared with that now in use. Anthracite coal, which was introduced here about 1820, was by no means exclusively used for melting iron. The blowing machinery was of a very primitive character, with unwieldy wooden bellows and open tuyeres. The best product was not more than two thousand to three thousand pounds of iron in an hour, and in the course of the heat an average much below this. With the present improved blowing machinery, and improved furnaces, eight tons have been melted in forty-six minutes, with a consumption of coal of one pound to eight pounds of iron melted.

In 1846, the works were removed from Market and Schuylkill Seventh streets to their present location, which is on the Delaware River, adjoining the Reading Railroad Coal Wharves on the south. The buildings, which are of brick, occupy a lot having a front on the Delaware River of 145 feet, a front on Richmond street, or Point Road, of 260 feet, and an entire depth or length, from the Richmond side to the end of wharf, of 1,050 feet.

The remarkable feature in this establishment is the extraordinary size of the tools in use, and the perfection of the machines employed in the various shops. In the *Foundry* there are three Cupola Furnaces, the largest of which will melt twelve tons of iron per hour. In the *Machine Shop*, there is a Planing Machine capable of planing castings eight feet wide, six feet high, and thirty-two feet long; a Lathe that will swing six feet clear, and turn a length of thirty-four feet; and a Boring Mill, possessing also the qualities of a horizontal lathe, which will bore out a cylinder sixteen feet in diameter and eighteen feet long. This is believed to be the largest in America or Europe. In their

Boiler Shop they have one large Riveting Machine, and facilities for making boilers or plate-iron work, of every description that may be desired. But a few years ago, Steam Boilers, made of plate-iron, were riveted exclusively with hand-hammers; and when the City Water-Works were located at Centre Square, the steam boilers were built of wood, with cast-iron furnaces. At the present time, in this, as in the best shops, circular boilers are riveted in a machine, by pressure produced by a cam operating upon a sliding mandril. In their *Smithery*, they have a Nasmyth Steam Hammer for heavy forgings; a [illegible]t Hammer for light work; and throughout the establishment, the minor tools, consisting of Lathes, Boring Mills, Slotting and Shaping Machines, Planing Machines, Horizontal and Vertical Drills, etc., etc., are all of the best description, and combine the latest improvements.

The monuments of this firm's engineering ability are found in all parts of the country. Probably the largest engines for producing iron with anthracite coal ever built in this country, are the product of their works. For the Lackawanna Iron Works, at Scranton, Pa., they built two Blowing Cylinders, nine feet bore, and ten feet stroke, and Steam Cylinders fifty-four inches in diameter and ten feet stroke. For Seyfert McManus & Co's. furnace, at Reading, they built a direct high pressure Blowing Machine, the steam cylinder being forty inches in diameter, and blowing cylinder one hundred and two inches, both seven feet stroke of piston. For the Lehigh Crane Co., they built a Beam Condensing Engine, having a steam cylinder fifty-eight inches diameter, and a blowing cylinder ninety-three inches, both ten feet stroke of piston. The beam of this engine works on a column of cast-iron thirty feet high, and the whole is set upon a heavy cast-iron bed plate. For the Thomas Iron Works, they supplied two very large beam engines, the steam cylinders being sixty-six inches in diameter, and the blowing cylinders one hundred and eight inches diameter, and ten feet stroke. These, it is believed, are the heaviest ever made for the purpose. The large engines of the United States Mint, and the lever beam Cornish Pumping Engine at the Schuylkill Water Works, sixty inches diameter, ten feet stroke, were constructed at their works.

This firm also built the Iron Light House for the ship shoal, in the Gulf of Mexico, which was put up on screw piles, in water fifteen feet deep, and at a distance of twelve miles from land. The whole height of the structure, from the water to the top of the spire, was one hundred and twenty-two feet, and from the water to the focal plane, one hundred and seven and a half feet. The structure above the foundation to the deck, a height of ninety-three feet, was erected in their yard, complete in all its parts before shipping

For Lousiana and the West Indies, they have manufactured every variety of sugar apparatus and engines for sugar mills; and North Carolina they have supplied with a large number of their celebrated Gang Saw Mills, by which a log of yellow pine can be converted into flooring-boards by once passing through the mill. The gangs consist of twelve to twenty-four saws, driven by direct connections with a steam engine at a speed of one hundred and twenty to one hundred and forty strokes per minute. They are not much known, except at the South, but we think they would be found highly useful in the pine forests of New Jersey, and the Middle and Western States. Recently this firm has been largely employed in building engines for government vessels—the gunboats Itasca, Scioto, and Tacony; the Ericsson batteries, Sangamon and Lehigh, and the Iron-clad batteries, Monadnock and Agamenticus.

The firm of I. P. Morris, Towne & Co., is now composed of Isaac P. Morris, John H. Towne, John J. Thompson, and Lewis Taws. The first-named gentleman was born in 1803, was one of the original partners in the firm of Levi Morris & Co., who commenced business in 1828, and since that period has been identified with the manufacturing interests of Philadelphia. In his business career, he has been distinguished for a discriminating intelligence, inflexible honesty, and a laudable public spirit. Mr. J. H. Towne was formerly engineering partner of the firm of Merrick & Towne, and is an engineer of unquestioned ability. Mr. Thompson, who has been connected with the establishment for many years, has under his charge the finances of the firm. Mr. Taws has been connected with the concern since 1834, and until 1861, when Mr. Towne joined the firm, had exclusive control of the mechanical department of the establishment. He served his apprenticeship with Rush & Muhlenberg, the successors of Oliver Evans, and in early manhood went to New York, where he entered into the employment of the West Point Foundry Association, then under the superintendence of Adam Hall, a distinguished Scotch engineer. The present arrangement of the Port Richmond Works is the result of his experience.

The firm of I. P. Morris, Towne & Co. have a capital invested in their business of over $400,000, and employ about 400 hands. Their list of manufactures includes every description of heavy machinery except locomotives.

The Southwark Foundry. Merrick & Sons, Proprietors.

This is another of the remarkable machine establishments of Philadelphia. It was started in 1836 as a foundry for castings only, but was soon enlarged, and now the entire space occupied by buildings is 63,650 feet, with a yard-room of 80,550, making the entire space occupied by the establishment 144,200 square feet. In addition, it has a tract of land on the Delaware River, about 400 feet front and 1,100 feet deep, affording ample space for extensive iron boat yards; and on this tract there is a fine pier, 60 feet wide and 250 feet long, with a very powerful shears at the end, capable of lifting fifty tons.

A brief description of some of the objects of interest in this establishment will show that the arrangements, tools, and appliances in use, are on a scale proportionate to the capaciousness of the buildings.

The foundry has two Cranes, capable of lifting fifty tons each, and three others of thirty tons lifting power, by which any object may be transferred from one extremity to the other, or to any point on the floor. Two fifty-inch Cupolas are used for melting the iron, and are supplied by a pair of Blast Cylinders forty inches in diameter, and three-feet stroke. Twenty-five tons of metal can be melted in three hours. The Ovens for drying the Cores are of immense size and capacity.

In the Smith Shop, the blast is obtained by an Alden Fan. There are two Nasmyth Steam Hammers, one of ten hundred-weight and one of five hundred-weight of ram. There are also in this shop Bolt and Rivet Machines, for the manufacture of these articles, large numbers of which are annually used. The Brass Foundry has a Cupola and four Crucible Furnaces.

The lower Machine shop has a Boring Mill which will bore a cylinder eleven feet in diameter, and fourteen feet high; a Planing Machine, believed to be the largest in the world, capable of planing eight feet wide, fifteen feet deep, and thirty feet long, besides other lathes and planers, of various dimensions and power; two Slotters, Drill Presses, etc., etc. The upper Machine Shop is well stocked with Smaller Lathes, Planers, Shaping and Drilling Machines, Vices, etc. The Boiler Shop is provided with a Riveting Machine capable of riveting a boiler forty feet long, and of any diameter; with a Treble Punching Machine of immense strength; with heavy and light Shears and Punches; an Air Furnace, for heating large plates; Rolls, for bending; Cranes, etc. The largest Erecting Shed, used for putting up sugar apparatus, has a

traveling Crane extending its whole length. The business of making Sugar Apparatus forms a large item in the productions of this establishment; and for a list of some of the extraordinary machines that have been constructed here, we must refer the reader to the work on *Philadelphia and its Manufactures*, to which we are principally indebted for these facts. Ordinarily, from three hundred and fifty to five hundred hands receive constant employment at these works.

William Sellers & Co.'s Machine Tool Works.

In the manufacture of Machine Tools, Philadelphia has a peculiar and deserved celebrity. Iron being comparatively cheap, by reason of proximity to the sources of its production, the Philadelphia builders use it freely in the beds and other important parts of their tools, which are consequently remarkable for solidity and freedom from injurious vibration when in active use. The weight of metal, however, is not so much their distinguishing characteristic as the excellence of the workmanship. Any one who will visit the establishment of William Sellers & Co., cannot fail to be astonished at the extreme pains taken to insure accuracy in all parts of the machines which they make. The wearing surfaces are *scraped* together—a slow and laborious process, which, however, secures absolute contact at every point. The bolt-holes are all reamed, and the bolts turned and driven home. The gearing is cut to a perfect form of tooth in every case. All the parts are made to standard guages, whereby each will fit its corresponding part in a hundred tools.

The firm which we have named has attained a reputation that is truly enviable. We know of no other that in so short a period of time has built up a mechanical reputation so wide-spread, resting on a basis of unquestioned substantial excellence. In 1848, the firm of Bancroft & Sellers commenced business in Philadelphia, and in a very few years their influence was felt in all branches of the machine manufacture. Tools from their shop were ordered from Russia, and supplied to other parts of Europe. Early in 1855, Mr. Bancroft died. Since his decease, the firm has been composed of two brothers, William and John Sellers, Jr., names that at this time are everywhere regarded as a sufficient guarantee of the excellence of whatever they manufacture. In workmanship, mathematical, not proximate accuracy, is their standard. A variation of a hair's breadth, if it can be overcome, is not left unremedied.

Besides Machinists' Tools, this firm manufactures a number of special

articles which are in extensive demand. The *Self-adjusting Hanger*, made by them, is of great value in the construction of shafting, inasmuch as it allows the shaft complete control of the bearing, so as to insure an equal amount of pressure on every part. By means of this, they are enabled to use a long bearing without danger of binding the shaft, thus reducing the pressure per square inch upon the bearing, and consequently requiring less oil, as the pressure does not force out the oil so as to bring the surfaces of iron in contact and cause them to heat and cut.

About six years ago, the firm introduced a new plan of coupling shafting together, which obviated entirely the necessity, before existing, of fitting each shaft to its proper coupling, and also enabled them to adopt a new style of hanger, of much cheaper construction than any in use, the whole completing a system at present unequaled, all parts being interchangeable. The ability to interchange the parts in any system of construction is a matter that manufacturers can fully appreciate; but in shafting, it not only greatly facilitates its first introduction, but it enables any subsequent alterations or repairs to be readily made, and, what is of prime consequence, reduces its first cost whilst it improves the article.

They also manufacture a Turn-Table, for turning an engine and tender, of which the largest size is fifty-four feet in diameter, and weighs 32,000 lbs. It consists of a quadrangular centre-piece or box, upon which the arms for carrying the rails are keyed in a very substantial manner. At the outer end of the arms are placed two cross-girts, carrying four truck wheels, which are intended to take the weight when the load is going on or off. The centre rests upon *Parry's Patent Anti-Friction Box*, and the power of one man is sufficient to turn the table and its load easily, without the intervention of any gearing. They are so constructed that water in the pit, within eighteen inches of the top of the rail on the road, will not impair their efficiency or durability. Twenty-five of these Turn-Tables are now in use on the Pennsylvania Central Railroad, and the orders for them require the firm to complete one in every four days.

Some three years ago, Messrs. Sellers & Co. introduced *Giffard's Patent Self-acting Water Injector, for feeding boilers*, of which they are now sole manufacturers and licensees. This is an apparatus which is intended to dispense with pumps in feeding boilers and the various movements for working them in all classes of engines. It is an adjunct to the boiler, and entirely independent of the engine, and its application is rendered especially easy by the fact that it can be placed in any position, vertical, horizontal, or otherwise, and near to, or at a distance from the boiler, and at any reasonable height above the line of the feed water. This Injector will supply itself from the hot well of a condensing engine, and

is connected with the boiler by two pipes, one leading from the steam space, and the other conducted to the lowest convenient point of the water space. By using this apparatus, those having boilers save not only the first cost of all pumps and the parts to connect them with the engine and boiler, but the power required to work them, and their wear and tear, which in high-pressure engines is very considerable. Since their introduction, and the improvements which they have made upon them, this firm have sold more than three thousand, and we believe with entire satisfaction to the purchasers. They have now forty hands constantly employed in manufacturing them, and their orders are at the present time fully up to their capacity for producing them.*

This firm are now manufacturing the Morrison Steam Hammer in this country. It is largely in use in England, being manufactured at New-Castle-upon-Tyne, by Messrs. Robert Morrison & Co. These ma-

* As this work will probably be perused by a large number of manufacturers, and others who have boilers and steam engines, we probably cannot do our readers a greater practical service than in calling their attention to this valuable improvement. The General Superintendent of the Pennsylvania Central Railroad, Mr. Enoch Lewis, writes: "We have a large number of Giffard's Injectors upon our stationary and locomotive engines, and they continue to give us entire satisfaction. Upon all the new engines built for us during the past year, and upon those being built for us at this time, we are using them to the entire exclusion of pumps. Wherever pumps require renewal, we use Injectors in place of them. We find them less liable to derangement than pumps, and at least equally efficient."

Robert Rennie, proprietor of the Lodi Print Works, Bergen county, N. J., certifies: "The Giffard Injector has now been in use on one set of my boilers for nearly two months. It is a perfect success, and, although I have some of the best known steam pumps on my other boilers, I intend to take them all out, and supply their places with Injectors. They are the most perfect boiler feeder ever invented, and a blessing to any one that has as many boilers as I have."

Isaac Hinckley, Superintendent of the Merrimack Manufacturing Corporation at Lowell, writes: "The No. 6 Giffard Injector, which we received in November last, has never failed to perform its duty perfectly. It takes feed water at about 125° Fahr't, from a tank placed about thirty inches below the water line of the boilers; and feeds in the most satisfactory manner a boiler of seven feet diameter and twenty-five feet long, and carrying steam at about twenty-four pounds. The second Injector of the same size, lately received, is also in successful operation, feeding a nest of boilers, where steam is carried at forty pounds. We shall want in April three more Injectors; and I now see no reason to doubt that this Company will eventually apply this apparatus to their whole system of boilers, which is of an extent to require nine thousand tons of coal per annum."

Garsed & Brother, proprietors of the Wingehocking Mills, write: "We have used no Force Pump since the Injector was put up. The average pressure of our steam is eighty pounds; and we are so well satisfied with it that we would not be without it for double its cost."

G. Dawson Coleman, proprietor of the Lebanon Furnaces, writes: "No one, after seeing the operation of the Injector, can hesitate as to which to adopt when ordering a new engine; and most persons would decide to abandon the pumps on an old one. They are particularly valuable at blast furnaces, where we have so little time for repairs."

chines differ principally from other Steam Hammers in having the piston-rod and piston forged in one solid mass, and of a size sufficient to give the required weight; the rod or hammer bar passes through both ends of the steam cylinder, which forms the only guides; the space underneath the cylinder is thus entirely clear, giving great facility for handling the iron.

The celebrated Armstrong guns have all been forged under this hammer, and the English firm are just completing an immense machine of this kind. The weight of the hammer bar, which has just been completely finished, is 40 tons, its fall 13 feet, having a piston of 78 inches diameter forged solid upon it, the bar itself being 26 inches in diameter, and 38 feet long. This is the largest forging ever made.

These hammers are of two kinds; in one the valve is worked by hand, and may be either single or double acting, that is, the steam may be admitted to the under side of the piston only, or by a slight additional movement to the same valve, can be admitted upon the upper side also; in the other, the valve is under the control of the hammer itself, which enables the workman to obtain very rapid blows, the intensity of which are entirely under his control.

The works of Wm. Sellers & Co. are located at Sixteenth and Hamilton streets, and consist of a machine shop 320 by 83 feet, and a new three-story fire-proof building 110 by 55 feet, for the storage of finished work and patterns. This latter building contains their offices, drawing rooms, etc. Adjoining the above, the firm have two foundries, in one of which the moulding floor is 80 feet square, and is entirely devoted to heavy castings; in the other, the moulding floor is 80 by 40, with a wing of 80 by 20, all of which are devoted to the lighter class of work. Beside the above are the requisite buildings for pattern shops, smithy, and brass foundry. The engine and boiler for driving these works are located in smaller buildings, distinct from the main ones, so as to make the whole as nearly fire-proof as possible.

The future of American progress in the arts and manufactures depends largely upon the perfection of the tools with which her machines are made; and it is a source of National pride and congratulation that such a great degree of excellence has been attained, and that the general standard of manufacturing is so far advanced as to maintain a demand for such a superior class of machinery.

The Pascal Iron-Works, Morris, Tasker & Co., Proprietors,

Is the most extensive manufacturing establishment in the southern part of Philadelphia, and the largest of its class in the country. The buildings cover an area of about four acres, and in them are employed 1,100 men, a much larger number, we think, than is at this time employed in any other iron-works in the city. The machinery is of the most approved description, much of it original with the firm, and surpasses, it is said, any that can be found in any similar establishment in England. This is propelled by five steam engines of great power, whose boilers are supplied with water from two artesian wells. Over twenty thousand tons of anthracite coal are annually consumed in the establishment.

The predecessors of the present firm were the pioneers in this country in the manufacture of wrought-iron Tubes and fittings for gas, steam, and water. They commenced this business in 1836, in which year they made 60,000 feet of tubes, and so greatly has the demand increased that the firm now manufacture nearly five millions of feet annually. Subsequently they added to these the manufacture of cast-iron Gas and Water Mains, Lap-welded Flues for boilers, and more recently Driving Pipes and Boring Tools for oil wells, of which large quantities have been furnished since capital has been so largely directed to the development of this wonderful product.

One of the specialities of this firm's manufactures is that of apparatus for warming public and private buildings, both by hot water and by steam. Mr. Thomas T. Tasker, Sr., one of the original partners, is the inventor of a very popular Self-Regulating Hot Water Furnace, by which the temperature in a house can be maintained at any required degree of heat for an indefinite period of time, without further attention than an occasional supply of coal. Mr. Tasker is also the inventor of a process by which the circulation of steam is kept up through heating pipes to any extent, the condensed steam returning back to the boiler by its own gravity, thus saving the heat which was formerly lost in running off the water. Messrs. Morris, Tasker & Morris made the first public experiment to test the value of this discovery at the Pennsylvania Hospital in 1846, and since then they have warmed many houses, factories, and other buildings. The original inventor neglected to patent his discovery, and others have made fortunes by its adoption and application. Mr. Tasker's list of inventions also includes one of a cast-iron Hydrant with a cock so arranged that it can be renewed or repaired without disturbing the pavement, an advantage that those who do not have it will best appreciate.

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This house dates its origin back to the year 1821, when Stephen P. Morris commenced the manufacture of Stoves and Grates at the corner of Market and Schuylkill Seventh streets. In 1828, he removed to Third and Walnut streets, where he erected a foundry, and not long afterward was joined by Henry Morris and Thomas T. Tasker, establishing the firm of S. P. Morris & Co. Subsequently S. P. Morris retired and Wistar Morris became a member of the firm, when the name was changed to Morris, Tasker & Morris, which continued until 1856, when the present style of Morris, Tasker & Co., was adopted. The partners in the firm at this time, are Stephen Morris, Thomas T. Tasker, Jr., Stephen P. M. Tasker, and Henry G. Morris—young men, but who have the advantage of capital, and of the experience of their predecessors.

Stuart, Peterson & Co.'s Foundry

Is one of the few extensive establishments that have as yet been erected in America, for the manufacture of the great variety of useful articles known as Hollow Ware, a term so comprehensive that it includes a diminutive saucepan and an immense Caldron. The foundry is located on Noble street above Thirteenth, and occupies an area of sixty thousand square feet, requiring to cover it an acre and a half of slate roofing. The moulding floor is in the form of a square, having a superficial area of 22,500 square feet. The quantity of iron annually used here is about 4,000 tons, consisting principally of that produced at the Thomas Iron-Works, at Catasauqua, which, in combination with the Leesport iron, is found to make a superior metal for fine castings. About three hundred workmen are furnished employment throughout the year.

The establishment, however, is not so noteworthy for its extent as for the new and improved processes adopted, especially in finishing, enamelling, and tinning iron ware. In these particulars this firm have so completely surpassed their foreign competitors, that articles of their manufacture have a marked preference in all markets. In the process of finishing, preparatory to enamelling or tinning, this firm have a peculiar advantage in consequence of owning the monopoly of an ingeniously constructed lathe, on which they expended over $20,000, and which performs its work in a most satisfactory manner. To illustrate—a vessel, whether it be a saucepan or a kettle, when it leaves the mould is necessarily rough, requiring the exterior to be improved and the interior to be bright and uniformly smooth. This process in

England is performed in a hand lathe, the workman using a chisel or tool, with his hand upon a rest; but this has the disadvantage of not securing entire uniformity of surface, and the workmen thus employed suffer in health from inhaling minute particles of the iron. In Messrs. Stuart & Peterson's foundry, however, a vessel, after having been annealed, is put into the lathe referred to, in which a tool is fixed that conforms to all the irregularities of the surface, automatically making the inside bright and smooth, and when this work is done stops, as if of its own accord.

The enamelling process is also peculiar to this establishment, and to describe it we will borrow the language of one who, being himself a foreigner, wrote, it may be presumed, without partiality, in favor of American manufactures:

The interior of the hollow ware, as prepared by the steam lathe, is covered with a white paste, and put into the oven to be dried. After drying, it is transferred to an enamelling oven, where a white heat, sufficient to melt glass, is applied, which fuses this coating, making it soft as liquid glass. While in this state it is swiftly taken from the oven, rapidly covered with a white powder, and immediately returned back to the oven, where it is again subjected to a white heat, and finally taken out to be gradually cooled in the open air.

The enamel is, in fact, a regular coating of porcelain upon the metal, and with ordinary care is imperishable. On the contrary, the enamelled iron ware made in England (which has been nearly driven out of American consumption by Stuart & Peterson's manufacture) finally runs into an infinitesimal number of minute cracks, which chip off and render the vessel quite useless.

Hollow iron ware is *tinned* in the following manner: The best Government Banca tin is melted in a cast-iron vessel, with a portion of sal-ammoniac, and is then rubbed on the inside surface with a cork, after it has left the lathe, until a thorough amalgamation takes place by the chemical affinity of both metals.

The outside of each vessel is Japanned with a preparation, fixed by heat, which leaves no smell, while the ordinary *gas tar*, generally used, invariably does.

The variety of vessels to which the patent enamel is applied is very great; saucepans, boilers, stewpans, sugar moulds, evaporating dishes, kettles, glue pots, skillets, pie plates, porringers, stove spiders, wash hand basins, soup and saucepan digesters, milkpans, spittoons, and so on, far too numerous to reckon up here. The tinned or patent metal hollow ware also includes a large variety of vessels. As for the plain turned hollow ware, the number of articles is great indeed. What is called "ton hollow ware" is made chiefly for the Southern market, and so called because it is sold by the ton of 2,240 lbs. Cauldrons, sugar pans, counter scales, twine boxes, copying-presses, furnaces, coffee roasters, waffle-irons, sinks, lamp posts, street lamps, fire dogs, etc., are all made here of cast-iron; so are corn and cob and meal mills, and lever mills, chiefly used South.

Besides hollow ware, Messrs. Stuart & Peterson are largely engaged

ia the manufacture of Stoves, of which they make as many as five hundred a week, or twenty-seven thousand a year. This is a branch of manufactures, in which Philadelphia, by reason of her proximity to the ore beds, producing the iron best adapted for the purpose, has peculiar advantages, and it is estimated that at least fifteen thousand tons of Stoves are annually made in this city.

Bement & Dougherty's Industrial Works

Have attained a national celebrity, by reason of the very superior class of Machinists' Tools, which have been produced in them, and distributed to all parts of the United States and to foreign countries. They are located on the square, bounded by Callowhill street and Pennsylvania avenue, and Twentieth and Twenty-first streets, and cover nearly the entire block. The main Shop has a front on Callowhill street of three hundred and seventy-two feet and, with the exception of the office, is two stories in height. The aggregate floor room of the various shops, including Smithery, Brass and Iron Foundry, is about sixty-five thousand square feet, which, with the contemplated extensions, is equivalent to a one story building, eighteen hundred feet in length by fifty in width; with yard room for storage of Coal, Iron and Flasks sufficient for all the requirements of the business. The location is peculiarly advantageous for obtaining Coal and Iron, which are delivered by the Philadelphia and Reading Railroad, from branches entering the premises.

Seventeen years ago, a single stone shop of a somewhat imposing aspect, stood in nearly the centre of the square now occupied by these imposing structures. This was owned by Mr. E. D. Marshall, who carried on the machine business, in connection with the engraving of rolls for printing Calicoes and other Fabrics. In 1851, Mr. Marshall associated with himself Messrs. William B. Bement and Gilbert A. Colby, formerly from the Lowell (Massachusetts) Machine Shop, under the firm of Marshall, Bement & Colby. Under somewhat unpromising circumstances, the new firm started out in a comparatively new branch of the Machine business, the manufacture of Machinists' Tools—coming at once into direct competition with older, and by no means unsuccessful, establishments—with the single object prominently in view, of turning out the best Tools that skill and genius could produce.

In 1853 Mr. James Dougherty became a partner, the immediate result of which was the erection of a Foundry; his experience in this

line, in a number of first-class establishments, having peculiarly fitted him for taking charge of this department. In 1855 Messrs. Marshall and Colby retired from the firm, and Mr. George C. Thomas entered it, though his connection with it was of short duration, and in 1857 Mr. Bement, an engineer of rare mechanical skill, and Mr. Dougherty, an experienced Iron Founder, became sole proprietors, and under their management the Works have grown until now they are scarcely second in extent and importance to any in the Union.

Among the remarkable Tools in these Shops is a Planer that will take in and plane a piece forty-five feet long, ten feet wide and eight feet high; a horizontal and vertical Planer that will plane twenty-four feet wide and twelve feet high; a Radial Drill with a swinging arm projecting ten feet; a Boring Mill to swing eight feet diameter; all heavy and massive Tools. At convenient distances, throughout the shops, are powerful Cranes attached to the columns of the building, that move with ease and safety the heaviest pieces to any required position.

The Foundry is fitted with two improved Cupolas, designed by Mr. Dougherty, capable of melting, the one twelve thousand and the other eighteen thousand pounds per hour. All the modern improvements are here combined to produce the heaviest work of the best character. A Corliss Engine of ninety horse power drives all the machinery, including fans for Foundry and Smithery.

The character of the work done at this establishment will compare favorably with that produced by any similar one at home or abroad; not only in its usefulness but its general appearance. The Works are represented by their productions, in nearly every State in the Union, as well as in Cuba, South America, France, Spain, Austria and Russia. Their growth and success, however, have not been due to any great or peculiarly striking invention, though inventive genius has not been sparingly applied in the production of the model Tools and appliances that have given the establishment its reputation. Among the most noticeable of Mr. Bement's improvements may be mentioned a Patent Cotter and Key Seat Drilling Machine now used extensively in Machine Shops; a Patent Pulley Turning Machine; a Patent opening Die Bolt Cutter; and the Patent Adjustable Hanger and other bearings with Ball and Socket Boxes, which are not excelled by any in use. As an illustration of the ready adjustment of these Hanger Boxes it may be mentioned, that a shaft that had become accidentally bent, was found to run without heating for some time, the box accommodating itself to the irregularities of the bearing with every revolution.

Among the specialities of this firm's manufactures may be men-

tioned the Vertical Railway and Elevator now in use in the Continental Hotel, in Philadelphia. Standing on a substantial foundation, in the basement, is a Rectangular Cast Iron Column, thirteen by seventeen inches in diameter and eighty-nine feet in height, made in six sections, accurately planed and bolted together, and connected by massive Iron Girders to the floor timbers of the building. Two iron rails, also planed, are bolted to the Girders, one on either side of the column, and parallel with it, which serve as guides for the car in ascending and descending.

Attached to the column by appropriate bearings, is the screw, composed of seven sections, permanently coupled, making one continuous spiral of eighteen inch pitch, from the basement to the roof. The diameter of this screw, exclusive of the thread, is twelve inches, with the thread, seventeen inches, turned and polished the entire length of eighty-four feet. The thread forms a smooth inclined spiral two and a half inches wide up and down, which the nut travels; direct contact being avoided by the introduction of numerous friction rolls of brass. To this nut the car is suspended, or forms a part of the same, with guiding wheels that press against the Parallel Rails on either side, to steady the car and prevent oscillation. A heavy weight attached to the car by a wire rope passing over a pulley counterbalances it, and so smooth and regular is its motion, that one hardly feels it when seated within the car. The finished weight of the screw is fifteen thousand pounds, and it rests on a step of peculiar construction, so arranged that no difficulty is ever experienced in the wearing or heating of the surfaces in contact.

The entire finished weight of the different parts is as follows: Main Column, 17,870 pounds; Parallel Tracks, 11,815 pounds; Screw 15,000 pounds; Girders and other work, 61,547 pounds; Total 106,232 pounds, or over fifty-three tons.

But the reputation of this firm does not rest upon specialties or patented improvements; it stands on the enduring foundation of general good workmanship. In their Machine Tools, all the modern methods of producing perfect joints, such as scraping, using surface plates and working to gauges and making the parts of similar machines interchangeable, are practiced, and no pains or expense is spared to secure absolute accuracy and perfection in the articles manufactured to adapt them to their required purpose.

About three hundred and twenty-five hands are employed in their Works at all times, and the value of the annual product exceeds a half million of dollars.

A. Whitney & Sons' Car Wheel Manufactory

Is, we believe, the largest establishment in the United States devoted exclusively to the manufacture of Car Wheels. The works are located on Callowhill street and Sixteenth, and have a capacity for making seventy-five thousand wheels per annum. The moulding room is four hundred feet long and sixty wide, and we know of none larger in the country. Two railways extend its entire length, on which carriage cranes are propelled and used for removing the molten iron from the furnaces to the moulds, and the wheels from the moulds to the cooling-pits. There are five large furnaces, three of which communicate by tubes with an immense caldron for containing melted iron. There are thirty-six cooling-pits, having a capacity for holding at a time two hundred and fifty wheels.

In 1848, Mr. Asa Whitney, as we have elsewhere stated, patented a process for cooling wheels, which secures results of the greatest importance. It has been described as follows: The wheels are taken from the moulds as soon after they are cast as they have become cool enough to bear moving without changing their form. In this state they are put into a circular furnace or chamber, which has been previously heated to a dark red heat. As soon as they are deposited in this furnace or chamber, the opening through which they have been passed is closed, and the temperature of the furnace and its contents is gradually raised about as high as that of the hottest part of the wheel when taken from the mould. All the avenues to and from the interior of the furnace are then closed, and the whole mass is left to cool as slowly as the heat will pass off by permeating through the exterior wall of the furnace, composed of brick four and a half inches thick, enclosed in a sheet-iron case one eighth of an inch thick.

By this process every part of each wheel is raised to the same temperature before cooling in the furnace commences, and as the heat can only pass off through the medium of the wall and case enclosing it, all parts of the wheel cool and contract simultaneously. The time required to cool wheels in this way is three days. In this manner wheels of any form can be made with a solid hub, free from all inherent strain, and without the hardness of the chill being in the least impaired.

The furnaces used in performing this process of prolonged cooling are so constructed that the combustion of fuel used in heating them may be rendered more or less active at pleasure.

This firm employs one hundred and seventy hands, and manufactures over two hundred car wheels per day.

William C. Allison's Car Works

Are the largest of the manufactories of Philadelphia located on the west side of the Schuylkill. They are new, having been erected since May, 1863, when the former works were destroyed in a most disastrous conflagration. As an illustration of what we believe to be the most complete establishment that has as yet been erected in the United States for building cars, it will be appropriate to devote some space to the details of its construction.

The works occupy an enclosure of about five acres of ground, situated between the West Chester and Junction railroads, and extending from Walnut to Spruce streets, in West Philadelphia. Nearly all of this extensive area is covered with buildings, generally of brick and stone, one and two stories in height. The greater portion of the building fronting on Walnut street is devoted to painting cars, the shop for the purpose being two hundred and fifty-nine feet long and eighty-one feet wide. Many of the workmen employed in this department are not merely good mechanical painters, but artists, whose productions, if on canvas, would be entitled to a place in a gallery of Fine Arts. On the second floor of this building are the varnishing rooms, and also a room eighty-one by forty feet used as an erecting shop for city passenger cars.

Adjoining the building just mentioned is a fire-proof structure, the lower floor of which is appropriated to offices and counting-rooms, including a fire-proof safe, which is a small room in itself, being sixteen feet long by nine feet wide, and on the upper floor are the upholstering department, pattern rooms, and rooms for the storage of valuable material. All the doors and girders in this building are of iron, and the structure is believed to be indestructible by fire. The inner office is arranged with a view of facilitating the clerk who acts as time-keeper. All the workmen make their entrance and exit through one gateway, and each man, as he enters, receives a metallic number which he returns when he leaves the yard. By means of a spring the clerk in charge of the gateway can close it without leaving the office, and all workmen who come late are known and registered.

A large space of ground between the painting and erecting shop is appropriated to the transfer table, over which is an arched bridge connecting the second stories of the two buildings. Beyond is the erecting shop, two hundred and forty feet in length, eighty feet wide, and where may be seen Cars in their various stages of progress, among them some of the first class, with raised roofs and facilities for ventilation, such as approach as near perfection as the art has as yet attained. Adjoining the erecting shops on the south, are the wood working

shops, one for hard, another for soft lumber; and also the repair shop, the machine shop and engine room. The greater portion of the floor above these shops is appropriated to pattern and cabinet-making, for which it is equipped with all of the most approved tools and best machines. West of these buildings, and detached, are the black-smith shops. In the bending room is a boiler in which wood is steamed preparatory to being bent into the various curvelinear and irregular forms desired. All of the rooms are heated in winter by means of steam pipes, of which there are about *eight miles* distributed in coils through the different apartments. The condensed water of all these pipes is brought back and collected, to be used again to supply the boilers.

In this extensive establishment about three hundred men are employed, though doubtless nearly double the number, if needed, could operate without inconvenience, and it has a capacity for turning out every week three large passenger cars, ten street cars, and thirty freight cars, without interfering with the General Jobbing and Repairing.

Henry Disston's Saw Manufactory,

On Laurel street, Philadelphia, is undoubtedly the most extensive in the United States, and probably the largest in the world. All the operations incidental to the manufacture of Saws of all kinds are carried on here, (including the Steel making,) on a scale of unsurpassed magnitude, and not only Saws, but all the minor constituent parts and adjuncts, from a saw Screw to a saw File.

The buildings on Laurel street cover two hundred and fifty thousand square feet of ground, and comprise a Rolling Mill, two hundred and forty by seventy-five feet; a warehouse for the reception of raw stock, one hundred and twenty by seventy feet; a Machine Shop and Main Saw Factory, two hundred by one hundred feet, three stories in height; a Wood working department seventy-five by forty feet, four stories high; a Blacksmith's, Hardening and File Shop, and Brass Foundry, two hundred by one hundred feet, and sundry other buildings of less dimensions. In the Lumber Department, a stock of three hundred thousand feet of Beech and Apple wood for Saw handles, is at all times in process of seasoning. On the north side of Haydock street there is another building fifty by two hundred and fifty feet, three stories high, in which Butcher Knives and Trowels and Reaping Knives, etc., are made.

These works are no less remarkable for the wonderful efficiency of their tools and machines than for their extent. To illustrate:

To toothe five dozen Wood-Saws in an hour, is rapid work for the best mechanic in the world; Mr. Disston has machinery by which one man can toothe thirty dozen in the same time. He can toothe perfectly a sixty inch Circular Saw in two minutes, which by the old process would require the labor of one man two hours. The tempering process, which is patented, is most complete, and saves at least one-third the labor ordinarily required, or in other words sixty men can do as much work as one hundred formerly did. The apparatus for grinding is novel, inasmuch as it includes machinery that will grind both sides of a saw at one operation, and long as well as short saws. We believe that the machines in the Grinding Department are the only ones of the kind in the world. Mr. Disston has also a new process for stiffening saw blades, or in other words, refining the grain after tempering, by repeated blows of a steam hammer.

In the Rolling Mill, there are forty melting holes for making Cast Steel, and three sets of rolls, the largest being capable of turning out a saw plate sixty-four inches in diameter. This mill gives its proprietor the ability to fill an order for any saw, however extraordinary the size, in a few days, that would otherwise have required months. The steel is made from the best brands of Swedish and Norway Iron.

Mr. Henry Disston is a man of remarkable force and energy of character, and possesses administrative and executive abilities of high order. He commenced the business, without the advantages of a capital, and it is said when he began, he wheeled the coal he required from the wharf in a wheelbarrow. He was the first manufacturer who effectually checked the importation of foreign saws, and competed successfully with the English in Hand and Back Saws. While engaged in this contest, he sold saws at a profit of only seven cents per dozen, over the cost of manufacture. He possesses a highly original and inventive mind, and has so far revolutionized the details of manufacturing saws, that a Sheffield workman, however experienced in the methods practiced abroad, would be lost amidst the new and labor-saving machinery of this establishment.

Mr. Disston's name appears in the records of the Patent Office in connection with more than twenty improvements, in this branch of manufactures. In 1859, he patented a novel combination Saw, with Square, Rule, Plumb and Level, Scratch Awl and Gauge attachments. He has made some improvements in Circula Saws, with *moveable* or *inserted teeth*, and has recently devised a form of tooth, only deep enough to receive the dust, which will so much increase the endurance and effective power of saws that, by its adoption, it is believed a million of

dollars in saw plates, may be saved to the country annually. He claims that the points of saw teeth should be varied according to their use, whether for hard or soft wood, and that the old method of making the teeth of one uniform shape, for all kinds of wood, is entirely erroneous. Among his recent patents, is one for grinding Rolls either flat, round or hollow, without the necessity of taking them from their bearings.

Mr. Disston is one of the few men who combine, in their mental organization, creative and executive faculties. His inventive genius is shown in the improvements he has originated; his practical sagacity is demonstrated, by the magnitude of his Works, which now produce nearly one fourth of all the saws annually required in the United States. He employs, in the various departments, over four hundred men; consumes over three thousand tons of coal yearly, and produces in the same time, a value of nearly two hundred thousand dollars in Steel and three quarters of a million of dollars in Saws.

The Harrison Boiler Works

Have recently been greatly enlarged, and are entitled to rank among the important Iron works of Philadelphia. They are owned and managed by Joseph Harrison, Jr., an eminent engineer, and are employed exclusively in making a Steam Boiler of his invention, involving entirely new principles of construction. It is formed of a combination of cast-iron hollow spheres, each eight inches in external diameter, and three eighths of an inch thick, connected by curved necks, and held together by wrought-iron tie bolts. No punching or riveting, which lessens the strength of wrought-iron boiler plates forty per cent., is required in its construction; and every boiler is tested by hydraulic pressure at three hundred pounds to the square inch. Mr. Harrison, the inventor, is no less distinguished for his scientific attainments than for his long and varied experience as a manufacturer, and he has not hesitated to claim for this form of Boiler, after practical tests for a series of years, ABSOLUTE SAFETY FROM EXPLOSION. His claims are, in fact, so bold and original, and so important to all manufacturers using steam power, that it will not be amiss to set them forth at length. He says of this Boiler:

"It cannot be burst under any practicable steam pressure. Under pressure which might cause rupture in ordinary boilers, every point in

this becomes a safety valve. No other steam generator possesses this property of relief under extreme pressure, without injury to itself, and thus preventing disaster.

"It is not seriously affected by corrosion, which soon destroys the wrought-iron boiler. Most explosions occur from this cause.

"It has economy in fuel, equal to the best boilers. Any kind of fuel may be used under this boiler, from the most expensive to refuse coal dust.

"It produces superheated steam without separate apparatus, and is not liable to priming or foaming.

"It is easily transported, and may be taken apart so that no piece need weigh more than eighty pounds. In difficult places of access, the largest boiler may be put through an opening one foot square.

"It is readily cleaned, inside and out. Under ordinary circumstances it is kept free from permanent deposit by blowing the water entirely out under full pressure once a week.

"It requires no special skill in its management or erection. Injured parts can be renewed with great facility, as they are uniform in shape and size. When renewed, the entire boiler remains as good as new. The greater part of the boiler will never need renewal, unless unfairly used.

"A boiler may be increased to any extent by simply adding to its width, and being the multiplication of a single form, its strength remains the same for all sizes. It has less weight, and takes less than one half the ground area of the ordinary cylinder boiler, without being increased in height.

"As an evidence of its safety, in one instance, by the accidental rupture of a water pipe (not a part of the boiler but connected with it), its whole contents were discharged, under a pressure of about one hundred pounds to the square inch, a full fire being in active combustion at the time. Means were taken, as soon as practicable, to deaden the fires, but the boiler became, as a matter of course, unduly heated. Under these circumstances, and as soon as the ruptured pipe could be closed, the boiler, without giving it time to cool, was refilled with cold water, steam was again raised, and all went on as before, the boiler sustaining no injury. What would have happened under the same circumstances with an ordinary wrought-iron boiler may be easily inferred."

Mr. Harrison's Boilers have been in use since 1859, and many extensive manufacturers in Philadelphia, New York, and New England have taken out their old boilers and adopted these. One hundred and twenty men are at this time employed in these Works, which are now

making six tons of boilers every day, with a constantly increasing demand. It would really seem that the desideratum so long sought for in boiler making—safety from explosion—has been attained, and, if further experience establishes this as a fact, Mr. Harrison will deserve the rewards and honors due to all who are the World's Benefactors.

The M'Cullough Iron Company

Have, in Philadelphia, the largest works in the United States, for manufacturing Galvanized Iron. This is a material formed from a combination of Iron and Zinc, and possesses the valuable property of being impervious to oxydation. The sheets of Iron used by this Company, are manufactured in their own mills, in Cecil county, Maryland. They are rolled very smooth, then well trimmed to the size required, and cleansed from all impurities, by a weak acid. The effects of the acid are in turn removed by immersion in a tank of clear water, and then the sheets are dried in an oven. The iron thus prepared is placed in contact with the zinc, and the two metals, being brought to the same temperature, combine and fuse, and form a material that will not rust, and requires neither paint nor any preservative agent. The proper regulation of the temperature of the zinc and the iron is a point of great nicety, requiring in the manufacturer much previous experience.

The principal managers of this Company were the pioneers in the manufacture of Galvanized Iron in the United States, having commenced it in 1852, with skilled workmen, brought by them from England, expressly for the purpose. Among the advantages they possess, in addition to their enlarged experience, is the exclusive right of Mr. E. A. Harvey's valuable Patent for cleaning iron and other metals from dust, dirt or oxide, which must in time become invaluable. The black dust from the bituminous coal used in the process of manufacturing, has heretofore remained on the sheet when finished, and was alway objectionable to the workers in this article. By this patent process the sheet passes through a cleaning machine of Mr. Harvey's invention (consuming but a moment) when it comes out as free from dust and dirt as a sheet of the finest paper. This is a great desideratum with the worker, and must in time altogether supersede the old method of manufacture.

For an account of the mills in which their Sheet Iron is manufactured, see article on the GREAT IRON WORKS OF THE UNITED STATES.

Passing from the great Iron Works, for which Philadelphia is famous, to the manufactories of Textile Fabrics, we find few that will compare in extent with the largest of those in New England, but many convenient and well arranged establishments. Philadelphia, it is claimed, is the centre of a greater number of factories, for the production of Textile Fabrics, than any other city in the world. There are within its limits, or adjacent thereto, over two hundred and fifty distinct establishments, where Cotton and Woolen goods are made, while the hand loom production is equal to that of seventy additional factories of average size.

William Divine's Factories

Are a fair representative of the establishments that have given Philadelphia her prominence in this branch of manufactures. They consist of a Cotton Factory, a stone building of four stories, one hundred and fifty by two hundred feet, located on Twenty-Fifth street, between Spruce and Pine streets; and a Woolen Factory, at Twenty-First and Naudain streets, which is thirty-six feet by one hundred and fifty, and four stories high. These factories contain two hundred looms, five thousand spindles, and employ three hundred and fifty hands. In addition, Mr. James Divine runs two sets of Woolen Machinery in the upper rooms of William Struthers' Marble Mill, Twenty-Fourth and Walnut streets, for producing Jeans, Flannels, etc.

Mr. William Divine belongs to that class of self-made men, whose history presents an encouraging example to aspirants for fortune, by straightforward and legitimate enterprise. His father was a manufacturer of linen goods, in the county of Tyrone, Ireland, where Mr. Divine was born in the first year of the present century. At an early age, he learned the Linen business with his father, and afterward removed to Belfast, where he paid an apprentice fee to learn Muslin Weaving. In 1822, he went to Manchester, England, where he was for several years engaged in the Silk manufacture. The Old World, however, did not present sufficient scope and encouragement for the exercise of his powers, and, in 1827, he resolved upon trying his fortune in the New. After a tedious passage of twenty-one weeks, he arrived in New York, where he remained but a few days, when he proceeded to Philadelphia, which has since been his home. He commenced work on a hand loom, for one dollar per day, the average wages of weavers, at that period. But in less than a month he was able, by his superior skill, to earn two dollars, besides paying his bobbin winder, double the usual wages. He was next employed on a broadcloth loom, in the Penn Fac-

tory, on Twenty-Fifth street near Spruce, of which he is now proprietor. By unremitted industry and rigid economy, he secured sufficient capital, after eleven years spent in others' employment, to procure one set of woolen machines, and, renting a room with power, in a mill on Pine near Twentieth street, he began the manufacture of Kentucky Jeans. His intimate and practical acquaintance with the details of manufacturing gave him advantages, his products commanded a ready sale in the markets, and in a few years he was in possession of sufficient capital to erect a mill. About 1841, he built the Kennebeck factory on Naudain street, near Twenty-First, and equipped it with four sets of machinery, which have since been increased to eight sets. In 1846 he purchased the "Penn Factory," in which he had been employed as a weaver and foreman, and began the manufacture of Cotton Goods, spinning his own yarn, and producing Checks and Printing Cloths. His subsequent career has been one of continuous prosperity. He has produced a great variety of both Cotton and Woolen fabrics, adapting his products to the wants of the market, and notwithstanding the periods of disaster which have attended manufacturing enterprises, from want of uniform and protective legislation, he has always met his financial obligations with punctuality, and preserved a name unsullied in all business transactions. He is now possessor of a fortune sufficiently large to entitle him to a place among the wealthy men of Philadelphia.

Mr. Divine, besides being a manufacturer, is entitled to recognition as an improver of Machinery. The six treadle loom, for weaving Kentucky Jeans, now manufactured by the Bridesburg Manufacturing Company, was remodeled by him, as was acknowledged by Mr. Jenks, the President of that Company, at a recent meeting of the stockholders. Though not an active politician, he has been a strong advocate of protection to American Industry, known as the American system, and for a period of four years, from 1846 to 1850, was a member of the Common Council. For several years, he was also a Director of the Girard College, and during the late rebellion his patriotism was evinced by large contributions to the Union cause, and in sending five sons into the field, one of whom was slain, and another brought to a premature grave.

Recently an association of the manufacturers of Textile Fabrics, in the City of Philadelphia, was formed, and Mr. Divine was chosen its President, a position he continues to hold. For many years, he has been a prominent member of the Methodist Episcopal Church, to which he has made large contributions. In all these varied relations he has maintained the character of an honest man, and discharged his duties with such fidelity, as to command that respect from his fellow citizens to which his well tried integrity and upright course entitle him.

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The Wingohocking Mills—R. Garsed & Brother, Proprietors,

Are the largest in the manufacturing town of Frankford, and among the largest of the Cotton Mills, in the consolidated city of Philadelphia. They are comparatively new, having been built in 1853, and as nearly fire-proof, as a stone structure, with stone floors, can be made. They consist of several buildings, the main one being five hundred feet long and sixty-six feet wide. It contains twenty thousand spindles, that turn out about four thousand pounds of yarn per day. The machinery is of English and American manufacture, with the latest improvements, and is propelled by an engine of three hundred horse power. About three hundred hands are employed in the spinning department.

In another structure, owned by Mr. Richard Garsed, the weaving of fancy fabrics, such as pantaloonery, cottonades, etc., is carried on extensively. This building is a substantial stone structure, one hundred feet long, forty feet wide and five stories in height, and is entirely new, having been erected during the year 1866, on the site of a former mill, destroyed by fire. About one hundred looms and seventy operators are employed in this department.

Richard Garsed, the senior proprietor, has been connected with the cotton manufacture since early boyhood, having commenced as an operator in a mill at New Hope, Bucks County, when only nine years of age. In 1830 his father removed to Delaware county, and embarked in the manufacture of Power-Looms, employing his son as an apprentice. On attaining his majority, young Richard succeeded to the business his father had established, and also commenced the manufacture of damask Table and Piano covers, by power-looms. This was in 1842, and it is believed that, previous to that time, no articles of this description had been made on power looms in Pennsylvania, and probably not in America. In 1843 he removed to Frankford, where, while continuing the manufacture of damask covers, he gradually extended his operations until they included cotton spinning, and other branches of the cotton manufacture. For several years the Wingohocking Mills were large producers of Osnaburg, and other goods adapted to the Southern market.

Mr. Garsed is distinguished for the active interest he has manifested in introducing improved machinery into cotton mills, and has labored in this field with a zeal, not inspired by the hope of profit merely, that is worthy of all eulogium. His experience and reliability have gained him the confidence of manufacturers, and he permits no invention or improvement in textile manufacture, either at home or abroad,

to escape examination; and if suited to American wants, recommends its immediate adoption.

Mr. Garsed has also given evidence of possessing the faculty of original invention, and has made improvements on various machines that have been of great value to manufacturers. From 1837 to 1840 his improvements enabled manufacturers to increase the speed of their power looms from eighty picks per minute to one hundred and forty picks per minute. In 1846 he invented the Scroll Cam, which very much simplified the power loom, and its value was evidenced by its almost universal adoption on the sliding cam loom. In 1848 he invented a loom for weaving Seamless Bags, and exhibited Salt Bags made by this loom at the Franklin Institute exhibition in Philadelphia, and at the American Institute, New York. Subsequently another person attained fame and profit for a similar adaptation, which he patented.

Mr. Garsed has also been a zealous advocate and active promoter of municipal improvements. When the subject of Passenger Railways in the streets of Philadelphia was being agitated, he advocated their adoption through the columns of the daily newspapers and did not cease his efforts until their success and popularity had been assured. The Fifth and Sixth street Railway Company, which was the pioneer of these corporations, elected him President, and he is thus entitled to the credit of having been the first President of the first Passenger Railway in Philadelphia.

Benjamin Bullock's Sons' Factory,

At Conshohocken, is probably the most notable Woolen manufactory in the vicinity of Philadelphia. It is a structure two hundred and eighty-five feet long, and eighty-five feet wide, and contains ten full sets of machinery, for making woolen cloths. Attached to the main building, are the dye-house, wool-house, fulling-room, engine room, and the building containing the apparatus for making gas from crude petroleum, which is supplied not only to the factory, but to the dwellings of the workmen in its vicinity. In addition, the firm have built around the mill a small town of neat and convenient dwellings, including a church, and having a fine macadamized road as its main avenue, and a park with walks and flower-beds, and a central fountain as its ornament. That the operatives in this factory appreciate the liberality of their employers and the efforts made to promote their comfort and well being, was evidenced in a very flattering and public manner by their presenting

on February 1, 1863, to GEORGE BULLOCK, the principal manager, a service of the purest silver, lined with gold, consisting of a pitcher twenty-two inches in height, a salver, goblets, and other articles, duplicates of those which received the Prize at the late International Exhibition held in Paris, weighing four hundred ounces, and purchased at a cost of one thousand dollars.

The motive power that propels the machinery is derived mainly from an engine of one hundred horse-power, though additional power is obtained from the stream on which the mill is located. The description of goods made here, includes Doe-skin Beavers, Moscow Beavers, Chinchillas, Coatings, Cloakings, etc., of a very superior quality.

The founder of the firm operating this mill, was Mr. BENJAMIN BULLOCK, who was born at Yeadon, near Bradford, in England, in the year 1796. Apprenticed to a grocer in Bradford, he discharged his duties so faithfully that his employer left him a legacy of twenty pounds, which sum he used to pay the expenses of emigration to the United States. Arriving here at the age of nineteen, he commenced his career of industry in this country as a wool comber in the establishment of Henry Korn, then a weaver of woolen laces and fringes, and a manufacturer of military goods. In 1822, having accumulated some capital, he associated himself with Anthony Davis, under the firm style of Bullock & Davis, and commenced the business of wool pulling on Front street, above Poplar. In the succeeding year he removed to the store 32 north Third street, where he remained for a period of nearly thirty-seven years. The first consignment of wool ever made from west of the Alleghanies was sent, it is said, to this house, and consisted of a lot of three hundred pounds. The entire sales, however, during the first year of their business, did not exceed five thousand pounds, which, contrasted with the fact that his successors, the present firm, have received, used and sold, during eight months of a single year, five millions of pounds, shows in a striking manner how vastly the traffic in wool has increased.

Perceiving a favorable opportunity to embark in manufacturing woolen goods, Mr. Bullock, in 1837, commenced the business in the "Spruce Street Factory," now owned by Mr. William Divine, who was then foreman at this mill. Subsequently, he purchased the "Franklin Mill," on Haydock street, near Front, and at a later period bought the property of Bethuel Moore, near Conshohocken, which, as has been previously stated, was, it is believed, the first woolen mill started in the State of Pennsylvania, and probably the first supplied with woolen machinery from Jenks' works, then located at Holmesburg. His operations, compared with those of the present firm, were limited; but he laid broad and deep the foundations of commercial integrity upon

which his successors have built, and on the fourth of June, 1859, ceased from his labors, leaving to his sons, who continue the business, a handsome capital, and the more precious legacy of a good name.

During the late Rebellion the firm of Bullock's Sons had, at one time, in operation thirteen factories, making blankets and blue or army kerseys, in which three thousand persons were employed.

Robert Patterson's Mills

Are among the largest manufactories of Textile Fabrics in Philadelphia or its vicinity. He is the proprietor of the Ripka Mills, in Manayunk, which have the capacity for producing between three and four millions of yards of Cottonades, annually. The principal mill in which the weaving is done, is one hundred and sixty feet long, forty-five feet wide, six stories in height, and contains six hundred and fifty looms. Besides this, there is a Repair Shop, a Beaming and Twisting room, and four other buildings in which there are twenty-one thousand spindles. The machinery is propelled by four overshot and one Turbine wheel, which have an aggregate of four hundred and fifty-horse power. The average number of hands employed in these Mills is six hundred.

In 1857, General Patterson purchased a Cotton Factory, erected on the Brandywine, in the State of Delaware, some forty years ago, and in 1858 removed the machinery to Chester, in Delaware county, where it is now known as the "Henry Clay Mill." This factory contains three thousand five hundred spindles and one hundred and eighteen looms. In 1862 he purchased, in Chester, the "Broad Street Mills," an extensive three story brick structure, built in the form of an L, having a front on Broad street of two hundred and ten feet, and extending along Mechanic street two hundred and seventy feet. The machinery for spinning is new and of modern construction, and includes over five thousand spindles. There are in this factory one hundred and eight narrow looms and fifty-four wide Jacquard looms for weaving Damask and Diaper Table cloths.

In 1866 General Patterson erected at Chester a new and very fine Cotton Mill, three hundred and sixty feet in length, seventy feet wide, with walls ranging in thickness from twenty-four to twenty-nine inches, and covering an area of twenty-six thousand two hundred and fifty square feet of ground. The first story of the main building is appropriated mostly as a finishing room, though a portion is set apart as a Machine shop, which is provided with many excellent tools The

weaving is done in the second story while the third is used for carding and spinning. Trestle-work forms the support of the roof. The mill contains two hundred and twenty-eight looms, and seven thousand spindles. The machinery is impelled by a Corliss engine of two hundred and fifty horse power, with a driving belt of double thickness one hundred and three feet long and thirty inches in width. The whole, or any part of the mill, can be heated by steam direct from the boilers, or by exhaust steam from the engine; and, if desired, exhaust steam will heat one portion of the mill, while another part is receiving its heating steam direct from the boilers.

In these three factories, known as the Patterson Mills, about six hundred and fifty persons are employed in producing Cotton cloths of various kinds. In addition to these General Patterson owns a Cotton and Woolen Factory in Delaware County, known as the "Lenni Mills," where he has produced largely, Balmoral Skirts, Kentucky Jeans, etc.

Robert Patterson, the proprietor of these mills, was born in the County Tyrone, Ireland, January 12th, 1792. On the failure of the rebellion of '98 in that country, he was shortly after brought to Philadelphia by his father, who had been implicated in the efforts made for national independence, and placed in the counting-house of Edward Thompson, at that time the leading merchant in the city, and extensively engaged in the Canton trade. But while diligent in his application to Commercial pursuits his predilection for military affairs early evinced itself, and when the war of 1812 commenced, young Patterson, who had not attained his majority, received a commission as Lieutenant in the United States Army, and subsequently became a Captain. When the war closed he embarked largely in various commercial enterprises, but maintained his connection with the militia forces of the State, and passing through every grade of the service he attained that of Major General, in command of the First Division of State troops, a position he held with distinction for more than forty years. At the commencement of the war with Mexico, in 1846, he became Major General in the army of the United States, and, under General Taylor, rendered efficient service in disciplining the wild spirits on the Rio Grande, after which he commanded the expedition against Tampico.

Under General Scott his command partook of the severe labor at Vera Cruz, and the hard fighting at Cerro Gordo. It was here that General Patterson caused himself to be lifted on horseback from a sick bed, and his gallant conduct in command on that occasion, elicited the commendations of the General-in-chief. When the war ended he returned to his counting house and engaged in manufacturing and in commerce with the energy he had displayed on more heroic fields.

On the outbreak of the Rebellion, in 1861, General Patterson tendered his services to the Government and was placed in command of the Department of Washington, which included, besides the District of Columbia, the States of Maryland, Delaware and Pennsylvania. He undertook the herculean task of organizing an army without a nucleus, and established communication with the Capital *via* Annapolis. The services of twenty-five thousand of the men whom he had called from Pennsylvania were declined by the Government, but a portion of them, entering the service of the State, became the famous Pennsylvania Reserve Corps; and General Patterson may therefore be considered as the Father of this gallant and efficient body of troops. With the rest of his forces, though delayed by the want of artillery, and contradictory orders from Washington, he compelled the evacuation of Harper's Ferry and routed, at Falling Waters, the forces of the Rebel General Jackson, after a severe conflict. On the expiration of the three months for which his Division had enlisted they were mustered out of service and General Patterson returned to devote himself to his large private interests. The failure to prevent a coalition between the forces of Generals Johnston and Beauregard was attributed to him, and severely criticised while the nation was smarting under the humiliation of the Bull Run disaster, but though his vindication was easy, he forbore to reveal the true history of the affair until the conflict had entirely ended, when he issued a pamphlet showing that he had discharged a soldier's first duty—obedience to orders—and which, in the opinion of the ablest military critics, has so completely exculpated him from responsibility for the misfortune that further animadversion is a slander. It is now clear, from official documents made public, that had General Patterson been allowed to carry out his own plans and go to Leesburg, where he could have checked Johnston, and at the same time have been in good supporting distance of McDowell, the first battle of Bull Run would have been a glorious victory instead of a defeat.

After the close of the war General Patterson made another important contribution to the nation's prosperity by loaning freely to Southern planters on liberal credits to aid them in developing their shattered resources. Now, at the advanced age of seventy-six, respected and honored, he is using his large accumulated capital in such a way as to furnish employment to over a thousand persons and advance the manufacturing interests of the nation.

A. Campbell & Co.'s Factories,

Represent very fairly a class of establishments that have made Manayunk, now included within the corporate limits of Philadelphia, a flourishing seat of manufactures, especially for the production of low-priced staple textile fabrics. This firm owns two factories, designated as the "Schuylkill" and "Crompton" mills, which are occupied exclusively in the manufacture of colored cotton goods, sometimes known in the market as "Philadelphia goods;" but as these are often found inadequate to supply the demand for their fabrics, they call into their service the machinery of other manufacturers.

The mills mentioned consist of an aggregation of buildings having an average width of forty feet, and a floor surface of 144,000 square feet; or, in other words, if extended in a line, one story high, they would make a building, forty feet in width, over three quarters of a mile in length. They contain 14,270 cotton spindles, 1,560 wool spindles, and 1,236 spindles for doubling and twisting—in all, over 17,000 spindles and 652 looms. The machinery is propelled by three Corliss engines—the firm being among the first to adopt these engines, now so generally appreciated; and besides these, there are two water-wheels, to be used in cases of accident or other emergency. The average product of each loom being about twenty-five yards per day, the aggregate annual product is over five millions of yards—consisting principally of pantaloonery ginghams, striped and plaid osnaburghs, etc. The Cottonades made here include all grades of exclusively fast colors (the demand for the very low-priced or fugitive colors having almost entirely ceased), and extend to the very best qualities, such as command a higher price than any other in the market.

All the operations necessary for the conversion of raw cotton from the bale into finished fabrics, including spinning and dyeing, are carried on in these factories. They are equipped, provided, and managed with reference especially to supplying temporary demands—whether it be for the highly-colored negro goods sought for in the South, or the more sombre and substantial fabrics demanded in the West, or the neater styles required by the merchants of the Middle States. In this respect they differ essentially from the large mills in New England, which are generally provided with machinery for making only one class of goods—and consequently, when the demand for these ceases, they must suspend operations or accumulate stock. In Messrs. Campbell's factories, however, a change, or rotation of fabric, according to the wants of the season, or demands of the market, is so far from being an

extraordinary circumstance, that it may be called an established rule. In another particular, too, these mills are operated in a manner that must render them of great accommodation to merchants. Jobbers, for instance, desiring the control or exclusive sale of a certain quality and brand of goods, can have their orders executed by this firm and the monopoly of the brand secured to them. The proprietors of these mills, appreciating the fact that the present high price of cotton calls for a corresponding improvement in the quality of the articles fabricated, are now importing new and improved machinery, with a view of producing a higher and finer grade of goods than any they have heretofore manufactured.

The firm of which we have written is composed of A. Campbell and his two brothers, John and William Campbell. The senior partner is a merchant, as well as a manufacturer, having charge of the firm's warehouse in Philadelphia; and thus has the advantage of obtaining more reliable and early information of the wants of the market and the state of trade, than manufacturers who are dependent for such facts upon the advices of agents or commission merchants.

M. Landenberger & Co.'s Factory

Is probably the best representative that could be selected, of a class of manufactories that have been established, within twenty-five years, for the production of Woollen Hosiery and Fancy Knit Goods. Even so recently as 1840, all the hoods, scarfs, and a greater part of the woollen knit hosiery consumed in this country, were imported from Nottingham and Leicester; but about that time workmen familiar with the hand loom began to produce them at their homes, and from this small beginning, aided by the cheapness of American wool, the manufacture has developed until importation has almost ceased. Philadelphia has always been the leading centre of their production, and so extensively are they made in one portion of it called Germantown, that this class of fabrics is known in the market as "Germantown goods."

Foremost among the skilful artisans, who have been identified with this pursuit from its commencement, is MARTIN LANDENBERGER, and his factory is now probably the largest that has, as yet, been erected for the purpose. The building, located at the corner of Frankford road and Wildey street, is of brick, five stories in height, including the basement, and has a front of thirty-eight, and a depth of about two hundred feet. The basement is used principally for the storage of wool and

woollen yarns, though it also contains the steam-engine that propels the machinery, and a machine for scouring wool. All the operations of carding, twisting, spinning, warping, reeling, dyeing, and weaving are performed on the premises, and each particular branch of the manufacture has its appropriate room.

The distinctive feature of the establishment, however, is the great variety of machinery employed, which is a consequence of the immense diversity in the styles of goods produced. In the Weaving Department there are upward of fifteen different kinds of looms at work. The greater portion of the machines are imported from England, but many of them have been improved by the proprietor, who is also an inventor. One of the looms for weaving neck comforts—the result of his genius for invention—will, at one operation, produce four of these articles, of a double fabric, and each of a different pattern. The Jacquard principle is applied to this loom, and by means of the Jacquard index, almost any design can be produced by it. This principle of combination, making one machine do the work of several, is susceptible of further extension in its application, and will, no doubt, be availed of to meet the growing diversity of styles, which is a marked feature of this manufacture.

There are employed in this manufactory, in the busy season, about five hundred persons, and perhaps, as many more receive employment from it in putting together and finishing, at their homes, the fabrics that are woven here. About 250,000 pounds of American wool are annually consumed in the production of hoods, hosiery, talmas, neck-comforts, scarfs, opera cloaks, which are made in about eight hundred different styles.

Besides the establishment mentioned, Messrs. Landenberger & Co., have factories in Chester county, near Avondale, with a water-power that is considered among the best in the State. In one of their factories Whitney Blankets of the finest quality are made; and another, which is provided with a variety of new and recently imported machinery, is employed in making Shetland Worsted. This is comparatively a new branch of manufacture in this country, but the advantage of having a Mill for the production of an article which is used so largely in their manufactory in Philadelphia, is obvious, giving facilities for the execution of orders promptly within a given time, besides reducing the cost of the manufactured goods to the minimum.

There were, in 1860, in the United States, one hundred and ninety-seven establishments for the manufacture of Hosiery, whose aggregate products exceeded seven millions of dollars.

The Gloucester Print-Works and Washington Mills.

Probably the largest manufactory of Textile Fabrics in the vicinity of Philadelphia is located at Gloucester, on the Delaware river, about two and a half miles below the city. The works cover an area of ten acres of ground, and include within the sphere of their operations all the processes necessary for converting raw cotton into finely-finished fabrics.

The mills for weaving and spinning, known as the "Washington Mills," consist of two brick structures, each three hundred feet long, fifty feet in width, and four stories high, with a two-story picking room attached to each mill, having chimneys one hundred and ten feet high. There are about seven hundred windows in these buildings, which, when lighted with gas that is manufactured on the premises, present a very brilliant and imposing appearance. The machinery is propelled by two steam-engines, each of three hundred and fifty horse-power, one of them being a Corliss engine, to which the proprietors pay high tribute for its economy in fuel. About seven hundred persons are employed in the various departments of carding, weaving, and dressing, and over thirty-five thousand bales of cotton are consumed annually.

In connection with these mills, there is at Gloucester a very large Print-Works, combining facilities for calico printing, fancy dyeing, bleaching, and finishing. Their production is mainly madder prints, which are attaining an enviable reputation in the market for choice styles and fast colors. At the present time, these works are producing of Prints seven thousand pieces per week, and about three thousand pieces per week of fancy dyed goods—being about two thirds of the capabilities of the establishment in printing and dyeing; though if the bleaching and finishing of white goods, for which it has ample machinery of the best description, were added, it would be capable of turning out twenty thousand pieces of finished goods weekly. Perhaps no establishment in the country has better facilities for these combined operations than the Gloucester works.

The heavy machinery in this department is propelled by an engine of three hundred horse-power, and there are on the premises, and in daily use, thirteen other engines, varying from ten to sixty horse-power. There are, in all, about twenty boilers, of considerable capacity, the main boiler house containing fourteen tubular boilers that generate steam very rapidly. One engine and boiler is used exclusively for pumping water from the Delaware river, which was found to be supe-

rior for both dyeing and bleaching, and of which a large quantity is used. The annual consumption of coal, of the best quality of anthracite, varies from five to six thousand tons annually. This is delivered from canal boats, on the wharf, by the side of the main boiler house, and thus very little handling is required.

Among the interesting machinery employed in the printing of calicoes, is that which produces the figure, in the copper rollers, with matchless accuracy and delicacy. The pantograph machine, which is elsewhere described in detail, is extensively used, and such is the facility it affords, that females are employed, and found in many respects to be the best adapted in skill for executing some of the processes. The greater portion of the hands employed in the printing department, however, are males, and include some of the most skilful workmen that can be obtained for the highest remuneration. They vary in number from one hundred and fifty to two hundred.

The apparatus employed for singing the goods, at the same time that they pass through the shearing machine, is most complete, there being but few establishments in the country provided with equal facilities. The singing is performed both by gas and copper-plate—the gas being manufactured on the premises, in works of sufficient magnitude to supply all that is required for this purpose, and also for lighting the buildings.

The proprietors of these works are nearly all residents of Philadelphia, the President of the company being DAVID S. BROWN, of Philadelphia, whose brothers, Jeremiah and Moses Brown, were among the earliest established dry goods commission merchants in the country, and the agents of Samuel Slater, of Providence. For nearly a half century Mr. Brown has been actively engaged in the distribution of American goods, and aiding to advance the interests of American manufactures. The establishments over which he now presides, extensive as they are, have capabilities for far greater development, if the policy of the government should be firmly established in favor of the protection of its skill and industry. They constitute one of the great art schools of the country, for the education of designers and chemists, whose genius we may reasonably anticipate will ere long elevate the art products of America to a level with those of France and Great Britain.

William H. Horstmann & Sons' Manufactory.

Is the oldest and principal establishment in Philadelphia for the manufacture of Ribbons, Military Trimmings, and Narrow Textile Fabrics. It is one that adds to the manufacturing importance, not only of the city in which it is located, but of the country. Its productions rival in elegance and substantial excellence those of France and Switzerland, and are sold by importing houses indiscriminately with their foreign importations.

The founder of this house, Mr. William H. Horstmann, was educated in the workshops of Europe, under the old system which demanded the production of a masterpiece of workmanship before an apprentice could receive a license to practice his trade as a master workman. He was a native of Germany, but came to this country in early manhood, and in 1815 commenced in Philadelphia the manufacture of trimmings. At that time there were but two patterns of coach lace made in this country, which were called after the Presidents, Jefferson and Monroe. Naturally ingenious, Mr. Horstmann set about enlarging the scope of the pursuit in which he had embarked, and to him probably more than to any other man, the business is indebted for its present perfection in this country. In 1824, he introduced from Germany the Plaiting or Braiding Machines, and in the succeeding year the Jacquard machines. Gold laces were made by power in Philadelphia, several years before it was attempted in Europe, and the use of power for making fringes may be said to have been first generally adopted here. In fact, we believe this firm was the first in any country to apply power to the general manufacture. Since the decease of Mr. Horstmann, the business has been conducted by his sons, and with what ability they have discharged the trust committed to them is evidenced in the present importance of their establishment. They have made several important inventions, as we have elsewhere mentioned, and their list of manufactures embraces a wide circle of fabrics of silk, silk and worsted, mohair, cotton, gold and silver thread, including some descriptions not made elsewhere in this country, besides every variety of military trimmings, not excepting swords, drums, and metal ornaments. Silk ribbons are made here, which are equal in all respects, not only in brilliancy of coloring and weight of material, but in evenness of manufacture to those of the looms of Lyons and St. Etienne. The English Commissioners to the World's Fair referred in their Report on the Industry of the United States to this establishment as presenting

an example of system and neatness rarely found in manufactories in which handicrafts so varied are carried on.

The manufactory is situated at the corner of Fifth and Cherry streets, formerly the burying ground of the German Lutherans, and bought of the congregation owning the old church (built 1743) on the opposite side of Cherry street. The building forms an L, having a front of one hundred and forty feet on Fifth street, one hundred feet on Cherry street, and fifty feet wide, containing six floors. The engine house and machine shops are in a detached building in the yard. The machinery in operation in the factory is new, much of it original, and includes one hundred and thirty Coach Lace Power Looms, one hundred Power Looms, making five hundred and fifty stripes, or rows of goods, three hundred and thirty-six Silk Spindles, and other complete silk machinery, four hundred Plaiting or Braiding Machines, fifty Hand Looms, using over one hundred and sixty Jacquard machines, ranging from forty to eight hundred needles; besides all the auxiliary machinery necessary in the business.

Adjoining the manufactory on Cherry street, the firm own an additional lot, bought of the Friends, having a front of seventy-five feet on that street. The building on this, formerly a Meeting-house, they have converted into a salesroom.

In 1857, Messrs. Horstmann purchased the entire stock, materials, looms, and patent rights of the Clinton Company, of Clinton, Mass., who were the largest manufacturers of Coach Lace in America. The designs of the best qualities of the laces, in which silk is freely used, are unsurpassed.

During the late Rebellion, the Military Depot connected with this manufactory was a general and most popular resort of the volunteers of the Federal army, especially officers, who were there able to find every article necessary to equip them for active service or holiday display. The immense manufacturing facilities of the firm enabled them to meet promptly a sudden and pressing demand and supply a national want.

D. & C. Kelly's Factories,

Located on the Darby Creek and West Chester Railroad, at Kellyville, near West Philadelphia, must complete the complement of the Representative Manufactories of Textile Fabrics in which Philadelphia abounds.

The Kelly family has been identified with the manufacturing interests of the city from the beginning of this century. As early as

1808, Mr. Dennis Kelly, the grandfather of the present proprietors, was engaged in the manufacture of woollen goods, and during the war of 1812 supplied the government with various useful fabrics. At the time of his death, in 1864, he was probably the oldest manufacturer in the State of Pennsylvania.

The factory at Kellyville was founded by the father of the present proprietors, Mr. Charles Kelly, whose decease, in 1864, was lamented by a wide circle of friends. Distinguished for his affability and courtesy no less than for his practical skill, he was one of the representative men whose fame is, as it deserves to be, gratefully cherished. He emigrated to this country in 1821, and in 1827 engaged in manufacturing, in a structure forty-five feet by eighty-one, five stories in height—to which additions were subsequently made, and around which numerous dwellings were erected, constituting the nucleus of a thriving village, now known as Kellyville. The original buildings were destroyed by fire, March 7th, 1856; but on their ruins a much larger and more substantial building has been erected.

The main edifice of the present buildings has a front of fifty feet, is two hundred and thirty-one feet long, five stories in height, and is divided by a stone wall extending three feet above the roof. This divides the building into two separate parts, in one of which the carding and spinning are performed, and in the other the weaving, etc. The rooms communicate by means of iron doors. The first floor contains woollen machinery; the second floor is the cotton carding room; the third floor is the spinning room, where the warps are manufactured; the fourth floor contains self-acting mules for spinning, filling, etc.; and the fifth floor contains warping mills, etc. On the weaving side, the first four floors contain the looms, and in the upper story the beaming, twisting, etc., is done. There are about ten thousand spindles altogether in the factory, and three hundred looms.

The space in and around the factory contains one hundred thousand square feet. Every thing in the manufacture of the goods is performed at the mill, from the cotton and wool in the bale until the cloth is produced ready for the market.

The machinery of the whole is propelled in part by a steam-engine of one hundred and fifty horse-power, and by two water-wheels of a hundred-horse power; making the aggregate force equal to two hundred and fifty horse-power. Steam can be thrown into every room in the building, at a moment's notice, in case of fire; and as a further protection, the fifth floor has water-tanks extending its entire length, two hundred and thirty-one feet, which are constantly kept filled with water by means of a force-pump attached to the engine—with a supply

of hose, within and without the building—that is capable of throwing several thousand gallons of water per minute.

The consumption of cotton in these mills is about forty bales weekly, and of wool about twenty bales. The average number of hands employed is three hundred and seventy, of whom two thirds are females. The aggregate production amounts to three millions of yards of cloth annually, consisting of a large variety of staple articles, such as jeans, denims, Canton flannels, and the well-known "Kellyville Tickings."

Lockwood's Paper Collar Manufactory.

The discovery that paper could be used as a substitute for linen, in the manufacture of Collars and Cuffs, for men's and women's wear, is of very modern and purely American origin. It belongs to a class of inventions that are not at all appreciated at first—fact is, regarded with contempt—and which subsequently become of such importance that they not only enlarge the fields of human labor, but affect established trades. It is conceded that the present enormous consumption of paper in the manufacture of collars, amounting as it does to over fifty tons weekly, has contributed to enhance the price of that commodity, and consequently affected the interests of book publishers and all who consume fine papers. Both the invention, and the means that were adopted to overcome popular prejudice against collars made of paper, have points of interest—the former being due to the inventive genius of a citizen of New York, while their successful introduction into popular favor must be accredited to the enterprise of a citizen of Philadelphia, of whose establishment we propose to give some account.

The history of the invention is briefly as follows: In 1853, Mr. Walter Hunt, a very ingenious and prolific inventor in the city of New York, who had been defeated in litigation concerning a sewing machine, of which he claimed to have been the original inventor, announced to the foreman of his machine shop that he would make a stitch that would supersede the sewing machine stitch; and subsequently explained, that he proposed to make collars of two pieces of paper, cemented together, and then use a serrated wheel and roll it over the paper, which would make a series of indentations representing and resembling rows of stitches. Not long afterward, collars of this description were made, and worn by him and others; but as no paper of the requisite strength could be obtained, he proposed to ce-

ment muslin, or other like material, to the paper, for the purpose of increasing its strength and elasticity. On July 25th, 1854, he received a patent for shirt collars of this kind, as a new article of manufacture, and his claims to priority of invention, after having undergone the ordeal of litigation, have been confirmed and established.

The history of the introduction of these collars as a marketable commodity, is no less interesting. Previous to the issue of letters patent to Walter Hunt, he disposed of one half his interest in the same to John W. Ridgway, of Boston, for four thousand dollars; and subsequently sold the other undivided half-interest for three thousand dollars, to E. H. Valentine & Co., who commenced the manufacture in the third story of a building, No. 408 Broadway, New York. The community, however, did not regard these new collars with favor, and the patent was frequently sold, and resold, with diminished value, none of the purchasers seeming pleased with their bargain. In 1858, Mr. William E. Lockwood, a young dry goods merchant of Philadelphia, purchased the interest formerly owned by Valentine, removed the machinery to Philadelphia, and commenced the manufacture in the Keystone Mills, near Fairmount. His experience during the first six months was by no means encouraging, and he was compelled to suspend operations, as the stock accumulated, for want of a market. When one considers that millions of these collars are now made and sold annually, it seems incredible that less than eight years ago it required persistent effort to overcome the prejudices of the community against them. This Mr. Lockwood succeeded in doing, by a judicious system of advertising, and setting forth their advantages, in which he was aided by the strong argument, that these patent collars can be worn much longer than an ordinary laundry-dressed collar without losing their gloss and brilliancy, can be sold at a price less than the cost of washing and starching linen collars, and what was convincing to those prejudiced in favor of cleanliness that they were in reality wearing the identical material used in a linen collar, only more clean and pure in its present form than ever before. His accumulated stock was then soon disposed of, his factory re-opened, and in less than two years his facilities for manufacturing were found inadequate to supply the demand, and he removed to his present location, 255 and 259 South Third street, where he has now probably the largest and most complete establishment of this description in the United States.

The buildings have a front on Third and Levant street of forty-seven feet, a depth of one hundred and eighty seven feet, and are five stories in height. In different apartments there are about ninety machines used in the various processes, to which power is communicated by means of over

six hundred feet of shafting, from a forty horse-power engine located in the basement. The exhaust-steam is utilized not only in warming the building, but in boiling water and heating glue or paste; and consequently fire is not required in any of the workshops. Many of the machines are novel, and some of them costly.

The first process in making cloth-lined collars, is to combine the paper and muslin, which is accomplished by means of a machine that has cost, with the various improvements necessary to overcome the unequal expansion and contraction of the two substances, nearly thirty thousand dollars. The finishing, or polishing, is effected by being passed between two highly chilled rolls, moving with different velocity, and which can be so nicely adjusted that an ordinary sheet of paper can stop an engine of forty horse-power. The collars are cut into shape by means of a self-registering cutting apparatus, having a capacity for cutting out 240,000 collars per day, and requiring the attention of only two operatives. The stamping of the patent and sizes, and the imitation stitching, is effected at one operation, by steel dies, and then the collars pass to the machine which punches out the button holes; and after that to the folding machine—which is the invention, in part, of the senior partner of the firm. All kinds and styles of ladies' and gentlemen's collars and cuffs, including Marseilles and fancy-printed patterns, are made; and whenever a new design of linen collar is adopted, either in this country or abroad, it is reproduced in paper in this establishment.

In connection with the Collar manufactory, there are apartments appropriated to the manufacture of Paper Boxes, of which about three thousand are made daily, or over a million in a year. The bottoms of these boxes are constructed largely of thin, circular wooden blocks, which the firm have found to be a satisfactory and economical substitute for pasteboard. All the printing of labels, cards, etc., is done on the premises; and so extensive is their business, that ten printing-presses, and ninety fonts of type, are employed in this department. There is also a forge, and a machine shop, where all repairs to the machinery are done. In the entire premises there are at times as many as two hundred and fifty girls and women employed, none of whom are taken without special recommendations or certificates of character. Dinner and dressing-rooms are provided for their accommodation. Elevators are used as a means of communication between the different stories of the building, and they are so arranged, by means of dogs that spring into ratchets in the sides, that any serious accident from the breakage of the wire rope is almost impossible.

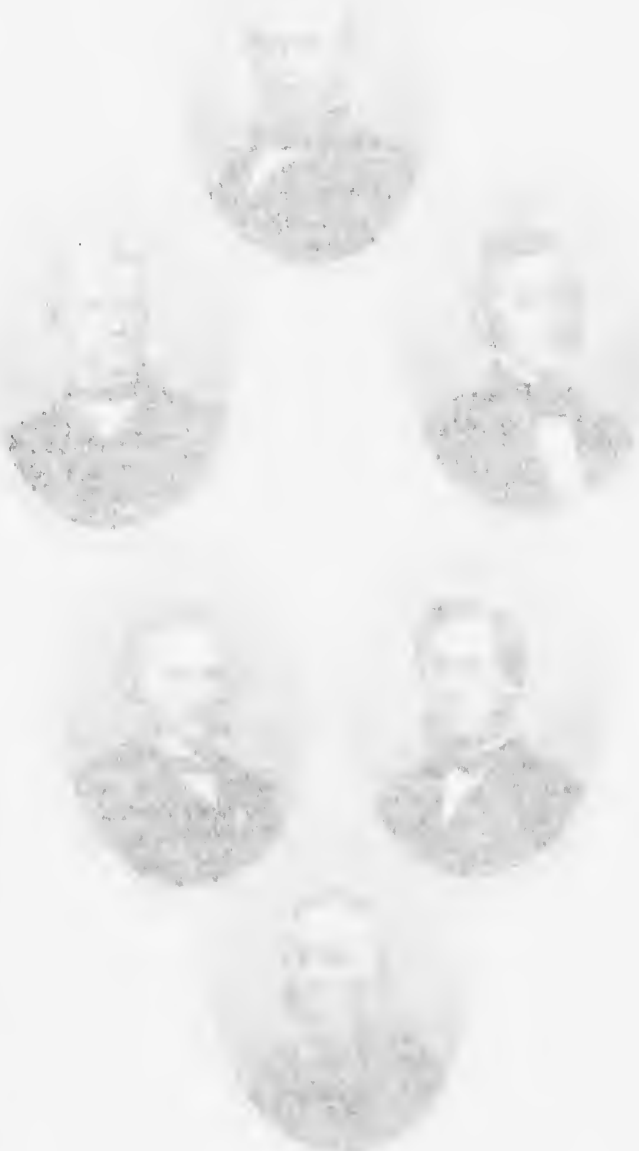
A large apartment on the second floor is appropriated to the manu-

facture of patent direction labels, commonly called "tags." The large amount of cuttings necessarily produced in the collar department, being as much as three thousand pounds weekly, is all, or nearly all, converted into tags, made under a special patent, and which, from their strength, ready absorption of ink, and neatness of appearance, have been adopted as the standard tag by the Transportation Companies of the city, and are used largely by merchants of all classes. The sales of these alone amount to $25,000 per year, while of the collars as many as three hundred thousand have been sold in a single week.

In 1862, Mr. Lockwood purchased the entire interest in the original patent, which was subsequently re-issued in four divisions, including both collars made of white paper, imitating starched linen, and collars composed of paper and muslin, or an equivalent fabric. In 1863, Mr. E. D. Lockwood became associated with his brother, establishing the firm of W. E. & E. D. Lockwood. Recently, the firm have disposed of their interests in the original patents to the Union Paper Collar Company, organized with a capital of three millions of dollars, but they still continue the business on a larger scale, working under a license from the Union Company, and paying a royalty monthly on their entire production. It is estimated that the annual sales of paper collars in the United States now amount to between three and four millions of dollars.

THE PHILADELPHIA SHIP YARDS.

In the preceding pages of this work, considerable space has been devoted to recording the progress of America in Naval Architecture, and mention has been frequently made of the early ship-builders of Philadelphia. The Government Navy Yard, located at this point, has been remarkably successful in constructing fine vessels, among which we might mention the ships of the line "Pennsylvania," 3,241 tons, and "North Carolina," 2,635 tons; the frigates "United States" and "Raritan;" the screw steamers "Wabash," 3,200 tons, and "Lancaster," 2,360 tons; the side wheel steamers "Mississippi," 1,692 tons, and "Susquehanna," 2,450 tons; the "Arctic," memorable for her connection with the Kane expedition; the "Shubric," used on the Coast Survey; the "Neshamony," and others. One of the ship houses in this yard is two hundred and seventy feet long, one hundred and three feet high, and eighty-four feet wide, and is said to be the largest of its kind in the United States. The Sectional Floating Dry Dock, constructed by the



Government, cost over eight hundred thousand dollars, and by means of it, two or even four vessels can be docked at the same time, and placed on the railways in the yard by the hydraulic engine.

The private ship yards have also turned out some noticeable vessels, as will be seen in the record of the operations of two or three of the most prominent.

William Cramp & Sons' Ship Yards,

Two in number, are among the largest in this country, and equipped with all the implements and facilities necessary for building both iron and wooden vessels. The iron ship yard, located on Richmond street above Otis, extends from the former street to the Delaware river, and has an area of six hundred thousand square feet, with a river front of four hundred feet. The machine shop, forty by three hundred feet, contains some tools of unusual size, among which we might instance the bending rolls, weighing over fifteen tons, and which will bend sheets of iron an inch thick and fourteen feet long, to a curve whose radius is three feet. This department also includes a large smith shop, and a furnace for bending angle iron frames without a blast. This furnace is thirty feet long, and diffuses equal heat throughout its whole length, thus obviating the objections of ordinary furnaces in which the iron is liable to be burnt at one extremity, while at the opposite it is comparatively cool. As an instance of the facility possessed by this firm for rapidly executing work, it may be stated that an iron side wheel tow-boat, one hundred and sixty-five feet long, twenty-five feet beam in hull, was begun on the second day of January, and on February 6th, the plating was all riveted, and the vessel, costing sixty thousand dollars, ready for use on the 1st of March. About one hundred and fifty men are employed in the yard for constructing iron vessels.

The other ship yard of this firm is located on Penn street, near the site of Penn's Treaty ground, and has a front on the river of three hundred feet, and a depth of eight hundred feet. A marine railway, capable of hauling up vessels of fifteen hundred tons, is in course of construction at this place, and when completed will cost about fifty thousand dollars. Here some of the largest and finest vessels in the merchant service were constructed. The "Bridgewater," of 1,525 tons, and which it is said was the largest merchant vessel ever constructed at this port, was built by this firm. Her length was two hundred and twenty feet, width of beam fifty feet, and depth of hold thirty feet. This vessel was launched full rigged, a feat that, it is believed, was never before accomplished with a vessel of equal tonnage. This firm also constructed ten steamers, each one hundred and eighty-five feet

long, for the Cuban trade, and which were found to be so superior for the purpose for which they were designed, that they entirely superseded side wheel vessels.

Within the last four years this firm constructed a number of fine vessels for the United States Government. The "Ironsides," famous in the annals of the late Rebellion, was built by them at a cost of nine hundred thousand dollars. Her dimensions are two hundred and thirty-five feet in length, fifty-eight feet beam, and twenty-seven feet hold, and tonnage 3,250 tons. The "Chattanooga," one of four of peculiar construction ordered by the Navy Department, was built by this firm at a cost of a million of dollars. Her dimensions are three hundred and twenty-five feet in length, forty-six feet beam, and depth twenty-two feet three inches. The light draught monitor "Yazoo" was built here, in accordance with designs furnished by the Navy Department, but which, when the vessel was ready to be launched, were found to be so defective, that it involved the necessity of rebuilding. The light draught monitor "Tunxis" was also raised twenty-two inches, and rebuilt by this firm. Besides these may be mentioned the transports "Stanton," "Foote," "Welles," and "Porter," and the double ender, "Wyalusing," and others, costing in the aggregate five millions of dollars. During this period many vessels were also constructed for private parties, amounting in the aggregate to about fifty vessels, of various sizes, with a tonnage of twenty-five thousand tons.

The firm is composed of William Cramp and his five sons, Charles, W. M. Cramp, S. H. Cramp, J. C. Cramp, Theo. Cramp. The senior partner has been identified with the pursuit for more than forty years, and advanced, by regular gradations, from a journeyman shipwright to a master builder. He constructed the first propeller tug-boat ever built in the United States. This was the "Sampson," which was used as a gunboat, during the late Rebellion, by the South.

John W. Lynn's Ship Yards

Are located in the southern part of the city, below and adjacent to the Navy Yard. They cover an area of over five hundred thousand square feet, and are provided with all the facilities necessary for the prosecution of the business on the most extensive scale, as will be inferred when we state that during 1863, Mr. Lynn built and launched a vessel every sixteen working days. The majority of these vessels were of course of the ordinary class, including Transports and Tugs; but among them were some fine steamers, as the "Continental," sixteen hundred tons; the "Liberty," fourteen hundred tons; and the Revenue

Cutter "Mahoning," which, on a trial of speed, made in accordance with orders from the government, from Boston to Cape Ann, a distance of sixty miles, surpassed all her competitors.

Mr. Lynn was, we believe, the first to appreciate and use the Knowlton Oscillating Patent Saw, which is now spoken of by shipwrights as "worth its weight in gold." It is really one of the most valuable machines ever introduced into ship yards for sawing frames of any desired crook and bevel, enabling three men to do the work that formerly required twenty, and to do it better than it can be done with the adze or axe, with the additional advantage of economizing time and material. He is also aiding to perfect and introduce another remarkable invention of the same inventor, for grinding and polishing shot and shell by steam power. It consists of a quadrangular series of arms or levers, that hold the ball in a central position over a revolving emery grindstone, and by its means a fifteen-inch shell can be converted into a perfect sphere in less than a minute. Commissioners appointed by the Government to examine it, have reported strongly in its favor, and no doubt it will soon be introduced in all foundries where shot and shell are manufactured.

Mr. Lynn was formerly of the firm of Birely & Lynn, and during this copartnership designed and built the vessel which subsequently became notorious as the "pirate Sumter." She was originally called the "Habana," and engaged in the trade between New Orleans and Havana. During his career as a shipbuilder he has constructed no less than thirty ocean steamers—among them the "Emily B. Souder," fifteen hundred tons; "Star of the Union," fourteen hundred tons; and "Neshammock," seventeen hundred tons, which made the outside voyage between New York and Philadelphia in the unusually short period of seventeen hours and twenty minutes. Thus, he presents another example illustrating that in a country unfettered by commercial guilds or governmental restrictions, a young man, by the force of constructive genius and faithful application, may rise to the front rank in his profession.

R. F. Loper, Philadelphia.

It would be impossible to do full justice, within the limits of a few pages, to a subject that affords materials for a volume; but we cannot dismiss it without some tribute to one, who, though not a shipwright by profession, has built many vessels, and contributed most efficiently to the advancement of the merchant marine of the country. We refer to Captain R. F. Loper, of Philadelphia. He was probably the first man who undertook the responsibility of contracting to furnish to owners a

completely equipped ship. In the five years between 1847 and 1852, inclusive, he built in the port of Philadelphia two hundred vessels of various kinds, and distributed among the mechanics not less than two millions of dollars. Up to the present time he has constructed about four hundred vessels, of different descriptions, the largest being the "S. S. Lewis," fifteen hundred tons, for the Boston and Liverpool Steamship Company; the "Star of the South," twelve hundred tons; ten steamships for the Parker Vein Company, of five hundred tons each; and the "California," for the Newfoundland Telegraph Company.

During the late wars in which the United States have been engaged, the government found in Mr. Loper a most efficient coadjutor. At the outbreak of the Mexican war, he built in thirty days a hundred and fifty Surf Boats, in which the American troops were landed at Vera Cruz; and in 1847 he supplied the government with eight light-draught steamers, and ten schooners, all of which were constructed under his direct superintendence. During the late Rebellion he performed much valuable service in the conveyance of troops to designated points, especially in the Burnside expedition, and the transportation of the Army of the Potomac, under General McClellan, to the peninsula.

Mr. Loper has also been a zealous promoter of inventions calculated to benefit the commercial marine, and some of them which he patented have been alluded to elsewhere in this volume. He also designed and constructed some of the fastest Yachts that have as yet contested for supremacy on American waters.

In the upper part of the city, at the foot of Palmer street, on the Delaware river, is a very extensive and notable establishment for building Steamers and Marine Engines, known as the

Penn Works—Neafie & Levy, Proprietors.

These works have been established about twenty years, and from a small beginning have grown to a magnitude that places them among the foremost establishments of the city. During the period of their existence as a firm, the proprietors of these works have constructed over four hundred marine engines, of various sizes, and have consequently accumulated a stock of patterns, and an amount of experience, that qualify them for executing any work of this description. Among the vessels whose engines were supplied from these works, may be mentioned the U. S. Frigate Lancaster, the Gunboats "Pawnee," "Pon-

tiac," "Neshannock," "Liberty," "Electric Spark," "John Rice," "Thomas Scott," "Belle Vernon," and others. During the late rebellion, the engines for about one hundred and twenty vessels, of all classes, were built here, some of them among the largest in the service.

The area of ground occupied by this establishment is about seven acres, and within these limits are the buildings, tools, and facilities necessary for constructing not only marine and stationary engines, high and low-pressure boilers, heavy and light forgings, but for building all sizes of iron and wooden vessels. Having a front on the river of over four hundred feet; docks in which twelve ships can ride abreast in safety; a marine railway capable of bearing a ship of a thousand tons; shears and tackling that will lift a hundred tons; a machine shop one hundred and sixty-five by sixty feet, three and a half stories high; a boiler shop one hundred and eighty by sixty feet; a blacksmiths' shop one hundred and thirty by forty feet; an erecting shop eighty by seventy feet; a foundry one hundred and fifty by sixty feet—all equipped and provided with the best tools—their facilities are unquestionable. Or, if other evidence were wanting, it is presented in the iron ships "Oriental," of fifteen hundred tons; the "Havana," twenty-two hundred tons; the "General Scott," eleven hundred tons; the "Union," four hundred tons; and many others built here, that have added to the glory and efficiency of the American marine.

In one special but important branch of naval architecture, this firm have a pre-eminence amounting almost to a monopoly. Among the first, or probably the first, to engage in building Propellers, and owning the patent for the curved propeller wheel, more of this description of vessel have been built at the Penn Works than in any other in the country. It has been said that at least two propellers may be seen on their stocks at all times; and on the western lakes, probably two hundred are performing valuable service.

Besides its advantages of location and equipment, the "Penn Works" has another, in the practical skill of its proprietors, Jacob G. Neafie and John P. Levy. Mr. Neafie served his apprenticeship in the machine shop of Thomas Holloway, the first marine engine builder in Philadelphia, and thus, from boyhood, has been identified with the pursuit in which he is now engaged; while Captain Levy has a thorough and practical knowledge of hulls, rigging, and outfit of steamers—a combination that completes the resources, both mental and material, necessary for constructing any vessel of wood or iron, and furnishing it with all machinery and equipments ready for sea.

In the city of Chester, fourteen miles below Philadelphia, there is another very extensive establishment for building iron vessels and marine engines, known as

The Pennsylvania Iron-Works,

Which were founded by one of the original owners of the Penn Works, just noticed, and of which Reany, Son & Archbold are now proprietors. They occupy an area of twenty-three acres, including about twelve hundred feet front on the Delaware river, with a Marine railway capable of holding a vessel of seven hundred tons burden. The buildings, located principally on the river front, are so numerous that they constitute a village in themselves. We can only allude to a few of the most prominent.

The erecting shop, in which all kinds of machinery are put together, is sixty feet long, sixty feet wide, and thirty-four feet high, and has within its walls three cranes, each of which is capable of raising thirty tons. The machine shop is two stories high, one hundred and fifty feet long, and sixty feet wide, the upper floor being used for the making and storing of patterns. The blacksmiths' shop is one hundred and thirty feet long, sixty feet wide, and thirty feet high, and has within it a one ton steam hammer, and a Nasymth double-acting steam hammer, recently imported from England, at a cost of one thousand dollars, and which can strike a blow equal to the force of forty-five hundred (4,500) pounds. Besides these, there is the boiler shop, one hundred and fifty feet long by sixty feet wide, with wing attached eighty feet long and fifty feet wide; a foundry one hundred and sixty feet long, sixty feet wide, and thirty-two feet high, in which are two cranes, each capable of lifting thirty tons, and with cupolas capable of making a casting of thirty-five (35) tons weight; a car shop two hundred feet long by fifty feet wide, with a wing attached of eighty feet in length; a copper shop and brass foundry, and numerous buildings connected with the boat yards, in which are kept punches, shears, rollers, presses, and furnaces capable of doing the heaviest work required in iron ship-building. To the uninitiated, the ease with which one of the punches, weighing some twelve tons, can force a three-inch hole through a two-inch plate of iron, is marvellous, and not less so is the facility with which the huge pair of shears near by can clip a piece of iron an inch and a half in thickness. Besides the buildings that belong to the manufacturing department, the firm erected about sixty dwelling-houses for the accommodation of their workmen, and are now building a handsome brick church which will seat seven hundred persons comfortably.

The productions of this establishment comprise Marine and Stationary Engines, Locomotives, heavy and light forgings, iron and brass cuttings, and a great variety of machinists' and boiler-makers' tools, but probably the most prominent branch is the building of iron and wooden vessels of all sizes and kinds. During the late Rebellion they built and fitted out three vessels of the monitor class, the "Sangamon," "Lehigh," and "Tunxis;" one gunboat, the "Tahoma;" four double-enders, the "Paul Jones," "Wateree," "Suwanee," and "Shamokin;" and two tugs, the "Nina" and "Pinta." During this period they also built and launched fifty merchant vessels, in size from a tug-boat to a steamer of nearly fifteen hundred tons; but by far the finest vessel which has yet been launched from their ways is the "Thomas Kelso," a steamer for the Chesapeake bay trade. A contract has been recently made with a gentleman of Philadelphia, to build a fast passenger and freight steamer, to run between Philadelphia and New Castle, and which, when completed, it is believed, will be the most rapid on the river. Between eight and nine hundred men are employed in these Works, and about 2,500 tons of coal and 3,000 tons of iron are annually consumed.

The firm of Reany, Son & Archbold combines, in more than an average degree, practical experience and scientific ability. The senior partner, Thomas Reany, was the founder of the Penn Works, previously described, and as such, is identified with the early history and construction of Propellers in this country, while, for a period of over twenty years, he has been a builder of marine and stationary engines and boilers. Previous to this he was connected with the Philadelphia and Trenton railroad, and one of the principal railroads in the State of Georgia. Wm. B. Reany, the son, served a regular apprenticeship in the machine shop at the bench, and in the drawing-rooms of the establishment formerly named, of which his father was the founder, and for sixteen years the senior partner. He is well known throughout the country as a thorough and scientific engineer and practical machinist.

Samuel Archbold, the remaining partner, is also well known throughout the country as a practical and scientific engineer. Having served a regular apprenticeship in the shop and drawing-rooms of one of the first establishments of the country, he soon attached himself to the engineering department of the United States Navy. Here he obtained such pre-eminence as a practical, efficient, and scientific engineer, that he was ultimately recommended to and appointed as Chief of the Bureau of Steam Engineering in the United States Navy. This position he filled with efficiency and success until his resignation, which was tendered in order to enable him to enter upon the business of the firm of which he is now a member.

Howell & Brothers' Paper Hangings Manufactory.

THE progress which had been made in the manufacture of Paper Hangings, previous to the Revolution, was alluded to in the first volume of this history.

The first manufactory in Philadelphia of which we have any account was one established about 1790, by two Frenchmen, named Boulu and Charden, in association with John Carnes, formerly American consul to Lyons, in France. Shortly afterward Mr. William Poyntell embarked in the manufacture. The kind of paper made, however, was of common quality and unglazed; and it was not until the war of 1812 that a superior style of French designs began to be attempted. Glazed grounds were introduced about the year 1824, but the circumstance that contributed more than any other to its improvement, was the introduction of the Fourdrinier machine, of which the first made in the United States was in 1830, by Phelps & Spafford, of Windham, Conn.

About the year 1813, John B. Howell, who had come from London to the United States in 1793, and established a manufactory of Paper Hangings in Albany, New York, removed to Philadelphia and commenced the business in that city. The house which he thus founded is now that of Howell & Brothers, one of the largest in the United States, and, it is said, not exceeded by any in Europe. They have two manufactories, one located at Nineteenth and Spruce Streets, 396 feet by 80, four stories high, and a smaller one on Eleventh near Catharine Street. They make about 5000 tons of wall paper per annum, including a fair proportion of velvet, velvet and gold, and satin-surfaced papers.

In their manufactories may be seen all the latest modern processes for printing, and machinery for coating and glazing that a few years ago, at least, had not yet been adopted in the English factories. For making the more common descriptions of paper, they employ machines in which the pattern is cut upon a cylindrical block, the process being the same as cylinder printing of any other kind. For the finer descriptions they continue the old style of printing by blocks, in which the outlines of the various tints, having been laved upon a block made of pear-tree, mounted in pine, the blocks are pressed on the sieves of color, and then applied to the paper, each one following the other on the guide-marks left by the previous impression. The blocks have a strap at the back to receive the workman's hand, and they are pressed down upon the paper by a mallet driven by the foot. The paper is received from the mill in rolls of about 1200 yards long and from 20 to 40 inches wide. The first

process is to cover the blank paper with a preparation of chalk which forms a basis upon which the colors rest. In the English factories this is effected by hand; in the best American manufactories it is accomplished by steam. The polishing or glazing which succeeds is also effected by a single machine, composed of a succession of cylinders, operated by steam. The patterns are mostly furnished by the Philadelphia Female School of Design, though the best designs emanating from the schools of France are frequently procured. This firm employ in their manufactories about 200 hands, one third of whom are females.

Messrs. Howell & Brothers have recently taken possession of one of the largest and what is generally regarded as the most elegant store in the city of Philadelphia. It is located at the southwest corner of Ninth and Chestnut Streets, and has a front of marble extending 33 feet on Chestnut Street, and a depth of 235 feet.

Remarkable Chemical Manufactories.

PHILADELPHIA contains some of the most extensive manufactories of Chemicals in the Union. The climate of Pennsylvania is peculiarly favorable for the production of some of the most important articles, and a capital of several millions of dollars is now invested in the manufacture. We condense from a reliable record the following account of the early manufactories which may now be said to be of national importance.[1]

John Harrison, of Philadelphia, was the first successful manufacturer of Oil of Vitriol in the United States. He had spent two years in Europe in acquainting himself, as far as he could gain access to them, with the processes used by the chemists, and after his return to America devoted himself to the manufacturing of Chemicals. How much earlier he succeeded we have no means of ascertaining; but in 1806 he was fully established as a manufacturer of oil of vitriol and other chemicals, in Green Street, above Third. His leaden chamber was a small one, and capable of making about forty-five thousand pounds or three hundred carboys of oil of vitriol per annum. So successful were these operations that in 1807 he had built a leaden chamber eighteen feet high and wide, and fifty feet long, capable of making three thousand five hundred carboys per annum. The price which the acid then brought was fifteen cents per pound.

John Harrison was the founder of the present well-known concern of Harrison Brothers & Co., whose chemical works in Kensington occupy

(1) Leading Pursuits, edited by Edwin T. Freedley.

the site of their father's old establishment. They manufacture extensively White and Red Lead and Litharge, White and Brown Sugar of Lead, Sulphuric Acid, Alum, Copperas, Pyroligneous acid, and the Carbonates of Ammonia. Their productions enjoy a high character for purity and genuineness.

Sulphuric acid cannot be concentrated in leaden vessels beyond a certain density, and for bringing it to the strength required in commerce, the only means then known was to boil it in large glass retorts to the standard weight. This was a precarious operation, and the losses sustained from breaking the glass and spilling the acid greatly increased the cost of the manufacture.

There lived at this time in Philadelphia a celebrated foreigner, Dr. Erick Bollman, who had distinguished himself by a gallant and all but successful attempt, in company with Francis K. Huger, of South Carolina, to rescue General LaFayette from his guards, during his imprisonment at Olmutz. Dr. Bollman was a Dane, a man of powerful and versatile mind, a physician, a chemist, a political economist, and a general scholar. Among other pursuits, he had turned his attention to the working of crude platinum, of which there was a considerable quantity in this country, and for which there was no demand. He had brought from France the method then lately discovered by Dr. Wollaston, for converting the crude grains into bars and sheets; and, in 1813, he had wrought it into masses, weighing upwards of two pounds, and into sheets more than thirteen inches square. One of the first uses to which he applied these sheets was the making of a platinum still for John Harrison, for the concentration of his oil of vitriol. This still weighed seven hundred ounces, and contained twenty-five gallons, and it continued in use for about fifteen years.

This early application of platinum to the concentration of sulphuric acid is highly creditable to the sagacity and ingenuity of the American manufacturer; for the use of platinum for this purpose was then a novelty in Europe, and had not been known for more than a year or two, and only to a few.

The next leaden chamber of which we have any account was put up by Farr & Kunzi. It was a small chamber, and they concentrated their acid in glass.

Charles Lennig was the first Philadelphian who entered largely into the manufacture of oil of vitriol, and put up extensive leaden chambers, concentrating the acid in platinum vessels so arranged as to be kept constantly at work while discharging a steady stream of concentrated acid. His works were in full operation in 1831, and they still continue so under the present firm of Nicholas Lennig & Co. at the new chemi-

cal establishment of this firm recently erected at Bridesburg, where they are largely engaged in this manufacture, as well as that of Soda Ash, Alum, Copperas, Aqua fortis, Nitric and Muriatic Acids, all the various preparations of Tin for the use of dyers, such as Tin Crystals, Oxymuriate of Tin, Pink Salt, etc. Besides the firms mentioned, those at present engaged in the manufacture of sulphuric acid, in and near Philadelphia, are Messrs. Powers & Weightman, at the Falls of Schuylkill; Savage & Stewart, and Moro Phillips, at Frankford; Potts & Klett, at Camden.

The war of 1812, and the commercial restrictions which preceded it, caused such a scarcity and dearness of chemicals that numbers attempted the preparation of the more prominent articles; and the complete establishment of the manufacturing business in this country dates from this period. Many of these works were undertaken by foreigners, who had learned something of chemical manipulations in the German, French, or English factories, or by capitalists among our own druggists, who made use of foreign skill, or pretensions to skill, in getting their works into operation. It was in this way that factories for the making of Prussian blue, Schule's green, and other pigments and chemicals, were from time to time started.

Many of the foreigners had been laborers in the laboratories abroad, who had no knowledge of chemistry as a science, and whose skill was confined to their own limited routine of work. There were others of a higher character, men of competent education as chemists, and of much intelligence. Of these, Dr. Gerard Troost was the most prominent. He was a Hollander, who had studied medicine and chemistry, and had been a favorite pupil in mineralogy of the celebrated Abbe Häuy. He was probably one of the best crystallographers of his day. He settled in Philadelphia, was one of the founders of the Academy of Natural Sciences, and was employed in several chemical enterprises. He superintended for a short time the laboratory of S. Wetherill & Son; was then engaged in chemical works with Lechleitner, the Swedish consul, and afterwards, about the year 1815, superintended an alum and copperas works on the Magothy River, on the eastern shore of Maryland. He did not possess the qualities of a practical manufacturer, and most of his enterprises were unsuccessful. He afterwards removed to New Harmony, with Owen, M'Clure and others; subsequently accepted a professorship in the University of Nashville, and became geologist to the State of Tennessee. Dr. Troost died in 1850.

Another of these intelligent foreigners was Abraham Kunzi. He was a Swiss, and had been educated as an apothecary, in a country where all the apprentices are taught pharmaceutic chemistry, and practised in

making most of the officinal chemicals. He worked for some time with John Harrison, and then with S. Wetherill & Son. He soon entered into partnership with John Farr, a young Englishman, who had served in one of the best retail drug stores in London. The practical skill of Abraham Kunzi, the popular manners and mercantile enterprise and prudence of John Farr, and the fair dealing and integrity with which the business of Farr & Kunzi was conducted, rendered the firm eminently prosperous, while the circumstances of the times enabled them to lay the foundation of the most extensive chemical works in America.

The concern thus founded by Farr & Kunzi is now owned and conducted by their pupils and successors, the well known Messrs. Powers & Weightman, who have not only enlarged its extent, but, if possible, advanced its reputation. This firm is now among the largest general manufacturing chemists in the world. They have two establishments,—one at the Falls of Schuylkill, where they make, in addition to Oil of Vitriol, Aqua Fortis, Nitric and Muriatic Acids, Epsom Salts, Copperas, Blue Vitriol, Alum, and Alcohol, all on a large scale. At their establishment at the corner of Ninth and Parish streets, Philadelphia, they manufacture Sulphate of Quinine, which is their staple article, the Salts of Mercury and Iodine, Citric Acid, Tartaric Acid and its Salts, and all the officinal chemicals of the British and American pharmacopœias. The reputation of this house is unsurpassed for the purity and beauty of its chemicals, and for the fairness and liberality of its dealings. It is not saying too much to add, that few examples can be found of a chemical establishment which, for a course of forty years, has uniformly sustained so high a reputation in all these particulars.

The manufacture of White Lead was first commenced in the United States, as we stated in the preceding volume of this History, by Mr. Wetherill, of Philadelphia, during or before the Revolution. His grandsons, of the firm of Wetherill & Brother, continue the manufacture, and have a factory on the west side of the Schuylkill. They employ an engine of eighty-horse power, and consume daily about 18,000 pounds of pig lead. The most extensive manufacturers of this article in the city of Philadelphia, where there are now four factories, and among the largest in the country, are the firm of JOHN T. LEWIS & BROTHERS. The history of their connection with the manufacture is as follows.

In 1813, Joseph Richards established a White Lead factory on a lot on Pine Street between Schuylkill Seventh and Eighth Streets, and in the winter of 1819–20 sold it to Mordecai and Samuel N. Lewis. They put the works in repair at once, and made during the first year 100 tons of White Lead. The increase in the quantity produced was

gradual, amounting in 1830 to 300 tons, and in 1840 to over 1000 tons. In 1827 they commenced the manufacture of Acetic Acid for their own use, in place of cider-vinegar; and in 1830, that of Linseed Oil. In 1849 the firm purchased from Redman and Joseph Wharton a lot in Richmond, having a front of 620 feet on Duke Street and 360 on Huntington Street, on which there was a White Lead factory already in operation. The works were much enlarged, and in addition to White Lead, Linseed Oil, and Acetic Acid, they began the manufacture of Red Lead, Litharge, Orange Mineral and Sugar of Lead, and at a later day other paints. In August, 1856, the firm of M. & S. N. Lewis, which had continued unchanged for fifty years, was succeeded by that of John T. Lewis & Brothers. Their present factory, on the lot above mentioned, is very extensive, and they have a capital invested of about $350,000, employ 90 hands, and produce annually of White and Red Lead, Litharge, etc., about 4,500,000 pounds; other Paints 1,200,000 pounds; Linseed Oil about 60,000 gallons; and of Vinegar about 300,000 gallons.

In 1820 there were but three establishments in the United States making White Lead, and their aggregate product did not exceed 400 tons. Now, on the seaboard alone, excluding several factories in the West, there are twelve which make in the aggregate annually about 14,000 tons, or 28,000,000 of pounds. Since 1852, however, it is believed that there has not been any considerable increase in the quantity produced, or any important additions to the number of factories. In that year the White Oxide of Zinc was introduced, which has satisfied the increased demand for white paints to the extent of about 6000 tons annually. It sells for about one-third less than White Lead, and the production is only limited by the demand.

Wright Brothers & Co., Umbrella Manufactory.

Philadelphia, in 1860, had more than one half the whole capital that was employed in the United States in the manufacture of Umbrellas and Parasols. There were in the city about twenty of those establishments, and among them one that, it is believed, was the largest in the world. We refer to that of WRIGHT BROTHERS & Co., a house that was founded in the year 1820 by four brothers—John, Joseph, Edmund, and Samuel Wright, natives of Oxfordshire, England, but who came to this country in 1816, and embarked in the business of preparing whale-

bone for Umbrellas, to which they added, in the year named, the manufacture of the finished article.

During the first ten years of their experience as manufacturers of Umbrellas, their production did not probably at any time exceed one hundred per day; but for the long period of forty-five years, with the exception of a few months, they have kept their manufactory in operation uninterruptedly, and in the busy seasons they have produced from twenty-five hundred to three thousand Umbrellas and Parasols per day. The exception alluded to was during the early part of the late Rebellion, when finding the demand for the articles of their manufacture had almost ceased, and their five hundred employees, principally females, in danger of suffering for want of their accustomed means of livelihood, they converted their establishment into a manufactory of army clothing; but when their contracts with the Government, amounting to a half million of dollars, had been executed and completed, they resumed their regular business, never having lost, in any degree, their perfect organization.

The manufactory and sales rooms of this firm are located at 322 and 324 Market Street, in a four story building, owned by themselves, having a front on Market Street of thirty-six feet, and extending in depth two hundred and six feet, widening in the rear to Hudson Street, on which the front is sixty-five feet. Steam power and a great variety of machinery are employed in all the manufacturing operations, superseding, to a considerable extent, hand labor, and thereby insuring uniformity of size and strength in the various parts, and giving to the finished article a beauty and accuracy only obtainable by the use of the best mechanical means. But probably the secret of the remarkable success of this firm in their department of manufactures may be attributed to their advantages in procuring, on the most favorable terms, the raw materials that are required.

Whalebone, which was formerly a prominent article of consumption in this manufacture, is now almost entirely superseded by rattan and steel, in consequence of its great cost, caused by the singular failure of the whale fisheries. To ensure a supply of rattans of the requisite quality, possessing the necessary hardness and elasticity, this firm have established connections in Hamburg, where alone the best quality, that is the Dutch East India Company's "selected," can be obtained, and their importations amount to two hundred and fifty thousand pounds annually, nearly all of which they consume in their manufactures; and that which is not suitable for their purpose, they dispose of to others, especially chair and basket makers. They have also favorable and extensive connections established with leading houses in Europe,

through whom they obtain their Silks, Scotch ginghams, and various other materials direct from first hands, and of which, in a yearly production of over a half million of umbrellas and parasols, great quantities are necessarily consumed.

The head of this firm is SAMUEL WRIGHT, the youngest and only surviving brother of the four who originally established it. For many years he has been the active manager of the establishment, and during a business career of a half century, has always been distinguished for honor and integrity in his dealings, and liberal and enlarged commercial views. Many of the mechanical improvements that give this firm their facilities for rapid production, are the offspring of his inventive genius. Though advanced in years, he continues an active supervision of the affairs of the firm, being aided by his three sons, who are now associated with him.

Massey, Collins & Co.'s Brewery.

THE manufacture of Ale and Porter is an extensive business in Philadelphia, and employs a capital of a million and a half of dollars. Though there are no Breweries which will compare in size with some in England, yet it has been said by competent judges, that Philadelphia Ale, for wholesome qualities and palatableness, is superior to that ordinarily made in London, as no other ingredients enter into its composition than malt, hops, and pure water. The largest Brewery at the present time in Philadelphia is that of MASSEY, COLLINS & Co., and they are regarded as leading brewers throughout the whole country, both by reason of the extent of their business and the superior quality of their manufacture.

The Brewery now owned by this firm was originally erected by farmers of Chester and Delaware counties, Pennsylvania, and transferred by them to the Brewers' Association of Philadelphia. Subsequently, M. L. Dawson, whose ancestors had been prominent brewers for a period of eighty years, purchased the establishment, which, however, was small compared with its present size. Poultney & Massey, the predecessors of the present firm, greatly enlarged the buildings in 1855, and the present owners have made important additions to their brewing facilities in order to meet the demand for their popular malt liquors. The main Brewery, as now erected, is in the form of a hollow square of one hundred and fifty feet each way, six hundred feet in all, seven stories in height, with extensive cellars and vaults underneath the whole eighteen feet in depth.

Attached to the Brewery are two malt houses, with a capacity for malting two hundred thousand bushels of barley per annum. The new malt house just erected, is one hundred and forty feet in length, fifty-two feet in width, eight stories in height, with five malting floors, and cellars and sub-cellars underneath, twenty-two feet in depth, which extend, also, under the yard, furnishing a storage capacity for twenty thousand barrels of Ale or Porter. In a wing of this building, thirty-five by thirty, there are six drying kilns, where the barley, after it has sprouted, is dried rapidly and converted into malt.

The mash tuns, in this Brewery, have a capacity for infusing twelve hundred bushels of malt daily. These are large circular tubs, with a double bottom, the uppermost of which is false, and pierced with numerous holes, and between the two there is a space of two or three inches, into which the stopcocks enter for letting in the water and drawing off the waste. From these tuns, after the starch has been converted into sugar, it is drained into boiling coppers, which, in this brewery, are heated by means of steam pipes.

The gyles or fermenting tuns, which are large circular vats or tubs bound with strong iron hoops, having in the centre pipes placed in a cylindrical form called attemperators, have a capacity of holding seventy-five thousand gallons, and the storage vats, of which there are almost fifty, are capable of containing from two hundred to four hundred barrels each. But the great feature of this establishment is the extent and depth of the cellars and vaults, where, in an atmosphere refreshingly cool in midsummer, twenty thousand barrels of the higher grades of Ale and Porter can be stored for maturity, preparatory to shipment to all the markets in the United States, the West Indies, and South America.

The firm of Massey, Collins & Co., is composed of men of long practical experience and more than average intelligence. WILLIAM MASSEY, the senior partner, has been familiar with the details of brewing from boyhood, both in England and in this country, and the position and influence of Mr. FREDERIC COLLINS in the trade, are shown in the fact that he was one of three commissioners selected by the Association of Brewers, to visit Europe and report upon the Excise laws appertaining to malt liquors; a Report that has been declared, by the United States Revenue Commissioners, to be one of the ablest that came under their notice, and from which we learn that the estimated annual production of malt liquors in the United States is five millions of barrels, in the manufacture of which twelve million bushels of barley and fifteen million pounds of hops are required

At Reading, fifty-eight miles from Philadelphia, is another extensive and celebrated Brewery, known as

Frederick Lauer's Brewery.

The main building is of brick, three stories high, having a front of one hundred feet, and a depth of one hundred and fifty feet, with a garden attached that occupies the entire remaining portion of a block four hundred by two hundred and forty feet. The cellars underneath are arched, and in them are four springs of excellent water, having a remarkable flow, which is forced by means of a steam pump into reservoirs, and used for brewing fine Ales. An engine of thirty horse-power propels the machinery, elevates the barley and malt, and works the apparatus in the mash tuns. The Brewery is provided with all the necessary puncheons, refrigerators, fermenting tuns, etc., usual in such establishments, and has a capacity for producing forty-five thousand barrels of malt liquors annually. The fermenting tuns will hold about thirty thousand gallons. Under the Brewery are vaults capable of storing two thousand barrels; but which are used only for racking and storing the liquor that is intended for immediate consumption. Attached to the Brewery is a malt house, which it is proposed to enlarge at an early day.

Besides the garden already mentioned, which contains a fountain and a fish-pond that is supplied with water from springs in the Brewery, Mr. Lauer, adopting the Russian or Berlin system, has a park of six acres of ground with a handsomely fitted up, shaded house, having a veranda its entire length, and an observatory from which a fine view of the city can be had. Here are vaults quarried from solid limestone rock, for storing Stock Ale, Brown Stout, and Lager Beer, and having a capacity for storing seven thousand barrels. Here, also, is an artesian well, which has attained a depth of two thousand feet, and though unfinished, has already cost $22,000. The water obtained from it is said to possess superior medicinal properties; but it is proposed to prosecute operations until a fountain of spouting water is obtained.

This Brewery was established in 1826, by the father of the present proprietor, who emigrated to this country in 1823, from Gleissweiler, near the Fortress Landau, in the Palatine. Its entire capacity in the beginning was not more than seven barrels a day, and for several years nothing was brewed here but what is known as the ordinary strong beer. In 1831, the brewing of ale and porter was commenced, and four years subsequently, the business passed into the hands of the son,

Frederick Lauer, a man noted for his remarkable industry and untiring energy, who, when the Brewery was in its infancy, rose every morning at two o'clock, and finished the brewing by daybreak, and who even now has not abandoned his habit of early rising. In 1862, the Brewers of the United States formed an association for mutual protection and the advancement of their interests; and in the first and subsequent meetings which they held, designated the "Brewers' Congress," Mr. Lauer was chosen as their presiding officer, and so successfully discharged the duties entrusted to him that, in the session held at Milwaukie, Wisconsin, in 1864, he was presented with a silver tea service and a gold-headed cane, worth $1,600. In 1865, when it was resolved to send a commission to Europe for the purpose of ascertaining what the experience of other countries had demonstrated to be just and equitable in taxing malt liquors without injuring the manufacture or diminishing the consumption, Mr. Lauer was selected as one of three, more especially to report upon the Excise laws of the German States.

This Brewery is now the third in the State of Pennsylvania in the amount of its production, and among the first in the reputation of its products for excellence in quality.

Cornelius & Baker's Chandelier Manufactory,

Is believed to be in its special line without an equal in Europe or America. The origin of this establishment dates back nearly to the commencement of the present century. It was then a small workshop, employing two or three journeymen; now it is an immense factory, requiring as its motive power several hundred workmen, and two large steam engines. The operations are in fact conducted in two extensive buildings, located in different parts of the city, but they are so managed in order and system as to constitute but one factory. A telegraphic wire, laid principally on poles erected at the expense of the firm, forms a medium for instantaneous communication between the two; and the state of forwardness of any work can be ascertained with almost as much facility as if it were in different parts of the same building. The Cherry street factory is an immense structure, five stories high, built in the form of a hollow square, and is entirely fire proof. The floors are of brick; the stairs and window-sashes of iron, and the roof of slate and iron—not a pound of nails nor a particle of wood having been used in its construction. Each distinct process has its room or department, and every grade of workmen, from the common

laborer to the artist and chemist, is needed in the various departments. In this miniature world, too, almost every nationality on the globe is represented.

To describe the processes necessary in the manufacture of the Lamps, Chandeliers, and Gas fixtures, as conducted in this establishment, would require more space than we can appropriate to the subject. Briefly, however, we may state, that the successive processes in the formation of an ornamental article from brass occur in the following order: The design is first *modeled* in a mass of prepared wax. Each modeler in the establishment mentioned has a private room, and every facility given him in the production of his patterns. Immense sums have been expended by this firm in procuring appropriate designs; and probably no other house in the world possesses such a rare collection. When the pattern, which is frequently the work of weeks, is finally completed, it goes into the hands of the caster, who makes a mould of it in brass, which is sent to the "chaser," and finally finished and elaborated into the dignity of a standard pattern, from which the caster may multiply an infinity of copies. It is one of the advantages which Philadelphia has for the manufacture of Ornamental Brasswork, that the sand found in the vicinity of the city is of so fine a character as to require no sifting for use, and the finest castings are easily made without the intervention of white metal. Thus, the shrinkage and variation of size between the white metal pattern and the brass casting, often found to exist in castings made from the former, is avoided, and the register of the two sides of a branch, or other portion of a Chandelier or Gas bracket requiring to be fitted together, is more perfect than it otherwise would be. The brass pattern, too, takes a sharper and more decisive chasing than white metal; and all that is required to be done, after the castings leave the foundry, is to file off the very small amount of superfluous metal retained in the casting, and fit the parts together.

The articles, after leaving the filing room, in which about one hundred men are employed, are sent to the *dipping* rooms, where, by means of acids and various chemical ordeals, a rich, pale gold color is imparted to the brass.

In the dipping process, as pursued in these works, great modifications are made in the character and strength of the acids used. It was found that, from the variation of temperature at Philadelphia, ranging as it does, from below zero in the winter, to 96° and 98° in the shade in the summer, nitric acid became unmanageable during the hot season, as its fumes were given off so rapidly as to injure the health of the workmen. The accurate scientific knowledge, however, brought to bear upon this point—one, too, involving the very existence of the trade, except at a

frightful destruction to human health and life—has obviated every difficulty, adapted the acids to the temperature, and the dipping department is comparatively free from noxious fumes, even under the highest of the above temperatures. The result is equally satisfactory as regards the color of the work when dipped, some novel effects being produced, and a singular purity of color obtained.

From the dipping rooms the articles are removed to the *burnishing* room, where a high polish is given to the prominent parts of the work by means of tools (which consist either of highly polished steel, or a very hard material called blood-stone) dipped freely into a cup of small beer. After the brass is burnished it is again cleansed by means of acids, and finally washed in hot water, the heat of which soon causes the work to dry; it is then thrown into a trough containing bookbinder's paper shavings, which complete the drying. The work is then ready for *lacquering*. The lacquering is of the utmost importance, and requires the lacquer to be scientifically made and skilfully applied to ensure a rich and lasting gold color unaffected by the action of the atmosphere. In this process the house to which we have referred has made considerable improvements. It was found that the lacquers made after the English formula lost color very quickly from the extremes of temperature already noted; and that during the months of July and August, when the dew point of the barometer is reached in Philadelphia, the red-lacquered work always streaked in the direction of the marks of the spinning tool on the broad surface of metal. After a series of experiments, carried through several months, this firm succeeded in making a lacquer which is quite permanent under any variation of temperature.

As the work is usually made in numerous parts, the fitting of these constitutes an important branch in such an extensive establishment. One room is occupied entirely by a number of men who are constantly employed in fitting together such Gas-work as Chandeliers, Pendants, Brackets, etc.; another, Girandoles and Candelabras; and a third, the numerous class of Solar Lamps designed for standing upon the table or for being suspended from the ceiling or against the wall. From all these apartments the goods are taken to meet once more in the packing room previous to bidding a final farewell to their birthplace, and starting for their port of destination, which often is Cuba, South America, the Canadas, and sometimes China and India.

Besides the rooms in which these leading processes are conducted, there are numerous others devoted to special purposes. Some of the ornamental work is painted in parti-colors to please fanciful tastes; some is bronzed with different shades, while other work is tastefully enamelled or covered with a coating of fine gold. Each of these processes has its

appropriate department. There are also rooms devoted to glass cutting, grinding, and polishing, and rooms appropriated to the workers in artistic bronze; while others are occupied by those who are employed at *damask* work, in which the chief agents are lacquer and acids. In the prosecution of such an immense business there is necessarily a vast deal of turning of metals. Many hands are constantly employed cutting screws, a branch in which considerable care and skill are requisite. All the screws of the different classes that are turned out of this establishment are made of one size. If a branch of a chandelier exported by this house to China should find its way to Russia, it would fit exactly into any of the chandeliers in the Kremlin.

The success which has attended the operations of this firm is, no doubt, due in part to the natural advantages of Philadelphia for this manufacture; in part to the large capital which the firm control, enabling them to procure the most perfect machinery, as well as purchase raw materials on the most favorable terms; but especially would we ascribe it to the constant attention paid by the managing partners to the scientific principles of Metallurgy, Chemistry, and Mechanism.

Mr. Wallis, an accomplished Englishman, in his report on the Industry of the United States, does full justice to the scientific attainments of the members of this firm, and observes that "the system, order, and accuracy, which prevail throughout the establishment is full evidence of the influence of a mind reaching as far beyond the ordinary traditions of the workshop and foundry in the scientific sense as in the practical result it goes beyond the mere dilettanteism of speculative science *sans* application."

To mention the master pieces which have gone forth from the establishment of Cornelius & Baker, and are now decorating halls and churches, public and private buildings, would extend our article to an unreasonable length. The apparatus which lights the Hall of Representatives at Washington was made by them, and also that of the Senate Chamber, which contains two thousand five hundred burners, but so arranged that all can be lighted instantaneously. All, or nearly all, the Capitols of the different States contain specimens of their manufacture, and many of them are remarkable for their size and elegance. The chandeliers and brackets of the Capitol at Columbus, Ohio, contain, among their embellishments, statuettes of Prudence, Science, Commerce, Liberty, America, modeled and bronzed in the highest style of art. The chandelier of the Hall of Representatives at Nashville, Tennessee, is fifteen feet in diameter, and appropriately decorated with the products of the State—corn, cotton, tobacco plants, etc. The Gas fixtures in the Academies of Music in Philadelphia, Boston, and Brooklyn,

were also made here. The chandeliers hanging in the auditoriums of the two first mentioned are said to be the largest in the world, being sixteen feet in diameter, and twenty-five long, and have two hundred and forty burners. The new theatres in Philadelphia, in Chestnut, Arch, and Walnut streets, are lighted by chandeliers from this establishment.

The firm of Cornelius & Baker is now composed of Robert Cornelius and Isaac F. Baker, Wm. C. Baker, Robert C. and John C. Cornelius. They usually employ about eight hundred workmen.

Wilson, Childs & Co.'s Army Wagon Manufactories,

Deserve a place among the remarkable Manufactories of Philadelphia, as they are probably the largest works of the kind in the United States. Their history is briefly as follows:

In 1829, D. G. WILSON, a wheelwright, and Mr. J. CHILDS, a blacksmith, formed a copartnership for making Farm Wagons, Carts, etc., and opened shops for the purpose, at the corner of St. John and Buttonwood streets. By fidelity in workmanship, and prompt attention to business, their products soon became in demand in all parts of the country, especially in the Southern States, where their plantation wagons were in the highest favor. They embarked largely in constructing Army Wagons for Government use, and the first Army Wagon made after the present improved pattern designed by General GEORGE H. CROSMAN, now Assistant Quartermaster General at Philadelphia, was built by them. Every part of these wagons is made with the same exactitude of dimensions as the Gun Carriage of a park of Artillery, and their utility was especially demonstrated in the Expedition to Utah, where they traversed the roughest roads for thousands of miles, without the breakage of any important part. In 1860 Mr. WILSON died, much regretted by his associates, leaving however, a son, WILLIAM M. WILSON, who now creditably represents his interest in the firm.

During this period, the original works were enlarged from time to time, but it was soon found that the premises, though containing two hundred and thirty feet on Buttonwood street, and one hundred and thirteen feet on St. John street, were too small to accommodate the increasing business. In 1850, they purchased a manufactory, erected by Mr. Simons, and additional property, comprising in all a square on both sides of Second street and Lehigh Avenue, containing two hundred and sixty by five hundred feet, or over six acres. The square on the west side of Second street, is now nearly covered with buildings.

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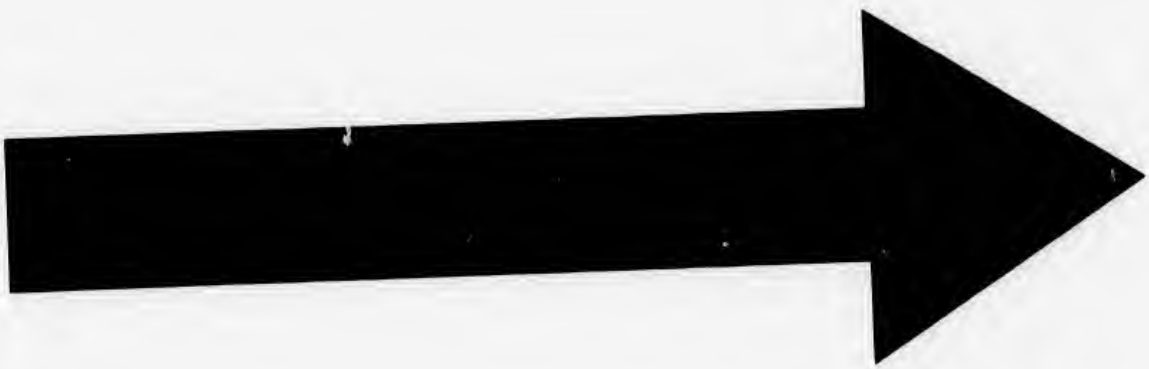

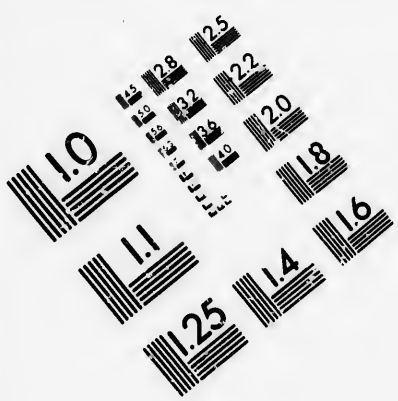

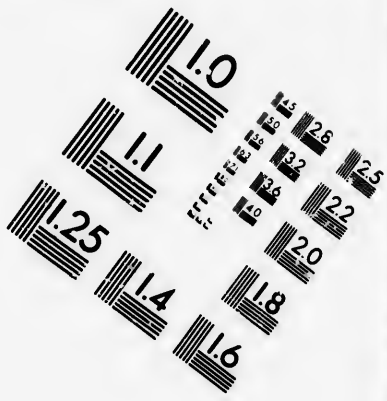

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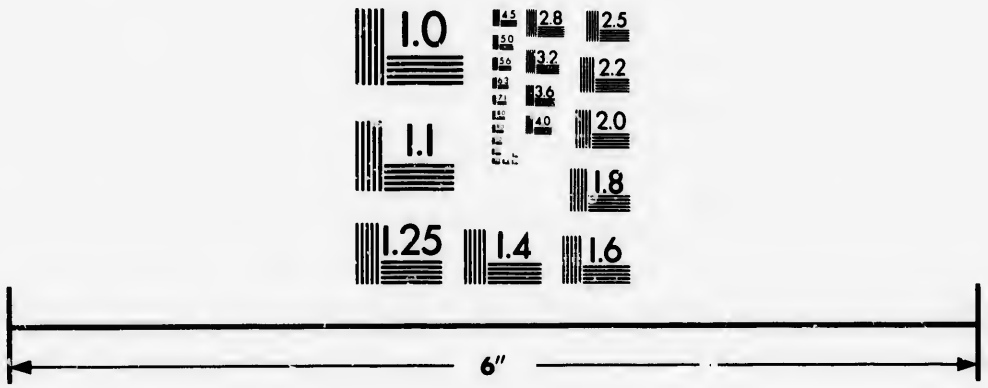

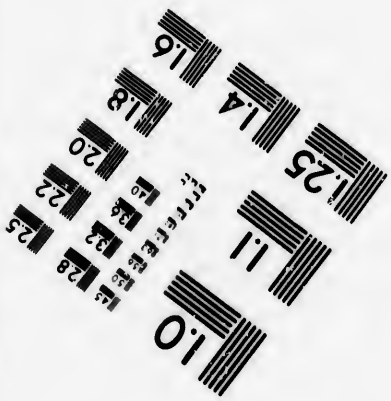

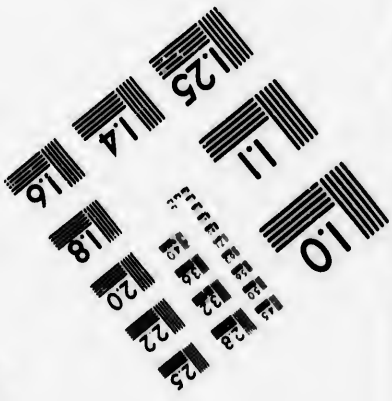

Photographic Sciences Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
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There is a main building, two hundred and fifty feet long, with a front of fifty feet, used mainly for Painting, Varnishing and storage purposes. The wheel and body shop is one hundred by forty-six feet, three stories high; the Blacksmith Shop is two hundred by thirty-five feet, the Saw Mill, Engine house and Machine shops, is eighty by forty-five feet, three stories high; the Running gear shops, one hundred by forty-five feet, and besides these there are numerous auxiliary buildings. On the east side of Second street is a Saw Mill, fifty by seventy-five feet, but the greater portion of the square, which is five hundred by two hundred and forty-eight feet, or nearly three acres, is occupied as a Lumber yard. Here is kept at all times an immense stock of lumber, amounting at times to two million feet of hard wood planks and boards, thirty thousand hubs, and five hundred thousand spokes. These, before being used, are thoroughly seasoned from one to five years, the usual allowance being one year for every inch in thickness. The hubs are made chiefly from black locust trees, sawed into suitable lengths, and before being put away to season, the bark is removed, and a hole bored in the centre to facilitate the seasoning process. In the store-rooms the firm also keep a large stock of finished work, including cart and wagon bodies, and several thousands of wheels.

These works have the capacity of turning out one hundred and fifty army wagons in a week, without interfering materially with the regular business, in Farm and Plantation wagons. The firm of WILSON, CHILDS & Co., have an established reputation for reliability, and their aggregate trade amounts to hundreds of thousands of dollars per annum.

Fitler, Weaver & Co.'s Cordage Works,

Are the most extensive in Philadelphia, and, with probably two exceptions, the largest in the United States. They are also among the oldest established rope manufactories in this country, having been founded by Michael Weaver in 1817. At that period, cordage spinning was carried on in the primitive way, and gangs of rigging were laid by hand, the neighbors being called in to assist. Subsequently horse power was employed for this purpose, but it was not until recently that steam power was applied, by means of which large Marline Ropes are now made with the same facility as twines. In fact, so great has the progress been, that now a gang of rigging suited for the largest vessel in the Government Marine can be finished and delivered within three days after receipt of the order. The original Rope Walk, with its hand spin-

ning apparatus, is still in use by the present firm, who, however, have introduced a Corliss engine of forty horse power, and made other improvements that adapt it to finishing fine cordage. In 1847, EDWIN H. FITLER became connected with the firm then carrying on the business, and possessing executive talents of a high order, soon made his influence felt in the firm's affairs. He saw that, for want of a mill possessing improved machinery, the trade of the South and West was passing through Philadelphia to the New York and Eastern manufactories, and he urged upon his partners the erection of works that would compete with any in the United States. These were begun and finished, but within ten days after their completion, were destroyed by fire. Another and larger factory was immediately erected on the former site, at Germantown road near Turner's lane, but this also was burned in July, 1866. Within four months, another mill was erected in accordance with plans drawn by Mr. Fitler, and this is now without doubt the finest and most conveniently arranged Cordage Factory in the United States.

The main building is of brick, three stories high, one hundred and eighty-four feet long, and fifty-eight feet wide. There are also attached an engine-room, which contains, besides the engine, two steam fire pumps, a boiler-room, and a machine shop twenty-four by forty-six feet All these buildings are of brick, with gravel roofs. The factory is warmed by steam and lighted by gas, and every precaution is taken to guard against fire. There are iron water pipes with cocks and hose on every floor. On the top of the Hoisting Machine is a tank containing five thousand gallons of water, supplied from the City Reservoir, and a large well in the rear of the engine-room. The steam-boilers are enclosed by brick walls, and the tar-boiling apparatus is heated by steam. In the main building are all the machines of modern construction that are best suited to spinning and preparing rope and cordage. The machinery is propelled by a Corliss engine of two hundred and fifty horse power, and has a capacity for performing work that would have required by the old process of hand-spinning at least a thousand men. Extending at right angles from the factory proper, is a rope-walk thirteen hundred feet long, and on the premises are numerous buildings auxiliary to the business. It is probable that the cost of this factory and its machinery was not less than a quarter of a million of dollars. About three hundred men are employed in the two factories, which consume each day from sixty to seventy bales of Manilla, Russian and American Hemp, and produce about seven tons of Rope and Cordage daily, or 4,500,000 pounds per annum. The facilities for manufacturing are so complete, and the machinery so perfect, that the Cordage cannot be surpassed in quality by any made in the world.

EDWIN H. FITLER, who is now the senior partner in the firm, and principal owner of the works, is a native of Philadelphia, having been born in the district of Kensington in 1825. He belongs to the energetic and progressive order of manufacturers, of whom it is often said that Philadelphia has too few. He has established a private telegraphic wire from the store on Water street to the Factory, which passes directly through his house in the city, by means of which not only orders and business reports, but private and domestic messages can be transmitted by telegraph.

The system he has organized is so complete that the affairs of a vast and complicated business are managed with the minimum of trouble and labor. Every evening, an account of the various kinds of hemp on hand is taken, and the quantity of the different sizes of rope in store is made up, and thus every morning he has a complete and exact report of the state of affairs ready for his guidance during the day. Every morning also, the report of the night-watchmen, registered on their tell-tale clocks, is submitted, and their fidelity in the discharge of their duties examined.

Among the minor but nevertheless novel and useful items of counting-house management, is a Diary or daily journal of events. For nearly twenty years this firm have kept, in an appropriate book, a record of each day's events, including an abstract of every important business conversation, a copy of every telegraphic despatch sent or received, and of all orders and purchases; and its utility, especially in cases where options or refusals have been given for a limited time, has been frequently demonstrated.

Messrs. Fitler, Weaver & Co., have a large warehouse at 23 North Water street, for the sale of their cordage, in connection with which is a store containing a full and complete stock of Naval supplies. Besides these, they occupy four other stores for storage purposes.

The partners in the firm are EDWIN H. FITLER, MICHAEL WEAVER, and CONRAD F. CLOTHIER.

Thomas Sparks's Shot Factory,

Sometimes known as the Southwark Shot Tower, is one of the old landmarks in Philadelphia. It is located in Carpenter street, in the Second Ward, and was founded in 1808, by Cousland, Bishop & Sparks, whose Patent Shot was celebrated in the early part of the present century. Mr. John Cousland was a Plumber at a time when that branch of business was shared by but two or three in Philadelphia.

The introduction of the Schuylkill water in 1799, gave the plumbing business a great impetus, and Mr. Cousland, one of the most active in it, removed, in 1801, from South or Cedar street, between Front and Second, to Farmer's Row, now Godley's Row, on Granite street. In 1803 he entered into partnership with John Bishop, another plumber; and their apprentice, Thomas Sparks, a young man of great fidelity and diligence, was when of age taken into partnership. At this period the principal establishment of the firm was at 49 South Wharves.

On the 4th of July, 1808, the corner stone of the present Philadelphia Shot Tower was laid, and the work of erection rapidly pushed forward. The structure is one hundred and eighty feet in height. The principal supervision of this department of their business devolved upon Mr. Sparks; and the shot made at these works became in great demand.

Mr. Sparks continued the manufacture alone until 1818, when he associated with him his brother, Richard Sparks. This partnership, however, was soon terminated by the decease of Richard Sparks, who fell a victim to the yellow fever in 1821; and for many years Mr. Thomas Sparks carried on the business without a partner. In 1838, however, he associated with him his nephew, Thomas Sparks, Jr., a son of Richard, under the firm style of Thomas & Thomas Sparks, Jr., which continued until 1854, when the senior relinquished active business.

During his active and useful life Mr. Sparks held several offices of public trust. He was for many years a Commissioner of the District of Southwark, and President of the Board of Commissioners appointed by the commonwealth of Pennsylvania to superintend the erection of the Eastern Penitentiary. He was also a Director in several Railroad and Insurance companies, and for many years was President of that admirably managed institution, the Southwark Bank. He did not however survive long his retirement from active business, and on May 15th, 1855, departed this life, universally regretted as a

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BENJAMIN BULLOCK, PHILA.
WILLIAM H. HORSTMANN, PHILA.
DAVID C. WILSON, PHILA.
SAMUEL COLT, HARTFORD.

representative of the high-toned and honorable Manufacturers of Philadelphia.

Thomas Sparks, Jr., his successor, was born in the year 1817, and at the age of sixteen was taken into the store of his uncle and instructed in the details of the business which his father and uncle had established. On becoming of age he was taken into partnership, and in 1854 became sole proprietor by the purchase of his uncle's interest. Since that time he has conducted the extensive operations of the business with success based on integrity. Steam and improved machines have been introduced to facilitate the various processes, and the Works have the capacity of producing three thousand tons of shot, bullets, and bar lead per annum.

Mr. Sparks, like his uncle, has been called upon to fill prominent positions of public trust. He is one of the largest stockholders in the Southwark Bank, and for many years has been its Vice-President. He is President of the Pennsylvania Salt Manufacturing Company, a Director in the Franklin Fire Insurance Company, and in several other companies.

Mr. Winslow, in his Biography of Successful Merchants, to which we are indebted for most of the foregoing facts, says of Thomas Sparks: "For objects of charity and improvement, he gives not only hundreds, but thousands of dollars. He has never withheld assistance from any object which has been worthy of care and encouragement. Since the outbreak of the rebellion no one has been more hearty and enthusiastic in support of the government. He has shown this not merely by words, but by deeds. He has given freely to every plan of benevolence designed for the comfort and assistance of our suffering soldiers. He has been ready to aid in fitting out troops, and has given enough for this single purpose to assist very materially toward equipping a regiment. Philadelphia has many such patriots, but among them few can excel, in devoted loyalty, readiness, and free and generous contributions, Thomas Sparks, late Jr."

John Baird's Marble Works,

In Philadelphia, are, for their extent and improved machinery, the most notable of their kind in the United States.

The new mill recently erected at Locust street wharf, on the Schuylkill river, is, with one exception, the largest in this country, and if equipped to its full capacity would exceed in working capacity any in the world. The building is two hundred and fifty-five feet long, seventy-five feet wide, and when completed according to the original plan it will contain gangs of saws and rip saws that will be capable of sawing one hundred thousand cubic feet of Marble in a year. The machinery includes all the latest improvements, such as the *Tingley Patent Feed Motion*, and *Merriman's Patent Gang*, and others original with the proprietor. But the special feature of this mill is the adaptation of the *English Steam Travelling Crab*, by the use of which a block of marble can be taken from the hold of a vessel at the wharf and placed directly under the Saw gang without the intervention of manual labor. This remarkable machine has been employed for carrying heavy weights in factories of a different description, but its use in a Marble Mill is, we believe, original with Mr. Baird.

The erection of this extensive Mill is destined to mark the beginning of an era of which the influence will be felt in all the wide ramifications of the Marble business. It is the first attempt to introduce into this trade the principle of subdivision or limitation to specialities which, in the Furniture and other branches of manufactures, has operated greatly to the advantage of consumers. It is well settled that those who have machinery and facilities for producing at one operation a hundred sets of any article, whether of wood, iron, or marble, can produce them at one fourth less cost than those whose capabilities are limited to one piece of the same size. By the system which he has introduced into his Works, the completeness of the machinery, and the consequent economy of time and material, Mr. Baird will be enabled to supply Marble workers with Grave-stones, Plinths, and other stock of standard sizes, nearly finished, at a little if any advance upon the price they have heretofore paid for the same material in the rough. Marble direct from Leghorn can be brought to his wharf, and placed under the saw gangs, at a saving of all transit duties and transhipment charges, that have heretofore amounted to more than the original cost in the block; and in providing a depot where those who have not similar facilities can participate in the advantages, Mr. Baird has supplied a national want, and conferred an economical benefit not only

upon the dealers in marble, but upon the consumers in its various forms.

In addition to this mammoth mill, Mr. Baird owns and operates the well-known Works on Ridge Avenue, above Spring Garden street, and is now, or was recently, interested as owner of similar works in Baltimore.

Mr. John Baird, the proprietor of these mills, though born in Ireland, has been a resident of Philadelphia almost from infancy. He has been identified with the working of marble since 1841, when he embarked in the business on Ridge Avenue, above Spring Garden street, where he achieved a distinction and success that placed him foremost in his pursuit in the Union. In 1846 he erected at this location the second steam mill in Philadelphia, and adopted a new principle in the application of power to the sawing of marble, known as the Crank Action or Pitman Motion, the superiority of which over the old pendulum mills was so manifest that all the marble factories in Philadelphia, and, with few exceptions, all in the United States, have been rebuilt or remodelled on this plan. He has always occupied the position of vanguard in the march of improvement, and incurred the risks of experiments that others might have a safe road in which to follow. He was among the first to adopt the modern method of feeding saws and regulating their motion, and is himself the originator of improvements that made his mill the wonder of the trade for its efficient action. It has been said by competent judges, that no marble mill in the world of equal capacity has performed so much work as his within the same period of time.

For many years Mr. Baird was the principal consumer of Italian marble in the Philadelphia market, his purchases for a series of years amounting to twenty-four thousand cubic feet annually. This he has converted into various beautiful forms for the ornamentation of dwellings and cemeteries, and some of the most beautiful specimens of the Phidean art of which this country can boast are the products of his workshops. It has been his practice not only to secure the best native and foreign artists in carving and designing, and to stimulate their ambition by rewards and liberal remuneration, but to encourage the study and practice of both these arts by establishing schools for the benefit of his apprentices. The fruits of his enterprise in this respect may be seen in his Mantel Warerooms, and in the Monuments and Tombs which adorn our Cemeteries. His warerooms contain upward of one hundred and thirty different patterns of Marble Mantels, made from all varieties of marble, common and rare, from the clouded Pennsylvania to the Carrara statuary. The designs in most instances are

original, and the carving on the most costly renders them worthy of a place among the *chef-d'œuvres* of the art. During his business career of more than a quarter of a century, he has supplied many of the most magnificent specimens of monumental art that adorn the resting places of the dead throughout the Union, and he was, we believe, the originator of the Mausoleums, or tombs above ground, which are in favor especially in marshy districts of the Southern States.

In this connection it may be proper to advert, as a fitting conclusion to our notice of the remarkable manufactories of Philadelphia, to a matter of great importance to manufacturers, and to which Mr. Baird's enterprise in establishing a mammoth mill on the Schuylkill river has given prominence. Before embarking in this enterprise he made a careful examination of the respective advantages offered by different localities for manufacturing operations, and decided that the banks of the Schuylkill river, below Chestnut street bridge, are superior to them all. Mr. FREEDLEY, in his work on the Manufactures of Philadelphia in 1867, remarks—"It is probable that the west bank of that river, from Chestnut street to Gray's Ferry, is the best site in America for the location of Iron Works and large Steam Manufactories of all kinds. There the proprietors of such works can obtain at all times a supply of the best workmen without the complications that result from the relations of landlord and tenant, where dwellings must be provided for the operatives. It is always best that manufacturers should have no other relations with their workmen than simply that of employer and employee. There, also, manufacturers are not only independent of the extortion of transportation companies, but have the advantage of numerous competing lines. The river itself is always accessible for vessels not drawing more than twenty feet of water, while along its banks is the Junction Railway, a neutral organization, that connects with the four great lines of railway leading to the North, West, and South. How important this consideration is, has been painfully realized in many instances by manufacturers in New England who are dependent upon one railway for the transportation of their raw materials and finished products; and this circumstance, combined with other advantages, confirms the correctness of Mr. Baird's judgment in declaring this to be the best site in America for large manufactories."

There are in the vicinity of Philadelphia a large number of very fine Paper Mills. The AMERICAN WOOD PAPER COMPANY recently erected, at Manayunk and at Roxer's Ford, the most extensive works in the world for manufacturing Paper from wood pulp. The buildings occupy

a space one thousand feet in length by three hundred and fifty feet in width, and cost, when finished, over $500,000. Logs of wood, principally poplar, are cut into chips by large steel knives set in revolving circular iron wheels, which have the capacity of cutting from thirty to forty cords of wood every twenty-four hours. The chips are then boiled to a pulp in alkalies, and by a peculiar process of evaporation, about eighty per cent. of the soda used is saved. It is estimated that by the erection of these mills, the daily production of printing paper has been increased thirty thousand pounds, and the daily consumption of rags diminished to nearly the same extent.

The WISSAHICKON MILLS, of CHARLES MAGARGE & Co., are celebrated for making fine Book Paper. These consist of two mills, the original one, formerly a merchant flour mill, and another, built in 1858, at an expense of about $80,000, both of which are provided with all the appliances of first-class Foudrinier Mills. The main building of the new mill is seventy-eight feet six inches by fifty-four feet deep, two stories high and attic, with a rotary boiler house, connected as a wing, twenty-six feet by fifteen feet six inches; a machine room, one hundred and ten feet by twenty-eight, with a wing on the rear, twenty-eight by fifteen feet; an engine room, seventeen feet by forty; a boiler house, forty by twenty-five feet, and chimney, one hundred feet high, ten feet at base, and five feet at top. The Foudrinier Paper machine is seventy-two feet long and sixty-two inches wide, and supplied with three 36-inch diameter iron dryers, and ten 8-inch diameter copper dryers, and two sets of calender rods. There are three washing and five beating engines of large capacity. The machinery is propelled by a Corliss engine of eighty horse power, and the mill is supplied with pure spring water by means of costly reservoirs on the hills adjacent, from which the water is conducted into the vats by twelve hundred feet of 8-inch pipe and nine hundred feet of 6-inch pipe. Some of the reservoirs are fifty feet higher than the factory. The weekly consumption of rags in this mill is about thirty-three thousand pounds, and the production about twenty-four thousand pounds of paper. The expenses per week of these two mills for raw material and labor are about five thousand dollars.

MANUFACTURES OF PITTSBURGH.

The following are the statistics of the manufactures of Allegheny county, according to the census of 1860.

	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male Hands.	Female Hands.	Value of Product.
Agricultural implements	11	$160,600	$91,995	128	.....	$217,383
Bags	1	10,000	37,858	8	7	75,000
Bolts, nuts, etc	3	85,000	85,960	84	.....	193,000
Boots and shoes	178	185,975	179,359	614	64	457,685
Brass founding	7	95,200	64,967	129	.....	120,346
brick	25	89,250	27,179	200	.....	247,020
Carriages	13	53,750	40,808	140	.....	121,695
Chemicals	2	206,000	83,960	307	.....	202,000
Cigars	28	93,900	62,853	158	.....	133,456
Clothing	61	461,450	539,345	707	1,050	1,110,831
Confectionery	2	9,500	15,000	6	6	24,375
Copper	3	970,000	660,380	75	.....	807,768
Cotton goods	5	925,000	683,643	301	870	1,076,333
Flour and meal	52	452,500	1,197,148	120	.....	1,335,741
Furniture, cabinet	20	152,150	50,819	273	.....	212,075
" chairs	4	10,150	17,000	34	.....	40,664
Glass ware	18	1,867,600	699,610	2,119	.....	2,075,143
Glue	5	63,700	47,165	46	.....	94 050
Hardware, locks, etc	15	421,300	179,734	543	.....	547,253
Hats and caps	6	20,100	9,160	12	9	23,075
Hosiery	3	5,000	3,400	9	.....	8,800
Instruments, optical	1	5,000	506	2	.....	2,100
" surgical	1	10,000	1,000	5	.....	10,000
Iron, bar and sheet	13	3,380,000	2,116,311	2,323	.....	3,761,683
Iron, pig	3	233,000	105,620	150	.....	265,500
Iron founding	17	742,000	313,562	544	.....	824,480
" stove founding	5	330,000	131,245	314	.....	381,750
Iron forging	1	11,000	6,800	7	.....	12,705
Iron rolling	1	6,000	4,975	8	.....	12,000
Japanned ware	2	54,000	23,452	51	3	67,500
Jewelry	3	5,000	775	4	.....	3,500
Leather	27	282,300	350,086	167	.....	452,467
Liquors, distilled	3	3,000	5,430	4	.....	10,000
" malt	32	354,400	200,937	177	.....	494,785
" rectified	19	130,500	165,820	40	.....	231,022
Lumber, planed	12	185,000	178,756	136	.....	300,020
" sawed	42	417,200	320,776	242	.....	527,147
Machinery, steam engines, etc	24	496,500	450,276	815	.....	1,031,068
Millinery, etc	27	23,075	28,891	118	.....	60,110
Military equipments	1	331,000	17,586	53	.....	29,856
Mineral water	2	2,600	2,325	6	.....	6,700
Nails	5	1,250,000	728,275	889	20	1,140,809
Oil, linseed	4	79,000	36,750	17	.....	64,450
Patent medicines	5	16,500	10,600	7	8	23,400
Picture frames	5	18,000	15,335	17	.....	39,270
Pottery ware	5	18,100	6,446	41	.....	22,068
Printing	16	248,400	138,684	326	40	538,103
Provisions, pork, beef, etc	2	150,000	216,262	40	.....	312,000
Rope and cordage	6	17,600	17,615	27	.....	31,460
Salt	11	63,500	23,608	84	.....	99,200
Sand, washed	1	42,500	8,000	20	.....	125,000

	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male Hands.	Female Hands.	Value of Product.
Safes, iron	1	$6,000	$8,010	17	.....	$26,149
Saddlery and harness	10	12,050	17,288	41	.....	41,454
Sash, doors and blinds	11	23,700	15,820	40	.....	37,030
Silver plated ware	1	5,000	3,500	15	.....	13,000
Soap and candles	15	278,800	441,107	98	.....	646,693
Spikes, railroad	2	175,000	158,500	110	.....	325,000
Springs, railroad car	1	15,000	25,100	7	.....	75,000
Steel	6	1,230,000	317,125	522	.....	880,000
Tin, sheet-iron, and copper ware	37	84,637	71,420	140	.....	174,491
Trunks	3	18,600	17,314	34	.....	49,000
Vinegar	8	27,850	14,554	19	.....	54,585
Wagons, carts, etc	25	124,400	87,343	179	.....	278,177
White lead	2	150,300	92,838	39	.....	125,932
Wigs and hair work	3	2,600	2,500	4	3	9,842
Wire work	2	1,200	600	3	.....	2,376
Woollen goods	5	78,200	61,730	55	36	96,800
Wool pulling	5	6,900	17,825	19	.....	33,475
Total, including miscellaneous manufactures not above specified	1,191	$20,531,440	$13,020,615	18,228	2,265	$26,563,379

Since the census of 1860 was taken, there has been a vast increase in the manufacturing industry of Pittsburgh, or the census takers were extremely negligent in the performance of their duties. It is estimated by competent authority that the aggregate product of two staples, Glassware and Petroleum, is now more than the total of the census returns for the county of Allegheny in 1860, and that the value of all the manufactures in Pittsburgh now exceeds $60,000,000. Of establishments for manufacturing Pig, Bloom, Bar, and Sheet-Iron, and Nails, there are thirty, which produce an annual value of $6,000,000. Of Steel, one half of all that is produced in the United States is made in Pittsburgh, there being seven extensive establishments, whose aggregate product in 1865 amounted to $2,200,000; and of Hardware, the same number of establishments produced a value of nearly $4,000,000. There are also fifteen stove foundries, five establishments making bolts, nuts, and washers, eleven gas pipe, tubing, and oil works, and thirty-two steam-engine, machinery, and boiler works, which employ nine hundred and seventy-five hands, and produce a value of $1,500,000 annually. For the manufacture of Flint, Window, and Vial Glass, Pittsburgh has long been the chief seat in the United States, there being now fifty-three works of this description, whose annual product is valued at twelve millions of dollars. There are also in the city and county thirty-three tanneries, five cotton-mills, six woollen-mills, and twenty-seven oil refineries. The manufacture and refining of petroleum, it is said, employs over three thousand persons, and the trade of the city in this article now amounts to $15,000,000.

The Fort Pitt Works—Charles Knap, Proprietor.

Among the many notable manufacturing establishments in Pittsburgh that might be alluded to with propriety, there is one that has attained a world-wide reputation for its success in casting Heavy Ordnance—viz.: the FORT PITT WORKS. This cannon foundry was first established during the war with Great Britain in the year 1814, by Joseph McClurg, who was, at that time, the owner of a foundry which supplied the ordinary iron castings needed by the inhabitants of a small town. It was situated at the corner of Fifth and Smithfield streets, on the ground which is now occupied by the United States Custom-House and Post-Office. It had supplied Commodore Perry with the cannon balls and grape shot used by his fleet in the memorable battle on Lake Erie, in September, 1813.

Mr. McClurg then made a contract with the Secretary of the Navy for the manufacture of cannon and carronades, and immediately proceeded to erect a boring mill and machinery on the ground now occupied by the Fort Pitt Works, which was then in the open fields, outside of the town limits. The boring mill was erected, and cannon were bored and finished during the year 1814. The boring machinery was driven by horse-power. At that period, all other cannon-boring machinery in the United States was driven by water-power, and as there were no water-falls convenient to the Pittsburg foundry, and as steam power was then but little known or used in the western country, the horse mill was of necessity resorted to. It was continued in use for three or four years, when the worn-out, blind horses were superseded by a high pressure steam-engine of the plan invented by Oliver Evans. In 1815, the foundry and boring mill passed into the hands of the sons of Joseph McClurg, who soon after made a contract with the Secretary of War for the manufacture of a large number of cannon, shot, and shells, which were completed in 1816 and 1817, when further contracts were made and completed. At this period, the largest cannon made for the military service was the 24-pounder, weighing about fifty-two hundred pounds. In 1818, a Board consisting of experienced engineer, ordnance, and artillery officers, was appointed by J. C. Calhoun, Secretary of War, to determine the calibre, form, and weight, of all the cannon thereafter to be used in the military service. That Board, in 1819, decided that the 24-pounder was the largest gun required, and none of larger size were cast until 1829, when the 32-pounder was adopted. Three years afterward, the 42-pounder, weighing about eighty-four hundred pounds, was added; and this continued to be the maximum calibre for many years.

In 1831, Alexander McClurg and Major William Wade became the proprietors of the Pittsburg Cannon Foundry. Up to this date, all the guns had been cast at the old foundry, on the ground where the post-office now stands; but in that year a new and larger foundry was erected on ground adjoining the boring mill, where the cannon were thereafter cast. The Works were enlarged by adding machine shops for the manufacture of steam engines and machinery, and for building locomotive engines and railroad cars. And here the first locomotives ever made west of the Allegheny mountain, were manufactured. In 1841, the establishment was purchased by Charles Knap and W. J. Totten, who had previously been engaged in managing the Works. They continued the manufacture of cannon, shot, and shells, and steam-engines and machinery; and in 1843 and 1844, they built and armed two iron steamboats, the "Jefferson" and the "Bibb," for the United States revenue service.

The military authorities having given much attention to the subject of a further enlargement of cannon, Colonel George Bomford, Chief of Ordnance, had, in 1839 and 1840, ordered the casting of two or three 64-pounders, eight inch calibre, and one 125-pounder, ten inch calibre, at Alger's foundry in Boston. They were designed for experimental shell guns, and numerous trials were made with them in 1840 and 1842, with both solid shot and shells. Up to this period, shells had not been fired from long guns, but from mortars and howitzers only. These experiments proved that large, heavy guns could be loaded and fired with ease and rapidity, and that heavy shells could be safely fired from long guns with equal rapidity, accuracy, and range, as solid shot; and that they could be used on board ships at sea with entire safety. These results were so satisfactory, that in 1842, both the eight inch and the ten inch guns were adopted as established calibres in the military service. After a further revision of their models in 1844, the weight of the eight inch was 9,250 pounds, and of the ten inch, 15,500 pounds. Further experiments, in 1844, having more fully demonstrated the safety and the greater efficiency of these large guns, another, still larger, was proposed by Colonel Bomford; and accordingly, a twelve inch gun, or 225-pounder, was cast at Alger's foundry in July, 1846. It was tried in the same year by firing it about one hundred times, with heavy charges. The results were satisfactory, in showing that a gun of the enormous weight of twenty-five thousand pounds, fired with a charge of twenty-eight pounds of powder, and throwing a loaded shell of one hundred and eighty pounds, three and a third miles, could be safely used, and readily handled.

Up to this period, the method universally practiced in making cannon,

was to cast them solid, and to form the bore by drilling a hollow cylinder into the solid metal. Lieutenant Rodman—now General Rodman—who had in 1845 and 1846 been employed in superintending the casting of a large number of eight inch guns at the Fort Pitt Foundry of Knap & Totten, conceived that the manner of cooling such large masses of iron was injurious to the quality of the casting, as has been elsewhere alluded to; and it occurred to him, that if the gun could be cast hollow, and be cooled from the interior, the direction of the strains would be reversed—and that instead of aiding the powder to burst the gun, they would increase the power of the metal to resist the internal force.

To test the accuracy of this theory, two eight inch guns were cast at the Fort Pitt Foundry in 1849. They were cast at the same time, from the same melting of iron, and under like conditions in all respects as far as possible—except that one of them was cast solid, and cooled from the exterior, in the usual manner, and the other was cast hollow, and cooled from the interior. After being bored and finished, they were proved at the same time, by continuous alternate firing, with equal charges of powder and shot, until both were broken. The number of fires endured by each, was about three to one in favor of the hollow cast gun. This result, although favorable to the theory, was not regarded as conclusive; and another similar trial of eight inch guns was made in 1851. In this, the solid cast gun was broken at the seventy-third fire; and the hollow cast gun endured fifteen hundred fires—and remains unbroken—without any material visible injury.

In the same year, a pair of ten inch guns were cast and tried in the same manner; and further similar comparative trials were made in the years 1856 and 1857; until six pairs, in all, of heavy guns were made and proved. The whole number of fires endured by the six solid cast guns, all of which were broken, was seven hundred and seventy-two. The number of fires endured by the six hollow cast guns, only three of which were broken, was fifty-five hundred and fifteen. The unbroken hollow cast guns, after having endured fifteen hundred fires each, remain in apparent good order, and capable of much further service. The manifest superiority of the hollow cast guns over those cast solid, being thus practically demonstrated, the Secretary of War, in 1859, ordered that all heavy guns made thereafter for the War Department, should be cast hollow, and cooled from the interior, on the plan invented by Captain Rodman.

The process of making the hollow cast guns, and the cooling them from the interior, is to place in the centre of the gun-mould a water-tight hollow core, the exterior diameter of which shall be a trifle less

than the desired bore of the gun. While the liquid iron is passing into the gun-mould and surrounding the core, a stream of cold water is conducted, by a separate pipe, down through the centre of the hollow core nearly to its bottom, where it is discharged from the pipe and then passes up through the annular space in the core to the top of the mould, where it passes off in a heated state. While the cooling of the interior of the gun is thus accelerated, the cooling of the exterior is retarded by surrounding the gun-mould with heated air, at as high a temperature as the safety of the mould will permit, or about eight hundred degrees. The water circulates through the interior of an eight inch gun at the rate of about two cubic feet per minute; and, in the beginning, its temperature is increased while passing through about twenty-five degrees. The circulation is continued until the water passes out at the same temperature as that at which it entered, when the cooling is completed.

In 1851, after the decease of Mr. Totten, Major Wade again became a partner in the Fort Pitt Works, and, associated with Mr. Knap, continued the manufacture of ordnance, steam-engines, and heavy machinery, until March, 1858, when the whole establishment was entirely destroyed by fire. The rebuilding of the Works was immediately commenced, and in three months thereafter the casting of cannon was resumed. In July, 1858, Major Wade retired, and Mr. H. F. Rudd and N. K. Wade came into partnership with Mr. Knap. They had both been for several years previously engaged in conducting the operations of the Works.

In 1859, a further experiment for the enlargement of cannon was made; and in December of that year, a gun of fifteen inch bore, designed by Captain Rodman, was successfully cast at the Fort Pitt Foundry. Seventy-six thousand pounds of iron were melted for this gun, in three furnaces. The liquid iron passed in separate streams from each furnace into a common reservoir, where it intermingled, and then passed to the gun-mould. The gun was cast on a hollow core, through which the water circulated at the rate of about six cubic feet per minute, for twenty-four hours, when the core was withdrawn, and the circulation of water thereafter continued through the cavity left by the removal of the core for six days. The quantity of water which passed through the interior of the gun was 3,595,300 pounds—nearly eighteen hundred tons—and equal to forty-eight times the weight of the iron cooled. The additional heat acquired by the water in its circulation, and carried off from the interior of the gun, was ascertained to be seventy-three per cent. of all the heat contained in the melted iron when it entered the mould. The cooling of the gun occupied one

week; and the time employed in lifting it from the pit, and in turning, boring, and finishing it, was nearly five months.

With the improved machinery since erected in these Works, a gun of this class may now be cast, cooled, bored, and finished complete, all within twenty-five days.

The gun, when finished, was sixteen feet long and forty-nine inches in diameter, and weighed forty-nine thousand pounds.

In May, 1860, it was removed to Fort Monroe for trial; and in the course of that year it was fired five hundred times, with charges of thirty-five to fifty pounds of powder, and with shells weighing from three hundred to three hundred and thirty pounds.

The Board appointed to make these trials, composed of experienced engineer, ordnance, and artillery officers, reported, that from the inappreciable injury which the gun had sustained in these trials—the rapidity with which it was manœuvred and fired—they were decidedly of opinion that the introduction of this class of guns was practicable and desirable.

The manufacture and trial of this fifteen inch gun having proved entirely successful, Captain Rodman proposed in April, 1861, that a gun of twenty inch bore, twenty feet long, and five feet diameter, weighing about one hundred thousand pounds, to throw a ball of one thousand pounds, be next manufactured and tried. But as the Rebellion, which broke out just at this period, demanded the utmost efforts of all officers, and the resources of all the foundries for its suppression, the proposition could not then be considered.

Mr. G. V. Fox, Assistant Secretary of the Navy, ordered a fifteen inch gun for navy service. It was cast at the Fort Pitt Works in June, 1862; and was cooled in the same manner as the fifteen inch army gun. But in order to adapt it to service in turrets on shipboard, it was made about three feet shorter; and weighed, when finished, forty-two thousand and three hundred pounds. It was sent to the Washington Navy Yard, where it was tried by firing it with charges gradually increasing from thirty to seventy pounds of powder, and with shot and shells weighing from three hundred and thirty to four hundred and thirty pounds each. It endured eight hundred and sixty-seven fires, fifty of them with sixty pounds of powder, and was broken at last with a charge of seventy pounds of powder and a shot of four hundred pounds. This severe test proving so satisfactory, it was decided to introduce guns of this class into service. And accordingly, thirty of them were cast, and ordered on board the earliest turreted vessels constructed.

The great advantage of employing this larger class of guns in ser-

vice, was soon after demonstrated by the capture of the Rebel iron-clad ram "Atlanta" by the "Wechawken," June 17th, 1863. A single fifteen inch shot from the "Weehawken" broke the armor and wood backing of the Atlanta, prostrating forty men by the concussion, and wounding many more by the broken fragments of the iron and the splinters. The safety and convenience with which this class of fifteen inch guns may be served, in both forts and ships, and the immense superiority of their destructive powers over all other cannon heretofore used or known having been thus practically established, Captain Rodman's proposition to make a twenty inch gun was considered and approved; and in 1863, the Secretary of War, Mr. Stanton, ordered that one be made at the Fort Pitt Foundry—where the first twenty inch gun ever made was cast, in February, 1864.

The rough casting for this gun was twenty-five feet long, five feet and a half diameter in its largest part. One hundred and seventy-two thousand pounds of iron was melted for it. It was cast on a hollow core, and cooled from the interior, in the same manner as the fifteen inch gun before described. When bored and finished it was twenty feet four inches long, sixty-four inches diameter, and weighed one hundred and sixteen thousand five hundred pounds. It was sent to Fort Hamilton, New York, where it was mounted on an iron gun-carriage, and tried in October, 1864, by firing it five times, with charges of eighty, one hundred, and one hundred and twenty-five pounds of powder, with a solid shot of one thousand and eighty pounds. It endured these fires without any perceptible injury.

In May, 1864, a twenty inch gun was cast for the navy. Its length is about three feet less than the army twenty-inch gun, and weighs ninety-eight thousand nine hundred pounds. It was proved in April, 1865, by firing it eight times, with charges of sixty, eighty, and one hundred pounds of powder, and one solid shot of one thousand and eighty pounds, without injury. It has not yet been placed on board a ship.

Both of these twenty inch guns have thus far proved to be entirely safe, and preparations are now in progress for testing their durability, and for ascertaining the extent of their destructive powers against the strongest iron-clad vessels and fortifications.

In the progress of the manufacture of cannon in the United States, the calibres have been enlarged from the twenty-four pounder, established in 1819, to the one thousand pounder, cast in 1864—an increase of forty-five fold in a period of forty-five years; and but for its projecting trunnions, the largest gun of 1819 could be used in the gun of 1864 as a projectile, and be fired from it against an adversary instead

of shot or shells. It is not improbable that soon after a full trial of the twenty inch guns, others of twice their weight will be cast and tried, since the method of interior cooling permits an indefinite extension of size.

To meet the suddenly increased demand for heavy cannon, shot, and shells, on the breaking out of the rebellion in 1861, the Fort Pitt Works were much enlarged, by adding new buildings, large furnaces, and heavy machinery, at a cost in all of about $240,000.

In 1863, Charles Knap again became the sole proprietor of the establishment, which is now one of the largest and most complete cannon foundries in the United States or in Europe, as no other is known having the capability of manufacturing guns of such enormous size, or of producing any other kinds with equal despatch. It is now the oldest cannon foundry in the United States, having survived for more than twenty years all others which existed when it was first established in 1814. Its proprietors had each in continuous succession been previously engaged in conducting its operations, thus inheriting whatever knowledge of the art had been acquired by the cumulative experience of their predecessors for more than half a century.

The Works are built in the form of a hollow square, on a lot of ground four hundred by two hundred feet, occupying the four sides of an entire city block, bounded on three sides by public streets, and on the other by the Allegheny river. The foundry contains six reverberatory air furnaces, capable of melting from twelve to fifty tons each, and two cupalo furnaces capable of melting twenty tons. If all of them were put in operation at the same time, they would be capable of melting one hundred and sixty tons of iron, and of making a casting of that weight in one single piece. There are fifteen gun pits in the foundry floor, in which the moulds are placed vertically on end when the guns are cast Grate bars and ash pits are placed in the bottom of the pits for receiving fuel, with underground air flues communicating with them for the purpose of heating the pits while the guns are cooling.

The boring mill contains thirty-one lathes, employed in turning, boring, and finishing cannon, besides other special machines for dressing irregular curves, which cannot be accomplished by ordinary turning or planing machines. The lathe constructed specially for the twenty inch guns is sixty feet long and eight feet wide, and weighs ninety thousand pounds. The boring tool does not revolve while the gun is boring, but advances in the line of the axis of the gun while the latter is revolving. When all the lathes are in full work, the weight of guns in revolving motion at the same time exceeds four hundred tons. The lathes have turned, bored, and finished complete eighteen heavy guns per week, viz.: two of fifteen inch, ten of ten inch, and six of eight

inch; or at the rate of nine hundred guns per annum, requiring eleven thousand tons of melted iron.

The casting and boring apartments contain twelve large cranes, eight of which are worked by steam power. Four of the latter are capable of lifting, lowering, and moving horizontally, forty-five tons each, and all the others from fifteen to twenty tons each.

By means of the steam power cranes and other machinery, the heaviest guns are lifted out of the pits in which they are cast, and moved from place to place through successive lathes and machines until they are finished complete, when they are sent out of the Works and loaded on railroad cars for distant transportation by steam power alone.

The importance of obtaining iron of the best quality for use in a cannon foundry, has led to the employment of various methods for ascertaining its qualities by actual mechanical tests before using it in guns. By comparing these tests with the endurance of guns subjected to an extreme proof trial by firing with powder and shot until they burst, the mechanical tests indicate the qualities of iron most suitable for making the strongest guns. The methods now practiced are, first to examine the crude pig-iron closely with the practiced eye of an experienced founder before it is put into the furnace. Such pigs as are approved, are then placed in the furnace, and when melted, small quantities are taken out at frequent intervals and cast into small moulds, and as soon as the bars are cooled, they are broken and the fractured surface is examined to ascertain the condition of the iron, and to guide its further treatment in the furnace.

Whenever a gun is cast, a test bar from the same iron is cast in a separate mould, which cools within a few hours, and is tested before the next gun is cast. When the gun head is cut off, a sample is cut from that part of it which is nearest to the muzzle of the gun, and tested. This sample is the best representative of the quality of the iron in the body of the gun which can be obtained. But as this cannot be tested for several days after the gun is cast and cooled, the approximate test of the test bar serves as a guide for preparing the iron for the gun to be next cast.

The machine used for testing the iron was invented by Major Wade, in 1844, and has since been enlarged and improved by Major Rodman. It is made to exert a force of one hundred thousand pounds, which is applied or removed with great facility by the simple turning of a hand-crank, and it measures accurately to a single pound the resistance offered by the body under trial. It is arranged for measuring the resistance of metal to tensile, transverse, torsional, crushing, and bursting forces; for measuring the extension, deflection, compression, and per-

manent set, in either form of strain, and for determining the relative hardness of metals.

The specific gravity is ascertained by a hydrometer, designed by Major Wade, which receives specimens of any weight not exceeding two pounds. It is exceedingly sensitive, and gives the weight lost by the specimen, in distilled water, to the one hundred and forty thousandth part of the specimen weighed. Duplicates of these testing machines were obtained and sent to England, for use in the Woolwich arsenal, by a special commission of English officers, who visited the United States in 1854 for the purpose of examining the machinery used in our national armories, duplicates of which, also, they procured for use in their public armory at Enfield.

The instruments used in verifying the dimensions of cannon are numerous and well devised. The "Star Guage," which measures the diameter of the bore, the part in which the greatest accuracy is required, denotes differences so minute as the one thousandth part of an inch And such is the perfection of the boring machinery, and the skilfulness of the workmen now employed, that the variations from the prescribed diameter of the bore rarely exceeds the one five hundredth part of an inch in any part of the bore.

Government inspecting officers are present, and witness all the successive operations in the manufacture of cannon, from the selection of the iron for melting up to the completion of the gun, all of which they note and register. When the guns are finished, they are carefully inspected, weighed, and proved; and when they are received, the inspector stamps upon them the official marks of reception. The instrument by which they are weighed has a capacity of one hundred tons. A register of all the details of the manufacture of each cannon cast, and of all the tests made, is kept in the foundry books also. So that a minute and exact history of every gun in the public service is preserved in the ordnance offices at Washington and at the foundries.

There is probably no single establishment in the United States which attracted so much of public attention during the war as the Fort Pitt Foundry. It was thronged daily with visitors. Many travelling strangers in passing would delay their journey a day or two in order to visit the Works. Distinguished military and naval officers from England, France, Spain, Russia, Sweden, Denmark, Prussia, Sardinia, and Austria, who had come from Europe to observe the operations of our armies in the field, or to note the progress of the war, and the manner of conducting it, came from Washington city for the special purpose of examining the Works, and to witness the casting of the monster cannon

The Pittsburgh Copper and Brass Works,

Owned by Dr. C. G. Hussey and Hon. Thomas M. Howe, is another notable establishment, and the first of the kind built west of the Allegheny mountains. The Works were erected in the year 1850, and are located on the bank of the Monongahela river, in the immediate suburbs of the city. All descriptions of rolled and pressed copper are made here from ore obtained in the mines of Lake Superior, in two of the most prominent of which, viz.: the "Cliff" and "National," the proprietors of these Works are largely interested, and of which they are also officers and managers. As this was the first establishment projected for working exclusively American copper, and as the senior partner was one of the first successful explorers and adventurers in the copper regions of Lake Superior, his history is that of a pioneer in the development of what has become an important element of national wealth.

The attention of Dr. C. G. Hussey was attracted to the Lake Superior region in the summer of 1843, immediately following the consummation of the Chippewa Treaty, which extinguished the possessory claims of the numerous tribes of Indians known by that name, and he dispatched thereto during the same season a small party to make the necessary examinations preliminary to the organization of a regular mining force, if their report should be favorable. In the summer of 1844, he visited the region himself, and under his directions was commenced the first mining shaft, which was sunk in the vicinity of what is now known as "Copper Harbor," on a tract selected in pursuance of the *first permit* to locate lands issued by the United States Government. In the following summer, regular mining operations were commenced by the company originated by Dr. Hussey, and known as the "Pittsburgh and Boston Mining Company," of which he is now the President, on the *second* tract selected in that region, and upon which is located the celebrated "Cliff Mine." This mine was the first to give character to the section as a reliable and remunerating copper producing district, and up to this time it has produced more than seven millions of dollars' worth of copper, and paid to its stockholders a sum exceeding two millions of dollars.

The Pittsburgh Copper-Works, it will thus be perceived, are the proper and legitimate outgrowth of the extensive and profitable mining enterprizes with which its proprietors have been long and intimately associated.

The ore is brought from the mines in solid masses of native copper,

cut with a cold chisel, for convenience of transport, into pieces weighing three and four hundred weight, and is often of great thickness. When smelted, it is cast into bars and ingots, or rolled into sheets, and in these forms is sent to the various seats of manufacture in the United States.

In addition to manufacturing all varieties of braziers, sheet, bar, and ingot copper, the proprietors of these Works are also manufacturers of sheet brass and brass kettles, and dealers in tin plate, block tin, spelter.

Hussey, Wells & Co.'s Steel Works,

Owned in great part by the proprietors of the Copper-Works just noticed, are also noteworthy on account of being one of the first established and extensive steel manufactories in the United States.

The buildings, located in the central part of the city, cover an area of nearly three acres, including rolling-mills, hammer mills, melting shops, furnaces, etc. The machinery for forging and finishing the steel includes six train of rolls, one train for rolling large circular saw plates, and a large number of steam and other hammers. The whole is propelled by eight steam-engines, which are supplied from nine boilers of large dimensions. The total capacity of the Works at the present time amounts to twenty tons of steel per day.

This firm use none but the best American iron, without admixture with foreign varieties, and as the quality of their Cast Steel is warranted to be equal to the best English steel, they have demonstrated that America has ores as well adapted to this purpose as those found in isolated localities in Norway and Sweden; and as they were among the most enterprising and persistent in overcoming the difficulties that confronted the pioneer manufacturers in this department, and are now producing, of purely American stock, steel of a high standard and uniform quality, they are entitled to the credit that belongs to those who have contributed any important advance toward the consummation of commercial independence.

Besides the Works just mentioned, there are six other extensive Steel manufactories in Pittsburg, viz.: ANDERSON, COOKE & Co., PARK BROTHERS & Co., SINGER, NIMICK & Co., HAILMAN, KAHN & Co., REITER & Co., and BROWN & Co.

The O'Hara Glassworks—Jas B. Lyon & Company, Proprietors,

Is probably the best representative that could be selected of the many excellent establishments of the same description for which Pittsburgh is famous. Established for nearly a quarter of a century, and enterprising in originating novel designs, they have accumulated an immense stock of patterns, or metal moulds, some of which have cost two and others three hundred dollars each. The Glassware made here is remarkable for its clearness, smoothness, and purity of color, and the designs are excellently adapted to the material and mode of production. The silex used is a sand of a beautiful quality, found in Berkshire county, Massachusetts, and the minium is manufactured by the firm from pig-lead brought from the State of Illinois.

The Glasshouse, an extensive structure, one hundred and fifty by fifty feet, contains three large furnaces, each of which is capable of accommodating ten pots, that hold a batch of three thousand pounds of metal. These pots are all made on the premises, of a clay obtained from Missouri, which is found preferable to the imported.

Contiguous to the furnaces are five annealing ovens for tempering the glass after being made; and opposite are four furnaces, known technically as "glory holes," where the glassware is revitrified and polished, by which it obtains that clear, elegant, and gem-like appearance that is so desirable and pleasing to the eye. On the ground-floor are also the mill room, for grinding the clay; the pot room, where these huge receptacles are made; the lead house, where the lead used in making the glass is converted into litharge; a blacksmith shop, and other apartments of more or less importance in the operations of the establishment.

Ascending to the second floor, we come first to the pattern shop, where the moulds are designed and prepared, first in wood, then in plaster of Paris, and finally in iron. Adjoining this is the turning and repairing room, which is a miniature machine shop, provided with lathes and all the requisite tools for repairing, turning, and polishing the interior of the moulds to the smoothness and delicacy of a mirror—the importance of which will be readily understood when we state that any defect in the mould reappears in a blemish in the glass. The grinding and final polishing of the wares are done in the third story, where there are a dozen or more grindstones revolving with immense velocity, and driven by steam power. On the second floor are also the receiving and packing rooms, each forty by seventy-five feet. Here the final operations of inspecting, assorting, and packing the wares of the firm are carried

on, under the personal supervision of a junior partner, preparatory to their shipment to all parts of the South and West.

These Works, when fully occupied, consume annually about seven thousand tons of coal, employ one hundred and thirty hands, and produce about $500,000 worth of Glass annually. The weight of raw materials used in a year is eight hundred tons, which yield in finished wares about seven hundred and eight tons, thus showing a loss of only fourteen per cent.

The English Commissioners, in their Report on the "Industry of the United States," remark that the Glass manufactures of this country "are fairly established, and there can be no doubt of the present healthy position and future progress of this branch of industry. With superior metals in abundance, and skilled labor increasing with the development of the trade in which it is employed, the progress from the earlier productions, in which articles of common use were the staple, to those rich and decorative works, which belong to luxury rather than utility, has been steady and continuous; and though, from the position of the people, the more useful articles are those to which the manufacturer directs most attention, there is a laudable spirit abroad which compels him to attend to those branches of his trade wherein his European rival excels in the artistic elements of production. It must be remembered, too, that the manufacturing Glass by means of metal moulds in imitation of cutting, now generally known as 'Pressed Glass,' is an American invention, and was first introduced into England in 1834."

The firm of Jas B. Lyon & Co., who are the proprietors of the "O'Hara Glassworks," consists of four partners, viz.: JAS B. LYON, J. P. SCOTT, WILLIAM JOHNSTON, and WILLIAM S. DIXON.

The Pittsburg Iron Works—J. Painter & Sons, Proprietors,

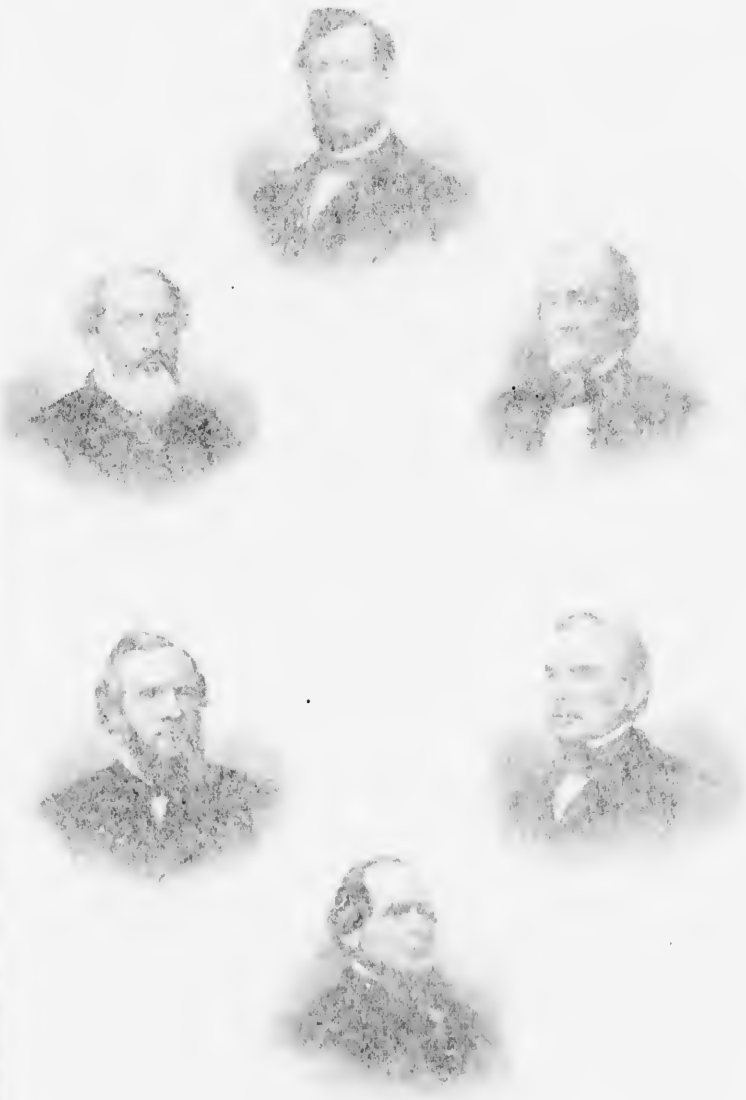
Located in West Pittsburg, is a fair representative of the many excellent Rolling Mills and Iron Works of which Pittsburg is the centre. They were originally erected in 1836, by Frederick Lorenz & James Cuddy, and provided with ten puddling and six heating furnaces, four trains of rolls, and about twenty-five nail machines. The principal building is of frame, with iron roof, two hundred and fifty by one hundred feet; but besides this, the firm own another mill, seventy by one hundred and forty feet, and numerous out-buildings, all with iron or slate roofs, for roll turning, warehouses, etc. In connection with the Works, and the property of the firm, are about one hundred tenement houses, occupied exclusively by their employees, who number over four hundred men, and with their families make a "settlement" of over fifteen hundred persons, directly dependent upon the Works for their means of subsistence. Many of the workmen have been especially trained for particular branches, and some have been connected with the Works fifteen and twenty years, and attained by long practice extraordinary proficiency.

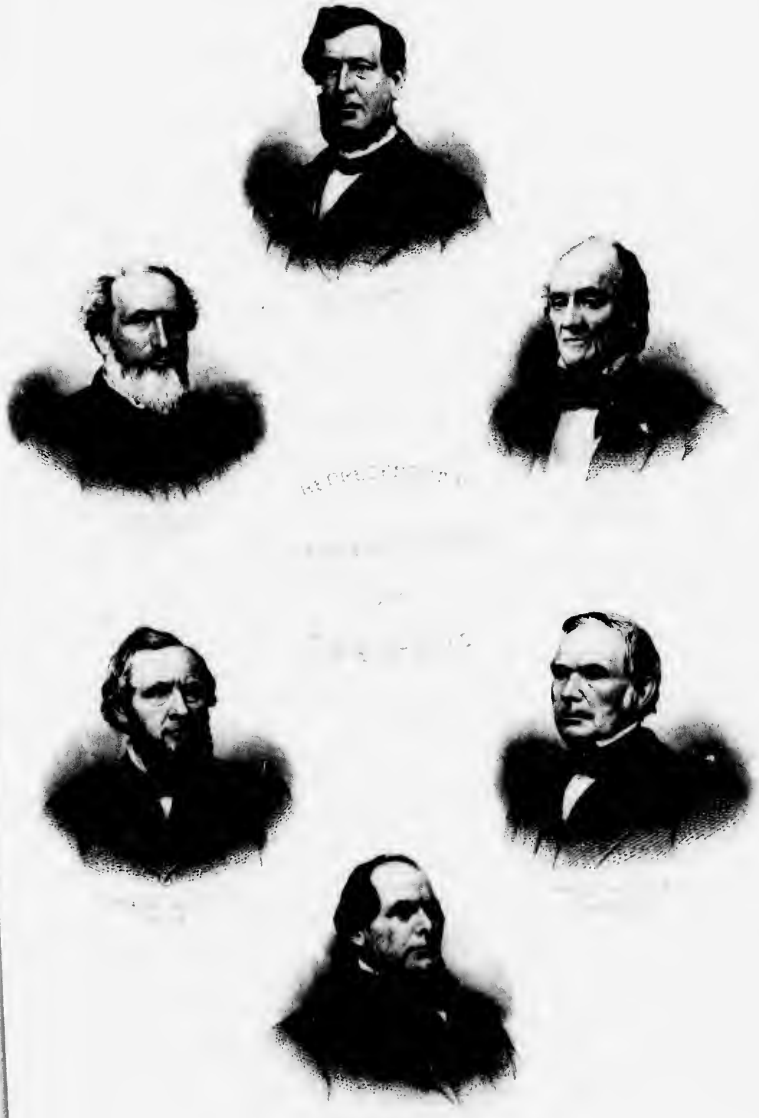
The machinery in the rolling mill has been greatly improved and increased within a few years, and now includes twenty-three puddling furnaces, seven heating furnaces, one sixteen-inch train of rolls, one twelve-inch, and three eight-inch, and one sheet roll (making sheets and plates up to thirty inches in width), besides a "Burden's Squeezer," and all the other late improvements to economize labor and material. The firm have a patent for the saving of the "fix" in the boiling furnaces, whereby they can save fifty per cent. over the old method. There are in the Works seven engines, of which the two largest have twenty-two inch cylinders, with fifteen feet stroke of piston, and seven boilers, each thirty feet long and forty-two inches in diameter.

The products of these works consist of Merchant Bar Iron of all descriptions, Sheets and Plates, Bands, Ovals, Squares, Rounds, and Tub and Pail Hoops. Of these last-mentioned articles Messrs. Painter & Sons supply nearly all the manufacturers of wooden ware in the West and Northwest. By long experience they are able to roll all the lighter descriptions of bands and hoops to a more uniform and exact gauge and width than the imported English, and, with one exception, perhaps superior to any made in this country. The capacity of these Works is fully equal to the production of twelve thousand tons of finished iron per annum, and it is claimed that their manufactures are

superior to the best English imported iron, and equal to the best American.

Mr. JACOB PAINTER, the senior partner in the firm, was born in the year 1802, in Westmoreland county, Pennsylvania, near the town of Greensburg. In 1828 he settled in Pittsburg, and for several years was a prominent wholesale grocer. Subsequently he became interested in the Iron manufacture, and was a partner in the firm of Lorenz, Sterling & Co., Zug, Lindsay & Co., and Zug & Painter, the former proprietors of the Pittsburg Iron Works. He has also been largely interested for many years in Charcoal Blast Furnaces in the Allegheny river region.





MANUFACTURES OF BALTIMORE.

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male Hands.	Female Hands.	Value of Annual Product.
Agricultural Implements	4	$248,000	$85,450	232	.....	$223,500
Blacksmithing	11	12,950	11,047	50	.....	37,080
Boots and Shoes	240	211,085	355,737	1,088	252	871,567
Baker's Bread and Crackers	68	72,135	277,722	184	9	460,585
Brass Founding	5	76,000	97,409	85	.....	154,000
Bichromate of Potash	1	70,000	100,300	50	.....	135,000
Brick	37	124,800	72,595	865	.....	278,600
" Fire	1	5,000	7,500	30	.....	18,000
Brooms	3	34,300	47,128	93	.....	63,358
Boxes	3	5,800	12,900	23	.....	27,300
Blocks and Pumps	6	4,000	2,980	15	.....	12,450
Burning Fluid	3	3,400	12,950	6	.....	27,368
Carriages	10	68,300	116,916	117	.....	217,025
Clothing	119	1,218,500	1,837,293	2,130	3,072	3,124,081
Confectionery	12	20,700	43,587	20	2	73,988
Carpets	6	16,050	6,296	12	.....	11,305
Cigars and Tobacco	129	226,850	254,703	516	1	706,649
Cloaks and Mantillas	4	12,200	17,450	1	41	28,425
Copper Smelting	1	600,000	1,050,000	150	.....	1,300,000
Cooperage	22	94,200	154,720	431	.....	319,005
Cotton Goods	1	10,000	32,500	150	.....	50,000
Chemicals	1	12,000	12,000	20	.....	30,000
Cordage	4	33,400	45,436	53	.....	66,490
Drugs and Dye Stuffs	1	43,450	52,900	40	.....	82,148
Earthen Ware	6	42,200	17,467	80	.....	54,138
Flour and Meal	5	72,000	548,550	51	.....	620,692
Furniture, Cabinet	38	266,400	193,480	435	35	534,010
Fringes, Laces, etc	3	35,800	18,121	22	13	39,800
Fruits, Preserved	4	26,500	34,500	15	56	63,700
Fire-Arms	3	12,000	3,019	19	.....	31,000
Gas	1	1,100,000	132,000	230	.....	375,000
Hoop Skirts	2	2,500	2,674	2	6	11,250
Hats and Caps	18	60,840	57,628	76	35	145,047
Horseshoes	4	1,300	3,401	13	.....	13,083
Iron, Bar and Sheet	2	225,000	305,777	315	.....	641,125
" Castings (including Stoves)	10	327,500	189,412	401	.....	589,000
" Pig	2	100,000	80,000	76	.....	130,000
Lumber, planed	7	106,000	234,950	155	.....	334,779
" sawed	2	70,000	25,600	22	.....	66,250
Locomotives	1	137,000	13,500	60	.....	50,000
Leather	14	335,100	345,165	99	.....	471,010
Liquors, distilled	2	70,000	117,300	18	.....	142,000
" malt	12	86,000	108,288	101	.....	211,161
" rectified	9	13,200	70,786	15	.....	124,367
Mathematical and Surg. Instr'nts.	2	9,000	1,500	12	.....	30,000
Machinery, Steam-Engines, etc	8	185,800	155,025	345	.....	302,500
Morocco Dressing	3	14,000	56,850	49	5	81,719
Marble and Stone Work	11	93,900	110,090	189	.....	229,760
Millwrighting	1	4,000	5,000	6	.....	10,000
Mirrors and Gilt Frames	4	17,900	15,045	19	.....	34,200
Nails, Horseshoe	3	2,500	4,095	0	.....	13,300
Nuts and Bolts	3	9,800	9,450	14	.....	23,460

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male Hands.	Female Hands.	Value of Annual Product.
Oil, Linseed	1	100,000	173,000	20		223,000
Oysters, Packed	25	652,434	520,130	1,247	451	1,025,920
Organs	1	3,000	3,800	7		12,000
Printing	7	201,000	114,178	204		324,954
Paper, Printing	1	4,000	13,000	12		30,000
Paints	4	3,500	8,405	8		24,055
Piano-Fortes	4	117,600	119,900	187		265,000
Plumbing	4	22,100	20,200	42		50,300
Pork Packing	5	187,080	748,250	65		928,235
Sash, Doors, and Blinds	4	13,760	8,040	14		23,840
Scales and Balances	1	20,000	1,500	8		10,000
Sugar, Refined	1	250,000	2,200,000	175		2,300,000
Soap and Candles	10	143,700	346,643	71		433,340
Saddlery and Harness	23	75,700	70,392	156	6	210,491
Ship and Boat Building	16	305,600	251,350	442		606,822
Shipsmithing	5	7,000	9,113	24		32,250
Sail Making	7	11,200	60,600	46		125,400
Shirts	2	7,500	27,075	5	48	35,000
Silver Ware	1	20,000	20,000	15		30,000
Shot	1	42,463	46,226	7		56,480
Tin, Copper, and Sheet-Iron Ware	37	88,500	100,820	205		282,030
Upholstery	4	11,500	27,200	33	20	47,045
Vinegar	5	2,000	3,432	9	1	11,020
Wheelwrighting	11	12,400	11,104	52		39,185
Wire Work	4	5,000	5,040	20		23,100
Total, including miscellaneous manufactures not above specified	1,100	$9,009,107	$12,624,737	12,388	4,666	$21,083,517
Aggregate of Baltimore County	1,310	$13,789,757	$18,068,683	15,925	5,907	$29,591,758
Aggregate of State of Maryland	3,083	$23,230,608	$25,494,007	21,930	6,773	$41,735,157
Increase since 1850, per cent.		20.3				

Hayward, Bartlett & Co.'s Foundry and Locomotive Works

Are among the most prominent of the manufacturing establishments in the city of Baltimore. They consist of two entire, distinct Works, and both extensive.

The general Iron Foundry of this firm occupies two squares of ground at the corner of Pratt and Scott streets, and the square at the corner of Scott and McHenry streets. This was established, in 1844, as a Stove Foundry, to which afterward was added the manufacture of Railing and other ornamental Iron work. As Iron came into general use for architectural purposes, their attention was directed to this branch, and with such success that they are now among the most extensive manufacturers in the country, having constructed a large portion of the elaborate Iron work used in the city of Baltimore and many sections of the South. Within the last ten years the firm have also engaged largely in the construction of Apparatus for heating by steam and hot water, in which they have been also remarkably successful, having sup-

plied not only many of the private and public buildings of Baltimore, but the Treasury building in Washington, and the Custom-houses in Portland, Me., in Buffalo, N. Y., and New York city. The size of the establishment and its adaptability furnish conveniences for the prosecution of all these different branches without conflict, as each department has its foreman and distinct set of workmen, from the Pattern shop to the Japanning and Gilding rooms.

In 1863, they assumed control of the extensive Works widely known as "Winans' Locomotive Works." They were established by Ross Winans, Esq., who removed to the city of Baltimore in 1830, and entered the employ of the Baltimore and Ohio Railroad—which then extended only to Ellicott's Mills—as Assistant Engineer. In 1835, he commenced the manufacture of machinery under the patronage of that road, and in 1838 founded these Works. Commencing with the manufacture of Chilled Cast-iron Wheels, he gradually extended his business until it embraced the construction of Locomotives, and, up to 1850, he had furnished the Roads in this section with over two hundred first class freight engines, known as the "Camel."

These Works adjoin the shops of the Baltimore and Ohio Railroad Company, and now occupy an area of four acres of ground, more than half of which is under one roof. The Boiler shop, in which from sixty to seventy hands are usually employed, has capacity for building twelve boilers at once. Adjoining this is the room for fitting up wheels and placing them under frames, and immediately adjacent, another for making Water Tanks. Then follow the Pattern Makers' and Carpenters' shops, in which some twenty-five hands are employed. Next are the Foundry and Smiths' shop, which contains forty-three forges, trip-hammers, and furnaces, with every other facility requisite for making frames, axles, and other heavy forgings. In this one hundred and fifty hands are ordinarily employed. But probably the most attractive feature of the establishment is the Machine shop, with its varied machinery, all moved by two powerful engines—this is large enough to furnish accommodations for two hundred and fifty workmen. Adjoining the Machine shop is a systematically arranged Storeroom for finished work, which connects with the Erecting shop, where a corps of mechanics set up the work as it comes from the different departments, after which it is rolled forward on railway tracks to the Paint shop.

The establishment has tools and shops sufficient to accommodate a thousand workmen, as many as eight hundred having been employed at one time. The present proprietors have changed the name to "The Baltimore Locomotive Works," added some of the best modern ma-

chinery, and are now constructing a new series of different styles of coal and wood burning engines, both freight and passenger.

The gentlemen composing this enterprising firm are J. H. Hayward D. L. Bartlett, and H. W. Robbins.

The Abbott Iron Company's Mills,

Near Baltimore, are among the largest and most celebrated Rolling-Mills in the United States. They are four in number, with another in course of erection, which it is intended shall be second to none in the completeness of its appointments. The original mill, built by Horace Abbott, in 1850, for rolling Plate and Boiler Iron, contains four heating and two puddling furnaces, a pair of eight feet plate rolls, and a train of muck rolls. At the time of its erection this Mill was larger than any before attempted in this country, and predictions were freely made that it would ruin its originator. Mill No. 2, completed in 1857, contains three heating and two puddling furnaces, a Nasmyth steam-hammer, one pair of eight feet and one pair of ten feet rolls—the latter being the longest plate rolls ever made in this country. Mill No. 3, built by Mr. Abbott in 1858, for manufacturing thin plates for Gas Pipe, Boiler Tubes, etc., contains two heating furnaces, and a pair of five feet rolls.

Mill No. 4, completed in the summer of 1861, contains three heating and four double puddling furnaces, a pair of ten feet rolls, a pair of "breaking down" rolls, a Nasmyth hammer, and other machinery, of the most approved and substantial character.

It was at these Mills that the armor plates for the original "Monitor" were made, which protected that little vessel from the shot and shell of her enemy so effectually that not a plate was pierced or injured. When Captain Ericsson had originated this form of iron-clad, he was apprehensive this country possessed no mills of sufficient capacity to furnish the Armor Plates of the requisite thickness and dimensions, and supposed he would be compelled to import them from England. Before doing so, however, he applied to Mr. Abbott, who at once agreed to undertake their manufacture, and completed the order in a shorter time than was anticipated. Had the completion of the Monitor been delayed, as it might have been, by the necessity of sending abroad for her armor plates, there would have been no obstacle to prevent the Rebel ram "Merrimac" from destroying our wooden fleet, and blockading the city of New York. Mr. Abbott subsequently furnished the armor plates for nearly all the vessels of the Monitor class built on the

Atlantic coast, and also for the "Roanoke," "Agamenticus," "Monadnock," and several other government vessels; and in 1863 he completed an order for two hundred and fifty thousand pounds of rolled iron in forty-eight hours—which elicited from the head of the Navy Department a letter highly approbatory of his fidelity and energy.

Horace Abbott, the founder of these Works, was born in Worcester county, Massachusetts, in 1806, and removed to Baltimore in 1836, where he purchased an interest in the Works known as the "Canton Forges," formerly owned and operated by Peter Cooper, Esq., of New York. He engaged in the business of manufacturing Wrought-Iron Shafts, Cranks, Axles, etc., for steamboat and railroad purposes, and claims the credit of having made the first large steamboat shaft ever forged in this country. This shaft was made for the Russian frigate "Kamchatka," and was exhibited at the Exchange in New York, where it attracted considerable attention. Mr. Abbott continued in this business until 1850, when he built his first Rolling-Mill; which was followed by others, as stated above. In August, 1865, he disposed of his Works to an association of capitalists, who organized a stock company known as the Abbott Iron Company of Baltimore City, who unanimously elected Mr. Abbott President, which position he now holds.

Charles Reeder's Marine Engine Works

Are among the old established institutions of Baltimore, dating their origin from a period nearly contemporary with our last war with Great Britain. They were founded by the father of the present proprietor, also named Charles Reeder, who removed from Pennsylvania to Baltimore in 1813, and built the first steamboat engine constructed in that city. He was distinguished for his mechanical skill and fidelity of workmanship, and established and maintained, during a long series of years, a wide-spread and enviable reputation. His son—the present proprietor—received his rudimentary instructions in the machinist's art in the workshop of his father, and in 1837 became a member of the firm, then known as C. Reeder & Sons. He aided in the construction of several vessels that, in their day, were considered of the first class; among others the steamer "Natchez," of eight hundred tons, built to run between New York and Natchez, Mississippi.

Since 1847, Mr. Charles Reeder has been sole proprietor of these Works, and within this period has furnished machinery for a number

of ocean and river steamers of large size. Probably the vessel that first attracted attention to his merits as a builder of Marine Engines, was the "Isabel," a steamer of twelve hundred tons, employed to carry the mails between Charleston and Havana, in the machinery of which he made several important improvements that rendered her eminently successful. Her superior speed and punctuality of arrival were so marked, that in Charleston she was called the "Chronometer." One distinguishing peculiarity of this vessel was, that her wheel houses were elevated some twelve feet above the water, while all other ocean steamers that had previously been built, and were at that time building, in this country, had their wheel houses only five or six feet above the water. No ocean steamers on the old plan have since been built, and the elevated wheel houses, of which the "Isabel" was the first, have been universally adopted.

Subsequently, the "Tennessee" and "Louisiana," and a number of other successful steamers for sea and river service, were furnished with machinery at these Works, the latest being the United States Revenue Steamer "Hugh McCulloch," which has received high commendation for the superior quality and excellent performance of her machinery.

This establishment usually employs one hundred and fifty hands, and its business embraces the construction of Stationary as well as Marine steam-engines, and manufacturing and mining machinery; for which ample facilities are afforded and every convenience is provided for executing work expeditiously.

MANUFACTURES OF NEW YORK AND BROOKLYN.

[According to the census of 1860 the aggregate of production in New York City exceeded that of any other city in the Union. It is but fair to add, however, that the items of Printing, Book, Job and Newspaper, amounting to over ten millions of dollars, and of Sugar Refining, amounting to over nineteen millions of dollars, caused the excess of production.]

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.	Brooklyn and Williamsburg, Annual Product.
Agricultural implements	1	$5,000	20	.....	$33,500	$256,000
Alcohol	1	125,000	20	.....	500,000	1,240,000
Artificial flowers	16	237,200	39	390	984,500	
Bakers' bread and crackers	207	573,748	998	111	4,367,993	1,139,845
Billiard tables	4	49,000	134	.....	269,050	
Bookbinding and blank books	37	407,400	530	471	1,036,218	322,977
Boots and shoes	491	1,612,680	3,644	440	3,869,058	
Boxes, paper	24	121,496	182	359	438,996	5,000
Brass founding	26	178,259	320	.....	570,660	
Britannia ware	3	11,500	14	.....	31,000	14,780
Brushes	22	283,100	245	15	595,957	180,000
Candles, adamantine	2	275,000	91	6	414,000	
Caps	18	67,050	97	134	359,557	
Cards, playing	2	63,000	51	4	154,000	
Carpets	9	766,200	466	580	930,149	112,500
Carriages and coaches	32	179,800	565	.....	599,825	
Cars and omnibuses	1	100,000	125	.....	125,000	
Chairs	37	304,425	568	6	714,026	459,800
Chemicals	5	28,000	24	.....	82,500	169,930
Cigars	162	277,100	843	29	1,114,451	
Cloaks and mantillas	15	81,700	18	379	618,400	210,486
Clothing	303	5,645,800	10,954	10,624	17,011,370	100,538
Coffee and spice grinding	11	179,100	81	2	426,184	37,720
Confectionery	38	352,150	369	117	1,208,536	481,006
Coopering	43	207,850	484	.....	538,160	131,434
Copper work	16	75,700	105	.....	265,200	1,390,196
Cordage	10	26,850	140	16	190,600	
Cured meats	20	678,000	205	.....	3,211,730	372,605
Drain pipe, pottery, etc.	7	17,800	158	6	294,700	10,000
Drugs, medicines, etc.	13	155,400	68	18	480,200	45,000
Earthenware	2	160,000	159	8	165,000	
Edge tools	5	20,400	33	.....	55,812	
Embroideries	3	11,000	3	78	56,216	
Engraving, plate and plate printing	29	48,850	123	.....	140,700	
Engraving, seal and die sinking	36	38,000	127	2	152,730	
Engraving, wood	29	49,650	147	.....	138,666	
Envelopes	9	235,300	110	179	602,700	
Firearms	7	26,300	83	.....	62,850	
Fire engines	4	43,500	73	.....	68,850	
Fishing tackle & fish-hooks	4	8,900	10	.....	13,000	157,000

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.	Brooklyn and Williamsburg, Annual Product.
Flour and meal	6	$272,800	193	.....	$2,612,500	$293,000
Furniture, cabinet	185	1,451,500	2,067	19	3,789,634	278,528
Furs	29	668,700	237	500	1,970,130	51,000
Gas	2	4,000,000	2,000	.....	3,284,500	797,000
Gas fixtures	17	232,350	578	.....	635,950	97,000
Gas meters	1	75,000	120	.....	100,000	
Gilt frames, mirrors, etc.	21	189,600	368	.....	548,300	20,000
Glassware	4	5,300	25	.....	32,750	504,436
Gold and silver refining and assaying	5	229,800	37	.....	420,570	148,700
Gold chains, jewelry, etc.	103	1,204,048	1,038	71	2,497,761	
Gold leaf	5	10,000	38	16	85,372	
Gold watch cases, etc.	19	96,900	127	3	337,090	31,700
Grates and fenders	7	85,000	67	.....	161,000	
Gutta percha goods	2	100,000	84	.....	125,750	
Haircloth	2	62,000	25	170	95,500	
Hats: silk, felt, and straw	44	334,900	538	205	2,215,783	1,632,456
Hoop skirts	20	267,800	210	1,434	2,064,667	167,950
India-rubber goods	2	305,000	69	53	380,000	
Ink, printing	6	131,000	54	.....	542,000	60,000
Ink, writing	2	6,850	20	3	81,658	12,000
Iron forging	1	150,000	60	.....	130,000	
Iron founding	41	1,074,300	1,904	.....	2,571,490	236,870
Iron, galvanized	1	30,000	40	.....	84,000	
Iron, malleable	1	10,000	15	.....	20,000	
Iron, pig	1	100,000	45	.....	216,000	
Iron pipes	3	60,000	102	.....	250,000	85,000
Iron and wire railing	22	297,100	337	.....	720,450	48,000
Iron machinery, steam engines, etc.	42	2,611,100	2,859	.....	4,560,942	1,278,300
Lamps and lanterns	8	88,000	102	.....	226,380	7,270
Lead, lead pipe and shot	4	950,000	126	2	1,937,000	10,700
Leather	7	66,000	55	.....	197,225	131,875
Leather belting and hose	2	104,000	42	.....	217,000	
Lithographing	23	157,850	321	.....	383,700	
Locks	19	61,900	98	.....	93,200	24,038
Mahogany sawing	7	108,500	51	.....	372,100	
Malt	7	443,000	97	.....	681,000	
Marble cutting	40	494,700	832	.....	1,260,949	471,300
Matches	2	110,000	172	170	41,200	15,000
Mathematical instruments	15	197,000	57	.....	7[illegible],116	2,500
Malt liquors	40	1,605,000	545	2	[illegible]40,875	732,833
Military equipments	5	42,300	64	16	13[illegible]50	
Military ornaments	1	700	4	.....	2,000	
Millinery	90	189,750	42	778	1,022,935	58,800
Millinery goods	0	31,500	44	265	238,154	
Mineral water	14	80,000	165	.....	244,378	163,400
Morocco	10	289,000	242	21	677,169	687,600
Musical instruments, miscellaneous	4	10,000	10	.....	27,000	
Melodeons	2	100,500	102	.....	160,000	
Organs	4	54,000	118	.....	112,000	
Piano-fortes	33	1,012,700	1,728	.....	2,429,867	74,000
Nails and spikes	4	5,000	14	2	40,000	35,000
Nuts, bolts and washers	4	41,000	60	.....	71,500	
Oils, coal	1	50,000	12	.....	90,000	391,110

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.	Brooklyn and William-burg, Annual Product.
Oils, lard	8	$165,000	56		$1,650,000	
linseed	2	200,000	70		660,000	$1,610,704
sperm and whale	5	523,000	53		1,170,481	
Optical instruments	3	7,800	31		66,620	
Paints and colors	10	597,500	272		803,500	
Paper	1	140,000	160		200,000	
Paper hangings	7	315,000	476	2	791,000	390,000
Photographs	80	101,980	129	10	427,202	1,200
Photographic materials, etc.	4	118,000	51	125	191,000	
Planed lumber	5	60,000	70		626,000	156,103
Plumbing and gas fitting	43	247,075	879		724,150	163,465
Pocket-books, porte monnaies, etc.	32	161,550	362	241	499,190	1,322
Preserved fruit and pickles	9	101,500	46	75	404,575	
Printing, book	17	3,121,000	1,435	718	3,225,551	
Printing, job	81	645,800	839	32	1,033,658	
Printing, newspaper	51	2,941,200	2,329	157	6,182,946	143,167
Printing presses	5	746,000	515		737,000	
Saddlery and harness	56	94,600	238	1	331,281	65,282
Safes	7	415,000	346		467,975	320,000
Saleratus	5	219,000	121		932,500	56,000
Sashes, doors and blinds	37	227,200	333		577,844	91,150
Satinet printing	1	25,000	15		15,000	
Sawed lumber	12	414,000	245		1,127,175	207,382
Scales and balances	3	53,000	60		138,000	
School apparatus	1	5,000	10	4	15,000	
Sewing machines	13	217,300	267		839,000	149,000
Ship-building	12	271,800	882		1,178,488	1,263,475
Ship-smithing	20	56,450	122		173,636	2,000
Shirts, collars, etc	42	406,950	125	2,704	1,845,357	
Shovels and spades	2	10,000	22		47,000	
Silk fringes and trimmings	27	209,180	262	522	724,687	186,040
Silverware	20	437,000	422	19	1,250,695	18,700
Silver-plated ware	20	83,600	135	63	257,770	
Soap and candles	22	606,600	293	2	1,800,505	858,200
Spiral springs	1	48,000	15		20,000	
Spirituous liquors, rectified	15	866,000	85		969,650	796,640
distilled	2	40,000	13		124,380	1,861,420
Stair building	6	36,000	69		114,300	34,000
Stair rods	2	9,000	15		38,000	
Steam & hot water heaters	6	195,000	211		413,050	
Steel springs	3	111,000	44		225,000	
Stereotyping and electrotyping	11	73,500	162		193,500	
Stone cutting	36	400,400	951		1,152,880	471,390
Stove polish	2	13,000	18	2	44,000	
Stoves, ranges and heaters	23	200,100	268		533,600	12,000
Sugar refining	14	3,949,000	1,494		19,312,500	3,794,000
Surgical and dental instruments	6	212,000	108	6	147,404	65,000
Tin and sheet-iron ware	92	353,350	496	1	757,184	455,446
Tobacco and snuff	7	218,500	429	318	1,000,700	10,720
Trunks and carpet-bags	26	113,300	161	8	282,868	19,800
Turning, ivory and bone	8	40,300	137		152,904	
Turning, scroll sawing, etc.	27	274,800	437		766,000	142,000
Type founding	8	290,900	222	188	465,400	

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.	Brooklyn and Williamsburg, Annual Product.
Umbrellas and parasols	18	$382,500	223	706	$1,660,066	$13,580
Upholstery	24	137,450	95	80	653,460	7,900
Varnish	2	310,000	74	.....	470,000	204,300
Vinegar	6	40,000	25	.....	65,470	24,850
Wheelwrighting	58	217,925	503	.....	624,935	125,087
White lead and zinc paints	1	20,000	10	.....	200,000	2,129,500
Willow ware	6	3,820	20	.....	15,408	5,312
Wire drawing	3	29,000	51	.....	156,008	
Wire work	11	57,200	155	.....	139,550	17,200
Woodenware	3	13,500	22	.....	25,800	
Total in 1860, including miscellaneous manufactures not above specified	4,374	$61,171,757	65,470	24,718	$159,082,366	$34,251,320

REMARKABLE MANUFACTURING ESTABLISHMENTS IN NEW YORK AND BROOKLYN.

The Marine Engine Works.

IT has been well remarked, that as the city of New York is sustained almost entirely by its commerce, and as this commerce is becoming every year more and more dependent for its prosperity and progress upon the power of the enormous engines by which its most important functions are now performed, the establishments where these engines are invented, made, and fitted into ships, which they are destined to propel, constitute really the heart of the metropolis; that the splendor and fashion of the Fifth Avenue, and of Union Square, and the brilliancy and ceaseless movement of Broadway, are mere incidents and ornaments of the structure; while these establishments, and those of kindred character and functions, form the foundations on which the whole of the vast edifice reposes.

In the first volume of this History were noticed the various attempts, of which any record is preserved, that were made during the last century to build steam engines in America, and the fact that Robert McQueen, of New York City, was probably the first who made the building of stationary engines a specialty. The rise of the Marine Engine Works may be said to date from the success of Robert Fulton in applying steam power to propelling vessels, as demonstrated by his

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steamboat *Clermont*, in 1807, whose speed was five miles an hour. Her engines and boilers were imported from England, and were manufactured by Bolton & Watt, of London. Very soon after the success of this first effort, Mr. Fulton erected a shop at what is now known as Jersey City,[1] where he built the *Car of Neptune*, and finished other engines during the balance of his life—the iron castings having been furnished by Robert McQueen and John Youle, and the brass castings by James P. Allaire, all of New York. Early in the year 1815, upon the death of Robert Fulton, Mr. Allaire obtained a short lease of his shop and tools, and, taking as partner Charles Stoutinger (Mr. Fulton's engineer), immediately commenced building the engine of the steamboat *Chancellor Livingston*, which developed a speed of eight miles per hour, with a cylinder 40 inches diameter and 4 feet stroke. Even at that early day, Mr. Stoutinger predicted that the cumbrous machinery then used in the engine would be dispensed with, that the running time of steamboats from New York to Albany would be about eight hours, and that steamships would cross the Atlantic Ocean within eleven days' time. It required almost the entire year to complete the engine and boiler of the *Chancellor Livingston*, about the close of which the copartnership of Allaire & Stoutinger was dissolved by the death of the latter. As Mr. Allaire had been in business as a brass founder at 466 Cherry Street, New York, since 1804, he transferred all the machinery and tools from Jersey City to that locality, in 1816, where he laid the foundation of the present establishment, the oldest of the existing steam engine works in New York, now so extensively and favorably known as

The Allaire Works.

From the earliest period of Mr. Fulton's efforts in developing steam as a motive power in navigation, Mr. Allaire felt a deep interest in the subject; and as all the brass castings of Fulton's engines had been furnished by him, he had had excellent opportunities of acquiring the requisite information to fit him to become Fulton's successor, and to carry out Stoutinger's idea of simplifying the construction of the steam engine. Immediately, then, on the removal of his machinery and tools to the scene of his earliest labors in brass founding, he devoted his best

(1) Mr. Zeno Secor's Fulton Iron Foundry, in Greene Street, Jersey City, marks the locality. Mr. Secor has just constructed and delivered to the United States Government the iron-clad Monitors *Weehawken*, *Comanche*, *Tecumseh*, *Manhattan*, and *Mahopac*. A large number of workmen are employed here, who within three years have completed work that is estimated to be worth three millions of dollars.

efforts to improve upon all that had been previously done. He now built the engines of the *North Carolina*, *South Carolina*, and *Robert Fulton*, steamships, and repaired the *Savannah*. The *Savannah* was finished in 1817, and will be remembered as having made the voyage to Liverpool in 1819, and as being the first steamship that crossed the Atlantic Ocean. Her original cylinder was on exhibition at the World's Fair, in New York, in 1853—diameter 44 inches, 5 feet stroke.

There was now found to be a demand for increased accommodations on the Hudson River, and the steamboats *North River*, *Fire Fly*, and *Chief Justice Marshall*, were built for that trade—each of them having boilers made of copper—as there was then no iron of suitable quality manufactured for the purpose, nor was it believed that this metal had the requisite tensile strength to stand the pressure. At this period wood was universally used for generating steam; and, with the flames extending out of the smoke-stacks of the steamboats at night, as they passed up and down the river, they were the wonder and awe of the ignorant and superstitious who beheld them. About this time anthracite coal was being developed to a limited extent in Pennsylvania, and Mr. Allaire entertained the opinion that it was possible to use it as a fuel for making steam. Most of his associates in steamboating resolutely opposed his theories on that subject; but he at length prevailed upon them to allow him to make the experiment, and the *Car of Neptune* was laid up to have new and suitable grate bars put in her furnace for that purpose. Such was the prejudice against this new innovation, that the firemen of the boat refused to attempt to burn "black stone," declaring it an impossibility, and Mr. Allaire was obliged to take some of his best workmen from his shop to assist him, and he (being chief fireman) did actually, after most herculean exertions, succeed in getting the boat to Albany in eighteen hours. Notwithstanding this trial had demonstrated that it was possible to use anthracite coal as fuel to make steam, Mr. Allaire's associates were too conservative to aid in developing a better method of accomplishing the purpose, and steamboats continued to light the heavens in their nightly voyages on the Hudson River for a longer period—wood being the only fuel that was deemed practicable.

Mr. Allaire continued in the business on his own account until the year 1842, always exerting himself to his utmost to improve and simplify the steam engine, giving his personal attention to details, and instructing his subordinates to invariably reject imperfect castings, and to permit no piece of machinery to pass their inspection unless it was perfect of its kind. During the year last named Mr. Allaire associated others with him, who formed a joint-stock company, incorporated under

the statutes of the State of New York, with a cash capital of $300,000, and they elected him their first President—which office he filled for eight years, retiring from the concern in 1850. The management of the works then passed into the hands of T. F. Secor, formerly of the Morgan Iron Works, who is general agent of the company, and the engines of the steamers *Baltic*, *Pacific*, *Illinois*, and *Panama*, may be cited as evidence of the continued capacity of the Allaire Works to build marine engines. The engines of the *Isaac Newton*, *Bay State*, and *Empire State*, on the Hudson River and Long Island Sound; the *Western World*, *Metropolis*, and *Niagara*, on Lake Erie; and the *America* on Lake Champlain, were also built here.

Among the more recent productions of this establishment, may be named the steamship *Vanderbilt*, as having the largest beam-engine on a sea-going steamer—with two cylinders, each 90 inches diameter, and 12 feet stroke; the steamers *Hu Quang*, *Po Yang*, *Kin Kiang*, and other vessels for the China trade. The chief work of this establishment has been for river and ocean navigation; but stationary engines have also been built here, and the company points with pride to a Cornish engine at the Cleveland (Ohio) Water Works, as a specimen of their skill in that direction; and also to the pumping engines of New Orleans.

A faint idea of the progressive increase of this manufacture may be gleaned from the fact, that while during the first year Mr. Allaire was in business as an engine builder, he was able to complete only a single one, now the Allaire Works occupy fifty-two lots of ground, each 25 by 100 feet, and employ about 1000 workmen, who turn out machinery annually that is estimated to be worth one million of dollars. A large number of men are now employed in the construction of a propeller engine, with a cylinder 100 inches in diameter and 4 feet stroke, intended for the double-turreted iron clad called the *Puritan*, one of Captain Ericsson's vessels of the Monitor style, and ordered by the United States Government.

The Novelty Iron Works.

About thirty-five years ago Rev. Eliphalet Nott, D. D., President of Union College, at Schenectady, New York, who had been very successful in the use of anthracite coal for warming houses, invented a boiler, with its appurtenances, for applying that fuel, then not used for such a purpose, to the generation of steam, and decided to test its merits fully by building a boat and equipping it with his improved boiler and en-

gines. In the plans determined upon, he was not only to use a new fuel, but a new boiler, and an engine constructed unlike any used in New York waters. His boat, therefore, embraced much that was *new*, and consequently received the name of "*Novelty*." Dr. Nott, finding that his projected enterprise would require special arrangements, not only for its creation, but also to enable him to keep the boat in the proper repair, decided to purchase the premises then known as Burnt Mill Point, on the East River, where a small wharf and some farm buildings furnished all the room he required. One of the engines of the *Novelty* was in a great measure built here with limited mechanical resources. From time to time the power and tools were added to, and when they were increased to an extent that enabled work for other parties to be undertaken, they were applied to such purpose. The place and shop where this work was being done for the steamboat *Novelty*, now became known in the neighborhood as the "NOVELTY WORKS,"—and thus originated the distinctive name by which it is still known throughout the engineering world.

At the time these new operations were carried forward, the business was conducted by the firm of H. Nott & Co., under the superintendence of N. Bliss, formerly of the West who had recommended the use of the horizontal style of engine for oat—the foreman being Ezra K. Dodd, who afterward was chief er of the *Novelty*. Subsequently Thomas B. Stillman had charge of the works, until the year 1838, when John D. Ward, Thomas B. Stillman, Robert M. Stratton, and C. St. John Seymour, purchased the premises, machinery, tools and fixtures, and conducted the business under the name of Ward, Stillman & Co.—the first two of the partners having charge of the mechanical operations, while the two latter-named gentlemen gave their attention to financial affairs. During the time the establishment was in their hands, its capacity in machinery and tools was greatly increased, and among the work turned out were the two ocean steamers, the *Lion* and the *Eagle*, constructed for the Spanish Government, and still in use under different names. In 1841, the firm of Ward, Stillman & Co. was dissolved by the retirement of J. D. Ward, and the establishment was conducted by Stillman & Co. In 1842, a new firm was created by taking in Horatio Allen, (the gentleman who imported the first locomotive engine into this country,) and the business was conducted under the name of Stillman, Allen & Co.—Mr. Seymour having retired. In 1855, the stock, machinery, tools, patterns, etc., were sold to an incorporated company, under the title of the Novelty Iron Works, of New York, whose cash capital is $300,000, by which company the business has been conducted up to the present time. Prior to the incorporation of this

company, the term Novelty Works was merely a designation of the place where the several firms carried on business; but since its incorporation The Novelty Iron Works is the legal designation of the body corporate by whom the works are carried on. At present, the principal management is in the hands of HORATIO ALLEN, President, and W. E. Everett Secretary.

The entrance to the works is on Twelfth, opposite Dry-Dock Street, where there is a large gateway, near which is a porter's lodge, with doors leading to the offices and to the drawing-room. At a short distance from the gate, and within the enclosure, there is a great crane for receiving or delivering the vast masses of metal, such as shafts, cylinders, boilers, vacuum pans, and other portions of the ponderous machinery that are continually passing to and from the yard. Turning to the left, and just beyond the crane, is the iron foundry—a building 206 feet long by 80 feet wide, with a wing upon one side. It contains four cupola furnaces, capable of melting at one heat sixty-five tons of iron, which can be deposited into one mould, making a single casting of that enormous weight. There is an additional furnace for special uses, and is employed as occasion requires. The blast for the furnaces is brought under ground through a pipe having a sectional area of five square feet. Opposite the furnace are six drying ovens, each having a railway and two carriages, and each within a sweep of one or more of six cranes, some of which are capable of hoisting twenty tons. Within this foundry, and below the surface of the ground, there are moulding pits, twelve feet in diameter and eighteen feet deep, the sides of which are firmly secured by plates of boiler iron riveted together. Six weeks are sometimes required to prepare the moulds for loam castings, employing from ten to forty men. Five of the strongest men are required to carry a ladle of molten iron from the furnaces to the reservoir from which it is discharged into the mould. The process of clearing the mould and hoisting out the casting requires about a week. In illustration of the capacity of this foundry for heavy work, it is sufficient to say that here were made the bed-plate of the steamship *Atlantic*, which weighed thirty-seven tons, and that of the *Arctic*, which weighed sixty tons. In the summer of 1854 there was also cast the cylinder of the steamship *Metropolis*, of the Fall River line, which was then the largest in the world—having a diameter of 105 inches, and a length of 14 feet, with 12 feet stroke of piston. Twenty-two persons sat down to lunch in this cylinder, with room to spare, and a horse and chaise were driven through it, both backwards and forwards.

In the smiths' shop, where all the wrought iron parts of the machinery are formed and fitted, there are thirty forges, with the requisite number

of men to each. Here also are large cranes, with chains connecting with small trucks on the top of the beams, for carrying whatever may be suspended further outward, or drawing it in, as may be required. These trucks are moved by a wheel at the foot of the crane, and are capable of carrying extraordinary weights. In one instance a single block of iron was forged which weighed 14,366 pounds. When forging such enormous masses, they are trucked up in a furnace to be heated, where they remain several hours. The masonry is then broken away, and the red-hot iron is lifted by the crane and placed under a massive trip-hammer. When the process of forging so large a mass of iron is going on, one man throws water upon the works to effect some purpose connected with the scaling, while others busy themselves about getting it into the requisite shape and dimensions as the forging proceeds.

Adjoining the smiths' shop are the machine and finishing shops, where the cylinders, piston rods, and other parts of the machinery, after being cast, are subjected to a refining and polishing process. These are provided with lathes, cutting mills, and planers of vast size and strength. There is also a brass foundry and a coppersmiths' room, each furnished with a crane and its appropriate tools. There are two boiler shops, provided with enormous shears to cut the iron plates into proper forms, rollers to give them the required curvature, punching machines to make the holes along the edges in which the rivets are inserted, and numerous drilling and boring machines. The whole establishment is divided into twenty departments, at the head of each of which is a foreman to superintend those under his particular direction, namely—iron founders, brass founders, machinists, boiler makers, carpenters, coppersmiths, blacksmiths, metallic life-boat builders, instrument makers, hose and belt makers, painters, masons, riggers, laborers, cartmen, watchmen, storekeepers, pattern makers, draughtsmen, and clerks; in all averaging more than one thousand men; and the value of the work finished is about $1,330,000 per annum.

The establishment occupies almost two entire blocks of ground, and includes two slips capable of accommodating the largest steamships.

The Delamater Iron-Works

Are situated on the North river, at the foot of West Thirteenth and Fourteenth streets. They were founded in the year 1850, by Messrs. Peter Hogg and Cornelius Delamater, who carried on business under the firm-style of Hogg & Delamater. This firm had a previous exist-

ence in 1842, at the well and favorably known Phœnix Foundry,[1] in West street, between Hubert and Vestry streets, which dated back to 1835.

The Delamater Works are distinguished for their capacity to build very heavy machinery, and have built larger cylinders than have thus far been cast and finished at any other foundry in existence. The original air engines of the caloric ship *Ericsson* were constructed here, which had eight cylinders—four of which each measured one hundred and sixty-eight inches, or fourteen feet in diameter; and the four others one hundred and twenty inches, or ten feet; the former having at least fifty-six inches greater diameter than that of any cylinder that was ever cast, finished, and put in a ship. In 1855, the firm was dissolved, Mr. Hogg retiring, and Mr. Delamater remaining to conduct the business as sole proprietor. Under his administration the Works prospered, and rapidly increased in reputation for the excellent character of the work finished there. As occasion required, the establishment was enlarged, new tools were added, and every facility obtained that was necessary to build light or heavy machinery, with the highest degree of perfection, in the shortest possible space of time. During the late Rebellion, the Navy Department of the United States Government derived very substantial aid from the skill and enterprise of this establishment. It was here that the machinery of the original *Monitor* was built; and the entire hull, turrets, and machinery of the iron-clad *Dictator* were also constructed here. The magnitude of the undertaking will be best understood, when it is stated that the *Dictator's* dimensions are three hundred and twenty feet long, fifty feet wide, and twenty feet depth of hold. Her engines have two upright cylinders, one hundred inches each in diameter, and six return flue boilers. The screw propeller is twenty-one feet six inches in diameter, with a pitch of thirty-two feet. The steam machinery and turrets of the *Kalamazoo* and *Passaconomy*, as well as the motive power of several of the iron-clads known to the public as the Monitor class, of which the *Passaic* may be taken as a representative, was built here, because nowhere else could they have been constructed within the time required by the government. A number of iron steamers were also constructed at these Works, among which the *Matanzas* is regarded as a vessel that reflects great credit upon her builders. Since 1842, the experimental

(1) The Phœnix Foundry, previous to 1842, was conducted by Mr. James Cunningham, an engineer of unusual skill, who contributed largely to the development of river marine engines, and was the first to cut off steam by the detachment of the inlet steam valve, an invention of P. Hogg, then an apprentice, in 1839. Previous to that date, independent cut-offs in the steam pipes were exclusively used.

machines, air, and other engines of Captain Ericsson, have all been constructed by the workmen of this establishment, superior facilities being enjoyed here for the purpose.

The Delamater Works occupy a space of two hundred feet fronting the North river, with a front of six hundred feet on Thirteenth street, and an equal space on Fourteenth street; as well as additional grounds on the south side of Thirteenth street, with a front of two hundred feet, by one hundred deep. The establishment is furnished with every requisite for building all kinds and varieties of machinery, besides stationary and marine engines, such as sugar-house machinery, machinery for water-works, etc., the proprietor having had considerable experience in most of these departments of mechanical engineering. There have at times been from one thousand to twelve hundred workmen, of all classes, employed here, the wages averaging during the past year $11,000 per week, equal to $572,000 paid for labor alone in twelve months. When the whole expense of conducting such Works is taken into account, and that the sum mentioned as paid for labor alone is but a fraction of the whole amount, it seems wonderful that such extensive operations should have been so successfully conducted under the proprietorship of a single individual. Most, if not all the large Marine Engine Works of New York, are conducted by corporations or firms comprising several partners; but the Delamater Iron-Works have achieved distinguished triumphs in engineering under the direction of a single proprietor possessing a mind of great executive and financial ability.

The Morgan Iron-Works—George W. Quintard, Proprietor,

Located at the foot of Ninth street, on the East river, are another of the noted Marine Engine Works of New York. They date their origin from 1838, when T. F. Secor, Charles Morgan, and William H. Calkin, trading under the firm-style of T. F. Secor & Company, leased eight lots of ground at that location, and erected buildings suitable for the construction of engines, boilers, and machinery of all kinds. The first marine engines built here were for the steamer *Savannah*, and the steamboat *Troy*, of the Troy line. In November, 1841, the Works were partially destroyed by fire, but were soon rebuilt. The business of building engines was prosecuted with such success, that in 1846 the facilities were found to be entirely inadequate to accommodate the increased demand, and the entire block bounded by Ninth and Tenth streets, Avenue D and the East river, was purchased, and the Works

enlarged to their present capacity. They also purchased one half of the block on the southerly side of Ninth street, running from Avenue D to the East river, and erected thereon the present offices, drawing-rooms, etc. Among the first large engines built at these new Works were those for the steamers *New World*, the *Crescent City*, and *Empire City;* and for the pioneer steamers of the United States Mail Steamship Company, the *Ohio* and *Georgia*. A highly successful business was prosecuted. From five to seven hundred men were employed until February, 1850, when George W. Quintard became sole proprietor, and the firm of T. F. Secor & Company ceased to exist.

Under his administration, important additions have been made to the mechanical resources of the establishment by the purchase of large and improved planers, lathes, slotting machines, and steam-hammers, one of which is capable of forging sixteen inch shafts. New docks, at which vessels of the largest class can be accommodated, have been built; and a floating derrick, capable of lifting, at one hoist, seventy-five tons, has been erected.

The engines in some of the largest of our sea-going merchant and war vessels were built at these Works; and those of two of the fastest boats running on the Hudson river, were designed as well as built here, namely, the *Thomas Powell*, forty-eight inch cylinder, and eleven feet stroke of piston; and the *Reindeer*, fifty-six inch cylinder, and twelve feet stroke of piston.

Among some of the well-known Ocean steamers running from New York, whose engines were designed and built at these Works, are the *Golden Age* and *Golden Gate*, eighty-three inch cylinders and twelve feet stroke of pistons; *Ocean Queen*, ninety inch cylinder and twelve feet stroke of piston; *Empire City*, eighty-three inch cylinder and nine feet stroke of piston; *Golden Rule*, eighty-one inch cylinder and twelve feet stroke of piston; *Mississippi*, eighty inch cylinder and eleven feet stroke of piston; *California*, seventy-two inch cylinder and eleven feet stroke of piston; *San Francisco*, seventy-six inch cylinder and twelve feet stroke of piston; *United States*, sixty inch cylinder and twelve feet stroke of piston; *Fulton*, sixty-five inch cylinder and ten feet stroke of piston; *Charles Morgan*, sixty inch cylinder and eleven feet stroke of piston; *Herman Livingston* and *General Barnes*, sixty inch cylinders and ten feet stroke of pistons; *De Soto* and *Bienville*, sixty-five inch cylinders and eleven feet stroke of pistons; *Manhattan* and *Vera Cruz*, sixty inch cylinders and eleven feet stroke of pistons; *Brother Jonathan*, seventy-two inch cylinder and eleven feet stroke of piston.

Of vessels for the United States Government, may be mentioned the

double-turreted Monitor *Onondaga*, carrying two fifteen inch Dahlgren and two Parrott guns. She has four main engines of thirty inch cylinder and eighteen inch stroke of piston. Her turrets are each worked by a pair of engines of twelve inch cylinder and twelve inch stroke, besides Blower engines, etc. Both the hull, which is entirely of iron, and the machinery, were designed at these Works, and she has proved a formidable addition to our iron-clad fleet. The list also includes the engines of the sloop-of-war *Ammonosuc*, consisting of a pair of geared engines of one hundred inch cylinder and forty-eight inch stroke of piston; and those of the *Wachusett* and *Seminole*, fifty inch cylinders and thirty inch stroke of pistons; and of the *Ticonderoga*, forty-two inch cylinder and thirty inch stroke of piston. At these Works were also built the engines for the sloop-of-war *Idaho*, consisting of four back-acting engines, thirty inch cylinder and eight feet stroke—twin propellers, of six blades each—which, together with boilers, condenser, and air-pump, are of novel construction and design. The engines of Webb's Italian frigate, the *Re Don Luige De Portugallo*, eighty-four inches diameter of cylinder, and forty-five inches stroke of piston, were made here; and also those for several Chinese steamers.

Besides marine engines, the Morgan Works have constructed some very important Pumping Engines for water-works, the largest being one of sixty inch cylinder and ten feet stroke of piston, capable of discharging fourteen millions of gallons of water in twenty-four hours; and another of forty-four inch cylinder and eight feet stroke of piston, capable of discharging eighteen millions of gallons in the same time. These were for the water-works in the city of Chicago.

The Works, consisting of an aggregation of buildings, foundries, and shops, cover an area of *ten city blocks*, and in them are employed from eight hundred to one thousand workmen.

The Continental Works—Thomas F. Rowland, Proprietor,

Located at Greenpoint, is a comparatively new establishment, that has attained prominence within a few years by the successful execution of important contracts, especially for Iron Steamships and Iron-clad Floating Batteries. Like almost all the Marine Engine Works of New York, these are situated on the East river, and have slips attached to the yard where vessels may be moored.

Among the first important contracts undertaken by the proprietor of these Works, was one with the Croton Water Board, in New York, in which Mr. Rowland agreed to construct a wrought Tube seven and

a half feet in diameter, and over a quarter of a mile in length, and place the same on the top of the high bridge over the Harlaem river—one hundred and twenty feet above its level—for the purpose of uniting the Croton Aqueduct and making a continuous water-way of equal transverse section from Croton Falls to the new reservoir at Central Park. This was successfully executed, and four hundred and fifty tons of wrought-iron plate, half an inch thick, and four hundred tons of castings, were consumed in the work.

At the outbreak of the Rebellion, Mr. Rowland commenced the manufacture of Gun Carriages and Mortar Beds for the Navy Department, and fitted out most of the steamers purchased from the merchant service which took part in the capture of Port Royal, and all of the vessels composing the "Porter Mortar Fleet."

In October, 1861, he contracted with John Ericsson and associates to build an Iron Floating Battery in accordance with Ericsson's plans. This vessel was launched from the Continental Works, January 30th, 1862, and arrived at Fortress Monroe, March 9th, the same year, where she fought the rebel Merrimac, establishing a complete revolution in the art of naval warfare. Mr. Rowland then contracted to build the iron-clad batteries "Passaic," "Montauk," and "Catskill;" and also the turrets for the batteries "Sangamon," "Lehigh," and "Patapsco"—the hulls of the two former vessels having been built at Chester, Pennsylvania, and that of the latter at Wilmington, on the Delaware.

Before the completion of these iron-clads, he undertook the construction of the hull and turrets of iron-clad battery "Onondaga," from Mr. Geo. W. Quintard, who had contracted with the government to furnish the vessel complete; and also built the iron-clad battery "Cohoes," known as one of the light-draft Monitor class; and the iron double-ender "Muscoota," designed for picket work, and the navigation of inland waters. The hull of the ocean iron-clad battery "Puritan," was also built here, and after being launched was laid up in ordinary at the Brooklyn Navy Yard, the return of peace having rendered her completion unnecessary.

The establishment at the present time is engaged in building Iron Steamboats designed for Cuban waters, and also in the manufacture of steam-engines and boilers adapted to the oil regions of Pennsylvania, and the various industrial pursuits of the Southern States.

The Etna Iron-Works—John Roach & Son, Proprietors.

These extensive and justly celebrated Works, like most of the other noteworthy establishments in this country, had an humble and unpretending origin. The original building was erected by Mr. John Glass, on a single lot of ground, twenty-five by one hundred feet, and designed for the purpose of making small castings. In 1852, Mr. John Roach purchased the premises; and though his cash capital in the beginning was limited to the insignificant sum of two hundred dollars, he has achieved a most remarkable success, for the Works in some respects are now without an equal on this continent in capacity to construct heavy machinery expeditiously. The building that occupied a single city lot, has grown under his proprietorship, until now the establishment covers a whole block, four hundred and ten feet long by one hundred and ninety-eight feet deep—bounded by four streets—and is four stories in height.

When his capital from the legitimate profits of the business had increased sufficiently to justify the undertaking, Mr. Roach resolved to supply a great national want by the erection of an establishment provided with facilities for constructing larger Marine Engines than any heretofore built in this country. With this object in view, he in 1860 despatched a confidential agent to Europe with instructions to examine all the most extensive Works abroad, and note every thing that he saw new or likely to be valuable. Having himself been an employee in several of the best Marine Engine Works of this country, and having obtained from the report of his agent a knowledge of the facilities enjoyed by European establishments, he was enabled to avail himself of all advantages in arrangement and selection of machinery. Among the many excellent tools with which these Works are equipped, there are at least two, that in size are not equalled by any in this country, namely, a planer that will carry a hundred tons weight, and work four cutting tools at a time—and a lathe, that is now capable of boring a cylinder of a diameter of one hundred and twelve inches, and can be easily altered to swing twenty-eight feet in diameter. In fact, the facilities of the establishment are such, that, it is conceded, more work can be executed here in a given time, than can be done elsewhere, either in this country or in Europe. An engine, from the time the castings are made until its completion, is pushed forward through the various processes with an ease and celerity truly remarkable; and payments, which, in the construction of engines, as of houses, are usually made at certain periods, according to the progress of the work,

are reached with a rapidity wholly unprecedented in similar establishments.

During the past few years there have been employed in these Works from nine hundred to fifteen hundred workmen of all grades, including some of the most skilful and accomplished that the offer of the highest wages could obtain. The whole establishment is controlled by a superintending engineer, Mr. T. Main, directly responsible to the proprietor; while the foremen of the various departments are absolutely supreme in their own sphere, yet responsible to the superintendent, from whose decisions there is no appeal. By this means a single controlling intellect is felt in the most minute details; and the consequence is a most thoroughly disciplined workshop, with a Napoleonic method of rewarding fidelity and skill when found a characteristic of a workman.

To the Etna Iron-Works belong the credit of having cast and finished some of the largest steam cylinders ever made. The United States Government steam-ram *Dunderberg's* two engines were built here, each having a diameter of one hundred and twelve inches, or nine feet and four inches, with twelve feet stroke of piston—which are among the very largest steam-engines that were ever built. Yet the workmen had little or no more difficulty in finishing these immense castings than if they had been of the usual size of ordinary marine engines. The engines of the *Bristol* and *Providence*, for the Merchants' Steamship Company, each having a cylinder one hundred and ten inches, were built here. So, too, were those of the *Rising Star*, the *Warrior*, and the engines and machinery of the United States Government double-end gunboat *Winooski*, and the steam frigate *Neshaminy*.

The Etna Iron-Works are not only creditable to the enterprise and skill of their proprietor, but they represent well the progressive character of the American people, whose patronage has sustained them. It is of course impossible to foresee the future wants of a rapidly growing nation, but it seems probable that these Works are prepared to anticipate any demand for still heavier machinery that may be made upon them for the next quarter of a century.

Besides her Marine Engine Works, New York is famous for the number of her ship yards, and the eminence of her ship-builders, though to notice them we shall be compelled to digress from the plan limiting descriptions to establishments, and trespass upon the province of biography. The department in which the ship-builders of New York have especially achieved eminence, is in the construction of steamers. In no other city of the United States have so many large steamships been built, and at this time nearly all the work is of this class, there being

not more than five or six sailing craft on the stocks in the combined ship yards of New York, Brooklyn, and Green Point. Foremost among the yards where magnificent specimens of naval architecture have been modelled and built, is

The Ship Yard of Wm. H. Webb.

This eminent ship-builder was born in the city of New York, June 19th, 1816, of parents whose ancestry on the paternal side was English, and on the maternal, Huguenot. His father, Isaac Webb, was a member of the ship-building firm of Webb & Allen, and for many years was associated with Henry Eckford, an eminent ship-builder in the war of 1812. Educated in the schools of the city, and at the grammar school of Columbia College, where he attained the first and highest position in mathematics, young Webb, at the age of fifteen, decided, against the wishes of his parents, to abandon school, and solicited an apprenticeship in the ship yard of his father, where he served for six years, with only one week of vacation, which was spent principally in a visit of examination to the first Dry Dock constructed in this country, viz.: that at the Boston Navy Yard. At the early age of twenty, he undertook a sub-contract for the building of the New York and Liverpool Packet ship "Oxford," of the old Black Ball Line, Charles H. Marshall, agent, though previous to that time he had been entrusted with the management of large numbers of mechanics, and the direction of works of importance. He pursued the business of constructing vessels as sub-contractor until he attained the age of twenty-four, when, his health failing, he made a voyage to Europe, from which he was speedily recalled by the death of his father, whose affairs were found to be involved. After these were arranged, he formed a co-partnership with Mr. Allen, his father's former partner, April 1st, 1840, which continued for three years, when Mr. Allen relinquished the then prosperous business to his partner, who has since conducted it alone with increasing and remarkable success, having built up to this time one hundred and thirty-three vessels, whose aggregate tonnage is greater than that of any other individual builder in the United States.

In the year 1852, Mr. Webb visited St. Petersburg, and received a contract for building a line-of-battle ship for the Russian Government. This was accomplished through the address and perseverance of the indomitable American, after an agent whom he had despatched twice for the purpose had failed in securing it, as it was contrary to the practice of all Governments to have vessels of war built outside of the Gov-

ernment Yards. The vessel, as originally contracted for, was to have ninety guns; but the occurrence of war between Russia and the allies having interposed an obstacle to the prosecution of the work as a violation of the neutrality laws, on its cessation a new plan and model, designed by Mr. Webb, were adopted, with a less number of guns, though of larger calibre.. The vessel was built in accordance with this plan, notwithstanding the written protest of the Representatives of the Russian Government, and the fact that it was never approved by the officials until after trial, when they were not sparing in their testimonials of approval and expressions of satisfaction. On September 21st, 1858, this steam frigate of seventy-two guns, seven thousand tons displacement, named the "General Admiral," in honor of the Grand Duke Constantine, was launched, and has proved to be the fastest steam vessel of war yet built, having made the passage between New York and Cherbourg, in France, in the unprecedented time of eleven days and eight hours, mostly under steam alone.

In 1860, Mr. Webb received an order from Count Cavour, Prime Minister of Italy, who sent for him to visit that country to conclude the contract to build two iron-clad steam screw frigates of thirty-six large guns, six thousand tons displacement. These vessels were clad with iron plates four and a half inches in thickness, from five and a half feet below water line to the upper deck, and when finished were found to possess extraordinary speed and sea going qualities, making the passage from New York to Naples, a distance of over five thousand miles, in eighteen days and twenty hours, principally with steam power, and in the winter season These vessels were contracted for just previous to the breaking out of the late Rebellion, and constructed during that time, when the demands of our own Government were pressing, and prices of materials had advanced largely, but no reclamation was made upon the Italian Government for an additional allowance on that account, and afford a convincing proof of the capabilities of the ship-building establishments of the city of New York.

Among the remarkable vessels now nearly completed at Mr. Webb's ship yard, is the steam screw iron-clad Ram, the "Dunderberg," ordered by the United States Government. This is the largest iron-clad that has yet been built, being seven thousand two hundred tons displacement, and affords more room for fuel, stores, provisions, and accommodations for officers, crew, and marines, than any other vessel of this description that has yet been built. The hull is massive, being solid from stem to stern, is three hundred and seventy-eight feet long, sixty-eight feet wide, and thirty-two feet deep. The frame timbers, twelve to twenty inches thick, are caulked and planked, and over the planking

two courses of heavy beams are laid, making in all an aggregate of five to seven feet of solid timber on the sides. The model or plan of the vessel, embracing a casemate, is entirely new and distinct from the turret or monitor class, the steering apparatus being especially novel, as one of the two rudders is placed before the screw, instead of aft, as usual. She is constructed expressly for a sea going iron-clad, and is expected to make fifteen knots an hour in smooth water. Her destructive power is immense, being armed with a prow of very peculiar shape, fifty feet in length, of solid wood, and covered with an iron peak, which it is believed will penetrate any vessel, whether wooden or iron-clad, that has yet been built, if struck with the force the Dunderberg can give. She is also armed with sixteen guns, on slide carriages, four of them being fifteen inch guns, carrying each 460-pound shot, and twelve eleven inch guns carrying each 182-pound shot, with two additional ports forward, in which two other eleven inch guns can be mounted if required. The total weight of her broadside is four thousand and twenty-four pounds of shot.

Among the new vessels now being constructed at Mr. Webb's ship yard are also two steamers for a line between New York and Boston, each being three hundred and sixty feet in length, forty-nine feet in width, and sixteen feet deep, and one of the two steamers ordered by the Pacific Steamship Line, to run between San Francisco and China. This is one of the largest steamers that has yet been built in this country, being three hundred and sixty feet long, forty-nine feet wide, and thirty-one and a half feet deep, and is intended to accommodate about one thousand passengers, and a thousand tons of freight. As this vessel is designed to combine the greatest strength with high speed, elements of strength in accordance with a plan originated by Mr. Webb have been introduced in her construction that have never before been adopted.

To enumerate all the important vessels that have been constructed by Mr. Webb in twenty years would be a tedious task. The list comprises three sloops, eleven schooners, five brigs, eleven barks, sixty-five ships, nine steamboats, and twenty-eight large steamships, in all one hundred and thirty-three vessels, with an aggregate capacity of nearly 200,000 tons. Among the sailing vessels built by him, were many of the famous London, Liverpool, and Havre packets of former times, including the "Guy Mannering," the first full three deck freighting ship ever built in this country; the ship "Ocean Monarch," of three thousand tons, which carried a larger amount of freight than any ship built in any country, having loaded over seven thousand bales of cotton with the extraordinary low draught not exceeding eighteen and a half feet of water; and the clipper ships, "Helena," "Chal-

lenge," "Comet," "Invincible," "Swordfish," "Young America," and "Black Hawk." Of these ships, the "Swordfish" made the passage from New York to San Francisco in ninety days, from wharf to wharf at the respective ports, and the "Comet" made five successive passages between the same ports that averaged one hundred days, one of which from San Francisco to New York, was made in seventy-six days, the shortest on record, and run, during one voyage, in three successive days, nine hundred and sixty-six knots, or about one thousand and twenty-five statute miles; and in one day, three hundred and thirty-two knots, or about three hundred and eighty-five statute miles. Among the steamships built by Mr. Webb, are the "United States," the first large steamer built for the New Orleans trade; the "Cherokee," the first large steamer built for the Savannah trade; and the "California," the first steamer built in this country for the Pacific trade, and the first to enter the Golden Gate in 1849, where now an immense fleet of sea and river steamers traverse the broad waters. Nearly all the large steamers engaged in the Pacific trade have been built in his yard.

Such a record of successful enterprise, in an important and difficult department, requiring for its prosecution mental qualities of a high order, is its own best eulogy.

The Westervelt Ship Yard,

Occupying the block bounded by Third, Goerck, Houston, and the East River, is another of the extensive ship yards for which New York is noted. Mr. Jacob A. Westervelt is probably the oldest ship-builder now engaged in active business; and has constructed, it is believed, more vessels of a medium tonnage than any other ship-builder in the United States. His history, which has points of instruction, as well as of interest, is briefly as follows:

He was born in Bergen county, New Jersey, January 20th, 1800, but removed with his father to the city of New York, in 1805. After the decease of his father, which occurred in 1814, he determined upon going to sea, and shipped, as boy before the mast, in a vessel bound to Charleston, South Carolina. Shortly after his arrival there the vessel was sold, and he suddenly found himself a stranger in Charleston, with only fifteen dollars in his pocket. After remaining there until nearly every dollar was spent, he again shipped as seaman on board a ship bound to Bordeaux, France. After making several voyages to Europe he concluded upon abandoning the sea, and learning the art and mystery of ship-building. With this intention, being then in his sixteenth year.

he visited all the ship yards, and finally entered that of Christian Bergh, as an apprentice, in the year 1816, where he remained until 1820. During that year, though only twenty years of age, an invitation was extended him by a gentleman residing in Charleston, South Carolina, to undertake the construction of two schooners at that place. Having obtained the consent of his employer (his apprenticeship not having expired), he at once embarked on board a sloop of sixty tons, and after a stormy and dangerous passage of fifteen days, landed safely in Charleston. He at once commenced his first two vessels, employing in their construction negro slaves owned by planters residing in and around Charleston. Upon the completion of the vessels he returned to New York, and at once became a partner of Mr. Bergh; with whom he remained associated until Mr. Bergh retired from business, in the year 1835; after having built, during fifteen years, seventy-one vessels, nearly all of which were ships ranging from four hundred and fifty to six hundred tons.

Mr. Westervelt then resolved upon a voyage to Europe, where he remained nine months, and upon his return he resumed business, taking a yard at Corlear's Hook (foot of Cherry street), where he built a number of large and fine ships, and remained until he removed to his present location. A yard at the foot of Seventh street was also taken, soon after, and for several years both were kept well filled with vessels in course of construction, and required by the then opening trade to California.

Mr. Westervelt originated and built, in connection with Mr. Edward Mills, the steamships "Washington" and "Hermann," the pioneers of American Ocean Steamers. The steamers "Franklin" and "Humboldt," the first of the present Havre line, were built by him shortly after; and at a more recent date he built the steamer "Arago;" now running in the same line; also the steamer "Rhode Island," now owned by the United States Government, and the "Eagle," and "Moro Castle," owned by Spofford, Tileston & Co. Among the most celebrated clipper ships built by him were the "N. B. Palmer," "Contest," and "Sweepstakes." Quite a number of vessels for the American and foreign governments have been constructed by him; among which may be named the frigate "Hope," of two thousand tons, built in the year 1825, for the Greek Government; the "Guadalquiver," for the Spanish Government; the "Fusiyama," launched last year, for the Japanese Government; and the "Ottawa," "Otsego," "Kankakee," and sloop of war "Brooklyn," for the United States Government. The last named vessel has, during the recent war, proved second to none in our navy, as her brilliant record fully demonstrates; and Vice-Admiral

Farragut has repeatedly asserted that she is the most efficient man-of-war belonging to the Government. This vessel was built by Mr. Westervelt during the year 1858; the contract having been awarded to him by the committee appointed by the Secretary of the Navy, after the leading ship-builders in this country had presented their models and drawings for the vessel. It may here be stated that Mr. Westervelt, although never a politician from choice or inclination, has held many important public positions, and after representing his ward and serving on many important committees, he was in the year 1852 elected to the Mayoralty of New York, by one of the largest majorities ever given to a candidate for that position.

The following is the number, class, and tonnage of vessels built by Mr. Westervelt and his son, up to the present time:

Fifty steamships, ninety-three ships, five barks, four brigs, fourteen schooners, one sloop, two floating light ships, one safety barge, eleven pilot boats, in all one hundred and eighty-one vessels, with an aggregate capacity amounting to one hundred and fifty thousand six hundred and twenty-four tons.

Since the year 1859 the active management of the Westervelt Ship Yard has been conducted by the son, Daniel D. Westervelt, although the senior still supervises most of the details connected with the building of vessels. This gentleman is probably the only American ship-builder who has received an order of knighthood from a foreign government for skill in his profession.[1]

(1) The particulars of the order of knighthood bestowed upon D. D. Westervelt are as follows:

Mr. D. D. Westervelt, during the year 1861, received an invitation from the Spanish Government to forward them models and drawings for three steam frigates of forty, fifty, and sixty guns, respectively; promising to Mr. Westervelt, at the same time, the construction of the ships, should the plans prove satisfactory to the Department of Marine, before whom they were to be submitted. The examination proving highly satisfactory, an Admiral was delegated with full power to close the contract, and to direct the builder at once to begin the construction of the vessels. Immediately upon his arrival the Rebellion broke out, and Mr. Westervelt, being unable to procure the live oak and yellow pine required to build the ships, was compelled to abandon the contract. The Spanish government, in order to testify the estimation in which the models and plans were held by them, recommended that the order of "Isabel la Catolica" be conferred upon Daniel D. Westervelt. The Queen, approving this decision, at once forwarded the insignia of the order, together with a complimentary letter, to the Spanish minister at Washington, from whom Mr. Westervelt received them. The emblem or order is an eight-pointed star, with enamelled circular centres, having on one side the initials of F. R., with the motto "Por Isabel la Catolica" circumscribing it; and on the other a representation of the Eastern and Western hemispheres, surmounted by the Spanish crown, alongside of which stands two columns, around which a wreath is entwined, bearing the words "Plus Ultra." Circumscribing it is the motto "Ala Lealtad Acriselada."

Henry Steers' Ship Yard,

Located at Greenpoint, Long Island, is noteworthy, from the fact that some of the largest and finest steamers in the merchant service have been constructed there, and the largest wooden merchantman yet built in this country, and, probably, in the world, is there at this time approaching completion. It is situated at the foot of Green and Huron streets, on the East river, and occupies an area of one hundred and sixty-two thousand five hundred square feet of ground.

Henry Steers, the proprietor of these yards, is one of the youngest of the eminent American ship-builders, having been born September 14, 1832; but is descended from a tribe of shipwrights—his father, grandfather, and great-grandfather having been connected with the profession. He is the nephew of George Steers, the celebrated yacht builder, whose untimely death, about ten years since, deprived New York of a man who had made American yachts famous in foreign waters. Young Henry was educated in schools of his native city, and was examined and passed for admission into the free Academy; but, at the age of sixteen, following the traditionary bent of his ancestry, he elected to go into the ship yard of his father and his uncle George, who were then associated in business. He there served a regular apprenticeship, passing through all the gradations, from a grindstone boy to a foreman, evincing quick perceptions and more than ordinary mathematical talent, which he assiduously cultivated, so that, upon attaining his majority, he was able to take a position with the best educated and most promising shipwrights. For several years he was foreman in the ship yard of his uncle, George Steers, and, from his association with him, undoubtedly gained much practical knowledge, which has since been of great service to him in his profession.

In 1857, he commenced business on his own account, first building several yachts and pilot boats, which were noted for their elegance and swiftness—among them the "Charles H. Marshall," one of the best and fastest pilot boats now in use in New York harbor.

In 1859, Mr. Steers located himself at Green Point, where he still conducts his business, and where he built the "Hu Quang," the "Che Kiang," and the "Foh Kein," now in the China trade. The "Foh Kein" made the quickest trip to China ever recorded, and is now the fastest boat plying in Chinese waters. Her length is two hundred and seventy-five feet; breadth, forty-four feet; depth, twenty-two feet; and capacity about two thousand tons. The "Arizona," launched by Mr. Steers in January, 1865, for the Pacific Mail Steamship Company, is just making her first trip from New York to Aspinwall. Her length

is three hundred and twenty-five feet; breadth of beam, forty-six feet; depth, 27 feet; and capacity about thirty-two hundred tons. The steam frigate "Idaho," built by Mr. Steers for the United States Government, is three hundred feet long, forty-four feet wide, and twenty-four feet deep, and of a most beautiful model. He is now building, for the Pacific Mail Company, a steamship, the consort of the one before referred to as being constructed by Mr. Webb, and as it is wider than that, is believed to be the largest wooden steamship that has ever been constructed. Her extreme length between perpendiculars at load line is three hundred and sixty feet; breadth moulded, forty-eight and a half feet; breadth extreme, fifty feet; and depth of hold to top of spar deck beams, amidships, thirty-one feet six inches. The vessel will have three full decks, and an orlop deck at each end, extending to boiler and engine bulkheads, and a platform in lower hold to receive cargo and coal. The bulwarks will be of white pine, and amidships the frame timbers will run up to the rail where the bulwarks will be of yellow pine, both inside and out, thus making them solid. She will be divided into four water-tight compartments, and strongly braced with iron bars, running diagonally throughout the entire length of the vessel. Her capacity will be forty-seven hundred tons burden, and the cost, when ready for sea, over a million of dollars.

Mr. Steers has constructed in all sixteen vessels, the most of them large, and some of them remarkable for the beauty and symmetry of their models. It is undoubtedly a proof of substantial merit and a fine genius that one so young should receive contracts requiring for their fulfilment the greatest skill and responsibility, and if his future shall realize the promise of the past, a more extended biography of Henry Steers will yet be written.

John Englis & Son's Ship Yard,

At the foot of Tenth street, East river, is noteworthy, from the fact that here nearly all the large Sound and the finest River boats in the world have been built. It has a front on the river of two hundred and fifty feet, and extends back five hundred and sixty feet, making the aggregate area one hundred and forty thousand square feet.

John Englis, the senior partner and proprietor of this yard, was born in the city of New York, and after serving an apprenticeship of seven years with Smith & Dimond, became foreman for Bishop & Simonson, then noted ship-builders. In 1837, he went to Lake Erie, and built his first steamers—the "Milwaukie" and the "Red Jacket"—and, on their completion, returned to New York and established himself at his present

location. Here he has built in all fifty-six steamers, averaging fifteen hundred tons each, making an aggregate of eighty-four thousand tons. Among them were seven steamers for the China trade, one of which, the "Sumo Nada," made the voyage from Hongkong to Shanghai, a distance of a thousand miles, in fifty-six hours. English ship owners have expended large sums in the construction of fast vessels for this trade, but have not succeeded as yet in securing any that have equalled in speed those constructed by Mr. Englis. In 1853, he also built the steamers "Plymouth Rock" and "Western World," which for a considerable time were the fastest steamers on the Western lakes. In 1861, he built the "Unadilla," which was the first of the gunboats delivered to the Government, and was constructed in forty-eight days, or twelve days less than the contract time. The Secretary of the Navy, under date October 8th, 1861, wrote that "It gives the Department much pleasure to add that the reports of the Inspectors are in the highest degree complimentary of the manner in which the work has been executed."

But, without doubt, the field in which Messrs. Englis & Son have achieved their greatest triumph is in the construction of magnificent Sound and River steamers. The Steamer "St. John," for the People's line, running between New York and Albany, heralded the dawn of a new era in marine construction, and is truly a "floating palace," that foreigners have not hesitated to say is worth a visit from Europe to America to see. She is a vessel of thirty-five hundred tons burden, and has a capacity for carrying seventeen hundred passengers and seven hundred tons of freight, without drawing more than six and a half feet of water, and can make the trip from New York to Albany in nine hours. Her saloons are in double tiers of state-rooms, lighted by gas and heated by steam. The upholstery and decorations are of the most costly kind. A recent mishap to her boiler has effected a revolution in boiler making, by inducing builders to brace and strengthen parts that it was before supposed did not need strengthening. Since her construction, Messrs. Englis & Son have built her consort, the "Dean Richmond," and are now constructing another of equal magnificence, three hundred and eighty feet in length and eighty-two feet across the guards. Among the fine Sound steamers constructed at these yards, are the "Newport," three hundred and forty feet in length, forty-four feet beam, and fourteen feet hold, which makes the trip from New York to Newport, a distance of one hundred and sixty miles, in eight hours, and the "Old Colony," which is three hundred and ten feet in length, forty-two feet in beam, and fourteen feet in depth of hold.

The average number of men employed at these yards is two hundred and fifty, though at times, as many as four hundred and fifty have been employed.

J. B. & W. W. Cornell's Iron-Works.

New York has, in this establishment the largest and most completely equipped Works in the United States for the construction of Fire-proof buildings. They date their origin from 1847, when the two brothers, after having served an apprenticeship of about six years, commenced business with a small capital, and employed, at first, only one man and a boy. They now employ about five hundred men, and occupy, with their foundries and workshops, twenty-six city lots of ground. The old or original manufactory is located on Centre street, on which it has a front of two hundred feet, and extending back one hundred feet; the new foundry, erected in 1859, is located on Twenty-sixth street, between Tenth and Eleventh avenues, and is four hundred and twenty-five feet by one hundred, and from one to four stories in height. The moulding floor has a superficial area of fifteen thousand square feet.

Less than twenty years ago, there was probably not a building in the United States occupying a plot of ground say one hundred feet square, in the construction of which as much as ten thousand dollars' worth of iron was used. Now there are several that contain from two to three hundred thousand dollars' worth of Iron-work. The first buildings in this country rendered fire-proof by the use of wrought-iron girders and beams for floors, were the United States Custom House at Savannah, and the Sun and Atlantic Mutual Insurance Company, and Seamen's Savings Bank of New York. That this very large increase in the use of iron for fire-proof buildings is, in part, attributable to the improvements made by Messrs. Cornell, is evident from the fact that much of the work used is manufactured under patents granted to them, of which about twenty have been issued to them during the last twelve years.

One of the first patents that we find credited on the records of the Patent Office to J. B. Cornell, is for an improved manner of uniting the sheet metal slats of revolving shutters for store fronts. This was patented September 12, 1854. In 1856, he received a patent for a new and improved plaster-supporting metallic surface, to be used in the construction of fire and burglar-proof plastered partitions. This was followed by a very valuable invention for a continuous corrugated sheet lathing, constituting fire-proof partitions and ceilings. Previous to this invention, it was usual to support a plastered surface of a partition or ceiling by narrow metallic strips, arranged with intervals between the edges for the plaster to pass through; but Mr. Cornell improved upon this by so arranging sheets of iron as to leave no openings for the plaster to pass, and form retaining locks upon the inner

surface, consequently rendering them in every way more safe and secure. It was in this way, by the exercise of mind in invention and valuable improvements, that the great work of popularizing iron as a building material was accomplished.

It is believed that the buildings of the Mutual Life Insurance of New York, and the New York Stock Exchange, recently completed by this firm, are the most complete and perfect fire-proof buildings in the United States. The beams, girders, roof, and studding for ceilings and partitions, are all constructed of iron, of which over two hundred thousand dollars' worth was used in each structure. The New York Herald building, now being erected by the Messrs. Cornell, will also be of iron and fire-proof.

Among the specialties manufactured by this firm, and extensively used, are burglar-proof safes, made in accordance with a patent issued to Ira L. Cady in 1858. Rivets, which are a vulnerable point in safes generally, are dispensed with in these, as they are formed by pouring in a stream of molten iron between plates of wrought-iron perforated and counter-sunk. The molten iron, coming in contact with the wrought, is chilled, and the combination, especially when several plates are thus cemented together, as in their first-class Safes, has thus far, we understand, proved impregnable to the assaults of the most ingenious and determined burglars.

Herring & Co.'s Safe Manufactory

Is one of the most prominent of the manufacturing establishments in the western part of the city of New York. It is located at the junction of Ninth avenue with Hudson street, and extends from Thirteenth to Fourteenth street. The building is five stories in height, with a basement, and each floor is divided into apartments for work of a special kind; the second floor being appropriated more especially for the construction of Burglar-proof Safes, while the ordinary fire-proofs are made principally on the fourth floor, and the locks, and vaults, and vault doors on the fifth floor. The engine that propels the machinery is in the basement, where are also the kilns, and a shears, operated by steam, for cutting boiler plates. Here the bar and plate iron is stored, and the japanning is executed. The first floor is divided into rooms for filling, for painting, the offices, and a wareroom for finished safes. The cabinet work is executed in an adjacent four story building, separated from the main structure by a fire-proof wall, and the foundry work in a distinct establishment, at 740 Greenwich street. Besides these estab-

lishments, the firm have manufactories at Philadelphia and Chicago, and employ in all about four hundred persons.

In 1851, at the London Exhibition, Mr. Herring's safes were exhibited, and European manufacturers challenged to a trial by fire; but none of them manifested a desire to accept this test of comparative merit. Two hundred pounds sterling were placed in the safe drawer, and a notice put up that the money was at the service of any one who could obtain it with or without the keys; but no one became any more wealthy by the offer. In 1859, a chemist of Philadelphia having discovered that carbonated chalk, a residuum in the manufacture of mineral water, was superior to any other substance then known as a non-conductor of heat and a resistant of fire, Mr. Herring purchased the secret, patented it, and commenced the manufacture of what has since had great celebrity as Herring's Patent or Champion Safe. Nearly fifty thousand of these safes have been manufactured and sold, and as they have passed through many devastating conflagrations, and preserved books and securities amounting in the aggregate to millions of dollars, the confidence of commercial men in their value is firmly established.

But besides the construction of safes designed to be a security from fire, this firm have given much attention within a few years to the manufacture of Burglar-proof Safes, Vaults, and Chests. In this department, it is probable, they are without a rival in the world. A Safe, made as they make their first-class Banker's Safes, must be invulnerable to any attacks within the resources and time afforded to any burglar, however accomplished. Among the specialties employed in their construction, is a peculiar material made from Franklinite ore, found in Sussex county, New Jersey, which possesses a hardness exceeding that of the finest tempered steel, and marks glass with the facility of a diamond. This metal, often presenting the appearance of beautifully crystallized silver, is so interwoven with wrought-iron rods that it can be battered until bent without being broken, and at the same time the combination of wrought and crystallized iron is such that, in any attempt to drill, the tool will pierce the soft metal faster than the hard, and, consequently, working sideways, will soon have its point fractured or broken off. A first-class Banker's Chest, as constructed by this firm, consists of three casings of one fourth inch wrought-iron with angle corners, a casing of one fourth inch steel bars, a casing of one fourth inch wrought bars with angle of solid corners, a casing of patent crystallized iron two inches thick, with wrought-iron rods cast through it and projecting rivets on both sides, so that the entire thickness is three and one fourth inches. Such a Safe will not only overcome any drill or cutting tool, but is also a resistant against sledging or battering, which

has been the weak point in Safes in which hardened metal has formed an integral part. These Safes are also secured by combination locks, of which the best form is the double lock, being two complete locks in one, or, in other words, it has two knobs and two dials, both of which can be set on entirely different combinations, and either one will open the lock or throw back the bolt independent of the other. This firm have the exclusive use of the Franklinite or crystallized iron in the manufacture of Safes, secured to them by letters patent.

Herring's Safes are found in counting-houses in Liverpool and London, in Asia, Africa, Australia, and Mexico, and, as has been stated, nearly fifty thousand have been sold in this country. A stock of about one thousand Safes, ranging in price from one hundred to twenty-five hundred dollars, is always on hand in their warehouses ready for sale

Joseph Nason & Co.'s Manufactory

Of Gas, Steam, and Water Fittings, is one of the oldest and most extensive in the United States. The house was established, in 1841, by Joseph Nason and James J. Walworth, who were the first in this country to undertake the sale of "Welded Iron Steam and Gas Pipes," as a distinct and separate business, and who also originated the plan of heating buildings by means of steam conveyed through small wrought-iron tubes. The application of small tubes, three quarter inch and one inch, now in almost universal use for warming manufactories and other large buildings, was, previous to the establishment of this firm, unknown, and they are also the inventors of nearly all the peculiar appliances which have rendered this method of warming convenient, and consequently popular. Among the most important of these improvements that may be mentioned is the substitution of the "Globe Valve" for the "Stopcock," which it has almost entirely superseded for steam uses. This invention, in fact, was the parent of a family of valves that are now scarcely appreciated, because so generally used.

In 1853, the firm of Walworth & Nason was dissolved, the former partner assuming control of the house which they had established in Boston, and Mr. Nason remaining in New York, where he subsequently was associated in partnership with Mr. Dodge, and then with his present partner, Henry R. Worthington, who is the inventor of the original Independent Steam Pump, and now very extensively engaged in manufacturing Pumping machinery for Water-works. The manufac-

ture of Steam and Gas Fittings is carried on in conjunction with that of Pumping machinery, in a large manufactory in Brooklyn, where nearly three hundred men are employed. All the iron castings required in both departments are made in the same foundry, which is one hundred and fifty feet long, and sixty feet wide.

This firm have the advantage of an immense stock of patterns, accumulated during a quarter of a century, and of the long experience and eminent scientific attainments of the senior partner, who may justly be called the founder or originator of the business, in which novelty of form and adaptation is the rule rather than the exception. No other person in this country has furnished so many large public buildings with apparatus for heating and ventilating as he. The evidences of his mechanical skill in this specialty may be witnessed in most of the Insane Asylums of the United States, including that at Utica, which is the largest in this country, and in many of the hospitals, of which the Emigrant Hospital, on Ward's Island, is the latest and probably the best example. But the monument which will perpetuate his fame, as an engineer, is the Capitol at Washington, which is now heated and ventilated in the most perfect manner by apparatus constructed under his direction. This is undoubtedly the largest work of the kind undertaken in this and probably any other country, and the results obtained are far superior to any heretofore accomplished by the most eminent engineers of England. An ample supply of fresh air is provided in all the immense chambers by means of four fans—three of them fourteen feet in diameter, and one sixteen feet—propelled by four engines, and a uniform temperature in winter is secured through the agency of coils of pipes, of which there are over nine miles in the House of Representatives alone. Many experiments were made during the progress of the work, both in boilers and in fans, and the form of fan now adopted for ventilating purposes is one of the results which those experiments established as the best. His success in this great work elicited flattering testimonials from the Chief Architect, and from the officer of the Engineer Corps detailed by the War Department to superintend the construction of the Capitol; and representatives of foreign governments, resident in Washington, solicited him to visit Europe for the purpose of introducing similar methods of heating and ventilation in the large hospitals, especially of Russia.

The firm of Joseph Nason & Co. are now confining their attention almost exclusively to the manufacture of Fittings, for sale to others, who apply them in buildings, and they offer special encouragement to skilful mechanics to engage in the business. The list of articles man-

ufactured by them, includes a large variety of Brass and Iron Valves, Cocks, Joints, Steam Traps, Gauges, etc., and some special and patented articles, as for instance, Worthington's Water Meter and Percussion Water Gauge, and Nason's Patent Vertical Pipe Radiators. These Radiators are a great improvement upon any heretofore made, as they combine elegance and beauty of design, adapting them to furnished rooms of all descriptions, with a method of construction which gives absolute security against leakage under high or low pressure. They consist of a series of vertical pipes with interior diaphragms for circulation, screwed to a common base or pedestal, and surmounted by a marble or metal top and entablature. Each pipe is screwed to the base *independently*, and may be tightened, loosened, or taken out without disturbing the adjoining pipes. In consequence of the vertical position of the pipes, and the direct communication of their lower ends with a receptacle of very ample dimensions, they are kept entirely free from water, which, in ordinary coils, is the source of many troubles, particularly of noise, damage by frost, and inefficiency in warming.

Stuart's Sugar Refinery.

The Refining of Sugar is the leading manufacture in the city of New York. No other employs so much capital, or yields so large a product. The official return of the Sugar refined in 1860, which we have given in the Table, vast as it is, is little more than one half of the value of the present product of twenty-six Refineries in New York and vicinity, which is estimated to be about $35,000,000 per annum. The history of the business, as a prominent pursuit, is so intimately associated with the enterprise of one or two firms, that, in describing their facilities and processes, we describe those of all the others.

Prior to the year 1832, Sugar Refining was conducted on a limited scale; but the process was very imperfect, and the quality of the Sugar, as compared with that now made, was very inferior. During that year, Messrs. R. L. & A. Stuart commenced business, in three wooden buildings, on Greenwich street, corner of Chambers street, where they were the first to succeed in employing steam in refining; and by the introduction of superior machinery, they were soon enabled to produce a better quality of Sugar than had hitherto been offered to the New York public—some samples of which, exhibited at the Fair of the American Institute in 1834, were the wonder and admiration of other refiners. The capacity of the establishment was then limited

to about three thousand pounds per day; but in the year 1835, the old wooden buildings were removed, and a six-story brick building was erected in their stead, by means of which the capacity for refining was increased to twelve thousand pounds per day—about enough to meet the demand at that time, at profitable rates. But with the improved quality of Sugar, and lower prices, consumption increased from year to year, and to meet the growing demand, in 1849, the Messrs. Stuart erected the nine-story building on the other half of the block of land adjoining, on Greenwich and Reed streets, by which their capacity was then so much enlarged as to enable them to refine annually from forty to forty-four millions of pounds of Sugar per year—employing about three hundred men, and producing refined sugar that was sold for $3,000,000 per annum. During the year 1863, this Refinery worked but little more than half its capacity; but the sales of refined Sugar, the prices of raw being about double those of any previous year, amounted to over three millions of dollars.

The whole establishment, with all the necessary machinery and appurtenances, occupies a space of one hundred and ten feet on Chambers street, one hundred and sixty-five feet on Greenwich street, and two hundred and seventeen on Reed street; with additional five-story buildings, seventy-five feet front, on the north side of the street last named—the whole having cellars beneath them, and vaults the entire length of their fronts, and extending half way across the first two named streets—while they occupy nearly all the space beneath Reed street, and extend under the building on the opposite side; also occupying, for warehouses, two buildings on the south side of Chambers street. This immense establishment is provided with every variety of machinery for saving human labor. Steam is not only used in the process of refining, but in lifting, hoisting, and pumping, and it requires eight large steam boilers, which consume eight thousand tons of anthracite coal per annum, to furnish the requisite steam for all these purposes. About two hundred thousand gallons of water per day are drawn from the wells beneath the buildings, and fifty thousand in addition taken from the Croton Water Department—making a total consumption of two hundred and fifty thousand gallons of water per day. For efficiency, rather than for purposes of economy, this firm constantly employs workmen in every branch of mechanics required in their business, viz.: coopers, carpenters, machinists, blacksmiths, masons, box makers, painters, etc., and rarely have occasion to call on outside parties for assistance, either for repairs or construction. By this means every thing is kept in a thorough state of repair, and when delays do occur from accident, they are necessarily of short duration.

The Sugar is received in hogsheads, boxes, etc., on the first floor, and hoisted by steam to the ninth story, where they are emptied; and the process of cleansing commences by dissolving the Sugar in steam and hot water, and the color extracted from the solution by means of chemical and mechanical agents—when it is passed to vacuum pans heated by steam, and through the subsequent processes by which Sugar is crystallized and refined.

William Moller & Son's Sugar Refinery

Dates its origin as early as 1805, when the business was established by Messrs. W. & F. Havemeyer. It was then a small building, standing on the rear of two lots, 87 and 89 Vandam street, occupying a space of about fifty feet square. At that date a small capital was only required in the Refining of Sugar; but as new and better processes were developed, the business gradually increased until immense structures, and a large capital, seemed to be indispensable.

In 47, the present ten-story buildings, having a front of one hundred and fifty feet on Vandam street, running through a distance of two hundred feet to Charlton street, where it has a front of seventy-five feet, were erected, but are now scarcely considered sufficiently capacious for the requirements of the present business. In 1849, a new firm was created by Mr. William Moller becoming a member—the business being conducted under the name of Havemeyers & Moller. Previous to entering this firm, Mr. Moller had a large and varied experience in all branches of Sugar Refining, having been employed for several years in large Refineries both in Boston and New York, and his influence was soon felt by the adoption of improved methods in conducting the operations of the business. Among the first of the improvements introduced by him, were the closed or tight filters, now so generally in use in other establishments of the kind. He was also the first to adopt the upright oval retorts, and the first to use muriatic acid to restore bone black; and the first in this country to use a machine for cleaning and washing bone black.

This establishment, under his proprietorship, has attained great celebrity for the excellence of its Cut Loaf Sugar—the machine for making it being the invention of Mr. Moller. This Sugar is well known throughout the continent, and is preferred by families because of its good quality, and the uniform size and shape of its lumps, at even a higher rate than the market price of "broken" or "crushed" sugar, or that cut into squares or cubes by hand labor.

Mr. Moller is now experimenting with a view of boiling Sugar by a new process, and forming a vacuum by a syphon, and is quite sanguine of success. Enthusiastic himself for the accomplishment of whatever seems calculated to improve the product or benefit the business, he is also disposed to encourage other inventors, who are admitted at suitable times to his Refinery to test the practical value of their ideas.

This Refinery is now conducted by William Moller & Son, and employs one hundred and forty men, of all grades, in the various departments of the business. In 1847, the product of the establishment was seven millions of pounds of sugar; and during the year 1865, it was quite equal to seventeen million pounds, valued at $2,800,000, with a demand that seems steadily increasing, and inciting the proprietor to renewed efforts to meet it by new mechanical and scientific processes for increasing the product. The entire capacity of this Refinery is about twenty-four millions of pounds annually.

Besides these, there are in New York the Refineries of the New York Steam Sugar Refining Co.; Williamson, Griffiths & Co.; Johnson & Lazarus; John W. Brockhorn; Camp, Brunsen & Sherry; Harris & Dayton; F. H. McCready & Co.; Daniel Pomroy; Ockerhausen Brothers; Plume & Lamont; Mollers, Hogg & Martens; Kattenhorn & Tuska; Greer, Turner & Co.; Booth & Edgar; Breck, Cushman & Stanton; Mollers, O'Dell & Dosher; and Brunjes, Ockerhausen & Co. In Williamsburg—Havemeyers & Elder, Sheppard Gandy, C. E. Bertrand & Co., and Wintjer, Dick & Schomacher; in Brooklyn—Meyer & Gomberat, and Finken & Wheatley; at Greenpoint—Brown, Furbish & Co.; and Matthiessen & Wieschers at Jersey City. These Refineries are now producing about $35,000,000 per annum, but have a capacity of production equal to five hundred million pounds, which, at present prices, would be worth at least $80,000,000.

John Stephenson's Car Manufactory,

On Twenty-seventh street, near Fourth avenue, is one of the oldest and best known establishments of the kind in the United States. John Stephenson has been identified with the construction of Cars and Omnibuses from their first introduction into this country. He commenced business, in 1831, in Broadway, where now the Lafarge Hotel stands, and while there, designed and constructed for A. Brower, a leading stage proprietor, one of the first Omnibuses that was run on the streets

of New York. This was four and a half feet in width, had elevated or elliptical springs, and swelled very slightly at the sides. The word "Omnibus," painted in large letters on both sides, was a puzzle to pedestrians, who pronounced it variously, and generally supposed it to be the name of the owner. Previous to that time, vehicles for the transportation of passengers were constructed on the plan of the family coach, which was succeeded by what was known as the sociable, with side doors. It was not until 1833 that the platform carriage was introduced in Paris and adopted in this country.

During the first year of his experience as a builder of Omnibuses, Mr. Stephenson's workshops were destroyed by fire, and he removed to Elizabeth street, where, in 1832, he constructed what was probably the first Street Car built in the United States. This was called the "John Mason," after the founder of the Chemical Bank, and was designed to run on a branch of the Harlaem Railroad from Prince street to the Harlaem Flats. At that time, railroads were in their incipiency, and Cars were constructed in compartments after the fashion in England. In April, 1833, Mr. Stephenson received a patent for an improvement in Passenger Cars for railways, which is signed by Andrew Jackson, President of the United States, Edward Livingston, Secretary of State, and certified to by R. B. Taney, then Attorney General; and as railroads became established, and the demand for Cars increased, he engaged extensively in their manufacture, sharing the perplexities and pecuniary hazards which are conspicuous features in the history of those early enterprises.

In 1843, Mr. Stephenson removed to the site of his present manufactory, and erected a four-story building, forty-four by one hundred feet, to which, in 1850, an addition was made by the erection of a six-story building two hundred feet long, extending from Twenty-seventh to Twenty-eighth streets. These now constitute the workshops, and here, for several years, an Omnibus was built each working day, or three hundred a year, and here Street Cars are now turned off with almost equal facility and rapidity. In the manufacture of Omnibuses, Mr. Stephenson was remarkably successful in securing the requisite strength with the least weight, and for many years enjoyed a popularity as a builder that was nearly tantamount to a monopoly. But in 1860 the demand for this class of vehicles had greatly diminished, in consequence of the general adoption of railways on the streets, and he thenceforth engaged extensively in the construction of Cars for this purpose, applying the principles which his experience as an Omnibus builder had demonstrated to be of value, and so successfully that he was able to

decrease the weight of these Cars from six thousand to thirty-five hundred pounds, without in the least diminishing their strength.

In the construction of durable carriages of all kinds, well seasoned timber is an indispensable requisite. In this establishment a stock for two years' use is kept constantly on hand. Oak selected from isolated trees found in pastures is preferred to that taken from forests. In the lumber rooms there is also a large stock of the constituent parts of Coaches and Cars, cut to sizes and shaped so that the body of a Car can be put together and made ready for painting in five days. In the blacksmith's shop, there are fifteen forge fires blown by a steam-engine, and here the iron work is so forged that the parts which in use will be subjected to the greatest strain, are made of double thickness, while the other parts have no superfluous metal. The hooks of the connecting rods and shackles, and the clogs of the breaker, are thoroughly strengthened in this way. In the Painting department the workmen are divided into classes, as primers, rubbers, colorers, flatters, letterers, landscape painters, scrollers, varnish finishers, and thus acquire a facility of execution which can only be attained by a daily repetition of the same duty. This principle, so far as possible, is observed in all the departments.

But, besides the general principles of construction which tend to expedite work, Mr. Stephenson has made special improvements, some of them patented, which tend to secure durability and diminish the cost of repairs. Of this description is the Patent Truss-rod, and the method of bracing the Cars at the corners, where, in consequence of the short curves in street railways, an immense strain falls, causing the body of the Car to swag or give way. The boxes of the journals of the axles, which are subjected to great friction, are made nearly double the usual length, thus affording fifty per cent. more surface for abrasion. To exclude dirt or grit from the journal boxes, which has been a subject of many patents, Mr. Stephenson employs a rotating gate, composed of two segments of cast-iron, forming a collar, and which keeps the orifice constantly closed by the action of the journal itself. Among the minor improvements which may be mentioned, is the step projecting beyond the body of the car, which has a tendency to lessen the number of accidents, the enlargement of the reel, and, in some instances, the adoption of wooden trimmings for seats in place of cushions, which on some railways have become infested with vermin.

Mr. Stephenson has constructed Cars for railways in India, England, Mexico, Valparaiso, and San Francisco. He now employs about three hundred workmen, and is producing about six Cars a week, or one each working day.

Carhart & Needham's Melodeon Manufactory

Is one of the most noteworthy manufactories in the city of New York, for its great variety of novel, ingenious, and beautiful machinery. It was erected in 1854, especially for the purpose to which it is applied, and is in the form of a T, the main building fronting on Twenty-third street, being seventy-eight by thirty-five, six stories in height, and the extension sixty-five by thirty-five, five stories high, including the basement. The engine and drying rooms, and lumber rooms, are detached from the factory, and occupy a large space in the rear.

The history of the firm of Carhart & Needham dates from 1846, when Jeremiah Carhart, who, after many years of experiments, had received in that year a patent for a new form of Melodeon, became associated with E. P. Needham, also of Buffalo, for its manufacture. The novelty of the invention consisted principally in the construction of a suction bellows, by which the wind was drawn through the reed, instead of being forcibly expelled through it, as in the accordeon. This being accomplished, the next labor to which Mr. Carhart devoted himself, was to invent a machine to make, rivet, and plane the reeds to the proper size and thickness, together with a tube board to hold the reeds when finished. He not only succeeded in this, but invented a new reed, the peculiarity of which is that it is held by the thickness and not the edge. All the obstacles in the way of doing this were overcome, and now those wonderful machines are doing their work so effectively, that the firm supply nearly all the reeds used in the trade, with the exception of two firms, which pay them a royalty for the privilege of manufacturing.

A reed, in the technology of musical mechanism, is not, as the name might imply, a species of cane, but a small tongue of metal, usually brass, inserted in an opening or slot in a block with one end free, which, by vibration, makes the sound, and the order of the sound, constitutes the melody. The raw material of the reed is simply a strip of brass, about a tenth of an inch thick, and two or three inches wide. The blank is cut out by a die, and then passed under a machine invented by Mr. Carhart, which, in one operation, planes the two sides and one face. One of the most effective of the small machines in this establishment, is that which rivets the reed to the block, and performs work that would require twenty men to do in the old method by hand. There is no pin or solid rivet in the reed or its block, but two raised heads, crossed with lines, are pushed up out of the reed block by this machine, or, as it is technically called, upset. After the reed is in its place in the block, it is planed on top, and as the thickness of the reed

is less at the base than at the free end, the tone of the reed is determined by this planing. So accurately does this planing machine work, that the reed, when finished in it, is within a sixteenth of a true note, and requires only a little adjustment, or filing, to make it perfect.

But probably the most remarkable machine in this establishment, is the one invented by Mr. Carhart for cutting the cells or tubes in the reed board, and the groove in which the reed block is placed. This machine is automatic, and the strip of plank, out of which the board is made, having been placed in a certain position, the cutter goes on and produces all the cells with a regularity and exactitude that is astonishing. This machine deserves to rank with the automatic lathe of Blanchard, for it is not only capable of executing work in straight lines, but also carves scrolls with such nicety and rapidity, that no hand work can approach it. The cutters revolve with great velocity—seven thousand seven hundred times a minute—and the speed of the driving belt is just one mile in a minute. The groove in which the reed block is set, and which is about one tenth of an inch wide and deep, is made by the same machine; and as each groove is an exact fac-simile of the other, those made years ago will fit any reed block made to-day.

A very important improvement affecting the shape, convenience, and simplicity of Harmoniums, or other large reed instruments, was made by the invention of E. P. Needham, patented in 1859, by which two or more actions are placed in rows, one above the other, in the manner of shelves or successive segments, each horizontal row divided in the middle to form two registers, and any one may be removed at any time, or exposed for repairs, with extreme facility. The invention also included an arrangement for combining the actions with the bellows.[1]

The firm of Carhart & Needham, since their removal from Buffalo to New York in 1848, have made about fifteen thousand Melodeons and Harmoniums, and are now using from fifty to sixty sets of five-octave reeds a week. Their manufactures include every grade of the reed instrument, from the small single-banked Melodeon, to the large Library or Hall Organ, with its fourteen sets of reeds, of remarkable variety and power, its splendid pedal tones, and its rich and imposing case. Probably the finest instrument ever constructed was one exhibited at a recent Fair of the American Institute in New York, consisting of two banks of keys, two octaves of pedals, and fourteen ranks of reeds,

(1) Mr. Needham is also the inventor of a Pneumatic machine for conveying packages and passengers through tubes from which the air has been exhausted, which is pronounced, by those competent to judge, to be the best of its kind that has yet been contrived. This means of transit, notwithstanding the obstacles in the way of its introduction, is destined to a triumphant success.

arranged one over the other, filling the case to its whole height, and affording a variety of stops not to be found in any other reed instrument. In this, they achieved what had never before been accomplished, namely, in making a thirty-two feet reed produce a full, deep, rich, and powerful tone, that can only be equalled in a Pipe Organ; and as a thirty-two feet pipe could not, by any possibility, be placed in a pipe organ of the size of the Reed Organ, the latter has, in this respect, a decided advantage. An eminent musical critic remarks:

"On the ordinary Parlor Organ, when a full chord is taken by both hands, only sixteen reeds are set in vibration; but in the Library Organ, the same chord sets in vibration one hundred and sixteen reeds. The power of the latter, in comparison with the former, is thus clearly indicated. The workmanship of the whole instrument was so singularly beautiful, the voicing of the stops was so perfect, the variety so admirable, and the capacity for effects so large and so superior to any other instrument of its class, that it excited universal admiration, and was unanimously awarded the Gold Medal by the public, long before the judges confirmed that opinion by their action."

Milbank Brothers' Brewery,

At the corner of Madison and Oliver streets, is one of the time-honored institutions of the city, forming a link connecting the metropolis of to-day with the New York of the past. A portion of the site on which it stands was occupied as a brewery before the Revolutionary War, and one of its early proprietors was John Murray, Jr., a Quaker and a philanthropist, the brother of Lindley Murray, whose educational works were at one time the text books in all schools. John Murray, Jr., was the Treasurer of what was probably the first society organized for the abolition of slavery, called "The Society for Promoting the Manumission of Slaves, and Protecting such of them as have been or may be Liberated," of which John Jay was President. General Washington, when he resided in New York, obtained ale at this Brewery, and John Hancock was one of its patrons. The firm at the commencement of the present century was Murray & Cunningham, which was shortly afterward changed to Murray & Milbank, the partner being Samuel Milbank, a brewer of Philadelphia, who came to New York before the war of 1812. After John Murray, Jr., retired from its management, Samuel Milbank, Sr., conducted the business until 1834, when he was succeeded by his son Samuel, who prosecuted it until his decease in 1865.

when it passed into the hands of his three sons, the present proprietors, Charles E., Samuel W., and Albert J. Milbank.

The present building is new, having been erected in 1862, is five stories in height, and has a front on Madison street of forty-three feet, and a depth of one hundred and twenty-five feet. The boiling coppers are of metal, with a capacity of one hundred and one hundred and twenty barrels respectively, and, what is unusual in similar establishments, are located on the top floor. All the boiling and heating are performed by steam. The hop back is of iron, with a false bottom of galvanized iron, and the mash tuns are square, a form that, it is believed, is peculiar to this establishment. All the important vessels are constructed of metal, which has a tendency to prevent sourness in the Ale, and at the same time facilitates cleanliness. The only cooler used is Baudelot's Patent Refrigerator, of which the principle was originated, and the process adopted by Samuel Milbank fifteen years before it was patented. The original refrigerator of this description is still preserved in the establishment. When the worts have been cooled to the proper temperature, they are discharged into the fermenting tuns, and after the active fermentation is over, they are racked off into puncheons of large capacity, where it is cleansed of the yeast, and refined. In the cellar there are twenty-nine storage vats, capable of holding from one hundred and fifty to two hundred and fifty barrels each. Attached to the Brewery is a malthouse, with facilities for malting fifty thousand bushels of grain. The Brewery has a capacity for producing about forty thousand barrels of Ale and Porter per annum.

This establishment, though not so large as some others, is believed to be a model in the completeness of its arrangements, and Milbank's Ale has a reputation unsurpassed by any. The author of the *Old Merchants of New York* can scarcely repress his enthusiasm in speaking of this Ale. He says: "The Ale from that time-stained Brewery is Ale. One pewter mug full of that is more precious than a big Missouri river of Lager. I am bursting with patriotism as I close this chapter, and am determined never to touch or taste a glass of porter or ale unless the patriotic vender of it can exhibit a certificate that it comes from John Murray's old Brewery, up at 70 Madison or 48 Oliver street."

Wm. Tilden & Nephew's Varnish Manufactory,

Corner of Rivington and Norfolk streets, New York, is accredited with being the pioneer establishment in this country for the manufacture of Copal Varnishes as an article of commerce. Previous to 1830, all the finer classes of Varnishes were imported from England and France; but in the autumn of that year, William Tilden, commenced their manufacture, and until 1836, was the only manufacturer of Varnishes in this country. There are, at this time, over thirty different manufactories of this description in the United States, but the original one is much the largest of any, employing a capital exceeding half a million of dollars.

Mr. Tilden was the largest consumer of the early importations of Gum Copal, direct from Zanzibar and the west coast of Africa; and the first exports of Varnishes, from this to other countries, were made by him, in the year 1836, to South America and Mexico. The experiment proved so successful, that in a short time there was scarcely a country, where American commerce reached, that American Varnishes were not shipped; and they, in a great measure, supplanted the importations of European manufacturers. This important element of demand in the foreign markets of the world, together with the large and increasing consumption at home, stimulated this branch of industry to such an extent, that the house, in the year 1851, established commercial relations direct with the coast of Africa, opening trading posts, and employing vessels to collect Gum Copals and other products of the country, by the interchange of the commodities of our own.

In the year 1847, William T. Blodgett was associated with Mr. Tilden, under the name of WILLIAM TILDEN & NEPHEW. The business of the house, in the thirty-six years of its existence, has increased steadily, from sales amounting to about twenty thousand dollars per annum, until they now reach about seven hundred thousand dollars per annum, requiring the ful capacity of three factories to support it, a fact which affords convincing evidence that there is one firm in America able to compete with the most skilful in Europe.

The revision of the Tariff, in 1862, increased the duties on Gum Copal so largely that this firm was compelled to open a branch of manufactory at Montreal, Canada, to enable it to retain its export trade and that of the British Provinces.

The books abound in recipes for the composition of Varnishes, but probably there is no manufacture requiring more care and attention in its details, or a better knowledge of chemical properties and effects. Varnishes, to be good, should possess the quality of remaining permanently brilliant after drying; they should adhere closely to the sur-

faces to which they may be applied, without scaling off, even after a considerable time; their drying should be rapid, and their hardness, when dry, as great as possible, without rendering them too brittle—characteristics that very few manufacturers have succeeded in attaining in combination. Moreover, the different branches of industry, the workers in wood, tin, and iron, the manufacturers of floor cloths and maps, all require different and peculiar kinds of Varnishes; and it is no slight commendation to Messrs. Tilden & Nephew, who produce over thirty varieties, that they have given satisfaction in all.

The Glen Cove Starch Works—W. Duryea, Superintendent.

Located at Glen Cove, Long Island, are one of the two large Starch Manufactories in the United States. The Company was organized under the General Manufacturing Law of the State of New York, November 13th, 1855, and built, at first, a small factory, to test a new process of manufacturing Starch and Maizena. In 1857, the capacity of the Works was increased from one ton per day to five; and shortly afterward the entire establishment was destroyed by fire. It was then rebuilt, on a larger scale, with a capacity of producing ten tons daily; to which additions have been made, until now the capacity is twenty-three tons per day—and the buildings, including those incidental to the business, cover about eight acres.

The main building is six stories in height, with connecting wings, and intended to be fire-proof. Situated directly on the line of open tide-water, Hempstead Harbor, an arm of Long Island Sound, and surrounded with a fine dock about half a mile in extent, the operations of the Company in the receipt and shipment of goods are greatly facilitated. The corn, when landed on the wharf, is hoisted by means of an elevator worked by steam power, to the top of the building, winnowed to remove foreign substances, and then transferred to vats, where it is long soaked before grinding. Only the best varieties of the white flint corn are used. It is run through troughs with water to the mills, and when ground the mixed meal and water is conveyed in a similar manner to the tub in which the separation of the starch is effected. The starch fluid is then conveyed to great vats in the basement of the building, where the water is partially removed, and then it flows into smaller wooden vessels, from which a portion of the surplus water drains away through a cloth laid in the bottom of each. The mass of Starch, then tolerably solid, is placed upon shelves made

of loose bricks, when more moisture escapes by absorption and evaporation. Kiln-drying finishes the process, and the Starch is obtained in prismatic forms, ready to be put up in paper or boxes for the market.

For grinding the corn, the Glen Cove Company have several pairs of burrstones, and large, heavy iron rollers. The machinery is propelled by a double-cylinder vertical engine of one hundred and sixty horse-power, and there is an additional water-power of about sixty horse capacity, which is obtained from a pond that covers about thirteen acres. The vats employed in purifying the Starch have a capacity of many million gallons, and the length of gutters for conveying and distributing the starch waters amounts to many miles.

In the manufacture of Corn Starch, considerable skill, especially a critical knowledge of fermentation, is required. Many manufacturers have succeeded in producing Starch very nearly white, but very few have succeeded in producing *uniformly* an article of Starch most desirable—of clear whiteness and at the same time free from sourness. Clear and perfect whiteness, *when free from sourness*, is an evidence of purity and strength. This superior quality of Starch will give to linen a beautifully white brilliancy, great strength, and elasticity. As the Starch made at the Glen Cove Works has the highest reputation in all markets, it may be reasonably assumed that the Messrs. Duryea, who conduct the operations, are among the few who possess the requisite skill and knowledge for the manufacture. They are also probably aided by the excellence of the water obtained from springs on the premises, which is remarkable for its purity and softness.

Besides Starch, this Company manufacture a novel article for puddings, custards, ice-creams, etc., known as Duryea's "Maizena." This word, "Maizena," was coined and adopted by the Messrs. Duryea as a trade-mark, and as such is claimed by them. The article bearing said trade-mark is composed of the flour of the choicest selected white corn, and is the most wholesome, nutritious, and agreeable article of food in the whole range of farinaceous substances; it is not only a choice article of dessert, but in the sick room an excellent substitute for the best Bermuda Arrowroot, being used in the same way. In many cases it is regarded as superior to Arrowroot as a diet for the sick, especially dyspeptics and infants.

The manufacturing operations of the Glen Cove Starch Company are conducted by the Superintendent, WRIGHT DURYEA; while his brother, WILLIAM DURYEA, has charge especially of the sales, at the Company's warehouse in New York.

It is estimated that the consumption of Starch in the United States now amounts to two hundred and fifty tons per day

Colgate & Co.'s Manufactory

Of Soaps and Candles, is probably the oldest and undoubtedly the most extensive in the United States. It was founded by William Colgate, the father of one of the present proprietors, who embarked in the business in a small way in 1806, when the total value of Soap and Candles made in regular factories in the United States did not probably exceed half a million of dollars annually. The manufactory was situated at Nos. 4 and 6 Dutch street, New York, and continued there until 1847, when it was removed to Jersey City, where the present extensive Works were erected to accommodate the increasing business of the firm. Mr. William Colgate died in 1857, after half a century of successful business enterprise, and many years of active benevolence, leaving to his family and successors an honorable name and a well-established business. The present members of the firm are Samuel Colgate and Charles C. Colgate, who continue to occupy for their warehouse the original premises in which Mr. Colgate commenced his career as a manufacturer sixty years since.

The manufacture of Soap in all its branches is essentially a chemical art, and rises in dignity in proportion to the amount of intelligence and scientific knowledge brought to its direction. In its higher departments no small degree of these attributes is required to insure success. Although the art is a very ancient one, the true theory of saponification was not known until the publication, less than fifty years ago, of the able researches of Mr. Chevreul, the French chemist, on the nature and constitution of the fixed oils and fats. All common fats and oils are now known to consist of three neutral bodies or proximate constituents: *stearin, margarin, and olein*, associated in different proportions. Upon the relative amounts of these elements depends the degree of consistency of the fatty body at ordinary temperatures, its fluidity being greater, and its melting point lower, as the latter constituent predominates. When saponified by the aid of heat with a strong alkaline solution, as of soda or potash, these bodies are each resolved into glycerine and a fatty acid, and the latter combining chemically with the alkali, produces Soap. This compound is therefore strictly a salt of the fatty acid and the alkaline base, and formed in a manner analogous to the neutral salts. Soda produces hard, and potash soft Soap, and both owe their detergent property entirely to the alkali. The consistence or firmness of the Soap also depends upon the oil or fat used, being greater when made of the solid fats, as tallow, bone-grease, butter, etc., which owe their consistence to stearin and

margarin, than when the liquid oils, as palm, almond, rape seed, castor oil, etc., are employed, which consist principally of olein.

Many of the modern improvements in Soap making, which have been quite numerous since 1840, consist in the use of new vegetable or animal oils as materials; in the mechanical and chemical methods of purifying, deodorizing, and preparing them; and especially of separating the olein and glycerin from the fatty acids, so as to obtain the stearin and stearic acid, either for Soap or Candles—in which operation hydraulic pressure has been found to be one of the most efficient agencies. But perhaps the most important invention ever made in the manufacture, has been in the employment of *steam*, which has wonderfully facilitated, cheapened, and improved the processes both of Soap and Candle making. It has effected a great saving of fuel, and enabled the manufacturer to arrest the boiling process at the precise moment—which is a matter of much importance. It has reduced the number of hands required, and in various other ways has proved to be an agency almost indispensable to the manufacture of Soap and Candles on a large scale.

In large Soap Laboratories, the steam series usually consists of three caldrons—one for white, and one for yellow, and one for palm and other fine Soaps—and these are often of very large size. In Colgate's Manufactory, these caldrons, though not so large as some others, have a capacity of thirty tons each. In this, as in other well-regulated establishments, the apartments are arranged with especial reference to convenience, and each is devoted to its special purpose The "frame room," or "drying loft," where the Soap, after it is formed, is placed to cool, is in the second story of the main building, and contains over three hundred cast-iron frames, which are now preferred to wood, both because they can be taken apart and put together with greater facility, and the metal is found to hasten the cooling of the Soap. In the other rooms are numerous presses for stamping Fancy Soaps, and all the appliances for producing a hundred tons of Soap weekly. In another part of the Works is a Candle Manufactory, where pressed Tallow Candles for the West India markets are made by means of a patent Candle-Moulding Apparatus, with extraordinary rapidity. In connection with the establishment is also a Box Manufactory, having machines and facilities for turning out one thousand boxes per day. The dovetailing machine used here is a remarkable labor-saving invention. The buildings have a front of about four hundred feet on the main street, and cover two thirds of an entire block.

This firm manufacture about a hundred different varieties of Soap,

including rare Fancy Soaps, and those for manufacturers' use. The department of Fancy Soaps was added to the business in 1850, and their success in this branch has materially diminished the importation of foreign Soaps. As an illustration of the extent of the business done by this firm, we may state that during the year 1865 they paid to the United States Government a Manufacturer's Revenue Tax of *one hundred and thirty-three thousand dollars.*

The Howe Scale Company,

Though their principal establishment is in Brandon, Vermont, have their warehouse and a branch manufactory in New York city, and as a correct and reliable standard for weighing commodities is a subject of very great importance to manufacturers, it may not be amiss to give, in this place, some account of one of the two great Scale manufactories of the United States.

On the 15th of January, 1856, two ingenious New England mechanics, F. M. Strong and Thomas Ross, received a patent for an improved method of making Platform Scales. This afterward became widely known as the "Strong and Ross Patent." The improvement consisted in dispensing with check rods, which are liable to be affected by frost and other circumstances; in requiring no pit, or a very shallow one, for the foundation of the largest Scales; the substitution of balls under the end of the platform beams, by which friction from the movement or working of the platform on the "knife-edges" or bearings, is avoided, and general simplicity of construction without diminution of strength.

Technically described, the principle of this Scale consists in extending across each of its ends a shaft whose extremities are enlarged in such a manner as to admit the insertion of knife-edges. These rest upon suitable bearings attached to the foundation or frame, and are so inserted in the shaft that they form the axis on which it partially rotates with the least possible friction. These enlargements project inwardly from the shaft, forming short cranks, and in these are inserted other knife-edges parallel to, and equidistant from, the first mentioned. At the extreme front end of the shafts, arms are secured which extend to the centre of the front side of the scale, where they meet, and are both attached to the "beam" in the usual manner. To the under side of the ends of the platform timbers are secured plates or "shoes," in which are concavities; these rest upon balls contained in corresponding concavities, in suitable plates, from which project downward the bearings that rest on the knife-edges inserted in the cranks projecting from the shafts; consequently, any weight placed upon the platform tends to

turn the shafts and depress the ends of the arms secured to them, which in turn actuate the beam where the weight is indicated.

This method of connecting the platform with the levers allows it to move freely in any direction, when receiving any impulse, without producing any shock or wear on the knife-edges, which would necessarily take place if the connection was rigid. The knife-edges consequently retain their fineness and accuracy.

The advantages which these Scales possessed attracted the attention of Mr. John Howe, Jr., of Vermont, himself an ingenious and intelligent gentleman, who purchased the patent, engaged the inventors for a term of years, and commenced their manufacture in the town of Brandon. Before, however, embarking extensively in their manufacture, he submitted them to the severest tests, and exhibited them at the principal State Fairs, where they were tested in competition with others, and the result was that in one year, within sixty days, they received seven first class premiums. Eminent firms in New York city and elsewhere were induced to purchase them; among others, Robert Hoe & Co., the Printing-press manufacturers who bought one that would weigh eight tons, and finding it extremely accurate ordered another of the same class. It was found that a copper cent laid on the platform of a Scale with a capacity of weighing fourteen hundred pounds lifted the beam, and four pennies would turn a Hay Scale of six tons' capacity.

One peculiarity of this Scale is that it will operate as accurately on an inclined plane as on a level. The Morris Canal Company purchased one seventy feet long and of two hundred tons' capacity, and placed it so that one end was seven feet higher than the other end. After seventeen months' use in weighing many hundreds of tons, they certify to its accuracy and extreme sensitiveness.

Repeated and severe tests having thus established its reliability as a standard of weights, combined with the advantages of a great simplicity of construction, Mr. Howe, in association with his energetic brother, Col. Frank E. Howe, of New York city, entered extensively into the manufacture. They enlarged their Works, employed the best mechanics that the highest wages could command, and are now producing, in large numbers, Scales of all sizes and capacities, constructed on the principles that have been detailed; each year increasing their popularity and extending their sales, not only to all parts of this country, but to Russia, China, Japan, and South America.

The firm of HOWE & BOUVIER, who are the Agents in New York for the Howe Scale Company, have also a Manufactory in the city where they make fine Gold and Druggists' Scales, Even-Balance Scales, Weighmasters' Beams, etc

New York Belting and Packing Company,

[JOHN H. CHEEVER, TREASURER.]

The history of the manufacture of India Rubber Goods in this country cannot yet be written, mainly because those who possess the most important facts are interested in concealing them. The day is not distant, however, when this obstacle will be removed, and a truthful account of the authorship of the various inventions that have contributed to utilize this wonderful gum can be given. Suffice it to say for the present, that since 1825, when the first importation of the Para rubber over-shoe was made into the Boston market, inventions have been made by which the juice or milk of an East Indian tree is now available for Clothing of all kinds, Boots and Shoes, Belting, and Steam-packing for machinery, Carriage Tops and Car Springs, Balls and Tops for children, Combs, Whalebone, and an infinite variety of other useful articles; and though it may be impossible as yet to assign to each his exact share and measure of credit, the names of Thomas C. Wales of Boston, Stephen C. Smith of Providence, John J. Howe of Birmingham, Connecticut, Daniel and Nathaniel Hayward of Easton, Massachusetts, Charles Goodyear of New Haven, Connecticut, William Atkinson, Dr. Thomas, Jas. Bogardus, Horace H. Day, and John H. Cheever, all of New York, Charles Mackintosh, Thomas Hancock and Charles Kean, of England, and numerous others in both countries, will be duly honored for their several contributions in opening up this new field of industry.

There are now over thirty manufactories of India Rubber goods in the States of Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania and New Jersey, which have a capital invested of nearly $4,000,000, employ about 4,000 operatives, and produce fabrics valued at $6,000,000. Connecticut alone has thirteen India Rubber factories, owned principally by capitalists of New York, and whose products find their chief market in that city. The most noteworthy of these manufactories, and the one producing a larger product than any other in the country, is that of the NEW YORK BELTING AND PACKING COMPANY, which we select to illustrate the modes and processes adopted for manufacturing India Rubber goods in the best establishments.

The Factory is located on the Potatok River, in Newtown, Connecticut, a place that nature and art have combined to render attractive, and is the one in which Vulcanized Rubber was first practically manufactured under the direction of Charles Goodyear. The building is nearly 300 feet long, 41 feet wide, and five stories high; and to propel the ponderous machinery that is employed in the various processes of

grinding and preparing Rubber, the Company have constructed a waterwheel fifty feet in diameter—which, with the exception of Burden's, at Troy, is probably the largest in the country. This is assisted by a steam-engine of three hundred horse power.

Before describing the details of manufacturing, however, we may remark, that as the goods made at this factory are designed principally for mechanical purposes, the proprietors spare no pains or expense to obtain rubber which has the strongest fibre; and as the East India gum, or *ficus elastica*, has been found to be the best, they import that from Calcutta, Penang, and Singapore. It is imported in rude masses about two feet long and one foot thick, and covered with a rude matting, woven in wide meshes, through which the dark rubber is easily seen. A stock of hundreds of tons is constantly kept in their vaults or storehouses, which are built as nearly as possible fire-proof.

The first process which the imported material undergoes is to cleanse it of foreign matter, the masses of native rubber as they are gathered in the East Indian forests being so mixed with dust, and bark and leaves, that in cleansing they lose over 20 per cent. of their weight. The rubber is first placed in a large vat filled with hot water, where it remains for some time, until the exterior is partially softened and the workmen are enabled to strip off the basket-work that is woven around the original bales, and which adheres so closely that it can be removed only in this way. The masses of rubber are then cut into slabs of about an inch in thickness, by means of a large circular knife, between three and four feet in diameter, which is driven by machinery and revolves with great speed, cutting the tough mass as easily as if it were clay. The slabs of rubber are then taken to the "crackers," as they are called. These crackers are large deeply-grooved iron cylinders, invented for this purpose, which revolve in pairs, slowly and heavily, grinding the tough rubber between, and driving out much of the bark and dust. These machines are so skilfully arranged that the long slabs of rubber are stretched as they are drawn through, and much of the dirt and bark drops out and falls beneath the machines.

From the crackers the rubber is taken to the "washing-machine," a large vat, where it is cut into small pieces by numerous sharp knives which revolve under the water, and where it undergoes a kneading and washing process, very much like the process of preparing the pulp in paper-making. By this process all dirt and foreign substances are perfectly expelled, and the pure rubber alone is left. From the washing-machine the rubber is taken to powerful grinding-machines, which consist of large hollow cylinders of cast-iron. These cylinders revolve in opposite directions, and here the rubber, which is brought from the wash-

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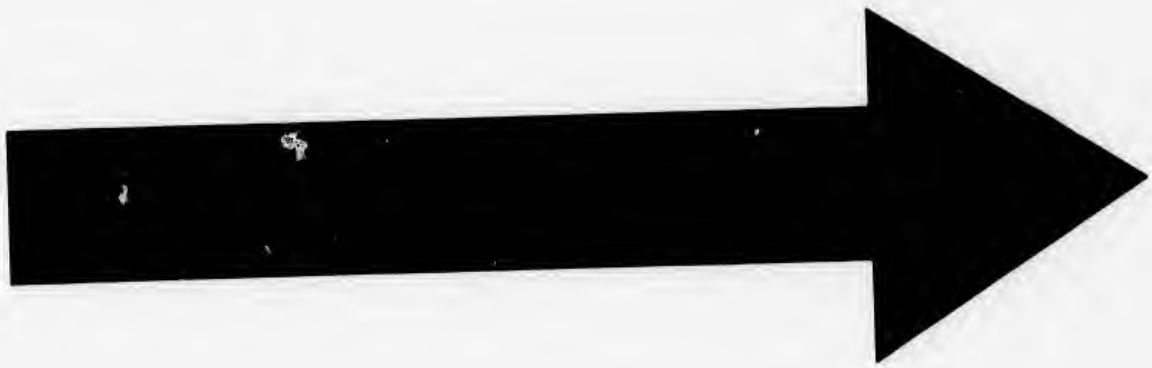

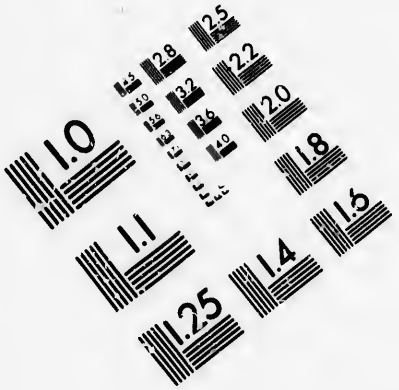

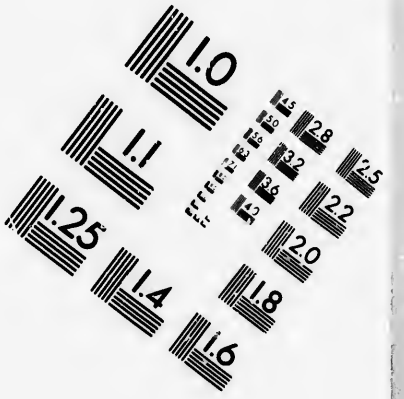

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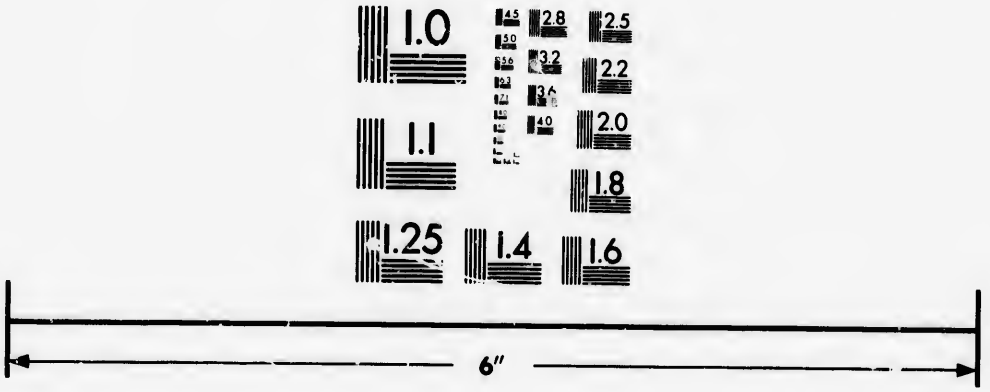

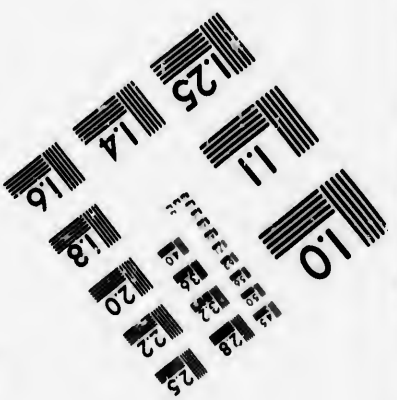

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ing-machine in small fragments loosely adhering to each other, is pressed and kneaded into thick sheets or mats. At this stage the process is suspended for some time, in order that the rubber may be thoroughly dried and cured by the action of the air. For this purpose these mats are suspended in long drying-rooms, where they are allowed to hang for many months before they are thought fit for use. Of course, a large stock of this cured rubber is kept on hand. The rubber thus cleansed and dried is first taken to the mixing-machines. This is the first important process, as it is here that the rubber is combined with the metals and minerals to which metallic rubber owes its peculiar properties. The mixing-machines like most of the machines employed in the factory, are hollow iron cylinders, and it is necessary that they should be kept at high but regulated degrees of heat, as the tough masses of rubber would otherwise resist the action of machinery, however powerful. These cylinders are of great size and strength, and are heated by steam, which is let into the ends. Two are placed near together, which, as they revolve towards each other, knead the substances placed between them like dough. The rubber is placed in the machine, and as the heated cylinders slowly revolve, the tough rubber is twisted and kneaded, and torn between. This is accompanied by a constant succession of sharp explosions as loud as pistol-shots which are caused by the air being forced through the rubber. As the rubber is folded over and over, air is confined in the folds, and when that portion of the mass is forced between the cylinders, the air is driven through the tough material with an explosion like an air-gun. When the rubber is somewhat softened, the workman mixes slowly the various substances which are to be incorporated with it; these consist principally of sulphur and of the oxides of various metals, zinc, lead, iron, etc., which are combined in various proportions, according to the uses for which the rubber is destined. It is in this department that the greatest science and experience are required, for different qualities of rubber require different compounds, and every difference in the compound makes a different treatment necessary in the subsequent stages of the manufacture. When the rubber is thus prepared it is ready to be molded and shaped into the various forms in which it is to be finally perfected and used.

As every distinct manufacture requires a different process and different manipulations, we will only describe the process of making "machine-belting," as that is of most importance and is the article for which this company are so celebrated. The rubber, which, after it is compounded as above described, resembles a dark slate-colored dough, is then taken to another department to the "calendering-machines." These somewhat resemble the other machines, but they are composed of more cylinders, and are of much larger size, and of a perfectly polished surface. Upon

these calenders the prepared rubber is placed, and after passing between the cylinders it is rolled out in a perfect and even sheet, upon a web of powerful cotton or linen duck, which has previously been coated with rubber, driven through and through its meshes by powerful machinery. This duck is somewhat similar to the heavy duck used for sails, but it is woven expressly for the New York Belting and Packing Company, in a factory which is exclusively employed for the purpose, and it is woven in a mode which gives it double the usual longitudinal strength.

The "bolts" of duck covered with rubber, after this process is completed, are taken to the belt-room; here the long webs are taken by the skilful workmen and unrolled upon tables 100 feet long, and in an incredibly short time, are cut into strips and folded together into machine-belting. In order to give the required strength to the belt, folds upon folds of the heavy duck are placed one upon the other, and then forced together by the tremendous power of the rolling-machines, until a belt is formed, more tough and solid than the best sole-leather.

From this room the belts are taken to the heaters. These are immense steam-boilers, with a long iron frame or railway, which can be thrust in or drawn out from the boilers at pleasure; the goods are placed upon the railway and rolled into the boilers, which are then closed, and steam is admitted. This part of the process is the most remarkable of all; for the rubber, which, when placed in the heaters, is like a tough, unelastic dough spread upon the various fabrics for which it is used, becomes wholly changed into the new and peculiar substance called metallic or vulcanized rubber. All the attempts of the most scientific chemists in this country and in Europe to discover the cause of this change, or to produce it in any other manner, have been wholly baffled. The causes, and even the manner of the change, are mysterious. All that is known is, that after the rubber has been heated at a regulated temperature from eight to twelve hours, it becomes a new substance, with properties unlike any other. The rubber-paste, which was soft and sticky, and but slightly elastic, becomes firm and dry, and ten times more elastic than the best native rubber. Heat and cold, which destroy the value of native rubber, have no effect upon it; the solvents in which the native rubber dissolved like gum have no influence upon it whatever; in fact it becomes, as it has been well called, an "elastic metal."

This Company make belts and bands of all sizes and lengths, from an inch to a yard or more in width, and adapted to all kinds of machinery. In their warerooms in Park Row there was recently a belt of seven plies thick, over a yard wide, and nearly 300 feet long. Such a belt, if made in the old-fashioned way, from leather, would have required the hides of 120 oxen, and would have been fastened together by thousands of

copper rivets; but here the great rubber belt was made in one operation, without joint or seam or imperfection. With regard to the comparative merits of leather and rubber belting, a writer in the *Scientific American*, to whom we are principally indebted for these facts, says he saw the ends of a leather and rubber belt of equal size firmly clamped together, and when power was applied to tear them asunder the tough sole-leather parted with a loud explosion, but the rubber belt was unharmed. He also witnessed an experiment to test the comparative value of these belts in driving machinery, and says that the peculiar elastic and tenacious surface of the rubber belt enabled it to hold much more firmly upon the iron drums and pulleys than the hard leather. "An accurate measurement showed that it took fully 25 per cent. more power to slip a rubber belt on a smooth pulley than it did to slip a leather belt on it. A large iron pulley, such as is used in driving machinery, was placed upon a shaft, and a piece of rubber belting was passed over it. Heavy weights were then placed on each end of the belt, in order to bring it down firmly and with an even bearing upon the pulley. The question to settle was, whether leather or rubber belting would bear the greatest weight without slipping, for this would prove which had the most perfect friction-surface and would drive the machinery with least loss of power. To test this, weights were slowly added to one end alone until the belt slipped on the pulley. The same experiment was then tried with a leather belt of the same width and under precisely similar circumstances, and it was found that the rubber belt greatly economized the power. Repeated experiments showed the same result in the most convincing and satisfactory manner." Certain it is that the demand for these rubber belts from manufacturers and our best mechanics, including the large manufacturing corporations of New England, is very great, for the Company are obliged to run their factory by night as well as by day to supply it.

Another article made extensively by the Company is Steam Packing. Rubber, it is said, is the only substance that can counteract the expansion and contraction of metal and make a joint so tight that steam cannot escape through it. It is made into sheets and plates of different sizes and shapes, or cast into rings or hollow ellipses of all imaginable forms, and is used to pack around the piston-rods, to place between the iron plates in steam pipes, and in fact wherever a joint is formed.

Another article manufactured to a great extent at this establishment is their celebrated "Croton Hose," and hydraulic hose of all sizes from a ¼ of an inch to 8 and 12 inches in diameter. A large force of workmen is employed in this department. The tube is formed by means of long metallic pipes, around which a sheet of carefully-prepared rubber is firs'

neatly folded; but the rubber alone has not sufficient strength to resist the pressure of water, which would swell and finally burst the elastic hose. To prevent this, and give additional strength, the outer covering is formed of webs of strong cloth, saturated and coated with prepared rubber. This is folded carefully around the hose until the requisite strength and thickness are obtained, and it is then finished by covering it with a final sheet of pure rubber. The hose, when formed, is taken to a steam-boiler of great length, where, while still remaining upon the iron pipes, it is heated and cured by a process similar to that before described; after which the rubber is drawn off from the pipe, and it is ready for the market.

Hose designed for steam fire-engines, which this Company manufactures largely, is tested by turning the whole force of the vast water-wheel upon two large force pumps, through which the water is forced into the hose and driven in jets over the factory and high above the summit of its lofty tower. Unless the hose resists this trying test it is not considered fit for market. Besides these leading articles, the Company manufactures a large number of others for household convenience or mechanical purposes,—for instance, carpets for halls, and stairways, and billiard rooms; sinks without joint or seam; door springs that can be adjusted either to hold the door open or to close it; bed springs, spittoons, and clothes wringers;—of which hundreds are made daily. Of their minor manufactures, however, perhaps the most ingenious is the solid emery vulcanite. It is a novel combination of emery and rubber, and used for grinding and polishing wheels, and which is destined to produce a revolution in many workshops where metals of any kind are ground and polished. The soft rubber when combined with emery makes wheels which will cut an inch file in two in a few minutes. The New York Belting and Packing Company own or are the sole licensees under no less than thirty-seven different patents, which secure to them not only the best means and processes and machinery for manufacturing their goods, but also a monopoly of certain branches.

Such is one of the numerous factories that are giving profitable employment to thousands of operatives, and furnishing contributions of the greatest importance in manufactures and the arts. This age has been prolific in wonders, and among them few are more marvellous than the product of the India Rubber factories of America. We desire, however, to place upon record our settled conviction that the application of vulcanized rubber in the useful arts is as yet in its infancy, and that our ingenious mechanics and manufacturers will discover hundreds of new uses for this wonderful "elastic metal."

The Piano Forte Manufactories—Steinway and Sons' Manufactory.

New York is the principal centre in the United States of the manufacture of Pianofortes. There are over fifty different manufactories; and though we believe there are none so extensive and complete as the one that we are about to describe, yet among them are many fine and some large establishments.

The name of Steinway as a manufacturer of Pianofortes has long been a familiar one to the musical artists of Germany. Mr. Henry Steinway, the founder of the immense establishment which strangers from afar now visit as one of the wonders of New York, commenced the business of making Pianos in Brunswick, Germany, nearly fifty years ago; and though during the quarter of a century in which he prosecuted the business he probably did not make as many instruments as his establishment now turns out in a single year, yet he acquired a reputation, and his European career as a master-builder may be said to have been a successful one. When, however, the uprising of the German people for their constitutional liberties in 1848 and 1849, in which he sympathized, proved a failure, he resolved to escape from the despotism that followed the subjection of the "liberal party," and to seek a more congenial field for the free exercise of his genius and enterprise. As a prudential measure he sent his son Charles to America as pioneer and explorer, to report upon the prospects of emigration which the country would be likely to afford to the family. His son arrived in June, 1849, and his report confirming the previous favorable impressions of the father, he followed with the family just one year after. Although possessed of some means, he deemed it advisable before commencing business on his own account to study the routine of manufacture as practiced in American workshops, and he and his sons commenced as journeymen in some of the best manufactories then in the city of New York. The advantages of this thorough training, which rendered them practically familiar with the American and European methods of manufacture, soon became manifest when the products of their skill and handiwork were entered in competition with those of others, even the best makers.

Their first instrument, made in 1853, in a small rear building in Varick street, at once attracted the attention of professional musicians, and at the "National Fair" in Washington, was awarded, by the unanimous vote of the jury, the first premium, notwithstanding there were some twenty competitors from the principal cities of the Union, including most of the names then of established reputation. A demand

for their instruments at once sprung up, and a change of location to one possessing more extensive facilities for manufacturing soon became an absolute necessity. The popular favor which rewarded their early enterprise has in this instance manifested none of its proverbial fickleness, but has increased and widened until from one Piano a week they are now called upon to make seven a day. During the last four years we are informed that over twenty first-class premiums have been awarded them by American associations for the promotion of industry and encouragement of talent; and at the late exhibition or World's Fair in London, in 1862, a jury composed of the most renowned musical celebrities of the old world decreed to Steinway and Sons, of the United States, the first premium for "powerful, clear, brilliant and sympathetic tone, with excellence in workmanship, as shown in grand and square Pianos." This was indeed a remarkable triumph that could not have been won except by the exhibition of the most marked, unquestionable and supereminent excellence. In fact, the superiority of these American Pianos over their European competitors has excited the attention of connoisseurs throughout Europe, and all the principal musical journals in London, Paris, Vienna and the continent noted the fact with astonishment and confirmed the opinion of the official jurors.

It is an axiom that there can be no great mechanical excellence without corresponding merit in the mechanic. Luck, whatever may be its influence in speculative enterprises, has no appreciable place in manufacturing operations. We may not be able to analyze or trace causes in results, but we can safely infer that where there is great success there is also adequate cause for it. One circumstance which has doubtless contributed to the success of this firm, is that all its members are practical Piano makers, and each takes in charge and superintends a special department of the manufacture. Another advantage which they possess is that they are musicians and adepts in the science of music and acoustics, which, combined with their practice, renders them scientific as well as practical workmen. They are also inventors, and have taken out some fifteen patents for new actions and scales. Among their first or earliest improvements was a new reversed bridge, constructed of metal, for improving the treble; a new way of bracing their Pianos by which they could use much thicker strings, thus producing a more powerful tone; an ingenious arrangement in the scale, having the sounding board nearly double as large as that in any other Pianoforte, which of course gave much greater volume of tone.

In 1859 Mr. Henry Steinway Jr. succeeded in overcoming the difficulties which had heretofore been deemed insurmountable in the way of overstringing Grand Pianos. The arrangement of the strings of the

lower notes in a tier above others, for the purpose of using larger strings, had been quite commonly adopted in the construction of square Pianos, and a substantially similar system of stringing had been applied to upright Pianos, but owing to the form of the case and arrangement of the key-board and action of Grand Pianos, it had been deemed impracticable if not impossible to apply the principle in their construction. But Mr. Steinway has succeeded in overcoming these difficulties by an improvement which he has patented, and arranges the strings of a grand Piano in two tiers, with the same advantageous results as had been obtained in Pianofortes of other forms, while the bridges are also brought nearer the middle of the sound-board than they are in any other Grand Piano. In the same year Mr. Steinway patented another valuable improvement, the object of which was to permit the use of "agraffes" for the tuning block-bearings of treble strings, and yet to permit the strings to be struck as close as is desirable to those bearings. This was effected by constructing the cast-iron plate which covers or partly covers the tuning block with a projection on its under side, to lap over the edge of and abut against the tuning-block, and in securing the agraffes down from the upper surface of the plate into the projection. Both of these inventions and improvements have been generally adopted by manufacturers abroad, which is significant evidence that they appreciate their value.

The present manufactory of Messrs. Steinway and Sons is one of the largest of its kind in the world. It was erected in 1859, and occupies an entire block fronting on Fourth Avenue, and extends from Fifty-Second to Fifty-Third street. The front on Fourth Avenue has a length of two hundred and one feet with a depth of forty feet. The wing on Fifty-Second and Fifty-Third Streets are one hundred and sixty-five feet in length and forty feet in depth. The whole building is six stories high including the basement. The architecture is of the modern Italian style, with brick lintel arches, brown stone trimmings, and brick cornices. It is very substantially built, the basement-wall being grouted brick two feet thick, the first story walls twenty inches and the upper walls sixteen inches in thickness. The main building covers fourteen city lots, eleven other lots being used for the purpose of seasoning lumber, of which there is a stock of about 2,000,000 feet always piled up on the grounds. In the yard there are four drying houses, each of which is heated by 2000 feet of steam-pipe, and contains about 60,000 feet of lumber, so that there are about 240,000 feet of lumber constantly under the process of kiln-drying.

There are about 400 men constantly employed, who turn out forty-Square and five Grand and Upright Pianos every week.

The machinery is driven by a splendid engine of fifty-horse power situated outside the building in the yard. It was manufactured by the Corliss Steam Engine Company, of Providence, and contains all their latest patented improvements.

All the heavier portion of the machinery is located in the basement. In this room are three large planers, one of which was made expressly for this establishment, and is certainly one of the largest instruments of its class existing, planing the largest Piano tops or bottoms at once. There are also four up-and-down saws and several circular saws, besides turning lathes, etc. etc. These wonderful and powerful instruments are constantly at work shaping the rough plank ready for use in the first floor above, where the bottoms, blockings, wrest planks, and other parts of the case are got up, with the aid of moulding, jointing, and other machinery.

The three stories above are occupied by the case makers, who take all those single parts made below, put them together, and veneer and finish the cases ready to go up to the top floor or varnishing room, where every case remains from three to four months to be thoroughly varnished. On each case making floor there are three large warming boxes constructed of sheet iron and covered with wood, with sufficient steam pipes in them to raise the heat to 200 degrees. The varnishing department comprises the top floor, extending the whole length of the front and side buildings—a length of five hundred and thirty-six feet. From this floor the completely varnished cases are taken one floor lower down in the front building—the sounding-board floor—where the sounding-boards are fitted in.

In the floor below the instruments are strung, and the action and key boards, and the tops, legs, and lyres adjusted and put on. The partly-finished instruments are then taken first to the floor below where the action is regulated, thence to the first floor, where the hammers and the tone are regulated; after which the final polish is put on the cases and the perfect Piano is ready to be sent down to the sales room. This floor also contains the office of the establishment, situated on Fifty-Third Street, through which every person entering or leaving the building has to pass.

In connection with the office is the store room, which contains the actions, felts, hardware, ivory, cloth, pins, wire, etc. used in the interior works of Pianos. Of these materials there is a vast supply always on hand amounting in value to over thirty thousand dollars.

The front basement contains all the iron work, plates and bars, drilling machines, japanning works, and the rosewood veneers. Of the last the stock on hand is rarely of less value than eight thousand dollars

No fire of any kind is used within the building. Every part of the factory is heated by means of steam pipes, 40,000 feet of which line the interior. The wood-heating apparatus is also warmed by steam, which also heats the kilns for japanning, etc., etc.

In the two extremes of the building are placed tell-tale clocks for the purpose of testing the trustworthiness of the night-watchmen. Wires are carried to each floor, and if they are not touched at certain intervals the watcher has neglected his rounds, and the tale is recorded on the faces of the dials.

There are from six to seven hundred pianos constantly in course of construction, and these, in connection with the hardware, machinery, engine, veneers, lumber, etc., etc., represent at least the sum of $400,000, exclusive of the buildings. The cost of the building and ground was about $150,000.

The distance between their Sales Room, on Walker Street, and the up-town factory, is so great, and the need of immediate communication so frequent, that a telegraphic correspondence was found to be necessary. Consequently a private telegraph line has been established between Walker Street and Fifty-Third Street, bringing the two business places into instant communication.

Messrs. Steinway have erected on East Fourteenth street, a few doors from Union Square, near the Academy of Music, a splendid marble building, which they occupy for a Piano Wareroom—the upper part being fitted up for a Concert Hall. Like their manufactory, it will stand as a monument of their enterprise, while it is also an ornament to the City of New York.

Haines Brothers' Piano Forte Manufactory,

Though less extensive and imposing in external appearance than the one already noticed, deserves a place among the largest and most important establishments of the kind in the United States. It is located on a corner of Twenty-second street and Second Avenue, and, including the space appropriated to storing lumber, covers about half an acre of ground. The manufacturing operations are carried on in two buildings—one, six stories high, having a front of sixty-six feet, and a depth of ninety feet; and the other, sixty by one hundred feet, four stories in height. Connected with the latter, is the Lumber Yard, in which a stock of nearly a million of feet is constantly kept, under-

going the process of thorough seasoning. No lumber is used by this firm, in the construction of Pianos, until it has been seasoned at least a year, and then dried for four months longer in rooms, kept at a uniform heat of about 100° Fahrenheit. The drying-rooms are most admirably arranged, with a capacity sufficient to contain one hundred thousand feet of lumber.

The selection of lumber, and its careful preparation, are points of essential importance in making Pianos that will be durable in any climate; and we know of no firm, engaged in the manufacture, who give more attention to this important particular than Haines Brothers, in which they are aided by a large capital.

After the lumber has been thoroughly dried, and judged fit for use by a high and rigid standard, it is converted into cases, in the building on the north side of Twenty-second street, which is provided with all the tools—such as planers, circular saws, upright turning saws, etc.—necessary for expeditious wood-working. The machinery is propelled by an engine of forty-horse power, and three boilers furnish steam sufficient for the drying-rooms, and to heat both buildings, in which there are over ten thousand feet of steam pipes, and which are connected by means of pipes under the street. Passing to the main building, we find the office and warerooms on the first floor, two entire stories occupied as varnish rooms, and the other portions divided into numerous rooms, each devoted to a special purpose. About three hundred Pianos are in course of construction in this manufactory each day, and, consequently, the workmen have constant employment in that in which long experience has made them perfect. In the Action-regulating Department, for instance, there are men who are employed all the time in adjusting and regulating the "action," which, though composed of several pieces, has been arranged according to a mathematical scale, and made by those skilled in the several parts. Perfect workmanship is hardly attainable, except in establishments like this, where the business is sufficiently large to afford the principal workmen constant employment in one line of duty.

The capital employed by this firm, in the manufacture, exceeds two hundred thousand dollars, which enables them to procure materials in large quantities, and on favorable terms. In the store-room, there are as many as two hundred and fifty sets of keys, ready for use, and a large stock of wire, buckskin and metallic plates. The steel wire used by them is of American manufacture, which is quite equal (and some say superior), in quality and finish, to the foreign wire.

All of the seven-octave Pianos, manufactured by this firm, have iron frames, with overstrung bass; and their seven-and-a-quarter-octave

Piano is the most powerful and superb instrument that has, as yet, been made. Among the improvements made by them, and which are adopted in all their Pianos, the least costly as well as the most expensive, is a peculiar construction of the sounding-board, and the substitution of Wooden for Iron bridges. The latter, it is asserted, is one cause of the distinguishing feature of the Haines Pianos, viz.: evenness and equality, as well as purity of tone. Among the novelties to be seen in their ware-rooms, is a Stereoscopic view of the interior of their manufactory, prepared at a cost of six hundred dollars, by which the visitor may see all parts of the extensive establishment, while comfortably seated on a Piano stool.

The firm of Haines Brothers is composed of Napoleon J. and Francis W. Haines, both practical workmen, who served a long apprenticeship in their present vocation. The senior partner has been engaged in the manufacture of Pianos since 1839, and, after thirteen years' service in other establishments, commenced business for his own account in 1852, in which he was shortly afterward joined by his brother. Adopting, from the beginning, the principle of making a thoroughly reliable instrument, and selling it for a moderate price, they, like the Steinways, have achieved a success that may truly be called remarkable. In 1856, they were enabled to erect their present manufactories, now too small for their extended operations; and, in 1857, they built the marble warehouses, now owned by them, Nos. 626 and 628 Broadway. Encomium, in instances of this kind, is but a just tribute to meritorious enterprise, which has compelled the musical journals of London to acknowledge that Americans are "much farther advanced in the art of manufacturing Piano Fortes than is generally supposed in Europe." Over 1000 Pianos were made by this firm in 1867.

Christy, Constant & Co.'s Paper Hangings Manufactory

Is one of the most imposing, in external appearance, of the manufacturing establishments of New York, and one of the largest of its kind in the United States. The principal building has a front of pressed brick, extending, on Twenty-third street, three hundred and twenty-five feet, and is five stories in height, exclusive of the basement. The superficial area of the floors in this building is seventy-five thousand feet. Besides this, there is a storehouse, and a parallel row of buildings in the rear of the main structure, three hundred feet in length, in which are located the chemical works, the print cutting, the machine and carpenter shops, the engine and boiler rooms, and the stables.

On entering this vast manufactory, and passing through its various departments, the visitor cannot fail but be impressed with the great revolution that has been effected in this manufacture within a few years. Here, Cylinder Printing may be seen on the grandest scale, and in its most perfect form. The facilities are such, that blank paper, as it comes from the mill, can be converted, in half an hour, into Printed Wall Paper, reeled and ready for market. Here, seventeen hundred tons of Paper were consumed, the last year; and now, seven hundred and fifty miles of Hanging Paper, as it is technically called, are converted into finished Paper Hangings, every week.

The first operation in this, as in all other Machine Printing, is the preparation of the design. The principal designer of this firm resides in France, which, it must be conceded, is the world's centre, in all that relates to Ornamental Art. The patterns are then cut on blocks of maple, inlaid with brass and felting, so as to increase their durability, and the print blocks, prepared as they are in this establishment, will endure constant wear for six months.

Entering the principal building devoted to manufacturing purposes, we find, on the first floor, four large cylinder machines, each of which will print twenty-four thousand yards of paper in a day. By arranging a separate roller for each color, twelve colors may be printed at one operation, and by this means one man and two boys can produce more finished Wall Paper in one day, than the same number of hands could have produced by the old process in six months. The paper, as it leaves the cylinder, is carried along India-rubber belts, in folds of eight yards each, over steam pipes, which dry it; and when it reaches the extreme end of the building, it is reeled into rolls, and is then ready to be transported to the warehouse. This facility of production enables us to understand why Wall Papers are now sold better in quality than those which twenty-five years ago could not have been produced for six times the present price.

Ascending to the second story, we come to the apartments devoted to hand printing, in which are twenty-five to thirty hand-presses, and where all the higher grades of Paper Hangings, including Gold and Velvet Papers, and Borders not made by machinery, are produced. For these Papers, the patterns are first printed with glue-size; and then with a preparation of varnish or gold-size, before receiving the flock or bronze. When this is partly dry, colored flock, or ground wool, is sifted over the varnish pattern, to which it adheres, giving an effect resembling velvet plush. The boys, who perform this service, seem to combine amusement with labor, in beating a reveille, in distributing the flock evenly over the surface. When gilding or bronzing

is introduced, the paper, after the figures have been printed upon it with gold-size, is passed through a Bronzing Machine, which covers the paper with bronze, and, at the same time, by means of fur rollers and rubbers, removes the surplus bronze; and when dry, it is reeled into rolls ready for sale. On this floor is also the Satin Polishing Room, in which are ten polishing machines of an entirely new construction, which were invented and patented by Mr. Christy. These machines are used for imparting a satin or glazed surface to the grounded papers before the figures are printed upon them.

The third floor is devoted to Cylinder Machine Printing, similar to the first floor. Here are six machines, capable of producing eighteen thousand rolls, or fifty-four thousand yards of Wall Paper per day.

The fourth and fifth floors are Grounding Rooms. In these rooms are ten grounding machines, used for covering the surface of the paper with a ground color preparatory to the process of printing. The color-mixing departments are in the basement of the main building; and, as the amount of colors or paints consumed is very large, being often as much as fifteen hundred gallons per day, the mixing is conducted on an extensive scale, in large tubs or vats, in which the mixers are driven by machinery. The more expensive tints are prepared by hand-labor entirely, and in this some fifteen hands find constant employment. The colors, and also the raw paper, are hoisted to the different rooms by steam elevators at each end of the building. For the Drying, some forty thousand feet of steam pipe are required. The machinery is propelled by a Corliss engine of sixty horse power, and three large boilers are required to supply steam sufficient for heating and drying. The engine room is remarkable for the neatness, and even elegance, of its furniture and appointments.

The firm of Christy, Constant & Co. was established by THOMAS CHRISTY, who came from Boston and commenced the manufacture of Paper Hangings in New York, in 1836. His sales, the first year, were thirteen thousand dollars; now they exceed a million. About 1842, his brother-in-law Samuel S. Constant, became associated with him, under the firm name of Christy & Constant—which, on the admission of other partners, was changed to its present style. The Warehouse and Salesrooms are at 25 Murray street, extending through the block to 29 Warren street. This part of the business is under the immediate supervision of the junior partner, T. C. Shepherd, a nephew of Mr. Christy.

Mr. Christy is an inventor, as well as a representative manufacturer. Among the inventions designed and patented by him, are the new polishing machines mentioned above, which can be operated with one

fifth the power required for those in ordinary use, the work at the same time being done with greater facility and perfection. The firm have in their employ some two hundred operatives.

Tiffany & Co.'s Jewelry Establishment,

Located at 550 and 552 Broadway, can scarcely be called representative of others, inasmuch as it is unique, and has few, if any, rivals in the field of personal ornament and luxury. For the vast extent of its dealings, and the costliness and comprehensiveness of its stock, its reputation is not confined to this country, but is essentially world-wide.

Messrs. Tiffany & Co. commenced business, in a very small way, during the autumn of 1837. Their store was located at 259 Broadway, the first story of a building otherwise occupied as a dwelling house. The sole partners at the start were two brothers-in-law, Charles L. Tiffany and John B. Young, who, from the townships of Brooklyn and Killingly, in Windham county, Connecticut, had come to New York with very little else in the way of material for success than strong wills, keen perceptions, energies unfaltering, and the determination, which New England soil seems to create and cherish, to conquer fortune in a fair contest. At the date of their opening store, Mr. Young was the only one of the pair who could claim to add to this very common-place, but often so productive capital, a moiety of experience. He had for six months been engaged in the Stationery importing trade as a salesman. It was Mr. Tiffany's first visit to the metropolis.

The stock of Tiffany & Co., at the start, was a miscellaneous selection of fancy wares—stationery (including paper and playing-cards), cutlery, walking sticks, Chinese goods, comprising chess-men, lacquered wares, fans, etc., porcelain, Berlin iron, etc.; a *melange*, the details of which would be as amusing now to peruse as difficult to enumerate. Chinese curiosities were then in much favor with buyers, and it would seem that every ship brought more or less of them, the private investments of officers and sailors. Tiffany & Co. made a specialty of these wares, selling the quaintly-monstrous chessmen, the queer-looking little red clay teapots, the enormous punch-bowls, and wonderfully clumsy *jardinieres*, in a profusion that would astonish the Fancy Goods trade now. The capital of the firm, at starting, was one thousand dollars, equally contributed by the partners. From the little cash-book, still preserved, in which is formally inscribed to the credit

of the House the above modest investment of capital, we find the daily amount of sales. On the 21st of September, the date of the first entry, the sales amounted to $4.98; on the 22d, to $2.77; on the 23d (entered doubtless with most jubilant penmanship), to $24.31. Occasionally, during the first two or three months, the entry was peevishly small, and it is easy to imagine the heart of the partnership was any thing but a glad one. On the 23d of December, the last salesday before Christmas, the cash counted up $236.00; and on the day before New Year's, $675.00. This excess of New Year's over Christmas is noteworthy as marking the change which fashion, or possibly a more worthy social impulse, has effected, Christmas being now the favored day for present-making, whereas then nearly all but the most observant Episcopalians adopted the Pagan annual for their general exchange of gifts and good-will. Perhaps a more notable change, though not of so public a character, would attract the attention of one having access to the cash-book of Tiffany & Co. now in use. From less than three hundred dollars, to a long way over one hundred thousand, the figure of our Christmas days, is a progress wonderful enough, but, after all, only illustrative of what success is within the reach of untiring energy and ever-watchful judgment.

In 1839–40, the addition of the first floor of No. 261 to the premises of the firm gave the first outward demonstration of the success which had been so fairly earned. From that time till 1847, enlargement of space was a most frequent occurrence, the new stock, constantly suggested or increased by the popularity of the House, requiring now an apartment, now a floor, added for its proper storage and display. With a sagacity, then not so common as now, the partners lost no available opportunity to advertise their business, the attractiveness of their addresses to the world and their discriminating detail of inviting wares largely and conspicuously remunerating them for the outlay.

In the spring of 1841 a new partner, Mr. J. L. Ellis, entered the concern, and in the fall of the same year Mr. Young made a first trip to Europe. This was a most important move, and one which was undertaken with high hopes, though after very serious consideration. That it eventuated with signal advantage, and was in fact the obvious original of the present extraordinary position of the establishment, need not be matter for surprise or argument; but, nevertheless, it was a great undertaking for so small and fresh a beginning. Mr. Young's first European visit was the inauguration of the Jewelry department of the House, and a general extension of the department of elegancies, articles of virtu, etc. Henceforward the House claimed a specialty for English and Parisian personal luxuries, rich Dress Fans, exquisite Por-

celains, elaborate Toilette Boxes of choice woods, and kindred wares. The first venture in Jewelry was, however, only the imitation Palais Royal article, of which, from its really tasteful design, quantities were sold for three or four years succeeding.

In 1844–5, stimulated by its success in the sale of the imitation, the firm made its first investment in an assortment of standard Gold Jewelry. The trial was immediately proved to be a fortunate one. Gradually the stock became more extensive, comprising in occasional instances articles of a costly nature, modestly displaying diamonds and precious stones. The frequent visits of one or the other partners to Europe kept the assortment constantly up to the mark of fashion, and the establishment in no long time acquired a popular estimation as a Jewelry mart. In 1848, the era of the *Coup d'etat*, Mr. Young purchased a very large amount of diamonds in Paris, availing himself of the remarkable decline in the value of precious stones incident to the Revolution, diamonds being sold at that period for considerably less than half their purchase money at the present day. Thenceforth the House began to make rich, and especially diamond Jewelry, a distinctive feature, and to rapidly gain the reputation, now universally accorded to it, of the representative establishment in that line on this side the Atlantic.

In 1847, the premises at 259 and 260 having become too small for the largely increased business, a move was made to No. 271, a spacious building on the corner of Broadway and Chambers street, now occupied by the white marble structure of the Shoe and Leather Dealers' National Bank.

In 1850, a most important addition to the firm was made in the introduction of Mr. G. F. T. Reed, previously of Lincoln, Reed & Co., of Boston, a House conspicuous for many years in the Jewelry trade. The incoming of Mr. Reed was the immediate occasion of an arrangement which has resulted most fortunately for Tiffany & Co., namely, the establishment of a permanent branch of the firm in Paris. The offices of Tiffany & Co. in Paris have been for years located at No. 79 Rue Richelieu, and are well known to Americans abroad. The advantages of a permanent Paris branch are too obvious to need more than a general suggestion.

In 1851, Tiffany & Co. commenced the manufacture of Silver Ware. Previously to this day this feature had been gradually assuming a place in their business since their introduction of Jewelry, it seeming to claim a certain cognate position and interest. It is the distinction of this House, that in several of its specialities it does a larger business than establishments which give exclusive attention to the same

line of production. Of sterling Silver Ware, Tiffany & Co. are, it is said, the largest manufacturers in the country. During the first two or three years the maximum of men employed in the production of Silver for the firm was fifty. They now have two hundred of the most skilful fabricants to be found, and use up in the course of the year 150,000 ozs. of metal. Their present superior facilities in the way of machinery, and the admirable organization of their factory, likewise enable one man to effect the same work which was originally expected of two, so that the force employed is to all purposes eight fold that of the commencement of the manufacture. This extensive production entails an extraordinary investment not only of capital, but also of taste and observation. Many of the productions of this department are indeed *chefs d'œuvre*. For years all the prizes of the New York Yacht Club have been made by Tiffany & Co. Nearly all the magnificent Race Cups that are yearly contended for throughout the country have had the same origin; and specimens of the ability of the House in this line may be met with in China, the Sandwich Islands, and in fact wherever sporting liberality requires such splendid guerdons. The rich case of Silver exhibited by this firm in the Paris Exposition, designed rather to illustrate the sensible elegance of American domestic life than to challenge comparison with the enormous show-pieces of old world production, is a notable exponent not only of the art resources of the establishment, but likewise of the excellent taste of its patrons.

In 1852 the firm, having previously to some extent imported fine French Chandeliers, commenced the manufacture, for which it is now so well known, of Bronze Gas Fixtures. The material, which is the same quality of bronze used by the Parisian founders of art-pieces, and the excellence of the workmanship bestowed upon their production, while they render the Gas Fixtures of Tiffany & Co. more expensive, at the same time produce articles of much greater artistic merit and durability than are the ordinary fixtures. As a branch of the firm's manufacturing, this enterprise, though requiring an insignificant number of fabricants in comparison with the Silver and Jewelry departments, has a fair claim to share with them in the general result of improving the country aesthetically.

Since 1858, the facilities of the establishment for the proper execution of the elegant designs of its artists have been so much enhanced, and have found so decisive public indorsement, that the firm at that date ceased importations in that line. A distinguishing merit of the home production is, that a design for the fixtures of a gentleman's dwelling can be patented by the House, and thus, should the order so specify, remain actually unique in style and finish. General experience

of the Bronze Chandeliers of Tiffany & Co. demonstrates likewise another merit quite creditable to American workmanship—that they are much more exactly and durably constructed than the foreign productions.

The Bronze Department of Tiffany & Co. does not however simply relate to Gas Fixtures. The importation of objects of art in this rich metal was one of the first results of their European trips. Liberal encouragement to what was then rather a novel venture, soon made the seasonable invoices so considerable as to become a distinct feature, and after a while to attain the dignity of a department in itself. For some years the Bronze Gallery of Tiffany & Co., constantly replenished by the receipt of the very choicest productions of French and other foreign articles, has furnished a more general assortment than any even in the old world. As a resort for artists and connoisseurs, as well as for the art-emulating public, it is deservedly one of the attractions of the metropolis.

In 1854, the business of the firm had so far exceeded the prescribed space of 271, though the whole of the building was in use, as to make another move unavoidable. This time the change of location was so great as to startle even the most ambitious advocates of "uptown" progress. A structure, at that day of unique elegance, and even now one the most ornate specimens of New York business architecture, had been erected for the firm at 550 Broadway. The new store was five stories in height, with basement and sub-cellar, covering an area of thirty-five feet front by one hundred feet depth. Perhaps the best commentary on the foresight of those who prognosticated evil from the change, is the fact that in 1861 the necessities of stock and trade obliged the firm to secure the adjoining store, No. 552. The premises of Tiffany & Co. now have a frontage of sixty-five feet, and are much larger than those of any similar establishment in the world.

As dealers in Precious Stones, the reputation of the House became superlative soon after its move to its new quarters. Having the unique advantage of a permanent Paris office, with a resident partner in the person of Mr. Reed, its capabilities for the purchase of gems were unequalled. It is not unusual to see, in the cases of the establishment, jewels of extraordinary size and purity, to which historic association lends the indefinable charm, that can be imagined, though it may not be materially estimated. Tiffany & Co. have been the instruments of transferring not a few Royal and Princely Jewels to Republican possessors. Some years ago they purchased in Paris the well authenticated zone of diamonds once worn by the hapless Marie Antoinette. During the year 1867, at the sale of the magnificent collection of

jewels of the Hungarian Prince Esterhazy, they were likewise among the largest buyers, their purchases approximating to one hundred thousand dollars. The romance of Jewelry, it will thus be seen, is not to be disregarded, though, in this instance, it is incidental to the more practical view of the way an American firm is enabled to cater to the tastes of its patrons.

At a very early date in the progress of their Jewelry trade, Tiffany & Co. became manufacturers. A repair shop was in fact almost an immediate necessity. After a while, as the House gained a reputation in that line of business, designers, diamond-setters, etc., became requisite. By such advances, from so small a beginning, has grown up perhaps the most extensive establishment engaged in the production of what is known as standard or eighteen-carat Jewelry in the United States. The number of workmen employed in all the Jewelry manufacture of the House is rarely less than two hundred; and during the holiday season is considerably larger. The difficulties incident to the collection of such a force of skilled mechanics, which comprises diamond-setters, link and chain makers, enamellers, modellers, chasers, engravers, polishers, etc., are very great, requiring energy and judgment as well as capital in an unusual degree. None but articles of the standard purity of metal (eighteen-carat gold, the proportion best adapted for richness of appearance and lasting wear), are permitted to leave the shops of Tiffany & Co.; and the quality of finish is equally regarded, it being a positive business rule that all productions shall be of guaranteed excellence. Connected with both the Jewelry and Silver Ware departments of the House, and equally essential to each, is the extensive Designing room. The enterprise of Tiffany & Co. has judiciously secured the most capable artists in their line of manufacture, and with a kindred liberality of foresight organized this important feature so perfectly, that the designer has constantly at his hand the published Art Treasures of the world, no cost being spared to procure the freshest authorities in the way of theory or illustration. The variety of uses to be subserved by such a feature is very great, the growing fastidiousness of public taste constantly requiring something out of the common in the wide range from signet-rings to diamond *parures*, or from silver christening-cups to the stately decorative *epergnes*. A Monogram, deftly and quaintly arranged for the leaves of a lady's fan; an emblematic Bronze Gateway to a Tomb in the City of Mexico; a sculptured Race Prize for the Hong Kong course; a Class Ring for the West Point graduates; a silver Wedding Memorial; an Album Cover, to comprise an instance of every Mineral and Stone from New York Bay to the Golden Gate; a Badge for an Army

Corps; a Sword for a General; a Medal for a Cable Layer; a Cane for a Judge; and a Punch Bowl for an Alderman;—however incongruous an assemblage it may be, is not, as experience has shown, an impossible circumstance in the multiplicity of a day's calls upon the resources of the Designing department.

The characteristic adaptability of American business houses, which, in seasons of commercial stagnation, or even civil rupture, enables them to sustain the vitality of trade by fitting their powers to new purposes, perhaps just suggested by the nature of the period, or by transferring their accumulated capital to temporary channels entirely strange to the country, was conspicuously exemplified in the instance of this firm during the recent war for the Union. Foreseeing the probability of a prolonged struggle, Messrs. Tiffany & Co. were the first to exhibit to the U. S. Quartermaster-General a complete outfit of French Army Furniture, comprising the uniform, the campaigning conveniences, the ambulance, tents, etc. Not long after this, a considerable portion of the store at 552 Broadway was arranged as a show-room of military accoutrements. During the continuance of the war, the firm enjoyed a very large patronage for the finest grades of military wares, and indeed became the depot with army men for the choicer requirements of the service. As the struggle progressed, and individual prowess brought one or another new popular idol into notice, rich Presentation Swords became frequent circumstances—a City or State indorsed its hero with a diamond-hilted Blade—a Brigade complimented its General with a pair of Gold Spurs—a Regiment its Colonel with Pistols of ivory and silver—or a Company its Captain with a splendid Field Glass, escutcheoned and inscribed. In this very considerable line of patronage the artistic and manufacturing facilities of the firm gave it an essential superiority. The number of rich swords made to order is ascertained, from existing memoranda, to be very near six hundred, varying in cost from fifty to two thousand five hundred dollars. The celebrated sword ballot in the great New York Sanitary Fair was suggested by Tiffany & Co., who presented one of their finest productions, eventually awarded to General Grant, to the directors of the charity, and thus inaugurated what has proved a prominent feature in subsequent philanthropies of the kind. The artistic merit of several of the swords seemed to surpass any thing previously known, as if the Genius of the country had inspired the eye and hand of the designer. In addition to swords, the House soon established a reputation for Flags of the most expensive character, requiring the organization of a small corps of wood workers and embroiderers. Every one of the Union States patronized the firm in this line to a greater or less degree,

the Flags costing from one hundred to five hundred dollars. The register shows that three hundred and sixty-two of the most costly style were produced, while probably treble that number of less expensive Flags were made, some States ordering for their entire quota. During the latter half of the struggle, individual and corps Badges, Medals of Honor, etc., came in vogue. The orders for these, strikingly illustrate the grandeur and nature of the Union armies. The Corps Badge was of the same design for all grades, but of so widely varying difference of material and workmanship as to furnish the commander with a jewel, and the subaltern with a device suited to the means of each. In one instance a General's Badge, presented, reached the cost of two thousand five hundred dollars. Badges for enlisted men, on the contrary, were made to sell for twenty-five cents. For a portion of Sherman's Grand Army twenty-five thousand Badges were manufactured; for the Eighteenth Corps, ten thousand, afterward increased from time to time; for Kilpatrick's Cavalry, five thousand; etc. Since the war, different States have awarded their veterans Medals of Honor, the State of Ohio, as an instance, ordering twenty thousand, of a design which is even finer than the well-known Crimean medal in point of execution. The finest Medal ever bestowed in this country, in the view of connoisseurs, is a recent production of this firm, to the order of the State of Tennessee, for presentation to Major-General Thomas. It is of pure gold, weighing exactly one pound, and in artistic excellence vies with the rarest specimens of the French medallist's skill.

The foregoing *resume* of the business career of one of the great commercial and manufacturing houses of the land, is necessarily inadequate, so far as statistics are to be regarded, but may be found at least suggestive of the resources of the particular establishment, and in some degree of the liberal encouragement offered by American progress and refinement to those who study such patronage. Before concluding, we may note one feature which has been adhered to by this firm from its commencement in its transaction with customers, the results of which have commended it as most exemplary to the business public, namely, the one price system. The articles on sale, from the cheapest to the most costly, are all priced in plain figures, and these prices are never deviated from. As a system of communication between seller and purchaser, this has merits so obvious as to preclude the need of illustration. But, were any needed, the best illustration is furnished by the unvarying prosperity of a firm which has always and strictly observed it.

A great Frenchman says, that "luxury is one of the signs of civilization;" and, in this view of M. Thiers, it is likewise safe to assume that the one result, of such a House as that we have been describing, is social and individual refinement, the offspring of civilization.

The White Lead Companies of New York

And Brooklyn are the largest in the United States. The oldest of these companies, and which may be called the mother of them all, is the BROOKLYN WHITE LEAD COMPANY, founded by David Leavitt, Augustus Graham, John B. Graham, and George S. Howland, who associated themselves together in what was then a hazardous enterprise, and in June, 1825, secured a corporate title under the general manufacturing law of the State of New York. At that time chemical knowledge was in its crude and experimental stage, and they encountered many of the embarrassments, losses and disappointments incident to the imperfect development of American manufacturers, especially in those branches where scientific acquirements as well as practical application are essential to success. Mr. David Leavitt was elected the first President of the Board of Trustees, and has continued to hold the office uninterruptedly until the present time, though for more than twenty years he has retired from active control of the business, and for the last ten years or longer, has resided at his country seat in Great Barrington, Massachusetts.

Augustus Graham took an active part in promoting the business of the Company, and visited Europe to secure information and advance the general success of the business. He continued to fill the office of Trustee, and devoted much of his time to the manufacturing department, until his death, on the 27th of November, 1851. John B. Graham also retained an interest in the business, and remained a Trustee, and devoted his time to the work until his death, on the 11th of March, 1853. By large appropriations of money during their lifetime, the names of the Messrs. Graham were permanently identified with some of the most important public and charitable institutions of the City of Brooklyn as their founders or patrons.

George S. Howland was one of the early projectors, and retained an active interest in the manufacturing department until his death, which occurred on the 21st of September, 1866, having filled the office of Secretary of the Board of Trustees for more than forty-one years. Much of the success of the company was due to his intelligence in all the chemical, mechanical and productive departments of the business.

The Brooklyn White Lead Company's Manufactory

Is located in the Second Ward of the City of Brooklyn, covering the block of land bounded by Front, Water, Washington, and Adams streets, and other adjacent lands. The buildings are of brick, and the

Works have sufficient capacity to produce three thousand tons of Manufactured Lead annually, and may readily be increased, though the average of production for the ten years previous to the late war was not fully up to that quantity. During the four years of the war the production was in the neighborhood of fifteen hundred tons annually; but during the year 1866 it increased until it very nearly approximated the capacity of the works. Seven hundred and fifty tons of coal are annually consumed, and about one hundred men are employed in the various departments.

The Works of the company were visited by a disastrous fire late in September, 1864, originating in the large wooden buildings covering the corroding beds, which were entirely destroyed, but fortunately the fire was arrested in the main manufacturing building before the machinery had received material damage. The works were speedily restored, and enlarged in a more permanent form; and means for extinguishing fires hereafter, should they occur in the buildings or their immediate vicinity, have been amply provided.

Since the retirement of Mr. Leavitt from the active control of its affairs, FISHER HOWE, Esq., has been the principal financial and business manager of the company. Mr. Howe is a gentleman of much general intelligence as well as experience in his special department, and is President of the Association of American Manufacturers of White Lead. This association now includes nearly all manufacturers of White Lead from the raw material in this country, and the interchange of views thus secured has resulted very beneficially to the advancement of this important branch of American industry.

The present officers of the company are—DAVID LEAVITT, President; FISHER HOWE, Treasurer; and EDWARD LEAVITT, Secretary. The principal office for the transaction of business is at 89 Maiden Lane, in the City of New York.

The UNION WHITE LEAD MANUFACTURING COMPANY, which may be called an offshoot of the former, was organized in 1828. The Works are located at Bridge and Front streets, in Brooklyn, and cover twenty-three city lots. The main building is two hundred by two hundred and twenty-five feet, and the establishment has a capacity for producing about three thousand tons of White Lead annually.

John Jewett & Sons' White Lead Works,

At Port Richmond, on Staten Island, are the next oldest in the vicinity of New York. They were established in 1842, by the present proprie-

tors, who have since greatly enlarged and extended them, until they now occupy about two and a half acres of ground. The main building for manufacturing purposes is one hundred and fifty feet long, forty feet wide, and three stories high. The corroding houses, of which there are two, are frame structures, about one hundred by one hundred and fifty feet each, and of the usual height to accommodate the beds. The machinery is propelled by an engine of eighty-horse power, and the Works have a capacity for producing two thousand tons of perfectly pure White Lead annually.

In connection with the Lead Works, Messrs. John Jewett & Sons have a Linseed Oil manufactory, which will be subsequently referred to, and at Elizabeth, New Jersey, an extensive Floor Cloth manufactory, which will be noticed in its proper place. See *Manufactures of New Jersey.*

The Atlantic White Lead and Linseed Oil Works,

Owned by ROBERT COLGATE & Co., are said to be the largest in the United States. They were established in 1845, and consist of twenty-one buildings, all of brick, with tin roofs, covering one entire block and half of another on the East River, in Brooklyn, with an extensive water-front, and unsurpassed advantages for loading and discharging the largest vessels.

In the winter of 1866 eight of these buildings, with a large quantity of valuable machinery, were destroyed by fire, but these have since been rebuilt in the most substantial manner, with the best and newest improvements. The machinery is propelled by four engines, supplied by twelve boilers for purposes connected with the manufacturing departments.

Messrs. Robert Colgate & Co. manufacture White Lead, Red Lead, Litharge and Linseed Oil, and the quality of their products is well and favorably known to dealers in all parts of the country.

The office of the Company is 287 Pearl street, in the City of New York.

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The Linseed Oil Mills of New York

And Brooklyn are the largest in the United States. It is estimated that a capital of two millions of dollars is employed in this manufacture, and the aggregate production exceeds ten thousand gallons daily. The only one of the companies and firms engaged in the manufacture whose Works are located in the city of New York, is that of

The Judd Linseed and Sperm Oil Company.

This Company are the successors of Samuel Judd, Sons & Co., who succeeded to the business originally established by J. & L. K. Bridge, in 1836. At that time the manufacture of Linseed Oil in this country was in its infancy. American seed only was used, and not more than fifty bushels a day were required to supply their mill. This firm were the first to import seed from foreign countries, and their first cargo was obtained in Sicily. The pioneer vessel in this trade, now so extensive and important, was the "Ship Hercules," Captain Maddigan, owned by this firm, who despatched her to Odessa and Alexandria, and afterward to the East Indies, her first voyage to Calcutta having been made in 1846. In 1838, Mr. Samuel Judd, who for many years previously had been largely engaged in the sperm and whale oil trade, relinquished his business to his sons-in-law, Lewis K. Bridge and James F. Penniman, under the firm of Samuel Judd's Sons; and in 1854, the linseed oil business previously conducted by J. & L. K. Bridge was added to the business of Samuel Judd's Sons, under the firm of Samuel Judd's Sons & Co., and in 1856 became the property of the Judd Linseed and Sperm Oil Company, incorporated in that year under the general manufacturing law of the State of New York.

The Works of this company, located on Cherry and Grand streets, have been greatly enlarged since they were originally established. They now consist of two buildings, covering the greater part of a lot two hundred and fifty feet by one hundred feet. The machinery is propelled by three steam engines, two of eighty and one of fifty horse power, and has a capacity for crushing two thousand bushels of seed and producing four thousand gallons of Linseed Oil a day. About one hundred hands are employed in their different departments.

Since 1863, Mr. JAMES F. PENNIMAN, an old merchant of New York, has been President of the company. Mr. Penniman came from Albany to New York in 1830, and, as before stated, was for many years associated with Mr. Judd in the sperm and whale oil trade. He is a gentleman of large capital and business experience, and affable manners.

Thomas Rowe & Sons' Linseed Oil Manufactory

Is located in Brooklyn, and covers about one acre of ground, bounded by the East River, Marshall, John, and Plymouth streets. In connection therewith is a pier, extending into the river nearly three hundred feet, which was built by themselves for the convenience of the works. The machinery is propelled by an engine of one hundred and twenty-five horse power, and has a capacity for producing about four thousand gallons of Linseed Oil per day.

Mr. THOMAS ROWE, the founder of this firm, is probably the oldest manufacturer now actively engaged in the business. He commenced life as a merchant, but embarked in iron founding in 1834. While thus engaged, he became interested in experiments as to the adaptability of the screw, lever and toggle-joint power for the pressing of oleaginous seeds and other substances, which resulted in the construction of a novel Hydraulic Press for the same purposes, and its success induced him to engage in the manufacture of Linseed Oil. Previous to this invention, it is believed that, with one exception, the screw, lever and wedge were the only mechanical powers employed in this country for the extraction of vegetable oils. During his business experience he has obtained three different patents for valuable improvements in the machinery employed in the manufacture, and is deservedly entitled to a place among those ingenious men who have rendered an important service to their profession.

Messrs. Rowe & Sons import most of the Linseed used by them direct from the East Indies, and their Oil has maintained an unsurpassed reputation in the American market for a quarter of a century.

Mr. Rowe has recently been elected President of the American Linseed Association, a highly respectable and influential body, composed of merchants, manufacturers and brokers interested in the Linseed trade.

Campbell & Thayer's Linseed Oil Works

Are probably the largest in the United States. They are located in Brooklyn, and cover an area of about thirty thousand square feet of ground. The machinery is propelled by an engine of two hundred horse power, and has a capacity for producing from five to six thousand gallons of Oil per day.

This firm was established in 1853 by its present members, GEORGE W. CAMPBELL and GEORGE A. THAYER, who have been associated together for fourteen years without change or interruption. They import most of the seed they consume direct from the East Indies, and their

agents abroad are instructed to give particular attention to its purity, upon which the quality of the oil produced, especially for decorative painting, so much depends. It is unfortunately the case that much of the seed that comes to the American market is intermixed with that of other oleaginous plants that have grown up with the flax, and which does not possess the same drying character as the latter, and consequently the product is seriously impaired. American seed is also used by this firm when it can be obtained in quality that will accord with their rigid standard.

Besides these, JOHN JEWETT & SONS have a Linseed Oil Manufactory in connection with their White Lead Works at Port Richmond, on Staten Island. The main building is of brick, one hundred and thirty feet long by thirty-six feet wide, and three stories high. The present capacity of the Works is about twelve hundred gallons of Linseed Oil a day, but with the new machinery now being introduced, this will be probably doubled.

ROBERT COLGATE & Co., as before stated, have a Linseed Oil Mill in connection with their White Lead Manufactory in Brooklyn.

The Bushwick Chemical Works—M. Kalbfleisch & Sons,

Situated in the Eastern District of Brooklyn, a few miles from New York, are among the most important and extensive Chemical Manufactories in the United States. The Works are composed of numerous buildings of various sizes, the largest being from one hundred and sixty to two hundred feet in length, and from sixty to seventy feet in width. Among them is a Glass House and Pottery, in which are made all the Retorts and Bottles used in manufacturing and packing the Acids and other products of the Chemical Department. The whole group of structures, with their extended walls, spacious roofs, and lofty chimneys, covers an area of over five acres, and presents an imposing appearance even at a distance. The interior appointments and equipments are of a character corresponding with the extent of the buildings. One of the chambers, for manufacturing Sulphuric Acid, is two hundred and seventeen feet long by fifty feet wide, no doubt the largest in existence, and is a model in every particular. Among the noticeable objects that attract the attention of visitors, are three Platina Stills, imported from France, at a cost of about fifteen thousand dollars each.

The products of these Works include a great number of those articles recognized as standards in the commerce of the world. Of Sulphuric Acid they have a capacity for producing three hundred thousand pounds weekly, and of Muriatic Acid, about three hundred and fifty carboys weekly. Besides these, they manufacture Aquafortis, Muriate of Tin, Strong Cx. Muriate Tin, Soda Ash, Aqua Ammonia, Tin Chrystals, Nitrate of Iron, Sulphate of Zinc, and other officinal chemicals. The firm employ constantly from seventy to eighty workmen, for whom they have provided comfortable dwellings in the vicinity of the Works. The Office and Salesrooms are in the City of New York, at the corner of Fulton and Cliff streets.

The House of Martin Kalbfleisch & Sons was established by the present senior partner in 1829, and under his judicious and successful management has attained its present commercial importance and eminence. As his four sons, Frederick W., Charles H., Albert M., and Franklin H. Kalbfleisch became of sufficient age, they were taken into partnership, and are now relieving their father of the greater part of the details and hard work incident to the business. With a long and thorough practical training in the pursuit in which they are engaged, they unite those qualities of integrity and capability which have gained for them the confidence both of the community in which they reside and of the multitude of patrons, at home and abroad, with whom they have correspondence.

Hon. MARTIN KALBFLEISCH, the founder of this House, was born in Holland, and has always exhibited the characteristic traits of industry, enterprise, and love of liberty traditional to his native land. Coming to this country when young, he engaged in a business that calls for more than ordinary mental acquirements, and conducted it with such success that he has attained a prominent social position, an eminent name in the commercial world, and political distinction. Kindly and affable in his manners, a liberal contributor for the relief of suffering, just to his employees, his qualities have been recognized by his neighbors and fellow-citizens, who have entrusted him with public as well as private interests and conferred upon him civic and other honors. He has held many important offices, from the less important to the highest in the city where he resides. In 1861, and again in 1867, he was chosen Mayor of Brooklyn, receiving many votes from his political opponents, in consideration of his known practice of pursuing what he esteems to be right, and a universal confidence in the purity of his purposes.

Before his term of office had expired, he was elected, in 1862, by an overwhelming majority, Representative to the National House of Repre-

sentatives from his Congressional District. As evidence of his personal popularity, it may be mentioned that upon this occasion the *majority* of votes cast for him exceeded the entire number given to his unsuccessful competitor.

His residence is near the Works in Brooklyn, and is one of the most magnificent and beautiful in the city. Although not retired from business entirely, he has the wisdom, in his advancing years, to rest somewhat on his well-earned laurels, and to leave the details of the great establishment to his enterprising and active junior partners.

The New York Dye-Wood Mills,

Of which James L. Harway & Co., of 27 Cliff Street, New York City, are the proprietors, erected at Green Point, L. I., during 1866 and 1867, are the most complete, costly and extensive Works of the kind in the United States or Europe. The main building is one hundred and forty feet in length, eighty feet wide, and four stories high; connected with this is a two-story structure one hundred and thirty-six feet long and thirty-six feet in width. The machinery for cutting and grinding Dye-Woods, and for making extracts, the engines, and all the internal arrangements, are of the most modern and approved description, and on a scale corresponding with the extent of the buildings. Their storage yard, with a capacity for storing ten thousand tons of Dye-Woods, is covered with a net-work of railroads, facilitating greatly the rapid receipt and discharge of their unmanufactured and manufactured products.

The firm of James L. Harway & Co. are the successors of William Partridge & Son, who commenced the business in 1798, and consequently were the oldest as well as one of the largest houses in the Dye-Wood trade. In the course of their business career, this firm contributed essentially to the constantly increasing excellence of American fabrics by providing manufactories at all times with Dyes of superior quality, and introducing to their notice, from time to time, new and valuable substances, which have since become articles of large consumption.

The present firm is composed of James L. Harway, formerly a co-partner with Mr. Partridge, Joseph C. Baldwin, and John W. Harway, who were originally clerks in the old house. All of the partners have a practical and minute acquaintance with the details of their

business, and are proficient judges of the articles which they manufacture and import. Messrs. Harway & Co. have an established trade of vast extent, reaching not only to all parts of this country, but to Europe and the East Indies, and this fact is evidence of their integrity and honorable dealing, which, conjoined with their experience and qualifications, afford the best guarantee to buyers that their purchases will be such as represented.

Messrs. Harway & Co. are now giving special attention to the manufacture of Extract of Logwood,—a Dye of large consumption both in the United States and Europe.

The Bishop Gutta Percha Company's Works,

Located at Nos. 208, 210, and 212 East Twenty-fifth street, in the City of New York, is the only establishment in the United States for manufacturing *pure Gutta Percha Goods*, especially Submarine Telegraph Cables, and Telegraph and Electric Wires coated and insulated with Gutta Percha. The Factory is a very fine one, and supplied with a great variety of novel machinery. The work is chiefly done by machinery, nevertheless from seventy to eighty persons are required and employed.

Gutta Percha, of which large quantities are consumed in this manufactory, is the gum or sap of the Gutta Tree, which grows in forests in and around the Indian Archipelago, Borneo, Ceylon, etc. It was first discovered by Dr. Montgomery, in 1822, during his residence at Singapore, in the East Indies; and the first introduction of it into England was made by him in 1842, since which time it has become a permanent article of commerce, being now imported into England and the United States to the extent of several thousand tons annually. The first importation of it into the United States was made by William S. Wetmore, now deceased, in the year 1847. Mr. Wetmore was then engaged in the trade with the East Indies, and brought, direct from Singapore, twenty-five thousand pounds of Gutta Percha for Mr. Samuel T. Armstrong, who had just returned from London bringing with him the four original patents granted in 1845, in England, for the working and using of Gutta Percha in all possible forms then known. Two of these patents were registered in the Patent Office of this country, and constitute the basis on which Mr. Armstrong, and his successor, Samuel C. Bishop, operated for many years without interference.

The commercial uses of Gutta Percha are already important, and increasing with the progress of invention. As an insulator of telegraphic wire, or cables, to be used under water, it has proved to be the best article that has yet been discovered for the purpose. In the year 1846, Dr. Werner Semens made the first experiment to isolate the conducting wire by means of an envelope of gutta percha, and in the subsequent year the Prussian Government ordered thirteen hundred and eighty American miles of this wire to be laid down under the streets of Berlin. Subsequently, many submarine and subterranean lines were made from Gutta Percha Insulated Wire, and it has been used from that time to the present with entire success.

The first Submarine Telegraph Cable ever made in the world, insulated with Gutta Percha, was made by Samuel T. Armstrong and Lorenzo Higgins, in the City of New York, in May, 1848, and laid across the North River for the Magnetic Telegraph Company.

Gutta Percha possesses the rare quality of resisting the action of almost every kind of acid, and as a substitute for lead, and other metals liable to corrosion or poison, it is recommended as an invaluable article for Pure Water Pipe. It is used also for Surgical Splints, being easily moulded and shaped to the limb; and by hatters, as a useful material to insert between the outside and the lining, making a glue that causes the two parts to adhere, and at the same time renders the hat or cap impervious to perspiration, and water-proof. The Artificial Flower makers use Gutta Percha for making the leaves, winding the stems, and putting the flowers together; and the Bishop Gutta Percha Company mould it into Bottles, Pitchers, Photograph Dishes, etc.

Samuel C. Bishop, the General Agent of the Company, is one of the pioneers in this manufacture in the United States. In 1848 he entered the employ of Mr. Armstrong, who has been mentioned as the first person in this country who applied and used Gutta Percha in coating telegraph wire, and in 1853 succeeded him in the business which he had established. He has maintained an uninterrupted connection with the manufacture from that time to the present. Mr. Bishop is also a pioneer in introducing the "eight hour system" in the city of New York; and as a testimonial of their regard, his employees presented him, on New Year's Day, 1866, a handsome silver pitcher, inscribed, "For being the Inaugurator of the Eight Hour System of Labor in the United States." In his address on that occasion he remarked:—

"And now, my friends, one word about the Eight Hour System, of which you have been pleased to call me "the originator." In this city we were the first to put it to practical test in our factory, and I believe (except to talk of it) we were "the originators" in fact; and we have not had any reason to

regret its adoption; and we shall continue it, whether Congress makes it a law or not. As a matter of right and justice to the working man, there can be no doubt about it; and as a matter of *policy* for the employer, it is equally clear.

"Why should *you* be compelled to work ten to twelve hours a day, when the greater part of the community labor only about six hours? The drones and consumers in the city of New York amount to many thousands—men who do not earn a penny from their birth to their death—men who are exclusively *consumers*, and who live for their own selfish gratification only, and are of no use to any one. Another class are those who labor with their brains and money, and who do much good in the community. But they do not work over six hours a day generally. There is still another class who occupy various situations, as bankers, brokers, clerks, etc., in the community, who work about five hours a day only.

"Why, then, should the only real producers in the country—the strictly laboring men—the bone and sinew of the nation—the men to whom the country is indebted for its life as a nation, and to whom it will be indebted for the maintenance of its financial integrity, and for the means to pay off the large national debt, incurred for war purposes—why should they be obliged to devote twenty-five per cent. more of their time to labor than any other class in the community—why, except that labor has not had its fair share of representation and influence in the community with capital, and has had to submit to any rules the employer might establish? This should not be so. Capital and labor should go hand-in-hand, as they are essential to each other."

Thomas Otis LeRoy & Co.'s Shot and Lead Works

Are among the most noteworthy of the many interesting manufacturing establishments in the city of New York. They belong to a class of manufactories of which there are but few in this country, and for the novelty of their machinery and the combination of science and practical skill exhibited in the management, are not surpassed, it is believed, by any in the world.

The works comprise two distinct manufactories, located in different parts of the city, with a separate salesroom, twenty-five by seventy-five feet, at No. 54 East Thirteenth street. The Shot Tower is situated on part of a block, consisting of thirty-two lots of ground owned by the firm, and extending from Fifty-third to Fifty-fourth street on the East River. This property has a water front of two hundred and fifty feet, with forty feet depth of water, being navigable for the largest craft, and supplying shipping facilities unsurpassed by any site on the East River. The Tower is a magnificent structure, octagonal in shape, one hundred and fifty feet high, thirty-three feet in diameter at the base, and twelve feet at the top, with walls that are four feet in thickness at the lower floor. The prospect from its summit is a very fine one, overlooking, as it does, Blackwell's Island, and commanding an unobstructed view of Astoria, Ravenswood, Hunter's Point, Greenpoint and

Brooklyn. The principal manufacturing operations however are carried on in the buildings, 261 and 263 Water street, which are four stories in height, fifty feet wide and one hundred feet deep. It is in these buildings that their celebrated Eagle Brand Shot are manufactured by an entirely new process. Ordinary shot are made by being dropped from the top of a lofty Tower, some two hundred and forty feet, but in their descent they acquire such a momentum that many of the pellets flatten from the force with which they strike the receiver. In LeRoy's factory the shot are dropped but a short distance, and are buoyed up in their descent by a current of cold air which retards their fall to an extent sufficient to prevent their flattening, and renders them almost perfectly spherical drops.

In these buildings, also, there is a great variety of novel machinery for manufacturing Lead and Tin Pipe by Hydraulic pressure, and a Sheet Lead Rolling Mill that produces Sheet Lead of a quality that cannot be surpassed. The pipe machines have a hydraulic capacity of six hundred tons, and are the only ones by which pipe can be made from the first pressure, and by which Tin and other hard metals can be successfully worked. Their pipe machines are of the Cornell patent, with the improvements, of which Messrs LeRoy & Co. are sole proprietors. Formerly they used a long core in the end of the Hydraulic Ram, but experience taught them that by this process, owing to vibration, true centres were impracticable. They then abandoned it and adopted the Cornell plan, which places the core in the bottom of the Cylinder, with the Lead around it acting as a support, and as the Lead only is in motion at the point of pressure, the balance being in a quiescent state, there is no possible chance for the core to waver, but the pipe has a *perfectly true* centre, and is of uniform strength throughout. The pipe is in continuous lengths, from one eighth of an inch to six inches calibre, and is entirely free from flaws, splits and all other imperfections. The vast superiority of the methods employed in this manufacture over the old fashioned processes has so stimulated the demand, that though the firm produced, in 1866, eight millions of pounds, they have been compelled to duplicate their machinery, and are now producing a proportionately larger amount.

The works were established by Thomas Otis LeRoy, in 1845. Among his earliest experiments, was the plan which has been recently revived of lining Lead pipe with Tin, but after prolonged investigation he abandoned it. He found that the Tin coating contracts or shrinks more than the Lead exterior, that from the unequal temperature at which the metals melt, the fusion is not perfect, and that the Tin lining, being thin, corrodes from the galvanic action of the two metals, and

is unable to resist the force of the water. Mr. LeRoy, however, was the original manufacturer of Pure Block Tin Pipe, and sent specimens to the Great Exhibition in London in 1851, where he was offered large sums to divulge the process by which it was manufactured.

In 1855 Mr. Thomas O. LeRoy associated with him his brother Edward A. LeRoy, and the two now compose the firm. They employ in their works about sixty persons.

East River Iron Works—Samuel Secor & Co., Proprietors,

Belong to the class of the great Marine Engine Works, for which New York is famous, and, properly, should have been noticed in that connection.

In 1850, Mr. Samuel Secor commenced business at 96, 98 and 100 Washington street, confining himself principally to the construction of High Pressure Boilers, Tanks, etc., and the repairing of Steamboats and Steamships. The Southern States, previous to the late rebellion, made large drafts upon his mechanical resources, and supplied him with many orders. After the breaking out of the war, he built several large Marine Boilers for some of the Iron-clads of the Monitor class. While building these, he found his shops too contracted to accommodate his increasing business, and he determined upon erecting an establishment on the East River, where most of the principal Marine Engine Works are located. In June, 1863, he associated with him Mr. EPHRAIM MILLER, Jr., under the firm name of Samuel Secor & Co., and they immediately commenced the erection of the new works at the foot of East Twentieth street, completing them the same year. These works are very extensive, and are supplied with all the necessary tools and conveniences for building Engines, Boilers, and other machinery, of the largest sizes.

The United States Navy Department, as well as the Merchant service, has availed itself of their increased facilities, and a number of large Marine Boilers and Engines have been constructed for both. Besides these, a large variety of miscellaneous work has been executed during the last five years, both in these and in the shops on Washington street, which are continued by them as a branch. When in full operation, the works employ from six hundred to seven hundred men.

The mechanical part of the business is under the immediate supervision of Mr. Samuel Secor, who has had a practical experience of

forty years, as a Machinist and Engineer. The Horizontal Tubular Boiler, for land use, which has effected a great saving of fuel, and is now extensively used, was first successfully introduced by him.

The Phœnix Works—John Savery's Sons, Proprietors,

At Jersey City, are old and very celebrated works for the manufacture of Iron Hollow-ware, Stoves, etc. They were founded, in 1838, by John and William Savery, who commenced business there under the firm style of John Savery & Son. In July, 1845, the buildings were destroyed by fire, involving a total loss of flasks, patterns, tools and machinery; but the foundry was rebuilt with such rapidity, that operations were resumed in October of the same year. On January 1st, 1846, Alexander Law was admitted as a partner, and the style of the firm was changed to John Savery & Sons. This was continued until the decease of Mr. John Savery, in 1853, when the style was changed to John Savery's Sons; his son William, a man eminently qualified by natural endowments to be successful in business pursuits, becoming the senior member of the firm. For several years, however, he has resided on the old homestead, in Massachusetts, and the active supervision of the business in Jersey City, and of the warehouse in New York, has devolved upon Mr. Law, who has filled the position with credit to himself and advantage to the firm. During this time, also, other partners have been added, viz.: G. W. Mason, G. W. Van Schaack, and William E. Savery.

JOHN SAVERY, the founder and originator of this concern, was a pioneer in developing American Manufactures. He was born in Carver, Plymouth County, Mass., in 1789, and served an apprenticeship to the moulder's trade. Among his earliest labors was digging ore in the pond—at the outlet of which was the foundry he was connected with—to make cannon balls during the war of 1812. In fact, he was the first man who succeeded in making, at that foundry, a perfect cannon ball. He made shot which was furnished the U. S. Frigate "Constitution," and which was used in her memorable engagement with the "Guerriere."

His first partnership was in the works where he had served his apprenticeship, in his native town. This continued until about 1826, when he removed to Albany, N. Y., and, in association with his brother-in-law, established a foundry there. In 1834–5, this partnership was dissolved, and was succeeded by Savery, Shaw & Co., until

1838, when he united with him his son William, and founded the works in Jersey City.

Messrs. Savery's Sons now employ, in the various departments of their business, about one hundred hands; and, by availing themselves of every improvement suggested by themselves or others, personally inspecting and superintending the details of manufacturing, and using only the best brands of American and Scotch Pig Iron, they have established a reputation for their products that is a valuable contribution to the renown of American Manufactures. The office and warehouse of the firm are at 97 Beekman street, New York.

The Architectural Iron Works,

Located on East Fourteenth street, between Avenues, B and C, in the city of New York, is one of the few large establishments of its kind in the United States. The works cover an area (including the various departments) of more than three acres, and employ from four to six hundred workmen. The Company was incorporated in 1856, and are the successors of Daniel D. Badger & Co., who introduced and established the manufacture of Architectural Iron Work, in New York, in 1846. This branch of Iron Work was unknown until after the year 1840, when Mr. Badger erected, in the City of Boston, the first Iron building ever seen in America. All the Iron buildings in this country have been erected since that period, and owe their existence to that introduction.

It is well known that, before 1840, Iron had been used in England and other European countries, and, to a limited extent, even in our own country, for *interior* supports in various kinds of edifices; but its introduction for the *exterior* of buildings is believed to be of very recent and purely of American origin.

The early history of this manufacture is the history of a long-continued struggle against prejudices, objections and conflicting interests, and of the ultimate triumph of resolute persistence and indomitable energy on the part of its founders. The innovation was resisted until Iron buildings had been thoroughly tested, and their superiority was too manifest to be denied. When we reflect upon the numerous advantages of Iron, as a building material, we may marvel at the obstinacy with which its introduction for that purpose was resisted. Besides the saving of space, (which, alone, would have been a sufficient warrant for the use of Iron in many structures,) the greater facilities for ornamentation

and architectural beauty entitled it to the consideration of all who would gratify their own taste, or improve that of the public.

The introduction of light into the interiors of buildings is a desideratum which is supplied by the use of Iron. While it renders all the interior space available for many purposes, the decided sanitary influence of light upon the inmates constitutes a valid argument for the use of Iron as a building material. It would be easy to enumerate many other points, in which decided advantages may be claimed for Iron over all other known building materials. Among them, may be mentioned superiority of strength, lightness of structure, facility of erection, capability of architectural beauty, cheapness of cost, incombustibility, facility of renovation, durability, intrinsic value of materials, and protection to life and property.

The Architectural Iron Works were incorporated, in 1856, by D. D. Badger, John M. Reed, Nathaniel Cheney and others, and re-chartered in 1866. Its present officers are: D. D. BADGER, President; NATHANIEL CHENEY, Vice-President and Treasurer; and C. C. GORDON, Secretary.

In April, 1864, the principal buildings were destroyed by fire, but the works were immediately rebuilt and improved, and such additions were made as experience had shown to be needful.

This establishment has an immense stock of patterns, trained and skilful workmen, and every facility for the manufacture of Architectural Iron Work, and, indeed, for the production of a great variety of Cast and Wrought Iron, including many kinds of machines. It has peculiar, novel and ingenious machines for the making of Iron Venetian Blinds, Iron Lathing, and Fire and Burglar-proof Iron Rolling Shutters.

In past years, it has been largely engaged in making shot and shell of all sizes, projectiles and gun-carriages, for the use of our own Government, and also for foreign powers. The largest Gun-carriages constructed were for twenty-inch guns.

It would require a large space to enumerate all the uses to which Iron has been applied by the Architectural Iron Works, but the following may be mentioned, viz.: Iron Store Fronts, Manufactories, Grain Warehouses, Arsenals, Ferry Houses, Bridges, Roofs, Domes, Rolling Shutters, Venetian Blinds, Wrought Sashes, Railings, Verandahs, Balustrades, Cornices, Stairways, Columns, Capitals, Arches, Window Lintels and Sills, Consoles, Brackets, Rosettes, Urns, Door and Window Guards, Lamps, Awning and Horse Posts, Girders, Beams, Patent Lights and Iron Sidewalks. Specimens of the work of this Company abound in the city of New York, and may be found in all the principal

cities and towns of the United States, and even in foreign places—Havana, Matanzas, Halifax, N. S., Rio Janeiro, Aspinwall, Alexandria, Egypt, etc.

Among the largest buildings erected by this Company, may be mentioned the Congressional Library, Washington, D. C.; the Grain Warehouses of the United States Warehousing Company, Brooklyn; and of the Pennsylvania Central Railroad Company at Philadelphia; the Iron Ferry Houses of the Union Ferry Company at Fulton and Whitehall Ferries; the King's County Court House, and Halsey Buildings, Brooklyn; Cary's Building, Gilsey's Building, Houghwaut's Building; and the Singer Manufactory in the city of New York; the United States Arsenal at Watervliet, N. Y., and several blocks of five-story Iron stores in Chicago.

In this connection, a brief memoir of the President of this Company, and the Pioneer in Iron Architecture in America, may not be inappropriate.

Daniel D. Badger was born in Portsmouth, New Hampshire, in 1806, and, during youth, was employed in working iron in his native town. In 1829, he removed to Boston, and commenced business as an iron founder. In the year 1840, he erected, in Washington street, Boston, the first Iron front ever seen in America; but so great was the prejudice against his enterprise, that he was compelled to give a guarantee that, if it should prove a failure, he would remove it at his own expense. The columns and lintels of this building were of iron.

About this time, A. L. Johnson, Esq., of Baltimore, invented and patented Rolling Iron Shutters. Mr. Badger purchased the patent, and introduced the shutters into his new structures. His Iron Fronts (known as "Badger's Fronts") came slowly into favor.

In 1846, he came to New York, and was associated with Charles Reed, Esq., in the prosecution of his business. Here, he found the Builders, the Fire Department, and the Fire Insurance Companies, all violently opposed to his innovation. He struggled against objections of the most diverse character, but, steadily persisting in his purpose, ultimately overcame all obstacles, and established the use of Iron as a leading building material. Structures for mercantile and mechanical purposes, having open fronts and large show windows, began to supplant the former cumbrous and ill-lighted warehouses, and their superiority was too obvious to be denied. The first buildings erected by Mr. Badger were, by many, regarded as experiments; but, from the outset, he was sanguine that they would receive the public approval; hence he prosecuted the business, for a series of years, with untiring industry, enterprise and persistence, and almost without a competitor.

All the Iron buildings that now adorn our great cities owe their existence to the humble introduction of iron, as an external building material, in Boston, in 1840; and we believe Mr. Badger may be fairly regarded as the originator, inventor and pioneer of Iron Architecture in America.

The Stover Machine Company,

Though comparatively recently established, has rapidly risen into prominence and public favor, by reason of the variety and uniform excellence of the Tools and Machines which have been constructed in its workshops. It was incorporated in 1859, under the general manufacturing laws of the State of New York, and commenced business at the corner of Pearl and Elm streets, with salesroom at No. 13 Platt street, New York. In two years, however, it was found that the manufacturing department was altogether too contracted to supply the demand for the company's Machinery, and more enlarged facilities were sought for and obtained in the old House of Refuge buildings at the foot of East Twenty-third Street. The main building was converted into a Machine Shop, with Foundry, Boiler Shop, and Store Rooms on the water front; and additional buildings were erected to facilitate operations. Here the Company embarked in the manufacture of Marine and Stationary Engines, as well as Machinists' Tools, and filled many important orders for the United States Government, among them, the Engines for the war steamers "Maumee" and "Tullahoma." The demand, however, for the Machinists' Tools made by this company increased so largely, that they purchased the extensive Works of Thayer, Houghton & Co., in Worcester, Massachusetts, which they enlarged, and from this point supplied with iron and wood-working Machinery the shops of the Atlantic and Great Western Railway, the New York and Erie, New York Central, Oswego and Syracuse, and Camden and Amboy railroads, and the Navy Yards in the principal cities. During this time the company employed over seven hundred workmen.

In the meanwhile, Mr. Stover, the President of the company, was seeking diligently for a site in New York where all branches of their business could be accommodated, and found it at the foot of Fifty-first street, North River, where the manufacturing department is now permanently located, with Salesroom at 117 Liberty street. The buildings extend the entire length of the block from Fifty-first to Fifty-second

street, fronting the river, but it is proposed to make large additions at an early period, and provide facilities for a thousand workmen to be employed in the enclosure. When completed according to the plans, this will be one of the largest establishments of its kind in the United States.

The success of this company is due in great measure to the improvements and inventions that have been made by the President, HENRY D. STOVER, giving their Machine Tools peculiar and distinctive features. Its history is in fact one of the marvels of American enterprise, and its rapid rise is a conclusive proof of the mechanical genius and organizing ability of its founder, and reflects credit upon all who have been associated with him.

The officers of the Stover Machine Company are, HENRY D. STOVER, President and Treasurer; A. BROWN, Secretary; and Mr. J. W. BICKNELL, originally of the firm of Stover & Bicknell, Superintendent.

The Eagleton Manufacturing Company

Are the largest manufacturers of Iron and Cast Steel Wire, for all uses, in the State of New York. The Company have two mills employed in the manufacture, the principal one, known as the "Eagle Wire Mills," being located on Twenty-second Street, between First and Second Avenues, and the "Brooklyn Wire Mills," in South Brooklyn. The former covers the greater part of six city lots, containing fifteen thousand square feet, and is five stories in height. In the numerous rooms there are nearly two hundred wire blocks, principally employed in drawing Steel Wire of all sizes, including about forty machines for drawing very Fine Wire, some as fine as No. 36. The machinery is propelled by an engine of two hundred and fifty horse power, through the agency of an immense belt three feet in width. In the boiler room there are six boilers of large size. The annealing ovens have a capacity for annealing seventy-two thousand pounds of steel a day. This is converted principally into Crinoline Wire, of which great quantities are made; and this is one of the few establishments in the United States where may be witnessed all the operations incidental to converting a rough bar of steel into a finished Hoop Skirt.

In close proximity to the Wire Mills are the "Eagle Skirt Works," owned by this company, where about two hundred dozen Skirts are

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J. W. BRADLEY

finished weekly. The scene presented in the rooms where fifteen hundred Braiding Machines are employed in covering the Wire, and a half dozen Jacquard Looms are busy in weaving the Tape, is one of unusual interest and animation. Each Skirt in the process of manufacture passes through eighteen or twenty hands before it is ready for market.

In the mill in South Brooklyn, Iron Wire is principally made. The building is of brick, one hundred and eighty-six feet long by one hundred and ten wide, and the machinery is of sufficient capacity to turn out seven tons of Wire daily. Telegraphic Wire, galvanized and plain, is made here, but the leading item of production is Spring Wire, which is manufactured into Sofa and Furniture Springs in the upper rooms of the Company's Warehouse, 81 John street, New York.

The Eagleton Manufacturing Company was incorporated in 1864, but its President, J. J. EAGLETON, has been engaged in the Wire manufacture since 1849. This enterprising Company employs from six hundred to seven hundred hands. The present officers are, J. J. EAGLETON, President; E. G. ANGELL, Treasurer; and R. A. PECK, General Superintendent.

Wests, Bradley & Cary's Hoop Skirt Works,

In the City of New York, are believed to be the most extensive of the kind in the United States. The business was originally established by J. W. Bradley, the inventor of an important improvement in the form of Skirts, who soon after associated with him J. I. & J. O. West. For several years the manufacturing operations of this firm, and their successors, the present firm, were confined to the upper floors of their extensive store in Chambers street; but, with the increase of business, enlarged premises were required, and now the firm occupy, in addition to their store, a six story building on the south side of Twenty-ninth street extending through to Twenty-eighth street, a length of two hundred feet; and another on the north side of Twenty-ninth street, seven stories high, exclusive of the basement, and one hundred feet square. The former is used for the manufacture of Crinoline Wire and weaving Tapes, and the latter for spinning cotton into yarn preparatory to being woven into Braid Bands and Tapes, and finishing Hoop Skirts. The firm have upward of five acres of ground, giving them ample accommodation for their extended Works.

This is one of the few establishments in this country that combine within itself all the facilities necessary, and in which may be witnessed

all the processes incidental to converting steel rods into finished Skirts. In the basement of the warehouse on Twenty-eighth street may be seen an immense stock of steel rods, a little less than a quarter of an inch in diameter, and which are imported in large rolls. These are taken into the blacksmith's shop, where the ends are pointed, to enable them to be started through the "wire plates." From this shop the rods, still in rolls, are placed in a large annealing oven, where by a heating of some hours' duration they are rendered soft enough to "draw." After this they are pickled, that is, steeped in a solution of sulphuric acid, the object of which is to remove the scale. The rolls are next suspended in the drying kilns, from which place they pass into the wire room, where, by powerful machinery and skilful manipulations, the wire is reduced in size, with a corresponding increase in length. But two drawings can be performed before the Wire becomes so hardened that it must be again annealed, pickled and dried, preparatory to further drawing. The wire as produced here is round, and, to give it the necessary ribbon shape, it is flattened by being passed through small but powerful steel rollers. These machines are quite expensive, costing not less than one thousand dollars each. The steel for the rolls is imported expressly for this purpose, from the famed works of Kruppe, Germany. This steel ribbon, of various gauges, is still quite soft, not having had communicated to it the necessary spring temper. To accomplish this, the reels containing the ribbon steel are conveyed to the tempering room, where the wire is passed through a furnace at a regulated speed, from which it issues red hot, and enters a vessel of oil, where the steel is hardened. Being now too brittle for use, it has the temper drawn by means of a vessel containing a melted composition of tin and lead through which it passes. These springs have yet to be covered, which is executed in an upper room, by machines of great ingenuity, that cover the flattened wire with a tightly-woven cotton thread. Some of the wires designed for the lower hoops of the Skirt are run through the covering machine a second time, to guard them against the excessive wear of dragging over stone steps, etc. These covered wires are now placed in troughs of starch. By means of bands the machinery carries the starched, braided wire backward and forward, over rollers heated by steam, and between which are attached a series of grooves of polished steel, which act as ironers, and give a fine glazed or enamelled appearance to the Wire. When properly dried it is again wound up into coils; and while this is being done, an index in the machine indicates the number of yards. Messrs. Wests, Bradley & Cary consume in this department over eleven hundred barrels of starch annually.

In the seven-storied building on the north side of Twenty-ninth street is a regularly-arranged Cotton Mill, where raw cotton is spun and worked up into Tapes and the Braid for covering the wires. Above the spinning department are rooms devoted to the fabrication of the Skirts, where hundreds of young women are engaged in this light and pleasant toil. Machinery is here called into play whenever practicable, and the results of machine labor are manifest in the regularity, precision and durability of the work performed; and it is indeed a most interesting sight to observe the intelligent operatives at their work, and note how deftly they weave the hoops with the tapes, and then fasten them in position by small metal fastenings.

This firm have a most wonderful and efficient piece of mechanism for inserting the eyelets into the bands of the Skirts. When under judicious guidance, it can accomplish work which formerly, by the ordinary process, required seven or eight hands to accomplish. There is also throughout the establishment a small army of inspectors, through whose hands all the work passes, and whose duty is to reject every article in the least defective. When finished, the Skirts are packed, a dozen of a kind, in strong paper bags, which bear the stamp of the manufacturers.

Some idea of the magnitude of the Works may be formed when we state that the floor surface exceeds five acres in area, and the pay-rolls of the firm contain the names of sixteen hundred employees—some seasons over two thousand—who have manufactured eighty-four hundred Hoop Skirts in one day, each of which contains from forty to one hundred and fifty yards of single steel, or from eighty to three hundred yards of Duplex Elliptic Steel, making a total of over 150,000,000 yards per annum, with a consumption of Tapes and Braids to the extent of 3,166,400 yards.

Mr. J. W. BRADLEY, in connection with his partners, has done more for the improvement of this manufacture than any man in America. His latest production is the celebrated Duplex Elliptic Hoop Skirt, consisting of two elliptic steel wires ingeniously braided together, edge to edge, which enables the wearer to place or fold it, when in use, as easily as a silk or muslin dress. The employment of two small elastic wires, instead of one single wire, gives the Skirt not only greater elasticity, but greater strength and durability, while at the same time it is one third lighter than any other made. These improved Skirts have attained a remarkable popularity not only throughout the United States, but in Cuba, Canada, and even in the markets of England and France.

Before closing our remarks on the great manufacturing establishments of New York, it may be proper to notice, in this connection, two companies that have acquired an honorable and deserved distinction for the production of Edge Tools, inasmuch as their principal warehouses, and depots for the sale of their goods, are located in that city, although the manufacturing operations are carried on in New England, viz.: The COLLINS COMPANY and the DOUGLASS MANUFACTURING COMPANY.

The Collins Company,

For manufacturing Axes and other Tools, is one of the largest and most important in America.

The business was commenced about forty-five years ago, by the brothers David C. Collins and Samuel W. Collins, in the city of Hartford. They were the first in this country to manufacture Axes ground and polished ready for use. Previous to that time the Northern States were supplied by country blacksmiths with axes, generally made from common blistered steel instead of cast steel, and a wood chopper was compelled to spend the greater part of the day in grinding one ready for use. The Southern States were accustomed to use the inefficient and ground Axes imported from England. In 1826 the brothers Collins removed their manufactory to its present location on the Farmington River, about fifteen miles from the city of Hartford. In 1834 they were incorporated by the Legislature of Connecticut, under the title of the Collins Company, though they still continue to use on their Tools the original stamp of "Collins & Co., Hartford." Since their removal to their present locality, the village of Collinsville has grown up, and now contains twenty-five hundred inhabitants, who are dependent for their support upon these works. This village has two churches, and schools of a high order, in which several hundred children receive instruction.

The Works have recently been increased by the erection of shops for the manufacture of Cast Steel, of which the Company are now producing all they consume. The buildings extend along the bank of the Farmington River for a distance about one-half mile, and although steam power is employed to some extent, the Company have recently completed a reservoir at the source of the river, covering over one thousand acres, to provide an unfailing water power. The works consume annually about seven thousand tons of Coal, fifteen hundred tons of Iron, nine hundred tons of Cast Steel, and turn out three thousand Tools per day. About six hundred and fifty men are furnished constant employment in the various departments.

The Collins Company have for more than forty years maintained the highest reputation for making Axes and Tools of a superior quality. At their shops may be seen the best mechanical skill aided by novel and original machinery unlike any other in use. One of their machines cuts up the Iron, gives it the shape and form of an Axe, and punches the eye ready to receive the helve, making a stronger eye than is made by welding in the usual way. The steel for the edge is then welded and drawn down by trip hammers, ready for shaving to a cutting edge, which is done by machinery, with knives suitably hardened. The next process is to harden the axe and draw the temper ready for use. This is a very important part of the work, and is done in a superior and perfect manner by a process, discovered and patented there, the temper being drawn in ovens, and the heat regulated by thermometers.

By this entirely new and unerring principle, the most perfect uniformity and accuracy are attained. This process of tempering insures a more perfect cutting edge than can be attained by the old and usual mode of tempering. The Axe also receives a high polish on Emery Wheels, which makes any flaw or defect visible, and is then inspected with great care. No Tool is allowed to receive the stamp of "Collins & Co., Hartford," that has any defect that can impair its value.

The process of shaving Axes to an edge, is not applied to tools with a bevel like Broad Axes, Adzes, etc. Tools of that description are brought to an edge on grindstones, of which article the Collins Company use more than six hundred tons per annum. In addition to Axes and Edge Tools, Picks and Sledges are made at these Works, which are largely exported to Australia and other foreign countries, together with machinery and tools especially adapted for Brazil, Mexico and Cuba.

The Collins Company also manufacture largely a Plow of pure Cast Steel, which has peculiar and superior advantages over any other in use. The steel is cast in moulds into the exact shape desired for the mould boards—shares and land sides giving the parts most exposed to wear any desired thickness. The parts are then highly tempered, ground, and polished. Their extreme hardness and smoothness give them great durability and lightness of draft, and enable them to scour in soil where no other Plow will.

This Company have now employed in their business a capital of about one million of dollars.

The Douglass Manufacturing Company,

Has selected a wider range than the Collins Company in its productions, which include a great variety of the most useful of Mechanics' Tools. Within a few years this Company has also become quite famous for producing Tools of superior quality, especially Edge Tools and Boring Implements. At the late Exposition in Paris, notwithstanding the best shops in Europe were represented by their products, the Douglass Manufacturing Company was awarded a Medal over them all for the superiority of its Edge Tools. Although not the originators of that indispensable instrument, the Auger, to this Company belongs the credit of having done more than any other to bring it to its present state of perfection. They are the sole manufacturers of Cook's Patent Boring Implements, which, discriminating mechanics who have used them assert, are superior to any other instruments of the kind that have yet been invented.

The Douglass Manufacturing Company have two distinct factories, one located at Arlington, Vermont, and the other at Seymour, Connecticut.

The factory at Seymour consists of two series of buildings; the first being located close to the Naugatuck river, and the other about one hundred yards higher up. The lower factory is devoted to the manufacture of the ordinary class of goods. The number of hands engaged in the several departments in these buildings is over one hundred, exclusive of some females who are employed in packing and labelling the goods when fully finished and ready for market. The factory is supplied with a great variety of new and improved machinery, which never fails to execute the purposes for which it has been constructed with much rapidity and mathematical precision; and the effective manner, as well as the ease and facility with which the various operations are performed, is no less astonishing, than the machinery employed is ingenious and creditable to the inventors.

The upper factory consists of a series of five buildings, appropriated to the production of the higher class or quality of goods. In these buildings the machinery is of a somewhat finer order. About one hundred mechanics are kept at work in the several shops, making in all over two hundred employed in the manufactory. We may remark, that the company have just perfected a machine for bending the handles of cork screws, which will be a great saving of time, and insure the performance of that part of the work with a precision and despatch hitherto unknown. The utmost order and regularity pervade every department of all the buildings. Nothing is done in a hurry, as is too

often the case in manufactories of the kind. Perfection in every implement, large or small, which is turned out, is the standing and inflexible rule of the establishment.

With regard to the implements or tools which were in process of manufacture at this establishment, we noticed cast steel spoke trimmers, screw cap or new pattern hollow augers, short and long bright augers, millwrights' augers, boring machine augers, ring augers, C. S. augur bits, patent extension bits, gimlets of all styles and varieties, Douglass's Patent Excelsior Expanding Hollow Augers. This, be it observed, is an entirely new tool, unlike any thing ever before produced. It secures all the efficiency and avoids the complications of the tools manufactured for this purpose heretofore, while it will also answer the purpose of a full set of eight or ten hollow augers. Under the head of Cork Screws, there are some eighteen or twenty sizes and styles, including the patent cork screws. Besides these, we found picking irons, round belt punches, carpet stretchers, tap borers, etc., all of which are most useful in their way, made of the best material, and finished in a style to please the expectation and taste of the most critical and fastidious. In addition to the foregoing, we observed at the Seymour manufactory Cook's Patent Boring Implements, which are exclusively made by this company, and got up in a style of great efficiency and elegance. It is almost unnecessary to say, that the boring implements made under Cook's patent have become highly prized by all who have occasion to use this particular class of tools, and are recommended by many as decidedly superior to any other instrument of the kind yet invented.

The Douglass Manufacturing Company has at the Seymour factory a machine room for making all the tools they require, and keeping those in use in perfect order. It also makes up such handles as are required for files, augers, gimlets, cork screws, tap borers, etc. Having perfected machinery, the company is also able to produce wooden boxes of any size, from the smallest required for tools to the largest sized tool chest, quite as cheap and much more durable than paper boxes. The wood boxes of this company are suitable for the retail hardware trade or adapted for any goods requiring a compact and durable package. All the company's regular goods are packed in wood instead of paper.

About two hundred men are employed in the manufactory at Seymour, and an equal number in the factory at Arlington, in all about four hundred hands. At both of their manufactories the company have a large water power, and as the machinery is of the most efficient and improved description, the producing capacity of the works is greater than that of any other similar concern in the United States.

Since the success of this company at the Paris Exposition, their manufactures are finding favor with European buyers, and some shipments have already been made to Scotland, a convincing proof that a critical people regard them superior to any in their home market.

The Company have a warehouse and salesroom in New York, at No. 70 Beekman street, which is under the charge of THOMAS DOUGLASS, one of the principal proprietors.

MANUFACTURES OF NEWARK.

NEWARK, New Jersey, nine miles from New York City, on the railroad connecting New York and Philadelphia, is largely engaged in manufacturing, especially Clothing, Hats, Jewelry, Saddlery and Harness, Trunks and Carpet-bags, Leather and various fabrics of leather. It was here that the first manufactory of Japanned Leather in this country was established. In 1860, according to the census returns, Essex County had a capital invested in manufactures of $13,495,305, by 769 manufacturing establishments, who employed 15,825 males, 5,908 females, and produced a value of $27,706,044. About three-fourths of this amount was produced in Newark. The principal manufactures were:

Manufactures.	No. of Establishments.	Capital.	Raw material.	Male hands.	Female hands.	Value of Product.
Brewing	16	$578,000	$371,017	105	.....	$833,875
Boots and shoes	55	163,440	276,844	690	146	583,970
Brass founding	8	25,660	43,045	31	.....	68,750
Coach lamps	3	26,000	29,960	39	.....	57,000
Chemicals	1	89,000	135,000	49	.....	228,000
Carriages	34	320,125	289,058	714	10	705,415
Cement	1	300,000	87,000	250	.....	255,000
Clothing	42	1,147,000	1,452,170	1555	3045	2,624,252
Coffee and spices	3	28,500	71,202	14	.....	92,200
Drugs	1	18,000	50,000	4	.....	90,000
Edge tools and cutlery	16	122,700	100,170	242	.....	273,725
Fire arms	1	32,000	18,000	60	.....	50,000
Hats	23	544,800	974,534	1196	406	1,757,878
India rubber goods	1	200,000	135,000	60	70	400,000
Iron founding	6	121,000	176,510	106	.....	276,500
Jewelry	21	726,500	694,465	718	71	1,341,000
Leather	14	217,800	510,731	169	.....	634,022
Looking glass and picture frames	5	38,100	47,631	37	.....	69,000
Morocco	3	105,000	254,000	138	19	366,000
Machinery	19	405,300	142,422	385	.....	760,250
Malleable iron	6	118,000	62,232	200	.....	193,300
Ornamental glass	3	28,000	19,215	28	3	72,000
Paper	3	64,000	68,307	28	.....	104,882
Patent leather	9	912,000	1,224,675	720	.....	1,797,000
Registers and ventilators	1	30,000	.....	30	.....	80,000
Saddlery and harness	24	1,224,100	758,320	1033	33	1,418,850
Sashes, doors, and blinds	6	73,200	71,550	126	.....	143,350
Spokes, hubs, wheels, etc.	8	110,500	97,714	121	.....	190 199
Springs	2	45,000	38,420	48	.....	79 000
Saddlery hardware	34	288,600	314,365	779	69	698,150
Soap and candles	2	65,000	93,750	20	.....	117,000
Stair rods	2	66,000	47,585	38	5	86,400
Straw hats	1	20,000	60,000	25	60	104,000
Trunks and carpet bags	13	314,500	474,850	665	117	920,000
Type metal	1	50,000	50,040	0	.....	68,000
Trunk rivets	2	45,000	20,025	180	28	53,500
Tin, sheet iron, and copper	12	101,000	103,860	131	.....	208,850
Varnish	8	185,250	104,950	24	.....	347,000
Zinc, oxide of	1	1,200,000	98,000	110	.....	165,000

The manufactories of Newark are generally of a medium class, many of them owned and operated by mercantile houses in New York, but there are a few sufficiently extensive to be called noteworthy. Of this description are the mills of

The Clark Thread Company,

Erected in 1865, at a cost of three hundred thousand dollars. The main factory building is three hundred and twenty feet long, one hundred and five feet wide, and five stories in height, requiring in its construction three and a half millions of brick. Adjacent thereto is the Picker and Spool Turning house, and in the immediate vicinity are the Dye and Bleach houses, with an ample supply of pure river and clear spring water. The rear of the premises is bounded by the Passaic river, having a wharf five hundred feet long, at which vessels of three hundred tons can load and discharge. The Spinning department contains twenty-five thousand spindles, with all the necessary preparation for producing the highest quality of yarns, and is separated by a thick wall and double iron doors from the Thread Mill, which has room for fifty thousand spindles, with all the requisite winding, polishing, and spooling machinery. The first story of both these departments is sixteen feet in height and the walls three feet in thickness. The machinery, of the newest construction, and part of it protected by patents held by the Company, is from the best shops of this country and England, and is propelled by two coupled condensing engines of upward of seven hundred horse-power, supplied with steam from a range of ten tubular boilers. The entire establishment, when fully equipped, will cost $750,000, and employ from one thousand to twelve hundred persons.

This splendid factory, the largest and probably the most complete of the kind in the United States, is owned by a Joint Stock Company, of which the principal stockholders and officers are Peter Kerr and George A. Clark, who for many years were celebrated manufacturers of Spool Cotton in Paisley, Scotland, where their respective firms have carried on the same business for above half a century. As the machinery is of the best and newest description and the managers men of large experience in this specialty, there is no reason why the Company should not produce Thread equal to the best imported, and even better adapted to the requirements of Sewing Machines.

Peter Ballantine & Sons' Brewery,

In Newark, is the largest in the State of New Jersey, and is entitled to a place among the large Breweries of the country. It has a capacity for producing over sixty thousand barrels of Ale per year, and has four malthouses attached, that will malt over two hundred thousand bushels of barley.

Peter Ballantine, the founder of this firm, is now one of the oldest brewers in the United States, having been engaged in the business for forty-six years. He was born in 1791, in Ayrshire, Scotland; came to this country in 1820, and entered into the employ of Robert Dunlop, whose Brewery, in Albany, New York, though its capacity was only five thousand barrels per annum, was then one of the largest in the United States. Here he obtained his first instruction in brewing, and by a close observation of the various processes as carried on by others, acquired such a mastery of the art that he was soon employed as brewer and maltster by leading firms in Albany and the vicinity, and subsequently was offered an interest as partner in the firm of Fidler, Ryckman & Co., which partnership lasted about six years.

In 1840, Mr. Ballantine removed to Newark, New Jersey, and rented a Brewery which none of his predecessors had been able to operate successfully. Beginning in a small way, he made steady progress, although he had not only to compete with the most celebrated brands of the country, but to contend against the reputation which the Ales brewed here had previously acquired. At the end of the eighth year he had increased his production to eleven thousand barrels, which, considering the size of the place and its limited facilities, was a large business—certainly larger than had ever been done in it before. The malthouse connected with this Brewery being able to furnish but a small amount of the malt required for such a business, Mr. Ballantine, in 1848, purchased property adjacent to the Passaic river, having an eye to future requirements, and built a malthouse of thirty thousand bushels capacity. In 1849, the business having completely outgrown the Brewery then occupied, he erected another adjoining and communicating with the malthouse built the previous year, with a capacity of one hundred barrels per diem. The sales continued to increase until from brewing four times a week he was called upon to brew every day, and in some instances twice in one day. Of course additional malting facilities were required to meet this demand, and another malthouse was built, of twenty thousand bushels capacity. At length, notwithstanding brisk competition, an enlargement of Brewery became a

necessity, and a third malthouse was built, of sixty thousand bushels capacity, increased afterward to eighty thousand bushels, and at this time the firm are about erecting another extensive malthouse, two hundred feet long, forty-eight feet wide, and six stories in height. It is proper to state that this firm supply malt to other brewers, and consequently produce much more than is consumed in their own Breweries.

During the first five years of his business career in Newark, Mr. Ballantine was associated in partnership with Mr. E. Patterson, and since 1859, his three sons have been members of the firm of P. Ballantine & Sons—one of them having charge of the principal depot in New York city, whence all the shipping and city trade is supplied.

The life of this patriarchal brewer covers the entire period within which the most important improvements have been made in the art of brewing. When he began, hand labor only was used in Breweries; now, modern inventions have supplied appliances that almost supersede manual labor, and the mighty agency of steam has accomplished the same radical changes in this as in other departments of industry. When he commenced, it was not deemed practicable to brew sound Ale except during about eight months in the year; now, brewing can be continued through all the seasons, and excellent Ale is made even in the warmest weather. He has succeeded in elevating the reputation of Newark Ale to a level with the best made in other places, as is evidenced by the constantly increasing demand for it; and though his career has been full of vicissitudes, his good name has never been tarnished or dishonored.

The Gould Machine Company,

In Newark, is one of the oldest and largest manufacturers of machinery in the State of New Jersey. The Works were founded in 1835 by Ezra Gould, and his machine shop was the second established in Newark. At that time there were but two steam engines in operation in that city, where there are now several hundred; and the tools in use, compared with the improved machines of the present day, were extremely ineffective. The business remained under his supervision until 1862, when he transferred it to his two sons, who obtained from the Legislature of New Jersey, by special act, a charter of incorporation as the Gould Machine Company, with a capital of $100,000, and privilege of increasing it to $250,000.

The Works of this Company are situated on Railroad Avenue, Green and Lafayette streets, on the line of the Camden & Amboy and New

Jersey Railroads, and consist of a Machine Shop, an Iron and Brass Foundry, Boiler Shop, Pattern Shop, and other auxiliary buildings, with the necessary yard room. They possess ample accommodation for the employment of five hundred hands, if so many should be required. They are equipped with all the best tools for the prosecution of the business, and, in this respect, are probably, not surpassed by any in the country.

The manufactures of this Company include a great variety of Machinists' Tools, and Wood-Working Machinery, Steam Engines and Boilers, Portable Engines, Saw Mills, Steam Fire Engines, Leather Hose, and other Fire Apparatus, Castings, and Machine Shop Forge and Foundry Equipments. Their machine tools are distinguished for their simplicity and originality of construction. The first compound planer ever made in this country was designed and built at these Works; and many other machines now in extensive use owe their paternity to the mechanical and inventive genius of the founder.

The Steam Fire Engines manufactured here possess several important improvements which have been patented, and it is claimed that by means of them, "with the same sized steam cylinder and pressure of steam, they discharge from seventy-five to one hundred per cent. more water than any other made; and are consequently that much more efficient, being able to project further and with greater force through any sized nozzle or length of hose, and have always their maximum efficiency, no matter where placed—whether near or far from the fire, whether playing through large or small nozzles, or where one or more streams are used." This is accomplished by means of the Pump, by which the discharge of water or the effective area of the pump is regulated to suit the various positions of the Engines at a fire. It is also capable of being applied to various other uses.

Among other important inventions originated by the members of this Company is a Pump for compressing air or other gases. This consists of two cylinders of different diameters, the air being first compressed from the large to the small cylinder, and from thence to the tank or receiver. By means of this pump it is claimed that four times more air can be put to the same pressure than by any other contrivance now known, with an equal expenditure of power.

The present officers of the Gould Machine Company are F. H. Gould, President, and Roscoe J. Gould, Treasurer. The warehouse is at 102 Liberty street, New York, where they also execute orders as supply merchants for other machinery than that manufactured at their Works.

MANUFACTURES OF PATERSON.

PATERSON, thirteen miles north from Newark, is the next largest manufacturing town in New Jersey. It had in 1860, according to the census returns, 123 manufacturing establishments, with a capital invested of $3,403,700; employed 3,523 males and 1,668 females; and produced a value of $5,939,873. The principal manufactures were as follows:

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.
Bleaching and dyeing	4	$218,300	237	44	$278,690
Carpets	1	60,500	60	75	98,800
Coffee and spices	1	40,000	13	.....	55,000
Cotton goods	11	683,000	267	629	874,961
Flax and hemp	1	200,000	67	94	140,000
Forging	1	110,000	45	.....	160,000
Hosiery	1	250,000	100	70	290,000
Lampwick	1	40,000	31	22	75,600
Locomotives (1)	3	600,000	1230	.....	1,380,000
Machinery and steam engines	8	310,000	712	.....	539,812
Musquito netting	1	40,000	32	55	90,000
Paper (2)	3	245,000	98	69	374,216
Silk—sewing, etc. (3)	4	153,000	112	478	846,500
Soap and Candles	2	11,000	8	.....	63,300
Tinware	5	32,200	47	.....	51,650
Table covers, etc	13	23,350	68	6	41,318
Wire drawing	2	3,000	41	17	63,600
Woolen goods and yarn	2	40,000	33	12	100,000

Of the large establishments in Paterson the most noteworthy are the Locomotive Works, of which there are three, the parent establishment being

The Rogers Locomotive and Machine Works,

Founded in 1831 by Thomas Rogers, for the purpose of building Cotton, Woollen, and Flax Machinery. In the succeeding year he was joined by Morris Ketchum and Jasper Grosvenor, establishing the firm of Rogers, Ketchum & Grosvenor, who, in their day, attained great celebrity as builders of Locomotives and Cotton Machinery.

The first Locomotive built by this firm was the "Sandusky," which was delivered to the Mad River and Lake Erie Railroad Company, October 14, 1837. During the first year, ending November 1, 1838, they built seven Locomotives. In 1839, they built a Locomotive for the New Jersey Railroad that conveyed with the greatest ease a train of loaded cars, weighing from one hundred and twenty to one hundred

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.....	290,000
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.....	1,380,000
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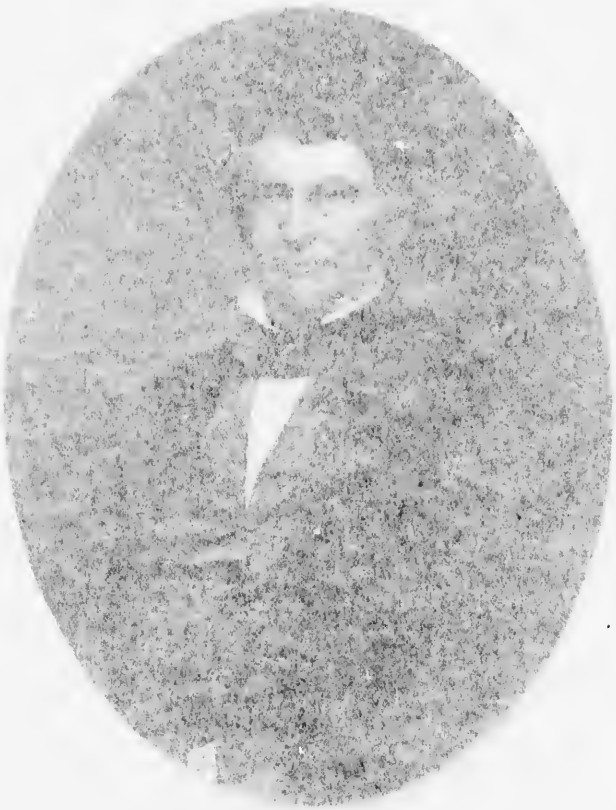


and thirty tons, up a grade of twenty-six feet per mile, at an average speed of over twenty-four miles per hour, a performance which, at that time, had not been equalled by any Locomotives constructed in England.

During the administration of Mr. Rogers, which continued until his decease in 1856, he made many valuable improvements that contributed to the perfection of the American Locomotives, and which are now generally adopted. As early as 1839 he protected the wire gauze in the Smoke Pipe by an Inverted Cone, placed in the axis of the Pipe, with its base curled over, so as to scatter the sparks over a large portion of the surface of the wire-cloth, and thus prevent the top of the spark-catcher from being burnt out before the other part was materially injured. He, at that time, also used driving-wheels with hollow spokes and rims, and two years previously counterbalanced the wheels, for which he entered a specification in the Patent Office in 1837.[1]

He also originated an arrangement for forcing the eccentric rods in and out of gear by the use of V hooks at the ends of the rods, in connection with the reversing lever and shaft, by which the reversing depended on no contingency, and a single handle only was required to manage the engine more efficiently than had heretofore been done.

Messrs. Rogers, Ketchum & Grosvenor were the first to introduce and use Expansion Braces—which was about the year 1840—and the Link Motion, which they adopted in 1849, and which has nearly superseded all other valve motions.

They were also the first Locomotive builders who put cast-iron ferrules in the ends of the flues to keep them tight, an improvement that is now generally adopted, as they are peculiarly suited to the purpose. This was in the year 1850.

The Rogers Boilers were also distinguished from those of other makers by their greater length and increased number of flues, being eight feet long for an eight ton engine, with one hundred and twenty flues, while the usual length was seven feet, with from eighty to ninety flues. By this deviation from the early standard, he not only obtained more heating surface, but the heat remained longer in contact with the flues, and the addition of weight was a trifle in comparison with the advantages derived from the saving of fuel. He, in fact, may be said to have originated a style of Locomotive that is now regarded as an acknowledged standard.

The firm of Rogers, Ketchum & Grosvenor maintained a prosperous existence until the decease of the senior partner in April, 1856, when

(1) *American Railroad Journal and Mechanic's Magazine*, of December, 1839.

the surviving partners took measures to form a Joint Stock Company, which was incorporated June 16th, 1856, under the name of "The Rogers Locomotive and Machine Works."

In 1859, the Southern Railroad of Chili ordered from the Rogers Works a freight and passenger engine, at the same time that they sent an order to England for similar engines, with a view of testing the comparative merits of American and English Locomotives. The English builders, anxious to secure the South American market for their engines, made the cylinders of both their engines considerably larger than ordered, with a view of obtaining more power. The trial lasted through four days—one day for each Locomotive—and resulted in demonstrating the very great superiority of the American Locomotives, as the American freight engine "San Bernardo" performed work in forty-one minutes which the English engine could only do in eighty-eight minutes; and the American Passenger Locomotive hauled a loaded train, up a steep grade, seventeen miles in thirty-four and a half minutes, which the English engine could not do in less than forty-nine minutes.

In 1864, the Rogers Company received an order from the United States Government for nineteen Locomotives, of the value of $20,000 each, which they completed and delivered in three months, a feat of rapid workmanship not paralleled we think, as ordinarily four or five months are required for the execution of an order for half the number.

The Works of this Company include two Blacksmith shops, one two hundred feet long by thirty-one feet wide, the other one hundred and two by forty feet; a Boiler shop, thirty-three by two hundred feet; an Erecting shop of the same size, and numerous auxiliary buildings, with the requisite tools and accommodation for a thousand workmen. The President of the Company is J. S. Rogers; the Secretary and Treasurer, R. S. Hughes, of New York; and the Superintendent, William S. Hudson. They are now employing over eight hundred and fifty hands, and turning out an average of ten Locomotives per month, besides a variety of machinery for Cotton and Woollen manufacturers.

The Danforth Locomotive and Machine Works,

In Paterson, are among the largest and most important in the United States. The establishment originated in a small machine shop erected, by Mr. John Clark, senior, a native of Scotland, where the grist-mill now stands, near the Beaver Mill, about the year 1800, and was probably the first machine works in New Jersey.

This shop was principally occupied in making wool-carding machines for country work for several years; and as manufacturing operations increased, other machinery was made, until the close of the war of 1812, when manufacturing operations were suspended for two or three years. About this time the shop passed into the hands of the late John Clark, Jr., and as power loom weaving was about being introduced, the first orders taken were for Power Looms. The late Thomas Rogers was a journeyman house carpenter, and as the looms were at that time mostly made of wood, Mr. Rogers was employed by Mr. Clark to do the wood work; and being an active, smart, energetic man, soon became a partner.

Subsequently, the late General Abram Godwin became interested with them, establishing the firm of Godwin, Rogers & Co. This was in 1822. At first all their tools were in the basement and first flat of the cotton mill, but they gradually increased their operations until 1828, when one half of the present brick machine shop was put up. At that time Charles Danforth, a native of Massachusetts, who had been living at Ramapo, Rockland county, New York, for several years, invented his celebrated Cap Spinning Frame, came to Paterson and made an arrangement with this firm to manufacture them. Large orders were taken for the new spinners at satisfactory prices, and a successful business was done. This circumstance brought the works into notice, and gave them orders not only for the new spinning machines, but for other machinery.

In the early part of the year 1830, Mr. Danforth went to England and introduced his spinners there, where he met with fair success, and would have done better but for the self-acting mule which was then about being introduced. He returned in the fall of 1831, just before which the firm of Godwin, Rogers & Co., had dissolved, Mr. Rogers going out and connecting himself with Messrs. Ketchum & Grosveneur, established the firm of Rogers, Ketchum & Grosveneur, who are now succeeded by The Rogers Locomotive and Machine Company.

Mr. Danforth took the place of Mr. Rogers in the old firm, which continued to do business under the name of Godwin, Clark & Co., with enlarged works, until 1840, when the firm was dissolved. The

machine shop was then conducted by Mr. Danforth, and the cotton mill by General Godwin, for two years, when Mr. Danforth bought out the whole concern, and conducted it alone until 1848, when Major John Edwards (who had served his time in the shop from 1826, and had been foreman for several years) took an interest in it, under the firm style of Charles Danforth & Co. In 1852, Mr. Edwin T. Prall, who had been principal bookkeeper from 1839, became a partner, together with Mr. John Cooke, who had been foreman for the Rogers Locomotive Shop for six or eight years, and had contributed much towards perfecting and improving character to the locomotives made by that Company. In the same year the locomotive shop was erected, and the business conducted in the name of Danforth, Cooke & Co., until 1865, when it was converted into a joint stock company under the title of the Danforth Locomotive and Machine Company, the old partners being the principal holders of the stock.

The Works of this Company now cover nearly two acres of ground, and include a Cotton Factory, a Foundry, a new Boiler Shop two hundred feet in length, a large Blacksmith Shop and Pattern Shop one hundred and ten by thirty-five feet, in which patterns are stored that originally cost $150,000, and a Machine Shop which has turned out in a single year $300,000 worth of Cotton Machinery, besides over seventy Locomotives. As many as seven hundred men are frequently employed.

Mr. Charles Danforth, the President of the Company, has had experience in all branches of the cotton manufacture, and probably there is no one now living so thoroughly conversant with all the details of cotton spinning and manufacturing machinery for the purpose. Since his invention of the Spinning Frame, with which his name is associated, he has made several improvements upon it, and it is now believed to be the most effective throstle spinner extant, and will produce, it is claimed, full thirty per cent. more yarn, "spindle for spindle," than any other spinning machine.

Todd & Rafferty's Machine Works,

In Paterson, is the principal establishment in the United States for making Hemp and Rope Machinery. The senior partner of this firm was the pioneer in this country in providing improved machinery for this purpose; and notwithstanding the want of governmental protection to the products of their works, the concern founded by him has achieved a distinguished success, and now supplies the principal

Roperies not only of this country, but of Great Britain, Calcutta, and Australia.

The buildings comprising the Works cover about two acres of ground, and bear evidence of having been adapted to accommodate the requirements of a growing business. The principal machine shop and erecting room is one hundred and twenty-five feet long, about eighty feet wide, and four stories in height. The blacksmith shop contains a dozen fires, and to this is attached a building devoted especially to the construction of heavy machinery. Here are two large lathes, one capable of turning twenty-two feet in diameter and the other twelve feet. The foundry is of brick, one hundred and twenty feet long and about forty feet wide; and the pattern shop is large and fireproof. Besides these, the firm have probably the most complete boiler shop in the State of New Jersey. It is two hundred feet long, sixty feet wide, and occupies nearly thirty city lots.

About twenty-five years ago the senior partner, Mr. JOSEPH C. TODD, commenced in Paterson the manufacture of machines for spinning Manilla, Russia, and other Hemp into Rope and Cordage. The firm was originally Todd & Mackey, which continued until 1848, when it was dissolved and Mr. Philip Rafferty became a partner. The machines made by them were improved from time to time, until now, it is believed, they are without a rival in the world. A set consisting of one Scutching Machine, one Lapper, two Drawings, and ten Spindles, will spin twelve hundred and fifty pounds of No. 20 Yarn per day, and the product is more uniform in quality and stronger than hand spun rope. A set of these machines may be put up and operated in a room of thirty by forty-five feet, and the whole can be driven by an engine of ten horse-power. These machines have superseded all others heretofore used in the United States and Canada, and have been adopted in the Government Rope Works at Boston. In 1859 Mr. Todd visited Europe, and notwithstanding the difficulties and obstacles thrown in the way of introducing American machinery in the European market, achieved a decided triumph, having secured their introduction into nearly all the principal rope manufactories of England, Scotland, and Ireland.

Messrs. Todd & Rafferty have recently perfected a machine for converting Tow into Balo Rope in one operation, and have prepared improved machinery for picking oakum, which is in use at the United States Navy Yard, Brooklyn, and at all the principal manufactories in the United States and in England. Besides this class of machinery, the firm have attained an excellent reputation for building Steam Engines and Boilers. Their Boiler Works, as we have stated, are large and unusually well arranged. The Horizontal Steam Engines manufac-

tured by them are notable for their simplicity, strength, and superior workmanship. The cylinder is cast with a jacket which prevents the condensation of steam, and the pistons are self-adjusting. These Engines are supplied with the Judson or Snow Patent Governor, and valve.

Messrs. Todd & Rafferty also manufacture a new Patent Cut-off Engine, and a novel and very effective Portable Engine, the peculiarity consisting in the construction of the Bed, which is a hollow box, in which are a series of pipes extending the entire length of the box. Through these the water is forced by the pumps into the boiler, after being highly heated by the exhaust steam, which enters the box at the cylinder end, and escapes through a small pipe at the opposite end into the smoke stack. The crank is made double, and the shaft projects on both sides of the boiler, so as to put the driving pulley on either side, or to use two, if the case requires. One end of the piston-rod acts as the pump-plunger, the pump setting between the two connecting rods, each of which takes hold of one end of the brass around the wrist of the crank, thus making the crank bearing seven and a half inches long.

About three hundred and fifty hands are generally employed in these Works, and sometimes as many as five hundred.

The Paterson Iron Company,

Whose Works are located within a short distance from the depot of the Erie Railway Company, was incorporated by an Act of the Legislature of the State, passed March 9th, 1853, and commenced operations by erecting a Forge, one hundred and thirty feet long by eighty-six feet wide; a Blacksmith and Welding shop, seventy-five feet long by fifty feet wide; and a Tire Rolling Shop, forty-three feet long, and thirty-six feet wide. This shop is equipped with machinery, by which the Tire, after having been laid on a horizontal face plate, and run between a pair of running rolls and two guide rolls, is taken out so perfect, as to require no boring or turning to fit the wheel centre.

In 1855, having purchased the patent right for the State of New Jersey, they put in one of Watts' one-thousand-pound Steam Hammers, and, from that time until 1861, they were almost constantly employed in manufacturing Locomotive Forgings and Tires for the Locomotive shops in Paterson and Jersey City, and a large amount of repair and renewal work for the railroads in the vicinity.

The entire machinery of the forge and tire mill is driven by an engine of seventy-five horse-power, built by Wm. Burdon, of Brooklyn. The ma-

chine shop is driven by an engine of thirty horse-power, built by Todd and Rafferty of Paterson, New Jersey.

The strength and durability of the Paterson Locomotives is no doubt due in no small degree to the skill and care of the managers of this establishment, and their reputation for superior workmanship has become so well established that they are called upon for forgings and tire from every State in the Union.

The Forge and Machine shop is now four hundred and eighty feet long by eighty-six feet wide, the Blacksmith and Welding shop one hundred by fifty feet, and the Tire Rolling and Bending shop eighty by thirty-six feet. There are thirteen Heating Furnaces, eight of Watt's patent Steam Hammers (six of one thousand and two of fifteen hundred pounds), two of Nasmyth's Upright Steam Hammers (one of three and one of ten tons), eight Lathes, five Planers, two Slotting Machines, etc.

They employ about two hundred men, and turn out from three thousand to four thousand tons of finished work per annum. The Treasurer of the Company is F. C. Beckwith, of Paterson.

Paterson, besides her extensive Locomotive shops and Iron-works, is the principal seat in the United States of the manufacture of Silks. In 1860, according to the census returns, there were but four Silk manufactories, whose aggregate capital was $153,000; now there are probably a dozen of these establishments, large and small, which employ nearly two thousand operatives, and produce Sewing and other Silks of a value approximating $2,000,000.

The pioneer in this department of manufactures in Paterson, to whom not only the city but the country is largely indebted for his enterprising and persevering efforts, is John Ryle, the founder of, and senior partner in, the firm of

John Ryle & Co.

A native of Macclesfield, England, where his brothers, Reuben and William, have been for many years leading manufacturers of Silks, supplying the London and Manchester markets, Mr. John Ryle emigrated to America in 1839, and engaged in the Silk manufacture at Paterson in 1840. His productions at first were limited to the ordinary varieties of Sewing and Floss Silks, but in 1843 he attempted weaving, in which he was entirely successful in producing marketable fabrics, though in consequence of the cost he abandoned it. Among his productions of that period was the beautiful flag which waved over the Crystal Palace

at the great exhibition in New York, in 1852. In 1860 he renewed the attempt, but in consequence of the Rebellion, and the want of encouragement afforded by the Government, it was not found profitable to continue it. During this period, however, he succeeded in attaining a high reputation for his Sewing Silks, which are everywhere regarded as equal in quality to the imported.

The firm of John Ryle & Co. have now a mill near the Passaic Falls two hundred feet long and seventy-five feet wide, two stories in height. The machinery consists of three thousand two hundred and fifty-six Raw Silk-winding Spindles, nine hundred and fifty-two Doubling Spindles, four hundred and seventy-six Soft Silk-winding, one hundred and ninety-two Soft Silk Finishing, ten hundred and twenty-four Cleaning Spindles, four hundred Reeling, six thousand five hundred and fifty-five Spinning Spindles, and twenty-one Spooling Frames, capable of spooling three hundred and fifteen gross of spools each day. The employes exceed three hundred, principally females, whose aggregate wage amounts to about $50,000 per annum.

All the operations, including dyeing and finishing, are performed in this manufactory. The raw Silk is imported from China and Japan, having been reeled from the cocoon, and arrives put up in large skeins of a dull white or yellowish color, the cost being from eight to ten dollars per pound. The first process in the manufacture is to place it on the winding machines and transfer it to bobbins, from twenty to thirty of these usually being on a single machine. One operative attends each machine. It is then cleaned, being made to pass over the edge of a knife, for the purpose of taking off bits of tow and other excrescences. The next process is doubling these threads; but this term comprises the placing together of any number of them from two to twenty-five, according to the use for which it is designed. To this succeeds spinning for the first time over, after which the article is sized, putting two or more threads together of the same size and twist to make the thread in its final shape look even. The last of these stages is spinning for the second time, the threads being drawn out on a long railroad and twisted by a process similar to that on the old mules in our cotton-mills, only at a far higher speed, the spindles making more than ten thousand revolutions per minute.

The Silk having been reeled up into skeins, is taken to the dye-house, where it undergoes the coloring processes required, after which it is steam-stretched and stringed, the latter, it would seem, a somewhat exhaustive operation, large bundles being jerked and twisted as tightly as the strength of a pair of powerful arms working on a lever bar

can twist them. It appears almost impossible that the article could endure such a test; but it never gives way. This process gives the finished article a beautiful lustre which it would not otherwise receive. This firm have been remarkably successful in their Dyeing Department, which is under the superintendence of a Macclesfield dyer of long experience.

Mr. Ryle has been a benefactor to Paterson, not only in establishing a new branch of manufactures of great importance, but in promoting civic improvements tending to increase the attractions of the city as a place of residence. The Waterworks, which furnish the city with an abundant supply of pure water, were erected mainly through his means and exertions, and the grounds around the "Cottage on the Cliff" and the Falls, that afford a delightful breathing place to the citizens, especially the operatives in the factories, were adorned by him and thrown open freely to the public.

The Dale Manufacturing Company

Have recently erected at Paterson the largest Silk manufactory in this country, and, it is said, larger than any single establishment of the kind in Europe. The Company was incorporated in 1864, the principal stockholders being members of the firm of Thomas N. Dale & Co., who were formerly leading importers of Sewing and other Silks in New York city, and who were the first to engage in the sale of Tailor's Trimmings as a specialty in which they are yet the principal dealers, having branch houses in Paris, Philadelphia, and Cincinnati. In 1861, the change in the Tariff, and other circumstances, rendered the importation of Sewing Silks unprofitable, and the firm engaged in the manufacture at Paterson, in a small way, producing the same qualities they had previously imported, and so successfully, that their facilities were soon inadequate to supply the demand. In 1864, therefore, Mr. Dale purchased one hundred city lots, twenty-four of which were opposite the Paterson depot of the Erie Railroad, and from his own designs proceeded to erect a manufactory which should be a model for all others. The principal mill is two hundred and seventy-five feet in length, forty-eight feet wide, and four stories in height, with a centre projection one hundred feet in length, and auxiliary buildings, including a Dye-house and an Engine and Boiler house, a Blacksmith and Machine shop. The aggregate floor superficies is nearly seventy-five thousand square feet. To insure the requisite strength and prevent vibration by the action of the machinery, the walls are built twenty inches thick, of substantial

masonry from the bottom to the top. The floors are double, the inside one of thick plank placed in the usual manner, the other of narrow boards laid diagonally, and the whole resting on joists fifteen by twelve inches. It is scarcely necessary to say that in a building erected so substantially there is no crack in the walls, nor is vibration by the motion of the machinery apparent.

In the construction of the building every precaution possible has been taken to guard against damage to life and property from fire, there being a force pump of great capacity, with sufficient hose on each floor, to throw water to every part of the story; an extra stairway is provided to facilitato exit in case of sudden alarm, and Fire-proof vaults of large size have been built, in which the raw and manufactured Silks are deposited. A well has also been sunk underneath the building from which water for the boilers can be obtained should the ordinary supply fail from any unforeseen cause. There is also, throughout the building, ample ventilation and an abundance of light, which has a tendency to promote both the health and cheerfulness of the employes.

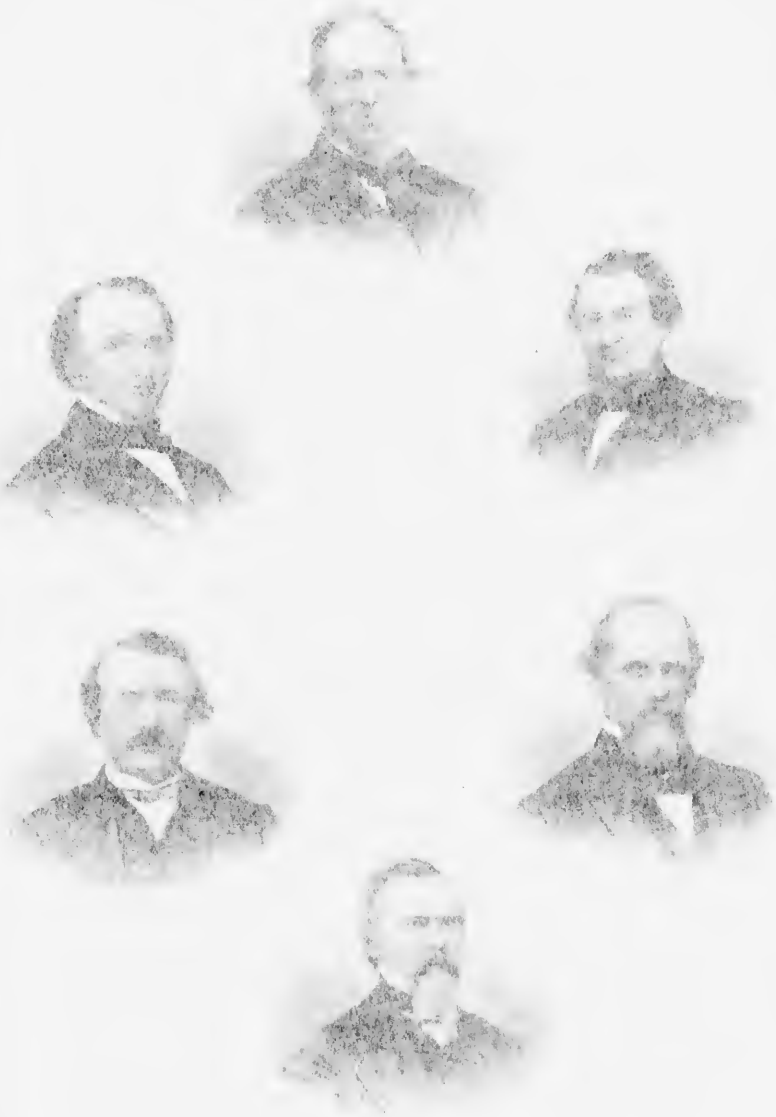
The machinery is propelled by a Corliss engine of sixty-five horse-power, and includes ten thousand six hundred and ninety-two spindles, of which over eight thousand are spinning spindles. There are also thirty looms now in operation on braids and bindings, and it is proposed to increase the number to eighty, a large proportion being the Jacquard loom. When fully equipped, this factory will have the capacity of "throwing" fifteen hundred pounds of Silk per week, which, it is believed, is a greater capacity than that of any single mill in England.

The capital of the Company is now $300,000, but it is proposed to increase it to a half million of dollars. All the stock is held by Thomas N. Dale, George Richmond, John R. Harris, and Joseph H. Brown, who are also members of the mercantile firm of Thomas N. Dale & Co.

Another new establishment that has contributed to increase the importance of Paterson as a manufacturing centre is

The Passaic Flax Mills,

For the production of Shoe, Sewing Machine, and all kinds of Linen Thread. It is well known to dealers in these kinds of Thread that the brand most highly valued in the American market has been for some years what is known as "Barbour's Standard," manufactured at the great mills of William Barbour & Sons, at Lisburn, near Belfast, Ireland. The representative of this firm in this country is the house of



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BARBOUR BROTHERS, New York city, who in 1864 determined to establish a branch of the manufactory here, and selected Paterson as the site, where they purchased land and fitted up buildings for the purpose. Their principal mill is now a stone structure, one hundred by forty feet, five stories in height, of which the first three stories are used for preparing and spinning the flax, which is imported. In these rooms there are all the different machines necessary for the complicated process of spinning, and they combine all the recent improvements.

The raw material is first taken into the lower stories, and from thence ascending, undergoing the various processes of manufacture till it reaches the top floor, when it is ready for market. Although these operations occupy comparatively little space, the quantity of work turned out (the machinery being of such improved and perfect construction) is very considerable.

All the Shoe Thread is papered and packed, and the Machine Thread spooled and labelled, in a three-story wooden building adjacent. Here, also, is a printing office, in which all the lithographic printing required for labels is performed.

Besides these, the firm have also a large Dye-house, one hundred by thirty feet, a new brick building one hundred by twenty in which the offices are located, twenty-four tenement houses for operatives, and other landed estate.

These Works are located near the Falls, and use water-power, which, being unlimited, can be made available to any extent that the constantly-increasing consumption of the country requires.

All the Flax used in these mills is grown in Ireland, where long experience in this branch of industry has given the people a peculiar aptitude in the pursuit, and about one fourth of the operatives now employed were brought over from Ireland, where they had acquired a thorough knowledge of the business.

In 1865, the "American Velvet Company," which had been previously established at Newark, erected in Paterson a large brick factory two hundred by forty-five feet, three stories high, and equipped it with machinery imported from England, for weaving velvets, hat plushes, foulards, and pongees. The Company spin the silk out of pierced cocoons, imported at present from France and Japan, though California promises soon to furnish an adequate supply of this important product. This is the first attempt to manufacture on a large scale Silk Velvets in this country, and judging by the specimens of its productions, excellent in quality and brilliant in dye, is likely to be successful.

The Dolphin Manufacturing Company

Is the style of a Company in Paterson, organized under the manufacturing law of New Jersey, which carries on the manufacture of coarse goods from Flax, Hemp or Jute, as the trade may demand. It was originally known as the American Hemp Company, and was established in 1844 for the manufacture of hemp into sail canvas and other articles for which this fibre was believed to be suited. The advance in the price of American hemp, from $80 to $300 per ton, combined with a preference for cotton duck, caused this Company to add Flax and Jute to their original articles of manufacture. They are extensive producers of Jute—or, as it is called, Hemp Carpeting—of Bagging for Hops and for Sea Island Cotton, of Burlaps and Tailors' Canvas; also of Yarns for filling for Venetian and Tapestry Woolen Carpetings, and of Twines for Wool. Before 1850 the consumption of jute carpeting was trifling. At that date their superintendent introduced the style of mottled grounds, by doubling and twisting two threads of different colors into one thread. This at once gave a great impetus to the business both in America and in Scotland, where large factories have since been built for the production of this article exclusively. This Company was the first to introduce canvas for tailors' linings made from jute entirely —formerly a mixture of flax and tow was invariably used; and also that description of burlaps for wrappers and bags known as "heavy tens" (ten shillings). All these articles have since become staples, and the consumption is very large.

This establishment is owned by nearly the same proprietors who built it in 1844. The Superintendent then and now is J. B. Meldrum, a native of Scotland. This gentleman claims to be the pioneer in jute manufacturing, having spun, in 1832, in Dundee, Scotland, the first yarns made from that article. The consumption of jute in Dundee alone has since attained the remarkable extent of sixty to seventy thousand tons annually.

The Dolphin Company's Mill is situated on the first raceway or level at Passaic Falls, Paterson. They use a turbine wheel of six feet diameter, drawing six square feet of water under head and fall of twenty-two feet, with a power equal to one hundred and eighty horses. The mill building is substantially constructed of stone with slate roof, two hundred and thirty feet long by forty-eight feet wide, two stories and attic; contains about twelve hundred spindles and fifty looms, all of the heaviest description, and produces about one hundred thousand pounds of yarns monthly, using six hundred tons of raw material annually. The market for their manufactures is found chiefly in New York, where they have an office and salesroom. The capital of the Company is $250,000.

G. De Witt, Brother & Co.'s Brass Wire Works, Belleville, N. J.,

Are the most complete and extensive of the kind in the United States. They were formerly owned by William Stephens & Son, and were one of the first brass rolling-mills established in this country. This firm was for many years largely engaged in making sheet brass, and then undertook the manufacture of Brass and Copper Wire. The first copper wire used for telegraphic purposes in the United States was made in these Works, and furnished to Amos Kendall for the line between Philadelphia and Washington. About 1849, Mr. Gasherie De Witt, a native of Hudson, New Jersey, and son of an eminent physician of the same name, became the agent in New York city for Messrs. Stephens & Son, and in 1857 purchased the entire establishment, associating with him his brother Josiah H. De Witt. They have greatly enlarged the original works, and by strict attention to the details of manufacturing, and to the maintenance of their credit by prompt payments, they have achieved an enviable success.

The manufactures of this firm include all kinds of Brass and Copper Wire, Sheet Brass, Wire Cloth, Foudrinier Wires, Fine Wire Rope and Sash Cord, Wire Window Screens, and Dandy Rolls for Paper Makers. The buildings cover an acre of ground and comprise a rolling mill, a casting shop, a wire-drawing shop, a weaving department, painting shop, and carpenter's building.

The processes of manufacturing wire cloth are both delicate and interesting. The ingot is first rolled into the bar, then drawn to the finest sizes, and then woven into fabrics, some of them being ten thousand meshes to the square inch. The machinery is propelled both by water and steam, equal in the aggregate to one hundred horse power. About seventy workmen are employed in the different departments, to whom $40,000 are paid annually in wages. Among them is one of the best artists in the country, who is employed in painting Landscapes on Wire Cloth for Window Screens.

The products of this manufactory are sold to all parts of the United States, and to Cuba and South America. Every sheet of paper made must be formed on wire cloth; while in the South it is extensively used for straining turpentine, and in California for sifting gold dust. This establishment was the first in this country to introduce the manufacture of Foudrinier wires, so essential to paper makers, and they continue to be the leading manufacturers of this important article.

Messrs. G. De Witt, Brother & Co. employ in their business a capital of $100,000, and produce annually about the same amount of fine goods. Their Sales Wareroom is at No. 90 John street, New York.

John Jewett & Sons' Floor Cloth Works,

At Elizabeth, N. J., are among the largest of the kind in the United States. Nearly three acres of ground are covered with buildings, the principal ones being, respectively, two hundred and twenty-five by seventy-five, and one hundred and twenty-five by forty feet; and the drying-rooms are seventy-five by eighty feet. In the manufacture of heavy oil-cloths, a large capital, as well as large buildings, is required; for several months elapse before the products can be thoroughly dried and prepared for market. The raw material used is canvas, imported from Scotland, in sheets sometimes a hundred yards long. From these, pieces are cut, of the required size, and then stretched upon substantial, upright wooden frames, each separated from the next by a space of a few feet. Ladders and platforms are conveniently arranged, to afford access to every part of the cloth. When strained, and well secured to the frame, an application of a solution of glue size is made to the back of the canvas with a brush, and then rubbed smooth with pumice stone. When this is dry, a coating of paint, of linseed oil and ochre, is laid on, by means of steel trowels, which are sometimes two and a half feet in length. In the course of two weeks, this becomes dry, and a second coat is applied. In the meanwhile, similar operations have been going on the face of the cloth, no less than three coats of paint being applied with the trowel; and, finally, a fourth coat is laid on with a brush, which is intended to form the groundwork of the design, to be afterward printed. For the best cloth, two and three months are required to complete these operations, and the materials laid on, amount to nearly three times the weight of the canvas. A piece of oil-cloth, twenty-four by one hundred feet, will weigh nearly a ton. The heavy pieces are received from the frames upon rollers, set upright, and are conveyed to the printing-room, where they are laid upon a table, and drawn along as fast as the printing, upon the portions in advance, progresses. The printing is accomplished by blocks of pine wood, faced with pear-tree, and engraved, each one, to print all those parts of the patterns which are in one color, the portions corresponding to the other colors being cut away. As many blocks are applied in succession, therefore, as there are colors to be printed, the operations being much the same as that described in printing wall-papers by hand, or in calico printing.

Messrs. John Jewett & Sons employ, in these works, about sixty men, and produce, annually, about three hundred and fifty thousand yards of Floor Cloth.

MANUFACTURES OF TRENTON.

TRENTON, the capital of the State of New Jersey, had, in 1860, according to the Census, 203 manufacturing establishments, with a capital invested of $2,347,755, and employing 2,388 male and 1,914 female hands, yielding products valued at $4,243,369. The leading manufactures were Bar Iron, Rails, etc., value $852,694; Machinery, Steam Engines, and Iron Castings, $349,370; Paper, $480,000; Hosiery, $461,712; Flour and Meal, $371,676; Cotton Goods, $55,000; Earthenware, $100,900; Fire Brick, $45,000; Clothing, $127,840; Coffee and Spices, $110,512; Wire Rope, $70,000; Soap and Candles, $56,100; Stone Pipe vitrified, $50,000; Marble work, $69,672; Cars, $40,000; Cigars, $64,968; Agricultural Implements, $36,850; Anvils and Vises, $38,300; Carriage Shafts, etc., $35,000; Cordage, $22,500; Leather Belting, $24,000; Lumber, sawed, $40,000; Sash, Doors, and Blinds, $43,120.

Trenton had also manufactories of Boots and Shoes, Brass Cocks, Brooms, Brushes, Cabinet Ware, Hats, Horse Nails, Knitting Machines, Preserved Fruit, Saddlery and Harness, Saws, Skins, Tinware, Springs and Belts, etc.

The most notable of the manufactories in Trenton have been alluded to elsewhere in this work. For some account of Roebling's Wire Works, see Article JOHN A. ROEBLING; and of the American Saw Company's Works, see Article JAMES E. EMERSON. The Trenton Iron Company have at South Trenton one of the largest Rolling Mills in the United States, containing fifty-eight Furnaces in all, and six trains of rolls, driven by steam, and producing about fourteen thousand tons of rails and wire annually. The area enclosed under one roof is three and a half acres, and is said to be the largest single building in the United States. Here were made the first Wrought-Iron Beams for fire-proof buildings for the United States government; and at these Works the Wire was made—a mile of which weighed but half a pound—that received the Prize Medal at the World's Fair in London. More recently the Company have succeeded in manufacturing Gun-barrel Iron equal in quality to the foreign, and the market is now fully supplied. The discovery of the process of making this description of iron is perhaps of greater value and importance to the country than any other new manufacture introduced since the commencement of the late Rebellion. Locomotive Tires are also successfully made at these Works.

Trenton is now the principal seat of the woollen manufacture in the State of New Jersey. It is estimated that the capital invested in this

business exceeds a half million of dollars, and that the value of the annual product is more than a million of dollars. Of the woollen mills the principal one is

Samuel K. Wilson's Factory,

A fine four-story brick structure, two hundred and twenty-five feet long and about sixty-five feet wide. It is erected on the site of an old cotton mill built by Jacob Hoy as early as 1814. In 1852 the property passed into the hands of Mr. Wilson, who made important additions to the buildings, and after the fire in 1864, which destroyed the entire old portion of the mill, rebuilt it in a substantial manner, making it one of the most complete and conveniently arranged woollen factories in the State.

The machinery includes six full sets of cards, eleven mules, three of them self-acting and larger than ordinary, containing about two thousand spindles, and two hundred looms. Nearly all the machines, excepting the automatic mules, which are of English manufacture, were made at the works of the Bridesburg Manufacturing Company, and are of the well-known Lewis' Patents. The machinery is operated by a steam engine of eighty horse power, and a turbine water-wheel of about seventy horse power. The two mediums of power are combined upon the shafting, but either steam or water can be used separately when desired.

This factory employs from two hundred and fifty to three hundred persons, according to the demands of the season, and when in full operation consumes twenty-five hundred pounds of wool per day, besides large quantities of warp purchased from other manufacturers.

The operations of manufacturing cloth, as conducted in this mill, are not dissimilar from those pursued in other factories, and need no detailed description. The wool is first cleaned or sorted, then scoured to remove the grease, when it is fit for the dye-vats, in which a day is sufficient to give the required color. From the dye-house the wool goes to the picking and carding room, where it is separated and prepared for the mules, which convert it into threads or warp of sufficient fineness for the looms, which first give it the appearance of cloth. When it leaves the loom it is eighty inches wide, and full of sieve-like interstices. Another process is required to give it the requisite "body," which is supplied by the fulling machine, where, under the action of a vapor bath, the eighty inches are contracted to fifty-five inches. The cloth is now ready for the "nap," which is raised by a peculiar kind of imported burr called "teasel," although the same object can be effected by other means. It is then dried on a large cylinder heated by steam,

and next passes to the shearing machine, where the knots, ends of thread, or other excrescences, are closely shaved off by revolving blades set diagonally on a small cylinder. Revolving brushes are also employed to remove flue or dust, and it is then laid between glazed boards with occasional layers of hot iron plates, and subjected to powerful pressure in a hydraulic press, which gives it the requisite gloss and finish. The cloth is then measured, and is ready for packing and transportation. Throughout the process the fabric undergoes repeated and rigid scrutiny to detect imperfections.

Mr. Samuel K. Wilson, the proprietor of this factory, was born in Gloucester county, New Jersey, in 1821. He commenced the manufacture of woollen goods in 1849, in Philadelphia, and removed to Trenton in 1852. He was one of the first in the State who purchased and operated self-acting mules; and for several years made a specialty of manufacturing "Trenton Cassimeres." This peculiar fabric, part cotton and part wool, became a standard article in the markets of the United States, and was exported largely to Canada. During the Rebellion he also engaged largely in supplying the wants of the Government for Army Cloth, but previous to this period he had already attained such success that he was entitled to rank among the wealthy men of New Jersey.

Mr. Wilson, though retiring in his manners and modest in the appreciation of his abilities, is a man of great energy of character and fertility of resources, and well deserves, for his manly and sterling qualities, the large success that has attended his business career. He takes an active interest in all that concerns the community in which he resides, and Trenton has no more valuable man, nor more public-spirited citizen. His aims have always been large, his plans beneficent, and his career is justly considered one of usefulness and honor.

MANUFACTURES OF ALBANY.

ALBANY, which is the capital both of the State of New York and of Albany County, differs from most of the State capitals in being a manufacturing centre of considerable importance. According to the latest census returns, there were in the county five hundred and ninety-four manufacturing establishments, having an aggregate capital of $9,534,079, and which employed 8,032 males and 3,671 females, and produced a value of $16,585,025. This however included the large cotton and woolen mills, and hosiery and other factories of Watervliet and Cohoes; and deducting them, it would leave for the City of Albany 337 establishments, with an aggregate capital of $5,501,119, employing 4,084 males, 2,516 females, and producing a value of $9,586,314. The principal manufactures, according to the census returns, which however are only approximately accurate, were the following:

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.
Agricultural implements (1)	4	$85,000	102		$214,060
Alcohol	2	260,000	60		950,000
Bricks	10	127,500	202		106,600
Brooms	13	22,300	159		57,664
Cabinet ware, chairs, and bedsteads	15	243,250	287	10	363,050
Carriages	11	97,400	222		211,740
Cigars	17	97,200	200		221,008
Clothing	46	326,500	459	855	713,912
Coffee and spice mills	2	40,000	22		51,500
Cotton goods	5	1,400,800	612	940	1,937,500
Drain tile	3	26,000	50		35,000
Edge tools	2	231,000	320		269,200
Fire brick	1	50,000	25		50,000
Flour and meal	22	357,000	75		823,170
Hats	10	73,000	90		281,200
Hosiery	8	802,000	365	1295	1,099,905
Iron founding	3	20,000	33		44,000
Leather	4	40,700	17		65,611
Linseed oil	1	40,000	15		70,000
Machinery and steam engines	8	$175,000	182		$205,200
Malting	9	510,300	68		561,000
Malt liquors	13	641,000	241		804,211
Paper	4	62,000	55	6	67,404
Patent medicines	2	5,300	5	6	76,100
Pianos	2	120,450	102		126,400
Planed lumber	4	140,000	237		861,075
Saddlery and harness	14	30,100	86	20	83,700
Soap and Candles	5	32,000	14		110,485
Stove founding	7	1,013,000	840		1,038,700
Woolen goods and hosiery	13	964,000	682	1421	1,515,180

(1) We believe that but one of the firms that were engaged in making Agricultural Implements in Albany in 1860, remains unchanged, namely, that of WHEELER, MELICK

The Albany Stove Foundries.

Albany and Troy have long been prominent centres for the manufacture of Stoves. The business as at first conducted, consisted in simply putting together the castings which were made at other places, generally at blast furnaces in New Jersey, near Philadelphia. The early castings were of great thickness, and, compared with those of the present day, were rough and imperfect.

Besides the well-known Franklin stove, for parlors, the first made was a box-stove, and then the oblong plate stoves, such as are yet in use to some extent for heating school houses and churches. The first advance toward a Cooking Stove was making the last-named with an oven; and the first that deserves the name of a Cooking Stove was an oblong affair having an oven running the whole length, the door of which was in front and directly over the door for supplying fuel—and having also a boiler-hole and boiler on the back part of the top near the pipe. Then, a stove similar in arrangement, with swelling or elliptical sides, was made, generally called the nine plate stove, but in Albany and Troy it was known as the Philadelphia stove.

About the year 1812, cooking stoves were made at Hudson from patterns made by a Mr. Hoxie, who was the first to elevate the fire-box above the bottom. This improvement was patented, and was sustained in suits against parties who in any way elevated the fire from the bottom. In Hoxie's cooking stove the fire was made above and upon the oven, and he was the first who made any stove in which the flame was made to descend from the top to the bottom of the oven.

& Co., who have been established there since 1849. They are the successors of A. & W. C. Wheeler, originally established at Chatham, New York, and who, it is said, built the first successful railroad, or endless chain horse-power of single gear, now so extensively used in driving threshing machines and sawing wood for railroads. It was patented in 1836. The firm at the present time have very extensive works, provided with all the most approved labor-saving machines, including some which are not in use in other similar manufactories. A mortising machine, invented by one of the firm, has, it is believed, no superior for rapid and effective work. Their manufactures include, besides the usual agricultural machines, a number of special and patented articles in extensive demand. Their *Combined Thresher and Winnower* is one of the best agricultural machines ever invented, and that it is appreciated by the farming interest is evidenced by the fact that it has been sold in nearly every State in the Union, including California and Oregon.

The manufacture of Tile for draining land is carried on largely in Albany. The statistics of this branch have evidently been underrated by the census-takers. The "Albany Drain-Tile Works," of which C. & W. McCammon are proprietors, is probably the largest of its kind in the United States. All descriptions of Drain Tile are made by them, including round tile from 1¼ to 2½ inches, horse-shoe tile from 2½ to 7½ inches rise, and sole tile from 2 to 6 inches rise. This is a very important and well-conducted establishment.

In 1815, William T. James, of Lansingburgh, afterward of Troy, made the stove known as the "James' Stove," which not only continued a leading cooking stove for nearly a quarter of a century, but may yet be seen on board of small Eastern coasting vessels, where, being cheap and durable, it supplies the place of a caboose. James' stove is probably better known as the "Saddle-bags Stove." James & O'Connell opened a retail stove store in Troy as early as 1816.

Perhaps no name is better known, not only in Albany but throughout the country, in connection with the stove business, than that of Joel Rathbone. In partnership with Mr. Heermans, who died in 1830, he opened a stove store in Albany, obtaining for some years his castings from New Jersey, and entered upon the business with such energy that in a short time his was the leading establishment in the country. The cost of transporting the castings from New Jersey, especially as a part was returned to Philadelphia and New York as finished stoves, being so heavy an item, he at first had some made from his own patterns in foundries in Albany which were chiefly engaged in making castings for machinery and agricultural tools; and soon afterward erected a foundry solely for stoves. His cupola furnace, which he built in 1838, is believed to have been the very first in the country for making stove castings. By this process castings were made smoother, and by dispensing with superfluous material they were furnished cheaper, and thus became more extensively used. This may really be said to be the commencement of the Stove Business as a leading pursuit, which increased with such rapidity that in a few years the name of Rathbone became a household word throughout the United States, and also in the British Provinces. At the present time the "Rathbone Stove Works" are among the largest in Albany. They are situated in the upper part of the city, near the canal, the buildings being respectively 314 by 151 feet, and 250 by 125 feet, and cover nearly two acres of ground—some of them are four and five stories in height, and the whole floor surface about two and a half acres. There are two moulding rooms, one being 170 by 136 feet, and the other 125 by 80 feet—amounting in all to 33,120 square feet. Each of these has a sheet-iron cupola furnace capable of melting twenty tons per day; and when worked to its full capacity this establishment can turn out thirty tons of clean castings, making three hundred stoves per day. The average number of hands employed in all the departments is three hundred, but for short periods they have employed nearly 600. The average production of Stoves is 35,000, but in some years it has amounted to 40,000. The consumption of iron is from 3500 to 4000 tons, and of coal from 1700 to 2000 tons. Constantly introducing new patterns, requiring new "flasks," six men are employed in making new

and repairing old ones. About 3000 of these flasks are in constant use in their establishment, and a two-story shed is filled with others ready for use.

As much as one hundred thousand dollars have been paid in wages in a single year, and the sales have amounted to a half million. A modern traveler asserts that he saw the Rathbone stoves in Constantinople, and on boats far up the Nile.

The present proprietor of these Works is Mr. JOHN F. RATHBONE, a nephew of Joel Rathbone, and a gentleman of capital and experience, fully qualified to maintain the reputation of the establishment.

S. H. Ransom & Co. are another of the leading Stove Founding firms in Albany, and the only one we believe that has survived without change the disasters of the last few years. Their works are situated on the banks of the Hudson River, in the southern portion of the city, and cover four entire squares. They give employment to about three hundred men, and have cast in a single year three thousand tons, or more than thirty thousand stoves, which have been distributed to all parts of the United States, and not a few have been shipped to foreign countries. Their iron warehouse on Broadway is one of the most elegant and capacious edifices that adorn that thoroughfare.

The other Stove Founders in Albany at present are S. B. McCoy, Shear, Packard & Co., and James D. Wasson. The entire product of all the foundries is about 18,000 tons per year.

In addition to the Stove Foundries, Albany has two manufactories of Hollow Ware, one of them ranking among the most extensive in the United States. Mr. John A. Goewey, the proprietor of this foundry, is the successor of Corning & Goewey, who succeeded W. C. Noyes, who commenced the business in 1853. His foundry possesses every convenience for an extensive business, as will be inferred when we state that over 120 men are employed in it, and about ten tons of iron are melted per day. Mr. Goewey supplies not only the stove foundries of Albany and Troy, but founders and dealers in other cities and in various parts of the country obtain their Hollow Ware from his establishment. His castings are said by competent judges to be fully equal to any made in the United States.

Mr. Goewey is also the inventor and patentee of a railroad car and switch Lock, of which he makes about forty dozen per week. These locks are in use on the principal railroads of the United States.

Mr. Hiram Seabury has recently commenced business as a Hollow Ware founder in Albany, and gives promise of attaining a fair share of success.

Albany has also an extensive manufactory of Fire Brick and Stove

Linings, known as the "Salamander and Albany Fire Brick Works," of which Palmer, Newton & Co. are proprietors.

To obtain linings that were good conductors of heat, and yet strong enough to bear transportation without fracture, has long been a desideratum of Stove and Range manufacturers, and judging from the extent of their business, we infer that this firm has attained the desired result. They supply not only the foundries of Albany and Troy, but the extensive Range manufacturers of Boston and Providence, and also many dealers in New York, Baltimore, and other places.

Among the specialties of this firm's manufactures, we might mention Fire Brick Grates for Thompson's patent furnace for burning wet tan. This improvement is of immense value to tanners, enabling them to use as fuel the tan which was heretofore an encumbrance to them, and thus save not only the expense of its removal, but of purchasing other fuel.

Besides the Stove foundries, Albany has several important establishments in other branches of the Iron manufacture, including one celebrated manufactory of Car Wheels, owned by George H. Thatcher & Co. This establishment, though not so large as some others in the country, has an excellent reputation, and when in full operation turns out over 100 wheels per day. Messrs. Thatcher & Co. manufacture the Atwood Patent Corrugated Wheel, the Dorsch Patent Wheel, and other patterns which experience has proved can be successfully cast and chilled, and possess strength and durability. In each wheel the proprietors of these works use from eight to twelve varieties of the best American charcoal iron, and exercise great care and judgment in selecting and mixing them. Every heat is subject to a test in order to determine (and when defective, remedy) the exact temper or degree of hardness. The New York Central Railroad and other important roads are chiefly supplied with wheels from this establishment.

The Albany Breweries and Distilleries.

The manufacture of Malt Liquor has long been a prominent pursuit in Albany. The oldest Brewer, now living, is Mr. Robert Boyd, who commenced the business in 1797. At that period there were two or three small Breweries—one belonging to Mr. Gansevoort, situated on Maiden Lane, below Broadway, where Stanwix Hall now stands. Another was owned by Mr. Van Schaick; and a Mr. Gill commenced about the same time as Mr. Boyd. Subsequent to this, one Lloyd, who was succeeded by LeBritton in 1805; Robert Dunlop in 1806; Boyd & McCulloch in 1808; then succeeded H. Burrill and L. Fiddler, who in

connection with Mr. John Taylor founded the firm of Fiddler & Taylor in 1822.

At the present time the largest Brewery in the United States is that of John Taylor's Sons, of Albany. It is located in the square bounded by Broadway, Ferry and Arch Streets and the Hudson River, and covers about two acres of ground—the main building being 200 by 80 feet, and six stories high. Adjoining the main building on the river front is a fire-proof storehouse seventy by forty feet square, and seven stories high. In this building elevators are erected which convey the grain from boats on the river to the bins on the top floor of the brewery at the rate of one thousand bushels per hour. Between Ferry Street and the main building fronting on Broadway, is a two-story edifice 200 by 50 feet, a large portion of which is used for coopering, cleansing, and steaming casks and barrels. The steaming apparatus was imported from Europe, and is probably one of the most effective ever built. After placing a row of barrels in position, the steam is driven completely through the staves, an inch in thickness, in ten minutes after its application. On the main story the front of this building is occupied by the counting-house and private office of the proprietors. In the upper story is a fire-proof apartment, fifty feet square, which contains a most valuable library of over ten thousand volumes—a rare feature in business establishments of this description. On the Broadway front of the Brewery is a tower, the top of which is one hundred and thirty feet above the level of the street, and which contains a clock with glass dials six feet in diameter, that are illuminated nightly.

The apparatus and equipments of this Brewery are of the most perfect description, and it has the capacity to produce over two hundred thousand barrels per annum. Previous to its erection in 1850, the senior of this firm visited Europe and made drawings of the most important improvements which he saw in the London Breweries. The pontoon apparatus for cleansing and refining the ale, consisting of three hundred and sixty-five large cedar vessels, with floats so arranged as to open and shut the valves, the liquor being always at the same height, independent of the flow of yeast in the receiving troughs, is as yet a novelty in American breweries. Connected with this establishment are five large Malt houses, in which they malt all their own barley.

Within the year 1863 the senior partner and founder of this firm died, highly esteemed and regretted—and also another of the partners, Edmund B. Taylor, of the Boston branch—leaving the management to the two remaining sons, Joseph B. Taylor, of New York City, and William H. Taylor, of Albany. They have a capital of nearly a half million of dollars invested in the business.

Previous to the erection of the Taylor Brewery, the largest in Albany was that of U. Burt & Co. The founder of this firm, Mr. Uri Burt, was engaged in the business of brewing since 1819, but the house of which he was the head dates its existence from 1836, when he and his son Charles A. Burt commenced business. The present Brewery, which occupies the block bounded by Centre, Colonie, Montgomery and Lumber Streets, being a square of 325 feet by 209 feet, was erected in 1847, to which an addition was made in 1851, and a malt house built capable of malting 100,000 bushels of barley per annum. They brew annually over 50,000 barrels—in one year 1,860,825 gallons—but their capacity to manufacture is much greater than this.

This firm was the first we believe to test the question whether malt liquors could be sold for cash only. They invariably obtain payment on delivery, not only for the ale but for the cask, when it is sent beyond the city limits—the money being refunded when the cask is returned. No variation is made from this rule except in the case of wholesale dealers, who are drawn upon at the beginning of every month for the amount of their purchases during the preceding month. They claim that by thus escaping losses from bad debts, they can afford to use better stock and increase the quantity of malt; and as their sales are large notwithstanding the adoption of a strictly cash system, the presumption in favor of the claim seems to be well founded.

The founder of this firm has recently deceased, and the business is now conducted by his son, Charles A. Burt, surviving partner, who exercises in its management the same judgment and skill that aided to build up the establishment to its present prosperous condition.

The "Arch Street Brewery," Boyd, Brothers & Co., proprietors, is another large establishment in Albany. Though the present firm commenced as recently as 1850, they may be fairly regarded as the successors of their father, Mr. Robert Boyd, who has been mentioned as the oldest brewer in Albany now living.

In 1796, Mr. Robert Boyd, the father of Robert, then living on an island below Albany, employed two Scotchmen, one of whom was a brewer, the other a maltster, to assist him in harvesting his grain. These men, who had emigrated to Canada to establish a Brewery, induced Mr. Boyd to build one. This was erected at the corner of Arch and Green Streets, and commenced brewing in 1797. It was but 24 by 30 feet, comprising a brewery and malt house. The two Scotchmen conducted the malting and brewing, and were required to instruct Mr. Robert Boyd, while his father furnished the capital. Mr. R. Boyd gave up the business in a few years and removed to the country, but returned in 1808, and was the senior partner of the firm of Boyd &

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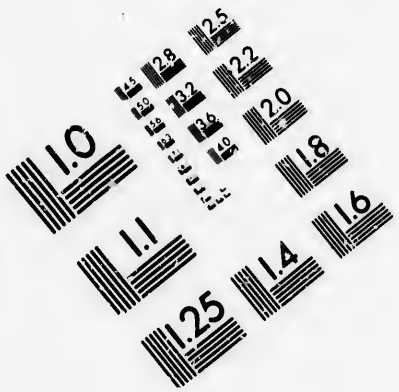

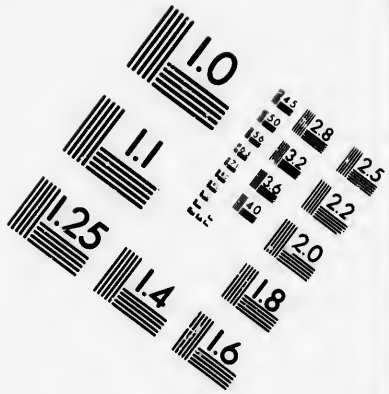

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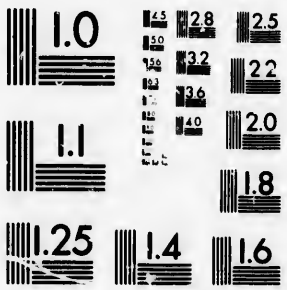

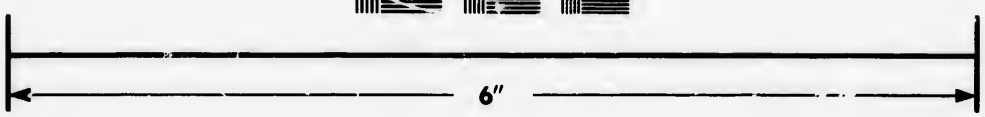

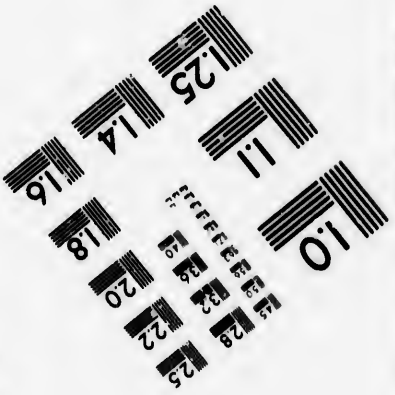

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McCulloch, who for many years conducted a heavy business. After various changes the Brewery was rented until 1850, when the present firm engaged in the business. The buildings, which had been added to from time to time, and now front on four streets, Green, Arch, Franklin and Perry, the length on Arch Street being 321 feet, are large and conveniently arranged, having the malt house in the same building, which obviates the expense of carting, and there is abundance of room for receiving and storing empty casks.

The other principal Brewers in Albany are John McKnight & Son, Armsdell Brothers, Anthony McQuade, James Quin, and Becker & Cameron.

There are also several firms engaged extensively in Malting, the principal being John G. White & Son, John Tweddle, and A. A. Dunlop. John G. White, who is also the President of the Bank of the Capitol, and the oldest in the business, has two malt houses, and supplies largely the brewers in Philadelphia, where so much malt is used, besides those in other cities.

Mr. Tweddle commenced the manufacture of malt in West Chester, Pennsylvania, many years ago, and removed to Albany in 1838. While the brewers in the principal cities from Portsmouth to Baltimore, as well as those in the interior, obtain Malt from his extensive malt house, his sales are chiefly in New York City.

Mr. Dunlop is the son of Robert Dunlop, a well-known brewer fifty years since, and was himself a brewer. His extensive establishment is in the adjoining town of Watervliet, and here he supplies brewers in New York and other principal Atlantic cities. Mr. Dunlop is also extensively engaged in brewing at West Troy.

There are two large DISTILLERIES in Albany, one of which, that of Edson & Co., distils from the grain; the other, that of John Tracey & Co., is devoted to rectifying liquors and making alcohol. Besides these there are a number of smaller rectifying establishments. The value of the yearly product varies with the price, but the average is nearly two million dollars.

The Distillery of Edson & Co., erected in 1849, consumed for a year or two but 450 bushels of grain per day. In 1851 a small column was erected for the manufacture of alcohol, capable of running 600 gallons per day. That small amount was then ample for the supply of the trade, indeed it required an effort to dispose of it. As the demand increased, another column was in 1853 added to the works, capable of running 800 gallons daily. In 1855 and 1856 the Distillery was enlarged so as to consume 900 bushels of grain per day. While superintending the start-

ing of the new works, Mr. Cyrus Edson, the proprietor, was killed by the explosion of the steam-boiler, May 15th, 1836. Since that period the business has been conducted by the present proprietors, Franklin Edson and Daniel Orr, and the works have been further enlarged. They now employ 35 men, and turn out daily 4000 gallons of Highwines and 3200 gallons of Alcohol. Besides using all the product of their own Distillery, they purchase largely, all of which they make into alcohol.

The use of Alcohol has increased greatly during the past few years. Large quantities are now consumed in making Burning Fluid, which requires four gallons of alcohol to one of camphene; while druggists have increased its use in their various preparations.

The other firm mentioned, that of JOHN TRACEY & Co., have a very large Rectifying establishment, and Alcohol and Camphene Distilleries. Their Alcohol and Rectifying establishments are perhaps not surpassed by any in the country. From the former they turn out daily upward of six thousand gallons highest proof alcohol, and from the latter they are able to furnish daily eight thousand gallons spirit and domestic liquors, which they sell principally in Boston and New York.

Mr. Tracey commenced Rectifying in a small way about 1842 and gradually extended his facilities. The manufacture of Alcohol he commenced in 1847, making six hundred gallons daily, which more than supplied the demand at that time. Now ten thousand gallons of alcohol are daily made in Albany, of which Messrs. Tracey & Co. make much the largest proportion.

Albany has also one of the largest and oldest-established manufactories of Carriages in the United States. Mr. James Goold, the senior proprietor, commenced the business of carriage making in 1813, and soon after engaged in building Coaches, which for many years was a prominent business in Albany and Troy. More recently the firm of James Goold & Co. embarked in Car building, and now carry on all branches of the Carriage manufacture, including Railway Carriages. The factory occupies nearly a square bounded by Division, Union, and Hamilton Streets.

MANUFACTURES OF TROY.

TROY, six miles above Albany, is even more largely engaged in manufacturing than that city. In 1860 it had 366 establishments, with a capital of $5,231,650, which employed 5,877 males, 4,669 females, and produced $11,682,989. The principal manufactures were the following:

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.
Agricultural implements	4	$77,100	79	.....	$116,025
Boots and shoes	44	202,750	457	103	487,007
Brass and bell founding	3	39,000	23	.....	126,000
Brewing	5	175,000	61	.....	163,000
Brushes	13	263,100	594	481	551,900
Cabinet ware	9	86,500	77	4	108,800
Cassimeres	1	50,000	46	39	105,365
Cigars	13	19,700	68	.....	87,030
Clothing	29	186,250	279	430	532,850
Coffee and spices	1	23,000	.....	.....	93,037
Confectionery	4	16,500	21	2	68,480
Cotton goods	2	130,000	101	179	159,294
Flour and meal	6	140,000	24	.....	348,408
Gun powder	1	80,000	16	.....	84,000
Hardware	2	80,000	100	6	93,500
Hosiery	2	92,000	73	101	161,000
Iron (Albany Iron Company, Burden's Works, and Rensselaer Works)	3	846,000	1220	.....	1,950,000
Jewelry	3	16,500	13	.....	50,000
Leather	5	290,500	161	.....	465,000
Machinery	1	30,500	35	.....	50,380
Malleable iron	2	15,000	8	.....	30,000
Malting	2	49,000	15	.....	126,000
Oil cloth	4	180,000	64	.....	130,000
Paper boxes	7	12,200	22	28	36,085
Printing and publishing	2	11,200	226	.....	180,880
Rectifying liquors	1	110,000	14	.....	253,815
Safes	7	30,000	100	.....	210,000
Sawed lumber	3	34,460	82	.....	388,230
Sheep skins	13	34,000	47	.....	258,020
Shirt collars and bosoms	1	248,900	60	3007	778,750
Shoddy	1	15,000	18	16	62,600
Springs	8	32,600	55	.....	88,229
Stoves	20	480,000	711	.....	1,022,250
Tinware	1	89,100	108	6	207,272
Turbine wheels		33,000	25	.....	45,000

REMARKABLE MANUFACTORIES IN TROY.

The Albany Iron Works—Corning, Winslow & Co., Proprietors.

In 1819, John Brinckerhoff, then an enterprising iron merchant of Albany, erected on the Hudson River, now in the sixth ward of the City of Troy, a small Foundry and Rolling Mill, for converting Russia and Swede iron bars into plates. These plates were afterward cut partially into nails, each nail being headed by hand. This business he conducted successfully for several years, and the works, though small and insignificant compared with their present extent, were creditable to their founder, and among the first then in existence in the State of New York. From Brinckerhoff they were transferred to Corning & Norton, and subsequently to the present proprietors, Corning, Winslow & Co., who have enlarged them until they now rank among the most extensive in the United States.

The works at present include three distinct rolling mills—one a large steam mill, containing 18 puddling furnaces, with a corresponding number of heating furnaces, five steam engines, one large Nasmyth hammer, two drawing-out hammers, four complete trains of rollers, Winslow's rotary squeezer with shears, roller lathes, wrought railroad-chair machinery, and other appurtenances; the whole within a brick building 365 feet long by 145 feet wide, covered with an iron-trussed roof. The second is a new forge and rolling mill, built in 1855. It is of brick, in the form of a cross, the greatest width and length being respectively 173 and 163 feet, and the wings 53 feet wide. This mill has an iron-trussed roof covered with slates. There are three chimney stacks, each 65 feet high, and each drawing from six puddling furnaces, making 18 puddling furnaces under this roof. The third rolling mill is worked by two water-wheels of great power, and contains three complete trains of rollers, with appropriate furnaces, and one steel converting furnace within a brick building 265 feet long by 119 feet wide. There are likewise upon the premises, and driven by water-power, a carriage-axle factory, 60 feet by 40; a spike factory, for making railroad, boat, and ship spikes, and boiler rivets; and a nail factory. Both of these latter branches of business are carried on within a brick building 300 feet long by 35 feet wide, and operated by a water-wheel 30 feet in diameter, the water-power being furnished by the "Wynantskill," affording a fall of about sixty-five feet, divided by three dams into as many successive falls. All the buildings of this fine establishment are of brick, with

metal roofs, and constructed in the most substantial manner, being as nearly fire-proof as possible, the proprietors having been taught to "dread fire" by two conflagrations which consumed all the earlier erections. The number of acres attached is between forty and fifty, on which there are numerous buildings, constituting a small village in itself.

The principal manager of these extensive works is John F. Winslow, Esq., whose experience in the working of metals is not excelled by any one engaged in the trade. He is also a man of genius, and the inventor of several highly valuable improvements to facilitate the working of iron. His rotary squeezers is a most effective machine, as one will do all the shingling for forty puddling furnaces, with but a trifle of expense for attendance, a small consumption of power, no waste of iron, and turning out the blooms very hot it facilitates the rolling. This preservation of the heat, coupled with the fact that the bloom is very thoroughly upset while undergoing its rapid squeezing, is said to sensibly improve the quality of the iron.

The firm of Corning, Winslow & Co. is now extensively engaged in the manufacture of puddled steel, which they commenced soon after the art of effecting it was made known in Germany about the year 1852. Few men in this country, if any, have devoted more attention to this subject than Mr. Winslow. Their puddled or semi-steel is capable of bearing a tensile strain ranging from 90,000 to 108,000 pounds to the square inch, and is beyond a doubt equal in every respect to any made in Europe. This material is now largely made into locomotive tires, boiler plates, and other forms where great strength and density are required. It is further manufactured by cementation and put into spring-steel for carriages and rail-car purposes. Corning, Winslow & Co. we believe are at present the only makers of semi-steel in the United States.

This firm give employment to about 750 persons, to whom are disbursed about $18,000 per month for wages. The annual product of the concern is about 15,000 tons, consisting of cut nails, spikes, rivets—band, bar, rod, and scroll iron, of all sizes—with large quantities of railroad-car axles, wagon axles, crowbars, and wrought-iron railroad chairs. They have a capital, invested in real estate, buildings and machinery, of about a half million of dollars.

Within the year 1863 a very considerable addition was made to their works, consisting of another mill for bar and band iron, about nine additional puddling furnaces, machinery and buildings for making Horse and Mule Shoes, extensive machine shops, and several dwellings for the families of employees.

The Troy Iron and Nail Factory—H. Burden & Sons, Proprietors.

Is another very large establishment in Troy, and, with the additions that have recently been made, is now one of the largest in the United States. Though there was previously a small factory, having a few Cut Nail machines, near the site of the present mill on Wynant's Kill, the works may be said to owe all their success and importance to the present proprietors, and primarily to Mr. Henry Burden, a native of Scotland, who came to this country in 1819, and who has been connected with the works since 1822.

Few men, now living, have had more experience in the working of metals than the gentleman mentioned, and none probably have more faithfully discharged the duty which Lord Bacon has said every one owes to his profession, by contributing something for its benefit. He is the author of several very ingenious and important inventions designed to facilitate the working of iron, among which we may mention a machine for making Spikes, another for making Horse Shoes, and the Rotary Squeezer for rolling Puddle Balls, now so generally used both in Europe and America. Burden's Spike Machine, patented in 1839, will make Spikes complete, including head and point, at one operation, at the rate of fifty per minute; and thus each machine will do the work of fifty men. Nearly all the tracks of railway in the United States are fastened with Spikes that were made by this machine, and that the progress of railroad-building has been thereby accelerated is evident, for Spikes could not have been made by hand with sufficient rapidity to supply the demand. His other invention mentioned for making Horse and Mule Shoes, is even still more ingenious in its nature than that for making Spikes, and in its automatic action and practical results is entitled to rank in the scale of inventions with Bigelow's Carpet Loom and Blanchard's Lathe for Turning Irregular Forms. A rod of iron fed into this machine is converted into Shoes entirely completed, with creases and countersunk holes (leaving nothing more to be done except to clean out the holes after being cooled), and each machine performs in a minute a day's labor of two men. Five of these machines are now in operation in Burden's Works, with five more in course of construction, and the number of tons of Shoes manufactured in a given time may be calculated by assuming the average weight of a shoe to be one pound, and the product of a machine, if kept supplied with hot iron, to be 3600 pounds per hour. Mr. Burden is now engaged in perfecting a machine for Rolling and Welding Bars, which, if successful, as it promises

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The Works of this firm comprise two extensive Rolling Mills, distinguished as the Old Mill and the New or Steam Mill, two Forges, a Spike Factory, a Nail Factory, Foundry, Pattern Shops, etc. The old factory, situated on Wynant's Kill Creek, is a stone-and-brick structure 550 feet long, 140 feet wide, and has 24 furnaces in all, seven trains of rolls, and five Horse Shoe machines. All the operations of making bars from the pig, bloom and scrap, are carried on in this mill, but the most novel and interesting feature is the manufacture of Horse and Mule Shoes to which we have alluded, and of which thirty-eight different sizes and patterns are made, ranging in weight from 6 ounces to 2 lbs. 10 ozs. Adjacent to the rolling mill is the Spike factory, where are ten machines constantly employed in making railroad and ship spikes, and boiler rivets. The manufacture of nails, formerly very extensively carried on at these works, has been discontinued. The motive power of this mill is supplied by an immense water-wheel 60 feet in diameter, the largest wheel of the kind in the country—the next largest being that of the New York Belting and Packing Co., at Newtown, Conn., which is fifty feet in diameter.

In 1862, Mr. Burden purchased land having a front on the Hudson River of about a mile and a quarter, extending eastwardly to the Hudson River Railroad, and proceeded to fill up the low land at an expense exceeding one hundred thousand dollars. On this the firm erected a brick forge 400 feet long and 100 feet wide, and a rolling mill 300 feet by 100 feet—works that in convenience of arrangement, abundance of light and air, and freedom from oppressive heat, are not surpassed, if equalled, by any in the United States. There are in these works 36 furnaces (to which the blast is conveyed by pipes under ground), and it is proposed to double the number as rapidly as they can be erected. The motive power is supplied by magnificent engines built by the Corliss Steam Engine Company at Providence. The product of this mill is exclusively merchant bar iron. Improvements are in progress which, when finished, will render the present works, extensive as they are, the mere nucleus of what they will then be.

As many as 1500 men have been employed by this firm at one time in their mills, and the sales in 1863 amounted to nearly $1,800,000. Mr. William F. Burden is now the Superintendent and active manager of the works.

The Rennselaer Iron Works

Are another of the prominent iron manufacturing establishments located in the sixth ward of the city of Troy. They are situated on the banks of the Hudson River, and comprise a main building 430 feet in length by 150 in width, with machine and blacksmiths' shop, etc., adjacent. There are 14 puddling furnaces and 13 heating furnaces, which together consume about 10,000 tons of bituminous and 15,000 tons of anthracite coal per annum. About 6000 tons of pig iron and 14,000 tons of old rails are annually used in these works and converted into railroad bars and merchant iron, which are the principal products. A machine for finishing locomotive tires is run in connection with the rail mill. The machinery is propelled by an upright low-pressure engine of 365 horse power.

The works were originally erected by the Troy Rolling Mill Company in 1846, and were reorganized by the present proprietors, the Rennselaer Iron Company, in 1853. The Hon. John A. Griswold, now a Representative in Congress from the Troy district, is President of the Company, and George Babcock, Esq., Superintendent. About 450 men are employed in the works.

E. A. & G. R. Meneely's Bell Foundry,

Situated in West Troy, is the most extensive and noteworthy manufactory of the kind in the United States. It was founded by Andrew Meneely, the father of the present proprietors, in 1826, since which time thousands of Bells have been sent out from this foundry into every State and Territory of the Union, and to nearly every part of the world During the last ten years, the number cast annually has averaged 600, of an average weight of 500 pounds—and among them were some weighing 12,000 pounds.

Bells are formed by casting an alloy of copper and tin in moulds prepared for the purpose. The usual proportion is four parts of copper to one of tin. The method of moulding conducted in this foundry is a very great improvement upon the old system. A mould consists of a hollow space the exact form and dimensions of the bell to be cast. Two separate hollow iron cases, shaped like a bell, and of a size to correspond with the casting to be obtained, are employed to form a mould. Their sides are full of small perforations or vent holes. One case is made smaller than the other, and forms the *core* for the inside—the

larger one, called the *cope*, forms the outside shell of the mould. The inner case is first swathed with straw rope, and a coat of loam is placed on the outside of this—when perfectly dry it forms the core. The outer case is lined on the inside with loam, and carefully swept, to obtain the proper thickness and surface for the casting. When the cores for a number of bells are ready, they are placed on the even floor of the foundry, and their copes are lowered over them by machinery, and guided to their exact positions by gauges. The spaces between these cases then form the moulds for the bell castings, and different sizes are employed for bells, according to their desired weight. Large reverberatory furnaces are used for fusing the bell metal, and when it has reached a proper state of fluidity it is poured into the prepared moulds in the usual way. The casting operation is an interesting sight at night, as the intense heat of the metal causes numberless jets of bluish-green flame to issue from the vent holes of the mould-covers, which appear like domes of fire, and rival a gorgeous display of colored fire-works. The straw ropes on the cores take fire, and burn very slowly, as the casting cools, and the shrinkage of the metal thus goes on gradually, and prevents sudden and undue straining. Great care and practical experience are necessary to conduct these operations, although apparently simple. The metal must be perfectly fluid, and of the same temperature at every part of the mould, to produce a homogeneous casting. Formerly, when entire loam moulds were employed for bells, these were packed in pits beneath the surface of the foundry floor, to enable them to resist the great pressure of the fluid metal. Serious explosions frequently occurred then, by the confined air within these packed moulds becoming highly heated; and inferior, porous castings, were also very common. These evils are now avoided with the iron vent casings.

After the bells are cast, they are scoured bright in rotary frames, in which a sand cushion is brought to bear upon the surface of the metal. Each bell is tested as to its tone and quality, and if the least imperfection is detected it is condemned. No inferior article is allowed to pass outside the foundry gate. After this, the bells are fitted with clappers and yokes, and mounted on frames. In this foundry all bells weighing 400 pounds and upwards, are fitted with Meneely's Patent Adjustable Yoke (patented 1858 and 1860), which obviates the danger of cracking the bell in consequence of the clapper striking continually in one place. By this contrivance bells can be easily adjusted so as to present a new surface to the action of the clapper.

This firm have been particularly successful in the manufacture of chimes and peals of bells, of which a large number have been made at their foundry and placed in some of the finest church edifices in the

country. At least eight bells, representing the octave of the natural scale, are requisite to constitute a full chime, and, ordinarily, a ninth bell is added, tuned a flat seventh above the tenor (largest) bell, by which addition a secondary chime in the key of the fourth is produced, and the range of tunes that may be played is largely increased. Not unfrequently a still larger number of bells are employed, the additional number being toned above the octave of the tenor, in order to obtain greater range in the higher notes. Peals of bells (as distinguished from chimes) consist of from three to four bells attuned with each other at harmonic intervals, which will not admit of a tune being played upon them, but, when rung, either successively or simultaneously, produce a fine effect. It is however usually anticipated, when peals of bells are procured, that they shall form part of a future chime: the intermediate bells to be added as may be desired. In constructing a chime, the tenor bell is taken as the model and unit of measurement of the whole, certain relative dimensions giving the different tones with theoretic exactness. This result does not, however, always follow in practical casting, since it is almost impossible to control the contingencies of the operation so that the conditions of each casting shall be absolutely uniform—any variation in which tends to affect the tone. When the tone of a chime bell thus proves to be incorrect, it is laid aside to be sold as a single bell, and the operation of casting is repeated, care being taken to vary the conditions as may be required; so that when the chime is completed each bell is in its perfect condition as it comes from the model, the quality and force of its tone not being impaired as in the English mode of tuning by having a belt of metal clipped from the side. The usual mode of placing a chime in the bell tower is, to mount the tenor bell in the centre of the bell-section, it being provided with yoke, wheel and frame, so as to be rung as an ordinary church bell, as also to be used in the chime. The remainder of the bells are suspended stationarily about the tenor from frames or beams of oak, in such relative positions as shall best conform to the capacity and construction of the bell-section and most equally distribute the weight. When chimed, the bells are all played upon by one person, by means of cords attached to the clappers and led down to the ringer's room below, there connecting with levers arranged in the order of a key-board, and worked by the hands or the feet as may be desired.

Messrs. Meneely have published a pamphlet for gratuitous circulation which gives a good deal of general and specific information on the subject of Bells.

The Schenectady Locomotive Works,

Located between the New York Central Railroad and the Erie Canal, is the principal manufacturing establishment in Schenectady, and entitled to rank among the most important of a similar class of works in the United States. The buildings comprise an Erecting and Machine Shop two hundred and fifty by seventy-five feet, two stories high—a Blacksmith Shop two hundred and fifty by fifty feet—a Boiler Shop one hundred and forty by forty feet—an Iron Foundry one hundred by fifty—a Carpenter and Pattern Shop, two stories high, eighty by forty feet—a Brass Foundry and Paint Shop, fifty-three by twenty-eight feet—a Round House eighty-five by fifty feet—a Store House, two stories, forty by thirty feet—and a three-story Office forty-three by forty feet. The buildings are nearly all of brick; and although they cover a large area of ground, are so connected by railroad tracks that the transportation, on light trucks, of even the heavy parts, is exceedingly easy. The Machine, Boiler, and Erecting Shops are new, having been erected since June 26th, 1866, when the former shops were destroyed by fire, and are provided with a complete stock of new tools of modern patterns.

The original Works were erected in 1848, by a company who discontinued their business in about a year. In 1851, John Ellis, D. D. Campbell, and Simon C. Groot, purchased them at about one half their original cost, and formed a new company, which was incorporated under the title of "The Schenectady Locomotive Works." During their administration, large additions were made to the buildings and machinery, and the business prospered greatly. Mr. Ellis, who was the active manager, proved to be a gentleman of more than ordinary business capacity, and of much personal worth. He was born in Garmouth, Scotland, December 13th, 1795, and came to the United States in 1814. He became a contractor of some of the most important works in the country, among them the McAdamized road between Albany and Troy; the Albany and Schenectady Railroad; the Utica and Schenectady Railroad; the Boston and Worcester Railroad; the Croton Water Works; and, in 1851, took possession of the Locomotive Works. Since his decease, October 4th, 1864, the Works have been owned by his sons and Walter McQueen, who superintended the mechanical department under the former administration. The present management is—JOHN C. ELLIS, President; CHARLES G. ELLIS, Treasurer; and WALTER MCQUEEN, Superintendent. About five hundred hands are employed in the Works, which are now prepared to turn out from five to six Locomotives of the largest class per month.

MANUFACTURES OF ROCHESTER.

ROCHESTER, by reason of the splendid water-power afforded by the Falls of the Genesee River, and its situation in the centre of a rich agricultural district, has peculiar natural advantages for manufacturing operations. Its infant enterprises, and their early history, were alluded to in the first volume of this work. In 1860 the city contained 545 manufacturing establishments, having a capital invested of $4,145,030, employing 5,136 males, 1,431 females, and produced an annual value of ten millions of dollars. The principal manufactures were:

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.
Agricultural implements	5	$258,500	88	.....	$173,750
Alcohol	1	120,000	9	.....	155,000
Brewing (1)	14	171,600	57	.....	237,840
Cabinet ware	8	79,350	256	.....	137,135
Carriages	6	65,800	23	.....	72,650
Cars	1	25,000	58	.....	60,000
Chairs	3	40,300	102	.....	177,600
Cigars and tobacco	4	20,500	51	.....	85,560
Clothing	88	336,600	800	735	1,156,403
Coffee and spices	1	15,000	8	.....	38,700
Confectionery	3	14,000	23	.....	55,800
Cotton goods	1	115,000	40	135	85,000
Distilling	3	25,000	7	.....	73,930
Flour (2)	19	900,000	.....	.....	2,563,425
Hardware and tools	10	119,000	209	.....	150,503
Harness	11	8,600	34	.....	46,650
Iron founding	2	40,000	65	.....	70,000
Iron railing	2	9,000	11	.....	19,000

(1) In this item the census-takers erred greatly, or the product of 1860 was much below the average. The more reliable statistics of this branch are as follows:

14 Lager beer breweries, product 60,000 barrels, worth a $5	$300,000
4 Ale and porter breweries, product 55,000 barrels, a $7	385,000
Malt	80,000
Total product	$765,000

Longmuir's Brewery, in Rochester, is probably the largest west of Troy. It was a few years since destroyed by fire, but has been rebuilt, with all the latest improvements. The building is 125 feet long and 100 feet deep, and the total area of the floors is 62,500 square feet. A powerful hydraulic apparatus, driven by water-power, throws water to all parts of the building, thus ensuring great cleanliness, as well as a precaution against fire.

(2) In the statistics of this branch the census-takers have erred more seriously even than in Brewing. There are 24 mills, having 122 run of stone, that average daily 6100 barrels of Flour for 150 days, or 915,000 barrels a year—which, supposing Flour to be worth $6 per barrel, would make the product $5,490,000. Add to this the coarser grains, feed, etc., and it will be seen that the milling interest of Rochester ranges from six to eight millions of dollars a year.

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.
Jewelry	5.....	8,350.....	9.....	.....	16,800
Leather	5.....	43,000.....	69.....	.....	113,810
Locomotive lamps	2.....	25,000.....	33.....	.....	76,065
Lumber	3.....	26,000.....	28.....	.....	84,340
Machinery and steam engines (1)	8.....	111,500.....	132	.....	213,650
Mattresses	2.....	13,000.....	5.....	6.....	52,400
Millinery	3.....	7,500.....	15.....	.....	28,700
Paper	1	60,000.....	54.....	30	112,500
Patent medicines	2.....	20,000	8.....	8	65,000
Perfumery	1.....	15,000.....	1.....	20.....	75,000
Picture frames	4.....	5,100	13.....	.....	29,250
Planed lumber	2.....	21,000.....	26.....	.....	78,000
Pottery ware	3... ..	15,300.....	16.....	.....	13,000
Printing and publishing	4.....	159,000	222	.....	239,420
Sashes, doors and blinds	8.....	12,250	31.....	.....	53,050
Saws	1.....	22,000	16.....	.....	16,000
Scales	1.....	10,000.....	25.....	.....	64,960
Shirts and collars	2.....	7,000.....	1.....	16.....	22,720
Soap and candles	2.....	18,000.....	10.....	.....	33,920
Spokes, felloes, and hubs	2	22,000.....	28.....	.....	40,728
Staves	4.....	38,000.....	84.....	.....	82,450
Thermometers	2.....	3,500.....	5.....	6.....	14,475
Tin and sheet-iron ware	14.....	67,000.....	79	.....	121,720
Trunks	3.....	12,500.....	28.....	2.....	30,715
Whips and gloves	4.....	10,900	33.....	30.....	38,250
Wood working, flour barrels, etc	39.....	80,050.....	363.....	103.....	272,585

Rochester is remarkable for the extent and character of its Fruit Nurseries. It is estimated that there are within ten miles of the city not less than 4,000 acres devoted to this culture. A single firm have a nursery that occupies 500 acres, and is probably the largest in the world. There are others of 350 and 250 acres each. The sale of Fruit Trees is estimated to amount to a million of dollars annually.

(1) We have no means of verifying this return of the census-takers, but we apprehend that the product has been considerably under-rated. There are several large firms engaged in the business in Rochester.

William Kidd & Co., for instance, manufacture Car Wheels, Steam Engines, and especially Mill Gearing, very extensively.

D. A. Woodbury & Co. have one of the most remarkable Steam Engine establishments in the United States. In 1851 this firm astonished the makers of steam engines by publishing and offering a list of certain sizes, ranging from ten to thirty-five horse power, at prices much below any that had ever been heard of before. This they were enabled to do by building a large quantity of each size at one time and confining their attention to one article of manufacture. Their workshops are conducted upon the English plan, each workman having a limited and uniform range of duty throughout the year. The principle upon which they commenced business secured the favor of the public, and their Engines are so popular both in the United States and in the Canadas, that though they designed to keep a large stock of finished Engines on hand at all times, the demand has outstripped their facilities for manufacturing. Messrs. Woodbury & Co. are about erecting new and more commodious workshops.

Along the line of the New York Central Railroad, between Troy and Rochester, there are several important manufactories. At Ilion, in Herkimer County, which is eighty-three miles west of Albany, is one of the largest private Gun manufactories in the United States, known as

E. Remington & Sons' Armory,

remarkable alike for its extent, and for its origin. The story of its origin has been told as follows: On Steel's Creek, about three miles from the site of the Armory, dwelt the father of the present proprietors, who, desiring a rifle-barrel for his own use, forged one, in 1816, with no other tools except such as an ordinary blacksmith's shop contains, and conveyed it to a gunmaker at Utica to have it fitted and completed. The gunmaker was much pleased with the skilful construction of the barrel, and Mr. Remington, perceiving the high estimation in which his workmanship was held, dexterously applied his knowledge to a profitable use, and commenced the manufacture of gun-barrels; and not long after this incident, the banks of Steel's Creek blazed with the cheery fires of many forges, and the surrounding hills rang with the joyous music of the anvil. The old factory, however, was found to be too distant from the line of transit—then the Erie Canal—and in 1829 Mr. Remington purchased a farm at Ilion, upon a portion of which, on plans supplied by himself, the establishment is erected. For many years the business was limited to the fabrication of barrels, but having received a large contract from the United States Government for arms, the manufacture of Rifles and Carbines, including all their parts, was embarked in, and has since been very successfully prosecuted.

Many of the most important improvements which now render the American firearm the most durable and effective in the world, have had their origin with this firm. They are accredited with having been the first to adopt steel as a material for the barrel of sporting guns, and we believe they now employ it exclusively in the manufacture of arms which they are making for the government service. For thirty years they have been patiently testing the steel of almost every manufacturer both in this country and abroad, and, by a long course of experiments, have ascertained which is the best adapted for the purpose. By the application of machinery to the manufacture of gun-locks, this firm has been largely instrumental in effecting a revolution in the trade in these locks. In England, whence nearly all the locks in use were formerly imported, they are made by hand; but in the Remington Armory every piece is made by machinery to a fixed and unvarying gauge, and the result is that not only are American Gun Locks cheaper than the foreign, but as each piece is uniform with every other of the same description, a great saving of labor is

effected in putting them together. Not long since, at the Arsenal at Bridesburg, Penn., 20,000 of Maynard's Priming Locks, of Remington's make, were fitted to old musket barrels, which had been rifled, and as Major Hagner, the Superintendent, has certified, with an economy of labor that was a marked advantage.

The result which usually attends an unwavering determination to produce nothing but good mechanism, combined with a genius for improvement and invention, is illustrated in the growth, progress, and present extent of this establishment. The Armory occupies two acres of ground, and the buildings, some of them four stories in height, have a frontage of 400 feet. Within the last two years large additions have been made not only to the structure, but especially to its resources in machinery Both steam and water power are employed in driving the machinery. Several steam engines are used upon the premises, the largest of which is of one hundred and fifty horse power, a second of fifty horse power, and a third of twenty-five horse power, with other smaller engines. Overshot, breast, and several Turbine wheels are also employed. Each process has its appropriate apartment—the aggregate comprising the welding and forging room, the lock and limb finishing room, the barrel room, the stocking room, the machine shop, the polishing room, and inspecting room; and each presents a scene of constant and interesting activity. From 600 to 700 men are employed in these works. This firm have also a branch of their Armory at Utica, N. Y., employing about 200 men in the manufacture of their Army Revolver.

The capacity of Messrs. Remington's establishment for the manufacture of firearms amounts at present to 150 Rifles and 500 Revolvers per day of the various kinds, which in the course of a year would be nearly 50,000 stand of arms, and upward of 150,000 revolvers. It is therefore, at the present time, one of the nation's resources on which the Government can rely with confidence for weapons with which to defend its existence and annihilate its foes.

At Utica, which is 95 miles from Albany, is a large and probably the oldest manufactory of French Burr Stones in the United States, known as Hart & Munson's Mill Stone Manufactory. It was established by Mr. A. Munson, an uncle of one of the present proprietors, in 1825. Its claims to distinction, however, do not rest upon the fact of its antiquity, but upon the many new and valuable improvements which the firm have made in the manufacture of machinery appertaining to the furnishing and complete equipment of a modern mill. Mr. E. Munson, of this firm, is a practical millwright, and has made the interest with which he is connected his debtor by the many

valuable improvements which he has designed and contributed for its benefit.

One of his inventions, which was patented in 1849, is a machine for balancing and finishing Burr Mill Stones. By means of this machine, the mill stone, after it is blocked up, is suspended upon its centre, where it is balanced in the course of filling up and finishing, instead of being filled up, as is usually the case, without the means of testing the accuracy of its balance. The superiority of mill stones finished in this way, over others, must be evident at a glance. To regulate the balance or correct any inaccuracy which might arise from drying of the moisture, or any other cause, this firm provide a Shot Balance without extra charge, and give directions for using it.

Another valuable invention of Mr. Munson is a new Cast Iron Eye and Mill Spindle, which can be put in an old stone equally as well as in a new one. The eye is formed of an outside and an inside cone, the two cones being connected by spiral wings. The inside cone or hub forms the bail or driving parts, and the driver is cast solid on the spindle. The advantage of this Eye is that it cannot be choked or clogged under any speed, carries more air under the stone, drives nearer the centre, and the runner cannot be thrown off the cockhead. It is peculiarly adapted for small mills where great speed is required.

In 1860, Mr. Munson patented an improvement adapted to mills grinding all kinds of grain, starch, plaster, etc., by which a more perfect adjustment of the stones to each other is secured, and a greater convenience in lubricating the joints, as well as effectually preventing the escape of the oil from its bush. The arrangement by which these important ends are secured is fully set forth in the firm's Circular.

Another valuable machine manufactured at this establishment is *Mattison's Flour Packer*, which, it is said, will save about 33 per cent. of labor in packing in barrels, and about 66 per cent in packing in bags, when compared with the lever press and the usual process of shoveling into bags. Its novelty consists in carrying the bag or barrel full-length upon the cylinder and delivering the flour in a compact state, the barrel or bag receding from the packer in process of filling. They are now in use in many of the best mills in the country.

The works of Messrs. Hart & Munson include a Mill Stone Manufactory, a Machine Shop, Plaster Mills, and Foundry, and are commodious and well-arranged.

Besides the establishment we have mentioned, Utica contains several other important manufactories. For instance, the Washingtonville Iron Works, conducted by Philo S. Curtis; the Iron Railing Manufactories of L. Dean & Co. and Chauncey Palmer; and the Portable

Steam Engine and Boiler Works of Wood & Hurlburt. This firm have effected a revolution in the construction of farm engines, by showing that they can be made light, compact, safe, cheap, and yet efficient. Their engines range from 1½ to 20-horse power, occupy a space from two by five feet to 6 by 7 feet, and cost from $175 to $1700. Recently they have devoted a good share of their attention to the construction of the Excelsior Engines, designed expressly for the oil wells. In Utica also are the extensive Stove works of Wheeler & Bailey, and J. S. & M. Peckham established in 1835. This firm are also largely engaged in the manufacture of Plows, Cultivators, and other agricultural implements, and have the exclusive right to "Peckham's Improved Agricultural Furnace," which is adapted for wood or coal. There are also the Utica Screw Company (C. Miller, Agent); the Utica Steam Cotton Mills (E. Chamberlain, Treasurer); the Globe Woolen Company (Robert Middleton, Agent); and the Oneida Brewery, established in 1813.

At SENECA FALLS, which is 189¼ miles from Albany, there are several important manufactories, especially of Pumps, Hardware, and Fire Engines.

One of the first to perceive and take advantage of the water-power furnished here by the fall of the Seneca River, and to whom the town is largely indebted for its present prosperity, is Mr. ABEL DOWNS, who is still at the head of some of its most important enterprises. He is accredited with having introduced the first steam-engine that was used for manufacturing purposes in the town, and with having made the first of the many thousands of Iron Pumps that have since been constructed there.[1] For several years the manufacture of pumps was a specialty

(1) A local chronicler says:

"In the year 1840, Abel Downs commenced the manufacture of Pumps in the wing of the "Old Cotton Factory," subsequently used as a plaster mill, and finally burned down in the great conflagration of 1853. He erected a small furnace over the river, employing five men. Only wood Pumps were manufactured. Mr. Downs continued in the business about two years, and at the close of the second year returned to the mercantile business, being succeeded in the Pump Factory by Wheeler & Kelley. In the year 1844, Mr. Downs again engaged in the Pump business in company with J. W. Wheeler and Smith Briggs, under the firm of Wheeler, Briggs & Co., for about one year, when Wheeler & Downs purchased the "old stone shop," originally erected by Bement & Co. for a carriage manufactory. Into this building their machinery and materials were removed, and a steam-engine placed in it—the first used for manufacturing purposes in this town—and there was made the first Iron Pump built in Seneca Falls.

In the year 1846, Mr. Washburn Race, who had recently invented and patented his since famous Stove Regulator, came into the firm, and subsequently Silsby & Thompson, who were then in the hardware trade, obtained an interest in the Regulator also. Previous to the purchase by Silsby & Thompson, the firm in the manufacture of Pumps was styled Wheeler & Downs—and in the Regulator it was Wheeler, Downs & Race. After

of the firm with which he was connected, but gradually other articles, usually classed as hardware, as Pipe Boxes, Thimble Skeins, Sadirons, etc., were added to the list, and the works were enlarged to meet the demands of an increased business. The DOWNS MANUFACTURING COMPANY now consume ten to fourteen tons of iron per day, and employ 200 hands.

A few years ago Mr. Downs engaged in the manufacture of Hosiery, having improved patented knitting machines for the purpose, and has supplied the United States Government with many thousands of dozens of half-hose. This enterprise has culminated in the establishment of the SENECA KNITTING MILL COMPANY, of which Seabury S. Gould is President, and Abel Downs, Treasurer, and now extensively engaged in the manufacture of Hosiery, Wrappers, and Knit Jackets.

Besides the Downs Manufacturing Company, and the Seneca Knitting Mill Company, there are the following important manufactories at Seneca Falls:

Cowing & Company's Pump and Fire Engine Works, established in 1840. This firm, composed of John P., Philo, George, and Marshall Cowing, manufacture 250 varieties of Polished Cylinder Lift and Force Pumps, besides Hydraulic Rams, Garden and Green House Engines,

the purchase, the firm in the manufacture of Regulators was changed to that of W. Race & Co.; but Wheeler & Downs retained the sole interest in the Pump business. Subsequently Silsby & Mynderse took an interest in the manufacture of Pumps, and the title of the firm was Downs, Mynderse & Co., Mr. Wheeler having retired from the business. At this time Pumps were manufactured of both wood and iron. This continued up to 1851, when Seabury S. Gould purchased the interest of E. Mynderse, and then the firm was entitled Downs, Silsby & Gould. In the fall of that year Mr. Silsby sold his interest to his partners, when the present firm of Downs & Co. was formed—being Messrs. Abel Downs and Seabury S. Gould. Commencing with five men, and melting from one and a half to two tons of iron per week, the business had gradually increased till in 1851 the amount of capital employed was $40,000, working up about four tons daily, and giving employment to between sixty and seventy men.

In the winter of 1853–4, Downs & Co. built their new works upon the canal and river where they now are, and their business has gradually increased until the number of men employed now amounts to two hundred and upwards, their "heats" consuming from ten to fourteen tons of iron per day. During the year that Mr. Mynderse came into the firm they had of actual cash capital only $0,000, which has been increased to about $150,000 —and this combined with real estate and machinery would swell the amount to over $200,000. Their sales in the year 1849 amounted to about $43,000; in 1850 to $70,000; in 1851 to $100,000; and have since increased until they now amount annually to near $400,000.

Messrs. Downs & Co. make 20 different kinds of Pumps, and upwards of 130 different sizes. They have gradually become engaged in the manufacture of many other articles of hardware aside from Pumps, among which are Thimble Skeins, Pipe Boxes, cast-iron Hand Sleds, Smoothing Irons, Jack Screws, Bench Screws, cast-iron Boot Jacks, iron and wood cylinder Meat Cutters, and a great variety of other useful articles. They sell nothing but their own manufactures."

Sadirons, etc. The Island Works, H. C. Silsby, Agent, make Steam Fire Engines and Rotary Pumps. Mowing Machines, said to be very superior, are made by E. F. Herrington; and Garden Implements, Potato Hooks, and Corn Knives, by S. H. Brainard. Sash, Doors and Blinds, are made with improved machinery by Powell & Milk, and Venetian Blinds by H. P. Westcott, who is the inventor of the only successful machine that makes the slats for these blinds.

At Lockport, a thriving town of 12,000 inhabitants, distant 21 miles from Buffalo, there is a number of respectable, though no very remarkable manufactories. The town possesses peculiar advantages for many branches of manufactures, by reason of the vast water-power created by the flow of water from Lake Erie as it passes around the locks and descends from the Erie to the Genesee level. This power is now owned by the *Lockport Hydraulic Company*, who dispose of it on liberal terms and furnish buildings and shafting at a cheap rent to mechanics of moderate capital. The most important manufactories already established there are the Lockport Edge Tool Company, the foundries and machine shops of the Holly Manufacturing Company, Race, Matthews & Co., Alexander Pound, C. G. Hildreth, T. R. Baily & Son, the foundries of Lemuel Gardner and R. Van Brocklyn, the Barrel and Stave factories of B. & J. Carpenter, Hiram Benediet, William Norman, and Daniel Ritson, the Shingle factories of G. D. Root & Son, and C. & H. T. Vandusen, the Saw Mills of D. A. Vanvalkenburg, H. F. Cady, and J. R. Edwards & Co., the Cabinet Ware manufactories of M. W. Evans and Tucker & Beck, the Woolen Factory of L. N. Edwards, the Woolen and Knitting Factory of J. L. Davison, the Flax Cotton Factories of W. J. Daniels, President, and F. N. Nelson, the Paper Mills of G. T. Crouch, the Plaster Mills of John W. Irving and F. J. Lavalley, the Flour Mills of Harman, Cope & Co., Douglas & Jackson, A. H. Smith, H. Finch, J. Playter, William R. Moore & Co., and George H. Elliott, the Distillery of Fletcher & Hoag, the Breweries of J. G. Norman and J. C. Bowers, the Potash anufactory of L. B. Stainthorpe, the Shingle Machine Manufactory o W. W. Trevor & Co., the Soap and Candle Factory of George Staint rpe, and the Lockport Gargling Oil Company (George W. Merchant, Chemist).

MANUFACTURES OF BUFFALO.

BUFFALO, situated at the eastern extremity of Lake Erie, and the terminus of the Erie Canal, has long been a principal commercial emporium of the West. Her citizens performed prodigies of labor at an early period, when the town contained not more than 2,000 inhabitants, to render the harbor available to the largest vessels and secure the termination of the Erie Canal; and at a later period they erected, at a heavy cost, immense elevators, to facilitate the rapid discharge of cargoes, especially of grain. There are now in the city of Buffalo twenty-one of these automatic laborers, that have in the aggregate the power of transferring 82,000 bushels of grain per hour, and a warehouse capacity of 4,415,000 bushels. By the promptitude with which they clear vessels, fleets have been enabled to leave the harbor in search of other freight within thirty-six hours after their arrival—a dispatch gratifying to the mariner, profitable to the owner, and highly reputable to the port.

During the last fifteen or twenty years the citizens of Buffalo have been not less indefatigable in establishing and encouraging the growth of manufactures, and with a success not less marked than that which attended their efforts to attract to their port the immense agricultural productions of the West. According to the Census Returns, furnished us in advance of their official publication, Erie County, of which Buffalo is the capital, had, in 1860, 791 manufacturing establishments, with a capital of $5,524,871, that yielded a value of $10,777,750. According to the same authority the city contained 404 manufactories, that had a capital invested of $4,617,743, employed 5,217 male and 380 female hands, and produced a value of $8,500,000. This, however, it may be safely asserted, is considerably below the present product. The census officials in Buffalo were not more successful than those in other places in securing accurate returns, as can easily be proved—besides, business was depressed below the average in 1860, and since then there have been important additions to the number of its manufactories. It is probable, therefore, that the estimate of competent judges, who state that the annual value of articles now manufactured in Buffalo is at least twelve millions of dollars, is not an unreasonable one.

The principal manufactures of Erie County, according to the census returns, were the following:

Manufactures.	No. of Establishments.	Capital.	Raw material.	Male hands.	Female hands.	Value of Product.
Agricultural implements	6	$290,400	$124,290	377	.....	$377,800
Brass founding	2	11,000	4,030	17	.....	15,500
Brooms	1	4,000	8,000	5	.....	18,000
Blank books and book binding	3	19,500	25,400	23	28	51,000
Boots and shoes	89	89,560	92,264	365	31	220,019
Clothing	35	130,350	201,231	313	173	366,952
Cigars	11	41,050	38,695	71	2	85,790
Carriages	43	126,166	46,882	209	.....	130,330
Cabinet furniture	22	102,700	44,827	150	.....	132,717
Car wheels	1	2,600	28,400	20	.....	51,550
Distilled liquors	3	200,000	580,816	60	.....	795,456
Edge tools	1	25,000	11,500	43	.....	41,000
Flour and meal	36	435,025	1,577,291	133	.....	1,787,920
Glass ware	1	10,000	9,250	60	.....	40,500
Hats and caps	11	50,700	44,887	25	12	72,386
Iron (rolled)	1	53,000	158,000	230	.....	250,000
Iron railing	4	48,800	17,290	28	.....	43,000
Iron forging	1	50,000	29,120	12	.....	35,000
Iron founding	9	138,300	119,236	272	.....	265,005
Leather	40	673,360	868,918	422	.....	1,622,166
Lumber (planed)	5	110,900	85,525	113	.....	136,103
Lumber (sawed)	80	138,525	71,101	181	.....	195,225
Malt liquors	33	168,600	161,324	137	.....	399,226
Malt	5	82,500	116,100	39	.....	129,700
Mill stones and mill furnishing	3	155,000	90,400	89	.....	217,000
Marble work	2	8,400	4,500	18	.....	9,500
Machinery, steam engines, etc	9	250,600	86,334	372	.....	374,520
Pianos, melodeons, etc.	3	201,000	66,848	150	.....	234,800
Scales, platform and counter	1	5,000	8,000	20	.....	25,000
Stove founding	4	93,000	98,262	252	.....	204,200
Soap and candles	40	33,400	55,492	40	.....	132,412
Sash, doors and blinds	6	69,600	47,720	83	.....	93,350
Saddles and harness	25	28,860	25,190	49	.....	52,687
Saddlery hardware	1	30,000	21,800	40	20	35,000
Shoemakers' tools	1	10,000	10,000	100	.....	70,000
Tin, copper, and sheet-iron work	26	94,500	76,395	98	.....	141,685
Type	1	20,000	40,000	25	5	75,000
Woolen goods	7	51,600	36,750	57	19	70,015
White lead	1	134,000	24,767	20	.....	63,000
Wine (native)	1	40,000	96,000	13	.....	125,000
Wash boards	1	15,000	10,000	20	.....	20,500

REMARKS

On the Manufacturing Establishments of Buffalo.

Agricultural Implements.—Buffalo contains some of the largest and most deservedly celebrated manufactories of agricultural machines in the United States. To no other city in the Union are the farmers of the West so largely indebted as to Buffalo.

Among the most prominent of these establishments in that city are the Pitts Agricultural Works, owned, we believe, by an incorporated company, from the fact that James Brayley, Esq., is announced as

Treasurer. This concern is indebted for its celebrity mainly to the valuable inventions made by John A. Pitts, from whom it derives its name. This gentleman is accredited with having invented the Treading or Endless-Chain Horse Power, which was patented by him in 1836; also the first Chain Pump, and the first Combined Thresher and Separator, patented in 1837, and which continues to be the leading article manufactured at the Pitts Works. Important improvements have been made in the construction of this machine since it was first invented, and now, when propelled by six or eight horses, it will thresh and clean from 300 to 500 bushels of wheat, and from 600 to 1000 bushels of oats per day, and leave the grain deposited in a perfectly neat and clean condition, requiring no handling after it is once fed into the machine until it is ready for the granary. Over five hundred of these machines are now made and sold annually. Recently the manufacturer has invented an attachment for measuring and registering the number of bushels threshed and bagging the grain, which runs from the Fanning Mill into the Elevator, then into the Reservoir and Measure, and then into the Bag, each half bushel being accurately registered and counted. The value of a labor-saving machine like this, to the country, especially at this time, and to the farmers of the West, cannot be computed.

Besides the Thresher and Separator, several other useful and popular machines are made at these works. We may mention the *Double Pinion Horse Powers*, which are remarkable for their strength, durability, and ease in working; *Pitts' Corn and Cob Mill*, and Rice Hulling machines. Pitts' Works cover an area of about three acres of ground, including the space devoted to the storage of materials. At times as many as two million feet of lumber, almost exclusively of hard wood, are kept in stock.

The BUFFALO AGRICULTURAL MACHINE WORKS are another extensive concern in this branch of manufactures. The proprietors of these works have the control of several patented machines—among others, of *Kirby's American Harvester*, a Buffalo invention. The distinctive feature of this Combined Mower and Reaper is that it will work as well on rough as on smooth ground. This is accomplished by an arrangement by which the finger-bar is independent in its action, or, in other words, rises and falls in following the inequalities of the ground independently of the driving wheel. It is also recommended for its exceeding lightness of draft, and being made of iron it is not affected by exposure to dew, or showers, or sun. This Company have also introduced to the notice of the agricultural community a *Combined Mower and Reaper* which is easily drawn by one horse, and is said to be capable of doing as much work as most machines that require two horses.

The Works are the property of a stock company with a large capital, all paid in, of which GEORGE L. SQUIER is President, LUCIEN HAWLEY Secretary, and JOHN VALENTINE, Superintendent.

R. L. HOWARD'S AGRICULTURAL WORKS, where Ketchum's well-known Mower and Reaper is made, is another celebrated establishment in Buffalo. Over 20,000 of these popular implements have been manufactured and distributed to all parts of the country.

About six years ago Messrs. MILLER, BENNETT & Co. took possession of the old "Vulcan Iron Works" and converted them into an agricultural implement manufactory, more especially for the manufacture of *Parkhurst's Patent Adjustable Mowing and Reaping Machine*, better known as the Buffalo Mower and Reaper.

Brass Founding.—The census officials evidently erred in their return of this branch. Instead of there being but two firms engaged in Brass work in Buffalo, we know of three, and there are probably others—the "Eagle" works, F. COLLIGON & Co. proprietors, who manufacture also Portable Steam Engines and Palmer's Hydraulic Lift and Force Pump; the "Buffalo Brass Foundry," BROWN & RUHLANDT proprietors, who make steam-engine and locomotive Brasswork; and the "Lafayette Brass and Bell Foundry," of which ADAM GOOD has been proprietor for nearly a quarter of a century.

Distilled Liquors.—The largest Distillery in New York State west of Albany, is that of THOMAS CLARK, in Buffalo. His consumption of grain is about 640 bushels a day—which, allowing one bushel to each three gallons of spirits, would make a daily product of 1920 gallons, or over 60 barrels. The still in his establishment, made in New York City by weight, is one of the finest ever constructed. It has the capacity of holding 70 barrels. "Clark's Rye and Monongahela" Whiskies are favorite brands in Western New York and in the Western States. In connection with the Distillery Mr. Clark has an extensive Rectifying establishment, and is the largest manufacturer of Alcohol on the Lakes. The oldest and largest Brewery in Buffalo is that of Moffat, established in 1835.

Iron Rolling and Machinery.—The first Rolling Mill erected in Buffalo was that known as the Buffalo Iron and Nail Works, built in 1846 by Corns & Co., and now owned by PRATT & Co. The main mill is 176 feet long by 140 feet wide, with Nail factory attached, and has eight puddling furnaces, six heating furnaces, and about fifty Nail machines. Besides this main building, there are blacksmith's, millwright and other shops. The works will compare favorably with the best of similar concerns in the country, and are now turning out large quantities of iron and nails of the best quality.

Recently Messrs. Pratt & Co. erected in Buffalo a very fine Blast Furnace, and contemplate the erection of another. The city is indebted to the enterprise of this firm for much of its present importance as a manufacturing centre.

In 1862 another large Rolling Mill was built in connection with the Blast Furnaces erected by Palmer & Wadsworth and Warren & Thompson, whose establishments have been consolidated under the title of the UNION IRON WORKS. The furnaces now in operation in Buffalo or in course of erection will have a capacity sufficient to produce 90,000 tons of Pig Iron annually. The ores are obtained from Northern Michigan.

The "Niagara Steam Forge," built by Charles Delaney in 1850, and now owned by HENRY CHILDS, is fully equipped for fabricating masses of wrought iron. This establishment has the capacity of turning out $200,000 worth of work annually. Another forge is now in the course of erection in Buffalo.

The manufacture of Machinery and Steam Engines is also largely carried on in Buffalo, much more so than the returns of the census-takers would lead one to suppose. The "Shepard Iron Works," for instance, have a capital of $125,000, and their annual product must amount to $200,000. The buildings of the works were erected in 1847, and consist of a brick foundry and machine shop 120 feet square, and a boiler shop adjoining 100 feet square. Here, in 1850, Mr. JOHN D. SHEPARD built the machinery for the propeller "Buffalo," and attached a screw propeller wheel of 16 feet in diameter, the shaft just touching the water when the wheel was loaded to ten feet. Although a failure was confidently and generally predicted, the experiment was entirely successful, and the reputation of the elevated screw propeller wheel established. Here too have been built several of the very best steam engines on the Lakes, and the boilers of some of the largest passenger boats, as for instance those of the "Southern Michigan," "Northern Indiana," "Crescent City," "Queen of the West," "St. Lawrence," and others. In addition to the manufacture of machinery for steamboats and propellers, the Shepard Iron Works make all kinds used in Saw and Flouring mills.

The "Buffalo Furnace," George W. Tifft owner, and J. N. Tifft & Co. lessees, and the Eagle Iron Works of Dunbar & Howell, are also extensively engaged in building Engines and Boilers; while MASON & BIDWELL have every facility for building vessels of the largest size. This firm and their predecessors have built Steamers, Propellers, Brigs and Schooners that have an aggregate tonnage of at least 50,000 tons. Some of the finest craft on the Lakes, and strongest steamers ever constructed, were built at the shipyards of this firm.

Leather.—Buffalo has peculiar advantages for this manufacture, and has more capital invested in it than in any other branch. The Tanneries of BUSH & HOWARD and AARON RUMSEY & Co. are the largest in Western New York.

Mill Stones and Mill Furnishing.—The establishments in Buffalo for furnishing mills are probably the largest of their class in the country. At JOHN T. NOYE'S Mill Stone Manufactory, for instance, a person who desires to construct and equip a Mill, can obtain every thing, from a steam engine to the bolting cloths. He has simply to send a statement and diagram of the situation, size desired, and other particulars, and the entire mill, except the buildings (and the designs for these are frequently included), will be furnished. We know of no other establishment of the kind so complete in all its appointments.

Mr. Noye is also distinguished as an inventor as well as a manufacturer. His *Centrifugal Feeding Portable Mill* has effected a revolution in the ideas of millers as to the relative value of large and small stones. He commenced the manufacture in 1852, and such were the prejudices of old millers against small stones, that the sales during the first year did not exceed a half dozen mills. One after another, however, was induced to test the experiment, and found the results eminently satisfactory. Brown & Smead, at their steam mill in Portage, N. Y., found that by means of Mr. Noye's improvement they could make a hundred barrels of flour with only one and a half cords of wood; and O. Whitney & Co. at their large steam mill in Detroit did the same work with one ton of bituminous coal. What was then an experiment has now become a fixed fact, namely, that portable mills with the centrifugal feeding principle can be run (say three feet stones) with an economy of power over large stones of from twenty-five to thirty-three per cent.; and the flour, from its superior liveliness, is preferred by bakers.

Mr. Noye is also the inventor of an improved Bolting Reel, a Pressure Mill, a Plantation Corn Mill, a Smut Machine and Separator, a Centre Vent Turbine Water Wheel, a Chinese Sugar-Cane Mill and Sugar Mill Horse-Power, and other contrivances that exhibit the fertility of his genius and his skill in the adaptation of mechanics to useful purposes.

ZADOCK G. ALLEN & Co. are another firm in Buffalo extensively engaged in making Burr Millstones and furnishing Mill Machinery. Mr. Allen has had a long experience both as a millwright and a manufacturer. He is also an inventor, and his *Improved Cast Iron Water Wheel* is believed to be the best now in use. It is cast whole, and finished in a lathe by boring the eye and turning the rim, and its quick and steady motion adapt it for milling purposes, as the stone can be

driven to the proper speed with but little gearing. His *Combination Smut Machine* and *Improved Self-Acting Flour Packer* are labor-saving machines that are also deservedly appreciated.

E. P. BUTLER, the other manufacturer, is the successor of Weston, Cogswell & Co. His Mills are peculiar in the novel method of hanging the stones, Mr. Butler having a patent upon the iron work employed for that purpose.

Pianos, Melodeons, etc.—Instead of there being but three establishments engaged in the manufacture of Musical Instruments in Buffalo, as the census takers have reported, there were four Piano manufactories in operation in 1859–60, those of A. & J. KEOGH, H. UTLEY, FROBOES & Co., and KURTZMAN & LINGE. Besides these, there was the Flute Manufactory of SHEPPARD & COTTIER; the Organ Manufactory of G. HOUSE; and the Melodeon Manufactory of GEORGE A. PRINCE & Co.; that usually employs 200 hands, and turns out 80 instruments per week, ranging in price from $35 to $350. This is one of the largest establishments of its class in the United States. The manufactory is built in the form of an L, five stories in height, and has a frontage of 120 feet on two streets, and 40 feet in breadth. Nearly 30,000 instruments have been sent out from this manufactory to all parts of the country.

Platform Scales.—The manufacture of Platform Scales in Buffalo was in its infancy in 1860. In September of that year Mr. JOHN WEEKS, formerly Agent of the Messrs. Fairbanks, succeeded in organizing the BUFFALO SCALE WORKS COMPANY, with Mr. EDWARD S. RICH, a gentleman of capital, as its President; and the business, now established on a solid foundation, will probably become an extensive one.

Stove Founding.—We are confident that this branch of manufactures is much understated in the census returns. The works of one firm, Messrs. JEWETT & ROOT, have the capacity of melting 40 tons of iron daily, and turning out 1500 Stoves per week. They alone usually employ about 400 men. Their works, in connection with the Eagle Iron Company's manufactory, owned in part by the same proprietors, occupy an entire block. The principal moulding room is 200 feet in length by 150 feet in width, and contains two cupola furnaces; and the other is 200 by 100 feet, and has one cupola. The firm has been established since 1835.

Messrs. WOOD, HUNBELL & Co. are another firm extensively engaged in the manufacture of Stoves. They make over a hundred different kinds and sizes.

Wine.—We presume the establishment alluded to in the census returns as manufacturing Native Wine is that of TURNER BROTHERS, who

make *Turner's Ginger Wine*, of which over 300,000 gallons have been sold in a single year. They make 23 different kinds of Wines and Cordials, and furnish employment to a large number of persons during a portion of the year in gathering fruits and berries, of which the consumption is enormous. In connection with the Buffalo house, which has been established about 18 years, this firm have a manufactory in the city of New York, and another in San Francisco. Their wines are a staple article, and are shipped largely to Europe, the West Indies, and South America.

White Lead.—There are two White Lead factories in Buffalo, those of THOMPSON & Co., founded in 1843, and the Niagara White Lead Company, established in 1852—G. T. WILLIAMS, President, and S. G. CORNELL, Secretary. Each of these makes about 1200 tons of White Lead per annum, and the aggregate product, instead of being $63,000, as returned by the census-takers, is about $300,000.

Buffalo has for several years contained, in the establishment of F. S. PEASE, one of the largest and most noteworthy Oil manufactories in the Union, but recently important additions have been made to this branch of manufactures by the erection of several establishments for Refining crude Petroleum. We believe there are no less than eleven of these Oil Refineries now in operation in Buffalo.

Manufacturing Centres of New-England.

PORTLAND, MAINE.

PORTLAND, which is the principal seaport of Maine, and the capital of Cumberland County, is a manufacturing city of some importance, though it contains no very remarkable manufacturing establishments. In 1860 the County of Cumberland had 334 manufactories, whose united capital was $2,898,263, and who employed 2,699 males, 592 females, and produced a value of $6,091,924. More than one-half of these manufactories were located in Portland and the adjoining town of Westbrook, and they produced more than three-fourths of the aggregate product, or $4,791,720. The principal manufactures were the following:

Manufactures.	No. of Establishments.	Capital.	Raw material.	Male hands.	Female hands.	Value of product.
Brick	19	$16,618	$20,130	130	.....	$53,294
Boots and shoes	32	56,150	107,551	256	128	226,781
Brewing	3	8,420	18,887	14	1	31,019
Boat building	6	5,450	3,548	20	.....	14,150
Bindings and linings	1	20,000	13,035	16	.....	30,000
Cotton goods	4	280,000	236,545	140	270	597,500
Cabinet furniture	2	16,000	36,010	81	.....	78,725
Bedsteads	2	6,300	875	12	.....	8,420
Carpets	2	8,000	19,910	26	11	42,000
Carriages	23	64,200	27,080	180	.....	149,885
Clothing	3	2,200	13,100	4	32	26,200
Coffee and spices (ground)	1	4,000	15,010	4	3	20,535
Distilled liquors	1	50,000	105,325	10	.....	147,500
Flour and meal	23	120,250	351,851	66	2	386,733
Gun powder	2	216,000	120,000	46	.....	237,500
Iron railing	1	10,000	4,400	15	.....	31,000
Machinery, engines, etc.	5	268,600	298,400	377	.....	439,300
Musical instruments	4	33,000	5,255	18	.....	25,800
Morocco	2	9,000	17,478	12	.....	42,400
Mastic roofing	1	1,400	10,195	4	.....	18,000
Meats, cured	3	52,100	52,807	14	.....	60,735
Paper	2	165,000	171,600	59	58	305,000
Preserved fish	1	25,000	30,000	15	6	50,000
Pottery ware	4	5,800	3,453	23	.....	37,150
Soap and candles	3	5,900	15,292	11	.....	28,930
Sawed lumber	44	153,600	87,580	138	.....	182,380
Sails	7	7,500	22,811	24	.....	41,004
Stoves	1	30,000	12,000	30	.....	40,000
Ship building	2	32,000	22,000	37	.....	47,000
Sash, doors and blinds	1	5,000	39,100	10	.....	48,250
Sugar refining	1	400,000	1,216,000	200	.....	1,350,000
Leather	12	96,650	169,945	117	.....	255,699
Woolen goods	2	28,000	60,000	25	37	135,500
Wire	3	40,000	29,130	39	.....	52,926
Wool cleaning	2	30,000	125,000	25	2	146,875

(1) The two largest manufacturing establishments in Portland are the Portland Company's Locomotive Works, JOHN SPARROW, Superintendent, and the Sugar Refinery of J. B. BROWN & SONS.

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males, 592 females,
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hs of the aggregate
es were the following:

Male hands.	Female hands.	Value of product.
130.....	.....	$53,294
256.....	128.....	226,781
14.....	1.....	31,019
20.....	.....	14,150
16.....	.....	30,000
140.....	270.....	597,500
81.....	.....	78,725
12.....	.....	8,420
26.....	11.....	42,000
180.....	.....	149,885
4.....	32.....	26,200
4.....	3.....	20,535
10.....	.....	147,500
66.....	2.....	386,733
46.....	.....	237,500
15.....	.....	31,000
377.....	.....	439,300
18.....	.....	25,800
12.....	.....	42,100
4.....	.....	18,000
14.....	.....	60,735
59.....	58.....	305,000
15.....	6.....	50,000
23.....	.....	37,150
11.....	.....	28,930
138.....	.....	182,380
24.....	.....	41,004
30.....	.....	40,000
37.....	.....	47,000
10.....	.....	48,250
200.....	.....	1,350,000
117.....	.....	255,699
25.....	37.....	135,500
39.....	.....	52,926
25.....	2.....	146,875

rtland are the Portland Com-
, and the Sugar Refinery of


ICHABOD WASHBURN, WORCESTER, MASS.
SETH ADAMS, BOSTON, MASS.
H.A. RICHARDSON, WORCESTER, MASS.
WILLIAM MASON, TAUNTON, MASS.
EBENEZER G. LAMSON, SHELBURNE FALLS, MASS.

Next to Portland, the most important seat of manufactures in Maine is LEWISTON. The water-power here, which is among the best in New England, is owned by an association of capitalists called the "Franklin Company," of which A. D. Lockwood is Agent, and Edwd. Atkinson, Treasurer. This Company have also a Cotton Mill with 21,000 spindles, and a Bleachery capable of bleaching six tons of goods per day. The other principal cotton mills are the Bates Manufacturing Co.'s Mills (Benjamin C. Bates, Treasurer, and D. M. Ayer, Agent)—capital $800,000, spindles 36,000, looms 812; the Hill Manufacturing Co.'s Mills (F. L. Richardson, Treasurer, and J. G. Coburn, agent)—capital $1,000,000; the Androscoggin Mills, which have about 40,000 spindles (A. D. Lockwood, Agent, C. Greene, Superintendent); the Porter Mill (R. A. Budlong, Agent); and the Lincoln Mills. Flannels and Cassimeres are made by the Lewiston Falls Manufacturing Co. (S. Pickard, Treasurer, and John M. Frye, Agent), and Bags by the Lewiston Bagging Company, who manufacture about 2500 grain sacks daily. Machine Cards are also made largely by J. Smith & Co., Bobbins and Spools by J. G. Drew, and Roller Coverings by H. H. Dickey. The Flour Mills of Bradley & Co. are probably the largest in the State. Besides these, there are machine shops, and two or more extensive saw mills.

BANGOR, situated on the west bank of the Penobscot River, at the head of sloop navigation, is principally noted for its extensive trade in Lumber. The head waters of the Penobscot traverse immense forests of pine, spruce, and hemlock, and its banks are lined with Saw Mills, converting the logs into lumber, which is floated down to Bangor. The principal industrial concerns of the city are therefore engaged in wood-working, and include firms like Blunt & Hinman, Babb & Strickland, Palmer & Johnson, Stetson & Co., Eddy, Murphy & Co., Morse & Co., John Dole, Watson Dyer, Paul D. Hartshorn, Oliver P. Merryman, and the Furniture manufactories of John Carlisle, Albert Dole & Co., Dole & Gilman, and George W. Merrill; the Barrel manufactories of Samuel Doyen, Farris & Webb, Amos M. Roberts & Son, and E. H. & H. Rollins. Carriages are made by Benjamin Adams, B. N. Thombs, and Whiton & Yeaton, and Harnesses by Jona. Batchelder, Stanford T. Chase, Geo. H. Chick, and John Williams & Son. There is also a manufactory of steel Squares (Darling & Schwartz, proprietors), two of Stoves (Eastes & Whittier and Isaac L. Johnson, proprietors), one of Saws (M. Schwartz, proprietor), and of Axes (Jefferson Higgins, proprietor); and of Files (Job Collett, proprietor); besides these, there are two Machine Shops (Muzzy, Franklin & Co. and Hinckley & Egery, proprietors); two Brass foundries (Geo. T. Allamby and Jona. Burbank, proprietors); and several manufactories of Clothing, Sails, Tinware, Confectionery, etc.

MANUFACTURES OF BOSTON.

[The following are the Census Statistics of the principal manufactures in the County of Suffolk, Massachusetts, which includes Boston and Chelsea, for the year ending June 1, 1860:]

Manufactures.	No. of Establishments.	Capital.	Raw material.	Male hands.	Female hands.	Value of product.
Bed springs	4	$4,600	$16,992	20	.....	$43,500
Billiard tables	4	50,500	27,055	25	.....	53,500
Blank books and book-binding	13	74,900	211,084	157	292	418,500
Boots and shoes	48	106,200	119,371	311	38	370,052
Boxes, paper	9	25,650	57,820	40	78	120,000
Bread, crackers, etc	39	96,400	363,652	155	23	515,106
Brass founding	10	155,800	161,125	122	.....	317,000
Brass cocks and guages	7	150,500	142,848	172	.....	299,445
Camphene	6	83,000	586,929	22	.....	729,040
Caps	5	32,500	19,950	10	47	51,000
Carriages	8	54,500	32,111	115	.....	95,100
Casks and barrels	5	31,000	26,687	53	.....	03,438
Chemicals	3	15,500	26,630	9	.....	45,100
Cigars	11	18,700	32,817	38	0	64,516
Cloaks and Mantillas	10	86,300	223,775	12	273	462,460
Clothing	61	1,078,300	2,482,628	1824	2693	4,567,749
Coffee mills	4	33,000	244,359	19	8	268,900
Confectionery	11	83,100	148,944	84	103	365,900
Copper smelting	1	300,000	465,000	55	.....	500,000
Copper smithing	12	273,100	243,253	201	.....	427,290
Cutlery	2	13,500	1,090	18	.....	30,000
Drugs and medicines	11	98,000	127,800	53	17	250,052
Flour	2	25,000	114,600	5	1	126,360
Furniture (1)	29	290,200	348,684	372	14	737,845
Furniture, school	5	51,900	40,990	177	.....	161,500
Furs	6	49,000	172,550	34	21	269,000
Gas	4	1,383,000	258,970	232	.....	608,733
Glassware	8	310,000	94,436	296	51	462,500
Hats	7	45,500	51,935	138	30	183,500
Horse shoes	3	900	7,185	16	....	13,900
Iron work, building	1	8,000	18,728	40	.....	40,000
Iron founding	5	261,000	279,070	322	.....	580,000
Iron railing	6	23,500	53,350	32	.....	83,700
Iron, rolled	2	470,000	1,093,600	400	.....	1,460,000
Iron safes	6	142,000	133,108	115	.....	290,980
Iron shafting	1	20,000	59,000	40	.....	86,500
Iron steamships	1	190,000	585,050	300	.....	914,700
Iron work, ornamental	1	20,000	18,000	60	.....	75,000

(1) The manufacture of Furniture is a very prominent and extensive business in Boston, and we have no doubt that the firms of DANIELS, KENDALL & Co., FORSTER, LAWRENCE & Co., HALEY, MORSE & BOYDEN, F. M. HOLMES & Co., H. T. ABORN & Co., C. A. GARDINER & Co., BUCKLEY & BANCROFT, KIMBALL & Co., and WINAND TOUSSAINT, make annually considerably more than the Census marshals have returned for 29 manufactories.

Manufactures.	No. of Establishments.	Capital invested.	Raw material.	Male hands.	Female hands.	Value of product.
Instruments, mathematical	2	$13,000	$7,000	9	.....	$24,500
Instruments, surgical	1	15,000	850	5	.....	10,000
Instruments, telegraphic	1	20,000	9,000	15	.....	20,000
Japanned ware	2	8,000	6,400	23	.....	19,500
Jewelry	9	14,050	15,653	31	1	43,800
Lasts	5	14,905	5,313	44	.....	53,395
Leather	7	103,000	384,235	143	.....	573,250
Leather belting	1	9,500	19,400	9	.....	27,600
Liquors, distilled	5	266,000	688,020	34	.....	766,000
Liquors, malt	6	118,500	133,570	65	.....	336,604
Locomotives, etc.	1	25,000	31,450	80	.....	80,000
Lumber, planed	6	74,600	670,650	81	.....	807,250
Machinery, st'm-engines, etc.	28	646,100	400,606	650	.....	972,650
Marble	22	242,200	242,841	454	.....	501,800
Masts	3	56,000	37,550	29	.....	93,000
Matches	1	30,000	33,450	8	60	65,000
Military caps	1	4,000	10,000	16	2	30,000
Millinery	18	41,500	123,550	10	157	238,456
Mineral waters	5	47,000	31,128	52	.....	122,774
Musical instruments, Miscellaneous (1)	4	88,200	34,249	111	.....	144,100
Pianofortes	16	823,000	515,768	730	.....	1,461,500
Oil, linseed	3	400,000	805,200	96	5	957,500
" lard	2	32,000	122,500	13	.....	149,850
" water	1	6,000	15,800	3	.....	20,000
" kerosene	4	280,000	428,439	166	.....	883,500
" whale	2	55,000	108,610	11	.....	128,110
" curriers'	1	4,000	6,283	2	2	8,500
Paper hangings	2	22,500	20,750	29	3	56,500
Picture frames	15	64,700	96,610	107	.....	183,600
Preserved pickles and fruit	2	70,000	122,100	45	42	177,250
Printing, book and job	23	285,200	381,396	308	54	689,522
" newspaper	77	1,176,500	790,137	743	150	1,703,280
Printing presses	1	200,000	30,180	100	.....	103,500
Pumps and blocks	6	23,700	14,000	31	.....	40,300
Rigging	2	20,600	22,548	28	.....	46,000
Roofing, composition	5	14,100	20,780	34	.....	66,000
Roofing, slate	1	12,000	57,600	20	.....	70,000
Saddlery and harness	23	74,000	104,336	178	9	210,310
Sails	13	20,200	59,060	46	.....	92,280
Salt (ground)	3	60,000	37,190	14	12	75,000
Saltpetre	1	3,000	18,000	.....	2	23,500
Sash, doors and blinds	4	10,900	13,235	25	.....	27,800
Sewing machines	5	236,000	57,405	451	5	1,045,000

(1) The manufacture of Musical Instruments, exclusive of Pianofortes, is a more extensive business in Boston than the census returns indicate.

MASON & HAMLIN'S manufactory of Cabinet Organs is the largest of its kind in the Union. They have the capacity of making a hundred a week, or five thousand a year.

E. & G. HOOK employ in their Organ Manufactory at Roxbury 50 hands, and for the last three years have averaged 22 Church Organs annually, some of them very large.

W. B. D. SIMMONS & Co. have also an extensive manufactory of Church Organs on Charles Street. Besides these, we find in a late Directory the names of S. D. & H. W. Smith, William Stevens, Walter Croshy, George Fremantle, Graves & Co., Charles W. Lawrence, Benjamin F. Richardson, Charles Stumcka (Guitar), the Wright Musical Instrument Company, White Brothers, and James H. White, as manufacturers of musical instruments, exclusive of the Pianoforte manufacturers.

Manufactures.	No. of Establishments.	Capital invested.	Raw material.	Male hands.	Female hands.	Value of Product.
Sewing machine needles	2	$23,500	$13,950	62	13	$53,330
Ship building	6	205,000	207,330	395	.....	760,820
Ship smithing	7	26,300	38,022	44	.....	72,300
Shirts and furnishing goods	9	51,500	44,735	7	333	189,170
Silk fringes, trimmings, etc	4	81,500	212,570	89	93	324,300
Silver ware	2	26,500	48,894	33	.....	130,000
plated ware	6	9,300	13,146	43	.....	55,000
Soap and candles	2	16,000	33,000	17	10	50,250
Soapstone	4	10,900	9,685	15	.....	19,600
Stair building	6	11,100	15,068	43	.....	53,600
Steam gas tubes	5	125,900	87,034	246	30	277,000
Steam heaters	2	50,500	7,980	18	.....	83,000
Steam and gas pipe machines	2	60,000	150,350	110	.....	230,000
Stoves and ranges	9	64,500	163,710	95	.....	297,250
Sugar refining	2	750,000	1,763,500	220	.....	2,383,057
Tin and sheet-iron ware	14	31,400	36,825	67	2	88,800
Trunks	10	59,900	153,265	142	17	278,050
Type and stereotype foundings	5	96,000	37,113	103	61	175,770
Umbrellas and parasols	4	24,500	38,300	10	40	81,000
Upholstering	9	122,000	216,733	209	61	560,681
Varnish	4	90,200	174,083	44	.....	254,900
Vinegar	2	12,000	9,563	8	10	22,000
Whalebone	1	10,000	32,000	0	1	38,000
Wagons, carts, etc	10	10,500	9,264	28	.....	36,900
Whips	1	5,000	22,800	100	.....	85,600
Window shades	4	2,800	10,220	12	.....	29,300
Wirework	2	15,000	21,250	25	.....	41,000
Total, including miscellaneous manufactures not above specified	1,050	$14,527,880	$20,254,277	14,100	4,993	$37,681,808

REMARKABLE IRON WORKS IN SOUTH BOSTON.

The South Boston Iron Company's Works.

Boston has a due share of manufacturing establishments that can be called remarkable, but none more deservedly celebrated or of greater National importance than the Works of the South Boston Iron Company, better known as Alger's Foundries. They were founded by Mr. Cyrus Alger, a native of Bridgwater, Massachusetts, in the year 1817, which was not long after the Dorchester Peninsula became a part of Boston. During the war of 1812 he supplied the Government with large numbers of Cannon Balls; and about that time he purchased a considerable tract of low land called the Flats, reaching to the channel, which then was considered of little value, but which now is covered with streets, dwellings, and extensive manufactories, including the works of which he was the founder.

Mr. Alger was one of the best practical metallurgists of his day. He discovered a method of purifying cast-iron which gave it more than

e	Female hands.	Value of Product.
.....	13.....	$53,330
.....	.....	760,820
.....	.....	72,300
.....	333.....	189,170
.....	93.....	324,300
.....	.....	130,000
.....	.....	55,900
.....	10.....	50,250
.....	.....	19,600
.....	.....	53,600
.....	30.....	277,000
.....	.....	83,600
.....	.....	230,000
.....	.....	297,250
.....	.....	2,383,057
....	2.....	88,800
.....	17.....	278,050
.....	61.....	175,770
... .	40.....	81,000
.....	61.....	560,681
.....	.....	254,900
.....	10.....	22,000
.....	1.....	38,000
.....	.....	36,900
.....	.....	85,600
.....	.....	20,300
.....	.....	41,000
	4,993	$37,681,808

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year 1817, which
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ve it more than

triple strength over ordinary castings, and which proved to be of immense value in the manufacture of Ordnance, in which he was for many years engaged. The United States Government largely relied upon him for this department of their supplies, and since his death that reliance has been continued to his successors. His cannon sustained most extraordinary tests when subjected to extreme proof. The mortar gun "Columbiad," the largest gun of cast-iron that had then been cast in America, was made under his personal supervision. It was of twelve-inch calibre, and had a range exceeding three miles. He also first introduced and patented the method of making cast-iron chilled rolls, by which the part subject to wear should be hard, while the neck remained unchanged as to hardness and strength—this being cast in sand, while the body is cast in a chill or iron cylinder. Until his time all the reverberatory furnaces for melting iron were made with hearths inclining from the fire, the metal thus running from the heat. He changed the form so as to allow the iron to flow towards the flame where the heat would be the most intense.

In 1836 Mr. Alger manufactured the first Malleable Iron Guns made in this country, and supplied our Government with quite a number. The first gun ever Rifled in America was done at his works in 1834. Cylinder Stoves were first designed by him in 1822.

Our Government stands indebted to him for numerous improvements in the construction of Time Fuses for bomb-shells and grenades. The following are some of his inventions:

The interposing a non-combustible material between the fuse and bursting charge in shell, so constructed that it shall be detached by the violent concussion it receives when the projectile is discharged from the gun;

The covering of a fuse-hole on the inside of shell with a wafer or disk of lead, which must be taken out previous to the firing of the shell in order to expose the surface of fuse and allow of its ignition when discharged from gun;

The angles given to the vent-holes in the head of fuse-cases, to allow the escape of gases formed by the burning fuse, and at the same time prevent the entrance of water and extinction of fuse when fired at sea;

The improved method of casting Shells, by using a metal arbor to support the core, and having the arbor hollow, so as to allow all the gases generated by moisture and organic matter in the core to escape, thus preventing porosity in the shell.

Mr. Alger also manufactured the first perfect Bronze Cannon for the United States Ordnance Department, and for the State of Massachusetts, and was, it is said, the first manufacturer to introduce the ten-hour

system in South Boston. He made it a practice never to part with good workmen if he could possibly retain them, and frequently kept a large force of hands on half-pay when their services were not needed. Admiral Dahlgren has said of him—"He possessed that rare quality, sagacity, which constitutes in truth the highest attribute of the intellectual man, and enabled him to arrive at results which others sought by disciplined study and often in vain."

After his decease in 1856, Mr. Francis Alger, his only surviving son—who has since died while these pages were passing through the press—succeeded him. Mr. Francis Alger brought to the business a thorough training, a cultivated mind, and a taste for the pursuits in which he was engaged, besides a knowledge of Metallurgy. Aside from his connection with the Foundry, Mr. Alger was eminent as a scientific man, and as the author of "*Alger's Philips' Mineralogy.*" He possessed one of the finest and most extensive Cabinets of Minerals in America, comprising specimens from all parts of the world.

In 1862 he obtained patents for two improved Fuses, each combining a time-fuse and a percussion-fuse in one case, adapted to shells for rifled guns. One of the most novel and valuable principles embraced in these patents is that in case the shell strikes any object when fired from a gun, previous to the fuse having been consumed, the fuse is driven forward by the concussion, and then allows free egress of the fuse-flame to the charge in the shell, thereby causing its immediate explosion.

The following year he patented the use of a pouch to contain the bursting charge to be used in shrapnel. In this the powder in the form of a cartridge was combined with the fuse, thus rendering the process of charging these shells much more expeditious and less dangerous than by the usual method of first filling the shell with loose powder and then inserting the fuse. These pouches also protect the powder from dampness, being impervious to moisture.

During the present rebellion Mr. Alger has frequently been called to Washington, and received large and urgent orders for projectiles of every description, particularly the rifled shot and shells, and for the "Schenkl projectile." He also obtained large orders for 9-inch and 11-inch Guns and Bronze Cannon both for the Army and Navy.

In order to meet the demands of government for Ordnance, the company have been induced to erect an additional Foundry, 125 feet long and 114 feet wide, and a large Machine Shop, specially designed for finishing guns of very large calibres.

This new "Ordnance Foundry" was put in operation in March, 1863, and the first work performed in it was the casting of a 10-inch Army Columbiad, according to the system of Major T. J. Rodman, of the

United States Army. After having cast five 10-inch Guns in this way satisfactorily, preparations were then made to also cast 15-inch Guns after the same method, and the work on guns of this calibre was commenced in June, 1863. Forty tons of metal are required to cast a gun of this size, and a description of the processes may interest our readers.

In the centre of the room is sunk a cylinder of three-quarter inch iron, water tight, and twenty-five feet deep. On the inside is placed a wall of brick 16 inches thick. The cylinder is thirteen feet four inches in diameter. In the centre of this is placed a heavy cast-iron flask six feet six inches in diameter. Upon the inside of the flask is placed a layer of clay and other materials, bearing in the centre the form of the casting required. When this is made as smooth as possible, the core is inserted, and suspended in its required position by a heavy iron frame resting upon the top of the flask. This core-arbor is formed by a cast-iron cylinder of 13 inches in diameter, turned and fluted on the outside. Around it is wound a small rope, plastered with loam, about an inch thick. This core-arbor is made perfectly water-tight, with the exception of having two orifices—one to force water in, the other to let it out. The Cochituate water is discharged through the core at the rate of forty gallons per minute. The object is to cool the gun from the inside to the outside, and prevent an unequal contraction of the metal. The utmost care is required in all these operations, defects in which might produce disastrous and fatal consequences. The metal is prepared in two air furnaces, each capable of melting 25 tons. When all is ready, and about 15 men are placed in their required position, the order is given, the furnaces are tapped, and the molten iron flows into the flask. One hundred and twelve hours are required to cool the gun so that it can be removed. On account of the risk incident to the casting, spectators are seldom admitted to the works during the operation.

The South Boston Iron Company have manufactured for the Government since the commencement of the present rebellion an immense amount of ordnance and projectiles. It has been remarked by those best qualified to judge, that had it not been for the South Boston works and the works at Pittsburg, a supply of the materials and enginery of war, which was furnished promptly and continuously by them, could not have been otherwise obtained in the United States in two years.

The present number of men employed in these extensive works is four hundred, and gangs are kept working night and day. The same system, adopted by Mr. Cyrus Alger, of retaining men through a series of years, often keeping many on half-pay when their services were not needed, has secured for this Company an unexcelled force of employees who fully understand the requirement of every department of labor in which they are employed.

The City Point Works—Harrison Loring, Proprietor,

Is another of the manufacturing establishments of South Boston that may be said to have attained a national reputation.

The founder of these works, Mr. Harrison Loring, though a young man, has achieved a highly honorable fame in his department of mechanics. He was born in Duxbury, Massachusetts, and served his apprenticeship with Mr. Jabez Coney, of Boston. Having passed a season in Cuba superintending the erection of engines and machinery, he returned to Boston, and in 1847, at the age of 22, commenced business for himself, not however without capital, for he was tendered by relatives a loan of $20,000, without security—a mark of confidence no less creditable to their sagacity than complimentary to himself.

For several years after commencing business Mr. Loring's operations were confined principally to building Stationary and Marine Engines and Boilers, though including Sugar Mills and Paper Mills Machinery, Iron Light Houses, and a great variety of other general work. He was among the first to foresee the great demand which must eventually come for Iron sea-going Steamships, and immediately set about making the proper arrangements to carry on this manufacture quite extensively, in addition to his other branches, which had been gradually increasing. Accordingly, in 1857, he made application to the city of Boston to purchase the House of Industry estate, then unoccupied,—which application stated that he would agree to carry on the business of Iron Ship building for not less than five years, and would employ not less than three hundred workmen. After much opposition from some of the capitalists of Boston he finally effected the purchase of this estate, consisting of seven acres of upland and a million feet of flats, and prepared it for the purpose by remodelling the old and erecting such new buildings as the business required.

This being the first Iron Ship Building establishment which had been permanently established in New England, there were many who expressed their distrust as to the success of the enterprise, and even some of the capitalists of Boston, who wanted work of this kind, seemed determined to place the new concern in the closest competition with the older concerns of other cities, and giving them the preference over the home establishment. Notwithstanding all these obstacles however, which to some men of less strength of character would have been insurmountable, Mr. Loring pursued his business with all the energy and steadfastness of purpose, which have characterized his career, by building steamers for foreign markets. Even in the years 1857–8, when almost all kinds of industry were suspended, Mr. Loring kept his estab-

lishment in full operation on vessels to go to India. He then made a contract with the Boston and Southern Steamship Company for two Iron Steamships of 1,150 tons each; and unlike the most of contracts of a later date, these two vessels—the "South Carolina" and "Massachusetts"—were completed and delivered on the very day named for their completion. They were afterwards sold to the U. S. Government, and proved to be among the most successful vessels in the blockading squadron on the Southern coast.

Mr. Loring has since built for the Union Steamship Co. of Boston two Iron Screw-Steamships, the "Mississippi" and "Merrimack," of 2,000 tons each, which have given the greatest satisfaction to the Company and are ornaments to the merchant-marine of the country. He has also done a large amount of work for the United States Government, including machinery for sloops of war, side-wheel and screw gun boats. After the manifest success of the "Monitor" over the Rebel iron-clad "Merrimac," and the Government had decided to build more Monitors, Mr. Loring's establishment was called upon to build as many as could be completed in a short time, and he immediately commenced on one, the "Nahant," which was one of the first of her class that was completed, and the first Monitor ever built in New England. The novelty of her construction attracted daily hundreds of visitors to examine her. While fitting the Nahant for sea Mr. Loring laid the keel for another Monitor called the "Canonicus." This vessel embodied all the improvements that suggested themselves while constructing the first, having a much superior deck and a thicker side-armor. She is a powerful Ram, and has more than double the propelling power of the Nahant class, and much superior in many other important points. Although the "Canonicus" was delayed in her construction by additions and alterations demanded by the experience of these vessels, when under heavy fire, to resist the modern projectiles, she was the first one completed of her description, and will doubtless sustain the reputation which the City Point Works have attained for excellent workmanship, as the government officials who were on board during her trial-trip expressed themselves in language of unqualified praise for her sailing qualities, her wonderful strength, and the completeness of all her appointments.

The City Point Works are located at nearly the end of the peninsula of South Boston, about one mile from the city proper. They have a water front of six hundred feet, upon which are built two spacious ship-houses. The machine shop is the structure formerly used by the city as the House of Industry. It is built of unhewn granite, is four stories high, and about three hundred feet in length. From 500 to 700 skilled artisans now ply their tools here both day and night.

The Globe Works,

Located on Foundry Street, are also entitled to rank among the noteworthy and remarkable manufacturing establishments of South Boston. Probably a greater variety of machinery has been built in these works than in any other, for it has been the practice of the Company to change their appliances and adapt their tools to the kind that may be most in demand in a given time, whether it be Sugar Mills, Locomotives, or Steamships.

In 1846, Mr. John Souther, who is now President of the Company, commenced business as a Locomotive builder near the site of the present works in association with Mr. J. Lyman (whose interest however he soon after purchased), on the unprecedentedly small capital of $2,000. Previously to embarking in this enterprise Mr. Souther had spent seven years in the service of the Boston Locomotive Works, and had made all or a greater part of their first models and patterns. He had also spent two years at Cuba studying the wants of the sugar planters, and in endeavoring to ascertain the machinery best adapted to supply those wants. The advantages of this practical and comprehensive training soon became manifest in the success of the establishment he had founded, and the sugar machinery built here for Cuba alone has amounted in value to $200,000 annually.

In June, 1854, the Globe Works Company was incorporated, with John Souther as President, and D. A. Pickering, Treasurer. The latter gentleman had been, previous to his connection with these works, General Superintendent of several railroads, and had acquired a large and varied experience that peculiarly fitted him for the position he now occupies. For several years the building of Locomotives was a prominent item in their general business, from twenty to thirty having been made annually. Since 1860, however, when the works were destroyed by fire, the building of Locomotives has not constituted an important branch of their manufactures.

One of the most novel machines built at these Works is the Steam Shovel or Excavator, the construction of which has become an extensive business. These Shovels have been used on most of the railroads in this country, and on many European railroads. They hold two cubic yards of earth, make two dips in a minute, and will dig the hardest clay pan. They will fill a train of twenty-five cars in twenty-five minutes. The shovel weighs twenty-eight tons. Its movements are wonderful in their complicated harmony, and it has been said to approach nearer to "a thing of life" than any other large machine ever built. It has distinct motions to draw the shovel back, force it forward into the bank, to

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raise it up, to swing it to the right or left over a car, and to drop the contents—all executed by steam power. The Company have applied this machinery to a boat for dredging docks, rivers, and harbors, which is used in many parts of the United States and the Canadas, and also by the Russian and Egyptian governments on the Amoor river and on the Nile. The iron boats for this machinery were built at the Works, and both boats and machinery compare favorably with those for the same purposes built in Europe. A second order was given by the Pacha of Egypt to the Globe Works.

For the last two years the Company has been largely engaged upon work for the United States Government. They constructed the U. S. steamship "Housatonic," and are now (1863–4) building one of the Monitors, both the hull and machinery, and also the machinery for a sloop-of-war and two side-wheel war steamers. The working force of the Globe Works has been about 400 men; it is now increased to 600.

Chickering & Sons' Piano-Forte Manufactory

Is one of the very largest Manufacturing Establishments that have as yet been erected in this country. It was completed in 1853, and is built in the form of a hollow square—enclosing a spacious court—with a front on Tremont street of two hundred and forty-five feet, and wings two hundred and sixty-two feet in length, and a uniform width of fifty feet. It is five stories in height from the street, and six stories from the centre court. Three millions of brick, two thousand perches of stone, one million six hundred and five thousand feet of lumber, three hundred casks of nails, and two thousand five hundred casks of lime and cement, were consumed in its construction. It has nine hundred windows, with eleven thousand panes of glass, and the superficial area of the floor room exceeds five acres.

The interior is arranged with a special view to convenience and facility in workmanship, and is provided with every known mechanical contrivance to assist manual labor. The engine which propels the machinery is of one hundred and twenty horse-power, and the furnaces and boilers, situated below the engine room, furnish steam not only for the engine, but for heating the whole building, in which there are eleven miles of steam pipe. The steam, after traversing the building, is returned to the boilers at one hundred and ninety degrees, and does its part in heating the rest. Passing from the Engine room to the room between the two wings, we enter the Steam mill, where the rough material, taken from the lumber yard in the rear, is fashioned, on numerous

machines, into the shapes required. Rosewood and mahogany logs are here sawed into veneers. The Dimension room is on the first floor of the north wing, where all the stock is cut and sawed to its proper length, and prepared for use in the room above, where it acquires the form of a Piano case. The third story of this wing is the Case room, where the veneerings are applied. In the fourth story the Piano case receives its sounding-board and iron frame. And going up to the fifth story, it passes through the Varnish room, in the main building, and begins its descent on the other side, gradually assuming shape and finish, until it is ready for the Sales room. Elevators, at each wing, moved by steam, make the passage of the Piano to the various rooms, a distance exceeding a mile, perfectly easy and expeditious.

The Drying room, which is at the top of the building, where the sounding-boards are finished, is kept all the year round at a heat of ninety, Fahrenheit. These boards are all made out of spruce, which comes from Herkimer county, New York, and have to undergo a preparation of several years before they are admitted into the Piano-forte.

As an illustration of the relative proportion of materials that enter into the composition of a Piano, the following statistics of the yearly consumption in this vast establishment are interesting, viz.: six hundred thousand feet of pine, maple, and oak; eighty thousand feet of black walnut; two hundred thousand feet [illegible], for packing-boxes; twenty thousand feet of spruce, for sounding-boards; three hundred thousand rosewood veneers; thirty thousand feet chestnut veneers; thirty thousand feet of walnut and twelve thousand feet of oak veneers; seventeen thousand pounds of glue; sixty reams sand paper; seventeen hundred and fifty gallons varnish; twelve hundred pounds white lead; thirty-one pounds pumice-stone; three barrels linseed oil; two barrels spirits turpentine; fifteen barrels alcohol; three hundred dollars' worth gold bronze, for plates; six hundred dollars' worth paints; three hundred thousand pounds iron castings; thirty-three hundred pounds brass-castings; twenty thousand six hundred pounds iron wire; five thousand pounds steel wire; thirty-three hundred pounds brass wire; five hundred pounds bar steel; three thousand pounds wrought bar iron; fourteen thousand pairs hinges; three thousand one hundred and fifty gross screws; two thousand locks; eight thousand castors; and two thousand sets ivory.

The founder of this large Manufactory was Jonas Chickering, who, however, did not live to witness its completion. He was born in the State of New Hampshire, near the town of New Ipswich, where he served an apprenticeship of three years at the cabinet-maker's trade. He early evinced a taste for Music, and at the age of nineteen, undertook

the reparation of a disordered Piano—the only one in the town—which, after much labor, he succeeded in restoring to usefulness. This instrument belonged to Samuel Batchelder, elsewhere alluded to, and was no doubt the first Piano-forte that Mr. Chickering ever saw. On February 15th, 1818, he arrived in Boston, and found employment at cabinet-making, commencing work on the very day of his arrival. One year afterward he entered into the employment of Mr. Osborn, then almost the only manufacturer of Piano-fortes in the city, with whom he remained four years. On February 15th, 1823, he entered into a copartnership with a Mr. Stewart in the manufacture of Pianos, which continued for three years, when it was dissolved; and Mr. Chickering prosecuted the business without a partner for several years. He then became associated with Mr. Mackay, a capitalist of Boston, and by the erection of large buildings, and the importation of rare kinds of wood, prepared for an extension of the business, which rapidly followed. It is a noticeable circumstance in his career, that all his partnerships, and all his most important undertakings, date from the fifteenth day of February, the anniversary of his arrival in the city of Boston. In 1852, his large Manufactory on Washington street was destroyed by fire, involving a loss of two hundred thousand dollars; and he then laid the foundations of the present establishment, which has been described. But before its completion, in March, 1853, he died, leaving to his sons the most famous name in the annals of musical mechanism, and a business which his genius and skill had increased from fifteen instruments—the number made by him the first year—to thirteen hundred per year.

Since Mr. Chickering's decease, the business has been conducted by his three sons, who have had the advantage of a thorough training and long experience, and who have made and adopted improvements that render the instruments which they now manufacture far superior to the best made by their father. They employ about five hundred workmen, some of whom earn forty dollars per week, and have been connected with the establishment for thirty years; and they turn out over two thousand Pianos a year. They have received, from Fairs and Exhibitions, gold and silver Medals sufficient to form an extensive numismatic collection, and Testimonials from eminent performers and competent musical critics, which, if arranged in a volume, would make a bulky octavo. Their Square and Grand Pianos have been repeatedly subjected to the most rigid tests of comparative merit in competition with the best instruments made in Europe and America, with results so satisfactory, that their superior quality and excellence cannot now reasonably be questioned; and recently Messrs. Chickering & Sons

have made such improvements in Upright Pianos—which have heretofore not been popular in this country—that they can confidently recommend them for refined beauty of tone as well as elegance of design and perfection of finish. These instruments, from their size and form, are suitable for many rooms where a Grand or Square Piano would prove an incumbrance.

To the Messrs. Chickerings the country is also indebted for the introduction of the "Circular Scale," which has contributed as much, certainly, as any other improvement, to the present excellence of the American Piano.

James J. Walworth & Co.'s Manufactory of Steam, Gas, and Water Fittings,

Is a pioneer establishment in its department, and now undoubtedly the largest in New England. Its early history is identical with that of Joseph Nason & Co.'s Manufactory in New York, which has already been alluded to, having been founded, in 1842, by James J. Walworth and Joseph Nason, who were the first in this country to commence the sale of Welded-iron Steam and Gas Pipes, as a separate and distinct business; and who also originated the plan of heating buildings by means of steam, conveyed through small wrought-iron tubes, which is now in extensive use, especially in Factories and other large establishments. The sale of Wrought-iron Pipe, which, at the time when they embarked in the business, did not exceed a few thousand feet per annum, now amounts to many millions of feet.

This firm are also accredited with having been the first to introduce successfully the plan of ventilating buildings by means of Fans propelled by steam, which was applied in the Boston Custom-house, about 1845, and which is now generally adopted in Asylums, Hospitals, and large public buildings. Among the numerous structures, of various kinds, that are now heated and ventilated by apparatus constructed by the firm of Walworth & Co., may be mentioned the Academy of Music in Philadelphia, the Music Hall in Boston, and the President's House in Washington. But probably the largest and most complete work undertaken by them is in the Free City Hospital, of Boston. The aggregate cubic capacity of all the apartments that are ventilated is nearly a million of feet, and this is effected by means of a Fan, that forces fresh air through air-chambers into the registers in the apartments—changing the entire quantity of air contained in the wards at any one time, or supplying its equivalent, every fifteen minutes. A novel method of regulating the supply and temperature of fresh air admitted to

the wards has been adopted, consisting of a double set of flues, one carrying cold and the other warm air, so arranged that the two currents may be combined and mixed at the point of ingress, thus affording the utmost facility for controlling the temperature of the rooms without diminishing the quantity of air required for ventilation. The heating surface of this Hospital amounts to about eighteen thousand superficial feet, and consists mainly of wrought-iron pipes, of one inch internal diameter, placed in large masses, in air-chambers, through which the fresh air passes on its way from the Fan to the registers in the apartments.

But, while Messrs. Walworth & Co. are always prepared to undertake large contracts of this kind, and probably employ a larger force of workmen, experienced in putting up the appliances they construct, than any other firm, their leading business is the manufacture of those numerous articles included in the general term "Fittings." Among these, there are several that are secured to them by patent; of which probably the most valuable is a simple and excellent arrangement for connecting the main and radiating pipes that dispenses with a number of joints, and the consequent liability to leakage. The improvement consists in inserting in the main pipe a branch Tee, or Manifold and Valve, in one fitting—by which at least one third of the labor and material in constructing the apparatus is saved; and as the water can pass without obstruction, it has no place to lodge or freeze. Considerable economy in the use of steam is effected by the adoption of double valves, by which all or only a part of the radiating pipes can be used at pleasure, according to the temperature of the atmosphere and the degree of warmth required. This Patent Manifold is the invention of one of the firm—C. C. Walworth—who has also invented and patented a "Solid Die Plate," and a machine for cutting gas fittings, using three taps at once, now the property of the "Malleable Iron Fittings Co." at Branford, Connecticut.

The firm of J. J. Walworth & Co. is composed of James J. Walworth, Marshall S. Scudder, and C. C. Walworth, who have been associated together since 1853, or the year subsequent to that in which the firm of Walworth & Nason was dissolved. They have two Manufactories, one in connection with the store in Boston, another in Cambridgeport, and also a house in Chicago.

Mr. Walworth is also largely engaged in developing some important and novel improvements in machinery for the working of the Flax fibre of the West. He has invested more than $100,000 capital in this enterprise, which promises to be of great value to the agricultural interests of the Western States.

Gardner Chilson's Stove Works,

Though located at Mansfield, Massachusetts, twenty-four miles from Boston, are regarded as belonging to the city, where the warehouse has been established for more than thirty years. This is probably the best known establishment of the kind in New England, for its proprietor has been remarkably successful in originating new forms of Stoves and Furnaces, which, by their novelty, would attract public attention, and he has not been backward in inviting the critical examination of those who, unsolicited, might overlook their merits.

Mr. Chilson, who deserves a prominent place among the inventors of the country, is a native of Thompson, Connecticut, and served an apprenticeship to Pattern and Cabinet-making, in the town of Sterling. On attaining his majority he established himself at Providence, Rhode Island, from which place he removed to Boston in 1837, and engaged in the business with which for nearly a third of a century he has been identified. His attention was early directed to defects in the generally adopted methods of constructing Furnaces and Ranges, and he applied his naturally ingenious mind to discovering a remedy for them. As early as 1844 he invented and introduced an Air Warming and Ventilating Furnace, which was acknowledged to be a very great improvement upon all Furnaces before constructed, and which received the Prize Medal at the World's Fair held in London in 1851.

But a greater invention than this was made by him not long afterward, and patented in 1854. It consisted in the discovery, after numerous experiments, that the greatest amount of heat, with the least possible waste of fuel, can be obtained by constructing radiators in the form of tapering cones, as by this method the smoke and gases usually wasted or lost in chimnies, are made alike available for heating purposes with the fuel itself. He applied this new principle in the construction of Warm Air Furnaces, and experience as well as philosophy has demonstrated its great practical value. It is found that not only the whole products of combustion, whether gas, smoke, or minute particles, by being confined and compressed, and exposed to the direct action of the fire are necessarily heated intensely and consumed, but the heat, continually impinging or bearing against the tapering surface of the radiators, is concentrated and thoroughly exhausted without any waste. More than twenty thousand Furnaces constructed on this principle are now in use, and it is equally applicable to steam boilers, or wherever it is desired to obtain the largest amount of heat from a given quantity of fuel.

In 1858, he invented and patented a novel form of Cooking Range with a double oven elevated directly over the fire, and self-regulating flue plates, that dispense with the complication incident to dampers. The ovens are so arranged that both or either one may be used at will, and being elevated over the fire, the articles to be baked or roasted are subjected to the heat on all sides equally. Thousands of these improved Ranges are now in use, and their value well attested, while the original cost is said not to exceed those of ordinary construction.

In 1862, he patented an attachment for regulating Fire Drafts, consisting of a Ventilator and Damper combined, and operated together by a single movement of a crank. It is said that by its use a continuous fire may be kept throughout a season by replenishing with fuel but once in from two to six days, according to the size of the heater and amount of heat required.

During the last two or three years Mr. Chilson's attention has been directed more especially to the improvement of Stoves for Offices and Parlors. In 1865, he invented a Stove of a peculiar form, being a Corrugating Radiating Cone resting on a fire-pot, and surmounted by a broad, slightly curved Radiating Disc or Reflector, which forms the top of the Stove. The practical effect of this form of construction is, that the heat is thrown down toward the floor, which it warms for a considerable distance around the Stove, displacing the cold air in the lower part of the room. It has been highly recommended by the Superintendents of Railroads for warming cars, and by others who have used it in offices and manufactories.

Another valuable invention is that of a new Parlor Stove, which retains the heat in the base radiator, thus warming the lower currents of air in a room instead of the heat being let off at the top of the Stove. The lever grate is so arranged that the ashes may be shaken out or the fire let down into the ash pan without making dust in the room. But his latest novelty is a new Cooking Stove, fitted, when desired, with extra hot closets, reservoirs, and all other modern fixtures for economy and convenience. This is an invention upon which he has expended much time and labor in bringing it to perfection, and the result, as we learn from those conversant with such matters, is extremely favorable as respects its economy and efficiency, and the excellence of its manufacture. There are sizes adapted for every requirement, whether for private families or hotels.

All of these Stoves are manufactured at Mr. Chilson's Works at Mansfield, which have a front on the Providence and Boston Railroad of two hundred feet, and a depth of one hundred and twenty feet, with a building in the rear one hundred and ten feet long, making the

total depth two hundred and thirty feet. The moulding floor has a superficial area of eighteen thousand square feet. The castings made here are remarkable for fineness combined with strength, the very best brands of pig-iron only being used. About one hundred hands are employed in these Works. All the operations incident to the manufacture of Stoves and other heating apparatus, from the original design to the final finish, are conducted here under the superintendence of a mind naturally ingenious and improved by long experience.

The Howard Watch and Clock Company

Is the successor of the pioneer establishment in America for the manufacture of Watches by machinery. In 1850, Edward Howard, of the firm of Howard and Davis, pupils of one of the celebrated Willards, manufacturers of fine Clocks and Gold Standard Balances, being determined to test the practicability of making Watches by machinery in connection with a proper system of factory labor, associated himself with David P. Davis, Aaron L. Dennison, and Samuel Curtis, under the style of the Warren Manufacturing Company, and built and fitted up a factory at Roxbury, Massachusetts, where the first American Watches were made.

It was originally proposed to make exclusively Eight-day Watches —and the first one made is still in the possession of Mr. Howard, an accurate and serviceable time-keeper—but this idea was not found practically satisfactory, and the manufacture of Thirty-hour Watches was commenced and adhered to. This enterprise, in its infancy, of course, encountered many difficulties, not only in the want of suitable tools and experienced workmen, but in the prejudices of dealers in Watches and the opposition of importers, whose profits would be diminished by its success. The name of the Warren Manufacturing Company was adopted with the view of concealing the kind of business the Company were doing, or intending to do, until the business had so far advanced as to be able to show some of its productions. When the Works were so far advanced that Watches were being put into the market, the name of the Company was changed to the Boston Watch Company. In 1854, this Company selected a site on the Charles river, in the town of Waltham, and erected a large manufactory, but, by incurring an outlay for buildings, tools, and machinery greater than their capital would warrant, while at the same time the former business of Howard & Davis had become much extended, all the parties became crushed by pecuniary embarrassments, and in 1857 the property passed into the hands of Appleton, Tracy & Co., who carried on the business

for some two years or more, when it was finally incorporated under the name of the American Watch Company.

Mr. Howard returned to the original factory in Roxbury, and abandoning the manufacture of the cheaper kinds, devoted himself to the higher grades, and, though beset with many difficulties at first, persevered until he has achieved a triumph that must be not only gratifying to himself, but a source of pride to every true American, whose sympathies are naturally enlisted in behalf of a worthy pioneer, deserving of success. His name is now, wherever known, regarded as a guarantee for fidelity of workmanship, and the demand for his Watches exceeds the present facilities for supplying it.

His factory in Roxbury is built in the form of a hollow square, one hundred feet on each side, four stories in height, and employs two hundred workmen. A plot of ground has recently been purchased for the erection of a new and much larger manufactory, capable of accommodating one thousand employees. There are few, if any, industrial establishments more interesting than a manufactory of Watches by machinery. We have carried our readers through many where their wonder would be excited at the size of the machines employed—the ponderous lathes and massive planers of the Marine Engine Shops—but here the tools and machines are miracles of minuteness. The drills for probing the orifice in the jewels, to admit the shaft on which the wheels revolve, are almost as fine as the filaments of a spider's web. The gauges, which are used to measure the correctness of the aperture, are so delicate as to indicate the thirtieth part of a hair or the ten thousandth part of an inch. The cutters, which are employed to form the teeth of the scape-wheel out of the solid metal, are sapphires, ground down to the proper shape in diamond dust and oil, and then inserted in small wheels or discs, and so fine do they cut that the chips which they can remove are only the thirtieth part of the thickness of a hair, and this infinitessimal portion can be taken from any part of the tooth, so easily are their motions controlled. A coil of wire, weighing a pound and worth about $5, is divided and worked into three hundred thousand screws, worth $3,600. These screws, which, to the naked eye, resemble particles of rifle powder, are finished in all respects as perfectly as those bolts with which we are familiar, having counter-sunk heads, threads, and grooves for the reception of a screw-driver. The threads, of which there are two hundred and forty in an inch, are cut with perfect accuracy by means of dies, and of a fineness not visible to the eye except with the aid of a micrometer. Many of the tools and machines which are in use in his and other manufactories are the invention of Mr. Howard, and over a dozen persons are constantly kept employed

in making tools to supplant those which are slightly worn, as well as new tools, which are required in a constantly increasing business.

One distinguishing feature of American made Watches is the simplicity of their construction. The fusee and chain, which are found in all English Watches, are dispensed with, the motive power being applied direct, and not dissipated amid a useless complication of machinery. In some foreign Watches there are as many as six hundred different parts, rendering them a perfect labyrinth of cogs and wheels, and this complexity of construction necessarily increases their liability to derangement, which, in the American Watch, is lessened two thirds, and the friction at least one half. Another distinguishing feature which is a necessary result of the mode of manufacture, and which was adopted at the beginning, is the perfect uniformity of parts, by which every Watch of the same class is a duplicate of every other. The European practice of Watchmaking is, to give a few wheels to one workman, a few pinions to another, who fashion them without any uniform guide except experience and manual dexterity, hence, the parts are very rarely interchangeable. In the American manufactories, on the contrary, a large number, say five thousand of the different parts, are wrought by machines in separate departments, and finished in detail, and the pieces are then taken indiscriminately from the several apartments to what in a Locomotive building would be called the "Erecting Shop," where they are put together and adjusted, and being made by an unvarying rule, they cannot fail, unless the machines are imperfect, to fit correctly and accurately. Hence, one result of this perfect correspondence of parts is, that if any one be lost or broken by accident, a duplicate can be obtained from the factory at slight cost, by letter, and any watchmaker can adjust it in its place; thus the great difficulty and expense which attend the repairing of other Watches are avoided.

But, besides these advantages which the Howard Watches have, in common with other American Watches, they have some peculiar to themselves, and secured by patent. One is an arrangement by which the manufacturer is enabled to use a longer and wider main spring than can be employed in the usual way, apply a series of finer toothed wheels and pinions producing an easy and uniform action, and at the same time they are protected from damage by the violent recoil caused by the very common accident of the breakage of the main spring. A main spring may break in these Watches, but the other parts cannot be injured thereby. The Stop works, too, are secured on the bridge or plate of the Watch, on which the force in winding is exerted, and thus the train is relieved from all extra strain, while in Watches where the Stop works are placed on the barrel, the force of winding is applied on

the train, giving an increased and unnatural motion to the balance, and at the same time endangering the teeth and pinions, especially if the divisions are fine and the Watch carelessly wound.

Besides Watches, very fine Clocks are also made in this manufactory, suited for offices and public buildings, and ranging in price from $20 to $700 or more. A Clock made here for the Boston Custom-house cost $2000, and the best are guaranteed not to vary more than two seconds in a year. Mr. Howard, we are informed, is also the originator of the Marble Faced Clocks, for which there is now an extensive demand.

Donald McKay's Ship Yard,

In East Boston, is a famous locality, made illustrious by the genius of its proprietor in naval construction. It was here that some of the largest and fastest clipper ships that adorn the American Marine were fashioned into shape, and were launched upon the waters. The record is a brilliant and extensive one, and includes the "New World" and "Ocean Monarch," of fifteen hundred tons each; the "Staffordshire" and "Empress of the Sea," two thousand tons; the "Sovereign" and "Champion of the Seas," twenty-four hundred tons; the "Star of Empire" and "Chariot of Fame," twenty-two hundred tons; the "Lightning," twenty-one hundred tons; the "Commodore Perry" and "Japan," twenty-four hundred and fifty tons; the "Donald McKay," twenty five hundred and ninety-four tons; and the "Great Republic," forty-five hundred tons, old measurement.

Donald McKay was born at Shelburne, Nova Scotia, in 1809, from parentage of Scottish origin, whose ancestry, in an unbroken line, can be traced back to the fifteenth century. His youth was passed on a farm; but the natural proclivity of his mind manifested itself at an early age, for at nineteen he is accredited with having constructed a fishing-smack of creditable proportions. Within a short time afterward, he was apprenticed to learn the trade of ship-building in New York, at which he served diligently, and after a few years he commenced business for himself at Newburyport, on the Merrimac river Here he built several ships for New York and Boston houses, and remained until 1845, when he removed to his present locality in East Boston.

When the opening of the California trade created a demand for a large class of clipper ships, Mr. McKay set about their construction, and so successfully that his name soon became famous in all commercial ports. He built over fifty of these ships of considerable size, of which

the largest have already been mentioned. The "Great Republic," of forty-five hundred tons register and six thousand tons storage capacity, was launched on the 4th of October, 1853, in the presence of sixty thousand spectators, and attracted attention at every port she visited not only for her great size, but the beauty and symmetry of her model, and the luxuriousness of her decorations. This vessel was subsequently reduced to three thousand tons, old measurement—one deck, which had been partially burnt off, having been removed—but she is still sailing from the port of New York, and performing her duty creditably.

In a little over a year after the launch of the "Great Republic," Mr. McKay had launched eleven other vessels, ten of which were ships of an aggregate of twenty-four thousand six hundred tons, which, at the then estimate of cost of eighty dollars a ton, makes the total value nearly two millions of dollars. Six of these vessels were built for James Baines & Co., of Liverpool, a house extensively engaged in the Australian trade. One of these, the "Lightning," of two thousand two hundred tons burden, was launched on the 2d of January, 1854, and was the first ship built for England by a foreign nation. Indeed, until a few years previous, the British law prohibited the purchase of foreign vessels. The "James Baines," another of these ships, sailed from Boston to Liverpool in the remarkable time of twelve days and six hours.

Mr. McKay, like Steers and Webb, has shown a positive genius in ship-building, and made those radical changes in his models that none but a man of original conception would dare to undertake. His primary idea was to construct vessels for speed and capacity, and in this he fully succeeded. His fleet coursers of the deep have sped from clime to clime, at once the wonder of the world and the heralds of his own fame. California, Australia, China, and the East Indies, have been brought, as it were, to our doors, and by a few months' voyage, their products are landed in our ports. The clipper ships with which his name is identified have effected a revolution in long voyages to distant seas almost equal to that which steam has made in navigation to Europe, and it is probably no exaggeration to say, as has been said by some writer, that "the advantage to commerce, and the renown which has resulted to the American Marine, are more due to the genius and perseverance of Donald McKay than to any other living man."

Mr. McKay has recently returned from Europe, where he gave critical attention to the iron-clad ships of war built by France and England; and has recently written a series of very interesting papers on the subject, in which he makes a scientific comparison between the iron-clad vessels of the United States and those which have fallen under his inspection abroad.

The Hinkley & Williams Locomotive Works,

Located on Harrison Avenue, are entitled to rank among the great Iron Works and Machine Shops of Boston. The organization of the Company, under its present corporate title, dates only from April, 1864, but it may be called the successor of the "Boston Locomotive Works," which was incorporated in 1848, and the works occupy a site where Locomotives have been built since 1840.

The buildings are very extensive, and, with the yards, cover an area of five acres of ground. They are erected in two parallel ranges, which are connected by a building sixty by thirty-five feet, and used as a Copper and Sheet Iron Shop. The Machine Shop, which is new, is two hundred and ten feet long by sixty feet wide. All the shops are provided with appropriate tools of modern construction, and, in busy seasons, furnish employment to several hundred men.

These Works are a monument to the energy, foresight and practical genius of their founder—HOLMES HINKLEY, Esq., the late President of the Company. His history is the record of an eventful life, abounding in remarkably successful achievements, mechanical and financial, and equally unexpected and startling reverses. The son of very poor parents, he was early inured to hardship. At an age when others are at school, acquiring the rudiments of an education, he was compelled to go out into the world, and seek his own means of sustenance. He first learned the trade of carpenter, and, in early manhood, plied the implements of that craft. Subsequently, he was employed as a pattern-maker of machinery for factories, and here acquired a sufficient knowledge of mechanical principles, to venture upon the construction of machinery. Accordingly, in 1826, he rented an old building on Lenox street, Boston Neck, and, with his accumulated earnings—a capital of two hundred and fifty dollars—he began his career as a machinist. His first bars of iron, he carried on his shoulders from the store, where they were purchased, to his place of business. Among his early attempts at Machine-making, was the construction of a Stationary Steam Engine, which, when finished, was the third one built in the State of Massachusetts. It was an entire success, and the demand for his engines so rapidly increased, that, previous to 1840, he had constructed a larger number than any other machinist in New England.

In 1840, he undertook to build a Locomotive upon a somewhat different model from any then in use. His friends sought to discourage him from the undertaking, while there were not wanting those who sneered at what they termed his "reckless attempt." But he worked on, cheered only by his own faith in ultimate success. When this machine

was completed, it was difficult to find a purchaser; but, finally, the Eastern Railroad bought it, and placed it on the Portland end of the line. He proceeded at once to build four more; and before they were completed, the success of the first Locomotive was so well assured, that all of them were ordered, and, in two years, ten were contracted for and delivered. From this time until 1848, Mr. Hinkley, in connection with Mr. Freeney, under the style of Hinkley & Freeney, made the building of Locomotives his principal business. During this period, the Hinkley Engine attained a reputation and popularity second to none in the country.

In 1848, a Company was organized and incorporated under the title of the "Boston Locomotive Works," with Mr. Hinkley as President and Superintendent. The buildings were greatly enlarged, the Locomotive shop was extended to a length of more than four hundred feet, and the business so rapidly prospered, that, in 1857, the property of the Company was valued at upwards of a half million of dollars. At this time, Mr. Hinkley resigned the superintendence of the details of the business into the hands of younger men, who, however, were found inadequate to the task of piloting the vessel through the breakers of that stormy period. Almost in an hour, he saw the structure which he had reared by years of faithful labor, overwhelmed and buried in a mass of ruins. He was now sixty-six years of age; and few men of that age would have had the courage to undertake the task of remedying the consequences of so great a disaster. With true Yankee "pluck," however, which cannot fail to excite respect and admiration, he determined to make the attempt. He took a lease of the works from the assignees, and associating his son-in-law, Rev. Adams Ayer, with himself, he proceeded to gather up, by a slow and toilsome effort, the scattered threads of business. And now the advantage of an unsullied character, and a life of sturdy integrity, became manifest. When the iron merchants, with whom the corporation had dealt, and who had suffered largely from its failure, were asked to open a line of credit, they cheerfully assented; and one firm freely offered to supply whatever was needed, at a discount from the regular prices, in order to aid, as they said, so deserving a man. The managers of the various railroads in New England, who, in the meanwhile, had carried their orders elsewhere, brought again their work of repairs to his shops, and the close of the year showed a very successful business.

In the Spring of 1861, Mr. Jarvis Williams, who had formerly carried on the Foundry business in Biddeford, Me., and who had won for himself an honorable name for enterprise and integrity, came to Boston to re-establish himself in the same line of business. A survey of the

prospects, in connection with the works then in operation, induced him to unite with Mr. Hinkley in the purchase of a part of the premises, formerly owned by the Boston Locomotive Works, when a copartnership was formed, consisting of Messrs. Holmes Hinkley, Jarvis Williams, Daniel F. Child, and Adams Ayer, under the style of Hinkley, Williams & Co., for the manufacture of Locomotives, Boilers, Tanks, Castings, and machine work generally.

Soon after the formation of the copartnership, the attack was made upon Fort Sumter, which inaugurated the war of the rebellion, and caused a general stagnation in business. For many months, the prospect was very dark. It was not long, however, before it became manifest that the Government would need all the assistance it could obtain from all the foundries in the country, and the firm mentioned accepted a contract, from the Naval Department, for two thousand shells, though, at that time, it was not expected that the order would be increased. Accordingly, preparations were made, by putting up new furnaces, and the erection of additional buildings, to supply ordnance and projectiles as they might be needed. The war proved to be of longer duration than was expected, and, during its existence, the firm supplied upwards of fifty thousand shot and shell, and more than one hundred guns of ten and eleven-inch calibre.

In 1863, Mr. Hinkley, foreseeing the future wants of the Railroads, proposed to his partners an extension of their works, and even offered to erect a Locomotive Shop on his own account. The wisdom of his proposition was not at once perceived; but, after a time, an arrangement was made to carry out his plan, which resulted in the organization and incorporation of "The Hinkley & Williams' Works," April, 1864. Since that date, the managers of the works have confined their operations to the manufacture of Locomotives, Boilers and Railroad Machinery. They construct a Boiler, invented by Mr. Hinkley, which is very favorably spoken of for its great economy in the use of fuel. Their Locomotives, to the number of several hundred, are in use on many railroads; and, in point of workmanship, are equal to any made in this country.

Mr. Hinkley was chosen the first President of the new Company, and held that position until his death, February 8th, 1866. Since his decease, the organization is as follows: ADAMS AYER, President; JARVIS WILLIAMS, Treasurer and General Manager; HENRY L. LEACH, Superintendent; who, with DANIEL F. CHILD and FRANCIS L. BULLARD, constitute the Board of Directors.

Welch & Griffiths' Saw Manufactory,

In Boston, is one of the oldest and most celebrated of these establishments in the United States. It is entitled to the credit of having been the first to demonstrate the practicability, in skilful hands, of manufacturing large Saws in this country, and supplying the pioneers, engaged in the work of building up a new country, with an implement second only to the axe in importance.

Previous to 1830, we were almost entirely dependent upon foreign manufacturers for a supply of saws; though the imported were so imperfectly adapted for the service they were required to perform, that the management of them was an exceedingly difficult, and, on the part of the circular saw, a dangerous operation. At that time, there were not, probably, more than three Saw manufactories in the United States, and the value of the saws, made by them, did not exceed, it is estimated, five thousand dollars per annum. In that year, Mr. Charles Griffiths, who had been engaged in the manufacture in Great Britain, came to the United States, and determined to establish himself in Boston, though the attempt to make, in this country, circular saws, especially, was pronounced visionary, and his failure predicted. Within a short time after this, he was joined, in the enterprise, by Mr. William Welch, establishing what is now the well-known firm of Welch & Griffiths.

For a long time, the obstacles in the way of success were numerous, as there was a strong prejudice existing in the minds of many against American Saws, which it was difficult to combat. It required great perseverance to introduce these "new goods" into the market, and unrivalled skill in manufacturing an article adapted to the wants of the country; but Messrs. Welch & Griffiths succeeded in both, and proved themselves equal to the task, not only of manufacturing a saw that would cut through the hardest oak that ever grew, but of overcoming what was then the still more formidable obstacle of prejudice against American manufactures.

From 1830 to the present time, a period of thirty-seven years, this firm have been steadily progressing and extending their operations; and there are now very few first-class mills, in the United States and Canadas, that are not supplied with their saws, whose reputation has become as familiar as household words.

Among the many valuable improvements introduced in the processes of saw manufacturing, by Messrs. Welch & Griffiths, we may allude to their patent machinery for grinding both surfaces of the saw at one and the same time, and of which they are the sole proprietors. By

this method, they are enabled to grind Circular Saws, from two inches to eighty-four, with the greatest accuracy and precision. The saws can be made perfectly even in thickness, so that there will be no variation in any part; or can be gradually increased in thinness, from the centre of the saw to the edge of same, as may be desired; and, as there are no thick or thin spots in saws ground by this process, the friction on the surface of the saw is uniform; consequently, it will remain stiff, require less set and less power, will saw smooth, save lumber, and not be liable to become untrue.

It is greatly to the credit of this firm that, though they have acquired a reputation which would enable them readily to sell an inferior saw, they have always maintained the quality of their products fully up to the highest standard.

Chubbuck & Sons' Machine Works,

At Roxbury, are by no means remarkable for the extent or peculiarity of the buildings, which consist simply of a two-story frame structure, ninety by thirty-five feet, with a boiler shop in the rear, eighty by thirty feet. These are well filled, in fact crowded, with such tools and appliances as are ordinarily found in machine shops employing about fifty hands; but neither in buildings nor in tools is the concern more than a fair representative of many similar Works in New England and in other portions of the country. Nevertheless, Chubbucks' Works are of national importance, and all who have difficult problems to solve in mechanics, regard them as the home of the prophet, the Mecca of America.

The founder and senior member of this firm has the reputation of being one of the most skilful machinists of which our country, though fruitful in men of this class, can boast. He felt at an early age such an irresistible disposition toward the mechanic arts, that, it is said, when a mere boy he walked a hundred and fifty miles to obtain a situation in a machine shop. After much disappointment he obtained entrance into the shop of Mr. Elias Strange, of Taunton, where, though not regularly instructed, his mechanical talent was so far developed that in little more than a year he was intrusted with the repairing of the machinery of a cotton mill which had been run by Mr. Bigelow, of Loom notoriety.

After the accomplishment of that work, being only nineteen years of age, he was made Superintendent of the Machine shop of the Boston

Ironworks Company; and after several years' service there he was for a considerable period connected with the repairing and running of engines on the Boston and Providence Railroad.

Having now become too decidedly a master of his profession to remain an employee, he, in company with Mr. J. C. Pratt, opened in 1843 the first regular Machine Shop in Roxbury. In 1847, Mr. Pratt was succeeded by Mr. B. F. Campbell, establishing the firm of Chubbuck & Campbell.

As early as 1844, Mr. Chubbuck devised the form of engine known as the "Chubbuck pattern," or "Gothic pattern," of which large numbers are now made every year by himself and others. He also originated a new form of Governor, substituting a Fan for the ordinary Ball Governor, which has been applied to a large number of engines and found to perform the offices of a regulator with remarkable efficiency. This Governor has been improved upon by one of his sons, who in 1859 received a patent for his invention. After the dissolution of the firm with which he was connected, Mr. Chubbuck, in 1859, erected his present Works, which are located near the Boston line and near Chickering's mammoth Piano manufactory. They were designed mainly for the building of stationary engines and boilers, but so widely has Mr. Chubbuck's fame spread as a skilful mechanic, that they are resorted to by all who have something novel in machinery to construct, and at times are a complete curiosity-shop. Of the Engines built here, those of the Boston Belting Company and Boston Lead Company, of one hundred and twenty and one hundred and sixty horse-power capacity, are among the largest; and much of the machinery of both these establishments was designed as well as constructed by him. In the day when the plain tubular boiler, invented by Mr. James Nason, was not thought likely to come into general use, the first one made in the vicinity of Boston was built in the shop of Chubbuck and Campbell. Though the constructing of Stationary Engines may be called the prominent item in the business done at Mr. Chubbuck's Works, his usefulness in his profession is not to be measured by his achievements in this direction. Under the head of "miscellaneous," his ingenuity is continually serving as the handmaiden of other men's purposes. If an engine become mysteriously inoperative, or perhaps broken down, Mr. Chubbuck is the man who is relied upon as a final resort to rejuvenate it; if a manufacturer conceives a new result in his business, Mr. Chubbuck is the man who is expected to adapt it, and invent means and machinery for its accomplishment. The first large and important Paper-Hangings Printing Machine ever made in the vicinity of Boston, an eight-color machine, was made and largely de-

vised by him. The Rubber machinery in use has had the benefit of his mechanical genius. Among his latest inventions is a new Elevator, very simple and effective, in which the friction of a wooden roller serves a purpose hitherto accomplished by a more complicated apparatus.

Mr. Chubbuck's sons, who are associated with him in the firm, share their father's fondness for intricacies in machinery, and are efficient coadjutors in the business.

The Adams Sugar Refinery,

In South Boston, is, with one exception, the largest in the United States, and in its appointment is one of the most noteworthy in the world. The ground on which it is built, containing about ninety thousand square feet, was rescued from the sea by the enterprise of Seth Adams, Esq., and, though the offspring of individual effort, the structure resembles in vastness and solidity those erected by the great corporations at Lowell and Lawrence.

In the summer of 1858 the work of building the sea wall was commenced; twelve thousand piles were driven, and inside the sea wall a filling of five thousand squares of gravel was deposited, over which a heavy granite foundation was laid. On this the superstructure of brick was erected, the walls being three feet in thickness at the base and ninety feet high, requiring the enormous quantity of five millions five hundred thousand brick—in the laying of which were used forty cargoes of sand, four thousand five hundred casks of lime, and fifteen hundred casks of cement. The main building is one hundred and eighteen feet long by eighty feet deep, and nine stories in height. The floors, which are either of iron, stone, or brick, are supported by one hundred and sixty-two large iron columns. In addition to the main building, there is a storehouse for raw Sugars two hundred feet long by fifty feet deep; also a storehouse, five stories high, for Refined Sugar; a charcoal house, one hundred and thirty by forty-eight feet, with a chimney one hundred and twenty feet high; a detached boiler house, sixty-four by fifty-four feet, with a chimney one hundred and twenty feet in height; and several other buildings of various sizes for purposes incidental to the establishment.

The main building is divided by a brick wall into two separate departments, the first division, which is eighty-six by fifty-six feet, being devoted exclusively to the Sugar after it leaves the pans. The Raw Sugar is first melted, then conveyed by pipes into the upper story,

where it is boiled to a certain degree, then passed through the various filters and finally received into the large vacuum pans, where the syrup is boiled to a granulating point, then drawn off into moulds and distributed over the different floors. These floors are of iron, made in the form of gutters, over which the moulds are placed to drip, the syrup running from them being conducted by pipes into tanks in the lower story. This arrangement is peculiar to the Adams Refinery, and dispenses with the tedious method used elsewhere of placing pots under the moulds.

The other division of the main building, which is eighty by twenty-four feet, contains all the apparatus pertaining to the first boiling and filtering, including thirty-six filters, each twenty-four feet high and four feet in diameter, and each requiring ten thousand pounds bone coal to fill it. In the upper story are eleven "blow-ups," in which the Sugar undergoes the process of clarification. The charcoal house is in the rear of the floor containing the filters, and is provided with every convenience for fermenting, making, and burning the char.

The capacity of this Refinery is seventy tons of Raw Sugar per day, which will produce of Refined Sugar about five hundred barrels.

Seth Adams, the projector of this Refinery, is one of the remarkably enterprising and successful self-made men of New England, whose biography is well worthy of record. He was intimately identified with the invention and introduction of the Adams Printing Press, one of the most valuable contributions which genius has made to the progress of printing in America. He is himself an inventor, and has received four patents for improvements in Printing Presses, Ship Windlasses, and Steam Valves. Born in Rochester, New Hampshire, in 1807, and while a boy left fatherless and poor, he was early apprenticed to learn the cabinet-maker's trade. After he had attained his majority he removed to Boston, and worked for more than a year as pattern-maker in a machine shop, where, by close observation, he acquired sufficient knowledge of the principles of mechanics to justify him in investing his earnings—a few hundred dollars—in the machinery business; and in 1831 he commenced for himself. In 1833 he became interested in the printing press which his brother Isaac had invented, and which was then being manufactured by two different concerns, whose interests he subsequently purchased. In 1836, after his brother had invented his famous power-press, he erected a new machine shop and embarked largely in manufacturing these presses, paying the inventor a royalty on each one made. Not long afterward the interests of the two brothers became united, establishing the firm of I. & S. Adams, which continued until 1856, and proved a remarkably fortunate and pecuniarily profitable copartnership.

In 1849, in consequence of the failure of a firm of sugar refiners who were indebted to him for machinery and cash advances, it became necessary for Mr. Adams to purchase the property in order to secure himself from loss. This led to his embarking in the Refining of Sugar; and though he had no previous acquaintance with the details of the business, he by study and application soon acquired information that enabled him to produce Sugars that for quality ranked in the market scarcely second to any. In 1858 the old Refinery was destroyed by fire, and in the same year he commenced building the great Works which have been described, and which were ready for operations in 1859.

Mr. Adams has been a member of the city councils, and board of Directors of public works, of Boston, and is distinguished for his interest in whatever concerns the welfare of his fellow-citizens. Some years ago the Bowdoin College, in Maine, conferred upon him the honorary degree of Master of Arts, and recently he has given a considerable sum to enable them to enlarge their buildings. Though afflicted for many years with impaired health, he has accumulated by industry and foresight a fortune of more than a million of dollars.

J. R. Bigelow's Paper Hangings Manufactory,

Is the largest establishment of the kind in New England, and, with one or two exceptions perhaps, the largest in the United States. The main building is one hundred and sixty feet long, four stories in height, and of various widths, from forty to eighty feet. The Hand Printing Department occupies a separate building one hundred and fifty by fifty-eight feet, and there are also extensive frame buildings, and a stone storehouse fifty by thirty-five feet. The entire establishment has an area of nearly two acres of floor room, and gives employment to over two hundred operatives.

Mr. Bigelow's connection with the Wall Paper manufacture antedates the modern application of machinery in the various processes, which has so cheapened the product that it is now possible for the humblest citizen to ornament his dwelling as handsomely, and with the moiety of the cost, as a noble man was able to do two hundred years ago. When Mr. Bigelow embarked in the business, in 1841, all the wall paper produced was made by what is called the hand process, which was the only one known. In 1843, he introduced and perfected machines for printing two colors, and, in 1853, got up—what is believed to have been—the first successful machine in this country for printing six or more colors at one operation. Since that time machines

have been introduced—on the same principle—to print twenty colors. With the introduction of machines for printing came the necessity of a process for continuous hanging up of the paper and rapidly drying the colors. The quick working of the printing machine having outstripped the more primitive method of hanging up the paper by hand, and drying it simply by the atmosphere, it became necessary to introduce a more expeditious means of drying that should compete with the printing machines, and thus keep them in constant operation without increasing—to any great extent—the territory of the factory, and this Mr. Bigelow accomplished by introducing a series of air chambers—heated by steam pipes—for the paper to pass through. This arrangement—with the invention of machinery for taking the paper from the machines through these hot air chambers as fast as it could be printed, consummated a new era in the manufacture of Paper Hangings, and has been the direct means of reducing the prices to the present low rates, which are within the means of all classes, and, at the same time, making this one of the staple products of the country. Printing paper by the hand process—as it was done twenty-six years ago—was a long, slow, and expensive method; for, in the same space of time, and with the same number of operatives that could print one thousand rolls, twenty thousand rolls can now be produced by the new mechanical method, and in style, finish, and color, the goods now made are very superior. Only a few years prior, the paper was made in sheets, about thirty inches long, and pasted together before printing, but for the last thirty years it has been made in bundles containing from one thousand to two thousand yards. Twenty-five years ago it was quite a matter of conjecture whether this branch of manufacture could be made a staple and self-sustaining one in this country; our markets—up to about that time—having been supplied almost entirely by importations of French and English Paper Hangings. The manufactories in this country were then in their infancy, with small resources and with so little encouragement that, out of about twenty persons and firms who were then engaged in this business in the New England States, Mr. Bigelow is the only representative manufacturer in those States at present.

Mr. Bigelow is also connected with the firm of J. R. Bigelow, Hayden & Co., Boston, and all the goods made at his factory are sold at their warerooms.

The Boston Rubber Shoe Company—E. S. Converse, Treasurer,

Is one of eight incorporated companies, in the United States, that are engaged in the manufacture of Rubber Boots and Shoes.

The manufacture of Water-proof Shoes from India Rubber was, in the beginning, like most infant enterprises, attended with many difficulties. It is true that India Rubber, or Caoutchouc, was used by the natives of the tropics, for a variety of purposes, long before its qualities were known to Europeans. It was moulded into water-proof boots, rough and uncouth, indeed, in appearance, and with fragments of the clay model often adhering to the inner surface; willow baskets were smeared with the gum, rendering them capable of holding water; it was shaped into flambeaux, which enabled the natives to thread the narrow foot-paths of their forests in the night, to light up their rustic villages, and to reveal to the fisherman his finny prey. But the projectors or pioneers in the manufacture in the United States aimed at producing something very different from the clumsy and unmanageable affairs, imported from Para in 1823, which softened in summer, and, whenever brought from the closet for use in the winter, required a preliminary process of warming, to overcome their iron-like rigidity. They aimed at an article which should commend itself for all of the useful, and none of the objectionable, qualities of the Para shoe; which should be not only water-proof, but shapely in form and beautiful in finish; though they probably did not foresee the late improvement which combines with these the qualities of ventilation and warmth.

With every step of progress, fresh difficulties seemed to arise; and every difficulty overcome, simpler methods of accomplishing the same result were discovered. Thousands of dollars were expended in experimenting with costly chemicals, to produce a result which could have been attained with cheaper materials, and by a simpler process. Machinists invented devices and obtained patents, which succeeding inventions rendered useless. Costly machines were constructed, to accomplish a definite purpose, or overcome a special difficulty: of this nature was the "Friction Machine," the joint invention of Francis D. Hayward and John C. Bickford; a machine, we may remark, which has never been superseded, and which every Company, that uses coated cloth, finds indispensable; the "Heel Machine," by Daniel Hayward, for the manufacture of solid heels, curing them under a pressure of many tons; the "Burring Machine," which roughens the concave upper portion of the heel, so that the cement may be more efficacious in attaching it to the sole; the "Rough-soling Machine," the invention of Christopher Meyer,

Esq., of New Brunswick, N. J., which *diamonds* the bottoms of the soles, and stamps them in relief with the device of the manufacturer.

From obstacles incidental to the starting of any branch of manufacturing by processes not well understood, the organization which was superseded by the Boston Rubber Shoe Company, failed to be remunerative to the Stockholders. A few of them, however, having faith in their final success, purchased the stock from those holders who were willing to part with it, procured an increase of capital, by Act of the Legislature of Massachusetts, reorganized, and determined to conduct the business of the Corporation by more direct and responsible agents. As a means to that end, they induced Mr. E. S. Converse to relinquish his other business, and devote his entire attention to the management of the affairs of the Company, as Buying and Selling Agent, and as Treasurer. Such confidence was placed in his ability, that almost unlimited power was given him, and the result vindicated the wisdom and propriety of their course. The "Boston" goods began to have a good reputation in the market, and to compete successfully with those of longer-established factories. The dark days of 1857, which involved so many business firms of repute in insolvency, obscured, for a time, the rising Company; and, to add to their embarrassment, the price of raw material advanced enormously; but the temptation to tide over, by the use of inferior rubber, was withstood; the financial ability and resources of their Treasurer carried the Corporation safely through the crisis, and it came out of the trial with an established credit, and a manufacturing reputation second to none. For the first time in its history, dividends were paid to Stockholders.

During the war, the demand thereby occasioned for blankets, ponchos, rubber overcoats, haversacks, tents, etc., was so great, that the inducement to Companies, which were already in possession of the requisite machinery, to manufacture such articles, was strong. Moreover, the labor, in comparison with that expended in producing boots and shoes, was light, and the profits large; while the trade in shoes was much curtailed, and the business greatly unsettled by the war, from constant changes in houses in the West and elsewhere. The Union Rubber Co. of New York, however, had obtained from Mr. Goodyear the exclusive right to use his process in the manufacture of Clothing. Some manufacturers attempted to ignore this fact, and proceeded to contract with the Government to furnish supplies of the articles named. Apparently successful in evading the many legal decisions which had established the validity of the "Goodyear Patent," and the consequent right of Mr. Goodyear to dispose of it as seemed most proper, it was not until payment was expected on account of the contracts that the infringing

parties found that there was a serious obstacle in their path. The Union Rubber Company had quietly estopped all payments on such contracts, unless the parties furnishing such supplies could produce a written permit or order from them. The only course that remained was to attempt some compromise with the Company whose rights had been invaded, which could usually be effected upon terms not unreasonable, in view of the circumstances. The managers of the Boston Rubber Shoe Company regarded the matter, in the outset, from a different standpoint. They at once conceded the justice as well as legal right of the Union Company to the exclusive control of such manufactures, but signified their desire to be remembered, in case that Company should obtain contracts for, or Government should require larger supplies, in a given time, than they could furnish. This honorable procedure was met in a similar spirit by the managers of the Union Company, and thousands of blankets were manufactured at the works of the Boston Company, few of which failed to pass the rigid inspection of the United States officials.

Upon the conclusion of the war, the legitimate business of the Corporation was resumed. The works were enlarged by the erection of two buildings of brick and granite, and several improvements were introduced in the processes of manufacturing Boots and Shoes. The improved boots, designed especially for use in the newly-discovered mining territories, were in greater demand than they could be produced. The high prices of leather boots and shoes rendered the cheaper rubber no longer, as formerly, a luxury, but a necessity; and they are now largely used by a class of people whose scanty earnings compel them to practise the strictest economy.

The goods of the Boston Rubber Shoe Company having, for a long period, had a reputation equal to the best in the American market, this Company shared in the general prosperity, and the Stockholders are being rewarded for their confidence in the managers whom they selected.

As we have stated, there are but eight incorporated companies, in the United States, engaged in the manufacture of Rubber Shoes; but these have such facilities for manufacturing, that they could, at any time, overstock the market, and the competition between them prevents the consumer from being charged an exorbitant price. The day for large profits in this manufacture has, contrary to current opinion, passed by, and the monopoly that is said to exist in this branch is, in effect, only nominal.

The Downer Kerosene Oil Company—Samuel Downer, President,

Is notable for the extent of its Works in South Boston, and at Corry, Pennsylvania; and especially for the fact, that its products were the first that became extensively known to the public, and performed an important part in popularizing Coal Oil as an illuminator. A brief history of the introduction of this remarkable material may not be inappropriate in this connection.

As early as 1850, a Mr. Luther Atwood, a natural chemist, and self-educated, and then in the employ of the late Dr. Samuel R. Philbrick, discovered a lubricating principle in the coal tars of the gas-houses, for which he obtained a patent, under the name of Coup Oil. Like many other new discoveries, although possessing merit as a lubricator, it was only partially successful, and large sums of money were lost in the costly efforts made to bring it to perfection. After the failure of these efforts, the parties in interest next proceeded to the manufacture of the asphaltum of the celebrated Pitch Lake, in the Island of Trinidad; and although that article had very decided merit, still, from the unhealthiness of the climate, and other difficulties, the project was abandoned, and with great pecuniary loss. It was at this time, 1857, that Messrs. Luther Atwood and Joshua Merrill, who were at that time engaged in the erection of a Coal Oil Factory at Glasgow, in Scotland, had their attention turned to the light oils of coal as an illuminator. Mr. James Young, of Bathgate, Scotland, had in 1850 obtained a patent for their manufacture from coal, but his attention had been principally directed to their heavy ends as a lubricator, and for its paraffine. The light ends as an illuminator had been offered for sale both in Europe and America, but they were of such an ordinary appearance, and had such an intolerable odor, as to prevent their use in families. It was at that time, and in Scotland, that Mr. Atwood purified those oils light and sweet, and they were the first ever so purified that were offered to the public. Their success was immediate, and their extension all over the world very rapid. These experiments on the hydro carbons of the coal series had now been continued for over five years; their manufacture then was intricate and dangerous, and accompanied with severe destruction of machinery, and loss by frequent conflagrations; and with the exception of the Boston Works of Mr. Downer, all had been abandoned from these causes. Illumination had became the principal idea, and lubrication and paraffine secondary; but as the whole manufacture was entirely new, with no help from books or experience, the task of creating works to meet the now

rapid call, and the selection of material to make it from, called into exercise all the mental and physical powers of those engaged in it, as it was found that those bitumens which were the best adapted for lubrication were the most unsuitable for illumination; and only after much research and experiment, it was discovered that the Albert mineral of New Brunswick, the Boghead shale or coal of Scotland, and the Brackenridge cannel of Kentucky, were the most desirable.

Immediately after the return of the projectors from Scotland, Mr. Downer commenced his present works at Boston, which were put under the superintendence of Mr. Joshua Merrill. The process of refining, then a secret, was also imparted to the New York Kerosene Oil Co., of New York, for a royalty, and Mr. Luther Atwood took charge of their Works. In the following year the Portland Kerosene Oil Works were built, under the direction of Dr. Philbrick and Mr. William Atwood (who, with very much impaired health, had just returned from their expedition to Trinidad), and these three factories, after expending nearly a million of dollars on their works, supplied the community with over a million of gallons of Illuminating Oil during the second year of their existence, without being able to supply the demand of the public.

In 1861, the discovery of the flowing wells of Oil Creek, Pennsylvania, was made. The first one was struck in the early summer of that year; and within four months later, the production was eight thousand barrels per day, of which the larger part was suffered to flow into the creek, with but little effort to save it, as there was then no market for it. The price fell to the nominal one of twenty to forty cents per barrel. The region was then secluded, and but little visited—with poor, and much of the time impassable roads—and covered with a dense forest, interspersed with small and poorly-cultivated farms. It was under these circumstances that Mr. Downer felt the necessity of again attempting another enterprise. At first it was proposed only to work the middle portions of the product, using the first and last ends for fuel, or flinging them away; and Works near the wells were deemed essential, or almost absolutely necessary. He purchased a farm at the then terminus of the Atlantic and Great Western Railroad, and on which and the surrounding hills the primeval forest had barely been disturbed; and here, under the superintendence of Mr. William H. L. Smith, then of Boston, but now Mayor of the new city of Corry, was commenced, early in the autumn of 1861, their present extensive Works. The mechanics were all brought with them from Boston, and they immediately commenced clearing the forest, erecting temporary buildings for the workmen, laying out a brick yard, building

a machine shop and sawing and planing mill, and the Oil Works (which by the winter of 1862–3 were sufficiently advanced to manufacture Oil), and substantial framed houses ready for the workmen, who, with their families, numbered a population of five hundred people. This was accomplished only at the expense of much hard labor and discomfort, for the forest was very dense and heavy, and much of the soil a stiff clay, which required extensive surface-drainage to build the roads and carry off the surface-water of the rains, and the numerous rivulets from the neighboring hills; but at the elevation of fifteen hundred feet above tide-water, the climate was clear and bracing, and proved very healthy. Since the beginning of the enterprise, the increase of population has been constant, and now the city of Corry contains about seven thousand inhabitants, and is the seat of many manufacturing establishments of various kinds. It is the junction of four railroads—the Atlantic and Great Western, the Philadelphia and Erie, Buffalo and Oil Creek Cross cut Railways; and it is the great northern outlet of the Oil Region of Western Pennsylvania.

The rapid extension of the oil product is one of the marvels of the present century. Though only ten years have elapsed since its success as an illuminator has been established, its annual production is now ten times larger than that of the whale fishery when in its zenith it employed between seven and eight hundred vessels. It is a prominent article of export to almost every part of the European continent; from three to four hundred manufacturing establishments, some of them of great magnitude, are employed in its production and purification, and towns, and even cities, are the outgrowth of its discovery.

The Works of the Downer Kerosene Oil Company are all built of brick, in the most substantial manner, and fire proof, and in both places cover about seven acres of ground. They consume nearly four millions of gallons of crude petroleum annually, and produce an article that has no superior for its entire safety, the brilliancy of its light, and the perfection of its purification. It has been the constant aim of Mr. Downer, and those associated with him, to maintain the excellence of their products, without regard to the expense necessary to accomplish it, and they have been rewarded by the reputation which their brand has obtained in all markets. Their Works in Boston have been continued in active operation through all the vicissitudes, and rapid, and at times disastrous fluctuations incidental to the new business, and with the branch in Corry, which is a Refinery as well as a place of deposit, are together accomplishing the object of their erection in supplying consumers with an illuminator safe, cheap, and brilliant.

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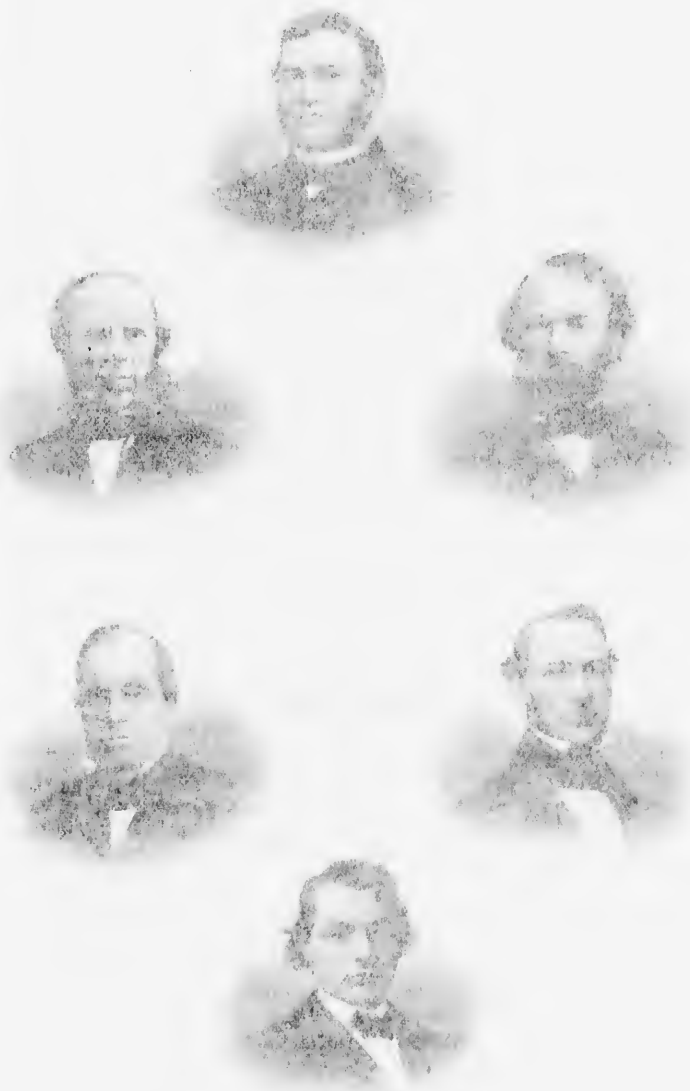

MANUFACTURES OF LOWELL.

LOWELL, twenty-six miles northwest of Boston, has been called, not inappropriately, the "Manchester of America." The history of the first purchases made here in 1821, with a view to the establishment of manufactories, has already been alluded to in this work. In January, 1866, the city contained a population of 36,876 persons, 22 churches, 45 school-houses, 5,324 dwellings, 7 Banks, with an aggregate capital of $2,350,000, besides 4 Savings Banks having an aggregate deposit of $4,000,000. The distinguishing characteristic of the city, however, is its immense Cotton and Woolen Mills, which consume, weekly, over 800,000 pounds of Cotton, and nearly 100,000 pounds of Wool.

The MERRIMACK MANUFACTURING COMPANY, which commenced operations in 1823, has six Mills and a Print works, a capital stock of $2,500,000, runs 88,960 spindles, 2,313 looms, employs 1,500 females and 620 males, and produces 450,000 yards of Prints per week. This company has been especially successful in the selection of their patterns, which are distinguished for neatness, comparing, in all respects, favorably with the best made in England. John C. Palfrey is Agent of the Company, and Henry Burrows is Superintendent of the Print Works.

The HAMILTON MANUFACTURING COMPANY, commenced in 1825, has 5 Mills and a Print Works, a capital of $1,200,000, runs 51,268 spindles, 1,348 looms, and, in 1867, employed 850 females, 425 males, and produces weekly 235,000 yards of Prints, Flannels, Ticks, Sheetings and Shirtings. The Prints are all madders, in from one to six colors, and the weekly produce is about 120,000 yards. O. H. Moulton is Agent of the Company, and William Harley Superintendent of the Print Works.

The LOWELL MANUFACTURING COMPANY has a capital of $2,000,000, runs 12,500 Worsted and Wool spindles, 2,816 Cotton spindles, 258 power Carpet looms, 174 other looms, employs 1,000 females and 450 males, and produces weekly 35,000 yards Carpets, 13,000 yards Sheetings, and 4,500 yards Stuff goods. The Carpets consist of two and three-ply ingrain, and are excellent fabrics of their class, both as respects make and permanence of dye. Samuel Fay is Agent of this Company.

The MIDDLESEX COMPANY has 4 Mills and 3 Dye Houses, employs a capital of $750,000, runs 16,400 spindles, 250 Broadcloth looms, and 50 narrow, employs 320 females, 452 males, and produces weekly 17,500 Shawls, besides Broadcloth, Doeskins, Cassimeres, etc. This Company uses annually 1,000,000 teasels, 1,300,000 pounds of fine

wool, and 18,000 pounds of glue. Oliver H. Perry is Agent of the Company.

The LAWRENCE MANUFACTURING COMPANY has 5 Mills, a capital of $1,500,000, runs 60,432 spindles, 1,564 looms, employs 1,300 females, 350 males, and produces weekly 280,000 yards of Drillings, Printing Cloths, Sheetings and Shirtings, and 6,000 dozen Hosiery. William F. Salmon is Agent of the Company.

The other Cotton Mills are as follows:—

The APPLETON COMPANY—3 Mills; capital, $600,000; spindles, 20,608; looms, 717; females employed, 400; males, 120; weekly product, 130,000 yards Sheetings and Shirtings, Nos. 14 and 20. George Motley has been Agent of the Company since 1831.

The SUFFOLK MANUFACTURING COMPANY—2 Mills; capital, $600,000; spindles, 21,986; looms, 892; females employed, 625; males, 275; weekly product, 125,000 yards Cotton, and 7,500 yards Woollen goods. John Wright has been Agent of the Company since 1842.

The TREMONT MILLS—2 Mills; capital, $600,000; spindles, 25,960; looms, 830; females employed, 608; males, 272; weekly product, 125,000 yards Cotton, and 8,000 yards Woollen goods. Charles F. Battles, Agent.

The BOOTT COTTON MILLS—5 Mills; capital, $1,200,000; spindles, 71,324; looms, 1,878; females employed, 1,020; males, 290; weekly product, 350,000 yards Drillings, No. 14, Sheetings, Shirtings, and Print Cloths. William A. Burke, Agent.

The MASSACHUSETTS COTTON MILLS—6 Mills; capital, $1,800,000; spindles, 62,928; looms, 1,887; females employed, 1,300; males, 400; weekly product in 1867, 540,000 yards of Sheetings, Shirtings and Drillings, No. 12 to 22. Frank F. Battles has been the Agent of the Company since 1856.

The LOWELL BLEACHERY has a capital of $300,000, employs 40 females and 360 males, and dyes 15,000,000 yards, and bleaches 8,000,000 pounds per annum. Frank P. Appleton, Agent.

The LOWELL MACHINE SHOP has 4 shops, a smithy and foundry, employs 900 men, and produces Cotton Machinery, Paper Machinery, Locomotives, Machinists' Tools and Mill Work. Andrew Moody has been Agent of the Company since 1862.

The average wages of the females, employed in the mills at Lowell, was, in 1867, $3.60 per week, clear of board; and of the males, $1.20 to $2.00 per day, clear of board. The medium produce of a loom of No. 14 yarn was 45 yards per day; of No. 30 yarn, 33 yards; and the average per spindle was 1¼ yards per day.

In addition to these great mills, Lowell contains other manufacturing

establishments that employ, in the aggregate, about 2,500 hands. Prominent among them, are the Chase Mills (A. H. Chase, proprietor), which produce 350,000 yards of Fancy Cassimeres, annually; the Belvidere Woollen Manufacturing Company; the Flannel Mills of Charles A. Stott, Faulkner & Son, John Holt & Co., and Livingston & Carter; the Lowell Felting Mills; the Eagle Braid Works; the American Bolt Company; the Machine Shops of S. Ashton, Thomas Atherton, B. F. Stevens and Richard Kitson, builders of English Cotton Lappers, and Shoddy and Waste Machines; the Foundry of Cole & Nichols; the Spool and Bobbin Manufactories of Edward Watson and Parker & Cheney; the Carriage Manufactory of Samuel Convers; the United States Bunting Manufacturing Company; the Wire Gauze Mills of Woods, Sherwood & Co.; the Card Clothing Factory of Howe & Goodhue; and, last, the great Laboratory of J. C. Ayer & Co.

Dr. Ayer's medicinal preparations are, perhaps, more widely and familiarly known in this and foreign countries than the products of any other manufacturing establishment in Lowell. This firm expend, annually, about $60,000 in advertising in newspapers, besides distribu ing, gratuitously, five million copies of an Almanac, which is printed by steam power, in their own establishment, in the English, French, German, Portuguese and Spanish languages. As a consequence of this extended publicity, they require, annually, in their manufacture, 288,000 pounds of drugs, of the value of $457,000; 132,000 gallons of pure spirit, of the value of $130,000; and 354,000 pounds sugar, costing about $60,180—making an annual expenditure, for these three items alone, of $647,180. Besides these, Messrs. Ayer & Co. use, annually, in their establishment, 1,100,000 bottles, 1,720,000 pill boxes, 350,000 square feet of packing boxes, and 91,000 square feet of card board—while the cost of the paper and printing ink consumed is about $64,500 per year. Boxes are sent from this mammoth Laboratory to almost every quarter of the globe, at an annual expense to the firm, for freight alone, of about $20,000; and their expenditure for postage is about $2,500 per year—an amount probably exceeding that of any other firm in Massachusetts.

MANUFACTURES OF LAWRENCE.

LAWRENCE, in Essex County, ten miles below Lowell, is the last of the important manufacturing towns that have been erected on the banks of the Merrimac River. It is but seventeen years since it was incorporated as a town, and it now contains a population of over 17,000.

In 1844 several capitalists of Boston determined to build at this place a manufacturing city, and formed a company with a capital of $1,500,000, which was incorporated April, 1845, as the Essex Company, having the following officers as its first board—Hon. Abbott Lawrence, President; Messrs. Patrick T. Jackson, William Sturgis, Nathan Appleton, John A. Lowell, and Ignatius Sargent, Directors; and Chas. S. Storrow, Treasurer and Chief Engineer. This Company proceeded to erect a Dam at a cost of $250,000 across the Merrimac, giving a head and fall for the whole river of 28 feet, and a water power said to be equal to that at Lowell. From this dam they conveyed water for manufacturing purposes by a canal on the north side of the river, over a mile in length, 100 feet wide at the upper end, 60 feet at the lower, and 14 feet deep in the centre. The canal is parallel with the river at a distance of 400 feet, giving that space for Mill sites.

The first Mills erected were "The Atlantic Cotton Mills," by a company incorporated in February, 1846, with a capital of $1,800,000. The principal building is 570 feet long, consisting of a centre Mill six stories high with two wings five stories high. The Company have 45,000 spindles, employ 1200 operatives, and in ordinary seasons consume 30,000 bales of cotton.

In 1853 the Pacific Mills were incorporated, with a capital of $2,500,000. The factory buildings of this Company were at the time they were erected the largest in the country. The principal building is 800 feet long, six stories high in front and eight in the rear. The river building is 1000 feet long, with wings 310 feet and 225 feet, three stories high. This company has 110,000 spindles, 2,500 looms, and when in full operation employs 3,000 operatives, and produces goods to the value of nearly four millions of dollars annually.

The "Washington Mills," incorporated in 1858, have a capital of $1,500,000, and occupy the premises of the "Bay State Mills," which failed in 1857. The mills form a parallelogram of 1000 feet in length by 400 feet in breadth between the canal and river, and are, it is said, the largest in the world devoted to the manufacture of Fancy Woolen Goods. They employ about 2,300 operatives.

The Pemberton Company's Mills are built on the site of the old Pemberton Mills, which were destroyed in January, 1860, while in full operation, by the falling of the main building and subsequent fire, which involved the death of a large number of operatives. The new mills have been constructed with the most careful regard to architectural strength, and probably no factories in the country excel them in this particular. The present Company has a capital of $650,000, runs 30,000 spindles and 600 looms.

The "Everett Mills," incorporated in 1858, occupy the buildings formerly used as the Lawrence Machine Shop, which are 400 feet long and four stories high. This Company has a capital of $800,000.

The "Lawrence Duck Mill" was incorporated in 1853, with a capital of $300,000, and employs about 250 operatives.

Among the new enterprises of Lawrence we may mention the "Fibrilia Manufacturing Company," and the "Lawrence Woolen Company," which has been incorporated and is about going into operation. The Fibrilia Company is making Printed Carpetings, Rugs and Crumb Cloths, from prepared flax and wool, of which they have sold many thousands of yards.[1]

Besides these companies, Lawrence has three Paper Mills, those of William Russell & Son, S. S. Crocker, and Wilder & Co.; two manufactories of Leather Belting (Edward Page & Co. and E. W. Colcord, proprietors); two Iron Foundries, the "Merrimack Iron Foundry," (Bennett & Josselyn, proprietors), and Edmund Davis & Son; and four Machine Shops, those of Albert Blood, J. C. Hoadly & Co., Webster, Dustin & Co., and Henry Arnold. Patent Fliers for cotton machinery

(1) Fibrilia is a new article for textile fabrics to be used as a substitute for cotton and wool, and susceptible of being spun or woven on cotton and woolen machinery. The principal plant used for fibrilizing is Flax, and the country is largely indebted to Stephen M. Allen, of Boston, for his persevering experiments in rendering this material available as a substitute for Cotton. Mr. Allen began his experiments in cottonizing flax in 1851, but the first Mill provided with machinery for the purpose was one established by him in association with George W. Brown and J. C. Butterworth in 1858, at East Greenwich, Rhode Island. In the succeeding year he fitted up a small mill at Watertown, Massachusetts, where it was fully demonstrated that Flax could be fibrilized for use as a substitute for cotton in the manufacture of Calicoes and Sheetings, by a mixture of half cotton and half flax. Since then great improvements have been made in the machinery and processes, and several factories have been established for the manufacture of various articles from this material. Besides the company at Lawrence, the American Felting Co. and the Mystic Mills, at Winchester, Mass., make Carpetings, etc. At Natick, Mass., are the "Flax Leather Company," manufacturing Fibrilia Leather, tons of which are now used for stiffening heels of boots and shoes, inside soles, etc., and the "Berkley Company," which is manufacturing Carpet Linings extensively. At Lockport are companies engaged in manufacturing Flax-Cotton Twine, etc., and in Canada, and at Pittsburg, Pa there are mills for preparing the fibre.

are made by Battles & Crombie, Loom Harnesses and Reeds by Edward Page & Co. and Spalding & Co., and Card Clothing and Cards, very extensively, by Stedman & Fuller and Warren & Robinson. Leather Board from pulverized leather scraps is made by Willard B. Hayden & Co., Wool Hats by Desmond Brothers, Files by Frederick Butler, and Sash, Doors and Blinds by Williams & Berry.

MANUFACTURES OF LYNN.

The principal industry of Lynn, it is hardly necessary to say, is the manufacture of Ladies' Shoes. The business was commenced here before the Revolutionary War, and though other towns have embarked in it extensively, Lynn still maintains its supremacy as the principal seat of the manufacture. The total value of all the manufacturing pursuits of Lynn was in 1860 $5,736,043, the whole of which, with the exception of about one hundred thousand dollars, is to be credited to the Shoe trade. There were 136 Boot and Shoe manufacturers, who had a capital invested of $1,035,100, employed 5,767 males, 2,862 females, and produced about 6,000,000 pair of Shoes, worth $4,867,375. Besides these, there were 19 Morocco establishments, 6 Last manufactories, 3 manufactories of Shoe Tools, 4 of Boxes, and 1 of Leather-Cutting Machines, making a total of 169 establishments directly or indirectly connected with the Shoe trade. The minor manufactures of Lynn were of Glue, Beer, Iron Railing, Lightning Rods, Tin and Sheet-iron Ware, Cigars, Soap, and Stove Polish.

In Haverhill, a town in the same County, there were 103 manufacturing establishments, that had a capital of $996,000, employed 5,667 males and 1,158 females, and produced a value, mostly in Shoes, of $4,811,550. The towns of Danvers, Woburn, Randolph, Reading and Abington, are also largely engaged in this trade.

The methods of manufacturing pursued in these towns is largely of a domestic character, though of late years it partakes of the essential features of a well-regulated factory system. The warehouses of those who manufacture largely generally contain a Counting room, a Sole Leather room, an Upper Stock room, two Cutting rooms (one for the upper leather and one for the soles), the Bound Shoe room, the Trimming room, and the Sales and Packing room. Sometimes a Last room, and others of less importance, are provided. The first operation is to cut out the various portions of the Boots and Shoes according to sizes

and half-sizes, which are put up with all the necessary trimmings in "sets" of 60 pairs for the coarser kinds, and 24 pairs for the finer qualities. These sets are numbered, recorded, and packed in boxes to be sent to the operatives or workmen to whom they are charged. The cutting out of the soles is generally done by machinery. A knife with a curvilinear edge is set in a frame and worked with a treadle, after the manner of a lathe. By a lateral motion in the machine it can be adapted to the cutting of any requisite width of sole, and being once fixed to a given width the process of cutting is very rapid, and material is saved by the leather being cut at right angles to the surface instead of diagonally as by the ordinary knife. The stitching of the upper leather is now generally done by sewing machines, the binding by females, and the other parts by males, who are styled "workmen" or "jours." These operatives do not belong to Lynn exclusively, but many of them reside in other parts of the State, and in Maine, New Hampshire, and Vermont.

For the convenience of the operatives residing in distant localities, the materials in their prepared state are collected from the manufacturers by expressmen or carriers. These deliver them to the workmen for whom they are intended, and on receiving the work made up deliver that to the manufacturer, and then receive the payment due to the former for their labor. The remuneration of these carriers is generally a small per centage on the amount.

MANUFACTURES OF TAUNTON.

TAUNTON, situated on the Taunton River at its junction with Mill River, 35 miles south from Boston, is the seat of a number of very important manufactories. It has been said that Iron Works were established here as early as 1652,[1] and the various manufactures of iron, as Tacks, Screws, Stoves, Locomotives and Machinery, continue to be among the prominent branches of its industry. In 1860 the value of the tacks, brads, and horse-shoe nails made by the Taunton Tack Company, A. Field & Sons, and Lovett Morse, amounted to $370,000. The Bay State Company produced Screws to the amount of $150,000, having a capital invested of $175,000, and employed 220 hands. Stove and other castings to the amount of $340,000 were made by Eddy & Co., the Foundry and Machine Co., Lemuel M. Leonard, Bartlett & Potter, and the Taunton Iron Works Co., employing in all a capital of $190,000, and

(1) See Vol. I., page 479.

three hundred and eighty-three men. The Locomotive Works of Taunton are the largest in New England. The Taunton Locomotive Company, incorporated in 1847, employs two hundred and fifty hands, and has made three hundred Locomotives, among them some so distinguished for speed and power that they have attracted attention in England. The first Locomotive that ran west of the Mississippi river was built at this establishment. William Mason's Locomotive Works will be described subsequently.

Besides its manufactures of Iron, Taunton has several Cotton Mills, that in 1860 produced Printing Cloths, Flannels, etc., to the amount of six hundred and thirty-two thousand dollars, employing two hundred and forty-eight males, and four hundred and thirty-eight females. One Woollen Mill employed seventy hands, and produced Cassimeres of the value of one hundred and ten thousand dollars. The "Whittenton Manufacturing Company," whose factories are near Taunton, was referred to in the previous volume. (See article, WILLARD LOVERING.) Enamelled Cloth and Car Linings are also made, to the amount of over two hundred thousand dollars, by three establishments, one of them quite extensive.

Another branch in which the Taunton manufacturers are quite celebrated, is that of Britannia and Electro-Plated Wares. The firm of Reed & Barton are among the most extensive manufacturers of these articles in the country, and their wares, in purity of material and richness of design, are not surpassed by any. The "Porter Britannia and Plate Company" was more recently established, but having spared no expense to obtain from abroad the most skilful workmen, and procuring suitable machinery, they have succeeded in producing wares fully equal to the best imported.

The miscellaneous manufactures of Taunton include Bricks, Carriages, Casks, Leather, Ring-Travellers and Belt Hooks, Sash, Doors and Blinds, Stoneware, and Stove Linings. The Phœnix Manufacturing Company has a capital of forty thousand dollars employed in the manufacture of Black Lead Crucibles and Stove Polish. These articles are also made by the "Taunton Crucible Company," of which J. L. Presbrey is Agent. The total product of all the manufactures of Taunton in 1860 was $1,910,902, nearly one third of which was in Copper, Yellow Metal, and Zinc, made by the Taunton Copper Manufacturing Company, of which Crocker, Brothers & Co. are Agents.

The most remarkable establishment in Taunton, from whatever standpoint we may view it, whether we regard its extent, the variety of its machinery, the excellence of its manufactures, or the celebrity of its founder, is

William Mason's Machine Works.

The founder of this splendid establishment belongs to that class of intelligent and ingenious mechanics who, in spite of early disadvantages, and by the force of native genius, leave their impress upon the age in which they live. New England has been especially fruitful in such men, and they in turn have rewarded her by making her the pride and glory of America. We however are not possessed of the facts from which to write a biography of this eminent mechanic; therefore suffice it to say, that after a boyhood spent successively in the blacksmith's shop, the cotton mill and machine shop, we find Mr. Mason, in 1829, when about twenty-one years of age, in Canterbury, Connecticut, constructing and setting-up power looms for the manufacture of diaper linen—believed to have been the first adapted to this kind of work in the world; subsequently, in Killingly, manufacturing a new article of "ring travellers," or ring frames, which still occupy a high place in "throstle" or "frame-spinning"; and, at a later period, in Taunton, Massachusetts, which, after many sad disappointments and crushing reverses, caused by the failure of others, became the theatre of his future triumphs. It was here, when foreman for Crocker & Richmond, machinists, he perfected the great invention of his life, the "Self-Acting Mule," a machine now so well known to all who use cotton machinery, that a detailed description of it would be superfluous. Here, in 1842, when his employers had failed, he through friendly assistance became the principal owner and manager of the works. The prosperous times which succeeded the Tariff of 1842, and the confidence of cotton and other manufacturers in his mechanical abilities, at once established a business which in a very few years enabled him to erect, after his own design, the noble buildings known as Mason's Machine Works—the largest, it has been said, ever erected at one time for the manufacture of Machinery. The main shop was three hundred and fifteen feet long and three stories high, but addition after addition has been made to accommodate a constantly increasing business, until now the buildings cover an area of six acres. His business comprised the manufacture of Cotton and Woollen Machinery, Machinists' Tools, Blowers, Cupola Furnaces, Gearing and Shafting; but the branch in which he was especially successful was the manufacture of Cotton Machinery. In this department he labored indefatigably to devise and introduce those various improvements which have contributed to increase the production, extend the consumption, and diminish the price of cotton fabrics. In Constantinople, Alexandria, and Cairo, it has been for years the practice of hawkers or pedlars of

cotton goods to represent those of British manufacture as "Americanas," because from the recognized superiority of American cottons they can obtain higher prices for inferior fabrics by giving them the American name. If unrestrained by hostile legislation, American manufacturers could monopolize the markets of the world in the sale of the lower grades of cotton goods, and for this advantage they are indebted not alone to the comparative cheapness of cotton, but to the superior machinery that has been placed at their command by American mechanics.

In 1852, Mr. Mason made an addition to the Works previously erected, for the purpose of undertaking the building of Locomotives; and in 1853 he brought out his first Locomotive, which at once attracted attention for its beauty, and remarkable symmetry of design. With characteristic fertility of genius, he aimed to step aside from the beaten track and originate a new model, combining especially beauty of external appearance with excellence of workmanship, and it has been said of him that he brought nearly all the credit upon New England engines that they are likely to retain, and he is probably the only New England builder who has left his mark on the American Locomotive. In his engines the dome was placed exactly over the joint of the equalizing lever between the drivers; the smoke-box cylinder and smoke-stacks were placed in the same vertical line as the truck pintle, and the sand-box was placed nearly midway between. The chimney, which although comparatively light, has necessarily the appearance of great weight, was thus brought directly over the truck, which supported its load with the symmetry of a pedestal in architecture. Mason discarded all outward incumbrances, such as frames and their accompanying diagonal braces—resembling a ship's shrouds—thus leaving all the working parts in full view, and a clear range from end to end and under the boiler. The horizontal lines of his running board, hand rail, feed pipe, etc., heighten the symmetry of the design, while the graceful forms and disposition of the details give a finished expression to the whole sufficient to raise it to the dignity of a work of genuine art.

A competent authority has remarked—"An examination of American Locomotives affords abundant proof that beauty of design and accuracy of proportion are almost always accompanied by excellence of workmanship. In mechanism, elegant outlines and an agreeable disposition of details are never the result of chance—while, at the same time, a mere artist would be as incapable as a careless workman to produce them. A truly beautiful Locomotive—for extraneous ornament and skin-deep decoration do not constitute beauty—must be the work of one who thoroughly understands its mechanism; and the machinist who

can produce an elegant design, will be constitutionally sensitive in the matter of workmanship, with all its mechanical refinements of fit and finish. No one, we are sure, will deny that even a Locomotive may possess beauty, and we pity any one who, having once seen an engine of the Rogers or Mason style, has failed to discover that quality in its outline, arrangement and detail. The forms of art may be as beautiful as those of nature, although the effect of the former may be due to certain outward analogies which they bear to the latter."

When the Locomotive branch of his business had become established, Mr. Mason made a step forward by equipping a foundry for the manufacture of Car Wheels. In these, as in every thing else that he attempts, he aims at improvement. His wheels are what are called "spoke," or tubular, in contradistinction to "plate" wheels, a shape which it is said experiment has proved to insure the greatest strength, besides securing uniformity with the driving wheels.

When the Government was called upon to defend its existence against the attacks of traitors, and it was found that there were but seventy thousand efficient muskets at the command of the authorities, Mr Mason, in common with many others, set about providing the necessary facilities for the manufacture of Firearms. He erected an Armory, and equipped it with the best machinery that could be obtained, some of which he further improved by original inventions. For a time he produced six hundred Springfield Rifled Muskets per week.

It will thus be seen that Mr. Mason's business comprises the manufacture of Cotton and Woollen Machinery, Locomotives, Car Wheels, and Firearms—each of which is usually carried on as a distinct business, in separate establishments, and considered sufficient to task the ability of a single individual; while, to conduct them all successfully, requires the talents and powers of a master mind. This is one of the few really remarkable Manufactories of America, exhibiting in all its details so much system, combined with fertility of invention, that if its founder and proprietor were not living, we should feel called upon to speak of it in terms of enthusiasm.

About seven hundred men are generally employed in Mason's Machine Works, and the annual product exceeds a million of dollars.

A. Field & Sons' Tack Factory,

In Taunton, is the oldest established and most extensive Tack manufactory in the United States. It employs nearly three hundred persons, and operates about two hundred machines of the Reed and Blanchard patents, with late improvements. Some of their machines will produce each over four hundred pounds of Shoe Nails daily, while the variety in the products of the establishment is no less astonishing than the quantity. Between five and six hundred kinds of tacks, brads, and nails, are made in these Works, ranging from the small pill-box copper tack, of which one thousand will weigh but half of an ounce, to boat nails, of which each one will weigh a half ounce. Over two thousand tons of metals, of various kinds, are converted into tacks and small nails every year.

Until late in the last century, the manufacture of nails, tacks, brads, etc., in this country and in England, was exclusively a manual process. It was during the emergencies of the Revolutionary War, which called into exercise the inventive talents of the country, that the first attempt appears to have been made to produce *Cut Nails* and *Tacks*. About the year 1775, Jeremiah Wilkinson, of Cumberland, Rhode Island, a manufacturer of hand cards, tired of making the tacks required in his business by the old and tedious process of hammering, adopted the expedient of cutting them with shears from iron hoops, or other thin metal, and afterwards heading them in a vice. This method he afterwards applied to the manufacture of other small nails, producing probably the first cold cut nails ever made. The same principle is carried out by appropriate mechanism in most of the modern nail-cutting machines which were introduced only ten or twelve years later, their invention having apparently become a necessity of an age fruitful in every form of labor-saving expedient. Between the years 1789 and the close of the century, machinery was estimated to have doubled the annual production of nails in Massachusetts. Several of the most distinguished of early American inventors employed their powers—some at a very early age—in devising machinery for cutting nails. Among these were Perkins, Whittemore, Reed, and Blanchard, while others in England, about the same time, labored, though less successfully, to accomplish the same end. Attention appears to have been first directed to improvements in the shears, and the independent operations of cutting the nail and of heading the same.

The first patent for nail making was registered in the United States Patent Office in August, 1791, by Samuel Briggs, Senior and Junior, of Philadelphia, who deposited with the State authorities of Pennsyl-

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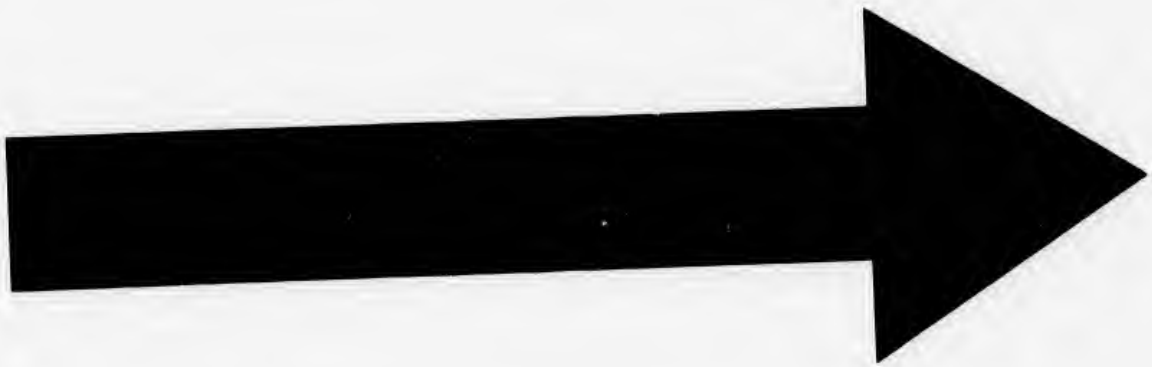

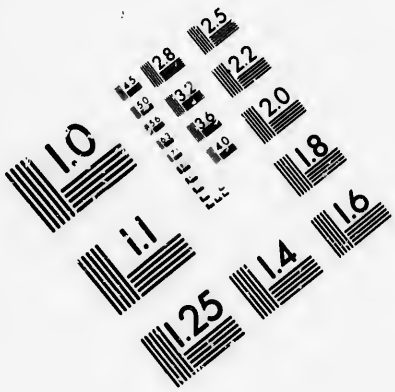

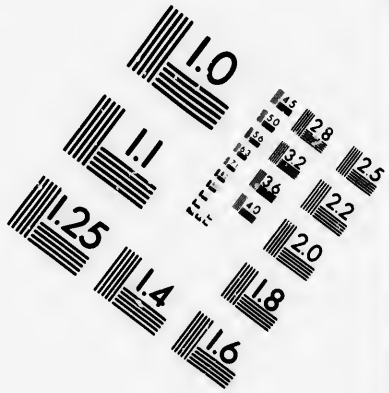

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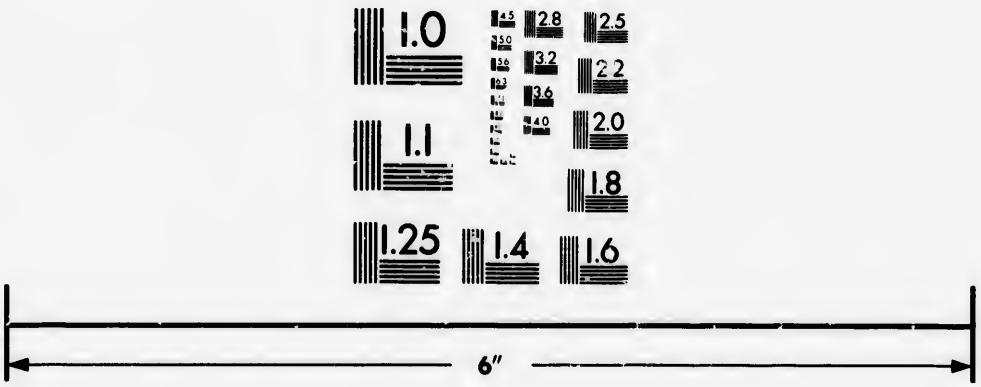

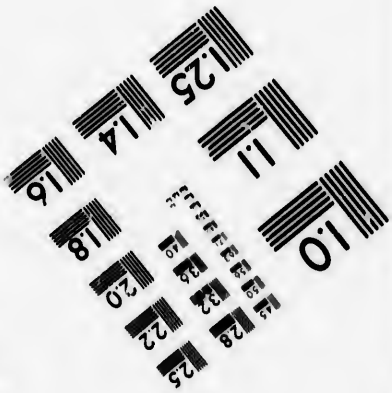

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vania the model of a machine for making nails, gimlets, rivets, etc., in June, 1789; but it does not appear whether it was for making wrought or cut nails.

The construction of the first cut nail machine has been ascribed to several persons, among whom were Benjamin Cochran, a shopmate of Eli Whitney (about 1790), Ezekiel Reed, of Bridgewater, Massachusetts, Jacob Perkins, of Newburyport, Massachusetts, and the late Walter Hunt, of New York. The first letters patent for nail cutting machinery on the patent records were issued in March, 1794, or 1795, to Josiah G. Pearson, or Pierson, of New York, who, four years later, put in operation, on the Ramapo in Hampstead, Rockland county, New York, the extensive rolling and slitting mill and nail works of Pierson & Brothers, which, in 1810, cut and headed by water power upward of one million pounds of nails annually. The nail cutting machinery of Jacob Perkins, though invented as early as 1790, at the age of twenty-four years, was not patented until January, 1795. Like many others, he found the invention, though efficient, a source of pecuniary embarrassment, in consequence of an injudicious partnership, with which he established a manufactory two or three years later at Amesbury, where a nail company was chartered in 1805 with a capital of nearly half a million dollars. The machine cut and headed nails at one operation, and was an advance upon any thing previously in use. In Dr. Morse's *American Gazetteer*, published in 1797, mention is made of a machine 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. In the same connection it is stated that there was a machine at Newburyport invented by Mr. Jacob Perkins, which would turn out two hundred thousand nails in a day, of a quality superior to English nails and twenty per cent. cheaper. In 1810, Perkins took out another patent for cutting nails and brads, and during the same year the nail cutting machinery of Massachusetts was patented in England by Joseph C. Dyer, an American merchant resident in London. The mechanism of Perkins and Dyer 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 those of powerful rotary pressers or hammers for squeezing metal rods into the forms of nail shanks, pins, screw shafts, rivets, etc., of cutters for separating the proper lengths, and of dies operated by revolving cams or cranks, for forming the heads by compression. It was the type of many later inventions for the same purpose, in which the machines have been improved by greater simplicity of parts and acceleration of speed.

In addition to the patents already mentioned, not less than ten others

were granted before the close of the last century for cutting or cutting and heading nails, brads, etc. The first in which the two operations were combined was obtained by Isaac Garretson, of Pennsylvania, in November, 1796. In May of that year, Peter Zacharie, of Maryland, registered a patent for cutting nails and brads. The machine of Ezekiel Reed, first mentioned, as it was afterwards improved by his son, Jesse Reed, of Kingston, Massachusetts, and others, was one of the most valuable pieces of mechanism ever devised for the purpose, and is extensively used at this time. Of numerous patents granted to Jesse Reed for improvements connected with nail making and other mechanical operations, the first in this branch was registered in June, 1801, and was for making nails out of heated rods. He obtained ten additional patents between that time and 1825, chiefly for cutting and heading nails and tacks, the first bearing date February, 1807, and including a wheel appliance in 1809. The addition of nippers to Reed's machine was the subject of a patent to S. Chubbuck, of Massachusetts, in 1835. The patent right to his machine, which completed the nail at one operation, was purchased by Thomas Oldwine and others, of Massachusetts, who put upwards of twenty machines in operation at Malden, Massachusetts, and established two other factories in the iron region of the Schuylkill valley in Pennsylvania, which subsequently became the principal nail producing region of the Union. Fifty-two machines in operation in these establishments were capable of making fifteen hundred tons of nails annually, with the aid of sixty men and boys. The machine was afterwards adapted to cutting brads by Oldwine. In 1816, Reed patented a tack machine, or an improvement on the old one, which enabled a single hand with one machine to cut and head at a single operation sixty thousand tacks in a day. These machines, to which Reed added in 1825 a feeding apparatus, were already in operation at Pembroke and at Abington, Massachusetts. At the latter place, in 1815, one hundred and fifty millions of card tacks were made. We may add that among the early patents for this manufacture was one granted in 1805 to Increase Kimball, for a machine for making nails, brads, and sprigs, for which originality has been claimed.

The great value of the cut nail machinery thus introduced, and perfected at great labor and expense, was first brought to the notice of the public in the report of Albert Gallatin, Secretary of the Treasury, on the manufactures of the United States, made to Congress in 1810. He there stated that two-thirds of the whole quantity of iron flattened by machinery, in the United States, was used in the manufacture of cut nails, which had extended throughout the whole country, and being altogether an American invention, substituting machinery for manual

labor, deserved particular notice. The only manufactory of tacks alluded to in that report was one in Bristol county, probably at Taunton, that produced eleven millions of tacks annually.

Among the early inventions for cutting brads and small nails was a machine patented in 1807, by Jonathan Ellis, of Massachusetts, a partner of Perkins; one by Seth Boyden, now of Newark, New Jersey, patented in 1815; a brad and sprig machine, by G. Jenkins, of Plymouth county, Massachusetts, in 1817; and the most valuable of all, the brad and tack machine patented by Samuel Rogers, of Plymouth, and Thomas Blanchard, of Boston, in the same year as the last mentioned. This machine, which is one of the most valuable now employed, was devised by Blanchard, at quite an early age, to relieve the tedium of the old process of cutting tacks from metal plates, and afterwards heading them one by one by the aid of a heading tool or clamp, attached to a lever and moved by the foot, while the head was flattened by one or more blows of a hammer. The ingenious inventor had previously sought to abridge the labor of counting and weighing, as he was required to do the quantity assigned him as his daily task. This he effected by a very ingenious counting machine, consisting of a ratchet wheel, moving one tooth every time the heading tool grasped a tack, and by a bell to indicate the completion of the allotted number. The tack machine was commenced about 1806, when he was eighteen years of age, and, under the greatest discouragements, was steadily kept in view and often remodelled, during a period of six years, when it was produced in such a state of perfection that, the iron being supplied through a tube or hopper, and the power applied, five hundred tacks were made in a minute with more finished points and heads than were ever made by hand, and weighing only half an ounce per thousand. The right to this machine was purchased by a company for five thousand dollars.

The following description is applicable to the machine now most extensively used in this country for cutting nails of all sizes. It consists of a main shaft for carrying the cams, driven by a belt over a pulley, and provided with a metal tube, through which passes the nail rod, holding the nail rod by means of pincers. In order to give the brad or nail its wedge shape, the cutter is set oblique to the direction of the nail plate, which is reversed after each cut, by which means every nail has a uniform taper. The reversing of the nail plate is effected by means of a rocking shaft, which receives its motion from the shaft through a gearing and crank, producing an alternate motion to the segments, which is communicated to the guide tube by a belt and pulley, the nail plate being fed to the cutter by means of a weight, the

nail rod with its attached plate vibrating freely within the guide tube. The cutter having the width of a nail plate, is adjusted by screws to the cutting block; the nail plate, lying between guides, rests on the iron block and bears by the action of the weight (before mentioned) against the face of the cutter. The vibratory motion of the latter is effected by the aid of a crooked lever worked by means of an eccentric on the main shaft; the cutter block forming the short arm of this lever has a short circular movement about their common centre. The lever, cutter block, and the axle arms or trunnions upon which they work, are all cast in one piece. The lever of the heading die is worked by a crank pin and rod attached to a wheel on the main shaft. To prevent the nail from falling from its place before the completion of the stroke, a small pair of nippers, operated by means of a cam on the main shaft, are placed below and in front of the cutter block. These are worked by the rods. 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 latter revolves, the lever falls, lifting the edge of the cutter above the cutting block, and also above the nail plate; the latter, by the action of the weight, is thrown forward under the cutter to a stop the width of the required nail. At this point, by the revolution of the eccentric, the lever is raised which lowers the edge of the cutter, shearing off a wedge-shaped strip of metal having the length of the width of the nail plate. This is seized at the same instant by the nippers below the cutter, and immediately after the rod, by the action of its crank, raises the lever of the heading die, and the nail is completed at a stroke. As the complete nail drops from the opening nippers, the nail plate is advanced under the cutting shears for another nail. In the factory of the Messrs. Field, shoe nail machines are used which are provided with a self-feeding apparatus, by which six plates are advanced to the cutter at one time without manual assistance. These machines are the invention of William H. Field, of Taunton, and the patent is owned by A. Field & Sons.

Nails and Tacks having been cut, require to be annealed, which renders them more tough and somewhat malleable, and at the same time imparts to them their rich blue color. This is done by heating them hot in iron boxes in an oven, and leaving them to cool slowly. The Messrs. Field have also ingenious machines for leathering carpet tacks, which perform the work with extraordinary rapidity.

Albert Field, the senior proprietor of these Works, was born in Norton, Massachusetts, July 4th, 1795. During the war of 1812, he was employed at Sharon, Massachusetts, in the file manufactory of the ingenious Seth Boyden, elsewhere alluded to. Shortly after be-

coming of age he went to the city of New York, and attempted manufacturing Tacks by horse power, but after a few months removed to Taunton, and was employed by Crocker & Richmond, the extensive nail manufacturers, with whom he remained for about nine years. In 1827, in a small building, on the site of his present Works, he commenced to manufacture Brads, with one machine, built by himself. In 1830, he purchased one of Reed's Tack Machines, and employed Elijah S. Caswell to run it. This person has been in his employ since that time, and has made great improvements on both the Reed and Blanchard machines.

In 1831, he employed Otis Allen (who is still with the firm) to take charge of the packing, and to him much credit is due for his efficient management of the packing and shipping departments since that time.

Under Mr. Field's judicious management the business prospered, one machine after another was built, the buildings were from time to time enlarged, improvements in the methods of manufacturing were originated or adopted, until now he is the head of the leading concern in his business in America.

Like most men who have achieved success by their own endeavors, Mr. Field has given evidence of possessing an original and ingenious mind. He designed and was the first manufacturer of that peculiar form of tack known as the gimp tack, for fastening linings on carriages and furniture. He drove out of the American market the English clout nails, by producing a different and much superior nail for the same purposes, and at a less price; and by various improvements in machinery, succeeded in producing Tacks of an uniform thickness and quality, until, now, Field & Sons' Tacks are a staple of American commerce, and are exported not only to the West Indies, South America, and Australia, but to Germany, Africa, China, and in fact to nearly all parts of the world.

Mr. Field is no less estimable as a man than eminent as a manufacturer. He has aimed to invest the profits of his business so as to yield the greatest good to the greatest number of his fellow-citizens. He was one of the original projectors of the gas works in the city of Taunton, and is now President of the Company. He also established the Taunton Foundry and Machine Company, and the Mount Hope Iron Company at Somerset, Massachusetts. As an employer he has been regardful of the interests and welfare of his workmen, and is rewarded with their good-will and attachment. Though not a member of any church organization, he has contributed liberally to aid in the erection of houses of worship; and of one church in Taunton, which, when finished, will cost over $50,000, he and his sons have

contributed more than one half the amount. Thus this venerable pioneer and patriarch presents an example of liberality in the use and distribution, as well as skill and success in the acquisition of a fortune.

Reed & Barton's Works,

For the manufacture of Britannia, Albata, Nickel, Silver, and Silver-Plated Wares, at Taunton, Massachusetts, are the oldest, and one of the largest in the United States. About 1824, Mr. Isaac Babbitt, the inventor of what is known as the Babbitt Metal, commenced the manufacture of Britannia ware at this place, and may be called the founder of the business. Subsequently, the business established by him passed through the hands of Babbitt & Crossman, West & Leonard, the Taunton Britannia Manufacturing Company, none of whom found it profitable, until, finally, Henry G. Reed and Charles E. Barton, who were apprentice boys to some of the other firms, associated with another, became proprietors, and by industry and perseverance succeeded in building up one of the largest manufacturing concerns in the country.

The principal buildings have an aggregate length of about one thousand feet, and are divided into departments for special purposes, such as the machine room and rolling rooms, the burnishing rooms, plating rooms, press rooms, buffing rooms, polish rooms, and others. In their press room they have a number of presses of immense power—one screw press weighing about seven tons, for stamping designs and figures upon the different articles of their manufacture; and their stock of dies is most complete. Their show room presents a brilliant array of specimens of their workmanship that would attract attention and extort admiration even in an exhibition of Solid Silver Ware.

Within the last five years, this firm have made important additions to their list of manufactures, and now produce, besides Britannia and Silver-plated wares, all kinds of Electro-plated Nickel Silver Table Ware, and Albata Spoons and Forks, that can only be surpassed by solid silver. They have increased the number of their hands to nearly five hundred, and have added so largely to their facilities for manufacturing that it may be said every tool or machine that can be used advantageously in the business will be found in their workshops.

Within the same period also, this firm have made great improvements in the patterns and styles of their wares. It is one of the advantages of electro-plating that all ornaments, however elaborate, or designs, how-

ever complicated, that can be produced in silver, are equally obtainable by this process, and one of the benefits that such firms as Reed & Barton confer upon the country, is that they familiarize the American people with forms of beauty and elevate the standard of public taste. An American artisan can now command exact copies of the choicest plate in the repertory of kings. The Anglo American, said the London Art Journal, some years ago, seems the only nation in whom the love of ornament is not inherent. "The Yankee whittles a stick, but his cuttings never take a decorative form; his activity vents itself in destroying, not in ornamenting; he is a utilitarian, not a decorator; he can invent an elegant sewing machine, but not a Jacquard loom; an electric telegraph, but not an embroidering machine." This reproach, if ever true, is rapidly losing its force. Even American artisans, while properly maintaining that ornament should be subordinate to utility, are yet beginning to understand that "a thing of beauty is a joy forever," and in schools like those of Reed & Barton, where chaste designs are multiplied and wares rivalling those of the jeweller and silversmith are made and sold at prices accessible by all, the American people are being educated in taste and love of the beautiful, which is said to be the finest ornament and purest luxury of a land.

MANUFACTURES OF FALL RIVER.

FALL RIVER, which lies at the head of the eastern arm of the Narragansett bay, where it receives the Taunton river, is one of the principal seats of the Cotton manufacture in Massachusetts, as will be seen by the following Table, which gives the date of the commencement of operations of the several Mills, number of Spindles, and the Capital invested in Real Estate and Machinery, not including the active capital of the respective Companies.

Name of Mill or Corporation.	Organized.	1820.		1830.		1850.		1866.	
		Spindles.	Capital.	Spindles.	Capital.	Spindles.	Capital.	Spindles.	Capital.
Troy C. and W. Man.	1813	1,500	$40,000	4,100	$75,000	6,468	$100,000	38,736	$500,000
Fall River Man'y	1813	1,200	40,000	3,000	50,000	9,240	140,000	9,240	140,000
Pocasset Man'g Co.	1822			2,500	75,000	34,248	600,000	34,248	600,000
Annawan Man'y	1825			5,400	100,000	7,704	120,000	8,832	125,000
Massasoit Mill	1830			11,000	125,000	14,448	200,000	14,448	200,000
Augustus Chace	1843			472	5,200	1,568	24,000	6,108	56,375
Metacomet Mill	1846					21,600	300,000	23,808	325,000
Watuppa Man'g Co.	1846					11,160	150,000	11,168	150,000
Fall River Print W'ks	1851							13,000	200,000
American Linen Co.	1872							83,000	1,200,000
Union Mill Co.	1859							44,784	600,000
Granite Mills	1863							35,328	475,000
Durfee Mills	1866							40,320	700,000
Tecumseh Mills	1866							20,000	350,000
Robeson Mills	1866							11,280	200,000
		2,700	$80,000	26,472	$430,200	106,436	$1,634,000	394,292	$5,023,375

Fall River contains, in the AMERICAN PRINT WORKS, one of the largest and oldest Calico Printing establishments in the United States. The Company was organized in 1834, and the Works started with a capacity of printing about twenty-five hundred pieces per week; but since that date the facilities have been greatly enlarged, and with the purchase of the Bay State Print Works, in 1862, their capacity is increased to about fifteen thousand pieces per week of forty-five yards each, or thirty-five million one hundred thousand yards per annum. They employ a capital in real estate and machinery of $500,000. JEFFERSON BORDEN, Esq., one of the originators of the Company, is still its Treasurer and General Manager.

The AMERICAN LINEN COMPANY, at Fall River, commenced operating their machinery in December, 1853, with ten thousand four hundred and sixteen spindles, manufacturing Sheetings, Pillow and Table Linen, Coatings, Huckaback, Crash, Toweling, and other Linen goods. They employed a capital of $350,000 in this manufacture until 1858, when their principal mill was changed to a Cotton-mill of thirty-one thousand two hundred and ninety-six spindles, manufacturing Print Cloths. They still operate thirty-five hundred spindles in the Linen manufac-

ure, and propose to add to their Cotton machinery fifty-two thousand spindles.

JESSE EDDY & SON are the owners of the Wamsutta Steam Mill, employed in manufacturing a superior grade of Fancy Cassimeres. It was built in 1849, with eight sets of machinery. Capital $150,000.

The FALL RIVER IRON-WORKS COMPANY was organized in 1821, with a capital of $24,000, and commenced the manufacture of Iron in February, 1822, with one set of Rolls for making Nail Plates, and twelve machines for Cutting Nails. Their production of Iron and Nails at that time was about five hundred tons per annum. They have gradually increased their operations until they have, in 1866, eight sets of Rolls and one hundred and five Nail Machines, producing four thousand five hundred tons of Hoop, Bar, and Wire Iron, and one hundred thousand casks of Nails, of one hundred pounds each, equal to five thousand tons.

They also have a Foundry producing eighteen hundred tons Castings per annum for machinery purposes, and a Machine Shop and Boiler Shop, for building and repairing Machinery. In 1845, they built the Metacomet Cotton-mill, with 21,600 spindles; and a Gas Works, which supplies the Mills, stores, and private dwellings with Gas. The capital employed by the Corporation at the present time is about one million of dollars. RICHARD BORDEN, Esq., one of its originators, is Treasurer and General Manager of the Company.

Besides these, Fall River has three important Machine Shops: those of MARVEL, DAVOL & Co., KILBURN, LINCOLN & SON, and WM. M. HAWES & Co.; the Flour Mills of CHACE & NASON, DAVID H. BRAYTON & Co., D. BROWN & SON; the Twine and Stocking Manufactory of E. M. SWART & Co., and other manufactories of some importance.

MANUFACTURES OF SPRINGFIELD.

SPRINGFIELD, according to the last Census returns, had 37 Manufacturing Establishments, with a capital of $1,074,000, that employed 1,100 male and 637 female hands, and yielded products valued at $2,065,594 This was exclusive of the Arms manufactured at the Government Armory located here, which is one of the most important arsenals of construction in the United States.

The establishment that employed more hands and produced a larger

value than any other in Springfield, with the exception of the Indian Orchard Cotton Mills, was the Car Manufactory of the

Wason Manufacturing Company.

The construction of Cars is comparatively a new department of manufactures in the United States, but in consequence of the vast and rapid extension of railroads it has become one of considerable magnitude. It is a singular fact that nearly all the companies that have been organized with a large capital for the prosecution of this business have not been successful, and those whose manufactories are now the largest, commenced with scarcely any capital except their individual enterprise and experience.

About twenty years ago, Thomas W. and Charles Wason commenced, on the banks of the Connecticut River, preparing lumber for Railroad Bridges, and did a small business in repairing and building Gravel and Freight Cars. In 1846 they advanced a step forward by leasing a lot of ground on which they erected a shop for making Freight and Baggage Cars, procuring the wheels and most of their castings from a neighboring foundry. In 1848 the "Springfield Car and Engine Co.," which had been organized in the year preceding with a capital of $100,000, for the building of Cars and Engines, and had erected extensive buildings for the purpose and filled them with machinery, finding that the business could not be economically conducted under their existing organization, determined to dispose of their stock and tools in the Car department, and Messrs. T. W. & C. Wason became the purchasers. In 1851 Mr. Thos. W. Wason became sole proprietor of the works by the purchase of his brother's interest, and in the latter part of the same year purchased a foundry for making Car Wheels and other castings. In 1853 he disposed of one-half his interest in the Car Manufactory to another person, which established the firm of T. W. Wason & Co., who continued business as a firm until 1862, when the "Wason Manufacturing Company" was organized, and incorporated with Thomas W. Wason, President, George C. Fisk, Treasurer, Henry S. Hyde, Clerk, and L. O. Hanson, Superintendent.

This Company is now largely engaged in the manufacture of every variety of Passenger, Emigrant, Baggage, Freight, Hand, and Horse Cars, and recently purchased the extensive property formerly owned by the "Springfield Car and Engine Company," the original cost of which with the buildings and machinery was over $120,000. The buildings, eligibly situated near the passenger depot at Springfield, are most substantially constructed, and cover nearly four acres of ground. They

comprise a two-story brick building 270 feet long and 70 feet wide, occupied upon the lower floor by the offices, the engine-room (containing a 90-horse power engine, built by Thurston, Gardner & Co. of Providence, R. I., fitted with the "Corliss" cut-off), the machine shop, 80 by 70 feet, and the passenger and freight car-body and truck building departments; upon the upper floor by the cabinet room, where the seats, sash, doors, blinds, and inside work of passenger and street-cars are made, and by the street car-building department. The blacksmith shop is of brick, 180 feet long and 44 feet wide, and contains 30 fires. There are also a brick planing mill 70 by 44 feet, a brick dry-house, and 3 large wooden paint shops (in the second story of one of which is the upholstery department), having accommodations for painting 10 passenger cars, 16 freight cars, and 6 street cars at one time. The foundry, where all the car wheels and castings used by the Company are made, adjoins the Car Works, and occupies a brick building 112 by 70 feet. This branch of the business is still owned separate and apart from the car works.

The machinery in the Car Works is of the most complete nature, no expense having been spared in the construction. Nothing is left to be done by hand that can by any possibility be accomplished by machinery, and a high degree of excellence in the products is thus necessarily attained.

Cars from this establishment have been sent to Egypt, China, Brazil, Venezuela, and to all parts of the United States and Canadas. A large portion of the rolling stock upon the Pacific slope bears their trade-mark. Improvements are constantly being made in all classes of Cars, especially passenger and street cars, of which this company have turned out large numbers that for beauty of finish and thorough workmanship cannot be surpassed. The first Sleeping-Car ever built in this country came from these works; and since then addition after addition has been made to their conveniences, until now there seems no room for further improvement.

About 300 men are now employed in these works, who receive monthly from ten to twelve thousand dollars. All the different departments are presided over by competent and experienced foremen, under the general superintendence of L. O. Hanson, a member of the late firm of T. W. Wason & Co. The Company use in their business about 1,000 tons of cast-iron, 450 tons bar-iron, 30,000 pounds of brass and composition castings, 450 tons of coal, and a million feet of lumber annually. The aggregate business, including car repairing, amounts to over $500,000 per year.

The foundry, purchased in 1851 for the manufacture of car wheels, is now owned by Mr. T. W. Wason, S. W. Ladd, and G. W. Lawrence,

trading under the name and firm of Wason, Ladd & Co. They manufacture exclusively Car Wheels, both single and double plated, and Railway Castings, furnishing the same not only to the Car Works but to a number of the leading New England railroad companies. Constant employment is afforded to 25 men, and upwards of 2000 tons of the best quality charcoal pig-iron are used annually.

MANUFACTURES OF CHICOPEE.

CHICOPEE, near Springfield, has several important manufactories. There are two establishments that make Agricultural Implements, one of them (Whittemore, Belcher & Co.) largely; one Leather Belting Manufactory, one of Loom-Harness, Reeds and Bobbins, one of Copper Faucets, and one of Military Accoutrements. Firearms are made by the "Massachusetts Arms Co." to an amount exceeding $100,000 per year. There are several extensive Cotton Mills, two of which in 1860 had 83,176 spindles, 2,443 looms, consumed 7,000,000 pounds of cotton, employed 2,450 persons, and produced 20,000,000 yards of cotton goods. But the most celebrated and remarkable establishment in the town is that of the AMES MANUFACTURING COMPANY, remarkable alike for the vast variety of articles made, the multiplicity of operations carried on, and the excellence of its manufactures. Its founder was Nathan P. Ames, who in 1829 commenced at Chickopee Falls the manufacture of Cutlery with nine workmen. Mr. Ames was born in 1803, and died in 1847, at the early age of 44. Though not an inventor, he possessed a wonderful insight into the practical value of new inventions, and at the time of his death he was regarded as one of the most eminent of American mechanics. Since his decease the business of the Company has been superintended by his brother, James T. Ames, a gentleman thoroughly skilled in mechanism, and possessing administrative abilities of a high order.

The manufactures of the Ames Company may be divided into four classes—Machinery, Swords and Ordnance, Gilt and Plated Wares, and Bronze Castings. The list of machines made here is very comprehensive, and includes heavy Tools, massive Castings, horizontal Turbine Wheels, Lathes, Planing Machines, and Cotton Machinery. The mechanical ability displayed by this Company is appreciated abroad as well as at home. In 1854 the British Government sent out commissioners to America, who employed the Ames Company to build machines for making

the Stock or woodwork of muskets, and which now are in use at the Enfield Armory, near Woolwich, England.

The manufacture of Swords was one of the earliest attempted by Mr. Nathan P. Ames, who in 1831 obtained a contract for furnishing them to the United States Government, and since that time nearly all the government Swords have been made at this establishment.

During the present Rebellion they have very greatly increased their facilities, so as to be able to furnish large numbers of Sabres, Swords, and Bronze Guns to the government, besides keeping their other branches, such as the manufacture of Plated wares and Machines, in full operation for the supply of the market.

They were one of the first, if not the first, to introduce the Electro-Plating and Gilding process into this country in 1839.

Probably however this establishment has obtained its greatest celebrity for its artistic manufactures in iron and bronze, and the colossal Statues of DeWitt Clinton in Greenwood Cemetery, Brooklyn—Franklin, in School Street, Boston—and the equestrian Washington in Union Square, New York—are highly creditable specimens of their skill in this department.

This Company have a capital of $250,000 invested, and employ about 500 workmen.

Holyoke, on the right bank of the Connecticut River, nine miles above Springfield, was designed by its projectors to be one of the greatest manufacturing towns in the United States. Acting under a charter granted by the State of Massachusetts to the Hadley Falls Company, with an authorized capital of $4,000,000, a number of capitalists purchased about 1200 acres of land, and constructed a dam across the river 1,018 feet in length between the abutments, and 30 feet high at the head-water, obtaining power sufficient to drive at least 1,000,000 spindles. They laid out a town on a plan calculated to secure many advantages to its future inhabitants, and erected two large Cotton Mills, each 268 feet long and 68 feet wide, five stories in height, and a Machine Shop 448 feet long and 60 feet wide, besides a large Furnace and Blacksmiths' Shop, and equipped them with machinery and tools of the best description.

In 1860 the town had a capital invested in manufactures of $2,072,400, employed 726 males, 1,271 females, and produced an aggregate annual value of $2,108,500. The principal manufactories were the Lyman Mills that had 50,000 spindles and 1,200 looms, the Hampden Mills with 10,000 spindles and 310 looms, the Holyoke Paper Company, the Parsons Paper Company, the Wire Manufactories of William E. Rice, two Machine Shops, and two manufactories of Loom-Harness and Reeds.

SHELBURNE FALLS, about fifty miles north of Springfield, on the Deerfield River, a few miles from its junction with the Connecticut, is noteworthy as a manufacturing place principally from the fact that it contains the largest manufactory of Cutlery in the United States, known as

Lamson & Goodnow's Cutlery Works.

Like most of the other remarkably successful manufacturing establishments of the United States, this has grown up from small beginnings, having been founded by Mr. Ebenezer G. Lamson, who commenced the manufacture of Cutlery at this place about the year 1842. Mr. Lamson is the son of Silas Lamson, who was the inventor of the present form of bent Scythe Snaths—the handles of scythes previous to his invention having been made straight; and for nearly sixty years the family, father and sons, have been manufacturers of these useful articles. In 1844 Mr. A. F. Goodnow became associated with Mr. Lamson in the Cutlery manufacture, establishing the firm of Lamson & Goodnow.

At that time American Cutlery had not yet overcome the prejudices with which it, in common with locks and other articles of hardware, was regarded by both dealers and consumers, and about forty men were sufficient to manufacture all that could be sold. By the introduction of machinery, however, not only the facilities of manufacturing were increased, but a uniformly good quality was secured, which elicited from Fleischmann, in his work on the branches of industry in the United States, the remark that the American "manufacturers of Cutlery have far surpassed those of the old world in the manufacture of Tools, and not merely in the excellence of the metal used, but especially in the practical utility of their patterns, and in the remarkable degree of the finish of their work."

In this manufactory, Table Cutlery, Butcher and Pocket Knives, Augers and Bits, are made almost exclusively by machinery, much of it invented and constructed in the establishment. The blade is forged by trip and drop-hammers, which measure off the amount of steel for the particular kind of blade required, and hammer it into shape; and the shoulder or bolster is formed by hammering between dies or swages so constructed as to give the required form and size. The blade is then passed again under the trip-hammer and receives its last hammering, giving it the required thickness and taper, and at the same time condensing the steel so as to impart to it a good cutting quality. After this operation is performed, which is regarded very critical and requiring the best skill, the blade is next passed through a punching press containing a pair of dies the exact shape of the entire blade, a process that secures

uniformity to all; and then it is returned to the drop-hammer and at a low heat is struck between a pair of finishing dies, so made as to touch every part of the blade, and by this means is straightened perfectly. The blade having been thus forged is ready to receive the stamp of the Company, which is put on by means of a large press operated by one man somewhat as a hand printing-press. An expert operator will stamp 3,500 blades per day. Now the blade is ready to be hardened and tempered, a very nice operation for which they use a machine of their own invention, and patented by them.

This machine consists of a series of cast-iron tubes, say 2½ inches internal diameter and 8 inches long, which are placed directly over the fire-box in such a manner as to allow the heat to pass all around them. In these tubes the blades are placed by the workman, commencing at one end of the machine. There is room in each tube for two blades—so, as one is taken out another is put in; and after the fire is once allowed to pass around the tubes, the workman continues to put in and take out of each tube in succession, not having to wait for the blades to heat, as they heat uniformly, and in perfect time, to the degree required. When heated and taken from the tubes they are placed in a vat of prepared oil and cooled; and when taken out and cleaned of the oil, they are passed into a sand bath heated by the same fire used for the tubes. In this bath they remain, watched by an experienced hand, until they are heated and reduced to the requisite temper.

After the Blade is tempered it is ready for grinding and polishing, operations that are performed by hand, by skilled workmen, and in substantially the same manner as in Sheffield. The blade is now ready for the Handle, which is made from ivory, pearl, horn-tips, cattle shin-bones, cocoa wood, rosewood, ebony, or buffalo horns.

The Handles are cut into shape by saws, then passed through various machines, giving them the required shapes, and fitting them to receive the Blades. Ordinarily the handles are fastened to the blade by cement or rivets, but in this establishment most of the handles are attached by special processes, that secure them firmly and prevents the possibility of their becoming loose by use or exposure to hot water. These improvements are patented by this Company and used only by them.

This Company make about five hundred different styles of Cutlery, and consume in their manufacture 200 tons of Steel per year, 18,000 pounds of Ivory, 150 tons of Ebony, 300 tons of Rosewood, 300 tons of Cocoa wood, 400 tons of Coal, 100 tons of Grindstones, 10 tons of Emory, 5 tons of Sheet Brass and Brass Wire, and about 300,000 pieces of Shin Bones.

The buildings are constructed so as to form a hollow square, and

cover an area of seven acres of ground. The main building, which is of brick, is 208 feet long by 45 feet wide, and two stories high. Adjoining this is their forging shop, 128 feet long by 45 feet wide, in which they run twenty-one trip-hammers, ten drop-hammers, and other heavy machinery. At the opposite end of the main building is the Polishing Shop, 116 feet long by 25 feet wide, containing two rows of polishers. The other buildings comprise one for making Knife Handles and for Finishing; and another, 112 by 25, for hand-forging and Tempering the Blade. Extensive as these buildings are, they are not sufficiently so to accommodate the increasing business, and the Company propose to erect, during the present year (1864), new buildings affording nearly double the capacity of the present workshops.

The manufacturing department is under the superintendence of J. W. Gardner, who has been with the Company the greater part of the time since they engaged in the manufacture of Table Cutlery, and who is the inventor of some of their most popular styles.

For several years the works have been owned by a Company incorporated as the "Lamson & Goodnow Manufacturing Company," with E. G. Lamson, President, A. F. Goodnow, Treasurer, and J. W. Gardner, Agent. They employ nearly five hundred workmen, and produce Cutlery to the amount of $600,000 annually.

In 1858, Mr. E. G. Lamson purchased the Armory at Windsor, Vermont, where the first Rifles were made by machinery to use the Minie ball or its equivalent, and where the greater part of the machinery and tools were made that are now in use in the principal armory in England, at Enfield, near Woolwich. Here he, in association with E. E. Lamson, under the name of E. G. Lamson & Company, is now making Springfield Rifled Muskets largely, having contracted in 1861 to supply the Government with fifty thousand of these weapons, nearly all of which have been delivered and approved. They also manufacture all kinds of Machinery for making Guns and Pistols, having patterns and drawings of every thing necessary to fit out a complete Armory. They are now engaged in manufacturing a new Breech-Loading Rifle, constructed on the repeating principle, which has been fired nine times in eleven seconds, as a Repeater; and without using the repeating principle, it has been fired twenty times per minute. This is the most rapid shooting of which we are advised. This Rifle has been tested by order of the Ordnance Department, and has been recommended as a most efficient weapon for soldiers' use. It belongs to the class called "magazine guns," the magazine being in the stock under the barrel. Experts who have examined almost all of the different kinds of breech-loading guns have expressed a preference for this, and even

predict that it will inaugurate as important an era in the history of fire-arms as did the invention of Colt's Revolver. The repeating principle of this gun will be applied to Pistols.

Ever since the invention of firearms the attention of ingenious men has been directed to the discovery of a perfect weapon loading at the breech. If our countrymen have succeeded in making a perfect weapon of this kind they will be entitled to the credit of having made an invention second only in importance to the invention of gunpowder. With such a weapon, an army lying on the ground and almost protected from harm, could pour into its antagonist a "sheet of flame and shower of lead" that none could withstand. With such a weapon and the metallic water-proof cartridge an army could make its most successful attacks in the heaviest rain-storms. With such a weapon and cartridge the present army of the United States, without calling for, much less impressing or conscripting one additional man, would be invincible by any foe armed with the ordinary musket or rifle, and standing exposed while "drawing ramrod" and going through the ceremonial required in loading at the muzzle after each single shot. Distinguished generals have expressed the opinion that the adoption of a weapon of proper construction, loaded at the breech, would double the effective force of an army, but in this instance common sense is quite equal to the most mature military experience.[1] It is believed that the officers of the government are now taking all of this class of arms that can be manufactured, but if it can be proved that they are not, the next generation will not judge them with the leniency of the present.

Messrs. E. G. Lamson & Co. are now employing about 400 men in their Armory and Machine Shop.

(1) Major-General Rosecrans, in a letter dated November 13th, 1863, stated—"The Government has already become convinced that breech-loading, revolving chambered, or single-charged arms, should be used for cavalry and other mounted troops. It should, and in my opinion will, ultimately adopt them for infantry. I have no doubt that could such arms, of proper construction, be substituted at once for those now in use, it would add not less than fifty per cent. to the force or power of the troops now in the field. In other words, we should *augment our army one-half* by changing the weapons."

MANUFACTURES OF WORCESTER.

[The following are the Statistics of the principal manufactures of Worcester County, which includes, besides the City of Worcester, the manufacturing towns of Clinton and Fitchburg, for the year ending June 1, 1860:]

Manufactures.	No. of Establishments.	Capital.	Raw material.	Male hands.	Female hands.	Value of product.
Agricultural implements	3	$15,000	$25,800	45	.....	$67,000
Fanning mills	1	800	368	1	.....	1,200
Plows	2	152,500	179,350	251	.....	367,150
Plow handles	1	9,000	4,000	7	.....	12,800
Rakes	2	6,000	1,535	11	.....	9,595
Straw cutters	1	26,000	24,000	30	.....	50,000
Baskets	6	1,275	525	9	.....	4,430
Bolts, nuts, etc.	1	3,000	7,000	7	.....	10,000
Boots and shoes	183	478,325	4,076,531	4,212	5,040	9,595,307
Boxes	26	155,100	103,280	108	.....	174,052
Brass founding	2	4,450	11,300	6	.....	17,900
Brooms and brushes	6	11,780	6,865	20	4	20,900
Broom and tool handles	5	12,000	2,415	17	.....	12,200
Buttons	1	4,800	1,200	2	7	7,200
Cabinet furniture	15	39,000	29,627	80	.....	90,200
Chairs	62	646,400	479,901	1,311	1,231	1,421,545
Calliopes	1	3,000	1,630	5	.....	8,000
Cane splitting	1	108,800	90,000	70	45	150,000
Car linings	1	1,500	1,967	6	.....	8,160
Carpets	1	300,000	397,000	95	129	600,000
Carriages	35	113,700	67,286	184	.....	180,853
Cars	2	45,000	27,542	38	.....	77,500
Carpenters' tools	2	49,000	5,900	15	1	34,000
Casks and barrels	1	4,600	3,275	11	.....	12,350
Clothing	37	140,650	283,708	139	326	478,250
Coffins	4	3,900	3,178	10	.....	10,550
Combs	25	131,500	114,665	262	51	371,200
Copying presses	1	5,600	3,000	9	.....	15,000
Cotton goods	2	4,137,514	2,380,608	2,970	3,345	5,598,089
Batting and wadding	2	6,500	7,470	4	1	9,600
Cordage	2	34,000	32,757	28	20	66,930
Yarn, thread, wick, etc.	6	90,500	115,460	71	80	161,545
Cotton and woolen machinery	7	232,000	261,650	663	6	730,940
Eave troughs	1	2,000	2,000	10	.....	12,000
Edge tools	6	329,300	211,639	336	.....	478,356
Envelopes	1	33,000	40,750	12	45	65,000
Firearms	2	52,500	21,900	132	.....	106,000
Flour	67	231,200	652,671	95	.....	732,487
Gun powder	1	30,000	42,938	9	.....	71,450
Hand cards	3	34,400	28,220	52	9	181,700
Hardware	6	33,500	54,910	62	.....	112,000
Hose and belting	2	18,000	48,000	10	.....	66,000
Hosiery	3	79,000	51,656	53	69	131,300
Hubs, spokes and felloes	10	23,960	9,075	31	.....	39,852
Iron founding	8	119,400	139,720	174	.....	274,000

Manufactures.	No. of Establishments.	Capital invested.	Raw material.	Male hands.	Female hands.	Value of Product.
Iron, rolled	1	$115,000	$367,000	212		$440,000
Jewelry	5	32,000	27,900	39	7	90,500
Lasts and boot trees	11	12,250	8,576	43		40,180
Leather	47	387,100	977,520	317		1,303,913
Linen goods	1	75,000	115 750	50	100	150,000
Locomotive and car repairing	1	10,000	3,000	20		13,000
Looms	1	20,000	21,000	60		75,000
Lumber, planed	9	29,800	66,985	41		95,620
" sawed	168	345,350	428,802	352	1	625,724
Machinery	26	236,000	149,535	406		472,893
Machine-card clothing	8	140,000	265,435	70	10	331,200
Machine knives	3	43,500	21,449	27		48,000
Malleable castings	1	9,000	12,300	40		38,500
Maps	1	3,000	3,330	3		6,000
Matches	2	1,400	5,345	4	7	8,705
Melodeon cases	4	16,000	13,275	39		52,400
Musical instruments	2	7,500	1,940	12		11,200
Musical reeds	1	6,000	3,610	15		18,500
Morocco	2	5,200	62,000	11	1	36,000
Needles	2	4,000	600	11		6,250
Organs	1	4,000	2,930	6	1	9,000
Packed provisions	1	7,000	11,000	1		13,000
Palmleaf hats	21	67,700	268,468	110	445	438,187
Paper, printing and writing	6	177,000	290,426	114	75	515,850
Paper, wrapping	3	51,000	42,000	25	10	124,000
Patent machines	3	26,300	51,400	14	11	74,200
Patterns and models	2	2,000	1,200	11		10,280
Pianos	2	18,000	11,800	20		46,000
Piano and melodeon legs	2	28,000	30,700	45		53,000
Pocket Books	5	30,700	118,960	36	136	157,500
Pottery ware	2	6,000	3,150	13		10,000
Preserves	2	4,200	4,851	3	3	150,000
Printing	4	25,000	6,350	22	2	21,600
Refined cider	4	13,200	6,827	12		14,856
Reeds and harness, etc	7	27,100	21,240	44	36	48,450
Saddlery and harness	17	16,950	16,400	43		42,990
Sash, doors and blinds	11	34,300	58,000	102		120,798
Scythes	6	77,000	39,720	99		114,200
Shoddy	5	11,300	42,081	26	4	73,620
Shoe nails	1	4,000	15,000	7		19,750
Shoe pegs	3	6,500	3,405	14	2	11,000
Shoemakers' tools	6	26,600	4,992	51		43,500
Skates	1	5,000	1,485	8		11,000
Soap and candles	10	30,750	45,377	27		68,235
Steel traps	1	2,500	1,020	6		4,500
Stoves	3	11,500	12,855	17		25,900
Straw goods	4	64,500	209,687	96	182	457,750
Tin and sheet-iron ware	28	82,200	83,613	101	1	148,455
Wire	5	275,000	508,700	394	28	940,000
Wooden ware	26	157,800	162,800	332	3	332,053
Woolen goods	42	1,910,000	3,067,531	2,005	1,106	5,105,542
Woolen yarns	3	42,000	66,150	46	33	112,000
Total, including miscellaneous manufactures not above specified	1,357	$13,334,769	$18,234,584	18,190	12,699	$37,092,920

REMARKABLE MANUFACTORIES IN WORCESTER.

The Washburn Wire Works—Ichabod Washburn & Moen, Proprietors

Worcester has long been known as one of the most flourishing and enterprising of the interior cities of New England, and noted especially for the variety and extent of its manufactures. The leading interest in the city, judged by the amount of the product (which is now considerably more than the statistics show), is Wire Drawing; and the oldest and largest of the establishments in this manufacture is the "Washburn Wire Works."

These works were founded in 1834, by Ichabod Washburn, who had previously been engaged in making wire at Northville, Worcester County, where he built a small factory as early as 1831. At that time Wire Drawing as an American manufacture was in its infancy—in fact Card Wire was not made from the rods to any extent in this country. What little had been made was of an inferior quality, that tended to excite a prejudice against American wire. This prejudice Mr. Washburn resolved to overcome, which could only be done by making an article of better quality than the imported; and that he did this, is evident from the fact that in five years after he had built the Grove Mill card wire was no longer imported. In this he was aided first by the protection afforded by a favorable tariff, and secondly by a large home demand. The County of Worcester has long been the principal seat of the manufacture of Cards, both hand and machine, in this country. Here the Earles, for three generations, and other celebrated makers of cards and card-clothing, have pursued this important branch of business. Indeed, until recently but few cards were made out of Massachusetts. But, more than to either of these circumstances, his success was due to the fact of employing novel and original machinery, that not only improved the quality of the wire, but increased the product. In 1851, at the London International Exhibition, it was freely admitted by the large wire manufacturers of England that the Americans had machinery superior to theirs, and that they were able to make four times as much wire with the same number of hands as was ordinarily done in that country.

Card Wire continued to be for many years the leading article of manufacture at the Washburn Works, but as other kinds became in demand facilities were provided for producing them. When the invention of the Telegraph had induced an extensive demand for wire for telegraphic purposes, Mr. Washburn directed his attention to its manufacture, especially to Galvanized Wire, which is a better conductor of the electric

fluid than ordinary wire. Previous to the adoption of the process of galvanizing, the scale had to be removed from the wire by means that required an exposure to acids from fifteen to twenty minutes, which rendered it brittle. To obviate this defect Mr. Washburn secured the control of an English patent for a process by which the wire is passed through a tube heated so as to bring it up to a slight red heat, and then through a cold acid bath, remaining in it however hardly a second, from which it emerges in a perfectly clean condition, and not injured as it usually is when long exposed to acids. Wire made in this way has borne the weight of trees falling upon it without breaking. The importance of great tenacity in telegraphic wire is too evident to need remark. The following Table represents the common numbers of iron wire used for this purpose, and its strength as plain wire, and also when coated with zinc—the figures representing in pounds the strain at which each had broken:

	Plain Iron.	Galvanized.		Plain Iron.	Galvanized.
No. 6	2,300	2,390	No. 10	1,270	1,385
No. 7	2,010	2,210	No. 11	1,043	1,155
No. 8	1,820	1,985	No. 12	832	992
No. 9	1,520	1,665	No. 13	631	886

Messrs. Washburn and Moen are the only makers of Patent Galvanized Wire in the United States, and notwithstanding it is established that the system which they have adopted uniformly secures the additional strength of 12½ per cent. in tension, and the same in the section power, over any other mode of galvanizing yet adopted, they sell it at same prices charged by others for the ordinary wire.

When the popularity of Hoop Skirts created a demand for Crinoline Wire, this firm engaged extensively in its manufacture, and they are now by far the largest producers of this wire in the United States. The steel used in making crinoline wire is imported from England in the form of coiled rods of about ¼ of an inch in thickness.

The first operation to which it is subjected, is heating it to about a bright-red heat, in a furnace adapted for the purpose, by which it is softened. It is next cleansed with an acid to remove all oxide from its surface, after which it is coated with rye-flour and dried in a special apparatus. It is now ready for drawing, which consists in reducing the steel rod to a much less diameter and at the same time greatly extending its length. One end of the rod is first pointed on an anvil down to the size or number to which it is to be drawn on the "gauge plate."

The wire, after it has been pointed, is passed through a hole of the proper size in a steel draw-plate, which is secured fast to the

drawing-frame, and is then carried forward and fastened to a drawing-block placed upon the top of a revolving vertical spindle on the drawing-frame. As the block revolves it winds the steel rod around it and pulls it through the hole in the steel draw-plate, reducing its size to wire gauge called No. 7. It takes no less than ten-horse power to draw the steel rod down to wire during this first operation, which compresses the atoms of the metal very close together, rendering it hard and brittle. Before it can be drawn a second time it requires to be softened again in the annealing furnace, and afterwards cleansed in the same manner as it was prepared for the first drawing operation. It is then drawn through a smaller hole in a draw-plate and reduced two sizes, and so on until it has been reduced to the requisite size and what was a few yards in length has been extended to two thousand yards. It is then flattened by drawing from one reel and passing it between a pair of pressure steel rollers. After this the flattened wire is next hardened by passing it through a bath of red-hot lead, then through a trough of oil where it is quenched, then through a bath of slightly-melted lead heated to such a heat as will reduce it to the right temper—requiring much practical experience to secure the proper temper. This process for tempering is patented by this firm. Messrs. Washburn & Moen have facilities for making thirty tons of Crinoline Wire per week. They furnish wires for others to cover, and have also over 900 machines employed in covering wire.

This process may be described as follows: The wire, after being tempered, is taken to the Covering Room on reels, which are placed in a frame near the floor and the wire passed up through the middle of the braiding machines and wound upon a top-reel. In passing upward, a spool carriage, similar in almost every respect to a cord-braiding machine, and carrying several spools of cotton yarn, covers the wire with cords. The spools are moved back and forth in grooves by a series of small sun-and-planet wheels underneath the roll-plate, and while they are thus moved they braid the yarn around the wire and thus perfect it ready to be sent to the warehouse. Not less than 250,000 yards of flattened steel wire are covered daily in this manufactory, and when running day and night double that quantity.

This firm are also the principal and we believe the sole makers in this country of Wire for Musical Instruments. Previous to 1850 all the pianoforte wire was imported, and the business was monopolized by a single house in England. At the solicitation of the late Mr. Chickering, of Boston, Messrs. Washburn & Moen were induced to engage in the manufacture of Wire for Piano Strings, and have succeeded in producing a quality of wire that is superceding the English. The great

value of this class of wire consists in its power of tension, which depends largely upon the practical skill of the manufacturer and the processes employed in tempering. Mr. Washburn invented a mode of tempering wire longitudinally, for which he obtained a patent, and the wire made at these works is distinguished not only for great strength but uniformity of temper, smoothness of surface, and high finish. It is used in all the best pianos made in this country. This firm also make fine Plated Wire, which is wound around the bass strings of other musical instruments. Besides these leading descriptions of wire, the firm make all the varieties of Steel Wire for Needles and for Machinery and Springs, and also wire from refined iron for Gun Screws—in fact all kinds of round, flat or oval, iron and steel Wire.

Since 1850 Mr. Philip L. Moen has been associated with Mr. Washburn in the proprietorship of these works, and has had charge of the financial department of the affairs of the establishment. Mr. Moen is regarded by the community in which he lives as one of their best financiers. The firm have two mills in Worcester, the Grove Mill in the northern part of the city, which has a roof 1500 feet in length, and a smaller mill in the southern part of the city, where the coarse kinds of wire are made. They employ about 600 hands, including 40 females, and produce an annual value exceeding a million of dollars.

The increase in the demand for Wire within the last twenty-five years has been enormous. When Mr Washburn commenced, in 1831, his production was limited to about 300 pounds per day: now his works alone produce about 7 tons of Iron and 5 tons of Steel Wire per day—and the product of the whole country, it is estimated, is about 90 tons a day. In Great Britain there has been a similar increase. About sixty years ago nearly or quite the whole product of iron wire in England was made at Prestwood, and taken to Birmingham with a two-horse team twice a week. It did not probably exceed four tons per week. Now one firm in Manchester manufactures 165 tons per week, and this is probably not more than one-tenth of what is made weekly in Great Britain.

Washburn, Barnum & Co.'s Car Wheel Works

Are among the new establishments of Worcester, but the senior partner has been identified with its manufacturing interests for many years, and has been largely instrumental in promoting its prosperity.

Mr. Nathan Washburn is a native of Stafford, Connecticut, where he was engaged in making iron castings for machinery. Previous to establishing himself in Worcester, he was also engaged in the manufacture of Iron, at Fitchburg, Massachusetts, and of castings for cotton and woollen machinery, at Rochester, New York, where, in 1847, he obtained his first patent for an improved Car Wheel. Not being as successful as he desired, he disposed of his business there in the fall of 1848, and went to Worcester, entering into partnership in the Car Wheel manufacture with E. A. Converse, under the firm-style of Converse & Washburn, which continued until 1854, when Mr. Washburn became the sole proprietor. In 1849 he invented another improvement in Car Wheels, which was patented in 1850, and now widely known as Washburn's Patent Wheel. He claimed as his invention the combination of the arch with the curved plate and arms connecting the hub and rim, and an improvement in the manner of disposing of the metal in the wheel so as to produce great strength and relieve it from strain, when cast and properly chilled, thus avoiding most of the defects to which ordinary wheels are liable when cast whole. The success of this wheel was such that it not only greatly increased the business of the foundry at Worcester, but led to the establishment of foundries for casting the wheels at Troy and Schenectady, New York, and other places. At the Car Wheel Works at Brandon, Vermont (which are in part owned by this inventor), Washburn's form of wheel is now being made. It was formerly the practice to cool wheels at the foundry in Worcester by immersing them while hot from the moulds in a pit of white sand, but now we believe the wheels are cooled in ovens expressly designed for the purpose.

The "Washburn Iron-works," founded by him, are now among the largest in New England, and consist of two Rolling-mills four hundred by one hundred and twenty-five feet, a Foundry one hundred and fifty by sixty feet, a Wire Mill one hundred and fifty by forty feet, with a wing sixty by forty, and other buildings, covering in all about four acres of ground. One of the rolling-mills is devoted to rolling Locomotive Tires, for which Mr. Washburn invented a machine that he has patented, which rolls the tire to its proper shape, and of any size, without boring. Until recently imported iron was used in this manufacture,

but tires are now made from the produce of the ore-beds at Salisbury, in Litchfield county, Connecticut, which supplied the metal from which cannon, shot, and shell were made during the Revolutionary war, and the heavy guns with which the "Old Ironsides" was armed. It is believed that this iron is fully equal if not superior to the English for the purpose.

These Works, while under his administration, were also largely employed in rolling Railroad Iron, producing about four hundred and fifty tons per week, and during the Rebellion were fitted up for the manufacture of Gunbarrels, of which they produced as many as five thousand per month. Previous to the commencement of the recent Rebellion, gunbarrels were welded under the blows of trip-hammers, upon anvils which contained a die—after the manner of the present "drop"—of the form desired, a similar die being placed above within the descending hammer. This process of welding the barrel required numerous heatings and repeated blows, and was both costly and laborious. Mr. Washburn was among the first, it is said the very first of the private establishments, to employ the rolling machine in this manufacture, which has reduced the cost of making a gunbarrel from twelve cents to four. The barrel being heated to a white heat in the furnace, is passed through rolls, or constantly decreasing grooves until it has attained the proper dimensions. It weighs ten pounds when it enters the first roll, and when it issues completed it weighs less than seven. The plan is English, and was brought to this country by an individual who enjoyed a monopoly of his art for a long time, but the process is a secret no longer, being now employed we believe in most of the best establishments.

In 1865, Mr. Washburn disposed of his interest in these Works, and erected, in the immediate vicinity, a brick foundry, two hundred by sixty feet, for the manufacture of his improved Car Wheel. This foundry has a capacity for producing one hundred wheels a day, but it is proposed to increase its facilities by the addition of mills for rolling Locomotive Tires. In the same year, Mr. Washburn, in association with William C. Barnum and other capitalists, purchased the extensive Rolling-mills and Iron-works at Spuyten Duyfel, near Yonkers, New York, where the best qualities of merchant Bar iron are now being made from Pig-iron produced at their Blast Furnaces, near Canaan, Connecticut.

Mr. Washburn is the architect of his own fortune. Commencing life with no advantages not usually possessed by ordinary workmen, he has achieved by hand and brain both wealth and an honorable position. It is a current observation in Worcester that to no other man is the city more indebted for its manufacturing importance and reputation for enterprise.

William A. Wheeler's Iron Foundry,

Though not so extensive as the others that have been remarked upon, is for several reasons entitled to rank among the notable manufactories of Worcester. It is one of the oldest establishment of the kind in the State, having been commenced by Mr. Wheeler in 1825, and has been owned by the same proprietor for a period of nearly forty years. The first Steam-Engine employed in the State west of Boston was put up in these Works.

Mr. Wheeler was also the first, it is said, to manufacture Hot-Air Furnaces in Massachusetts, and it is a somewhat remarkable fact that notwithstanding the number of new articles of this class with which Boston and its vicinity have of late years been supplied, his Furnace maintains an undiminished popularity, though but few changes have been made in it to provide an increase of radiating surface since its introduction in 1835.

Wheeler's Iron Works are located centrally in Worcester, on the line of the Nashua and Worcester Railroad, and comprise an Iron Foundry, a Brass Foundry, a Machine Shop, Forge, and Stove Shop, and their buildings, that cover in all about two acres of ground. The machine shop is furnished with every convenience for expeditious work. The manufactures of the establishment comprise almost every description of Machine, Railroad, Iron, Brass and Composition Castings, Stoves, and Hot-Air Furnaces for wood or coal, Tilt and Drop Hammers, Water, Gas and Steam Pipe, Hydrants, Retorts, Boring Mills and Punching Presses, Building Iron Work, Cauldrons, Kettles, etc. The Pattern Shop is provided with a large stock of patterns, accumulated in the course of years, and the assortment for shafting, gearing, and general mill work, is especially noticeable.

Mr. Wheeler is one of the most highly respected and ingenious, as well as one of the oldest of the American iron founders now engaged in active business. Among the latest of his inventions are improved Drop and Trip-Hammers, which are now extensively used for the manufacture of Firearms and jobbing, and a number of them are now in use in the government armories.

Richardson, Meriam & Co.,

Whose works are at Worcester, are in every respect among the leading manufacturers of Wood Working Machinery in the United States. As the successors of the original manufacturers who first made this a speciality, and with which firm all the members of the present firm were at one time connected, they may also be called the oldest established manufacturers in their department in this country.

Previous to 1836, the manufacture of Wood Working machinery was not carried on as a separate and distinct branch in any part of the United States. In that year, the firm of J. A. Fay & Co., commenced the business at Keene, New Hampshire, and by superior workmanship established a reputation that extended even to Europe. As their business increased it became necessary to enlarge their manufacturing facilities. Accordingiy, in 1853, they puchased a small concern in Worcester, and organized a branch under the name of J. A. Fay & Co., of Worcester, making its business affairs distinct from those of the parent establishment in Keene.

In April, 1854, Mr. Fay died, but his widow continued the business with the other partners until 1861, when the prostration of business incident to the breaking out of the Rebellion, rendered a dissolution of the firm advisable, and, accordingly, its affairs were settled so far as they could be, and every demand paid.

In April, 1852, Horace A. Richardson, Rufus N. Meriam, William B. McIver, and Samuel F. Bond, all of whom, as we have stated, had been connected with the old firm, commenced business under the name of Richardson, Meriam & Co. Mr. Richardson was a nephew of Mr. Joslin, of the firm of J. A. Fay & Co., and he enjoyed the benefit of his uncle's counsel and experience to a large extent. He has been connected with the manufacture of Wood Working machinery since 1846, and from 1858 to its dissolution was a member of the firm of Fay & Co. Mr. Meriam entered the employ of that firm in 1853, and for several years was their foreman in the wood department. Messrs. McIver and Bond entered the employment of J. A. Fay & Co. in 1855, the former as journeyman, the latter as an apprentice in the machinery department. They were devoted to the business, became excellent workmen, and to them was assigned that part of the work which required the greatest skill to execute. At the formation of this firm it was predicted that its career would be short lived on account of the adverse state of the Nation's affairs, but the combined experience of its members, resulting in the production of the most perfect Wood Working machinery ever manufactured, insured a complete and undoubted success.

The machines made by this firm do not differ essentially in appearance from those made by other manufacturers, but they are constantly adding to the variety of their productions by inventing new patterns, substituting iron for wood, steel for wrought iron, and wrought iron for cast iron, whenever a benefit is to be derived from the change. All the working or small parts are made of uniform sizes, so that should a duplicate part be needed to repair, or for any other purpose, it can be furnished without difficulty. Among the inventions made by the members of this firm and the improvements applied to their machines the following may be mentioned :

The *New Cutter Arm* for Daniels' Planing machines, invented by Mr. R. N. Meriam, and for which he received Letters Patent dated September 20th, 1864, is the greatest improvement ever attached to that kind of machines, adding not only greatly to their value, without increasing cost to the purchaser, but very much to the personal safety of the operator.

The *Expansive Feed Geering* for Woodworth's Planing Machines, invented by Mr. William B. McIver, and patented March 27th, 1866, is a very valuable addition to that class of machinery. It has been tested most thoroughly for the purpose of ascertaining its real merits, and has been found to do the work required of it in a most satisfactory manner, and with less wear and expense for repairs than any thing before used.

The *Self Oiling Journal Box* invented by Mr. S. F. Bond, for which Letters Patent issued to him April 23, 1867, is one of those valuable improvements which can be adapted to almost every machine in use, and relates to that description of self-lubricating journal boxes in which the oil or lubricating material is contained in the lower or box part, and is drawn out on to the journal by the rotation of the latter, while the surplus, or any extra oil so extracted, is, by the same motion, returned or worked back to the reservoir. This invention is duly appreciated by the most intelligent machinists, and is now applied to all the machines of their manufacture.

This firm is, in fact, an eminently progressive one, making improvements constantly in the line of their business, which are furnished to their patrons without extra expense. They have several Moulding machines, novel both in design and construction, that bid fair to surpass any thing before made.

Messrs. Richardson, Meriam & Co., employ about seventy hands, and produce machines to the value of nearly two hundred thousand dollars annually. They have recently established a warehouse at No. 107 Liberty street, New York, for the accommodation of their patrons, and its advantages are very apparent.

L. W. Pond's Machine Tool Works

May be called the pioneer of those establishments which, from their number, have given such a distinctive character to the city of Worcester that some one has said if he were called upon to define its position, he would answer that it was bounded on the north by Engine Lathes, on the east by Planers, on the south by Steam Engines and Bolt Cutters, and on the west by Machinery for all sorts of purposes. Mr. Pond is the successor of Samuel Flagg, who came from Boylston and established in Worcester the first manufactory of Machinists' Tools. At that time it was asserted that he could supply, with his small force of six or ten men, all the tools of this description that would be required in the United States; and no one predicted that, in less than twenty years, Worcester alone would employ in the aggregate a thousand men on this class of machinery.

Mr. Pond began in Mr. Flagg's establishment as an apprentice, then became foreman, and not long afterwards a partner. In 1854 the original manufactory was destroyed in the great fire, and though the loss was very heavy through the failure of the Insurance Companies, every creditor was paid in full, and no one was ever solicited to accept less than the amount of his claim justly due. Subsequently, during the same year, Mr. Pond purchased the interests of the other partners, and soon after erected a new building near the former site, and commenced the manufacture of tools for his individual account, which he has since successfully prosecuted without a partner.

The main building in which his manufacturing operations are now carried on is one hundred and ninety-four feet long, forty feet wide, and three stories high. To this are attached a smith's shop, pattern shop, and boiler room. Among the remarkable machines to be seen in the lower floor of the main building is an immense iron planer weighing thirty-two tons, another weighing fifteen tons, and a horizontal boring and turning lathe, particularly adapted to boring steam cylinders. This lathe originated in this establishment, though it has been extensively copied by others. The second floor is appropriated principally to the manufacture of medium-size Engine Tables, Drilling Machines, and the manufacture of Tafts' celebrated Patent Rolling Lever Punching and Shearing Machines, Mr. Pond having the exclusive right of manufacture; while the third floor is used in part for the manufacture of light machinery—also the manufacture of a new and greatly improved Spring Caliper, said by experts to be destined to supersede those of English manufacture, as they can be furnished for about one half the cost. The machinery is driven by an upright double-cylinder

engine of sixty horse-power, and about one hundred and twenty-five hands are employed in the establishment.

Mr. Pond has the reputation of making tools equal in quality to any made in the United States. His gear-cutting machine, with inclined arms to keep the cutter in place, and arranged to cut all kinds of gears to eight feet diameter, is remarkable for its fine finish and efficient action. The dividing machine, adjustable to any required bevel, is a most ingenious affair. His engine lathes are provided with an improved Gib or Lock Rest, so arranged that the tool can be raised or altered when in operation with the same convenience as the Weighted Rest. The lower half of the Rest is so constructed that the upper part can be easily removed, leaving the lower part well arranged for boring purposes. His Iron Planing Machines are provided with a set of Double Spiral Gears, the peculiarities of which are the combined smoothness of motion given by the Screw, and the increased strength and durability of the Rack and Gear.

At a late exhibition of machinery in Worcester, Mr. Pond exhibited a lathe for turning Locomotive Driving Wheels that weighed twelve tons, and was pronounced by experts as unusually fine in point of finish, while its proportions were massive. The back heads and spindles of his Locomotive Driver Lathes are unusually strong, and in convenience for shifting the carriage and general accessibility for changing the speed of the cone, are not excelled by any. In order to accommodate the public, and supply the continually increasing demand for his machinery, Mr. Pond has opened a Wareroom in New York city, at 85 Liberty street, two doors from Broadway, where a good assortment of Iron and Wood-working Machinery may be seen—this being the only wareroom in the city where the public can see samples of such machinery in motion.

Mr. Pond is now, for a third term, a member of the Massachusetts Senate, and is noted for the zeal he manifests in subjects of a practical character designed to advance the manufacturing and industrial interests of his State.

Wood, Light & Co., Worcester, Massachusetts,

Whose reputation for manufacturing Machinery and Tools of a superior quality is second to none in New England, occupy for their Works several rooms one hundred by fifty feet, in the large building known as the Junction Shop. The firm, which dates the commencement of its present style from 1852, is composed of Aurin Wood and Joseph F. Light, both of whom have had a long and varied experience in the

construction of Machinery. Mr. Light, who may be called the senior partner, inasmuch as he was connected with firms that preceded the present copartnership, was formerly employed in the celebrated Foundry of Cyrus Alger, in South Boston, and is a practical Machinist of acknowledged ability. Mr. Wood, previous to his removal to Worcester, was several years Master Mechanic in the workshops of the James Screw Company, at Somerville, New Jersey, and possesses a genius for originating improvements and solving intricate problems in mechanism that entitles him to a high rank among American Inventors.

The Tools made by this firm are distinguished for good material, care in construction, and a suitable proportion of weight—or, in other words, adaptedness to the work required to be done by them. They include all the usual varieties of Lathes, Planers, Boring Mills, Vertical Drills, Milling and Profile Machines, and a variety of novel machines not ordinarily made in such shops, such as Traverse Drills with an upright attachment, Nasmyth Hammers, and Gun Barrel Welding and Finishing Machines—in fact, this firm seem to possess the ability to construct any kind of Tool that may be required, however special or peculiar the purpose. Most of the Tools made by Wood, Light & Co. have also certain distinctive features and novel devices in their constituent parts, designed to promote the convenience of those who operate them; and many of the improvements that are now generally adopted by Tool Builders originated with this firm. For instance, Messrs. Wood, Light & Co. originated the arrangements in *Lathes*, now used by many Tool builders, for changing the motion of the screw from right to left hand, by the use of three gears upon a plate inside the head-stock, with the hub of plate running through the stock, on which is fastened an arm or lever with index pin attached. When the arm is raised to a certain point, the pin is thrown by a spring into a hole drilled in the head, and holds the gears in connection with the gear on the spindle, giving the screw a right hand direction. When a left hand direction of the screw is required, the pin is drawn and the arm dropped, so that the pin falls into a hole in the head-stock and holds the gears in connection therewith. At an early day, this firm also made an important improvement in the friction feed of Lathes, designed to take the place of the chain feed formerly employed. This form of feed is regarded by those practically familiar with its advantages, as among the most simple and perfect in use. To remedy the difficulty frequently complained of by persons using lathes, that the journals cut and grind through neglect in oiling, Mr. Wood has invented and patented a Self-Oiling Attachment, that keeps the journal always lubricated. The cup is so placed that oil always finds its way to the journal until the cup is empty,

which can readily be seen, and then easily replenished. Experience has established that the best metals for Lathe heads are cast steel and cast iron; and as, by this attachment, the journals are always kept oiled, the objection to their cutting is effectually removed.

Mr. Wood has also recently patented an improved Lathe for turning shafting, that is said to do double the work of any ordinary lathe in the same period of time. The bed is cast with a bottom forming a cistern, which is partly filled with soda water, and by an arrangement of a small pump and cup, which admits water to the tool at its cutting point, both the tool and the shafting are kept cool, the result being a great increase in the effective action of the Lathe. This firm also manufacture Lathes for turning irregular forms, of almost any desirable shape, both outside and inside of any piece of metal, and improved machines for turning ends of rods and cutting Screw on the same.

In the manufacture of *Planers*, Messrs. Wood, Light & Co. have made important improvements, directing their attention especially to remedy the defects in the "shipper." By a novel arrangement they are enabled to change the feed from fine to coarse in an instant, ranging from a fine cut to one and a half inches wide; and, secondly, the belt shipper is disconnected from the motion of the table, and all the parts placed on the outside of the machine, where they are easily oiled, and, when required, repaired. This firm also manufacture a Planer with crosshead and tool-stock on both the front and rear of the upright. On this machine two pieces of metal may be placed on the bed at the same time, allowing say eight feet between points of tool on the two sides of the upright, and the one will be planed by the forward and the other by the back action of the table. This is, in effect, two Planers in one, requiring only the power of one, but performing the work of two, and peculiarly serviceable in manufactories requiring duplicates of many pieces of moderate length.

Messrs. Wood, Light & Co. are one of the few firms in this country that manufacture the Nasmyth Steam Hammer. Their Hammers of this pattern are notable for greater weight of material than is ordinarily employed, and also for certain improvements, that give them such solidity and strength, that, though in constant use night and day, for years, in welding railroad bars, they have not suffered from the jar, or required repairs. Instead of casting the posts in one piece from bed-plate to cylinder, as is usually done, they cast two posts, as high as may be desired, and place upon them a heavy iron plate, that firmly holds the machine from spreading or springing. Upon this, again, two other uprights are placed, between which the Hammer slides, and upon these the tablature, and upon that the cylinder. The posts are firmly bolted together, and made in this

way there is no strain upon the castings, besides being more easily transported and set up.

During the late Rebellion, this firm engaged largely in the construction of Gun Barrel Machinery, and supplied the United States Armory at Springfield with a large number of the Milling and Profile Machines they have in use. This branch of their business they continue, and are now supplying Austria and other portions of Europe with Edging Machines. Mr. Wood is the inventor of an ingenious machine for turning grooves in gun-barrel rods.

About eighty persons are ordinarily employed in these Works.

L. & A. G. Coes' Wrench Manufactory,

In New Worcester, is one of those peculiar manufactories that can rarely be found outside of New England. It is a large and important concern, that has made fortunes for its proprietors, though devoted to the manufacture of a single article, with only seven different sizes. It owes its origin to the invention of one man, a house-carpenter, who conceived the idea that it would be an improvement upon all former methods of manufacturing wrenches, by having the screw or rosette, for moving the sliding-jaw, maintain the same relative position, at all times, to the handle. Described in the technical language of the patent of April 16th, 1841, Mr. Loring Coes claimed, as his invention, "the moving the sliding jaw by a screw, combined with, and placed by the side of and parallel with, the bar of the permanent jaw and handle when the required rotation for sliding the jaw is given by the head or rosette, which retains the same position relatively to the handle during the operation; and also moving the sliding jaw by a screw combined with, and placed by the side of, and parallel with, the bar of the permanent jaw, in combination with a rosette or its equivalent, retained in its position relatively to the handle." At that time, both the inventor and his brother, who became associated with him, were so entirely without means, that they had difficulty in procuring the malleable iron, requisite to manufacture the original sample. Overcoming the obstacles, however, incident to a want of capital, they succeeded in introducing a few of their improved wrenches into the market, when their superiority was at once recognized and acknowledged, and orders flowed in upon them; so that, in 1845, they were enabled to purchase a building in New Worcester, formerly a woollen mill, and fit it up as a manufactory. The original building was one hundred feet long by thirty-

five feet wide, to which they have since added another of the same size, and a blacksmith shop, seventy-five by fifty feet. At this time, they employ, in these buildings, about fifty hands, who produce, by the aid of the best machinery, ten thousand wrenches per month.

The processes of manufacturing screw-wrenches, as conducted in an establishment like this, are very interesting. The bars and shanks, which are of wrought iron, are drawn under trip-hammers; though this firm have invented and patented a machine for rolling them. This machine, which, however, is not yet in use, consists of a pair of peculiarly-constructed rolls, with a novel guide for holding and directing the bar in an oblique or inclined position, as it is drawn through the rolls. The heading of wrench-blanks is done in this establishment with astonishing rapidity, by means of a machine invented and patented by L. & A. G. Coes. It consists of a combination of an anvil-block, side-dies, gauge and hammer, the gauge being arranged so as to define the relative position of the several parts, with regard to the blank, for the purpose of paring down the thin part of the jaw, and the hammer being provided with a tripping-arm, so that, when tripped, the hammer will not fall upon the cam; and also with a foot-lever or treadle, in combination with a hinged catch, for catching and holding the hammer. After the blanks are headed, they are passed through milling machines, then the sliding jaw is put on, and they are then ground on grindstones. This firm have invented a novel and ingenious machine for holding the wrench to the grindstone, and in such a manner, as to wear the stone evenly. The handles are made of apple-tree wood, and turned in a machine, by the aid of which, one man, it is said, can finish eight hundred in five hours. The wrenches, when finished, are put up, six in a package, and twelve packages in a box. They are of seven different sizes, ranging, in length, from six to twenty-one inches, and classified as "bright" and "black," the former being brilliantly polished. This firm have adopted, as their trade mark, a ball governor in a triangle, which is placed upon all packages. Coe's wrenches are now a standard article in the stock of hardware merchants throughout the United States, and are sold largely to Cuba, Australia and California.

The Messrs. Coes, by their inventive genius and business talents, have accumulated handsome properties, and are owners of nearly one-half of the village of New Worcester, with large tracts of adjacent land. Both have filled, creditably, the positions of Aldermen and members of the City Council, and Mr. A. G. Coes is now a member of the Massachusetts Legislature. They have been prominent, also, in establishing the Mechanics' Association of Worcester, and are directors in various companies, organized for the public benefit.

T. K. Earle & Co.'s Card-Clothing Manufactory,

In Worcester, is the oldest establishment of the kind in the United States. It was founded by Pliny Earle, the uncle of Messrs. T. K. and Edward Earle, who now comprise the present firm. He was the first manufacturer of Machine Card-Clothing in this country, and his first customer was Samuel Slater, who has been repeatedly mentioned in this history. He left to his nephews and successors many important improvements, which they have used as a basis of still other improvements, that have rendered this manufactory confessedly pre-eminent in this branch of manufacture.

Messrs. Earle & Co. have now over a hundred machines for the manufacture of Card-Clothing in constant operation in their new mill on Grafton Street, near the Western Railroad depot, combining many important improvements, that enable them to produce an article as uniform and perfect as can be desired. They cut up about twenty-three thousands sides of leather in a year, consume sixty-two tons of wire, from No. 18 to 36, and produce from four to five hundred square feet of Card-Clothing per day. They keep on hand a stock of Doffer Rings of all widths, with all the fractional variations, to meet the urgent demand which frequently arises from accident. They have also introduced a new kind of Fancy Cards, which have given great satisfaction. Their Diamond Point or Angular Wire has become an indispensable Card for Feeders, Tumblers, and Leader-ins in all fine work, and is much used in coarse heavy work for all cylinders. They furnish Aprons for Combing Silks and Worsted, Fillet for Apperly's Patent Self-Acting Card Feeder, and Cards of Diamond-Pointed Wire, of brass or iron, for Cleveland's Drying Machines.

For several years Messrs. Earle & Co. have been experimenting on Cards for the manufacture of Flax Cotton, the importance of which has already been alluded to. They are now prepared to supply every variety required in this branch of manufacture. They also publish a pamphlet of estimates of the number of feet of Card-Clothing required to cover the various wool and cotton carding machines.

During the year 1865, the members of this firm, in association with others, erected, in Worcester, extensive works for the manufacture of stoves, especially of a stove invented and patented by SIDNEY SMITH, the Superintendent of the Company, which possesses properties that elicited expressions of wonder and surprise from professors and scientific men who have examined it. It is claimed that, by the peculiar construction of the fire chambers, this new form of Stove produces a pure oxygen flame, consumes those gases that are usually lost, and

obtains four times more heat from a given quantity of coal or wood than any heretofore invented. The radiating surface of the Stoves designed for warming purposes is twice as large as in those in common use, so that the Stove may be kept at a very low temperature, and yet warm a room; while in the Stove designed for cooking there are four flues to carry fresh hot air to the oven continually, keeping the oven free from impurities by carrying the poisonous gases and vapors into the chimney as rapidly as they are generated. It is quite certain that there are secrets of economical combustion that have never yet been discovered, and it is also certain that the experimental tests of this inventor have excited great interest and astonishment in those who have witnessed them.

The officers of the Company are T. K. Earle, President; Edward Earle, Treasurer; J. S. Rogers, Secretary; and Sidney Smith, Superintendent.

The Sargent Card-Clothing Company

Was organized, in 1866, with a capital of one hundred thousand dollars, and proceeded to erect a building in Worcester, that, in architectural beauty, and the admirable arrangements of its interior for the purposes of the business, has no superior in this country. The main building is one hundred and fifty-four feet long by forty feet wide, four stories in height, with an L, fifty feet square, and two towers in the front and rear, through which all the staircases ascend. Entering at the L door, the visitor finds himself in the boiler room, and examines with interest one of Harrison's non-explosive boilers, which consumes only five hundred pounds of coal per day. Next is the engine-room, where a thirty-horse-power engine does its work with less noise than the flutter of a lady's fan. In the rear is a large room occupied as a manufactory of packing boxes. Passing into the main building, the visitor stands in an immense room, one hundred and fifty-four by forty feet, well-lighted, and floored with a mixture of Roman cement and gravel. This apartment is used exclusively for carrying purposes, and is furnished with all conveniences that can be made serviceable in the business.

Going up a winding staircase in one of the towers, the machine-shop in the rear of the building, on the second story, is reached. Here, eighteen hands are constantly employed in manufacturing all the machinery used in the establishment. This is a notable peculiarity of the factory, and will have its legitimate influence on the prices of its

products. On the same floor is the leather-room, where the curried leather is dressed and made ready to receive the card teeth. All of the machinery in this room is of the latest style, and embraces many improvements not in use in other mills of the kind. Parallel with this apartment is a room where the cards receive the finishing touch, previous to packing and shipment, and in front are the counting-room and private offices, most tastefully and conveniently arranged.

On the next floor, the visitor finds the machines in operation, making clothing for cotton, woollen and flax cards. There are few things in the world of machinery more beautiful, or more strikingly illustrative of the mechanical genius of man, than one of these machines in motion. The original machine used for inserting wire was patented, in 1810, by Thomas Whittemore; but the real inventor was Elijah Smith, of Walpole, Mass. The Hon. Daniel Webster said of it, that it seemed to be more nearly endowed with human intelligence than any other machine ever invented; and John Randolph, after looking at it, exclaimed, "All but the immortal soul!" It seizes the wire with its steel fingers, bends it, punches holes in the cloth, leather, or paper, then inserts the wire, at the rate of one hundred and ninety teeth per minute; and, if the slightest derangement take place, or the least imperfection is manifested in the manufactured product, it stops, and waits until the difficulty is remedied. The machines here are all new, and present important improvements over those in ordinary use, in the rapidity of movement and mechanical combination. With the improvements that have been made, only three men are required to tend over seventy-five machines. There are fillet machines in these works that will insert four hundred teeth per minute. The spacious room is as light as daylight can make it, and, by the skilful arrangement of colors on beams and posts, the glare of unrelieved whiteness is avoided. The fourth story is a counterpart of the third, and, when the establishment is fully equipped, it will contain two hundred and eighty machines.

In general plan and completeness of detail, having regard not only to the requirements of the business, but to the comfort of the operatives, this new mill may fairly be regarded as a model. It is built in the most substantial manner—and, in its construction, all possible precautions have been taken against fire—a point which is too often neglected in these days. There has been no stinting in outlay, and the same liberal policy which is visible in the construction and arrangement of the mill, governs the entire business. The most expert workmen in the country have been secured, noted for their skill in making uniform work, the only true test of a good card.

The visitor of mechanical tastes is forcibly attracted by the machinery, all of which, as has been said, is made on the premises. It seems

to represent the highest attainable degree of human ingenuity and mechanical cunning, *and gives assurance of a material saving in the cost of the goods manufactured.* It is all built under the immediate superintendence of Mr. EDWIN S. LAWRENCE, a practical card maker, who has had twenty-three years' experience in this business; and his superintendence of the mill is a guarantee of thoroughness in the goods manufactured, and an assurance that the very latest improvements in machinery will be availed of to render them in all respects perfect.

The resources of this mill, as may be inferred from the foregoing, are very extensive, and, while producing standard Card Clothing of all kinds in immense quantities, at prices just to the consumer, this company will furnish to order carding machines of every description, manufacturers' supplies of every variety, all kinds of cotton and wool hand and stripping cards, etc., etc. The Agents of the company in New York are the well-known and extensive hardware firm of SARGENT & Co., No. 70 Beekman street, and in Philadelphia, the successful builders of Woollen Machinery, FURBUSH & GAGE.

E. C. Cleveland & Co.'s Manufactory of Machinery for Woollen Mills

Is, with one exception, the largest in New England. It occupies the Junction Shop in Worcester; a building four hundred feet long, fifty feet wide, three stories high, and, with the Forge Shops, Paint and Drying Houses attached, covers an area of several acres.

The firm is composed of E. C. Cleveland and John C. Mason; both of whom have had a large experience in various departments of mechanics. Mr. Mason was formerly of the firm of Ruggles, Nourse, Mason & Co., at one time, the most extensive manufacturers of agricultural implements in New England. Mr. Cleveland, though born in the State of Vermont, has been identified with the manufacturing interests of Worcester since he was eighteen years of age. He early perfected himself in the arts of draughting, designing and pattern-making, and, for several years, was employed by the firm of Goddard, Rice & Co., makers of paper machinery. While in their employ, he was sent to Cuba, to superintend the erection of paper mills, and spent eighteen months on that island. On his return to Worcester, he became connected with the firm of Thayer, Houghton & Co., manufacturers of Machinists' tools; and, as a member of that firm, prosecuted a successful business for eight years, until the great fire of 1854 destroyed the

entire establishment, and, through the failure of Insurance Companies, the greater part of the accumulation of years of labor was instantly swept away. Mr. Cleveland then embarked in the manufacture of special machines for woollen factories, being shortly afterwards joined by Mr. Mason, and the concern speedily became entitled to rank among the most important of its class in the United States, having produced nearly a million dollars' worth of woollen machinery in a single year.

Such, in brief, is an outline of the history of one of New England's foremost mechanics. At this time, Messrs. Cleveland & Co. employ from one hundred and fifty to two hundred men, and produce, it is believed, a greater variety of wool-finishing machines than any other concern in America. This, in fact, may be called their specialty, though their manufactures include the entire range of machines, employed in converting wool into cloth. Mr. Cleveland has made and patented several important improvements in machines for finishing cloth, but it would be impossible to give a lucid explanation of them, without the aid of drawings. Suffice it to say, that this establishment has supplied many of the largest woollen mills in New England, including those of Edward Harris, the Lippitt Manufacturing Company, Olney & Metcalf, and Taft, Weeden & Co., in Rhode Island, with a greater part of their carding and other important machinery.

Oliver Ames & Sons' Agricultural Implement Manufactory,

Is the largest establishment of the kind in New England, and, some say, in the world. This firm are the successors of Nourse, Mason & Co., who succeeded Ruggles, Nourse & Mason, who commenced the business in Worcester in 1836. To Diaper Ruggles, Joel Nourse, and John C. Mason, the farmers of America are under many obligations for their unwearied assiduity in supplying them with superior Plows, at low prices. They found the cast-iron plow a rude and imperfect implement —they left it so nearly perfect in point of efficiency and convenience as hardly to be susceptible of further improvements. When they engaged in the manufacture, about a hundred cast-iron Plows supplied the annual demand. Twenty years afterward, they made and sold in a single year thirty thousand Plows, of one hundred and fifty different forms. Their manufactory, originally in a small shop now or lately used as a stable, then in the basement rooms of "Court Mills," became, by the addition of building to building, to accommodate an increasing business, nearly as remarkable for its extent as for its importance.

In 1860 this establishment passed into the hands of Oliver Ames & Sons, who had been distinguished in another though kindred branch of manufacture, that of Shovels and Spades. Ames' Shovels have for many years been a well-known and leading article in the hardware trade. Nearly sixty years ago Mr. Ames commenced the manufacture at Easton, Massachusetts, in the most unpretending manner, buying the iron and steel for not more than a dozen shovels at a time—manufacturing them, carrying them to market, and with the proceeds procuring more stock. He however lived long enough to see his establishment, thus begun, grow to be the largest of the kind in this country, and perhaps in the world, requiring for its weekly supply from twenty to twenty-five tons of Swedish and Russian iron, and from twelve to eighteen tons of cast-steel, employing about three hundred and fifty hands, and producing about four thousand Shovels and Spades per day, or nearly a million and a quarter per year. The main building of the Finishing Shop at North Easton is five hundred and twenty-five feet long, with an L ninety feet in length; and the next largest building is one hundred and fifty feet by seventy feet wide, with an L, which contains a steam engine of one hundred and ninety horse-power, with a fly-wheel attached, twenty feet in diameter, that weighs over nine tons.

Besides the Shovel Factory at North Easton, and Forge Shops at West Bridgewater, Canton and Braintree, and the Agricultural Implement Manufactory in Worcester, Messrs. Ames & Sons have a manufactory at Groton Junction, where Patent Hay Cutters, and a variety of other farming utensils are made. They are now making nearly a hundred varieties of the cast-iron Ploughs, and over fifty with steel mould-boards, which are peculiarly adapted for the rich sticking soils of the new lands of the Western States.

Their Warehouse or Salesroom is in Boston, in the spacious halls above Quincy Market, and extends nearly the entire length of the market.

The Crompton Loom Works,

In this city, are justly entitled to rank among the noteworthy manufactories, not of Worcester alone, but of New England. There are in fact but few establishments having a greater variety of novel and ingenious machinery, and of which the productions are of greater importance to the manufacturers and consumers of woollen goods. It holds the same relation to the woollen manufacturers in the Eastern States, that the Providence Machine Company does to the manufacturers of cotton goods.

The name of Crompton is one that for nearly a century has been distinguished in the annals of ingenious inventors. Toward the close of the last century, Samuel Crompton patented in England a combination of the jenny and water-frame, calling it the Mule, now in general use in Cotton factories, and received from the British Parliament a gratuity of £5,000. Recently there died in England Thomas Bonsor Crompton, who invented a valuable apparatus for drying paper, and who was the owner of the celebrated Farnworth Mills. In 1837, an ingenious Englishman, named WILLIAM CROMPTON, came to America, and in the following year invented a Loom for weaving figured cassimeres, for which he received a patent from the Government of the United States. He then visited England, and received a patent there, returning with his family to America in 1839. In 1840, this Loom was introduced into the Middlesex Mills, in Lowell, where its operation was so satisfactory as to establish its claims to being a most valuable machine; but like many other meritorious inventions, it was slow in gaining the confidence of those whom it was destined so largely to benefit, and the inventor, in consequence of pecuniary misfortunes and ill health, realized but little benefit from his invention during the existence of the patent, which expired in 1851. At that time his son, GEORGE CROMPTON, had become of age, and entering into partnership with Merrill E. Furbush, they engaged in the manufacture of the Loom, and by extreme care in the workmanship, and some improvements, the Crompton Loom soon took a position at the very head of all machines for figured weaving. This partnership lasted until 1859, when Mr. Furbush withdrew, and Mr. Crompton has since continued the business alone, extending his facilities and improving his machinery until he has now probably the most complete Loom Works in this country.

The main building is of brick, with projecting arched ends, one hundred and ten feet long, fifty feet wide, and three stories high, with a basement used for grinding and polishing, wood working, making packing boxes, etc., and a part is appropriated to an engine of forty horse-power, which propels the machinery. In this building the shafting is turned, the small work finished, and the frames for Looms are made. These rooms, with their long lines of shafting, the revolving cog-wheels, the vices, lathes, and intricate and compound tools, present to the visitor when in full operation a scene of the most lively and inspiring industry. Attached to the main building, forming with it an L, is the Blacksmith shop, and beyond a Boiler shop, surmounted with a chimney of enormous height. At some distance from the manufactory, but connected with it by a covered bridge, is a two-story frame building, one hundred and eighty-five feet long by forty-five feet wide, which is used

for putting together or "setting up" Looms. The Foundry is a separate building, one hundred and twenty feet long by fifty feet wide, with a shop for cleaning castings attached, forty by sixty feet. The machinery in this is propelled by a Corliss engine of twenty horse-power. These Works are located within an enclosed lot, having a front on a principal street of five hundred feet, and occupying about an acre of ground. Extensive as they are, we believe it is the intention of the proprietor soon to devote them to some other purpose, as he has purchased land in another location contiguous to the railroad, and is now burning two millions of brick, with a view of erecting another and much more extensive establishment.

The productions of these Works include, besides plain and fancy Looms, a novel Tape Loom, for weaving webbing, saddle girths, mattress and carpet binding. This Loom operates one hundred pecks a minute, and contains from twenty to thirty webs in each machine. The leading article made here, however, is the Loom for fancy weaving, distinguished as the Crompton Loom. This, in the hands of the present proprietor, has undergone many modifications and improvements, for which he has obtained patents, and is now a very different Loom from the original, and probably the most perfect machine for its purposes in the world.

Mr. Crompton now employs three hundred and seventy-five hands, and turns out an average of one hundred and twenty-five Looms per month.

MANUFACTURES OF FITCHBURGH.

FITCHBURGH, in Worcester County, is the seat of several extensive manufactories of Paper, Chairs, Hardware and Machinery. The growth of this city, as a manufacturing centre, is largely due to the enterprise of one man, Alvah Crocker, of the firm of CROCKER, BURBANK & Co., Paper manufacturers.* He removed from FRANKLIN,

* A friend, familiar with his career, has placed at our disposal, the following interesting account of some of the incidents in the early life and business career of that remarkable man,

ALVAH CROCKER, OF FITCHBURGH.

He was born in Leominster, Massachusetts, October 11th, 1801. His father had been a "vatman, or coucher," in the Paper Mills of Nicholls & Kendall, of that town; but his earnings were not sufficient to support the family. His mother, of the John Adams' stock, kept her boys from the poor-house, by sending them out to farmers, during the summer months, to "dress corn," ride horses, plow and rake hay. This, Alvah was compelled to do even at the early age of six years, living mostly from home; and, when only eight years old, he was placed permanently in the Nicholls & Kendall Paper Mills, and, from that time until he was sixteen, earned for his mother, from one and a half to three dollars per week, exclusive of board. He generally had eight weeks' schooling, yearly; although one year (1813), he remembers, he had but two. He managed, however, to keep along with the best of his class, by night study.

His father, whose character may be summed up in saying he was a rigid, uncompromising Puritan, had no library, or even books, save "Edwards on Religious Affection," Lives of Watts and Doddridge, "King Philip's Indian Wars," and "The Westminster Assembly's Lesser Catechism;" but his "boss," Israel Nichols, Esq., allowed him access to a very good library, for those days. He was, also (a part of the time), allowed to work in the mill during the night, earning about four cents per hour. This pittance, his mother, poor as she was, would never take from him. At the age of sixteen, his wages had accumulated to fifty dollars. This sum, he spent at Groton Academy, returning to keep school and earn more money; sometimes reading the classics at the common schools, when the teacher was competent, and sometimes at the Hon. J. G. Kendall's Law Office, in Leominster, who, pitying his extreme poverty, gave him a *carte-blanche* to recite to him when he pleased, for sweeping his office and doing a little writing. Owing to the Puritanical feelings of his father, Alvah was interdicted from entering Cambridge University, which he had intended to do, and, finally, he returned to the manufacture of Paper in Franklin, N. H., in 1820. After remaining in this town about three years, he removed to Fitchburgh, and engaged in the Paper manufacture; first as employee, and then for his own account, having erected a mill, principally on borrowed capital, at "Old Crockerville."

The years 1827–8–9 were disastrous for business affairs, and Mr. Crocker was further retarded in his progress by a freshet that injured his mill. At that time, the whole process of making Paper by hand was changing rapidly to machine work, and he had no money to spare for the purchase of machinery of any kind.

His embarrassments were further aggravated from the fact that the few old farmers who had a little money, were afraid that an increased manufacturing population might vitiate the morals of the town; and this feeling was intensified by their having to make a road by his mills. They had no particular wish for his triumph over his struggle. At this time, he had sent his product to a commission house, in Boston, against the rags and chemicals

N. H., to Fitchburgh, in 1823, for the purpose of starting and operating a new Paper mill, which had been built, by General Leonard Burbank, to replace one destroyed by fire. At that time, Fitchburgh was a straggling village, of some twelve hundred inhabitants, and enjoying only weekly communication, by mail, with Boston and Worcester. Early in 1826, he commenced, with a small capital, to build a mill, for making Paper by hand, at "Old Crockerville" (a mile and a half from the town, in a birch swamp, which he cleared), and began to make

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he used; and the last quarterly bill he made showed that some of his paper had been sold well, and some to men of straw, while the commission house informed him "they had concluded not to guarantee," leaving against him a large balance in their favor. Here, then, was his position; he had not, up to that time, made any profit, owed twelve thousand dollars on the original investment, and, commission debt included, four thousand dollars more, while ten thousand dollars, in addition, were required for his new machinery. His property, located as it was, would, on a forced sale, accrue but little to his creditors; and, though his old debts were carefully distributed, his commission debt, though not due, was loudly and unscrupulously called for. With no friend to lend him a dollar, what was to be done in such a crisis? Under the "Grab Law," failure, then, was destruction, and no money could be had.

There was, still, one course left—sell his Paper directly to consumers; open barter accounts, with yearly settlements only, for all the stock he wanted, all over the country. Added to this stock was his Cotton Waste—then used first by himself, so far as he is advised—in making white Paper. Thus, he worked on, from month to month, during the day, and frequently taking his product, during the following night, to Boston, till 1834, finding the greatest difficulty in paying both debt and interest.

A ludicrous anecdote will serve to illustrate his position at this time. There were then no Banks about Fitchburgh, and commission houses controlled business, at that period, in Boston. It being impossible for him to continue with his commission house, and without capital, he found himself, one morning, in Boston, with the notes of two well-known firms, for the paper he had teamed forty-seven miles from Fitchburgh, during the night. He looked round for some Bank, to get the money on his notes. Verdant, weary, and supposing the business of a Bank was to discount notes, he stopped his team before the "New England." Marching in, and believing he was right, proceeded at once to the cashier's desk, pulling out his promises to pay from his pocket, demanded the money. The cashier informed him, with a graceful bow, "they did not discount." With a voice that might have been heard to the bottom of the street, and looking the cashier in the eye, Mr. Crocker exclaimed, "I have not a cent to go home with, sir! I have workmen and debts to pay. Must have it; shall fail, sir! I must and will have it." His manner, his old "Tom-and-Jerry" suit, coupled with his strange singing voice, was too much for the cashier, tellers and clerks, who all joined in a loud roar of laughter. While the applicant was trying to consider what it might mean, still keeping his eye on the cashier, the noise brought the President from his room. Illy suppressing his own risibles, he asked him his name, and where he lived; and, finally, repeated the inquiry, if he did not know that Banks did not, then, discount. "How should I know that!" sang a stentorian voice; Mr. C. still maintaining his attitude, and green enough to suppose they were trying to impose on him, and that he had some inherent, inalienable right there, while his highwayman sort of bearing was a dilemma of no ordinary kind. Literally to get rid of their ignorant and persistent customer, as his paper was good, the President told him, "if he would get on his box, and go right home, telling no one where he got his money, the cashier might take his paper."

Ledger Caps in November of that year. This, we believe, was the pioneer of the five large Paper Mills, now owned by Crocker, Burbank & Co., which produce from seven to eight tons of paper per day.

In 1835, he purchased the Burbank property, before referred to, where he was first employed, and which he has since almost covered with shops and foundries. It was here that the first Machine shop and foundry, ever erected in Fitchburgh, was built. Soon after this purchase, he was the first to use Palm-leaf as a fibre for making course

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In 1834, Mr. Crocker was employed by the town to get a road further up the Nashua Valley, and the landholders opposing it, and asking exorbitant prices for their land, he bought the whole Nashua Valley, to Westminster line, gave the land for the road, gained only by a protracted struggle, and thus laid the foundation of his present fortune. All the mills of his firm are in this valley.

In 1835, Mr. Crocker was returned to the Legislature of Massachusetts, and, in 1836, voted, with his friends, in favor of the State Subscription to one million of stock, in the Western Railroad. He endeavored, also, at this period, to arouse the people of Fitchburgh and vicinity to the great importance of steam communication with Boston, either by a branch road to the Lowell trunk, at Lowell, or to the Worcester trunk, at Framingham, expending considerable sums, from his own pocket, for surveys; his motto, at that time, being "Northern Massachusetts must have steam communication with tide-water, or [illegible] away into utter insignificance." It is not a little remarkable that both of the surveys which he then made to Lowell and Framingham, have since been followed by railroads.

The period of 1837 arrested all public enterprises, while "*Sauve qui peut*" was the cry of almost every business man. The scarcity of the circulating medium was then so great, that some of the soundest men gave up in utter despair. Mr. Crocker remembers but few of his customers who met their paper, and relates an anecdote of the period, illustrative of the straits to which business men were then subjected.

He had paid his protested notes, as they came back upon him, until he had found the "inside bottom" of his pocket, with every dollar due him, all over the country, that he could scrape together. Still, his protested paper kept coming. Having never failed to meet his paper, he was driven almost to distraction. Mortgage, he would not; it was his cardinal policy never to do so. Finding, by examining his note-book, that, if the notes all came back, ten thousand dollars would meet the Bank portion of his liabilities; and, living out of town, he prevailed upon the cashier of the Fitchburgh Bank to let his protested paper accumulate to the Monday forenoon of each week; still not knowing where he could get the money, but believing in that Power who blesses those that try. He became so excited, at last, that, on a Wednesday, previous to the Monday settlement, sleep was out of the question. His fevered imagination presented images of jail limits and a beggared family, until, at last, a vision appeared, though probably an hallucination, that a debt, due him for a family he had supported for some three years, from the extreme South, would be paid, and that the debtor would be at Fitchburgh, the following Saturday, to pay him, though he knew he had been a bankrupt. To his repeated assurances to his wife to that effect, she could only express her fears that his brain was either turning, or had entirely turned. The Saturday morning breakfast, however, following another sleepless night, he harnessed "Old Whitey" and rode to town, meeting the *identical* debtor before the door-yard gate where his family resided, as he knew or dreamed he would. "Come in," said this instrument of God's mercy, "and get your money. You did not let my poor family suffer, did you? What, on earth, ails you? What do those tears mean? Southerners will always pay a debt of honor!!!" After satisfying it, the debtor took out another package of United States Bank bills, saying, "Here, my boy, take that." Mr. C., then, tried to tell

Hanging or Wall Paper, softening it with strong alkali and bleach, of which large quantities have since been used.

Mr. Crocker has filled several positions of public trust and confidence, with honor to himself and advantage to his constituents. He has been an organizer and President of Railroad Companies, a member of the Massachusetts Legislature, a Senator in 1862 and 1865, and has recently been appointed, by the Governor, Commissioner of the State work on the Hoosac tunnel.

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him about the uncertainty of his security. His reply was: "You trusted me, and fed my children. I shall trust you."

On Mr. Crocker's repairing to the cashier, who had so kindly relied upon his honor, calling for the batch of protested notes, which he knew had arrived, the cashier, a stern, commanding six-footer (though with a heart as kind and gentle as a lamb), replied: "Well, what of it?" On the second request, the cashier, knowing that the Bank Board would help Mr. C., if he asked for help, and believing he had no money, again responded, "What are you going to do, Crocker?" "Pay!" was the reply. "Where? how? when?" "Money, sir;" at the same time, uncovering, from an old, rusty pocket-book, two large packages of "Nick Biddle's" bills. Such was the entire absence of currency, the cashier began to doubt his own opties. and, with a countenance of utter surprise, almost of consternation, that so much money could be found anywhere, exclaimed: "I vow, Crocker; did you steal it?"

From 1837 to 1842, Mr. Crocker had prosperous years of business; when, in a night, a fire levelled his best mill, and a large stockhouse full of paper and white rags, with but little insurance.

In 1842–3, he was re-elected to the Legislature, having again come out in favor of Steam Communication with Boston, by a route entirely independent of the Lowell or Worcester trunks. He obtained the charter from the Legislature, against the influence of both; and, amid their bitter sneers and opposition—denounced as a humbug and impostor—he obtained the stock, and built the road.

Mr. Crocker came into Fitchburgh on the first Locomotive, March 5th, 1845. He was elected the first President of the Fitchburgh Road, but resigned it the following June, to accept that of President of the Vermont and Massachusetts Railroad, until built, and resigned that on its completion to Brattleboro. This road, having but little stock, was built with much difficulty.

From 1843 to 1850, Mr. Crocker was engaged largely in various railroad enterprises, especially in aiding the Troy and Boston and the Tunnel Railroads; and, during 1847–8, delivered several hundred lectures, in their behalf, in New York and Vermont. On November 9th, 1849, the largest fire that ever occurred at Fitchburgh took place, and Mr. Crocker lost his Chair and Machine Shop, on which there was but a trifling insurance. This circumstance induced him to relinquish public life; and, in 1850, the firm of Crocker, Burbank & Co., now the largest Paper Manufacturers in Fitchburgh, was formed.

Mr. Crocker is blessed with a power of endurance, almost incredible, and has, probably, performed as much labor as any man of his age in this country. His life has been full of startling incidents and dangers passed over, and he has made many hairbreadth escapes from death, without a scar upon his person.

The Putnam Machine Company,

At Fitchburgh, have recently erected a Machine Shop, that is probably the most remarkable of any in the United States. It is original in design, having for its architect the President of the company, and combines, in the form of its construction, points of excellence and convenience that are rarely found in any similar Works.

The main building is of brick, four hundred and eighty-seven feet long and forty-four feet wide, with seven wings projecting from the west side, at regular intervals, whose average dimensions are fifty-two by thirty-six feet; opposite to which, on the east side, are similar projections of lesser dimensions, used as offices for the foremen of the various departments. In these wings, the individual parts of the Machines and Tools manufactured in the central portion of the building are put together, or "set up," and thus very little handling is required; while the arrangement of the offices is such, that each manager has at all times a ready and complete survey of all the operations in his department. The floor of the main shop is composed of cement or concrete, several feet in thickness, so solidly compacted that not the least jar or vibration in the movement of the machinery is manifest. The roof, which is of slate, is supported by a row of iron columns extending the whole length of the premises, which is as nearly fire-proof as it is possible to construct a building.

The machines used in the various mechanical operations are ranged along the central building, and derive power from a seventy-five horse engine, communicated by means of a single line of shafting nearly five hundred feet long. Among the remarkable tools in these Works, is a Lathe that will swing twenty feet; a Planer that will plane thirty-six feet long and seven feet square; and an enormous Crane that will handle with ease a weight of twenty-five tons. Attached to the Machine Shop there is a Blacksmith Shop seventy by thirty-six feet, an Engine House thirty-four by twenty-eight feet; and separate from it, at a short distance, is an Iron Foundry one hundred and twenty-five by sixty-six feet; a Brass Foundry thirty-eight by twenty-six feet; a Pattern and Box Shop eighty by forty feet; and a Pattern Shop seventy by thirty-six feet. The Works are located directly on the Vermont and Massachusetts Railway, from which the coal and iron can be delivered, and by which the finished products can be transported without the necessity of much handling. All these buildings are amply furnished with windows, which, besides imparting an air of cheerfulness to the interior, tends to secure accuracy of workmanship.

The list of Machines and Tools manufactured at these Works is

quite comprehensive, but they may be classified under the general heads of Steam Engines, Machinists' Tools, Woodworth's Planers, and Mill Work.

1. STEAM ENGINES. This department of the Putnam Machine Company's Works has been, since March, 1859, under the charge of Louis D. Bartlett, formerly Superintendent of the Boston Steam Engine Co. (better known as "Otis Tufts"), an able mechanic, and an inventor of many important improvements. He has aimed to combine simplicity of construction with economy of fuel, and has greatly reduced the number of parts usually found in Steam Engines. The Engines constructed here have a patent reglating cut-off gear, which is so contrived that the cut-off has a range throughout the whole length of the stroke, or, in other words, the ordinary regulator-valve is dispensed with, the governor acting directly on the steam-valves, by means of which the steam, admitted to the cylinder at boiler pressure, is cut off by action of the governor at any point in the entire stroke. These Engines are also distinguished for a peculiar arrangement of poppet valves and steam passages. The lower disks of both the steam and exhaust valves are of smaller diameter than the upper ones, so that the valves can be readily withdrawn for cleaning or repairs by simply removing the covering plates from the top of the valve chest. The construction of the chest is remarkably simple, compact, and economical. Another peculiarity of the Putnam Engine, is that the cam shaft for opening and closing the valves is run at a less number of revolutions than the main shaft, by which the steam may be used through the whole length of the stroke or be cut off at any point; and also, in consequence of reduced speed, overcomes certain mechanical difficulties hitherto experienced in "cut-off gear." The Company own the patents for the improvements that give their Engines their distinctive character—among which may be mentioned a Cylinder Oiler, by means of which the waste of oil attending the use of the ordinary injecting apparatus is avoided. This Company have built Engines for the U. S. Navy Yard at Portsmouth, N. H., and other government workshops; for the U. S. Watch Company at Jersey City, and the National Watch Company at Chicago; for many leading manufacturing establishments in New England and the Western States; four for California, two for the Sandwich Islands, and one for China.

2. MACHINISTS' TOOLS. This department of these Works is under charge of J. Q. WRIGHT, who is the joint inventor, with S. W. Putnam, of the Frictional Feed Gearing for Engine Lathes. All the Lathes constructed here have a peculiar feed arrangement, that is more simple and convenient than that ordinarily applied. The disk for throwing the side-feed in or out of action, is operated by a swivel or union-jointed nut;

the cross-feed is thrown in or out of action by the agency of a hand wheel, and the power is transmitted from the driving wheel to the wheel operating the cross-feed by means of a hollow shaft. The Lathes have two feed arrangements, one for ordinary turning, and the other for screw cutting. All the beds of the Tools made here are in one casting, and it is the aim of the company to construct tools that cannot be excelled in strength and quality of material. Particular attention is paid to thoroughness as well as nicety of workmanship in all the details, and such a proportion in the relative parts is observed as experience has demonstrated tends to render a Tool serviceable for a long period.

3. Woodworth's Planers. An important department of these Works, under charge of Charles Burleigh, is appropriated exclusively to manufacturing these Planers. The present well-known style of these popular planing machines originated, it is said, with the Messrs. Putnam, who were among the first to engage in building them. For over sixteen years they have been the principal manufacturers, and from time to time have adopted improvements which render the machines now constructed by them as nearly perfect as it is probably possible to make them. Among the latest of these improvements, are patent extension connecting gears, by which the strain on the intermediate gears is greatly relieved.

4. The Mill Work, Shafting, etc., are under charge of John Burney.

This Company, like most machine shops, construct a great variety of miscellaneous machinery. They differ, however, from many others, in having tools and facilities for constructing very heavy machinery, especially Shafting. During the late Rebellion, they undertook a contract with the government for building the cast-steel Blakely Gun, which involves great nicety of construction. Some of the guns manufactured by them weighed forty-four thousand pounds. They are also the builders of the Burleigh Drill which is used in excavating the Hoosac Tunnel.

The Putnam Machine Company, which now employs two hundred hands, is the successor of J. & S. W. Putnam, who commenced business in Fitchburgh in 1838, with no capital, and worked for a time with no assistance except one apprentice and one journeyman. They came originally from Peterborough, N. H., and are related to General Putnam, of Revolutionary memory. After twenty years' experience, during which time they established their claims to a position among the best mechanics of the country, they organized a Company, that was incorporated in 1858, with a capital of forty thousand dollars, which was increased in 1866 to one hundred and twenty thousand dollars. Its shares, numbering three hundred and twenty, are all owned in Fitch-

burgh, and are worth in that market over one thousand dollars each. The President of the Company, SALMON W. PUTNAM, has displayed executive as well as mechanical abilities of a high order, and has selected men of ability as managers of the various departments, who, while independent in action in their proper sphere, recognise him as their chief, whose decision on controverted points is final. The Company and its officers at the present time are—S. W. PUTNAM, President; BENJAMIN SNOW, Jr., Treasurer; L. D. BARTLETT, Clerk. Directors—JOHN PUTNAM, S. W. PUTNAM, BENJAMIN SNOW, Jr., CHARLES BURLEIGH, JOHN Q. WRIGHT, L. D. BARTLETT, RODNEY WALLACE, and GEORGE E. TOWNE.

The Walter Heywood Chair Company,

In Fitchburgh, is one of the three largest Chair Manufacturing Establishments in the United States. It dates its origin from 1842, when Mr. Walter Heywood commenced manufacturing Chairs with about ten hands. He pursued a steadily successful career, enlarging his facilities from time to time, until 1849, when the Works were destroyed by fire, but were rebuilt with great expedition.

The Works, as at present constructed, consist of three large buildings, two of them of brick and one of frame. The main building is one hundred and thirty feet long and forty feet wide, three stories high; the other brick building is eighty by forty feet, four stories in height; while the Frame is one hundred and forty feet long, thirty-two feet wide, and three stories high. Besides these, there are Dry Houses, Varnish Rooms, and other auxiliary out-buildings.

The machinery employed in this manufactory is sufficient to manufacture sixty-five dozen Chairs per day, and is undoubtedly remarkable, but difficult to describe. It includes all varieties of tools and machines that are suited for boring, shaping, fitting and finishing wood. As nearly all the Chairs produced in this establishment are exported to foreign countries, they are packed in boxes, in separate pieces, to save bulk in transportation. Though put together for convenience in painting, they are again taken apart for shipment; and this necessarily implies delicate and nice machinery in the manufacture, so that the different parts will go together again readily. In fact, the same principle is applied in this manufacture, as in that of watches by machinery, namely, making the parts interchangeable. The wood is bent by what is known as Blanchard's process, and the appliances for the purpose are numerous and ingenious.

The Walter Heywood Chair Company employ in their shops about one hundred and fifty men, and as many more women and children, who cane and seat chairs at their homes. Besides the ordinary cane-seat, they manufacture largely wood-bottom Chairs, adapted in style of shape and finish to the tastes of foreign markets.

Mr. Heywood, the founder and President of this Company, is a descendant of one of the Pilgrim families who came over in the "Mayflower" and landed at Plymouth Rock.

MANUFACTURES OF PROVIDENCE, R. I.

[The following are the Statistics for Providence County, which includes, besides the City of Providence, a part of Pawtucket and other manufacturing towns, for the year ending June 1, 1860, as prepared for this work at the Census Office.]

Manufactures.	No. of Establishments.	Capital.	Raw material.	Male hands.	Female hands.	Value of product.
Agricultural implements	3	$13,300	$6,380	10		$15,845
Batting	2	20,000	92,000	40		140,000
Bleaching and dyeing	9	487,300	110,060	300	30	494,300
Bobbins and spools	8	19,300	11,293	33	15	26,577
Bolts, nuts, washers, etc	4	182,000	120,250	122		186,300
Boots and shoes	53	92,945	146,295	341	16	277,259
Boxes	5	20,900	18,904	24		37,610
Brass founding	8	30,600	41,675	29		68,377
Bread	7	54,100	182,303	39	4	258,511
Bricks	6	83,000	12,950	160		62,000
Cabinet furniture	16	125,900	88,063	125	1	181,472
Calico printing	3	513,000	424,060	965	30	1,826,400
Carriages	24	93,900	72,075	192	7	232,740
Chemicals	5	110,000	123,980	67		157,100
Cigars	7	45,800	37,438	89	62	204,536
Clothing	47	257,600	567,731	370	904	1,071,586
Coffee and spices	2	20,000	58,860	13	1	84,500
Combs	1	30,000	8,600	29		35,000
Confectionery	8	17,700	47,030	30	15	100,395
Copper smithing	1	4,000	16,000	17		40,000
Cotton goods	59	5,662,200	3,010,644	3,591	4,142	6,516,105
Cotton yarn, batting & cordage	27	579,400	509,073	405	661	985,205
Cotton-seed oil	1	150,000	90,000	40		118,000
Distilled liquors	1	15,000	48,000	3		62,000
Doors, sash and blinds	13	61,500	75,175	129		219,686
Dye woods	2	13,000	42,178	8		69,800
Files	2	57,000	36,834	58		80,000
Fire engines	1	6,000	20,000	35		36,000
Flour and meal	13	112,500	489,581	35		560,522
Gas	4	792,600	62,213	64		107,735
Hair cloth	6	39,500	35,325	18	86	60,500
Hats and caps	6	15,000	27,880	23	18	52,258
Hinges, cast-iron	2	120,000	42,405	190		200,000
Horse shoes	2	6,000	3,265	14		13,500
Hose and belting	6	114,000	145,132	75		230,000
India rubber goods	2	156,000	103,111	69	44	248,700
Iron founding	7	168,000	90,584	221		218,225
Jewelry	77	1,112,900	916,297	1498	263	2,251,282
Leather	5	18,000	56,187	20		77,367
Lime	3	62,000	24,000	22		45,000
Looking glass & picture frames	4	6,100	10,340	10		22,500
Lumber	12	24,600	26,375	32		42,575
" planed	6	102,800	158,700	71		246,500
Machinery	15	539,900	252,235	657		797,975
Machinery, cotton	11	529,500	152,318	719		659,194

CE, R. I.

ce County, which in-
Pawtucket and other
1860, as prepared for

	Male hands.	Female hands.	Value of product.
	10.....	.....	$15,845
	40.....	.....	140,000
	390.....	30.....	494,300
	33.....	15.....	26,577
	122.....	.....	186,300
	341.....	16.....	277,250
	24.....	.....	37,610
	29.....	.....	68,377
	89.....	4.....	258,511
	160.....	.....	62,000
	125.....	1.....	181,472
	965.....	30.....	1,826,400
	192.....	7.....	232,740
	67.....	.....	157,100
	80.....	62.....	204,536
.	370.....	904.....	1,071,586
.	13.....	1.....	84,500
.	29.....	.....	35,000
.	30.....	15.....	100,395
.	17.....	.....	40,000
.	3,591.....	4,142.....	6,516,105
..	405.....	661.....	985,265
..	40.....	.....	115,000
..	3.....	.....	62,000
.	129.....	.....	219,686
..	8.....	.....	69,800
..	58.....	.....	80,000
..	35.....	.....	36,000
..	35.....	.....	560,522
..	64.....	.....	197,735
...	18.....	86.....	60,500
..	23.....	18.....	52,250
...	190.....	.....	200,000
...	14.....	.....	13,500
...	75.....	.....	230,000
...	69.....	44.....	246,700
...	221.....	.....	218,225
...	1498.....	263.....	2,251,282
...	20.....	.....	77,367
....	22.....	.....	45,000
....	10.....	.....	22,500
....	32.....	.....	42,575
....	71.....	.....	246,500
....	657.....	.....	797,975
....	719.....	.....	659,194

Manufactures.	No. of Establishments.	Capital invested.	Raw material.	Male hands.	Female hands.	Value of product.
Malt liquors	2	15,800	13,213	14		21,267
Marble work	8	94,400	43,625	108		102,900
Mathematical instruments	1	10,000	17,000	20		40,000
Nails	3	344,200	199,000	223		327,000
Packed provisions	4	13,500	114,125	12		125,677
Patent medicines	1	50,000	35,000	7	9	75,000
Printing and publishing	3	23,000	24,027	48		98,812
Reeds and loom-harness	5	30,600	30,537	40	118	80,600
Sad irons	1	30,000	33,200	120		100,000
Saddlery and harness	12	22,000	16,293	37		40,955
Sails	2	5,500	17,000	17		32,000
Screws, wood	2	1,004,000	397,000	315	300	1,092,600
Scythes	1	100,000	55,000	100		100,000
Sewing machines	1	35,000	6,745	60		102,000
Shirts and furnishing goods	2	8,000	24,800	2	64	53,800
Silver-plated & Britannia ware	6	18,800	86,390	17		101,750
Silver ware	3	392,000	317,131	235		490,000
Soap and candles	4	45,500	79,793	19		104,460
Spiral springs	2	23,300	51,489	20		65,000
Steam and gas pipes	4	45,000	81,800	79		139,000
Stoves	4	205,000	91,050	270		259,000
Tin and sheet-iron ware	28	84,400	92,577	126		217,242
Wireworking	1	4,000	5,000	12		15,000
Wheelwrighting	16	24,300	11,223	35		37,975
Woolen goods	26	2,087,000	2,246,604	1742	883	3,995,845
" yarn	1	500	7,800	2	4	10,000
Wrought-iron pipe	1	15,000	25,800	24		80,000
Total, including miscellaneous manufactures not above specified	893	$17,936,985	$13,654,956	15,875	9,882	$20,206,478
Aggregate in Rhode Island	1191	24,278,295	19,858,515	20,795	11,695	40,711,298
Do. do. in 1850	864	12,935,676	13,186,703	12,923	8,044	22,117,688
Increase	327	$11,342,619	$6,671,812	7,872	3,651	$18,593,610

Increase 84 per cent.

REMARKS

On the Manufactures of Providence.

Providence is one of the wealthiest and most enterprising of American cities in proportion to its population, and the greater part of its capital and enterprise is now invested in manufactures. It has been estimated that if all its wealth could be equally divided amongst the inhabitants, each man, woman and child, would be entitled to nearly seventeen hundred dollars. Besides the numerous manufactories located within the city limits and the vicinity, there are many important establishments in other parts of Rhode Island, and other States, that are owned by citizens of Providence. A few years since, Dr. Snow, of Providence, investigated the subject, and ascertained that 77 Cotton

Mills, 4 Print Works, 3 Woollen Mills, and 2 Bleacheries, located outside of the city limits, were owned in Providence. The firm of A. & W. Sprague run 153,000 spindles, 3,600 looms, and produce in ordinary times 33,280,000 yards of Cotton Cloth per annum, besides printing about 24,000 pieces per week; but none of their mills, we believe, are within the boundaries of the city of Providence.

Providence is noted for its extensive and excellent establishments for Bleaching and Coloring. The oldest and the largest of these is that of the PROVIDENCE DYEING, BLEACHING AND CALENDERING COMPANY, of which William C. Snow, Esq., has been Agent for many years. It has been so long established, that, we are informed, nothing is known of its original capacity, or the exact time of its commencement, except that at the beginning its capacity was quite limited. Both Dyeing and Bleaching have been carried on from its commencement. When it was first established, and for some time after, the charge for bleaching was twelve and a half cents per pound, payable in cotton yarn, at the ticket price, yarn No. 12 at thirty-four cents per pound. In the year 1819 or 1820 the price was reduced to eight cents per pound, payable in cash. At present, in this as in the other Bleacheries, the average price for bleaching and finishing is about three fourths of a cent per pound.

Among the manufacturing establishments of Providence, there are several that stand out so prominently, and are known so widely, having in fact a national reputation, that they deserve an extended notice among the remarkable manufactories not only of the city, but of the United States. Of this class are

The Corliss Steam-Engine Works.

On March 10, 1849, we find in the Patent Office Reports that a patent was granted to George H. Corliss, of Providence, for an improvement in the Steam-Engine. Such an announcement is usually the epitaph, as well as the introduction of an invention; and as the improvements in Steam-Engines which have been patented exceed a thousand—one hundred and sixty-nine having been patented in a single year—the fact that any one of them is remembered at all, is in itself evidence that it possesses more than ordinary value. But of all the inventions that have been made during the last twenty years, there are few, if any, which have attracted a larger share of public attention than Mr. Corliss' improvements in the Steam-Engine—none probably, unless it be the inventions in India Rubber, that have passed through ordeals so costly and trying—or which have more triumphantly vindicated their claims to a high rank in the list of American inventions. We shall state, as briefly

and succinctly as we can, the object and nature of these important improvements.

The object of Mr. Corliss' improvement was to secure a more equable motion to stationary engines than had been before obtained by rendering the regulator purely automatic and practically perfect, and to save fuel by applying and utilizing the entire expansive force of the steam. Previous to his invention it had been the practice to construct engines in which the steam and exhaust-ports of the cylinder are opened and closed by slide-valves, with valves connected rigidly—that is, where one was moved, the other moved with it to the same extent—and it was found that the force required to move the valve while closed, its office having been performed, was expended fruitlessly, and tended only to increase the wear and tear of the engine. Mr. Corliss proposed to avoid the sacrifice of power by moving each of the steam and exhaust-valves independently by means of one crank-wrist, of a series which are all attached to a common disc, wrist-plate, or other equivalent device, which is secured to and moved with a rock shaft. The several wrists which work the different valves are arranged upon the wrist-plate in such positions with respect to the rods and levers, or other devices which connect them with the valves, that they shall act like so many cranks, each of which vibrates near its dead point, or point of slowest throw, and therefore imparts but little movement to the valve it actuates when the latter is closed: while each moves with its fastest throw, and therefore communicates the greatest movement to its valve when the latter is open.

In addition to this, Mr. Corliss invented a method of regulating the cut-off of steam in its passage to the engine, by combining the governor with the catches, that liberate the steam-valves by means of movable cams or stops, so that when the velocity of the engine is too great these cams will be moved by the regulator to such positions that catches on the valve-rods may the sooner come in contact with them to liberate the valves and admit of their being closed by the force of weight or springs, and thus cut off the steam in proportion to the velocity of the engine—this being done sooner when the velocity of the engine is to be reduced, and later when it is to be increased. In this arrangement throttle-valves are dispensed with altogether, and the governor adjusts the motion by indicating the change required to the levers which move the steam-valves, which are opened or shut by quick or sudden motions, and thus the whole expansive power of the steam is saved and used. In other words, 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.

No one can fail to see that these improvements, if in practice they are found effective, must be of vast utility. A leading authority on the steam-engine, says the apparatus for opening and closing the passages is of more importance to the perfection of the steam-engine than any other part of its mechanism. These improvements may be said in fact to have revolutionized the construction of the steam-engine; and in view of the history of other meritorious inventions, one is not surprised to learn that the inventor and his friends have been compelled to expend nearly $75,000 in establishing the claims and defending the rights guaranteed to him by the patent laws. But after a thorough investigation, or, to use the language of the Commissioner of Patents in granting an extension of these patents, May 9, 1863, after "every means which the highest abilities and great legal sagacity and experience could suggest were used to secure a correct decision," the Court decided that the invention was "new and patentable."

(1) The following is the Opinion of the Commissioner in full:

U. S. PATENT OFFICE, March 9, 1863.

In the matter of the application of George H. Corliss for the extension of six Patents re-issued to him on the 12th of July, 1859, for improvement in Steam-Engines.

The original Patent was granted on the 10th of March, 1849; re-issued on the 10th of May, 1851; and re-issued, divided into six patents, on the 12th of July, 1859. The novelty of the invention has thus been three times affirmed by the Office—and four of the six patents have passed the ordeal of a most thorough and able examination in the Circuit Court of the United States for the District of Connecticut, the other two having never been controverted. The court was composed of Judge Nelson of the Circuit, and Judge Shipman of the District. The counsel on both sides were among the most distinguished attornies of the country. Experts were examined—models and drawings were exhibited—and every means which the highest abilities and great legal sagacity and experience could suggest, were used to secure a correct decision. The Court, after a thorough investigation, decided that the invention was "new and patentable."

Incident to the present application for an extension of these patents, the question of novelty has been again submitted to the decision of this office, and the Examiner-in-charge has in an original report made a statement of facts and deductions therefrom strictly accordant with those several prior decisions.

All the inventions alleged by the present remonstrants to interfere with the claims of the petitioner were before the court in the contest already referred to, and were minutely described, and compared with or contrasted to his invention. As nothing has been found in the record which appears to justify any exception to the decision so uniformly reiterated, it is not now necessary to recite descriptions of the several inventions, nor to analyze them for the purpose of showing the essential difference of points alleged to be substantially the same. It is deemed sufficient for me to say, that having examined the invention comprehended in the petitioner's several reissued patents by the light of the entire record, and with the most careful consideration of the objections and arguments of the remonstrants and their learned counsel, I can find no sufficient reason for refusing the prayer of the petitioner because of any lack of patentable novelty in his invention, whether with respect to the precise combination described in the several claims, or to their equivalents.

No question has been raised in relation to the usefulness and importance to the public

In introducing these Engines the inventor and manufacturers adopted the novel plan of offering to take the saving in fuel, in a given time, as their pay, or a stipulated amount in cash, at the option of the purchaser. To the James Steam Mills, at Newburyport, Mass., they offered to furnish two new high-pressure engines with 18-inch diameter of cylinder, 4 feet stroke of piston, and take, in lieu of a stipulated sum, five times the value of the coal saved the first year, the coal being reckoned at six dollars per ton. The amount received by the manufacturers under this arrangement was $19,734 22, the saving in coal during the first year being $3,946 84; and in addition, Wm. C. Balch, Agent and Treasurer of these mills, certifies that there was ten per cent. increased production, so that the actual saving in a cotton mill of 17,024 spindles in one year was $4,341 28. To the Ocean Steam Mills, at Newburyport, Mass., they proposed to take their former engines as they stood, and furnish a new one, for the saving of fuel in two and a half years, or for $3,000 in cash, at the option of the purchasers. The proprietors decided to pay the cash sum, and did wise by so doing, as the saving in fuel amounted to three thousand dollars in about two years. To Messrs. Crocker, Brothers & Co., proprietors of the Copper-Rolling Mill at Taunton, Mass., they proposed to furnish an Engine that would do one-third more work than the one they were using, with a consumption of less than one-half the coal, namely, two tons for five, or forfeit one dollar per pound for every pound per day used above that amount. The proprietors certify, that though they increased the work of the engine about one-third by the addition of machinery, and also increased the production of their mill by the uniformity of motion secured by the improvements in the mode of regulation, yet the average consumption of Pennsylvania coal has not exceeded two gross tons per day; or, in other words, the real difference in the engines, in proportion to the amount of work performed, was 2 tons against $6\frac{2}{3}$ tons. To the Atlantic Delaine Mills,

of this invention; nor, in view of the testimony elicited, and of the admissions made, can such question be reasonably entertained, except in its bearing upon the question of the adequacy of the remuneration already realized by the inventor—in relation to which it may be affirmed, that the invention, being confessedly of vast importance, and the ingenuity, time, persistence in labor, capital invested originally, and expense incurred in introducing it to the public and in defending the right guaranteed by the patent laws, all being great, the remuneration already received as shown in the statement of the petitioner, is regarded as falling far short of an equitable reward.

It is therefore Ordered, that the said Letters Patent, numbered respectively 763, 759, 760, 758, 761, 762, and reissued to George H. Corliss, on the 12th of July, 1859, be and the same are hereby extended for the term of seven years from and after the expiration thereof.

D. P. HOLLOWAY,
Commissioner of Patents.

Providence, R. I., whose engines previously required six tons of coal per day, they proposed to furnish new engines that would give the same power at an expenditure of coal not exceeding three tons per day, under a penalty of one dollar per pound for every pound of coal consumed beyond that amount, and pay $25 per day for every day during the first year that the engine should fail to give the requisite motive power The actual amount of coal consumed by the new engine was less than two and a half tons per day. Such contracts as these strike us as curious, and certainly evince in a remarkable manner the confidence of the manufacturers in the value of Mr. Corliss' improvements. At the present time, as their engines are now working in several hundred of the largest manufactories of the country, and their value so well attested, we presume it would be difficult for them to make contracts payable in saving of fuel.

The Works of the Corliss Steam-Engine Company are among the most prominent of the manufacturing establishments of Providence. They are among the first objects that attract the attention of passengers entering the city by the railroads from Boston and Worcester. They were built during the years 1848, '49 and '50, and occupy an area of nine acres. The Machine Shop alone covers about an acre of ground, being 608 feet long, with an average width of 70 feet. The Boiler Shop, Smiths' Shop, Iron and Brass Foundries, are all spacious, and well-equipped with appropriate tools. The Patterns are made and stored in a separate building, which contains large and airy Drafting Rooms in its second story. In their aspect, and especially in the interior arrangement, these buildings present a marked contrast to works of a similar description, being light, cheerful and comfortable, a circumstance that not only imparts pleasure to visitors, but conduces to the health of the workmen employed.

The capacity of this establishment for dispatching work will be inferred when we state that an order for an Engine of 350-horse power, including boilers and all the appurtenances, has been executed in sixty days—and also including a gear fly-wheel of 25 feet diameter, 18-inch face, $5\frac{1}{4}$-inch pitch, weighing 64,000 pounds, turned, and with cogs on the face cut with the accuracy of clock-work. Finer specimens of workmanship than some of the engines turned out at these works are not produced in this country or in Europe.

Within the last ten years Mr. Corliss has patented a number of very important improvements having relation to the objects of the Company's manufactures. Among those which are probably destined to prove of the greatest practical importance, we would instance his recent invention for obviating the necessity of using salt water in Marine Engines,

by the substitution of an Improved Boiler with an apparatus for condensing and using over again the waste steam. The corrosive action of salt water upon iron boilers is so destructive, that those of the best construction rarely last more than three or four years, while iron cylinder boilers, where pure water is used, are found practically to last fifteen or twenty years without becoming destroyed by rust or decomposition.

The external view of Mr. Corliss' new boiler is simply a dome about eleven feet in diameter, with eight furnace doors arranged around the circle of the base. Internally there are seven vertical cylindrical boilers, each of the diameter of 32 inches and height of ten feet, arranged around a larger vertical cylinder boiler, serving as a common centre of union, by means of a connecting-pipe at the bottom and top of each. The eight furnace doors all open into one common furnace, with the grate bars arranged about the vertical boiler, of the diameter of 42 inches, and directly beneath the lower ends of the smaller boilers. These contain numerous tubes like those of locomotive boilers, ascending to the smoke-flue which surmounts the dome above them.

All these congregated boilers being cylindrical, and of small diameters, and constructed of extra-thick flange iron, with no flat sides requiring the support of braces and clamps, are calculated to be worked safely with the pressure ordinarily used in boilers of locomotive engines, say from 90 to 135 pounds to the inch. Thus is available a compound boiler, combining all the desirable elements of extraordinary strength. But to secure its durability, a further very important arrangement is added in an iron tank containing numerous tubes, like those of organ-pipes, with the tops partially closed, and kept cool by a continuous stream of sea water, for the purpose of condensing the waste steam as fast as it escapes from the engine—to be returned again at nearly the boiling temperature to the latter in the form of pure distilled water. It has been found that the boilers, after being filled with pure Croton water in New York, require a fresh supply of only 150 gallons to replenish them after making a trip of the propeller from New York to Providence; and as there is always a surplus supply of several hundred gallons filled into the boilers at starting, several trips or passages may be made without the actual necessity of replenishing the boilers.

To replenish the small waste during long Atlantic voyages, it is only necessary to apply a small distilling apparatus, operated by the steam from the boilers.

Indeed, the longer the voyages, the more important becomes the preservation of the boilers from destruction by the corrosive salt of the sea water. The fact is impressively manifest from the last advices from the two American Steamships of War now in China, which state that

both of them have become already unsafe, on their arrival out, from the corrosion or "honey-combed" condition of the boilers, and suggesting modes of getting them home under canvas to obtain new boilers. The efficiency of these ships of war thus actually depends on the preservation of the boilers as the source of their motive power.

The Corliss Steam-Engine Company was incorporated in June, 1856, with a capital stock of $300,000. At present the capital employed is nearly double this amount. Its officers are GEORGE H. CORLISS, President; WM. CORLISS, Treasurer; JOHN H. CLARK, Agent.

The Providence Tool Company's Works

Are another of the establishments of Providence that are entitled to a place among the remarkable manufactories of America. This Company has been a pioneer in certain branches of the Hardware manufacture, and at the outbreak of the present rebellion was one of the first of the private establishments that engaged in the manufacture of Firearms. Its history is briefly as follows:

In 1845, several gentlemen associated themselves together for the purpose of engaging in the manufacture of Carpenters' and other Mechanics' Tools, more especially Plane Irons of all kinds, Chisels, Augers, etc., and erected a stone building 80 by 40 feet, two stories high, with a wing 110 feet by 52, one story high. The location selected was but a few rods from the harbor, affording every desirable advantage for shipping, and also accessible by streets from every side. The capital at first was of small amount, and the number of hands employed did not exceed fifty. In 1847 the Company was incorporated, under the special law of the State, as the Providence Tool Company; and in the following year they made an addition to their works of a stone structure 40 by 40 feet, three stories high, with basement. In 1849 a wooden building was added 132 by 40 feet, including a wing one story high; and in 1853 a brick building 67 by 40 feet, four stories in height, making length of main building 187 feet, and width 40 feet. In the subsequent year there was built and put in operation a furnace of brick designed for casting parts of machinery, and various portions of articles manufactured by them, such as plates for hinges, etc. Thus building was added to building, until the establishment grew to be one of the most prominent in that city of manufactories.

As fast as the buildings were completed they were filled with machinery—and as a facility for transporting materials about the works, an under-ground railroad was provided. Among the important machines

which this Company was the first to introduce, were the presses for punching through cold iron. The first press of this description ever made in this country, was one got up in Pennsylvania by Mr. J. O. Arnold, who was subsequently employed by the Providence Tool Company in constructing and operating presses for cold punching. The Company have now in use 23 of these presses, one weighing twenty-five tons, which readily punches from cold iron, nuts four inches square and two inches thick.

During the period that the Company occupied the premises we have mentioned for the manufacture of Tools, they added to their list of articles many not before made to any extent in this country, and which have contributed essentially to the mechanical facilities of the age. They devoted attention especially to the production of those minor but important parts of machinery which facilitate the operations of locomotive, car, and ship-builders—such as Nuts, Washers, Chain-Links, Chains, Stirrups and Levers, Hooks and Thimbles, Sister Hooks, Connecting Shackles, Clinch Rings, Marline Spikes, Plate Hinges, Draw Plates, Bunter Heads, Can Rings, Bolts, etc., and thus provided machinists, ship chandlers, and others, with articles like these, ready to hand cheaper than they could make them, and far more perfect. When, however, the demand for firearms became urgent, in consequence of the present rebellion, the Company converted these premises into an Armory, having erected a new establishment in the north part of the city for their business proper, consisting of a main building 400 feet by 70, one story high, with several smaller buildings in the rear for furnaces, carpenter shop, storehouse, etc. This they equipped with all the requisite tools for the purposes of their manufactures, including those necessary for making United States Cavalry Sabres, Musket Bayonets, and Ramrods. Besides the 23 presses for cold-punching that have been already alluded to, there are 20 Trip-Hammers, for heavy and light forging. They employ in this establishment over 300 hands, besides some 500 in the Armory.

The Armory and Tool Manufactory are under one corporate name and one management, and, though two miles apart, are connected by a private telegraph, operated by a clerk in the office of each establishment. The President of the Company is RICHARD BORDEN, the well-known manufacturer of Fall River, Mass., and the resident Agent and Treasurer is JOHN B. ANTHONY, of Providence, to whose energy and enterprise our country is indebted for an important addition to the number of her first-class manufactories.

The American Screw Company.

The manufacture of Wood or Gimlet-Pointed Screws, is at present a monopoly in the United States. It is carried on by but one Company, whose principal establishments are in Providence, R. I., where Screws were first made by machinery about the year 1834. The Company has its origin in the consolidation of the Companies previously engaged in the manufacture, the two principal ones being the Eagle and New England, and its success is due to the fact that it controls the best machines which have as yet been invented for cutting screws, having purchased nearly fifty patents of inventions designed to facilitate the manufacture, including all the important ones that have been made in England.

The processes of manufacturing Screws, as conducted in these factories, are of marked interest, as the machines employed perform functions that one would suppose could not be executed except by dexterous manipulation. The wire out of which screws are made is all imported in coils, and the first process is to immerse it in acids, after which it is annealed, and then drawn to the proper thickness. The first of the screw-cutting machines employed cuts the wire to the length desired and cuts the head of the blanks. This is done at the rate of about 90 blanks per minute. These blanks are then removed to the second story, which is well filled with machines that perform the second operation by shaping the head of the screw and cutting with a fine saw the groove in the head, and trimming the burr. They are then carried one story higher, where are the threading or finishing machines, which give them the gimlet-point and cut the thread at the rate of about five screws per minute for each machine. Both the shaping and the finishing machines are nearly automatic. The blanks are put into hoppers—the machine extends fingers to receive them, conveys them to the cutting appatatus, holds them there the required time, and then drops the screw into a box prepared for its reception. One woman can attend probably a dozen of these machines. When finished the screws are taken to another room, where they are counted by weighing one gross and allowing the same weight to all others of the same size. About 150 hands are constantly employed in counting, sorting, and papering Screws in these factories.

The American Screw Company has 625 machines, which have the capacity of making 14,000 gross of screws per day, or 4,200,000 gross during the year. It employs on an average 600 hands, 300 male and 300 female, to whom $24,000 is paid monthly as wages. The value of the screws made per year exceeds a million of dollars, the gross product

in 1860 being $1,086,600. Over three thousand tons of iron are consumed in the factories, and the trimmings or chips average three tons per day.

The Providence Machine Company—Thomas J. Hill, Proprietor,

Is one of the most extensive and complete establishments in New England for manufacturing Cotton and Woolen Machinery. Although it might be supposed, from its title, to belong to a Company, it is the property of one individual—Thos. J. Hill, of Providence. The buildings are of brick, three stories in height, and present an appearance, externally, that is very imposing. The main Machine Shop is two hundred and twenty feet long by sixty wide—with another, parallel to it, two hundred by thirty-six feet; the two being connected together in the centre. There is also a Foundry eighty by sixty feet; a Pattern Shop, ninety-five by twenty-six feet; and Storehouses and other buildings, covering in all an area of about five acres. In these buildings are produced, annually, a half million dollars' worth of Machinery used in cotton and woollen mills, especially Roving Machines, including the various kinds of Fly Frames, Slubbers and Speeders, Self-Acting Mules, Spinning Frames, Copper-Dresser Rolls, and Spindles.

Mr. Hill, the Proprietor of these Works, is one of the few men who have rendered an important service to America by aiding to make her independent of England and other countries in her supplies of cotton machinery. He was born in Pawtucket, Rhode Island, in 1805, and served his apprenticeship as a machinist with Pitcher and Gay, of that town, and remained with them and their successors until April, 1830. He then removed to Providence, and entered the employment of Samuel Slater, the pioneer of cotton spinning in America, taking charge of his machine shop, which was located on the first floor of the Providence Steam Cotton Mill, on Eddy street. During the first year he received as compensation the sum of one dollar and fifty cents per day. He commenced his second year on a salary of $900, which continued until the spring of 1834; when was formed the copartnership of the Providence Machine Company, composed of Mr. Slater and Mr. Hill, the former furnishing the room and power, the latter his services and skill. This arrangement continued even after the decease of Mr. Slater, and, with some modifications, until 1846, when Mr. Hill, having accumulated a capital of nearly fifty thousand dollars, purchased the old Stonington Depot, and erected the building which is now his principal machine shop. He also purchased the tools of the Providence

Machine Company, and commenced business under the style of the old firm.

Mr. Hill, during his youth, was remarkable for his great physical strength, and his capacity to execute work with astonishing rapidity. After others were fatigued and worn out with their day's labor, he was as fresh and vigorous as one of his own trip-hammers. He has a natural genius for mechanics, and his judgment respecting new machines, and improvements in machinery, has been so uniformly accurate, that many things have been thrown to the scrap heap at his suggestion; and it is said nothing that his judgment condemned has ever made its way in the world. As an expert in machinery, he has few superiors; and it is a common remark among manufacturers, when a new improvement is brought to their notice—"Has Mr. Hill seen this? what does he say about it?"

The distinguishing quality that has given him eminence in his department of mechanics, is that he always commenced his labor on a machine with the highest conception of perfection his knowledge had attained, and kept all parts of the work up to this standard. Instead of gradually coming up to his own notions of perfection, it was just there he began. In this way, he made every machine with such thoroughness and completeness, that nothing was left to be done till another advance had been made in the invention.

On one occasion, he was employed to construct a certain piece of machinery. He ordered his pattern-maker to furnish the patterns. When they were brought to him for his approval, they were inferior to his conception of perfection. The pattern-maker thought they "would do." "That is not my standard," he exclaimed, and stamped the pattern to pieces. The result was, that no pattern was again presented for approval that simply "would do." On another occasion, when certain machinery of great value had been completed, which operated imperfectly in some of its parts, he is said to have caught a sledge-hammer and broken it in pieces with such determined will and heavy blows, in the presence of foremen and laborers, that ever afterward they understood the emphasis which he put upon the proper working of a machine.

Mr. Hill has amassed a large fortune, is President of the Lime Rock National Bank, and connected with many of the public institutions of the city and State, as Director and otherwise, and has a high reputation for honor and integrity throughout the community.

The Hope Iron Works,

At Providence, Rhode Island, is in several respects one of the most remarkable manufacturing establishments of New England. It is remarkable for the rapidity of its growth, for the admirable system with which it is managed, and for the great variety of novel and excellent Machines that it has produced.

In March, 1857, Mr. Joseph P. Manton, the present Agent and Superintendent of the Company, in association with a few others, commenced business in a small foundry, with a capital of twenty thousand dollars, and employed at the beginning about ten men. In ten years the concern has grown and developed until now the Works include Three Machine Shops, a Pattern and Blacksmith's Shop, and Foundry, with an invested capital of over two hundred thousand dollars, and employing two hundred men. This rapid growth is not due to any peculiarly fortunate or adventitious circumstances, but rather to the extraordinary fertility of inventive genius that has been displayed in supplying acknowledged wants by novel means.

One of the subjects that first engaged Mr. Manton's attention, was an improved method of handling Anchors and Chains on ships, which resulted in the invention of what is known as Manton's Patent Windlasses. This has effected a revolution in the methods of taking in and letting go anchors. Instead of having two turns of the chain around the barrel of the windlass, as formerly, requiring the chain to be stopped and fleeted every few fathoms (a tedious process in cold weather, or when the chain is muddy), now the chain is merely laid over a chain gear, and stows itself in the locker below as fast as taken in; while, in letting go the anchor, instead of having to get a range of chain on deck in advance, by the improved method a ship is always ready to anchor without previous arrangement, with any range of chain—saving two thirds the time in each case, besides making life safer, and the vessel less liable to accident or loss. Besides these, Mr. Manton has devoted much time to various improvements for saving manual labor on ship board, and for convenience in loading and discharging ships, an item of great importance for vessels in port when there are no conveniences for handling the cargo.

The Windlasses for the "Monitors" engaged during the late war, were built at this establishment.

When the late Rebellion broke out, there was a great demand at the various armories for an improved Drop Press, to strike up forgings of parts of the gun, and the Hope Iron Works succeeded in producing the most successful Drop Press that had been invented. Having been

thoroughly tested in gun work, and proved its excellence, it has since been adopted in the various shops, where work is struck up in duplicate, such as parts of Sewing Machines, Ploughs, Shovels, Cutlery, Axes, Pickaxes, Kettles, Tools, Harness and Sailmakers' Trimmings, etc.

Besides these, the Hope Iron Works are manufacturers of Babcock & Wilcox's Patent Cut-Off for Steam Engines. The peculiarity and advantages of this Cut-Off are as follows:—Steam is introduced into the cylinder at full boiler pressure, and is cut-off by closing the valve suddenly when sufficient steam has been admitted to maintain the engine steadily at a given speed, the governor so acting upon the cut-off valve as to determine the amount of steam required. But, in this engine, a more correct result is attained by a simpler mechanism than has heretofore been used.

The valves are operated by a positive motion, dispensing with detachable valve gear, dash pots, cams, etc., and the arrangement is such that the steam may be allowed to follow any portion of the stroke of the piston, a point of great value in an engine with extreme varying resistances, and where a perfect regularity of speed is required.

The Engine is fitted with a Regulator or Governor, on an entirely new principle, by which the same speed is maintained under all variations of load or pressure of steam. Careful experiments, made by means of a tachometer, upon one of these Engines, extending over several days, showed but one per cent. maximum variation each side of the regular speed, under greatly varying resistances, and a heavily-loaded Engine can be instantly disconnected from the load without a noticeable variation of speed.

The cylinder is encased by a *steam jacket* having free communication with the boiler, whereby the cylinder is maintained continuously at a high temperature. This is found to effect a great saving in fuel, especially where the steam is expanded many times, and only by the use of the *steam jacket* can the fullest benefit of expansion be secured.

This Engine has a plain slide valve, worked by an eccentric, with a cut-off valve on the back, actuated by a small steam cylinder.

The valve gear of this supplemental cylinder is so constructed that the slightest change in the speed of the governor varies the instant at which the cut-off shall close, thus allowing the steam to enter the main cylinder for a longer or shorter period, as the varying resistances may require. All the valves in this Engine are flat slide valves, and they each have a regular throw under all circumstances, thus embodying the most favorable conditions possible for tightness after the wear consequent upon a long use.

It can safely be said, that this Engine combines in the highest de-

gree all the improvements in steam-engines at the present day, and works steam expansively with a perfection in regulation of speed that cannot be excelled.

In addition to the specialties named, they build the following.—Automatic Bolt or Stud Machine, for milling-up and cutting bolts and studs, which are exact duplicates of each other, for use in steam-engine and locomotive machine shops; Marine Portable and Hoisting Engines and Boilers; Planing Machines; Lathes; Tools; Pumps; Shafting and Gearing; Mill and Rubber Machinery; Marine Railways; and a great variety of miscellaneous machines for various uses.

They have a large and efficient corps of mechanical engineers and mechanics, who possess the necessary skill to plan any novelties in mechanics that may be called for, and each Department is under control of a foreman who has had long training and experience in the system observed in the mechanical details.

The Officers of the Hope Iron Works are—GEORGE CHATTERTON, President; F. S. MANTON, Secretary; and JOSEPH P. MANTON, Agent.

The Gorham Manufacturing Company

Is one of the most interesting of the manufacturing establishments of Providence. It is the ripened fruit of long experience, a cultivated taste, and a large accumulated capital. It dates its origin from 1831, when Jabez Gorham established himself at Providence as a manufacturer of pure Silver Ware. In 1841, he was joined by his son, and prosecuted a constantly increasing business until 1847, when he retired. After his retirement, the son became the senior of the firm, which continued as a copartnership until 1865, when the present company was incorporated, with JOHN GORHAM, President, GORHAM THURBER, Treasurer, C. C. ADAMS, Agent, and J. F. P. LAWTON, Secretary.

During a period of over thirty years, the founder and his successors confined themselves exclusively to the production of Pure Silver Ware. In 1851, the manufacture of large articles in silver ware was undertaken, and in order to derive every possible advantage that could be gained from visiting the manufactories of the old world, Mr. Gorham made repeated voyages to Europe, and sought among the silversmiths of France, England and Germany, for every thing by which the art might be improved in America. He imported costly machinery; collected a valuable Library of works of art, and procured the services of the best European and American artists. These not only

adopted the designs so cherished by the artists in silver in Europe, but wrought from the dictation of more modern thought. They made more harmony between use and design. It has been well said, "The freedom of the country's institutions, which leaves its imprint on men and things, has given some of its tone to this art. In American designs, the modern predominates; in Europe, the antique and medieval. The American designer in part gives the spirit of the Living Age; the Dead Past is revived by the European."

The Messrs. Gorham, from the first, established a high standard for the quality of their Silver Ware, and never lowered it. Not a grain of metal enters into the composition of a single item manufactured by this company that has not been thoroughly tested. The silver must assay to the standard value of the United States Mint or be thrust aside; and none is used, except standard coin, before it is so assayed. They have always offered to their customers to abide by the test of an impartial assay, and, when found wanting, they will pay costs, and replace the defective service with another that shall have proved worthy of their reputation.

Having succeeded, by the aid of improved machinery, capable designers, and adherence to a uniform high standard of quality, in attaining a position at the very head of American Silversmiths, Messrs. Gorham & Co., in 1863, directed their attention to the manufacture of Silver-Plated Goods. There was a great demand for an advancement in this branch of the art. For this, one of the firm visited Europe several times. The best foreign and American machinery was secured, without regard to cost, and after two years of preparation, the machinery was finished, and in 1865 the Plated Ware was offered for sale. The expectations of the company were fully realized. They were successful in their new enterprise; and to-day the Silver-Plated Ware of no manufacturing company in the world stands higher than does theirs. Not only will the dealers of New York —where they have long had Salesrooms—attest this, but dealers throughout the country.

The Gorham Plated Stock is formed on a base of nickel silver, which is electro-plated with the pure metal. The patterns and styles are quite as artistic, and just as elaborately finished as are those in solid silver; and so thorough is the deposit, that not even an expert can, upon close examination, say whether a Salver or an Urn be of solid silver or simply plated. It is said that the Plated Ware made by this company will withstand the wear of a generation.

At this time the Gorham Manufacturing Company occupy five large buildings that have about sixty thousand feet of flooring. These

buildings are divided into compartments; and one distinguishing feature of this company is that it is entirely self-sustaining, having shops not only for Designing, Modelling, Chasing, Casting and Rolling, but, also, a Carpenter's Shop, Photograph Gallery, and Machine Shop where tools are made and repaired. About four hundred persons are employed in the various departments.

Among the remarkable machines in these works, are Rolls that weigh more than twenty tons, and Drop Presses with bed pieces weighing from four to twelve tons each. As a support for these ponderous machines, immense piles have been driven deep into the earth, and on the top of these rests a solid mass of granite seven feet in thickness.

So successful have the Gorham Company been in originating new designs in Plated Ware, that the manufacturers in England have imitated them in a lower grade of wares, which they have exported to this country for sale. But, while the compliment implied in this transaction may be gratifying to the American manufacturer as an indication that native talent finds appreciation abroad, it is questionable whether purchasers will not prefer the genuine article to a European copy of inferior quality. As a protection to such as may desire wares of undoubted purity, the Company have adopted, as a trade-mark, an Anchor, with their name, which they stamp upon all wares, both solid silver and electro-plated, that they manufacture.

The Fletcher Manufacturing Company

Have one of the largest and most imposing manufacturing structures in the city of Providence, though their productions are designated by the modest term of "Small wares." There are two factories, both comparatively new, and tastefully and ornamentally constructed of pressed brick and cut stone. One of these buildings is one hundred and eighty-four feet long and sixty-four feet wide, and five stories in height, with a Bleachery and Dyehouse attached of the same width, and one hundred and twenty-three feet long. The machinery in this manufactory is propelled by an engine of three hundred and fifty horse power. The other building is one hundred and forty-four feet long by forty-seven feet wide, and also five stories in height, with a Storehouse and Finishing Shop attached, one hundred and ten feet long, thirty-five feet wide, and two stories in height. The machinery in this building is propelled by an engine of one hundred and fifty horse power. These factories

contain about eighteen thousand spindles, and turn out, daily, twenty-five hundred pounds of Cotton Yarns, or seven hundred and fifty thousand pounds yearly, which are manufactured into Lamp Wicks, Boot, Shoe, and Corset Laces, Crochet and Plain Braids, and other similar small wares. The machinery is much of it of a novel description, and the words—"No admittance"—have more significance on the doors of this establishment than ordinarily.

The Works are operated by a Company, incorporated in 1865, with THOMAS FLETCHER, President, HENRY FLETCHER, Secretary and Agent, and JOHN S. ORMSBEE, Treasurer. This Company are the successors of Thomas Fletcher, who, in 1793, commenced the manufacture in a small way of Lamp Wicks, Tapes, and Webbing. After his decease, in 1824, the business was carried on by his two sons, Thomas and William, under the firm-style of T. & W. Fletcher. Another brother, Joseph, was soon after admitted, and the style was changed to Fletcher Brothers, who added the manufacture of Corset Laces to their original business, and employed two small machines. In 1827, they embarked in the manufacture of Boot and Shoe Laces, of which the production is now enormous, and from year to year enlarged and increased the capacity of their Works, but without a change in the firm-style until 1860, when, by the admission of sons as partners, it became Fletcher Brothers & Co., which continued until 1865, when the Fletcher Manufacturing Company was incorporated.

THOMAS FLETCHER, the late President of the Company, was born in Boston, Massachusetts, in 1798, but was a citizen of Providence from 1809 until his decease in 1867. The business which came into his hands upon the death of his father, in 1824, was then so small, and carried on with machinery and appliances so inefficient, compared with those now employed, that he may be called the founder of the present establishment, whose immense structures are a monument to his persevering industry, commercial sagacity, and well-directed enterprise.

At the present time, William Fletcher is President of the Company.

George Chatterton's File Manufactory,

In Providence, is one of the most notable establishments of the kind in the country. It is not at all remarkable for the extent of the buildings or amount of its products, but as the place where the most highly prized File is made that is sold in the American market.

Mr. Chatterton is a descendant of a long line of File-makers. His father, grandfather, and great-grandfather, were File-makers in England. He served an apprenticeship in the celebrated manufactory of W. & S. Butcher, of Sheffield, and learned all that could be acquired of the art in the best shops in England. Having made himself obnoxious to the English government by a too strenuous advocacy of Reform, at a time when less latitude of opinion was tolerated than now, he came to the United States, in 1839, and chose Providence as the field of his future operations. Commencing with no capital but a thorough knowledge of his trade, he had difficulties to surmount which only those can appreciate who have gone through a similar ordeal. It is said that he frequently travelled two hundred miles on foot, exhibiting samples and soliciting orders. His skill and perseverance, however, triumphed over the obstacles in his way originating in the want of capital, and after ten years' labor he found himself in a position to undertake operations on a larger scale.

In 1851, he visited England, and made arrangements to secure constant supplies of the best qualities of English Steel, both for use in his own manufactures and for sale to others. On his return he secured a building where he could have the advantage of steam power, and fitted it with all the modern appliances for the successful prosecution of his business. At this time he employs about thirty men in his File Manufactory, has an engine of thirty-five horse power, and is, besides, a large importer of English Steel.

Within the time comprised in his business career in America, there have been several large establishments organized for manufacturing Files by machinery, but none have as yet succeeded in producing an article that has superseded, in the favor of manufacturers, the Chatterton Hand-Cut File. There is a radical difference in the operation of making Files by machinery and cutting them by hand-labor. Cutting by machinery presupposes an absolute number of teeth in the blank to be cut, entirely independent of any conditional requisites to insure sharpness in the tooth; and as these conditions constantly vary during the operation of cutting, the most improved machines have failed to produce uniformity as regards sharpness and depth of the teeth produced. In hand-cutting, the sharper the chisel the sharper the tooth,

while regularity and evenness are the result of mechanical skill and practice. The number of teeth to make a good File is not absolute, provided the requisite sharpness is obtained.

Mr. Chatterton has steadily adhered to the rule of selling his Files to consumers direct, and not through the agency of middle-men. During the late Rebellion he supplied the National Armories with the finer class of Files used in the manufacture of guns. These files were formerly imported, and their manufacture in this country was an important element of national economy.

Mr. Chatterton belongs to the class of foreigners whom America delights to honor. Bringing with them skill, patience, and sturdy perseverance, they establish industries that are the bulwark of civilization, and a guarantee to a nation of real and substantial, not nominal independence.

PAWTUCKET, in Providence County, four miles north of the City of Providence, has long been an important manufacturing place. This town, lying on both sides of the river, was formerly partly in Massachusetts and partly in Rhode Island, but in 1861 the boundary was so arranged as to place it wholly in the latter State. It was here that cotton cloth was first successfully made in this country by water-power machinery, as has been stated in the first volume of this History. An interesting incident connected with this enterprise, however, was not there alluded to; but as the principal actor was one of the first machinists in this country who turned his attention to the manufacture of cotton-machinery, and as his son is now proprietor of the most important Works in the place, it deserves a recital.

When Brown, Almy & Slater came to Pawtucket in 1790, they employed Mr. Sylvanus Brown to construct their machinery under the superintendence of Mr. Slater. He worked in his own shop, under bonds not to furnish patterns to other parties, and with closed doors and great secrecy he constructed cards, drawing, roving and spinning frames. When completed, as was supposed, Mr. Slater found to his dismay that the card would not work. Every effort to start it proved a failure; and Mr. Slater was in despair. Fearing that his associates would deem him an impostor who had been wasting their capital upon a visionary enterprise, he communicated to Mr. Brown his intention of running away to avoid their censure. Having asserted again and again that he had seen it in successful operation in England, Mr. Brown persuaded him to remain, declaring, with unconquerable resolution, "This machine shall go!" While perplexed with this difficulty, which threatened to baffle their whole enterprise, Mr. Brown went home to dinner one day, and

while sitting by the fire he casually took up a pair of hand-cards with which his wife had been carding cotton. Carefully examining them, his attention was attracted by the peculiar bend or crook in the teeth. Fired with a new suggestion, he hastened to his shop, proceeded to make in his card a bend or crook similar to that which he had observed in the hand-card, and started up the machine—which immediately performed its work with satisfactory results. Thus it was that the great obstacle was removed—not by the suggestion of a marvellous dream in the mind of Mr. Slater, as has been currently reported, nor by mere chance.

In 1792, Mr. Brown invented and used the first Slide-Lathes for turning spindles; also the first machines for fluting rolls. These machines were constructed of hard wood. They were of great utility, and enabled one man to accomplish the work of six.

James S. Brown's Machine Works.

His son, Mr. James S. Brown, now proprietor of the most extensive Machine Works in Pawtucket, is even more distinguished than the father as a Machinist and an Inventor. In 1817, while yet a boy, he went to work on cotton machinery in the shop of David Wilkinson, in Pawtucket, and in 1819 he went into the employ of Messrs. Pitcher & Gay, in Pawtucket, on the Massachusetts side of the river. He remained with them until 1824, when Mr. Gay retired from the firm, and Mr. Brown was taken into the business as a partner by Mr. Pitcher. This firm, under the name of Pitcher & Brown, did a successful business in the manufacture of cotton machinery till September, 1842, when Mr. Pitcher retired from the business, leaving it entirely in the hands of Mr. Brown. The *Slide Rest* used on Turning Lathes, by which the height of the tool can be adjusted while the lathe is in motion, was invented by Mr. Brown, while in the employ of Pitcher & Gay, in 1820.

Among other useful tools, now familiar to machinists, Mr. Brown, in the year 1830, invented his Gear Cutter for cutting Bevel Gears. The advantage of this machine is, that it requires no change of the headstock to make the proper taper in going once round the wheel.

After the introduction of the celebrated Sharpe & Roberts' Patent Self-Acting Mule into this country, Mr. Brown immediately turned his attention to their manufacture, and in building these machines has acquired a reputation second to no machinist in the United States.

These Mules were first introduced into the United States by Major Bradford Durfee, of Fall River, Mass., in the years 1839–40. Major Durfee was then agent of the Annawam Cotton Mill at Fall River, and

visited Europe on business connected with his company. While in England he purchased of Sharpe & Roberts six of their Mule Head Stocks. They were shipped to some port in France, whence they were reshipped to this country and forwarded to Mr. Durfee at Fall River. From Fall River they were sent to Messrs. Pitcher & Brown at Pawtucket, and a part are now running in the Annawam Mill, and the remainder in the Fall River Cotton Mill. The first Sharpe & Roberts' Self-Operating Mules made in this country were built by Pitcher & Brown for Messrs. S. & H. B. Chace, of Valley Falls, R. I., where they are now in successful operation. Mr. Brown applied himself with great diligence to perfecting and simplifying the work on this Mule invention, making many new and ingenious tools for that purpose. Among other improvements made by him on this Mule, was putting a *Catch Box* in the middle of the carriage under the head, in place of a set of changing gears—which improvement is believed by many to be the life of the mule in this country.

The castings used by him in his Works were procured from the foundry of General Shepard Leach, in Easton, Mass., up to 1847. In that year he purchased the land on which his present establishment is located, and erected a Foundry Building forty by eighty feet, and made his first castings therein on the last day of that year. This furnace has supplied him since with all the castings he has required in his business. The extensive and well-arranged shop in which his business is now carried on, was erected by him in 1849. Having decided to build, he was met at the outset with the difficulty of not finding in the market such bricks as he required. With characteristic energy and self-reliance he purchased a tract of land in Pawtucket river, called Bucklin's Island, containing a fine bed of clay, and manufactured his own bricks. His shop is built entirely of brick from his own brick-yard. It is four hundred feet in length by sixty in breadth, two and a half stories high, with a large wing attached in which is stationed the steam-engine that supplies the power for the whole shop. In addition to this shop and furnace, is a substantial Pattern House forty by seventy-two feet, two and a half stories above the basement, built in 1859, and several other smaller buildings, for various uses—all so conveniently arranged and admirably adapted to their several purposes, as to make this one of the largest and most complete establishments of the kind in the country. The tools in this establishment were nearly all of them built by Mr. Brown, and for several of them he has obtained letters-patent. His Tool-Holder Turning Lathes, the Fluting Engine improved by him, and many other of his Tools, are well known to machinists, and unequaled for the several purposes for which they are used.

The Sharpe & Roberts' Mule, and the Long Flyer Speeder, are the only cotton-manufacturing machines which Mr. Brown has built for several years. When the English Fly-Frame was being generally introduced, he was urged by many manufacturers to build that machine for them; but he steadily refused to do so, with a firmness that seemed to them almost like obstinacy, insisting upon it that they were not what manufacturers of cotton wanted, and that the American long-flyer Roving Machine could be rendered far superior to the English Fly-Frame. He turned his attention to the improvement of the American Speeder. After careful study and many experiments, he succeeded in accomplishing the desired result, and took out a patent for his improvements in January, 1857. The result has fully verified the correctness of his opinion. Almost from the time that he took out his patent for his improvements, the demands of manufacturers compelled him to abandon the building of Mules, and to turn the whole force of his shop to the construction of his Patent Speeder; and nearly the entire force of another large machine shop in the vicinity has been employed in making the same machine, without being able to supply the demand.

Among the many inventions of Mr. Brown, for which he has secured letters-patent, is his improved Turning Lathe, for turning bodies longitudinally of irregular surfaces, and in a great variety of forms. This machine, which was designed for turning cotton-machinery rolls, has acquired a new reputation since the outbreak of the war, and the extraordinary demand for muskets, which converted so many machine shops into armories. During the progress of the war, the building of Tools for the manufacture of guns occupied much of the attention of Mr. Brown, and to a great extent superseded all other kinds of work in his shop.

Fales, Jenks & Sons' Machine Works.

Another of the old and distinguished families whose names are associated with the first essays in establishing manufacturing enterprises in Rhode Island, is represented by the firm of Fales, Jenks & Sons, whose Works are at Central Falls, in Providence County.

The founder of this firm, Mr. David G. Fales, having served an apprenticeship in the shop of David, George, and Alvin Jenks, trading as David Jenks & Co., formed a copartnership in 1830 with Alvin Jenks, and commenced the manufacture of Cotton Machinery under the name of Fales & Jenks, at Centre Falls, in a shop belonging to Ruel, Richards & Co. The first new machinery constructed by them, was a Spooler, made for Cunningham & Anderson, of Richmond, Virginia. This machine was sold for sixty dollars. During the first two years

of their existence as a firm, their business was limited to the manufacture of cotton-spinning and thread-making machinery; but in 1833 they purchased the right to manufacture in Rhode Island, and sell in New England, Hubbard's Patent Rotary Pump, which has ever since continued to be a prominent article in their manufacture. This simple and ingenious machine consists of two wheels, enclosed in a cylinder, one driving the other by close-fitting gearing. These wheels, revolving in opposite directions, expel the air, which escapes from the enclosing case at the outside of the wheels, thus creating a vacuum, which, the water rushing in to fill, is in its turn expelled, with great force, in the same manner that the air was. They have made important improvements in their construction from time to time, greatly increasing their working power and durability, and now they are the most effective security against fire that has yet been devised. To supply the demand for them has become a business of great magnitude, in which Messrs. Fales & Jenks, by the excellence of their work, improved tools, and other facilities, have acquired an almost exclusive monopoly.

The manufacture of these Pumps, however, has been but a part of their business. From the first they have continued to build various kinds of cotton-machinery. The first Ring Spinning Frames were made by them in 1845; the first Ring Twisters, being among the first of these machines built in this country, for thread, worsted, woollen and silk, were made by them in 1846, for Mr. Benjamin Green. Since that time their whole attention has been given to building Spinning and Twisting Machines and the Rotary Pump.

In April, 1854, Alvin F. Jenks and John R. Fales, sons of the original partners, were taken into the business, and the firm-name of Fales, Jenks and Sons was adopted.

In January, 1856, Mr. Alvin Jenks, whose rare mechanical skill, sound judgment, and sterling integrity of character, had contributed so much to the reputation of the firm, died, and another of his sons, Stephen A. Jenks, was admitted into the partnership—the business being continued under the same name.

Previous to 1860, they had procured most of their castings to be made at other establishments, but in 1859–60 they built their present furnace, a brick building sixty by one hundred feet in dimensions, with an L attached fifty by sixty-three feet, connecting the furnace with the spacious machine shop since erected. During the same years they built a boiler-house twenty-five by fifty feet, a three-story building forty by seventy-three feet for a spindle shop, and also a lumber house forty by eighty feet.

In 1861, they built a large lot of Milling Machines, used in the manufacture of guns and sewing machines.

In the years 1862–3 they erected a new building for their main shop. This building is of brick, three hundred feet in length by sixty-three feet in width, and three stories in height, with an attic. Connected with this is an L of the same height, seventy-three and a half by sixty feet. The flooring of this building covers an area of considerably more than two acres. The whole structure is of the most substantial character, and admirably adapted to the purposes for which it was designed. Their establishment is now among the largest and best-arranged of its class in the country.

The Pawtucket Hair Cloth Company,

Of Pawtucket, Rhode Island, have the largest Manufactory in the world of the various descriptions of Hair Cloth. The building is a four story structure of brick, two hundred and fifty feet long by fifty feet wide, and is provided with a great variety of novel machinery, embracing all known inventions and improvements for the production of this peculiar fabric by power-loom.

A capital of about half a million is invested, giving employment to some one hundred and fifty hands.

Hair Cloth is of various descriptions, including that designated as Hair-Seating, used for Upholstering Chairs and Sofas—that known as Padding, used by tailors—and that known as Skirtings or Crinolines.

This company manufactures principally the style known as Hair-Seatings, in which, so far as reputation is concerned, it has attained great success, its product having a decided preference over all goods of its class wherever made. Its aim has been to demonstrate (what has been quite generally doubted), that consumers of this class of fabric could safely depend on a home product. To this end, no expense has been spared in improving the quality of the goods; the Directors feeling satisfied to defer dividends, rather than to lower their standard of excellence in product.

The hair used in this manufacture is horsehair obtained from Tartary, the Ukraine, or Buenos Ayres, South America. Black being the favorite color, the manes and tails of the Ukraine horses are preferred, although the hair of a lighter shade can be dyed to a brilliant black. The width of the cloth is governed by the length of the hair. The wider the cloth the more valuable the fabric.

The woof or warp of Hair Cloth is of linen, cotton, or worsted. In England, linen warp is quite generally used, but in this country cotton

warp is almost universally preferred, because of the greater degree of pliability thereby given to the fabric, any supposed requisite of a brilliant warp being removed by so weaving that the face of the cloth shows only hair.

The hair is imported "in the rough," and must be cleansed, dyed, hackled, and so assorted that the bunches, as ready for the loom, must be of hairs of uniform length. It is believed that this company is the only manufacturer in the world that has successfully applied machinery to the "drawing and assorting" processes.

The shorter hairs, which are unfit for weaving, find use largely in the manufacture of Brushes, for which purpose the company make large sales, and in the manufacture by the company of Curled Hair, the best article known for stuffing of the best upholstery work—the use of pure hair insuring freedom from insects and vermin.

The loom for weaving Hair Cloth by power, with its various devices for feeding the hair and regulating the action, is exceedingly ingenious and interesting, and the Pawtucket Company has the exclusive right to its use.

The original device for power weaving in hair, was known as the "Angell Patent." This having been purchased by the company, was improved by the purchase and addition of the "Stafford Patent;" and both were greatly improved by an entire revision of plan through the genius of Isaac Lindsley, Esq., who is the inventor of most of the processes now used by the company. Mr. Lindsley is an extremely quiet and unobtrusive man, thoroughly wedded to the study of mechanism, and by his success in this intricate machinery has earned high rank as an inventor, with brilliant promise for the future.

The first President, and manager of the company, was DAVID RYDER, Esq., of Pawtucket, well known as a most indefatigable worker, with rare qualifications to introduce and propel a new enterprise.

DANIEL G. LITTLEFIELD, Esq., is the present Agent. He has been all his life in manufactures of various kinds, and is reputed to be a man with whom success is a duty. The Treasurer is OLNEY ARNOLD, Esq., Cashier of First National Bank of Pawtucket.

The Selling Agents are HENRY B. METCALF & Co., of Boston, and METCALF & LITTLEFIELDS, of New York.

Moshassuck Bleachery, W. F. & F. C. Sayles, Proprietors,

Situated about two miles from Pawtucket, was pronounced, by the late Governor Allen, of Providence, to be the most complete and best arranged Bleachery in New England, and probably in the world. It occupies the site of buildings that were originally erected for Print Works, and used as such until December, 1847, when they were sold at auction under mortgage sale, and purchased by Mr. Sayles. Soon after, he erected additional buildings, and converted the establishment into a Bleachery of Shirtings and Sheetings, with a capacity of turning out about two and a half tons per day. Though Mr. Sayles had no previous knowledge of the business, and labored under the disadvantage of a want of sufficient capital, yet, by close application and energy, he steadily increased the capacity of the works, until, in the spring of 1854, he bleached about four tons per day, of the finest grade of shirtings made in the United States. At that time, his reputation had become so well established, that about three fourths of all the fine goods made were brought to his bleachery. The water of the Moshassuck river has long been known to possess valuable properties for bleaching purposes, but these Works possess an additional and extraordinary advantage in a fountain of pure water flowing from a hundred boiling springs, and invaluable in the last processes. These springs have been enclosed by a wall three hundred feet in circumference, of cut granite, and which is an ornament to the grounds.

In June, 1854, the entire Works were destroyed by fire; but the work of rebuilding, on a larger scale, was at once commenced, and in the autumn of that year an establishment was in operation capable of producing six tons of bleached goods per day. Before the close of the following year, however, it was found necessary to enlarge the capacity of the works, and the work of extension has been gradually going on from year to year; and when the buildings now in process of erection are completed, and filled with machinery, this establishment will be capable of turning out not far from one hundred and sixty-two thousand yards, or twenty tons, of fine Shirtings and Sheetings per day. The buildings are all of brick, and in point of architectural beauty are scarcely excelled by any used for manufacturing purposes in the country. The arrangements for protection against fire are as complete as can be made, every room being heated by steam, from pipes passing through tin tubes; while there are also four force pumps connected with the Works, and so arranged that they can be operated either by steam, water, horse or hand-power. The Works are lighted by gas manu-

factured on the premises. The machinery is new, and some of it novel, from patterns made under the immediate supervision and direction of the proprietor, expressly for bleaching fine goods.

One noticeable feature is the use of brass pullies for carrying the goods from one process to another. Two splendid Corliss engines, one of one hundred and twenty, and one of one hundred horse-power, have been provided as an adjunct to the water-power, for driving the machinery.

Connected with the Bleachery is a fire-proof Planing Mill, for preparing the lumber used in making cases for boxing goods, of which about thirty thousand are required annually. There is also a Machine Shop, for the building and repairing of machinery.

The present capacity of the establishment is about twelve tons of cloth, or twenty-four hundred cuts, of forty-five yards each, per day, employing about one hundred and twenty hands. When the additions in progress are completed, the number of hands will be increased to about two hundred. Surrounding the Works is a neat village of houses, mainly built by Mr. Sayles for the accommodation of his workmen. There is also a modern built school-house, in which a free school is kept during the year, and none but first-class teachers employed.

In the spring of 1860, a Sabbath-School was organized, which for several years has registered more than one hundred scholars. It has a Library of about six hundred volumes.

Mr. Frederic C. Sayles, a brother, is now a partner, the style of the firm being W. F. & F. C. Sayles.

Pawtucket and Central Falls are the principal seats of the manufacture of Thread and Spool Cottons in this country. The celebrated Mills of GREENE & DANIELS are located in Pawtucket, on the east side of the Blackstone River, and consist of a main mill, four stories high, with an L, one hundred feet in length, a cotton-house disconnected from the other buildings, and a large office building, part of which is used for putting up goods. All the buildings are of brick, and new, having been commenced in the summer of 1860. In addition to these the firm lease a mill on the west side of the river. They contemplate a considerable extension of their works within an early period.

The machinery of the mills is of the first class, and especially adapted to the working of both the common staple and the Sea-Island cotton. The Dressing Machinery, invented by Mr. Daniels, is patented, and is said to be superior to any thing of the kind. The production amounts to upward of twenty thousand dozen spools of two hundred yards Thread, weekly, both white and in colors, and is known as "Greene &

Daniels' Ivory Finish" Spool Cotton. They also manufacture a considerable quantity of Skein Thread and Embroidery Cotton, and much of the Thread is furnished on large spools for manufacturing purposes, and is extensively used as a substitute for silk.

This firm also have a Bleachery and Dye House connected with their works, and do a considerable business in bleaching for others, as well as that necessary in their own manufactures. They have, on their own premises, an extensive reservoir of pure spring water, affording an ample supply for steam, bleaching, coloring and other purposes. About two hundred and twenty-five hands are employed in these works.

One of the oldest-established Thread manufacturers in Pawtucket is NATHANIEL G. B. DEXTER, who, for more than thirty years, has been connected with the business. His specialty is the manufacture of Knitting, Darning and Tidy Cottons. When he commenced, the value of the entire production did not exceed twenty thousand dollars a year; now, the value of the knitting and darning cottons, manufactured in his establishment, amounts to four hundred thousand dollars, annually. Mr. Dexter has two mills; one situated in the town of Pawtucket, the other, in Valley Falls. The buildings are of brick; the one measuring eighty-four by forty-four feet, five stories in height, and the other, sixty-four by forty feet, and three stories high. Both establishments are run by steam power. There are, in these mills, five thousand spindles, and they employ about one hundred and fifty hands.

LITTLEFIELD BROTHERS have, also, an extensive manufactory in Pawtucket, and make every variety of Skein Sewing Cottons.

The Works of R. J. STAFFORD, late Stafford & Wood, manufacturers of the celebrated "Stafford & Brothers' Enamelled Thread," are situated in the village of Central Falls, directly upon the west bank of the Blackstone River, and present a fine and imposing appearance. They consist of a brick mill, forty-five by twenty-eight feet, five stories high; a stone mill of same length and width, four stories high; a two-story building, eighty by forty feet, with a wing, forty-five by thirty feet, and a long wooden building, one hundred and twenty-five feet by twenty-five feet. The brick mill was built in 1824; the erection of the stone mill dates back to a period considerably more remote.

In these mills, Mr. Stafford runs ten thousand spindles, employs two hundred and fifty hands, and produces, weekly, five thousand dozens of spools, both white and in colors. This Thread, for evenness and strength, is not surpassed by any made in this country.

MANUFACTURES OF HARTFORD.

The following are the Statistics of Hartford County, including Hartford City, New Britain, etc., for the year ending June 1st, 1860, prepared for this Work at the Census Office.

Manufactures.	No. of Establishments.	Capital.	Raw material.	Male hands.	Female hands.	Value of product.
Agricultural Implements	11	$45,300	$19,700	75	1	$61,314
Axes and edge tools	3	306,000	212,465	370	.....	458,000
Bells	1	4,800	2,768	5	.....	7,000
Bolts, nuts, and washers	6	134,000	111,410	225	10	250,500
Book-binding and blank books	2	14,500	8,305	19	26	51,000
Boots and shoes	10	37,500	130,932	358	40	373,075
Boxes, paper	3	3,900	5,980	10	34	20,300
Brass founding	1	25,000	5,500	16	.....	25,000
Brick and drain-tile	10	21,500	7,482	87	.....	35,810
Brushes	1	6,000	6,000	10	3	22,000
Buttons	2	8,200	4,605	20	19	34,500
Cabinet furniture	5	69,250	35,885	72	2	111,000
Carpets	1	600,000	435,000	320	275	666,000
Carriages	21	89,850	77,850	214	3	205,080
" children's	2	3,500	4,600	9	1	8,000
Carriage hardware	3	19,000	12,360	57	.....	34,400
Carriage trimmings	3	40,000	24,087	62	16	78,000
Cartridges	2	9,000	6,160	3	12	13,400
Cigars and tobacco	23	243,300	202,350	295	85	473,850
Cigar boxes	4	13,000	13,260	10	.....	22,000
Clocks	10	86,500	106,625	239	13	239,000
Clothing	7	110,600	228,000	208	595	439,000
Coffee and spices (ground)	3	44,000	83,680	9	3	103,800
Copper smithing	1	2,000	5,059	4	.....	9,000
Cordage	1	10,600	5,975	5	.....	11,875
Cotton goods	13	333,000	213,091	316	284	484,078
Fertilizers	1	6,000	1,150	4	.....	2,500
Firearms	2	1,750,000	91,999	650	19	1,050,000
Flour and meal	18	157,700	524,965	48	.....	662,972
Gas	2	230,000	33,828	21	.....	64,954
Gold leaf	1	10,000	60,000	19	3	80,000
Gunpowder	3	773,500	473,300	166	.....	991,560
Hardware	20	750,900	642,292	1053	74	1,368,284
Hooks and eyes	2	62,000	32,300	12	46	85,000
Hoop skirts	2	83,000	108,000	65	275	212,000
Hosiery	9	787,000	343,633	303	409	907,850
Hames	1	12,000	6,000	35	.....	35,000
Iron founding	2	20,000	12,250	42	4	39,250
Iron railing	1	4,000	5,572	8	..	11,245
Jewelry	3	78,000	60,242	49	.....	104,000
Leather	7	54,200	62,930	25	.....	92,050
Leather belting and hose	3	141,000	223,000	57	.....	355,000
Liquors, malt	4	42,000	49,845	13	.....	70,410
" distilled	7	65,700	64,750	30	.....	107,800
Lithography	2	9,500	5,100	17	6	17,500
Looking glass & picture frames	1	5,000	15,000	10	....	25,000

Manufactures.	No. of Establishments.	Capital.	Raw material.	Male hands.	Female hands.	Value of product.
Lumber, planed	2	40,000	79,000	26		95,000
" sawed	14	43,700	41,710	35		87,095
Machinery, steam-engines, etc.	7	265,200	135,005	307		368,485
Marble work	5	55,500	28,000	112		94,000
Melodeons	1	5,000	2,610	7		10,000
Paper	21	1,134,500	808,855	361	302	1,316,320
Pottery ware	3	10,800	1,700	12		14,700
Printing and publishing	11	156,600	184,818	249	97	422,488
Rules, bevels, and planes	3	76,000	23,603	123	4	96,400
Saddlery and harness	7	68,650	256,062	246	112	367,750
Saddlery hardware	3	80,000	60,100	115	35	140,000
Safety fuse	3	40,000	47,245	14	18	70,940
Sash, doors and blinds	4	42,800	38,765	50		69,600
Saws	2	21,000	10,470	12		26,500
Shirts, collars, etc	5	61,000	72,675	13	278	136,900
Silk, sewing	2	620,000	338,683	104	512	571,000
Silver-plated & britannia ware	4	285,000	200,230	235	63	518,000
Soap and candles	3	66,800	87,318	29	5	159,325
Spokes, hubs and wheels	4	5,000	5,670	19		14,836
Steam and gas fittings	1	10,000	2,250	20		14,000
Stereotyping	1	5,000	500	6		4,000
Stone quarrying	1	1,350	500	13		5,000
Tinware	8	23,300	20,707	29	4	50,500
Tinners' tools and machines	3	85,000	29,055	108		105,335
Toys	1	12,000	8,000	25	25	42,000
Upholstering	3	41,000	131,200	35	19	230,000
Whip lashes	1	5,000	3,000	5	20	7,800
White lead	1	20,000	48,000	12	2	60,000
Willow ware	1	10,000	2,125	30	10	20,000
Woolen goods	8	376,500	403,692	249	148	657,060
Total, including miscellaneous manufactures not above specified	405	$11,171,200	$8,157,227	8,437	3,917	$16,827,016

The city of Hartford contains several noteworthy manufactories, and a few that are really remarkable. It also contains one whose products are known not only in both America, in England, and the continent of Europe, but in the Indies, in Egypt, in Australia, and by the far Asiatic tribes. We need hardly say that the one alluded to is

Colt's Patent Fire-arms Manufacturing Company.

A gentleman intimately conversant with the history of the founder of this establishment, and formerly a member of Congress from Connecticut, has asserted that Samuel Colt, at the age of fifteen, while upon a voyage which he made as a runaway sailor boy to Calcutta, first conceived and wrought out "with a chisel on a spun-yarn, with a common jack knife and a little iron rod, the rude model in a piece of white pine, of that firearm, which now, from the shores of the Pacific

to the Japan seas, over the whole civilized world itself, reports the triumph of his skill and blases his fame." This early model is still carefully preserved in the collection of Col. Colt's curiosities, and is certainly a remarkable exemplification at what an early age inventive genius sometimes manifests itself. His original conception, however, was very different from the latest "Colt's Improved." It was the combination of a number of long barrels to rotate upon a spindle by the act of cocking the lock, in the same manner that they have since been made by others, and it was not until he perceived the objections to which they are liable, arising from weight and bulk, that in his study to obviate them, the idea of a single barrel and a chambered breech suggested itself to him. In order to obtain the necessary means to prosecute his experiments and manufacture specimen arms, he traveled the United States and the Canadas as a public lecturer on chemistry, and though only a youth of not more than seventeen or eighteen years of age, he administered, it is said, more laughing gas to more men, women, and children, than any other lecturer since chemistry was first known as a science. In 1835, when not more than twenty-one, he received from the United States Government his first Patent for a Repeating or Revolving Firearm. In the following year he succeeded in engendering sufficient confidence in the minds of a few capitalists to procure the establishment at Paterson, New Jersey, of a company with a capital of three hundred thousand dollars, for the manufacture of the weapon which he had invented. This Company continued in existence until 1842, when they were forced to discontinue operations, after expending the original capital without beneficial results, except those gained in further simplifying the mechanism of the arms and perfecting the machinery required for their manufacture. From the failure of the Paterson Company until 1847, none of these arms were made, and it was not until after the commencement of the war with Mexico, when Gen. Taylor, who had witnessed their utility in the Florida campaign, sent Captain Walker of the Texan Rangers to procure from Col. Colt a supply of revolvers, that an opportunity presented itself to retrieve the embarrassments into which he had been involved. He at once contracted to furnish the Government one thousand arms for $24,000. As a temporary arrangement he hired an armory at Whitneyville, Connecticut, where he completed his first contract, and shortly afterward established the nucleus of his own manufactory at his native place, Hartford. One order rapidly followed another, and the business increased so that constant additions of room, machinery, and workmen, were required. From that time to the present the business has been a constant success, and has resulted in the erection of the most perfect establishment for the manufacture of Firearms in this or any other continent.

Colt's New Armory is located on the west side of the Connecticut River, about one hundred yards south of the mouth of Little River, immediately inside of a dyke which Col. Colt erected to exclude the overflow of the Connecticut River. This embankment is about two miles long, averaging over one hundred feet wide at the base, and from forty to sixty feet in width at the top, and from ten to thirty feet in height. It is built in the most substantial manner, the sides being covered with osier both for protection and ornament. The buildings are of Portland freestone and brick, and consist of four parallels, four stories high, each five hundred feet long, two of them sixty feet and three fifty feet wide, connected by a fifth at right angles.[1] There are also two others of one story in height, five hundred feet long and fifty feet wide. The floors if extended in one line, would be a mile long by fifty-five feet wide, and contain an area of six and a half acres. Running through the centre of the main buildings is a row of cast iron columns, sixty in number, to which is attached the shafting, which is fifteen inches in diameter, and arranged as a continuous pulley for driving the machines as close together as possible, only allowing sufficient space to get around and work them. The motive power is supplied by five different engines, having an aggregate of nine hundred horse power. One of them was built in Providence, Rhode Island — the others by Woodruff & Beach of Hartford.

Within these buildings there are fifteen hundred separate machines, the majority of which were both invented and constructed on the premises. Every part of a Pistol or Rifle is made by machinery, and being made to a guage, is an exact counterpart of every other piece for the same purpose. Even all the various parts of the lock are made by machinery, each having its relative initial point to work from, and on the correctness of which the perfection depends. Taking the lock frame for instance, they commence by fixing the centre, and drilling and tapping the base for receiving the arbor or breech-pin, which has been previously prepared—the helical ground cut in it and the lower end screwed—once grasped is firmly fixed in its position, furnishing a definite point from which all the operations are performed and to which all the other parts bear relation. The facing and hollowing of the recoil shield and frame, the cutting and sinking the central recesses, the cutting out all the grooves and orifices, planing the several flat surfaces and shaping the

(1) We regret to learn that while these pages are passing through the press, a large portion of this magnificent structure was destroyed by fire; but as it is the intention of the Company to erect others in their place of the same kind, the description will stand for the past and the future, if not for the immediate present.

curved parts, prepare the frames for being introduced between hard steel clamps, through which all the holes are drilled, bored, and tapped, for the various screws; so that, after passing through thirty-three distinct operations, and the little hand finishing required in removing the burr from the edges, the lock-frame is ready for the inspector. The rotating chambered cylinder is turned out of cast-steel bars, manufactured expressly for the purpose. The machines, after getting them the desired length, drill centre holes, square up ends, turn for ratchet, turn exterior, smooth and polish, engrave, bore chambers, drill partitions, tap for nipples, cut pins for hammer-rest and ratchet, and screw in nipples. In all there are thirty-six separate operations before the cylinder is ready to follow the lock-frame to the inspector. In the same manner the barrel, forged solidly from a bar of cast steel, is bored and completed to caliber, and is then submitted to the various operations of planing, grooving the lower projection beneath the barrel, with which the base pin is ultimately connected, tapped, and then rifled. The barrel goes through forty-five separate operations on the machines. The other parts are subject to about the following number: lever, twenty-seven; rammer nineteen; hammer, twenty-eight; hand, twenty; trigger, twenty-one; bolt, twenty-one; key, eighteen; lear spring, twelve; fourteen screws, seven each, ninety-eight; six cones, eight each, forty-eight; guard, eighteen; handle-strap, five; stock, five.

Besides the exactness and uniformity which are arrived at by the adaptation of machinery, there is additional security in the minuteness of inspection to which each weapon is subjected. As soon as completed and before being polished, the different parts are carried to the Inspecting or Assembling Department, and there undergo a rigid examination. The tools to inspect a cylinder, for example, are fifteen in number, each of which must gauge to a hair so great is the nicety observed, and on finishing his examination the inspector puts his initial letter on the piece inspected, thus pledging his reputation on its quality. Again, after the different parts have been finished, they are once more carried to the assembling room, and each chamber is loaded with the largest charge possible and practically tested by firing; after which they are wiped out by the prover and returned to the Inspection Department. The inspectors again take them apart, thoroughly oil and clean them, when they are for the last time put together and placed in a rack for the final inspection. The orders from the principals being perfection—the slightest blemish, a small scratch in the bluing or varnish, is sufficient to prevent the arm passing this final inspection. But if passed, it is returned to the store room and papered, and then transferred to the wareroom, and is now ready for the market.

Previous to the erection of his new armory, Colonel Colt organized, under a special law of the state, the association styled "Colt's Patent Fire-Arms Manufacturing Company," with a capital of $1,250,000, the whole of which is invested in the buildings, tools, machinery, and raw materials. The stockholders were few, he himself being largely the principal, and the others the heads of the various departments of the business. Since his decease the position of President has been filled by ELISHA K. ROOT, one of the most accomplished mechanics of the age, to whom we elsewhere alluded as the inventor of some of the most important machines now in use in the manufactory. He invented the "Drops," as they are called, for forging—great hammers raised by screws on racks and dropped by a treadle—the face of the hammer, steel die and anvil, together forming a matrix to shape the red hot steel at a single blow. He also improved the self-operating rifling machines and invented the compound machines which perform many operations without change of cutters. The cam pump attached to the engine which raises the water of the Connecticut to a reservoir on a hill and supplying the factory village, is another emanation of his genius, and is said to perform its work better than the Cornish pump as the stream flows continuous and steady. The other officers are R. W. H. JARVIS, Vice President; THOMAS J. FALES, Secretary; HUGH HARRISON, Treasurer; HORACE LOUD, Superintendent—all of them men of large experience in their respective departments.

The Company at the present time are turning out about 250 rifled muskets and the same number of revolving pistols, besides a considerable number of revolving rifles and shot guns. They make forty-four different styles of pistols, six different patterns, eleven different lengths, and twenty-seven different finishes. Of rifles they make three different calibres and five different lengths. The weight of the arms for which the demand is largest, and which are constantly in course of construction, are as follows:

	Pounds.	Ounces.
The military rifle, barrel 36 inches, fitted with improved bayonet	11	8
Sporting rifle, barrel from 18 to 30 inches, average	9	
The army or holster pistol	4	4
The navy or belt pistol	2	6
The pocket pistol, barrel 6 inches	1	12
The pocket pistol, barrel 5 inches	1	10
The pocket pistol, barrel 4 inches	1	8

The barrels of all these pistols and rifles, with the exception of the

rifled muskets, are of steel, for which the Company pay about $30,000 per month.

Besides Arms they also manufacture Bullet Moulds, Powder Flasks, and other accoutrements; and they have a separate factory for the production of Metallic Foil Cartridges, a contrivance invented by Col. Colt, that always insures "dry powder" to the possessor. They employ about 1500 persons, to whom they pay monthly over $80,000, or nearly a million of dollars a year. Almost the entire manual labor of the establishment is performed by contract. The contractors are furnished room, power, material, heat, light—while they furnish muscle and skill—themselves and subordinates being all subject to the immediate government, as prescribed by the code of rules laid down by the Company. They number several hundred—some particular manufacturers requiring only their individual exertions, while others employ from one to forty assistants. Many of them are men of more than ordinary ability, some have been connected with the concern since it was first established, and have rendered themselves pecuniarily comfortable by their exertions.

On the 10th of January, 1862, the founder of this vast establishment passed from the scene of his labors, at the early age of forty-seven, his decease being hastened, it is supposed, by mental anxiety and over-exertion. He died at a time when the country most needed his talents and experience in the construction of weapons for warfare. He died in the midst of unfinished projects, which would have made his native city the principal centre in the United States of the manufacture of ordnance, having designed to build foundries, forges, and workshops, to produce every thing necessary to equip an army, or navy, or fortress. He lived long enough, however, to add three millions of dollars to the taxable property of Hartford; to redeem from annual or semi-annual overflow by the Connecticut River, 250 acres of land within the city limits; to build two complete villages, now inhabited by several hundred families, having their Gas Works, Public Hall, Stores, Society for Mutual Relief in case of sickness, Military and Quadrille Bands, and to enrol his name among the foremost in the list of America's most famous inventors.[1]

(1) It was not only in the department of arms that Col. Colt's mechanical genius displayed itself. He also invented an apparatus for blowing up vessels and for coast and harbor defence which, in his own hands, was signally successful, and for a time experimented upon under the patronage and at the expense of the American General Government. It was while engaged upon this submarine battery, and as auxiliary to it, Col. Colt —to his great additional fame as a man of rare inventive genius—constructed the *first submarine telegraphic insulated wire* which was ever put under water—and which he operated with perfect success, first at New York—from the city to Coney Island, and to Fire Island —from the Merchant's Exchange Reading-Room, crossing several streams of water, down

Sharps' Rifle Manufacturing Company.

On September 12th, 1848, Mr. Christian Sharps, a native of New Jersey, then residing in Cincinnati, received a patent for an improved Breech Loading Gun, claiming as his invention, "the combination of the sliding breech with the barrel, the breech supporter and the stock, in such a manner as that when the sliding breech is forced down, the breech bore will be so exposed as to enable it to receive a cartridge on a line with the bore, and when the sliding breech is forced up, it will shear off the rear end of the cartridge, so as to expose the powder to the fire communication, and will finally and securely close the breech bore." He also claimed as his invention the combination of the cap-nipple with the sliding breech. This is the first account of what we believe was the first perfectly successful Breech Loading Rifle. The importance of the invention is attested by the fact, that for more than a hundred years the ablest writers on gunnery have asserted that the breech, and not the muzzle, is the proper place in which to deposit the charge; and ever since the origin of Firearms, the attention of ingenious men has been directed to accomplishing the object. Robins, whose work was published in the first half of the last century, and which is acknowledged as a standard, refers to the Breech Loading Rifles of his day, and says, "Somewhat of this kind, though not in the manner now practised, would be of all others the most perfect method for the construction of these sort of barrels." Experience has confirmed the correctness of the opinion of this ancient experimentalist, and established the fact that success in warfare depends more on the character and efficiency of the weapons used than upon the number or courage of the combatants.

In one of the Mexican revolutions in 1858, Colonel Suasue, at the head of 1,000 men, armed with Sharps' Carbines, attacked Governor Manero, who was in command of the Government forces, and achieved a most signal victory at San Lonis, Mexico, killing upwards of 600 men, taking the city and making prisoners of Governor Manero and three of his colonels, with a slight loss. In the same year, on our western frontier, Colonel Wright's command, armed principally with Breech Loading Carbines, utterly routed, without the loss of a man, a large band of Indians who had previously defeated Colonel Steptoe's forces, who were

to the mouth of the harbor—and afterward operated with it in the offing at Boston. His sub-marine cable differed only from the Atlantic cable recently lost, in this respect, that in the latter gutta percha was used as an insulator, and in the former, gutta percha being then unknown, a combination of cotton yarn with asphaltum and beeswax was used around the wires, enveloped in a metallic pipe as insulator.

armed with the old muskets and carbines. In the present Rebellion the efficiency of weapons loading at the breech has been so signally demonstrated as to leave no room for doubt. At Springfield, Mo., the "Fremont Body Guard," of 250 men, armed with Colt's Revolvers and Repeating Rifles, firing eighteen shots to the man, routed 1500 rebels, though the latter were acting on the defensive and chose their ground, while the former were crowded into a narrow lane between timber, and subjected to the cross-fire of the enemy. At Yorktown, a single man with a Breech Loading Rifle, kept a 100 pounder gun silent for days. At Fredericksburg, a single company, only partially full, silenced an entire rebel battery across the river, six hundred yards distant. At Pea in Arkansas, 550 men, armed with Sharps' Rifles, defeated and actually drove away four thousand under Marmaduke, though the latter had the advantage of being provided with artillery. The preservation of Gen. McClellan's army in his seven days retreat, is said to have been due mainly to a Connecticut regiment, armed with these Rifles, coming forward on a critical occasion; and the wonderful victory at Mission Ridge near Chattanooga, to the fact that a portion of the Federal forces engaged, were armed with Spencer's Breech Loading and Repeating Rifles: "Who," said a prisoner, "could withstand men that kept shooting and never loaded?" Such is the brief outline of the record that has been made in actual service by Guns loading at the breech.

In view of these facts it would be singular indeed if eminent military men, sincerely desirous of promoting the nation's welfare, had not expressed opinions in their favor and recommended their adoption. Major-General Rosecrans has stated (November 13, 1863) that he had no doubt that could such arms of proper construction be substituted at once for those now in use, it would add not less than fifty per cent. to the force or power of the troops now in the field, or, "in other words, we should augment our army one-half by changing the weapons." The Government, he informs us, has already become convinced that breech-loading, revolving-chambered or single-charged arms should be used for Cavalry and other mounted troops,—and adds, "it should, and in my opinion will, ultimately adopt them for infantry." It is certainly most unfortunate for the present executive officers of the government that the resources of the establishments engaged in making these arms are not more than sufficient to supply the Cavalry troops, for it cannot be supposed that the Administration could be guilty of forcibly conscripting men if it were in their power to augment the army "one-half by changing the weapons."

The history of the Sharps' Rifle Manufacturing Company is briefly as follows: It was incorporated in 1851, with a capital of $100,000. Mr.

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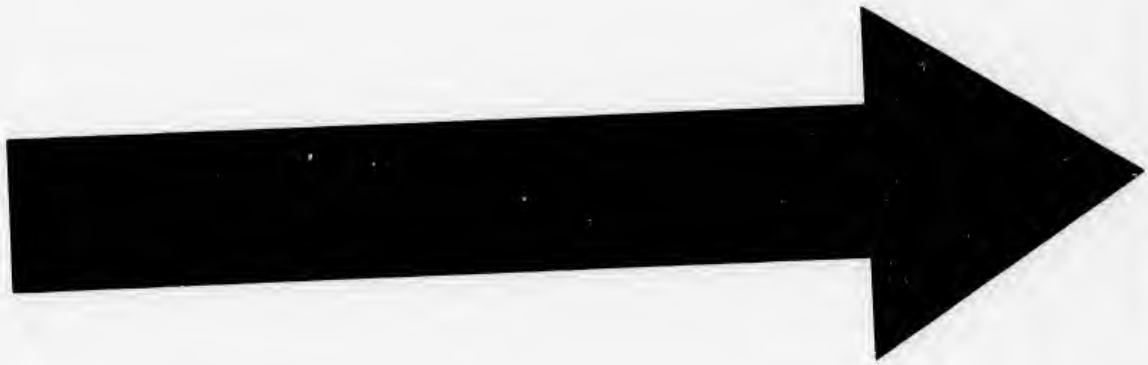

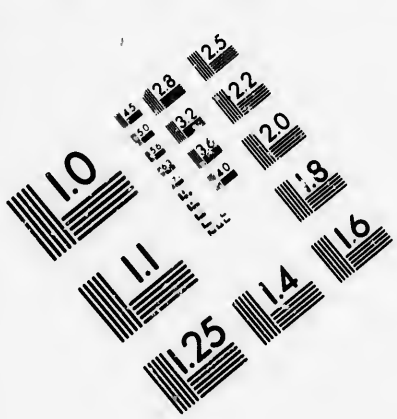

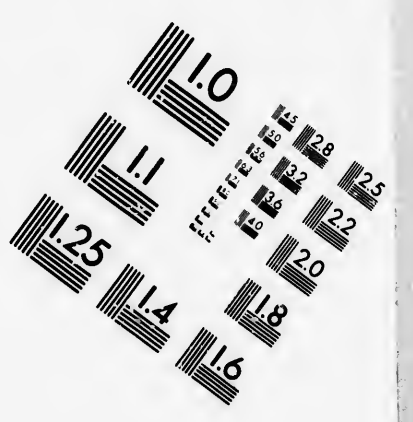

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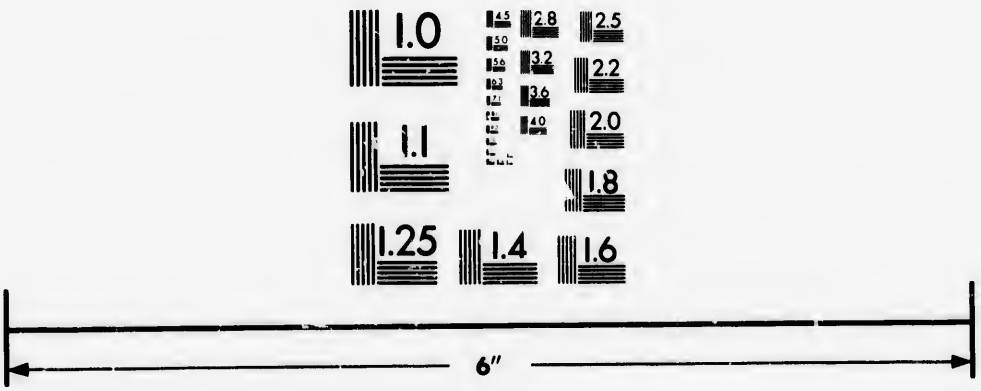

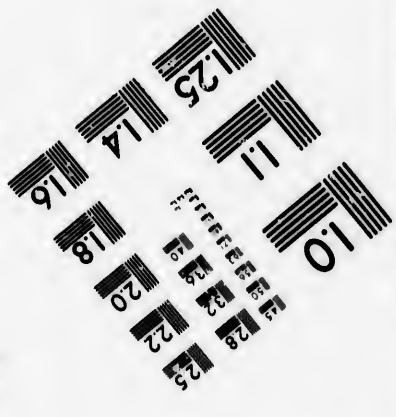

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JOHN C. PALMER, of Connecticut, was elected the first President of the Company, and has occupied the same position in relation to it ever since, discharging the duties with marked ability. Mr. R. S. LAWRENCE, of the firm of Robbins & Lawrence, manufacturers of firearms at Windsor, Vt., was invited, soon after its incorporation, to take charge of the mechanical department as Master Armorer—and most of the improvements that have been made in the establishment are the result of his experience and practical skill. The buildings originally erected were small in comparison with their present extent. The main Armory was about 160 feet in length by 60 feet wide, two stories high, with an L containing the Forge Shop, etc. Recently new buildings have been erected, and will soon be filled with machinery and workmen, which will more than double the present resources of the works. The main building is 215 feet long by 45 wide, and four stories high including the basement. The Assembling Room occupies the entire first story, without a partition, and is a most imposing and spacious hall, as may be imagined from the length and width of the building which has been already stated. In the basement is an engine of 250-horse power, made by the Corliss Steam-Engine Company of Providence. It is a horizontal single-cylinder of 26 inches in diameter, having a driving-wheel of 20 feet in diameter, and is intended to propel the machinery of the whole establishment. It will be run as a low-pressure engine in summer, and high-pressure in winter, the exhaust steam in cold weather being used to heat the buildings.

The processes and tools employed in the manufacture of a Sharps' Rifle are not essentially different from those in use in other Armories. The Barrels are cut from round steel bars, large enough to finish to the required diameter at the breech, and then tilted, or drawn under heavy trip-hammers, until the required taper is attained. These bars of steel, soon to become barrels, are then bored by upright machines, then turned, and finally rifled. The groove in a Sharps' is similar to that in the Springfield rifle-musket, broad and shallow. Nearly all the work is done by machinery. No part of the rifle or its appendages is made out of the establishment, and many of the tools and machinery in use were also made by the Company under the supervision of Mr. Lawrence. The "drop" for finishing the formation of the forgings are hand-drops, operated by means of hand-belt and pulley. Every thing is formed by dies of steel, so that every piece of forging is a counterpart of another for the same purpose. The rifling machines are remarkable specimens of mechanical finish and accuracy in working. Milling, forming, and compound machines perform operations which seem to require the exercise of the most exact and almost human intelligence.

Since it was first invented, improvements have been made upon the

original Rifle which obviate all the objections that have ever been alleged against it. One of these objections was the escape of gas at the time of firing. This has been remedied by inserting in the slide which closes the rear end of the barrel, a steel ring, attached to a face-plate around the circumference of a concavity in the centre of which the vent enters. This ring is called a "gas check," as the action of the charge when fired forces it out an imperceptible distance against the rear end of the bouching so as to close the joint and prevent the escape of any portion of the force of the fired charge. In 1859 an improvement was made which obviates the necessity of having a portion of the cartridge exposed, as originally required; and now in loading a Sharps' Rifle the cartridge can be forced into the barrel as far as the chamber will allow it without hazard that the fire of the primer will not reach it.

The Sharps' Rifle, as now constructed, is unquestionably one of the most effective of modern weapons. The barrel is of cast-steel, bored from a solid bar, round, not octagon in shape, at the breech, and having a thread cut on the exterior, instead of the interior, as all muzzle-loading pieces have, for the reception of the breech-pin. This Rifle has no breech-pin. The base of the barrel screws into a frame of iron, through which, between the lock and barrel, is a "slot" or mortise running transversely to the line of the barrel from the upper to the under-side of the gun. Fitting accurately in and sliding through this slot is a block of steel, one side of which comes squarely against the end of the barrel, thus forming a gas-tight breech-pin. On this sliding block is the nipple on which the hammer strikes. The bottom end of the block is attached by a pivot to the "guard strap" of the trigger, which, being hinged at its forward end, can be depressed by the thumb, thus bringing down the sliding breech and exposing the rear end of the barrel-bore for the reception of the cartridge. This is the grand peculiarity of a Sharps' Rifle. But it has another. It requires no capping, though it has a tube or nipple for the use of caps if preferred. It can be fired fifty times without renewing the primers. These primers are little flat discs of copper, containing, between two thicknesses of the metal, the fulminating paste. They resemble the top of a common percussion cap or minute copper wafers. Back of the nipple, and directly under the hammer, is an aperture closed by a slide, that can be moved by the thumb. Into this aperture, leading to a magazine, is dropped a tube of fifty primers, each entirely detached from the other, so that the danger of spontaneous explosion, urged against the Maynard or tape primer, is entirely obviated under this plan. Caps may be used, even when the magazine is charged, simply by shutting the slide. In firing,

a single primer is thrown under the hammer directly on to the tube by the action of a lever inside the lock, which moves simultaneously with the hammer, and never misses capping the nipple just in time, no matter in what position the piece may be held at the time of firing.

For rapidity of firing the Sharps' Rifle is remarkable if not unrivalled. In the testing range at the Works, the piece is frequently loaded and fired twenty-six times per minute. An inexperienced practitioner finds no difficulty in firing and loading from ten to fourteen shots per minute. Its simplicity of construction, freedom from accident, and facility of cleaning, as well as its accuracy and rapidity of firing, have given it a popularity, both as a weapon of warfare and for purposes of sport, that places it among the most successful and remarkable of modern inventions.

About 450 men are now employed in these works, and about 30,000 Rifles are produced annually. When the new machinery is in full operation it is probable the production will be doubled.

Woodruff & Beach Iron Works,

Is the corporate title of a Company incorporated in 1853, and are the successors immediately of Messrs. Woodruff & Beach, and remotely of Alpheus & Truman Hanks, who, under the firm-style of A. & T. Hanks, established in 1821, at the same location, the first Iron Foundry in Connecticut, known as the "Hartford Iron Foundry."

The works of the Company have for several years been among the most extensive in New England for the manufacture of Engines and heavy machinery, and recently large additions have been made to the foundries, consisting of a centre and two wings, 230 by 63 feet inside area. The centre will contain a pit capable of holding the mold for the heaviest castings ever founded, and two immense cranes, with a working radius of a circle forty-three feet diameter, and a lifting capacity of fifty tons each. On the river is a dock fifty feet long, sustained on piles, with a shears the two legs of which are two single sticks each ninety-eight feet long. This enormous engine rests on two piers of stone sunk in the river bed twenty feet, and is guyed by cables of wire rope. It is for loading engines and boilers into the ships which they are afterwards to propel. It has a capacity for moving masses of seventy-five tons. To this apparatus runs a railroad from the machine and boiler shops, which is supported on piles driven through the sandy strata of the earth to the "hard pan." An addition has also been made to the boiler shops of a brick structure 125 feet long and 60 feet wide.

To enumerate all the important engines and machines that have been constructed at these works would require more space than we can devote to the subject. The celebrated engines for the Brooklyn, N. Y. waterworks, which are the admiration of mechanics, were built at this establishment. They are constructed on a novel plan, without crank or wheel, every motion being reciprocating. The pumping apparatus for the Hartford Waterworks was also built here, and is known as the *Double-Piston* Pump. It consists of one cylinder and two pistons, as its name indicates, the working-rod of one being hollow to admit the rod of the other working in the same; and these pistons are provided with flap-valves, and are caused to rise and fall by an ingenious combination and arrangement of parts, in such order and in such relation to each other as to cause one of them to be rising and performing its function of moving the column of water upward at all times; so that, the inertia once overcome, the column of water is kept continually and uniformly moving forward without cessation, with a small power for keeping up its velocity compared with that which was originally required to start it, and which is necessary to put the water in motion at every stroke of the ordinary pump. The advantage thus derived is obvious.

This Company also built the engines, 200-horse power, which drive the machinery at Colt's Works, and many others of great size now in successful operation in manufactories throughout the country.

In another and more difficult department of mechanics, Messrs. Woodruff & Beach have attained even still more eminent success, and that is in the construction of Marine Engines. The two transports *Dudley Buck* and *George C. Collins*, which have been employed by the Government for over two years, are propelled by engines built by them, and have never missed a single trip for repairs. The engines of the *Nipsic*, a steam gunboat, have sustained a trial of ninety hours constant action at the dock, and three months at sea, without the heating of a journal—a fact almost without a parallel. This ship has one propeller wheel, which, with the engines, was constructed here. The wheel is of composition (brass), 11 feet diameter, and of 3,500 pounds weight, in a single casting.

The *Pequot*, built at the Navy Yard, Charlestown, Mass., has a pair of engines built here, of very peculiar construction, on a plan never before attempted. They are reciprocating engines, but the cylinders, instead of being straight, are curved, being segments of a circle, or, in other words, bent tubes. They are thirty inches in diameter. The piston rod is a complete circle, swinging vertically on a pivot, passing through a hub which connects with the periphery by arms or spokes. The motion of the piston turning back and forth through the arc of a

circle, determines the rotation of a crank by means of a connecting-rod leading without cross-head directly to the piston-rod itself. The steam-chest is connected with the cylinder, and the valves are worked by eccentrics precisely as in a common horizontal engine. As there are neither slides nor crossheads, much of the friction is avoided. The boring of these bent cylinders is the most curious process in their manufacture, yet it is perfectly simple, and no more difficult than that of the straight cylinder. Simple however as it will appear to any one who witnesses the process, it is difficult to describe without the aid of cuts.

Besides the Nipsic and Pequot, this Company built the engines for the U. S. sloops-of-war Mohican and Kearsarge, and the gunboat Cayuga.

Messrs. Woodruff & Beach, at the time of our visit, were finishing engines for the government transport *United States*, of 1,250 tons burden, which was about ready for launching at Gildersleeves' yard, Portland, on the Connecticut. The boiler for this ship is cylindrical, and fourteen feet diameter, weighing about forty tons. They now have contracts with the government for the machinery for three steam sloops-of-war (propellers), which will be among the most effective vessels afloat for speed and weight of battery. The cylinders of these engines will be sixty inches diameter, stroke 36 inches, working propeller wheels of composition 17 feet in diameter, and weighing about 12 tons each. The journals of the shafts will be thirteen inches in diameter and forty-five inches in longitudinal bearing. The rudders, also of brass, will be cast here. Some of the iron castings for these engines will weigh not less than thirty tons. The amount of metal in a mass of that weight is hardly comprehended under the familiar terms of pounds and tons. When one of these masses is being cast, the interior of the vast foundry is an inferno of smoke, flame, and corruscations; streams of molten incandescent iron, in slow but irresistible flow, empty into the pit, which is a seething, bubbling cauldron of liquid metal.

It is evident, from what has been said, that the Woodruff & Beach Iron Works have facilities for constructing the heaviest machinery, and have every apparatus that can assist the human arm in moving and working immense weights and masses of metals. The President of the Company, SAMUEL WOODRUFF, has been connected with the works since 1840, and the Treasurer, HENRY B. BEACH, since 1842. About 450 hands are now employed in the establishment.

P. Jewell & Son's Belting Manufactory.

This is said to be the largest manufactory of Leather Belting in the world. We do not vouch for this, for though our facilities are unequalled for ascertaining the comparative business of leading manufacturers in the country, we have no means of knowing how large and important the establishments are in foreign countries. It is sufficient to say that the Messrs. Jewell convert five to six hundred hides into belts weekly, and produce an average annual value of from six to eight hundred thousand dollars.

The leather which this firm use in the manufacture of Belts is made at their own tanneries, located in Michigan, and at least a year is consumed in the various processes incident to its production. The hides are tanned whole instead of in sides, as the "back piece" is the choicest, from which are made the great twenty and thirty inch Belts. The leather when received from the tannery is placed in vats filled with a strong decoction of tannin, and is kept in perpetual motion by means of wheels with floats like those of a steamboat. This makes the leather soft and pliable. Taken from the bath it is placed upon a table and curried, rubbed, scraped, and kneaded, until every portion is uniformly soft. An expert then takes the hides and cuts them into strips, the "back piece" being always reserved for the wide Belts. This cutting is not determined by the wish of the proprietors or workmen, but by the capacity of the hide as interpreted by an expert. Still wet, the strips are placed in machines which stretch them as far as they can bear while wet, which is known by the water being forced from the substance to the surface, consequent on the closing of the cells from which the gelatine has been expelled in the tanning process. In drying, the leather becomes susceptible of still greater tension, and is again subjected to the rack until it is certain that its use as a Belt will not stretch it further, which would be a gain in length at the expense of width and probably straightness. The strips, now quite uneven on the edges, owing to the different degrees of density in their substance, are rolled to consolidate the fibres, and rubbed one way by a machine, which by an indescribable system of levers comes in contact with the leather on one stroke, for the purpose of consolidating the fibres and inclining them one way. Still another machine is used for the same purpose, on which the leather is fixed and drawn slowly under a steel scraper or smoother, which by "toggle joints" is brought with immense pressure upon its surface. The leather is now cut into strips of different widths for Belts, which requires workmen of

experience, with a culture of the eye and a sensitiveness of touch truly astonishing.

The "laps" or ends of the strips are shaved by a simple machine, cemented with a glue so tenacious that the Belt will part anywhere as soon as at the splice, then riveted and made ready for the market. The riveting with copper straps over the edges of the "lap" is a patent owned by the company, as is also the plan of making round Belts solid instead of hollow. These round Belts are in great demand for mowing machines, nearly nine miles having been ordered recently at one time by a single manufacturer. It is a singular anomaly, that the demand for Belting has since the war been greater than ever before—pushing the resources of this vast establishment to its utmost capacity.

Besides leather for Belting this firm manufactures Lace Leather. This is made from the hides of East India or Patna cattle, which are imported by them direct from Calcutta. They are simply cured in salt, alum, and hot tallow, and do not undergo the ordinary process of tanning.

Hartford has also in the establishment of SMITH, BOURN & Co., a very extensive and, in some respects, a remarkable Saddle and Harness manufactory. It was founded by Normand Smith, the father of the present partners of that name, in 1794, and is probably the oldest established manufactory of its class in the country.

Within the last fifty years great improvements have been made in this, as in other branches of manufactures, especially in saddles, and to this firm equestrians are indebted for much of their present security, ease, and comfort. The American saddle, it is generally conceded, is superior to the English, for though the same material (hog skin) is used for the best saddles in both countries, the American has the advantage in shape and comfort to the rider. In this country buckskin is frequently used for the seats and horns of ladies' Saddles. This firm, however, make Saddles adapted to all the principal markets of the world, including the English, Spanish, Mexican, California, and Sandwich Island Saddles, the styles of all which are different.

Within the last half century there has also been a great change in the modes and facilities of manufacturing. Presses and stamps now form ornaments, which, if attempted a half century ago, were the result of painful and protracted manual labor. The sewing machine has in a great measure superseded the awl and "waxed end." This firm has ten large sewing machines, constructed with special reference to the resistance of material, which, as in tugs or "braces" of solid leather seven-eighths of an inch thick, is often considerable.

No one, unless he visits a manufactory like that of Smith, Bourn &

Co., can form any conception how numerous and varied the articles are that are comprised in the term "horse furniture." The range in modes of ornamentation is almost as limitless as man's imagination, and the styles are as varied as his tastes, whims, or caprices. This firm are extensive manufacturers of horse and mule collars, which are sold largely to the Western States. It is a singular fact that since the commencement of the present rebellion, the demand for their manufactures has been greater than ever before; the Western and Northern States more than supplying the deficiency of the Southern market. As many as five hundred hands have been employed in this establishment at one time, though the value of the average product of this manufactory is about $200,000 per year.

The firms of J. T. Smith & Co. in New York, and Smith & Brother in New Orleans, are branch establishments of this house.

Hartford has also one of the most important Silk Manufactories in the United States—that of the CHENEY MANUFACTURING COMPANY. This Company have for several years made sewing silks that, as competent judges assert, surpass in quality the best made in Europe. It is preferred for use on sewing machines on account of its strength, uniformity of twist and beauty of finish. Within a few years this Company have made great progress in weaving silk goods by power looms, and are now making printed as well as plain dyed silk fabrics, which give assurance that the day is not distant when American Silks will rival in every respect those made in France. The Cheney's have a manufactory in South Manchester as well as in Hartford, and employ a capital of about $600,000.

The HARTFORD CARPET COMPANY, though its mills are at Thompsonville and Tariffville, villages in Hartford County, may without impropriety, be noticed among the manufactories of the city. The Company have a capital of $1,200,000, and have machinery and the capacity to produce annually, 1,700,000 yards of Ingrain Carpetings, 500,000 yards of Venetian Carpetings, 200,000 yards of Brussels Carpetings.

The Brussels Carpets made by this Company have been pronounced by competent English judges to be most creditable specimens of American manufacture. Mr. WILLIAM ROBERTS is President and GEORGE ROBERTS Treasurer of the Company.

At HAZARDVILLE, near Hartford, are the extensive Gunpowder Mills of the HAZARD POWDER COMPANY, who have mills also in the towns of East Hartford and at Canton. This Company have 18 sets of rolling mills, with 36 iron wheels, each wheel weighing eight tons; 7 granulating mills; 5 screw-press buildings; and 3 hydraulic-presses of five hundred tons each, in different and separate buildings; and about fifty buildings used for dusting, assorting, drying, mixing, pulverizing, glazing, and

packing-houses—with extensive saltpetre refineries and magazines, cooper, iron, wood-working and machine shops—in all about 125 buildings at their main works at Hazardville and Scitico, extending a distance of over a mile in length and half a mile in width. To propel this vast mass of machinery 25 waterwheels and 3 steam-engines are required.

This Company manufacture annually over a million dollars worth of Powder of various kinds, known as Government, Sporting, Shipping, and Mining Powder, of which large quantities at one time were exported to Europe. During the Crimean War they supplied the British Government with ten thousand barrels of powder, which officers of the British Army certify was of very superior quality. The Works were founded many years ago by Colonel A. G. HAZARD, who is now President of the Company.

NEW BRITAIN, ten miles west by south from Hartford, on the Providence, Hartford and Fishkill Railroad, is distinguished for the intelligent enterprise of its inhabitants, who, without water privileges of any amount or any peculiar natural advantages, have established a great variety of important manufactures. The Russel & Ervin Manufacturing Company have here an extensive manufactory of Locks and miscellaneous Hardware,—a catalogue and price-list of the various articles made by them fills an octavo volume of over 200 pages. The Landers & Smith Manufacturing Co. and P. & T. Corbin are also extensively engaged in manufacturing Cabinet-Makers' and other Hardware. Besides these, Saddlery Hardware is made by the North & Judd Manufacturing Company and H. Butler & Son; Wrought and Cast Iron Door Bolts, Hinges, etc., at the Stanley Works; Sash Fasteners, Window Springs, Axle Pulleys, etc., by Judd & Blakeslee; Malleable Castings at the Malleable Iron Works; Wrought Cow and Sheep Bells by Charles L. Baldwin; Hooks and Eyes by North, Stanley & Co.; "Isham's Patent" Bank and Safe Locks by the New Britain Bank-Lock Co.; Umbrella Frames by J. Shepard & Co.; and miscellaneous Hardware by the Humason Beckley Manufacturing Company and Edward Doen. The Stanley Rule and Level Company, who are leading manufacturers of Rules, Levels, and Squares, have their works in New Britain.

In addition to Hardware, there is a manufactory of Jewelry (Churchhill, Stanley & Co. proprietors); and the New Britain Knitting Co. are manufacturing cotton and woolen Shirts and Drawers largely. There are also three manufactories of Shirts—of which the proprietors are William Bingham, J. N. Lee & Co., and Julius Parker. The various establishments produce annually about $2,500,000.

At Kensington, near New Britain, the Hart Manufacturing Co. have an important manufactory of Builders' and miscellaneous Hardware.

MANUFACTURES OF MERIDEN.

Seventeen miles southwest from Hartford, on the Quinepiack River and the Hartford and New Haven Railroad, is Meriden, another important manufacturing town in Connecticut.

In 1832 Mr. Charles Parker commenced here the manufacture of Coffee Mills, employing at first only three or four men, and to his business energy and successful enterprise the town is largely indebted for its present industrial importance. Probably there is no one now living whose history, if the facts could be obtained, would illustrate more satisfactorily the means by which immense enterprises are developed from insignificant beginnings. Mr. Parker is now the proprietor of four large manufactories, located at different places in Meriden and its vicinity, and some of them comprise so many departments for the manufacture of distinct articles that they might be regarded as several distinct establishments. His principal factory, located at Meriden centre, is an aggregation of numerous buildings that cover an area of more than two acres of ground. Here are manufactured Coffee and Corn Mills, Patent Bench Vises, Plated Wares, and Sewing Machines. His Coffee Mills have long been standard articles with the hardware trade, and with the recent improvements, are not surpassed by any in this country. They are now made having a combination of two sets of runners or grinders—the first or upper set cracking the coffee, spices, wheat, or rice, and the second or lower set grinding them as fine or as coarse as may be desired by means of a regulating screw acting on the lower runner. His patent Parallel Vises are in general use in all New England manufactories. The Plated Spectacles, Spectacle Cases and Tobacco Boxes, are made by patented machinery so expeditiously and cheaply that the demand for them is very extensive. The Parker Sewing Machine is manufactured under the patents of E. Howe, Jr., Wheeler & Wilson, and Grover & Baker, and makes the double-lock stitch, with the tension so arranged that the stitch lays perfectly flat and smooth on the under side. The parts are all adjusted before leaving the factory, and are pinned together in such a manner as not to get deranged by using. This machine has very many valuable qualities, is one of the simplest now made, and the sales, not only in this country but in Europe and South America, are very large. Recently, Mr. Parker erected an extensive building adjoining these works, and is now fitting it up with newly patented machinery for the manufacture of Gimlet Pointed Screws. This enterprise, if successful as it promises to be, will be welcomed with great satisfaction by all dealers in American Hardware.

At Yalesville, three miles from Meriden, Mr. Parker has an extensive manufactory of Britannia, German Silver and Plated Wares of all kinds. Large quantities of Britannia Spoons, and Plated Spoons and Forks, are made here by machinery. At another manufactory, east of Meriden, Hammers, Iron Table, Tea and Basting Spoons, and Ladles and Flesh Forks are made largely; while at a fourth manufactory, about two miles west of Meriden, Mr. Parker makes Scales, Door Handles, and a very popular Patent Hinge and Fastening for window blinds, which are designed to secure the blind in any position that may be desired.

Mr. Parker is also a principal proprietor in the extensive machine works of PARKERS, SNOW & Co. This concern was founded in 1839 by Oliver Snow, an ingenious and skillful mechanic, and after having passed through numerous changes of firm style—Snow, Hotchkiss & Co., Oliver Snow & Co., the Meriden Machine Company, Snow, Brooks & Co., Parkers', Snow, Brooks & Co.—it is now an established and important concern under the proprietorship of Parkers, Snow & Co., and well known to machinists and manufacturers for its ability in constructing substantial and fine Machinery, Steam Engines, Mill Gearing, Printing Presses, and Machinists' Tools. Among the special articles made here, are Farnam's Double Acting Lift and Force Pumps, Burnell's Patent Rotary Pumps, the Fowler Punching and Shearing Presses, and Kerosene Lamp Tops and Trimmings.

Recently this firm fitted up an extensive Armory, with all the modern machinery for the manufacture of Springfield Rifled Muskets, which they are now producing at the rate of a hundred a day. They are also owners of the very valuable breech-loading magazine carbine known as the Triplett & Scott Carbine, and are preparing to make the weapon in large quantities.

In all these establishments more than 1000 men and 100 women are furnished employment, and their monthly pay-roll for labor is from thirty to forty thousand dollars. .

The second most extensive manufacturer in Meriden is Jedediah Wilcox, the present senior partner of the firm of J. WILCOX & Co., who, in 1860, manufactured Skirts, Leather Belts, and Carpet Bags, to the amount of $570,000. His history supplies another addition to the remarkable instances of successful enterprise.

For four years, from 1845 to 1849, Mr. Wilcox labored industriously in the manufacture of Carpet Bags, and at the end of that period had accumulated a capital of only $1,500. He then associated with himself a partner, who contributed an equal sum, and in 1850 their sales amounted to $75,000. This partnership, however, did not continue beyond the year, when Mr. Wilcox purchased his partner's interest, and

having added the manufacture of Belts to that of Carpet Bags, his sales rapidly increased until, in about four years, they amounted to $300,000 a year. In 1855 he embarked in the manufacture of Hoop Skirts, which soon became so much in demand, that in less than one year the sales of these alone amounted to $300,000. For several years these have been the leading article of the firm's manufacture, though recently they have added Corsets. The principal manufactory of the firm is a building in West Meriden, having a front of 160 feet and an average depth of 115 feet, where about 400 dozen Skirts are made daily and a proportionate quantity of Corsets. Besides these, two other shops in the town are employed in making Skirts for the firm.

Since 1860 Messrs. Wilcox and Co. have made the Tape used in Skirts, and occupied a building for the purpose that is 135 by 40 feet. To this an addition has been made 100 feet long by 40 feet deep, $2\frac{1}{2}$ stories high, and another 60 feet square and 4 stories high, both of which are being filled with costly machinery for the manufacture of Balmoral Skirts, the dyeing as well as the spinning of the yarn being done on the premises. They have also just completed a large boarding house for the convenience of the operatives, of whom from 700 to 800 are now employed in the various manufactures. When the manufacture of Balmoral Skirts is further established, this firm expect to increase their sales to the amount of a million and a half of dollars per annum, which will make it the largest manufactory of the kind in the United States.

Besides these concerns, which make about one-half of the total product of the town of Meriden, the next three largest are the Meriden Britannia Company, which in 1860, employed 320 hands and produced a value of $480,000; the Meriden Cutlery Company, which employed 126 hands and manufactured to the amount of $167,000; and Read, Pratt & Co., who manufactured Ivory Combs and Piano Ivory to the amount of $175,000. A consolidation of all the principal firms engaged in the manufacture of Ivory Combs in the United States, has been recently effected, and their principal factory at Meriden. The Malleable Iron Works of M. C. Augur & Company employed thirty-five hands; the Caster Manufactory of Foster, Merriam & Co., employed thirty hands; the Clock and Bell Manufactory of Bradley & Hubbard, employed sixty-two hands; the Hoop Skirt Factory of Charles P. Colt, employed ten men and eighty women; while sundry manufactories of Brass and Plated goods, Lamp Trimmings, Japanned and Tinware, Machine Castings, Soap and Candles, Fertilizers, Carriages, etc., contributed to make up the aggregate product of $2,786.000.

MANUFACTURES OF NEW HAVEN.

According to the Census of 1860, there were in the city of New Haven 216 manufacturing establishments, having a capital of $3,986,465, employing 4,926 males, 3,110 females, and producing a value of $8,835,663, or about one-third of the aggregate product of the county. The leading business was the manufacture of Carriages, of which there were 41 manufactories, having a capital of $1,174,000, and which employed 1,774 men and 55 women, and produced Carriages to the amount of $2,462,057. A brief account of the history of this important business, in the leading centre of its manufacture, deserves to be recorded.

One of the earliest Coachmakers in New Haven of whom we have any account, was Mr. John Cook. He commenced business there in 1794, in a shop in the rear of his house on Chapel Street, and on the north side of where Orange Street now is, opposite to the factory of his sons, Messrs. Thomas & George Cook. At that period the principal pleasure carriage was a Chaise or Gig, and it was not until just previous to the war of 1812 that four-wheeled carriages were introduced. In 1809 a circumstance occurred that has indirectly exerted more influence than any other in making New Haven the principal seat of carriage-building in New England. A young man named James Brewster, while travelling in a stage-coach on his way to New York, was detained in New Haven by an accident to the coach; and while walking around the town "happened in" to Cook's Carriage Shop on Orange Street, and had an interview with the proprietor which induced him to locate in New Haven. In the succeeding year (1810) Mr. Brewster commenced business in a little shop on the corner of Elm and High Streets. At that time the aggregate annual production of all the Carriage manufactories in the town did not exceed $30,000, and the quality of the workmanship was very indifferent, the journeymen being generally paid in trade. Drinking customs prevailed among them to a disastrous extent, and the morals of the "craft" were not of a high order. Mr. Brewster's first object was to attract to New Haven a superior class of workmen, by offering good wages, payable in cash, and to educate them to a higher sense of their responsibilities by Lectures on moral and practical subjects, which he delivered to his employees in the evening. He also originated and sustained a course of scientific Lectures, by such men as Professor Silliman and Olmsted, and paid a thousand dollars a year to a gentleman to aid Prof. Silliman in preparing the Lectures, which were illustrated by experiments.

In 1827 Mr. Brewster opened a repository in New York, and em-

ployed as his principal salesman John R. Lawrence, who is now the senior partner of the firm of LAWRENCE, BRADLEY & PARDEE.

In 1829 Mr. Lawrence was taken into partnership by Mr. Brewster, and in the succeeding year Solomon Collis was admitted as a partner, establishing the firm of Brewster & Lawrence in New York, and Brewster & Collis in New Haven. These continued until the first of February, 1837, when Mr. Brewster retired from business, disposing of his interest to his partners, who continued business under the firm-style of Lawrence & Collis in New York, and Collis & Lawrence in New Haven, until 1850, when Mr. Collis disposed of his interest in New Haven to William H. Bradley, and in New York to his partner, who soon after associated with himself L. A. Durbrow and his son John Lawrence, under the firm-style of John R. Lawrence & Co. The business was conducted at New Haven by Lawrence & Bradley until January, 1857, when Mr. William B. Pardee became a partner, establishing the present firm of Lawrence, Bradley & Pardee. In the same year they enlarged their factory to its present size, which is 200 feet in length and 45 feet in width.

This firm and their predecessors have probably constructed a greater variety of Carriages, of all kinds and sizes, from a child's carriage to the largest and most expensive coach, than any other in the country. During the last few years they have supplied large orders for Carriages from Cuba, Mexico, South America, Africa, and Australia. The trade in carriages with the West Indies is rapidly increasing, as it has been found that American woods are more durable in warm climates and less liable to crack than those of Europe. Important orders have also been filled for Prussia, and other portions of Germany. Since the Exhibition of 1851 American Carriages have been growing in favor in Europe. Great improvements of late years have been made in upholstering and leather work, and in the article of enamelled leather, it is said, American manufacturers are even now excelling all foreign competitors.

The manufactory of this firm is managed in accordance with a system perfected by experience. About 200 hands are employed in it, generally by the day, and consequently they have no inducement for slighting their work. Each department has its foreman, and light and heavy carriages are considered as distinct articles, and made in different parts of the factory. For the convenience of their distant customers they have prepared an expensive illustrated volume, containing the largest collection of carriage-cuts ever issued. Over 200 different styles of vehicles are shown in this work, and yet these compose but a part of the styles they are constantly manufacturing. They guarantee, we believe, full satisfac-

tion to any one, from any part of the world, who will accompany his order with an accurate statement of his wants, including width of track required, height of wheels and body, whether light or heavy, and designed for rough, hilly, sandy or smooth roads, with or without perch, with shafts or pole, or both—color of painting, trimming, stitching, and plating—the kind of axles and springs—and the material for trimming, whether leather, cloth, or silk. Nothing would perhaps better illustrate the progress that has been made in American carriage-building within the last half century, than a comparison of the establishment of Lawrence, Bradley & Pardee and its facilities for expeditious work, with the best factory in New Haven at the time when Mr. Brewster, its founder, was detained there by an accident to the stage-coach.

The man who first applied machinery propelled by steam-power to the manufacture of Carriages in New Haven, is Mr. GEORGE T. NEWHALL, now one of the most extensive and enterprising manufacturers in that city. Having noticed, while on a visit to Rhode Island, that steam-power was employed in almost every branch of industry in that small but enterprising State, he resolved to attempt it in carriage-building, and purchased a small engine and the requisite machinery and put it in his factory. It seems scarcely credible to be told that, at a period so recent, his experiment was regarded with such distrust that creditors refused to extend him any further credit, and his best friends looked upon him as an early candidate for the insolvents' court, if not a lunatic asylum. But success crowned his efforts, and we suppose his establishment is the one referred to by Mr. Chauncey Jerome, in his work on American Clock-Making, where he says—"I live in the immediate vicinity of the largest Carriage manufactory in the world, which *turns out a finished Carriage every hour!* much of the work being done by machinery, and systematized in much the same manner as the clock-making."

Mr. Newhall's manufactories are situated about a mile north of the centre of New Haven, on a tract of land which fourteen years ago was a corn-patch and a cow-pasture, but which is now laid out in broad streets, and contains neat dwelling-houses, extensive factories, churches, and school-houses. The main building is 235 feet long, 35 feet wide, and three stories high. This is filled with machinery, to which power is conveyed from a steam-engine of 65-horse power, by means of a main shaft running the entire length of the building. On the first floor is the engine room, and the heavy machinery for cutting up timber and giving it form and shape. Here all parts of the bodies are sawed and dressed, and framed, leaving only the putting together for hand labor. Three machines are used for turning Spokes, others for turning and mortising Hubs. On the same floor are found the necessary machinery

for making all kinds of Bolts used in the construction of carriages and cars.

In an adjoining building, disconnected from the large factories, are fourteen blacksmiths' forges. Here, as in all the other departments, there is a systematic division of labor, and in ironing a carriage it passes through five or six different hands before it is completed. The fires are all kept in full blast by the steam-engine. In this building there is a trip-hammer and furnaces for the manufacture of Springs and Axles.

Another building, 150 feet long, 45 feet wide, and four stories high, stands fronting on Newhall Street. On the first floor is the Private Office and Counting Room, with two rooms of large size devoted to building Horse Cars. This is an entirely new branch of business in New Haven, having never before been attempted by any one. The second floor is divided into different apartments for Trimming purposes, Coloring, and Varnishing. On the third floor there is a large room for cutting out and preparing Trimmings, and above this is a room extending the entire length of the building used wholly for Painting the running parts of carriages.

Mr. Newhall not only makes more of that class of vehicles known as "Buggies," in a year, than any other manufacturer in the United States, but makes more of the constituent parts of a carriage. Nearly every thing belonging to a carriage is made on his own premises. He employs about 176 hands, and previous to the breaking out of the war and the loss of the Southern custom, his average product was about 2,000 Buggies a year.

Having thus noticed at some length one of the oldest and one of the largest of the carriage manufactories in New Haven, we must pass the others in review more rapidly, not because they are less important, but because space cannot be afforded to notice all.

Messrs. D. & L. Wilcoxson are engaged chiefly in making Coaches, Rockaways and Bretts. The senior partner of this firm is now regarded as one of the old coach-makers of the city, having commenced business in 1836, as a partner in the firm of Hooker & Wilcoxson. Subsequently he carried on the manufacture alone, and for many years had a repository in New York. The factory of this firm has a front of sixty feet on Park Street, and extends back over two hundred feet.

Messrs. Miner & Wier have two extensive factories, each almost two hundred feet in length, and well equipped with all the requisite machinery for expeditious work. They manufacture Barouches and Buggies in every variety of styles, including Slide-Seats, Tilburys, Prince Alberts, Drop-Fronts, Side-Springs, etc. They sell largely to dealers in all parts of the country.

DURHAM & BOOTH make Rockaways, light Coaches, Bretts, and Buggies. Their factory, located on the corner of Chapel and Hamilton Streets, is new, of brick, and four stories high. It has a front of sixty feet, and extends back 120 feet with an L. Their facilities for manufacturing economically, in point of improved machinery propelled by steam-power, are not surpassed by any. They ordinarily employ about one hundred hands.

BLACKMAN & RENDELL are another well-known firm engaged extensively in the manufacture of Coaches, Rockaways, Cabs, and Chariotees. Their factory is built of brick, four stories high, and is 60 by 106 feet, with an L 30 by 40 feet. Both the partners in this firm are practical coach-makers, possessing a thorough knowledge of the business in all its details. They ordinarily employ from 70 to 75 hands.

WELLS, CRITTENDEN & Co. are the successors of Killam, Crittenden & Co., who had attained a high reputation in the manufacture of Carriages. They build Coaches, Barouches, etc., and sell largely to dealers in all parts of the United States.

BOGART & BETTS make chiefly four and six-seat Rockaways in various styles, light Coaches, and Jersey Wagons. They also make a new style of "Westchester Wagon," which is strong, durable, light, and cheap. This is comparatively a young firm, who, by care in the selection of materials, and fidelity in workmanship, have secured a desirable position in the trade.

GIDEON FERRIS & Co. have for many years directed their attention chiefly to the manufacture of Rockaways, which they made a specialty, and in which they achieved considerable distinction. For several years they made almost one a day of this class of vehicles, or nearly 400 a year, in a great variety of styles.

Besides these, the list of carriage-makers in New Haven includes the important firms of Hubbell & Morton, F. A. Bradley, George Hoadley & Co., W. & C. Dickerman, Henry Hale & Co., Osborne & Adriance, Scott & Stevens, and others, whose names if known to us we would mention.

There are several important establishments in New Haven employed in making parts of carriages, as wheels, axles, springs, etc.

The NEW HAVEN WHEEL COMPANY (David Wilcoxson, President, and H. G. Lewis, Secretary,) is probably the largest concern in the United States engaged exclusively in the manufacture of Wheels, and their constituent parts. Their machinery is new, much of it invented by themselves or manufactured expressly for their use, and is capable of turning out Wheels, Spokes, Hubs and Felloes with astonishing rapidity and remarkable accuracy. They keep constantly on hand a stock of about a million Spokes finished in the rough. About one-half of all

they make is shipped abroad to the Canadas, Mexico, the West Indies and Australia.

L. F. GOODYEAR has an important establishment for the manufacture of Axles. His factory is provided with trip-hammers, lathes, boring machines, and all the requisite machinery for producing Axles in the best manner and at the lowest cost, including some machinery of his own invention, and not in use in other similar manufactories.

Springs are made largely by the "New Haven Spring Company" (G. J. Hine, Secretary) and W. & E. T. Fitch. They use in the manufacture the best-tempered English steel.

Carriage Hardware and Trimmings are made largely by the Plants Manufacturing Company, C. Cowles & Co., H. Galbraith, and others.

Harnesses are made in New Haven to the amount of about a quarter of a million of dollars annually. The manufactory of S. T. CUMMINS is probably the largest in the State with the exception of one in Hartford. Dealers in several of the principal cities obtain their Harnesses from this establishment, and commend both the styles and the quality of the workmanship. By the introduction of sewing-machines in this manufacture, the number of hands formerly required to do a given amount of work has been considerably reduced. Horse Collars are made largely by Gillette & Smith.

The Silver-Plating of Harnesses is a prominent business with the firms of Roberts & Sperry, H. Galbraith, and others. All the Ornamental portions of harnesses and carriages, in close plate, electro plate, and crystal plate, are made by them. Mr. Galbraith also manufactures Cook's Patent Slat Irons, silvered and japanned, and Patent Top Lifters, with handles silvered or japanned

The New Haven Clock Company are the largest manufacturers of Clocks in the United States. They employ 250 hands, and produce about 150,000 Clocks per annum, many of which are shipped to England, and even to India and China. This Company are the successors of the Jerome Manufacturing Company, originally established by Chauncey Jerome, who is entitled to be called the father of clock-manufacturing in America. So perfect is the system now adopted in this business, and the facilities for manufacturing, that an ordinary O-G Clock Case can be made at a cost for labor of twenty cents, a whole Dial for less than five cents, the Tablets for about four cents, and the entire Movements of a One-Day Brass Clock at a first-cost of less than fifty cents.[1] The Clock

(1) Those who are curious to know how this is done, are referred to the little work on the History of American Clock-Making, written by Chauncey Jerome, and published by F. C. Dayton, Jr., New Haven, 1860. In reference to the process of making the wheels,

manufacture, important as it is, is yet comparatively in its infancy. It is estimated that there are now a half-million Clocks made in this country annually, but it is probable that in twenty years from this time more than a million of clocks will be exported to foreign countries, and all the factories now in existence would not be able to supply the home demand.

There are several important Machine Shops in New Haven, and five or six Foundries of Malleable Iron—one of them, recently erected by a firm from New Britain, quite extensive. Iron Railing is made by the New Haven Iron Railing Company, Building Iron Work by Lagon & Stevens, Machinists' Tools by the New Haven Manufacturing Company and by Milo Peck & Co. The last-named firm are the manufacturers of Peck's Patent Drop Press, which has been elsewhere alluded to in this volume. The first Press made under this patent is now in use in Cowles & Co.'s extensive manufactory of carriage-hardware and stove ornaments. Messrs. Peck & Co. also manufacture power and foot Cutting Presses, and a variety of special and patented articles, some of them of their own invention, as for instance Peck's Patent Atmospheric Forge Hammers.

Among the miscellaneous manufacturing establishments of New Haven there are several that deserve to be mentioned especially, as for instance the Shirt manufactories, at one of which (Winchester & Davies') over one hundred dozen Shirts are made daily; the American Suspender Works; the manufactories of Firearms; the Lock Manufactory of Davenport, Mallory & Co.; the Coach-Lamp Manufactory of Cutler & Hanover; the Spectacle Manufactory of George L. Streeter; the Melodeon Manufactory of Treat & Linsley; the Morocco manufactories of J. Barnett & Son and T. Ensign & Son; the Globe Manufactory of C. D. Candee & Co.; the Silver-Plated Ware Manufactory of J. S. & E. Bromley; and the Paper Mills and Hardware and Cutlery manufactories in Westville.

he says—"It will no doubt astonish a great many to know how rapidly they can be made. I will venture to say that I can pick out three men who will take the brass in the sheet, press out and level under the drop, then cut the teeth and make all of the wheels to five thousand Clocks, in one day. There are from eight to ten of these wheels in every clock, and in an Eight-Day Clock more. This will look to some like a great story, but is one of the wonders of the clock business. If some of the parts of the clock were not made for almost nothing, they could not be sold so cheap when finished."

MANUFACTURES OF BRIDGEPORT.

BRIDGEPORT, as well as New Haven, is largely engaged in the manufacture of Carriages. It also contains the largest manufactory of Sewing Machines in the United States. In 1860, according to the census returns, the city contained ninety-six establishments, having a capital invested of $1,466,400, employing 2,196 males, 1,131 females, yielding a product of $5,622,120. The principal manufactures were the following:

Manufactures.	No. of Establishments.	Capital.	Male hands.	Female hands.	Value of Product.
Beer, porter, etc	2	$35,000	5		42,000
Boots and shoes	14	37,000	153	29	135,450
Cabinet furniture	4	51,000	130		163,000
Carriages	13	223,600	408	7	604,550
Carriage hardware	1	17,000	35		36,000
Coach lace and trimmings	2	25,000	41	9	55,000
Coffee and spices	1	5,000	3		31,000
Felloes, etc	1	30,000	8		30,000
Flour, meal, etc	2	5,000	5		39,720
Hoop-skirt springs	1	3,000	11	6	46,800
Iron Founding	1	67,000	21		30,000
Lumber (planed)	3	58,000	26		117,900
Machinery	1	44,000	70		65,000
Marble	2	3,300	10		12,250
Patent leather	1	20,000	18		60,000
Saddlery and Harness	4	130,500	254		431,650
Saddle trees	2	7,500	25	3	27,000
Sash, doors and blinds	2	8,000	34		37,350
Sewing machines	1	400,000	650		1,050,000
Shirts	2	38,000	11	1,000	225,000
Shovels	1	2,000	6		20,000
Soap and candles	3	7,000	7		92,000
Springs and axles	2	80,000	147		218,500
Tin and sheet iron	5	14,600	19		64,200
Varnish	1	10,000	1		75,000
Veneers	1	5,000	4		15,000
Wheels	1	18,000	15		31,000
Wire cloth	1	3,000	6		3,000

Since 1860, important additions have been made to the productive industry of Bridgeport by the erection of new manufactories and the enlargement of others previously existing, and it is probable that the aggregate product now amounts to eight millions of dollars annually. Among the most important of the new establishments in Bridgeport is

The Howe Sewing Machine Manufactory,

Erected in 1863 by a Joint Stock Company, of which the principal stockholder and President is Elias Howe, Jr., the inventor of the Sewing Machine. The buildings were erected under the superintendence of A. C. Hobbs, the celebrated American Lock-picker, and consist of a main building two hundred feet long, thirty-six feet wide, four stories high, and a three-story wing one hundred by thirty, all of brick. As the visitor passes from the office to the lower floor of the main building, a long vista of busy machines and their attendants is disclosed, and if he examine the operations critically he will be astonished at the perfection of the mechanism. Here the heavier parts of the Sewing Machine are prepared for the other fittings. So automatic are some of the machines employed that one man can attend eleven, and execute work that could not be done by hand for less than five thousand dollars.

It may be proper to remark at the outset that in the construction of Sewing Machines the system prevails which was first adopted in the manufacture of fire-arms, of employing special mechanism adapted to each operation, whereby such accuracy of finish is secured that every part of the machine, from the smallest to the largest, is the exact counterpart of every other piece of the kind, and may be used interchangeably without any danger of a misfit. Being thus reduced to its ultimate shape and use, each piece, whether of cast or wrought-iron or of steel, usually passes through many hands and a series of machines, each adapted to a particular operation upon it. Thus the little screws used in the machine are made from rods of iron, and in the process pass through four or five different operations on as many machines, some of which cost as much as $400 each, before it is ready for the silver plater. Another peculiarity of this manufacture is that there is a set of gauges or duplicates provided for every section, spring, or bar of the machine, and for each piece there is not only one gauge, but there are also separate gauges for every variation and curve existing in these shapes, so that every radius and every angle is precisely similar in each individual machine. These gauges are supplied to the various operatives, and are made from originals to which no one has access but the Superintendent of the Company. By conforming to these rules it is apparent that the whole factory, however large, can be made to work with entire uniformity. Part after part goes through the required operations; passing from one machine to another in regular sequence, thence to the inspect

ing rooms, and finally to the assembling rooms, where they are put together and tested.

In the second story of the main building the lighter parts of the Sewing Machine are fabricated, and in the third story are the Plating, Japanning, Inspecting, and Packing rooms.

Probably the most interesting of the many ingenious operations to be witnessed in this manufactory is the manufacture of the shuttles and the needles, which employ the second and third stories of the wing referred to. A shuttle, with all its complexities, is made by three operations—a feat that until recently was deemed to be an impossibility, and to describe it intelligibly we think remains an impossibility. The needles are made from coils of steel wire, cut to the proper length. After this wire has been softened it is turned in a lathe to nearly its proper shape, and then the groove is formed on one side by means of a pair of steel dies having grooves in them of the size of the required needle, with a raised edge or rib in the centre. The embryo needle then passes through another machine that stamps its size and number and date of the patent. The eye is drilled by means of minute, highly tempered drills, which, however, are as perfectly constructed as drills of the largest size. Reamers as fine as a hair are used for polishing the eye, in the use of which great expertness on the part of the operative is required. The hardening of the needle, and the straightening by means of a slight tap with the hammer, are also operations of great delicacy. In fact, all the processes and all the machines in this department are curious and interesting, and so original that experienced English needle makers are said to be far less successful in acquiring the art than untrained Americans. This Company manufacture needles not only for their own but for other makers of Sewing Machines, and each needle is gauged and separately inspected with extreme care.

The Howe Sewing Machine Company are now employing four hundred hands and a Superintendent to whom they pay the extraordinary salary of ten thousand dollars a year. This circumstance affords evidence that the Company intend to spare no expense to secure the best workmanship, and as they have the latest machinery and a President who, as the originator, may naturally be supposed to take a pride in showing how perfect his invention can be made, they present for their machine extraordinary claims to public confidence.

The Wheeler & Wilson Sewing Machine Manufactory.

Also located in East Bridgeport, is the largest establishment of its kind in the world. It has, however, been described so often in the scientific and daily journals as one of the great manufactories of the United States, that our readers would consider another description of it as the repetition of a more than "twice told tale;" but its origin and history, which are less generally known, may be stated briefly.

In 1851, Allen B. Wilson, who had patented some important improvements on the Sewing Machine, which have been previously alluded to, formed a copartnership with Nathaniel Wheeler, a capitalist and a practical manufacturer, and they commenced building machines in a small shop in Watertown, Connecticut. The first machine that they constructed they sold for $125, and the purchaser, who states that she earned with it in one year $295, besides performing the labors of a household, including the care of an infant, carried it with her to Iowa, where it was probably the first Sewing Machine introduced.

In 1865, the Company succeeded in recovering this original machine by exchanging it for No. 193,320, and it is now on exhibition at their salesrooms in New York city as a curiosity.

The firm of Wheeler & Wilson made from eight to ten machines a week during their first year at Watertown, and in 1852 their production was in the aggregate about five hundred. In the subsequent year they organized a Joint Stock Company with a large capital, and elected Mr. Wheeler President—a position that he has ever since filled with marked ability. The Company continued to manufacture the machine at Watertown until 1856, when they removed to Bridgeport and took possession of the large manufactory so familiar to all travellers on the New York & New Haven Railroad, and which no one of them who has seen it illuminated by its six hundred gas burners is likely to forget. Here they commenced manufacturing on a much larger scale, producing, in 1859, twenty-one thousand three hundred and six machines; in 1860, nineteen thousand two hundred and sixty-five, and during the year 1865 they turned out a machine every three minutes, or about fifty thousand in the year.

This Company was the first to organize the complete system of manufacturing previously referred to, and which is now adopted in all similar large establishments. Many of the most valuable labor-saving tools that now so greatly facilitate the operations were also originated by them. Nearly every part of the machine and its appurtenances are made on the premises from the crude material, and as the principal

parts—the legs, bed plates, balance wheels, etc.—are of cast-iron, a large portion of the factory is devoted to iron work. The pig metal direct from the furnaces is run into the immense foundry on a side track of the New Haven Railroad, and thence taken on small railways to the first floor of the main building. This large room, five hundred and fifty feet long, with its lines of shafting from end to end, transmitting motion to three tiers of machines, presents to the visitor, when he first sees it, a bewildering maze of machinery, and his astonishment is not lessened when he witnesses the wonderfully automatic action of the machines, rendering the attendants mere feeders to supply the food, or superintendents to watch the operations. But when he once comprehends the system prevailing throughout, the absolute accuracy of construction required, the repeated tests by standard gauges, the rigid inspection of every part, the final trials before approval, his astonishment will be lost in admiration at what may be called the perfection of mechanical precision.

We shall not attempt to follow the separate parts as they are fashioned into shape, but glance at only one which is peculiar to this Company's machine. It is generally known that in the Wheeler & Wilson Sewing Machine the shuttle is dispensed with and a rotating hook substituted therefor. This hook, during its manufacture, passes through more than one hundred different operations and the hands of many workmen, aided by some of the most curious machines ever invented, of which the most remarkable one was originated in the establishment. This beautifully polished and most deftly automatic contrivance for casting off the loop in making the interlocking stitch is fashioned, with great economy of material, out of rods of steel an inch in diameter. These are submitted to machinery which accurately measures and cuts it into proper lengths, to the action of steam hammers which partially shape the instrument, and to successive processes of turning, sawing, cutting, carving, and polishing, etc., until it assumes the desired contour and beautiful polish of the finished article.

The Wood working department of this manufactory is scarcely less interesting than that devoted to the metallic work. Though less extensive, it employs upward of one hundred men and exhibits the same systematic management and use of labor-saving machinery, utterly precluding competition on the part of manufacturers of limited capital. The tables are formed of some five or more layers of veneers or sections of wood cut across the grain and firmly glued and pressed together, so that they can neither split nor warp. The cases, which are made of polished black walnut, mahogany, and sometimes of rosewood and other costly materials, are made in the same way, and when elaborately

ornamented, to correspond with the costly finish of the higher priced machines, form elegant articles for the boudoir. Among the novelties in this department produced by this Company, some years since, was a combination of a Sewing Machine and Melodeon in the form of a small escritoire or parlor sideboard, which, when opened, presented a set of piano keys, and after closing and turning back the top, revealed a complete Sewing Machine. Within side doors below were two pedals, one for the musical and the other for the sewing apparatus, and by changing her foot from one to the other the operator was able to play either at sewing or at music as she felt inclined.

This manufactory, vast as it is, will soon be but an appendage or auxiliary to one still more extensive. The Company are at this time erecting on an adjacent lot a new factory, of which the main building will be three hundred and two feet front by two hundred and seventy feet deep, with an office surmounted by a pagoda dome sixty by sixty-eight feet, and a Tool room thirty-eight by fifty. All the walls will be of Croton faced brick, and the roof of tin, supported by wrought-iron trusses, requiring for these and the supporting columns three hundred and fifty tons of iron. Though only one story of fifteen feet in height, one million eight hundred thousand brick will be consumed in its construction and seven thousand panes of glass, besides nine thousand feet of rolled glass skylights. The floors will be of brick, cement, and tiles, and the entire structure as nearly fire-proof as architectural skill, without regard to expense, can make it. In this connection we may remark that Wheeler & Wilson have owned and kept on their premises for some years, a splendid steam fire engine that cost $4,000, and which is manned by over one hundred of the workmen, who are furnished a neat and appropriate uniform.

The salesrooms of this Company, 625 Broadway, New York city, occupying the site of the Art Institute building, are fitted up in a style of regal magnificence that make them one of the attractions of that far-famed boulevard. Here visitors may have demonstrated the superior excellence of the "Lock-stitch," and of the "Rotary Hook" for making it; and inquirers will also receive a pamphlet of eloquent eulogiums from the pens of nearly all the great writers whose names adorn the pages of American literature.

Besides her Sewing Machine manufactories, the list of important manufactories in Bridgeport includes Hotchkiss & Son's Hardware Manufactory; the Bridgeport Brass Foundry; the Pacific Iron-works; the Central Iron-works; the Bridgeport Iron-works; the Carriage Factories of Wood Brothers and Haight & Co.; the Tomlinson Spring and Axle Company, and others.

MANUFACTURES OF WATERBURY.

WATERBURY, Conn., it is well known, is the chief seat in the United States of the manufacture of Sheet Brass, and Gilt Buttons. The first manufactory of Buttons there, of which we have any account, was one established before 1800 by Henry, Samuel, and Silas Grilley. Their Buttons were made of block tin or pewter and cast iron moulds, the eye being at first of the same material, but afterward wire eyes were employed. The manufacture of Gilt Buttons was commenced about 1802, by Abel Porter and others associated with him. This firm employed eight or nine hands and made Buttons of various forms, convex, concave, and oval—the face only being gilded. Their brass ingot they carried to Bradleyville, in the west part of Litchfield, where it was rolled in an iron mill. The metal was brought back in strips in a very rough state, and pressed between steel rolls two inches in diameter, moved by horse-power, and thus smoothed and finished. All the other work was done by hand. This firm were the founders of the extensive manufactory of the

Scovill Manufacturing Company,

whose history is as follows: In 1816, Abel Porter & Co. disposed of their business to Leavenworth, Hayden & Scovill, who continued it with moderate success for sixteen years, until the fall of 1827, when Dr. Leavenworth and Mr. Hayden sold out their interest to William H. Scovill, and the firm became J. M. L. & W. H. Scovill. Two years subsequently this new firm met with a severe loss in the destruction of their factory by fire, but it was soon rebuilt and the business was prosecuted with much energy and marked success.

In 1840, Mr. S. M. Buckingham and Abram Ives became interested in the button business, which was now carried on under the name of Scovill & Co., while J. M. L. & W. H. Scovill continued the manufacture of Rolled and Plated Metal, which had then become an important interest. They also associated with themselves John Buckingham, under the name of Scovill & Buckingham, in the making of Brass Butts, the business being carried on at the place now owned by the Oakville Pin Company on Steel's Brook.

In January, 1850, a joint stock company was formed under the name of the Scovill Manufacturing Company, into which all the interests named above were merged, and some of the employees were admitted as

stockholders. The capital was at first $250,000, but subsequently increased to $300,000.

This company has for many years been the principal manufacturer of Daguerreotype Plates in this country, a business which was commenced about the year 1842. These were made of British copper, which being more perfectly refined and possessing a more even fibre is preferable to American copper, where evenness of surface is indispensable. The plates are prepared by the rolling process, the silver being plated upon the copper in the course of the operation, and then is afterwards cut into the various sizes required. The "mats" or ornamental mountings, usually fitted into the cases for keeping in the pictures, are engraved and chased for the most part by machinery, and by an ingenious adaptation of eccentric movements the "sight" of the metal frame is connected to the true circle, oval or oblong, with turned corners in the same operation by which the chasing is performed. The manufacture of these plates and mattings was for many years a very extensive branch of this Company's business, but since the introduction of photographs there has been a marked decline in the demand for Daguerreotype Plates, though the quantity produced at this manufactory is still large.

Buttons are now made very extensively by the Scovill Company (their establishment having a capacity for producing 1500 gross per day), and chiefly by machines invented and constructed upon their premises. One machine for punching out the blanks for spherical buttons and raising them to the required convexity in one operation, does its work at the rate of 280 buttons per minute; whilst another machine, fitted with punches, strikes out 1800 plain blanks in the same space of time. An ingenious machine is also employed for "milling" the eyes of the ordinary plain gilt buttons, and does the work of ten or twelve girls. The military Buttons made at the establishment, as also the general range of ornamental articles of the same class, are in better taste, it has been conceded by competent judges, than the generality of the same goods produced in England.

This Company now occupy extensive and commodious buildings, and are manufacturing Sheet Brass, German Silver, Plated Metal, Brass and Silver-Plated Hinges, Military Buttons, Daguerreotype Plates, Kerosene Burners, Brass and German Silver Thimbles, and numerous miscellaneous articles in brass, including a novel and highly ornate style of Metal Boxes for druggists' and chemists' use.

About 400 persons are furnished employment in their manufactory.

The Benedict & Burnham Manufacturing Company.

Forty years ago, in 1823, Mr. Aaron Benedict and Bennet Bronson of Waterbury, and Nathan Smith, William Bristol, and David C. De Forest of New Haven, formed a partnership under the style of "A. Benedict," for the manufacture of Gilt Buttons. The capital was $6,500. This firm was succeeded in 1829 by another, under the name of "Benedict & Coe," with a capital of $20,000. On the 10th of February, 1834, the copartnership expired and another was formed with a capital of $40,000, under the name of Benedict & Burnham, the partners being Aaron Benedict, Gordon W. Burnham, Bennet Bronson, Alfred Platt, Henry Bronson, Samuel S. De Forest, and John De Forest. The two first were the managing partners and agents of the firm, Mr. Benedict having charge of the business at home, which was prosecuted with great energy and success, and carried through the financial crisis of 1837 and 1839 without dishonor or serious loss. The copartnership was renewed in 1838 with a capital of $71,000, and again in March, 1840, with a capital of $100,000.

On the 15th of January, 1842, the firm of Benedict & Burnham gave place to the "Benedict & Burnham Manufacturing Company," a joint stock corporation, and the first, we believe, established in the town. The capital was $100,000, and Mr. Benedict chosen President, which office he has held ever since. In 1848 the capital was increased to $200,000, and in 1856 to $400,000. This Company has from time to time became the parent of several joint stock companies, as for instance, the American Pin Company, Waterbury Button Company, and Waterbury Clock Company. Whenever a branch of its business could be better carried on separately, the property necessary for its prosecution was detached and distributed as a dividend to its stockholders in the shape of stock in a new company.

At an early period this Company engaged in the manufacture of German Silver, and they now probably make greater quantities of it than any other establishment in the country.

Besides Sheet Brass and German Silver, this Company manufactures Brass and Copper Wire, Brass and Copper Tubing, Copper Rivets and Barrs, and a variety of miscellaneous manufactures in Brass, such as Spurs, Fender or Grate Ornaments, and Army Belt Buckles and Plates, which are made here in vast numbers.

The City Manufacturing Company occupy a part of the buildings of the Benedict & Burnham Company for the manufacture of Button Backs, Kerosene Lamp Work, etc. They have a machine that produces Button Backs at the rate of nearly 200 a minute.

Waterbury Brass Company.

This Company was more recently organized than either of the two just mentioned, and probably sells a larger proportion of its manufactures in the form of Sheet Brass. They, however, are also extensively engaged in Wire Drawing and making Brass Kettles and Pans of a novel and excellent character.

Wire, like almost every thing else in Waterbury, is made by machinery. The ingot, which is a brass piece about eighty inches in length, by four inches in width, and $1\frac{1}{4}$ inches in thickness, is rolled into long ribbons and then brought to a slitting machine for the purpose of being divided into a number of long square bars or rods. These rods are taken to another machine, where the rough edges are slightly rounded and the ends tapered, and then they are passed forcibly through an aperture of a specified size which does not round the rod by removing its edges by abrasion, but condenses the metal into itself and increases its length; it also becomes so hard that it has to be annealed or it would break. For different sizes of wire the dies are of course proportionately lessened, and any degree of tenacity can be obtained by skillful workmen, even down to a filament of brass or copper as fine as a spider's web.

The process of making Kettles as practised in this Company's establishment, is still more curious. Instead of casting them as is frequently done in England, the article is "spun" up from a flat plate by powerful machinery constructed for the purpose. The blank is put into an ordinary engine lathe running at high speed. The face plate of the lathe has a cast iron cone or *fac simile* of a kettle secured to it, and the blank having been previously partially formed up in a shape somewhat like the finished kettle is now rapidly rotated. There is a small steel roller placed in close contiguity, which runs along the surface of the blank and draws it up or spins it out to the shape of a cone; thus the kettle is formed, and it only remains to wire the top and bail it to complete the article. Kettles holding twenty and thirty gallons are made in this manner, as well as the smaller sizes. Locomotive Head-Lights and Lighthouse Reflectors are made by the same machinery. The officers of the Waterbury Brass Company are—JOHN P. ELTON, President; C. H. CARTER, Treasurer; and J. S. ELTON, Secretary.

The other principal companies or firms in Waterbury engaged in the manufacture of Sheet Brass and Wire Drawing, are BROWN & BROTHERS, and HOLMES, BOOTH & HAYDENS.

No city in the Union, certainly none of equal population, contains so

great a variety of ingenious and labor-saving machinery as Waterbury. The American Pin Company have machines that turn out 1200 packs of solid headed pins per day, each pack containing 255 dozens of pins. No description of them can be given, as the process of papering is all that is permitted to be seen. The pins are all prepared by machinery; they are placed in an inclined feeding dish, from which they fall into a trough having a slit sufficiently wide to admit the shank of a pin and yet suspend it by its head. The descending line of suspended pins is conducted by the slit to a sliding frame carrying a dozen grooves, in each of which a pin is deposited as it passes under the slit; the pins are thus arranged in a row, with their points all turned the same way. The sheet of paper for receiving them is placed by the attendant on a grooved table, and deep folds are pressed into it at equal distances, and into the cross ridges thus formed a row of pins is pushed by the carrying-frame at every thrust forward.

Messrs. Blake & Johnson have a machine of their own invention and construction that makes Ladies' Hair Pins at the rate of 180 per minute. A coil of wire is placed upon a drum or cylinder which is suspended from the ceiling, and the point being inserted on to the machine, it does all the work and requires no immediate superintendence until the whole quantity of wire is exhausted.

The American Flask and Cap Company have machinery for filling Percussion Caps with fulminating Powder and also an arrangement for counting caps that is somewhat peculiar. A little girl holds in her hand a perforated tin plate, which she thrusts in the heap of caps before her, each hole being just large enough to admit a single cap, and slight sifting motion causes the apertures to be filled. There are one hundred holes in a plate, and consequently when the plate is full the exact number is known. There is also a false bottom to the counter, which being pulled out allows the caps to fall into a long trough, from which they are easily slid into the paper boxes. About one hundred tons of copper are annually converted into Percussion Caps in this establishment.

The Waterbury Clock Company is one of the five large companies engaged in manufacturing Clocks in the United States. At their manufactory is also made the walking Dolls or "brazen young ladies"—a toy which has attracted a vast deal of attention in the leading cities.

Charles J. Taylor has an establishment for making Drawers, Undershirts, and Merino Wool knitted articles. The American Suspender Co. is probably the largest manufacturer of Elastic Webbings in the United States. Besides these Companies there are in Waterbury the Mattatuck Manufacturing Company, which makes Lamp Tubes, Thimbles, Umbrella and Parasol furniture; the Waterbury Hook and Eye Company;

the Waterbury Button Company; the Lane Manufacturing Company, which makes Buttons; Oakville Company, solid headed Pins; Hitchcock & Castle, Buttons and Hooks and Eyes; American Ring Co.; E. Robinson & Son, cloth Buttons; Waterbury Buckle Co.; Waterbury Gas Light Co.; Maltby, Morton & Co., manufacturers of Ivory and Steel carriage Trimmings, fine Pearl, Vest, and Ladies' Dress Buttons; Charles W. Johnson, manufacturer of Machinery; H. A. Mathews, Carriage and Harness Trimmings; the Farrel Foundry and Machine Company; the City Manufacturing Company, which makes patent Lamp Tops and Tubes; Steel & Johnson, Manufacturing Company, Metal Buttons and Jewelry; D. B. Hurd, Button Eyes, Backs, and Staples; and the Waterville Knife Company, manufacturers of Pocket Cutlery.

MANUFACTURES OF MIDDLETOWN, CONN.

MIDDLETOWN, situated on the west bank of the Connecticut River, fourteen miles south from Hartford, has several important manufactories, especially of Firearms, Gum Elastic Suspenders, Hardware, Pumps and other hydraulic machines.

The manufacture of Firearms is carried on by the Alsop's & Savage Firearms Manufacturing Companies, gun-locks by Ira A. Johnson, gun-barrels by Peter H. Ashton, and cartridges by De Witt Sage. All these shops are now busily employed.

The first manufactory of Gum Elastic Suspenders established in the United States, was, we believe, that of the Russel Manufacturing Company at Middletown. This Company has now five mills, and makes Suspenders, Patent Solid Belting, Patent Cord Clothing, Girth, Roller Rein, and Boot Webs, to the amount of $300,000. George H. Hurlbut is Treasurer of the Company. Suspender Twist, Thread and Yarn, are made by the Falls Manufacturing Company, of which S. G. Hurlbut is Treasurer.

Machinery and various articles in metals are, as is usual in Connecticut, made at several establishments. The two principal machine shops are those of William Stroud and the Sanseer Manufacturing Company (C. F. Browning, Treas.), who also manufacture Cast Iron Bolts; Locks are made by William Wilcox & Co.; Grommets, Thimbles, and Clews by J. K. Penfield & Son; and Patent Iron Grommets and Galvanized Iron Clews and Thimbles, by Wilcox & Hall. Blind Fastenings and

Saw Stretchers are made by Horace Van Sands; Washing Machines by the Washing Machine Company; Clothes Wringers by the Metropolitan Company (W. M. Terrell, Treasurer); Sewing Machines by the Middletown Manufacturing Company (J. Hotchkiss, Treasurer); and Tysquares, bevels, etc., by J. Tidgewell & Son and Steel yards by Hibbart Smith, Jr. There is also an important manufactory of Britannia ware (F. W. & O. Z. Peltor); of Hoop Skirts and Corset Braces (Ferdinand A. Hart); of Paper Boxes and Hoop Skirt Trimmings (Henry S. White); of Body Braces and Trusses (J. Danforth); of Patent Rein Snaps and Snap Hoops (J. R. Henshaw & Co.); of Doors, Blinds, Sash and Patent Well Curbs (Hubbard, Bros.); of Soap and Candles (Allison, Bros.); of Carriages (Cornwell & Warner); and of Japanned Ware, of which J. O. Smith is proprietor.

But probably the manufactory, which of all others in Middletown is most widely known in this country and abroad, is that of the W. & B. Douglas Manufacturing Company. This concern was founded in 1832 by William Douglas and W. H. Guild, who then commenced business as machinists and manufacturers of small engines, but it dates its celebrity from 1842, when the brothers, William and Benjamin Douglas, having invented a novel Revolving Stand Pump, determined to make its manufacture a specialty, and for the purpose of introducing it traveled with a pump under each arm from store to store. At that time an iron or metallic pump was scarcely known, and it required the most persevering efforts to convince the public, then less disposed than now to encourage novelties, of their value. These men, however, who were grandsons of Col. Wm. Douglas, of Revolutionary fame, and descendants of the renowned Douglas of Scotland, whose motto, "jamais arriere" (never behind), they still maintain, came of stock that were not to be dismayed by difficulties, and, though their sales in the first year of their enterprise did not amount to three hundred pumps, they persevered until now the Douglas pump is a standard article in the stock of almost every dealer in American Hardware.

In 1858, the elder brother, William Douglas, died, and a new Company, incorporated by a special charter granted by the Legislature of Connecticut, was formed, under the old name of W. & B. Douglas, of which Benjamin Douglas is President. Besides a great variety of Pumps, they manufacture Hydraulic Rams and Garden Engines, in which they have made important improvements, and also Wrought Iron Butts and Hinges. Their sales now of Hydraulic machines alone amount to about $300,000 annually, and their market includes not only this country, but the Canadas, South America, the West Indies, Australia, and Europe, Asia, and nearly every portion of the civilized world.

MANUFACTURES OF NORWICH.

Norwich, situated in New London County, at the head of navigation on the Thames River, formed by the confluence of the Yantic and Shetucket, had in 1860, according to the Census Returns, 146 manufacturing establishments, with an aggregate capital of $2,498,300, employing 1,674 male and 1,398 female hands, yielding products valued at $4,686,972. About one-fourth of this amount was in Denims, Ticks and Stripes, made principally at the factories of the Falls Company and the Shetucket Company—each of which has a capital of $500,000—William P. Greene being President, and Gardner Greene, Secretary, of both companies. At five woolen mills, Flannels, Cassimeres and Worsted goods were made to the amount of $744,800, while Hosiery was made at one manufactory to the amount of $75,000. The Norwich Bleaching and Callendering Company employed 52 men and 12 women, and produced a value of $150,000. Paper has long been a prominent article in the manufacture of this place. The first paper manufactured in Connecticut was made in Greenville, now a part of Norwich, where are now the extensive mills of the Chelsea Manufacturing Company (E. G. Bartow, President, and T. Bartow, Secretary), which has a capital of $200,000 employed in making Printing Paper.

The manufactures of Iron are also important. Machinery and Castings were made at seven establishments to the amount of $535,000, including Springs, Axles, and Paper Machinery made by Samuel Mowrey to the amount of $60,000, and including Auger Bits made by Charles B. Converse & Co. The Sterry Faucet Company manufactured Faucets, Cocks and Valves, to the amount of $30,000. There are also two manufactories of Firearms—the Bacon Manufacturing Company (John W. Stedman, President, D. P. Coon, Treasurer), and the Norwich Arms Company (A. H. Almy, President, and W. H. Tingley, Treasurer). The latter company have now one of the largest private Armories in the United States. They are manufacturing about 1200 Muskets, 3,000 Bayonets, and 2,000 Locks, besides Rifles and Carbines, per week. They are sole manufacturers of a new breech-loading Rifle invented by Armstrong & Taylor, of Augusta, Kentucky, which is said to be a very superior and effective weapon.

Probably no firm in Norwich has done as much to make the town known abroad as Richardson & Co., manufacturers of Dr. Sweet's Liniment. This physician was most remarkable for his skill as a bone-setter, and a preparation made in accordance with his prescription has been advertised by this firm wherever newspapers are printed.

The miscellaneous manufactures of Norwich include Confectionery, Carriages, Harness, Sash, Doors and Blinds, Case's Morocco Manufactory, Crocker's Cork Factory, Turner & Co.'s Cordage Works, and the Wood Type Manufactory of William H. Page & Co., whose wood letter is in great demand not only by the printers of the United States but of Continental Europe.

NEW LONDON, the other county town of New London County, has a few manufactories of importance, and as the people are active and enterprising, it is probable that the next decade will witness a considerable addition to their number. The principal manufactories are those of the Wilson Manufacturing Company, who make Hardware and Brass Castings; the Iron Foundries and Boiler Shops of the Albertson & Douglas Machine Co. and New London Manufacturing Co.; the Paper Mills of O. Woodworth and Robinson & Bingham; the Piano Manufactory of T. M. Allyn & Co.; and the New London Horse-Nail Co. (J. C. Tate, President). Besides these, Jewelry is made by William Butler, David Liscomb, and Leonard S. Brown; Melodeons by Nathan D. Smith; Pumps and Blocks by Barnes & Crocker and Charles H. Whittemore; Carriages by William F. Reables and John N. Brown; and Harnesses by W. B. Lewis.

In no State in the Union is the manufacture of the lighter articles in metal so extensively carried on as in Connecticut. Almost every village, especially in the valleys of the Naugatuck and Housatonic, is the seat of several manufactories, where both skilled handicraft and highly ingenious machinery are employed for the production of articles of utility in iron, brass, or copper. Each village, too, is generally distinguished for the prominence of some particular manufacture. Bristol is noted for its manufactories of Clocks and Clock Trimmings; Waterbury and Ansonia for their Brass manufactures; East Hampton for its Bells; New Britain and Meriden for Hardware; Winsted for its Scythes; Birmingham for its Hoop Skirts; Danbury for Hats; and in these, and the more prominent manufacturing centres that we have mentioned, are produced articles that it would require a volume to enumerate, and which for cheapness and ingenious workmanship are the Wonder of the World.

MANUFACTURES OF MANCHESTER, N. H.

MANCHESTER, situated on the Merrimack river, 58 miles from Boston, is the largest manufacturing town in New Hampshire. In 1860, according to the census returns, it had 178 manufactories, with an aggregate capital of $8,327,695, employing 3104 male, and 5024 female hands, and produced a value of $10,665,296. Fully three-fourths of this amount was in cotton and mixed goods, made by four Companies, which had an aggregate capital of $6,300,000.

Manchester, like Lawrence and Lowell, is a magnificent specimen of the enterprise and skill of the New England people. Thirty-five years ago the place upon which the city is built was occupied by a few farmers, there being nothing more than a small village at Amoskeag Falls. It is now a municipality, with a population of 25,000, which is rapidly increasing. Its prosperity is due largely to the proprietors of the AMOSKEAG MANUFACTURING COMPANY, who owned originally, 26,000 acres, lying on both sides of the river; and who, instead of attempting a great speculation, disposed of the land on very favorable terms, and encouraged manufacturing enterprises. This Company was incorporated in July, 1831, and commenced operations in 1839. Its capital was originally $1,000,000, but has since been increased to $3,000,000. Its business comprises the selling of lands, letting water-power, and manufacturing cotton goods and machinery, including locomotives. In all these enterprises, the Company has been remarkably successful; and during the last two years it declared annual dividends of 40 per cent. upon its capital stock. When in full operation, this Company gives employment to over 3000 persons.

The "Stark Mills" is another large corporation in Manchester, and commenced operations in 1839, with an authorized capital of $1,250,000. This Company has two mills employed in making ducks, denims, sheetings and canton flannels, and seamless grain-bags—a novel and important article of trade. These bags are 45 inches long, and are manufactured of various qualities and weight. The warp is a double one; and, by the construction of the loom, the "filling," or weft, traverses both sides, uniting the warps at the edge, instead of producing a selvage. The loom—the invention of Cyrus W. Baldwin—is a perfect self-actor or automaton. It commences the bag, goes on until the requisite number of picks has been thrown in, to make up the length; it then closes the bottom, throws in a given number of picks as a *tab*, and then commences another bag. All that the weaver has to do is to attend, in the usual way, to the perfect working of the machine, and cut out each bag, as from their thickness, any quantity

accumulated on a cloth-beam would be an encumbrance to the machine. As the bags are cut out, the weaver folds and piles them by the side of the loom, and these are removed, and an account taken every half-day. The bags are hemmed round the top, or mouth, by sewing-machines, each machine being attended by one female operative; and the average work of each is 650 bags for a machine per day. There are 126 of these seamless bag-looms at work in the Stark Mills. The average make is 47 bags for a loom per day, and the speed about 130 picks per minute.

The "Manchester Print Works," incorporated in 1839, has a capital of $1,800,000, employs 1500 operatives, and produces about 15,000,000 yards of delaines, bareges, and calicoes, annually. The Printery is a fire-proof structure, built of brick, in the form of a hollow square, 165 by 200 feet. This Company has been among the foremost in adopting devices calculated to save labor. A cotton piece in this establishment is scarcely touched by hand, from the time it enters the machine until it is dyed, and has to be untwisted from the wringing, after dyeing. The engraving of the rollers, instead of being performed by the old, tedious hand-process, is executed by the ingenious Pentograph machine, invented by John Hope, of Providence, and which has been previously described. The singeing of the cloth, instead of being accomplished as formerly, by being drawn over red-hot cylinders, is now effected by an ingenious machine, which supplies gas for the burning material. The fabric is passed rapidly over a horizontal pipe, along which numerous little apertures extend in a straight line, so that the gas, ignited, gives a long line of flame, equal to the width of the cloth. The movement is at the rate of about three feet in a second, and the loose fibres are burned off without igniting the fabric. The stopping of the motion cuts off the gas beneath the cloth, and of course extinguishes the flame, which is immediately relighted as soon as the movement again commences, by means of side-lights—the extinguishing and relighting being effected by the action of the machinery itself, without any additional manipulations of the workmen. Any sparks that may remain are extinguished, as the cloth immediately passes between two rubbers placed in front of the line of flame.

The other important corporations in Manchester, are the Amoskeag Duck and Bag Company, which has a capital of $300,000, and manufactures 600,000 bags per annum; the Amoskeag Paper-mill, which produces about one and a quarter tons of book and news paper per day; the Amoskeag Axe Company, which employs 50 hands, and makes about 800 tools per day; the Langdon Manufacturing Company, capital $225,000; the Manchester Iron Works, and the Manchester Locomotive Works, which were incorporated in 1854, with a capital of $100,000, and have been very successful.

MANUFACTURES OF NASHUA, N. H.

NASHUA, in Hillsboro' County, at the confluence of the Nashua and Merrimac rivers, about forty miles from Boston, is the second most important manufacturing town in New Hampshire. It has a capital of over two million dollars invested in manufactures, employs about 2800 hands, and produces an annual value of nearly $4,000,000. About twenty million yards of cotton goods were made in 1860 by three corporations, the Nashua, Jackson, and Harbor Manufacturing Companies, whose aggregate capital was $1,660,000, and who employed 1500 operatives. The oldest and largest of these companies is the Nashua, which has 4 mills, having 40,600 spindles and 1200 looms, and also an extensive machine-shop. The Jackson has 3 mills, with 2,000 spindles and 700 looms.

Next to Cotton goods, the most prominent manufactories are those of Iron and the various fabrics of Iron. Of these the most important are the works of the NASHUA IRON COMPANY, which manufactures every description of forged work, including forged iron locomotive driving-wheels, locomotive tires, piston and connecting rods, frames, crank, straight and car axles, locomotive cranks, etc. The works comprise two forge shops, one with four steam trip hammers, and one with three steam hammers, a rolling-mill, and a machine-shop. In equipments and general facilities, these works are not surpassed by any similar ones in the country.

The Nashua Iron Company was organized in 1848, and its present capital is $125,000, though the Company have the privilege of increasing it to $300,000. All the extensive additions that have been made to the works and machinery within a few years, were paid for out of the profits of the Company, which had been set aside as a reserved fund, after paying the usual dividend. About 180 men are now employed in the works, and the average annual product is $500,000. Moses A. Herrick, Esq., of Boston, is Treasurer of this well-managed and successful Company.

Machinists' Tools and Steam Engines are made quite extensively by the firm of GAGE, WARNER & WHITNEY. The senior partner of this firm established in 1837 what is believed to have been the first shop in the United States devoted exclusively to the manufacture of machinists' tools. The present co-partnership of John H. Gage, David A. G. Warner, and George Whitney, dates from December, 1851. Their manufactures include iron planers of all sizes, engine lathes, from the smallest watchmaker's up to a size suitable for turning locomotive driving-wheels six or eight feet in diameter, hand lathes of all sizes, chucking lathes of all

dimensions, with sliding bed, bolt-cutting machines for rapidly transforming any part of a plain bolt into a nice evenly-threaded screw, upright and swing drills, boring machines for shaping the interior of steam cylinders or other bores of large diameter, slabbers of all kinds, gear-cutting engines of all sizes for shaping and smoothing the teeth of gear wheels with perfect accuracy, power punching-machines of various sizes, &c. Since 1852 Messrs. Gage, Warner & Whitney have also been manufacturers of Steam Engines. The first steam engine built by them is now employed in driving their own machinery, and as a specimen of workmanship is highly creditable to its builders.

Nashua has also a very important manufactory of locks and house trimmings, known as the NASHUA LOCK COMPANY. This company is the successor of Col. L. W. Noyes, who commenced business in 1837, and was one of the first in the country to engage extensively in the manufacture of locks. When this company was organized American locks were scarcely recognised as articles of hardware, but by improvements in machinery, and facilities for manufacturing, the price has been gradually reduced, until imported locks are almost excluded from the American market. Every description of mortise and rim locks, mortise and rim latches, and every variety of knobs and house trimmings, are now made by this Company, and sold at their warehouse in Boston. The works comprise an iron and brass foundry, where castings are made for sale, as well as for consumption in their other manufactures. This Company make locks that range in price from 50 cents to $60 per dozen.

In 1859 Mr. Franklin O. Munroe purchased the interests of his associates in the Nashua Lock Company, and he is now, we believe, sole proprietor.

The Underhill Edge Tool Company have also an important establishment in Nashua for making tools of all kinds.

Besides these, Gage, Murray & Gilman have an extensive manufactory of cards and fancy papers, Eaton & Ayer, of bobbins and shuttles, George W. Johnson, of fliers and spindles, F. S. Rogers & Son, of palm-leaf hats, Chase & Baldwin and Alonzo Taylor, of sewing machines, Lewis Kimball, of bedsteads, Holt & Jones, of mattresses, etc., J. & P. Mullen, of carpets, George A. Rollins & Co., of machinery, and S. S. Davis and Scott & Noyes, of soap and candles. Confectionery is made to a considerable amount by J. C. Kempton, John Webster, C. Goldthwait, and Charles Holman; iron castings at the foundries of Charles Williams and J. D. Otterson; flour and meal by Sargent & Cross and Eaton & Ayer; sash, doors and blinds by George E. Wilder; bird-cages by Fletcher & Webster; patent money-drawers by A. O. Miles; and hop yeast by M. & K. F. Worcester and S. P. Dean.

MANUFACTURES OF CONCORD.

CONCORD, the capital of the State of New Hampshire, is distinguished principally as an industrial centre, for its manufactories of carriages and wagons. In 1860 there was a capital invested in this manufacture of $294,000, employing 311 men, whose production for that year was $359,945. It is probable that the annual average product is considerably more than this. The firms engaged in the business in 1860 were J. S. & E. A. Abbott,[1] Lewis Downing & Sons, J. T. Blodgett, James Butters, Benjamin Coffin, William Crockett, Samuel M. Griffin, and David Pearson, and Warde & Humphrey, whose shops were at Fisherville.

The Iron and Stove foundries of J. D. Cooper & Co., and W. P. & T. H. Ford, employed 53 men, and produced a value of $115,400. The Messrs. Ford, proprietors of the "Concord Iron Foundry," also manufacture ploughs, harrows, cultivators, and other agricultural implements. Among the special articles made by them are Harrow and Cultivator Teeth, so formed that they can be chilled, which peculiarly adapts them for sward land; and, as many practical farmers have certified, they pulverize the soil more effectually than any other implement of husbandry in use.

Melodeons and Seraphines are made by the firms of Prescott Brothers, and Liscom, Dearborn & Co. The church Seraphines made here, with double reeds, costing from $125 to $150, are especially suitable for small churches. The firm of Liscom, Dearborn & Co. also manufacture Piano Fortes, and have attained more than a local reputation in this branch.

Boots and shoes are made by nine firms to the amount of $110,000, and Lasts by J. L. Jackson to the amount of $10,000. Men's half-hose are made by B. F. & D. Holden, and worsted goods by T. H. Brown. These firms in 1860 employed 53 hands, and manufactured to the amount of $77,900. Concord has also manufactories of Brooms, Carriage Springs, Gloves, Palm Leaf Hats, Essential Oils, Ground Plaster, Soap and Candles, Spokes and Hubs, and several saw and planing mills. In West

(1) The works and lumber-yards of the Messrs. ABBOTT occupy about four acres of ground. They commenced business in Concord in 1828, and since then have built every description of vehicle from a wheelbarrow to a coach, including express wagons, circus wagons, stage coaches, monkey and lion cages for peripatetic menageries. They recently built four leviathan coaches for Australia, six feet four inches between the wheels, designed to carry thirty-two passengers, and a large number of mail-wagons for the Pacific Mail Company and the Overland Mail Transportation Company. About one-fourth of all the wagons they make are exported to the Canadas, Mexico, South America, Australia, and Europe.

Concord Henry Dunklee employed 10 hands in the manufacture of Sewing and Embroidery silks.

Fisherville, generally regarded as a part of Concord, though situated six miles north of the main village, contains a number of important manufactories. Here is the cotton mill of H. H. & J. S. BROWN, who in 1860 employed 65 males and 110 females, run 11,500 spindles and 304 looms, and produced 2,750,000 yards of print cloths. As a general rule, the manufacturers of Textile fabrics are not so much distinguished for general intelligence and enterprise as the workers in metals; but this firm is an exception to the rule.

In Fisherville also is the saw manufactory of GAGE, PORTER & Co., one of the most important of its class in the country. This firm import their steel direct from England, and have adopted several improvements in grinding and tempering their saws, the important process of tempering being personally superintended by the senior partner, Mr. Gage. They manufacture every description of cast-steel saws ordinarily used, including circular, mill, cross-cut, and wood-saws, and each is accompanied with a liberal warranty, and if defective, can be returned. The firm has been established since 1849, and in fifteen years has attained a reputation that older firms may envy. We believe this is the only firm engaged in the manufacture of saws in the State of New Hampshire.

Piano Forte Hardware is made by the firms of J. B. Rand and Wilson & Blake, who employ 20 hands. Mr. Rand is also a manufacturer of Piano Fortes, and is proprietor of Huntoon's patent machine for cutting Serpentine Fluted work. Piano Forte and Seraphine legs, bedstead posts, balusters, etc., can be carved or fluted by means of this remarkable machine with as much facility as wood is turned in an ordinary turning-lathe.

Furniture is made in Fisherville to the amount of over $80,000 annually by the two firms of Caldwell, Amsden & Co., and William Robinson, who employ 120 hands.

The aggregate value of the articles annually manufactured in Concord amounts to about two millions of dollars.

MANUFACTURES OF VERMONT.

VERMONT is more exclusively agricultural than any of the other Northern States. In 1850 the persons engaged in agricultural pursuits exceeded those employed in manufactures in the proportion of nearly six to one. In 1860, according to the census returns, there were in the State 1501 manufacturing establishments, producing more than $500 a year, which had a capital invested of $9,500,000, employed 8940 male, and 1860 female hands, and yielded products valued at $16,000,000. The census-takers in this State appear, however, to have been more negligent in the performance of their duties than usual, for, including carpenters, builders, and blacksmiths, which are enumerated in other places, we have before us a list of the names of over 3000 individuals and firms engaged in manufacturing pursuits in Vermont in 1860, and it would be preposterous to assume, though the factories are generally small, that as many as one-half of them made less than $500 per year. Of these establishments, about 1500 were engaged in the various manufactures of wood, there being in the State over 600 saw, clapboard, and shingle-mills; 50 manufacturers of wash-boards, butter firkins, clothes-pins, pails, wooden bowls, etc.; 250 carriage and sleigh manufacturers; 150 cabinet-makers; 50 chair and 75 bedstead manufacturers; 26 pill, cheese, and packing-box factories; 50 manufacturers of agricultural implements; 80 of doors, sash, and blinds; 4 of axe-helves; and 13 of broom, fork, hoe, and scythe-handles. There were in the State over 400 boot and shoe shops, and 160 tanning and currying shops, about 50 iron foundries, 75 machine shops, 1 car, and 1 car-wheel manufactory. The number of grist and flouring mills exceeded 300. There were also 17 paper mills, 5 paint, 4 linseed-oil, and 2 yellow-ochre manufactories. About 20 firms are engaged in the quarrying and working marble at Rutland, Dorset, and Brandon; and slate is quarried at Castleton, Fairhaven, Guilford, and other places, by about the same number of individuals and firms, including some important incorporated companies. There were in the State, in 1860, 8 cotton mills, which employed 157 male, and 222 female hands, and produced print cloths, wadding, batting, etc., of the value of $357,450; and 51 woollen mills, having 23,371 spindles, 463 looms, employed 901 male and 1178 female hands, and produced a value of $2,961,137.

Within the last few years there has been considerable increase in the development of the natural resources of the State, especially marble, slate, iron, and porcelain; but there is yet a very remarkable deficiency in extensive establishments. With the exception of the Brandon Iron and

Car-wheel Works, we know of but one establishment in all the State that, for extent, celebrity, and national importance, can be fairly called remarkable, or having a history worth relating, and that is the Platform Scale Manufactory of

E. & T. Fairbanks & Co., St. Johnsbury, Vermont.

Previous to 1830, platform scales, though not entirely unknown, were very little used. Transactions by weight were confined to the even balance, the Dearborn balance, and the Roman steelyard. The introduction of platform scales has wrought a revolution in almost every department of business where measurement of quantities is required, whether relating to the sale or exchange of commodities, or the transportation of heavy bodies; so that this instrument, of comparatively modern invention, is now as indispensable in the various transactions of business, as the railroad car or the canal boat. In the year 1830 and 1831, Mr. Thaddeus Fairbanks invented important improvements in platform scales, which were patented, and the manufacture was commenced by Messrs. E. and T. Fairbanks & Co. The most essential improvements claimed by Mr. Fairbanks were the employment of *two levers* only in the construction of the scale, being the most simple combination in a compound scale, and the use of *knife edge bearings*, resting upon plain polished steel surfaces.

The first manufactures of the Company were confined to hay scales, but additional improvements were from time to time made, and new modifications adopted, with reference to the wants and conveniences of the commercial, manufacturing, and agricultural community. Their operations were for several years limited in amount, and the introduction of platform scales was slow, until the public had time to become assured of their accuracy, and by experimental trials learn their great utility. As public confidence was secured, and the utility of the instrument was more and more demonstrated, a demand was created which has rendered it necessary to increase the manufacture of scales, until at the present time the establishment of the Messrs. Fairbanks employs a force of about three hundred mechanics solely in the manufacture of scales, and their annual production is about $500,000. About 150,000 scales have been made by the firm, including a number of weigh-lock scales, having a capacity of from 200 to 250 tons.

The general management of the business of the Company being assumed by the other partners, Mr. Thaddeus Fairbanks, who is a practical inventor and machinist, has from the first devoted his time and attention to the science of weighing as applied to the compound balance, and to perfecting the various modifications of scales, until at the present time

more than one hundred different modifications have been introduced, adapted to all the various departments of business in the civilized world.

The works at which these scales are made are composed of about 20 structures of wood or brick, of all periods of erection and of all sizes, and are less noteworthy than the system employed to secure reliable work. The theory of individual responsibility is so fully carried out, that the name or initials of the scaler is stamped on the working parts of each scale, large or small, and thus any derangement or inaccuracy subsequently discovered recurs directly to the workmen, who are frequently so anxious to maintain their reputation, that they go long journeys at their own expense for the purpose of investigating or correcting alleged imperfections.

For the manufacture of the smaller varieties, such as druggists' scales, weighing single drachms, the firm have a manufactory in the city of New York. Fairbanks' scales are now extensively used in foreign countries, and it is no exaggeration to say, that they have done more than all other agencies combined to equalize the weight of commodities in commercial transactions.

STATISTICS OF COTTON MANUFACTURES IN NEW ENGLAND FOR THE YEAR ENDING JUNE 1ST, 1860.

(Prepared at Census Office expressly for this work, and never before published.)

	Maine.	New Ham'shire	Vermont.	Massachusetts.	Rhode Island.	Connecticut.	Total in N.E.States.	Total in Unit'dstates
No. Establishments,	19	44	8	217	153	129	570	1,093
Capital Invested,	$6,018,325	$12,586,883	$271,200	$33,704,674	$10,052,200	$6,027,000	$69,260,279	$98,469,769
Lbs. Cotton used,	23,731,165	51,002,324	1,447,250	131,012,759	41,014,797	31,891,011	283,701,306	422,704,975
Value Raw Material,	$3,319,335	7,128,196	181,030	17,224,502	5,700,223	4,028,406	37,580,782	57,231,498
No. of Spindles,	281,050	636,788	17,600	1,673,498	814,554	435,496	3,858,962	5,235,727
" Looms,	6,877	17,336	362	42,779	17,315	8,775	93,344	126,313
Males Employed,	1,828	3,829	157	13,691	6,353	4,028	29,886	46,766
Females do.	4,036	9,001	222	24,760	7,724	4,074	51,017	75,206
Annual Cost Labor,	$1,368,888	$2,888,604	$78,468	$7,798,476	$2,847,804	$1,743,480	$16,725,720	$25,907,029
Val. Product in 1850,	$2,630,616	$8,861,749	$280,300	$21,394,401	$6,495,072	$4,122,952	$43,785,090	$65,501,687
" " 1860,	6,235,023	13,690,994	357,450	38,004,255	12,151,191	8,011,387	70,359,900	110,331,229
Increase per cent.	140.8	50 4	27.5	77.58	87.05	116.34	81.24	77.6
Product in Yards,	60,377,000	151,713,600	4,030,000	418,291,458	147,652,300	78,161,000	857,225,347	1,148,252,406
Yds. of Print Cloths,	3,000,000	25,021,750	2,100,000	76,991,280	70,734,887	21,539,515	211,687,382	271,857,060
Lbs. Yarn & Thread,	481,823	221,000	570,000	3,770,340	5,072,114	2,282,256	12,409,527	47,241,693
" Bat'g, Wad'g, &c.	200,000	280,000	95,000	3,290,000	366,240	1,557,000	5,648,240	12,967,956
" Cordage & Twine,				1,241,762	1,028,740	2,317,775	4,021,277	4,870,277
No. Seamless Bags,	1,250,000	2,800,000		145,600		730,000	4,025,600	6,235,040

MANUFACTURES OF THE WEST.

In a country so recently settled as the Western States, and so abounding in all the elements that reward agricultural labor, one would not expect to find much development of the manufacturing arts; yet it appears that one-fifth of the aggregate product of manufactures in 1860 is to be credited to nine Western States, including, as such, Kentucky. It is, however, also true that much the largest proportion of this product was of the commoner and coarser articles, as flour, whiskey, lumber, etc., and that outside of the principal cities comparatively little progress has yet been made in the higher or artistic branches of manufactures. It is also a remarkable fact that there has been so little increase in the production of cotton and woolen goods within ten years, some of the Western States having reported a less value in 1860 than in 1850. Of the nine States, Ohio takes first rank in manufacturing importance, and next to New York, was the largest producer in the Union of Agricultural Implements and Flour and Meal. Illinois is also a large producer of agricultural implements, and in products of distilleries was second only to New York. Michigan is the leading State of the West in sawed and planed lumber; and Kentucky takes precedence over all the other Western States in the production of Woolen goods.

APPROXIMATE STATISTICS OF THE PRODUCTS OF MANUFACTURES IN THE WESTERN STATES FOR THE YEAR ENDING JUNE 1, 1860.

States.	Manufac'g Estabm'ts.	Capital invested.	Val. of Raw Material used, including Fuel.	Average No. of Hands Employ'd. Male.	Female.	Value of Ann'l Product.
Ohio	10,710	$58,000,000	$70,000,000	60,800	11,400	$125,000,000
Indiana	5,120	18,875,000	27,360,000	20,600	710	43,250,000
Michigan	2,530	21,000,000	10,000,000	22,860	1,260	35,200,000
Illinois	4,100	27,700,000	33,800,000	23,500	870	56,750,000
Wisconsin	3,120	10,580,000	17,250,000	16,320	770	28,500,000
Minnesota	562	2,388,310	1,004,070	2,104	19	3,373,172
Iowa	1,790	7,500,000	8,500,000	6,475	162	14,900,000
Missouri	2,800	20,500,000	21,000,000	20,130	1,200	43,500,000
Kentucky	3,100	20,000,000	21,380,000	20,580	1,460	36,330,000
Kansas	200	1,063,000	669,260	1,719	.....	2,800,000
Nebraska	107	266,575	237,215	334	2	600,058
Total in Western States...	34,298	$100,872,885	$224,100,554	204,422	17,793	$390,200,230

STATISTICS OF THE LEADING ARTICLES PRODUCED IN THE WESTERN STATES, INCLUDING KENTUCKY, IN 1860.

	1860.	1850.
Flour and Meal	$96,038,794	$42,073,302
Spirituous Liquors distilled, 44,746,193 gallons	10,927,591	
Malt Liquors brewed, 1,173,576 barrels	6,343,070	
Lumber, sawed and planed	33,271,703	11,577,250
Agricultural Implements	7,955,545	1,123,927
Pig Iron, 152,784 tons	3,777,200	
Bar and other Rolled Iron, 17,117 tons	1,582,000	
Machinery and Steam Engines	8,233,876	3,625,317
Iron Founding	5,170,984	3,8[illegible]7,987
Leather	5,986,457	5,081,351
Boots and Shoes	9,165,205	5,141,520
Furniture	6,674,889	3,9[illegible]0,993
Soap and Candles	5,667,187	1,8[illegible]3,802
Cotton Goods, 22 mills	1,612,107	1,2[illegible]9,403
Number of Spindles	43,926	
Number of Looms	1071	
Woolen Goods, 633 mills	4,350,842	3,940,084
Number of Spindles	22,979	
Number of Looms	470.	

MANUFACTURES OF CINCINNATI, OHIO.

[In 1859 Mr. Charles Cist published a work on "Cincinnati as it is," in which he stated that the manufacturing industry of that city yielded a value of $112,254,400 annually. In 1860 the same Mr. Cist was one of the Assistant Marshals for the Eighth Census, and his return and those of his associates, when added, give for the whole of Hamilton County a product of $46,691,617. We cannot reconcile the discrepancy. We have no doubt whatever, knowing how negligent census officials are, that this return is below the truth, but we are equally confident that Cincinnati does not produce a hundred million of dollars yearly. The following are the returns for Hamilton County, for the year ending June 1, 1860, as reported to us from the Census Office.]

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male hands.	Female hands.	Value of Annual Product.
Agricultural Implements	2	$13,000	$13,612	27	.....	$33,200
Plows and Harrows	7	150,400	43,773	121	.....	182,700
Reapers and Mowers	1	3,000	700	4	.....	6,000
Alcohol	2	53,500	202,700	10	.....	2[illegible],500
Baking Powders	2	20,150	11,[illegible]55	3	.....	25,750
Bellows and Forges	2	4,000	7,200	6	.....	1[illegible],000
Billiard Tables	2	153,000	158,571	100	.....	31[illegible],000
Blacking	1	2,000	7,000	15	5	20,000
Boat Building	11	166,700	102,708	232	.....	26[illegible],214
Bolts, Nuts, &c.	2	21,700	18,[illegible]08	62	.....	52,000
Boots and Shoes	285	402,100	558,013	1,575	172	1,[illegible]62,043
Boxes, Packing	7	61,300	42,891	49	.....	73,[illegible]06
" Paper	1	10,000	8,000	20	.....	20,000
Brass Founding	9	85,000	106,550	112	.....	221,000
Bread and Crackers	55	99,205	852,822	256	3	0[illegible],450

CINCINNATI—*Continued.*

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw material.	Male hands.	Female hands.	Value of Annual Product.
Britannia Ware	2	47,000	31,080	43	.....	84,000
Brooms	5	10,200	23,805	44	.....	65,250
Brushes	8	26,450	36,065	79	.....	71,510
Burning Fluid	1	6,000	6,500	2	.....	8,000
Carpenters' Tools	1	2,000	6,340	10	.....	25,000
Carpets	3	950	3,296	15	.....	9,796
Carriages	27	178,612	172,841	447	1	484,450
" Children's	1	2,600	2,500	15	.....	10,100
Cars	1	12,000	3,790	30	.....	22,800
Car Wheels	1	50,000	40,000	20	.....	75,000
Chemicals	4	141,000	86,000	48	.....	165,260
Cigars and Tobacco	107	106,800	225,093	632	.....	615,856
Clocks	1	600	300	1	.....	900
Clothing	222	2,200,900	3,076,571	5,016	4,063	6,381,190
" Ladies' Cloaks, &c	2	27,000	41,225	80	.....	74,000
Coffee and Spices, Ground	4	101,200	412,520	52	.....	519,360
Coffins, Metallic	1	80,000	34,300	60	.....	153,060
Confectionery	18	67,850	165,219	80	31	249,202
Cooperage	90	81,250	130,665	572	.....	396,442
Coppersmithing	5	33,650	45,305	21	.....	77,565
Cordage	7	62,000	62,975	119	.....	119,200
Cotton Goods	3	165,000	230,630	195	100	420,500
Cutlery	6	6,200	3,270	19	.....	16,800
Drugs and Medicines	11	27,400	52,092	31	.....	121,906
Dyeing and Printing	2	600	1,425	3	.....	4,700
Fertilizers	1	1,500	2,000	4	.....	6,400
Fire Arms	1	200	600	3	.....	2,500
Flour and Meal	31	312,010	1,432,057	113	....	1,773,003
Flour Sacks	2	7,000	18,130	7	.....	23,500
Furnaces, Heating	2	24,000	13,100	20	.....	39,000
Furniture	48	1,032,886	559,516	1,840	43	1,830,136
" Bedsteads	4	199,400	103,170	332	.....	377,570
" Chairs	18	352,000	77,766	406	.....	352,085
Gas	1	1,017,350	52,650	200	.....	302,000
Gas Fixtures	1	4,200	2,720	9	.....	12,000
Gasometers, &c	2	17,000	24,000	37	.....	43,500
Glass-staining	2	8,000	10,000	10	.....	17,000
Gloves, Buckskin	1	2,000	1,600	4	10	7,000
Glue	3	45,000	22,000	29	.....	40,400
Gold Leaf	2	2,750	9,600	8	.....	18,000
Grates	2	24,000	13,300	50	.....	85,000
Hames	3	7,000	6,100	24	.....	18,300
Hardware—Files	1	100	75	4	.....	2,496
Bedstead Fasteners	1	6,000	1,440	3	.....	7,040
Building and Saddlery	1	20,000	22,680	50	.....	120,000
Planes	2	6,700	5,490	15	.....	13,000
Squares, Bevels, &c	1	2,000	2,000	4	.....	7,000
Hats and Caps	20	73,000	91,742	60	9	199,432
Hosiery	8	9,500	10,055	19	28	26,950
Ink, Printing	1	1,000	1,988	1	.....	3,600
" Writing	1	2,000	2,800	8	1	15,000
Instruments—Dental and Surgical	6	16,300	11,405	23	.....	31,400
" Optical and Philosophical	3	17,500	4,000	13	.....	16,000
Iron, Bar	1	120,000	140,000	120	.....	200,000
" Founding	9	640,500	373,624	915	.....	920,000
" Perforated	1	4,000	6,508	5	.....	8,750
" Railing	4	24,100	76,815	104	.....	168,785
Ivory, Black	1	5,000	2,000	6	.....	6,000
Japanned Tinware	1	25,000	32 800	75	.....	100,000
Jewelry	10	26,600	30,700	43	.....	80,800
Ladders, Patent	1	2,000	7,500	4	.....	12,500
Lead and Lead Pipe	1	25,000	50,000	5	.....	90,000
Leather	31	570,300	699,141	311	1	1,093,041
Leather Belting and Hose	3	18,500	41,450	16	.....	77,000
Lightning Rods	3	14,000	28,685	15	.....	50,900
Liquors, Distilled	9	316,000	434,141	120	.....	818,400
" Rectified and Manufact'd	48	517,400	2,350,947	172	.....	2,837,809
" Malt	38	940,202	419,107	318	1	881,237
Lithography	1	10,000	12,500	28	1	58,000
Locksmithing and Bell-hanging	10	48,600	18,781	56	.....	67 671
Looking-glasses & Picture Frames	6	40,200	87,654	94	.....	131,075
Lumber, Planed	18	131,000	288,420	123	.....	400,620
" Sawed	5	253,100	310,200	177	.....	488,937
Machinery, Steam Engines, &c	89	1,057,200	810,294	1,414	.....	2,081,300
Malt	3	40,000	115,800	19	.....	164,000

CINCINNATI—*Continued.*

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male hands.	Female hands.	Value of Annual Product.
Marble and Stone Cutting	28	164,300	209,497	479	.....	550,550
Matches	1	27,000	29,605	50	16	122,000
Meats, Cured	33	1,488,600	4,008,145	318	.....	4,543,465
Millinery	29	47,600	81,408	6	240	193,788
Mills, Portable	2	52,000	17,850	8	.....	56,500
Millstones, Burr	2	8,000	4,500	12	.....	16,000
Mineral Water	5	9,750	17,000	31	.....	50,500
Morocco	3	2,100	8,500	11	.....	17,100
Musical Instruments	7	5,600	5,024	14	.....	12,000
Nails, Wrought	4	900	1,715	13	.....	7,385
Oil Cloths	1	3,000	2,150	6	.....	5,000
Oil, Coal	1	25,000	9,000	12	.....	30,000
" Lard, and Candles	18	892,500	2,557,263	255	48	3,176,021
" Linseed	2	60,000	70,800	28	.....	124,000
Paper, Printing	1	30,000	33,240	29	.....	59,280
" Wrapping	3	82,000	42,300	28	.....	102,000
Patterns	4	24,800	3,087	31	.....	30,560
Photographs	16	46,700	13,380	51	12	80,650
Plaster Ornaments and Casts	5	1,450	2,400	10	.....	10,400
Plumbing and Gas-fitting	14	41,300	68,054	79	.....	147,810
Pocket-Books	1	6,000	5,000	10	.....	15,000
Pottery Ware	7	53,500	9,535	86	2	64,712
Printing	32	989,000	783,610	721	320	1,503,101
" Presses	1	15,000	6,400	25	.....	23,500
Pumps and Blocks	3	3,000	1,250	9	.....	7,075
Regalias	2	8,000	4,500	3	9	14,000
Roofing, Composition	1	2,000	7,545	10	.....	12,000
" Metal	5	22,800	65,912	66	.....	125,000
Saddlery and Harness	36	51,550	66,085	141	.....	130,293
Saddle-trees	3	7,300	6,100	15	.....	18,700
Safes, Fire-proof	3	91,000	59,100	145	.....	200,000
" Provision	1	500	735	5	.....	5,000
Sash, Doors, and Blinds	11	305,750	230,580	250	.....	402,020
Saws	3	3,800	3,280	9	.....	13,814
Scales	4	11,800	23,200	26	.....	56,000
Seal Presses	2	14,000	5,500	8	.....	24,000
Sewing Machines	14	39,000	61,108	113	.....	216,905
Shirts	8	34,700	29,300	11	111	61,755
Shoemakers' Tools	1	1,500	4,500	2	.....	8,000
Show Cases	3	5,100	12,000	14	.....	24,000
Silk Frioges, Trimmings, &c	4	11,500	14,300	11	14	41,200
Silver Ware	4	200,000	66,000	33	4	103,000
Silver Plate and Ware	2	13,200	3,720	14	.....	15,500
Soap and Candles	3	11,200	15,583	10	2	31,252
Sofa Springs	1	2,000	6,000	1	.....	7,000
Spikes and Railroad Chairs	1	19,840	75,000	15	.....	93,000
Spokes, Hubs, and Felloes	2	65,000	40,940	79	.....	124,504
Starch	1	25,000	15,000	16	.....	30,000
Stove Foundries	8	223,800	185,159	400	.....	439,000
Terra Cotta Ware	2	11,750	2,345	16	.....	18,000
Tin, Sheet Iron, and C. Ware	62	88,400	154,615	257	.....	393,373
Trunks	0	64,800	86,347	221	.....	242,800
Turnings and Mouldings	1	10,000	15,000	20	.....	54,000
Turning and Scroll Sawing	9	6,600	6,025	31	.....	24,555
Type and Stereotype Foundries	8	99,000	61,500	162	20	210,000
Umbrellas	2	10,000	10,614	9	5	31,450
Upholstery	17	73,700	120,403	95	57	245,688
Varnish	3	200,000	193,700	28	.....	379,000
Venetian Blinds	4	3,000	10,550	18	6	20,700
Vinegar	14	16,700	33,547	17	.....	67,812
Wagons, Carts, &c	42	85,425	80,558	168	.....	146,331
White Lead, &c	3	110,000	233,252	103	.....	305,600
Willow Ware	7	4,000	2,972	11	.....	8,395
Wire Work	2	25,000	17,000	87	.....	57,500
Wooden Ware	2	60,000	41,400	72	.....	114,500
Woolen Goods	1	1,000	600	2	1	1,580
Wool Pulling	1	2,000	7,600	2	.....	9,225
Total, including Miscell's Manufactures, not above specified,[1]	2,077	$18,887,693	$25,087,603	23,620	6,493	$46,691,017

(1) Catawba wine, which is largely made in Cincinnati, is included in the Statistics of Agricultural Products, and not of Manufactures.

The Greenwood Iron-works—Miles Greenwood, Proprietor,

is undoubtedly the most prominent manufacturing establishment in Cincinnati, and is fairly entitled to rank among the great manufactories of the United States. It was established by its present proprietor in 1832, and has grown by gradual enlargement until now it covers upward of four acres of ground. Commenced with a view of making principally heavy castings for Mill work, the range of its productions has extended until now it includes small as well as large castings, embracing a greater variety than probably any other manufacturing establishment in the country.

In the introduction of several important departments of Iron manufactures Mr. Greenwood has been the pioneer in the West. He was among the first to provide patterns for architectural castings, and engage largely in the construction of Iron Building work. Since 1843 this has been a branch of his business, and, with the increased use of Iron for building purposes, has grown in importance, each year adding to the list of buildings erected by him in all the principal cities of the Northwest and Southwest, from Cincinnati and St. Louis to Memphis and New Orleans.

In the Eastern States the manufacture of Stoves and of Heating and Ventilating Apparatus is usually made a specialty, and carried on in separate and distinct establishments, but both of these branches have for a long time been successfully prosecuted in the Greenwood Foundries. From a thousand to twelve hundred tons of Stove castings are now made here annually, and the Steam Heating Apparatus of Greenwood's manufacture has been applied in a large number of public and private buildings.

The Machine Department of these Works is quite extensive, and has turned out every thing that is usually made in Machine shops, and some novelties. Besides stationary and portable steam-engines, planing and saw-mill machinery, turbine wheels, boring tools for oil wells, etc., Portable Gas Works are made to a considerable extent, and the demand for them is increasing. Steam Ploughs have also been cast here that worked quite successfully; one, with six in a gang, having ploughed, with three men and two and one half cords of wood, fourteen acres in a day. Steam Fire Engines were made here, that by their success first demonstrated the practical value of this machine, that is now employed as an important auxiliary in the Fire Department of all the large cities in the United States.

But the most interesting branch of the extensive business carried on

in this establishment is the manufacture of Hardware and Malleable Iron Work. For more than twenty years Messrs. Greenwood & Co. have been the leading manufacturers of Hardware in the West, and the list of their productions, at first limited to a few designed for building purposes, has increased and extended, until now their catalogue contains more than fifteen hundred distinct articles, including about thirty varieties of Locks and Latches, from the plainest to the best styles of Vault, Safe, and Bank Locks. Butt Hinges are made here far superior to the English, which are often unequal in thickness, imperfectly jointed, and being light are apt to break when exposed to sudden jars or strains. The English Commissioners to the World's Fair, held in New York in 1852, refer to this establishment in their Report on the Industry of the United States, and say:

"Probably the most extensive, and certainly the best conducted and most systematically arranged establishment for the production of miscellaneous Hardware articles in the United States, is that of Messrs. Miles Greenwood & Co., Cincinnati, Ohio. In addition to Foundries for large castings common to nearly all establishments of this class, the manufacture of the smaller cast-iron articles is fairly and successfully established, and most of those coming under the denomination of 'Builders Hardware,' which a few years ago were almost entirely supplied by this country (England), are now produced here in immense quantities, to supply the constantly necessary requirements of the Western States.

"In the important item of Butt Hinges there can be no doubt of the great superiority of those manufactured by Messrs. Greenwood, alike as regards the general quality of the metal as in the adaptibility of strength or weight of material to size. In the finish of the joints great accuracy is obtained, whilst the labor of filing is saved by grinding the joints of the hinges on stones adapted to the purpose, and driven by steam power. Most of the Hardware articles for domestic use, usually manufactured by a large class of the Hardware establishments of this country, are also made in Cincinnati, and the general finish of the articles is certainly of a superior character. Malleable cast-iron is also manufactured by Messrs. Greenwood into a great variety of articles usually made of wrought-iron. These consist of braces or bit-stocks, screw-wrenches, bed-keys, chest-handles, gun-mountings, saddlers' ironmongery and coachware, kettle-ears, thumb-screws, nuts, etc., and have the reputation of being very excellent substitutes for the more costly wrought-iron articles."

Mr. Greenwood, we think, was the first in this country to engage largely in the manufacture of Butt Hinges, having commenced it as early as 1840, which precedes, by at least two years, its establishment in

Providence, Rhode Island, which is now the principal seat of this manufacture.

During the late Rebellion the resources of this great establishment were employed in sustaining the Government, and supplying it with warlike material, in spite of much earnest entreaty on the part of the friends of the Southern Confederacy, and still more formidable obstacles interposed. The Secretary of the Treasury wrote to Mr. Greenwood that his machinery should be employed in manufacturing Arms, and the request was to a loyal man equivalent to a command. For a time all other business was suspended. Rifling machines were built, and smooth bore muskets were rifled at the rate of a thousand a day. Two hundred bronze field guns—six and twelve pounders—were cast in a brief period, besides turning out a large quantity of gun carriages and other warlike material. At the beginning of the war, General Fremont, then commanding in the West, required in great haste a number of anchors for a pontoon bridge, and Mr. Greenwood made and shipped twelve anchors within twenty-four hours after receiving the order. At a later period, when other builders declined the contract, he undertook to construct a turret Monitor, and completed it at a cost of $625,000.

The distinguishing mental characteristics of this eminent manufacturer, like those of leaders in other departments, are originality, perseverance, and courage. While Chief Engineer of the Fire Department of Cincinnati he foresaw the advantages that would result from the introduction of Steam Fire Engines and a Paid Fire Department, and he advocated both these measures with persistent energy, notwithstanding the most determined opposition, until he had succeeded in establishing them, for which, afterward, the property holders, as a testimonial of their appreciation of his services, presented him a service of plate of a value of $3,000. When the friends of the Southern Confederacy found that neither their entreaties, nor threats of the loss of Southern custom could prevail upon him to forbear in aiding the Government, by furnishing warlike material, they resorted to intimidation, setting the establishment on fire three several times, involving a loss of $100,000; but the attempt, so far from inciting timidity, tended to arouse his courage and renew his energy.

We shall allude to only one other feature in the history of this interesting establishment. In Works so extensive as these there are many boys employed, who have never had educational advantages, and for all such Mr. Greenwood has provided a school-room, and employed a teacher, who instructs them two hours every morning. His paternal regard for young employees contrasts most favorably with the barbarous treatment of children, of which there are many sad instances in the history of English manufactories.

Mitchell & Rammelsberg's Furniture Manufactory,

In Cincinnati, is the largest in the West, and one of the largest in the United States. It dates its origin from 1844, when Mr. Robert Mitchell and Mr. Rammelsberg, since deceased, commenced business with a very limited capital, and erected a four-story building forty by eighty feet, which two years afterward was totally destroyed by fire. The advantages of machinery in the manufacture of Furniture had, however, within that time been fully tested, and they rebuilt on a larger scale, and subsequently made additions as the business increased, until now three large buildings are occupied by them for manufacturing purposes; one, eighty-one feet square, with eight floors; one, one hundred and twenty by sixty feet, also of eight floors; and another, one hundred and fifty-two by eighty feet, of seven floors, with a building principally used for ware-rooms, one hundred and fifty by thirty-three feet, of seven floors, making altogether a floor surface of over five acres.

In the application of machinery to the working of wood our countrymen are in advance of all other nations, and probably nowhere in the United States are its advantages, when employed in the manufacture of Furniture, more distinctly manifest than in this Cincinnati Factory. Messrs. Mitchell & Rammelsberg have over eighty different machines, for turning, sawing, planing, moulding, jointing, mortising, tenoning, and boring, besides machines for a variety of miscellaneous uses. When we reflect that one man with a machine, even if not a mechanic, can do the work of from four to ten mechanics, the rapidity of production in an establishment so extensive as this can be imagined. Each of the Factory buildings is supplied with an Elevator, working the entire height of the building, and is used both for distributing the material, after the machine work is done, to those who put it together and finish it, and also for removing the finished articles to the Warehouse. The buildings are also furnished with a water-pipe and fifty feet of hose ready for use in each story, by means of which a large stream can be thrown in a few seconds of time, although the danger of a conflagration is materially lessened by the fact that no fire is used in any part of the buildings, which are heated by steam pipes, except under the boilers.

Furniture of all kinds and styles of finish is manufactured at this establishment, ranging in price from the cheapest to the most costly, and adapted to the wants of all classes of purchasers. About four million feet of lumber are annually worked up into various articles of household and office furniture, and a force of from five to six hundred men is constantly employed.

Mr. Robert Mitchell, who since the decease of Mr. Rammelsberg has been sole proprietor of this extensive establishment, though the firm-name is still maintained in the business transactions, is distinguished for urbanity and public spirit, as well as for mechanical skill and enterprise, and is an excellent representative of the most intelligent of the manufacturers of the West.

At Canton, Ohio, are two of the largest Agricultural Implement Manufactories in the United States.

C. Aultman & Co.,

Who supply the Western and Southern States with Mowers, Reapers, and Threshers to the amount of a million of dollars annually, commenced business in Canton in 1851, as manufacturers of Stoves and Ploughs, with a very limited capital. In 1855, their Works were destroyed by fire, but through the aid of prominent men of the city they succeeded in rebuilding them on a larger scale, and equipping them with a great variety of suitable machinery for manufacturing Mowing, Reaping, and Threshing Machines, to which they then exclusively devoted themselves, meeting with extraordinary success. The "Buckeye Mower and Reaper," manufactured at their Works, is one of the most popular machines ever introduced to agriculturists; for though the firm in 1863 made six thousand, and in 1864 seven thousand, the demand was not half supplied. It combines a series of improvements, the inventions of the mechanics of this firm, which have been elsewhere alluded to. Besides Mowers and Reapers, Messrs. Aultman & Co. manufacture annually about three hundred Threshing Machines called the "Sweepstake Thresher," for which the demand is very great.

The members of this firm, beginning as humble mechanics, have been remarkably successful, and besides owning real and personal estate, they are also the proprietors of the "First National Bank of Canton." The death of one of their firm has induced them, in order to avoid the legal consequences of such an event in the future, to obtain a Charter of Incorporation, and they are now a corporation styled "C. Aultman & Co.," with a capital of $450,000, all paid in.

In 1863, a large branch of their establishment, costing $150,000, was built at Akron, Ohio, which is also in a very flourishing condition.

Ephraim Ball,

Whose inventions and agricultural improvements have been previously noticed, has also an extensive establishment in Canton for the manu

facture of what is now known as "Ball's New American Harvester." The buildings are mostly of brick, very substantially constructed, and have an aggregate area of nearly sixty thousand square feet. The rooms, of which there are some seventeen in number, are equipped with machines and tools of the best description, with capacity for turning out six thousand machines per annum. The most careful supervision is exercised in all parts of the work; skilful mechanics and the best materials only are employed, and the result is a finely finished machine, which has attained extraordinary popularity.

As Ball's Harvester is manufactured in several other places in the United States under license from the inventor, whose patent revenue amounts to a large sum annually, it is believed that fully ten thousand were made in the United States in 1865.

MANUFACTURES OF CLEVELAND, OHIO.

[The following are the Statistics of Manufactures of Cuyahoga County, of which Cleveland is the capital, for the year ending June 1, 1860, as prepared for this work, at the Census Office, in advance of official publication.]

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male hands.	Female hands.	Value of Annual Product.
Agricultural Implements	6	$19,400	$43,750	92	.....	$120,500
Bags	1	3,000	15,000	4	5	21,067
Boots and Shoes	19	66,189	86,979	217	73	222,830
Brass Foundries	2	6,400	18,000	10	.....	28,009
Bridges	1	15,000	50,340	50	.....	104,000
Bricks	8	12,450	10,285	88	.....	42,650
Brushes	1	5,000	500	18	3	4,700
Cabinet Furniture	13	81,400	28,578	138	4	71,500
Carriages	5	43,000	19,008	75	.....	53,675
" Children's	1	1,400	355	5	.....	4,000
Cars	1	25,000	20,000	30	.....	50,000
Chairs	4	50,500	17,950	180	.....	99,000
Cider and Vinegar	3	12,700	8,685	6	.....	33,585
Cigars and Tobacco	4	8,700	8,500	13	.....	28,105
Clothing	27	235,500	367,892	452	500	621,133
Confectionery	1	2,000	8,150	5	3	13,000
Copper Smelting	1	10,000	252,500	15	.....	266,500
Cordage	1	3,000	2,000	6	.....	5,000
Flour and Meal	21	220,200	895,448	74	.....	1,008,120
Glue	2	15,000	5,740	7	1	63,400
Grindstones	6	77,200	10,900	115	.....	58,000
Gunpowder	1	42,000	71,500	11	.....	80,000
Hardware Tools	1	500	275	4	.....	3,000
Files	1	1,500	1,000	10	.....	5,000
Saws	1	4,000	9,000	5	.....	13,000
Hats and Caps	5	22,100	15,600	5	16	24,590
Harness	11	16,400	17,981	35	.....	41,649
Hosiery	1	800	1,000	2	.....	2,000
Iron Foundries	5	77,800	35,150	55	.....	74,170
Iron Railing	1	800	1,225	4	.....	2,400
Iron Rolling	3	280,000	735,200	374	.....	1,209,500
Leather	7	24,400	10,400	21	.....	30,480
Lime	1	10,000	9,500	10	.....	28,000
Liquors, Malt	15	143,000	83,067	79	.....	191,205
" Rectified	5	23,600	102,100	16	.....	131,273
Locomotive Lamps	1	10,000	3,800	7	.....	6,025
Lumber, Planed	2	19,000	12,372	38	.....	31,000
" Sawed	48	89,700	53,870	129	.....	127,657
Machinery, Steam Engines, &c	17	151,400	142,854	274	.....	318,947
Marble Work	4	27,600	24,350	70	.....	92,700
Millinery	1	1,500	1,550	.....	7	4,000
Mill Furnishing	2	5,000	10,000	12	.....	35,000
Mineral Water	2	5,000	3,500	8	.....	10,000
Morocco Dressing	2	6,500	7,450	17	.....	10,500
Musical Instruments	3	4,200	1,389	6	.....	11,050
Oil Cloth	1	5,000	4,970	9	.....	20,000
Oil, Coal (Refined)	1	2,000	5,000	3	.....	8,000
Pails and Buckets	2	45,000	81,250	110	.....	147,650
Paints	2	5,500	1,780	3	.....	7,000
Paper	3	132,000	98,800	88	16	103,350
Printing	10	245,4 4	89,087	174	11	257,334
Pumps	1	2,000	1,250	2	.....	2,500
Safes	2	1,900	4,385	7	.....	8,200
Sash, Doors, and Blinds	5	75,000	46,775	98	.....	112,200
Scales, Platform	1	1,000	810	6	.....	6,000
Sewing Machines	1	7,000	1,500	10	.....	6,000
Shingles	11	13,250	14,315	29	.....	28,445
Shoe Pegs, &c	1	9,000	1,500	11	4	15,000
Soap and Candles	9	55,500	181,683	52	.....	270,540
Stoves	1	50,000	38,000	65	.....	100,000
Tin, Copper, and Sheet Iron	14	41,000	70,488	73	.....	135,281
Trunks	4	4,600	3,100	14	.....	9,370
Wagons	6	5,800	4,225	24	.....	13,600
Willow Ware	2	10,300	3,272	14	5	21,500
Wooden Ware	3	8,000	4,545	15	.....	24,719
Total, including Miscell's Manufactures, not above specified,	388	$2,676,963	$4,028,315	3,794	661	$6,987,737

MANUFACTURES OF CHICAGO, ILLINOIS.

[The following are the Statistics of Manufactures of Cook County, of which Chicago is the capital, for the year ending June 1, 1850, as prepared for this work at the Census Office, in advance of official publication.]

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male hands.	Female hands.	Value of Product.
Agricultural Implements:						
Miscellaneous	1	25,000	6,000	27		35,000
Mowers and Reapers	1	500,000	66,210	200		414,000
Threshing Machines	2	137,000	15,890	67		80,000
Alcohol	2	17,500	333,750	10		520,000
Blacksmithing	9	18,050	7,210	27		30,150
Boat Building	2	2,500	1,505	8		3,700
Bone Black	1	3,000	990	10		3,500
Book Binding, &c.	1	1,000	3,330	4	3	9,300
Boots and Shoes	00	75,800	05,543	253	3	216,231
Boxes, Packing	5	24,000	42,045	70		86,040
Boxes, Paper	2	4,500	2,050	6	3	8,000
Brass Founding	0	54,000	51,490	08		136,000
Bread and Crackers	11	121,800	238,364	119	9	391,688
Brick	5	95,700	15,795	266		139,200
Brushes	1	200	145	2		600
Cabinet Furniture	18	83,750	68,311	209	3	247,803
Camphene	1	6,000	180,325	2		190,000
Carpentering	10	15,250	34,390	50		73,975
Carriages	25	253,000	55,595	188		213,070
" Children's	1	6,000	1,480	4		11,100
Cars	3	130,000	37,500	82		82,000
Car Wheels	1	10,000	43,500	8		56,000
Cigars	6	0,650	12,285	22		65,715
Cisterns	1	1,000	1,000	3		3,100
Clothing	28	115,000	331,446	321	82	545,409
Coffee and Spices	3	02,000	158,090	27		192,700
Coffins	4	9,200	3,984	7		12,000
Confectionery	5	15,000	84,400	26		143,950
Coopering	20	205,480	77,725	243		178,765
Copper Smithing	1	250	460	1		1,100
Cotton Bags	1	1,000	70,000	6	8	90,000
Cotton Batting	1	1,500	10,000	5		15,000
Engraving	2	3,300	2,150	12		12,550
Flour	8	103,000	970,550	78		1,135,125
Gas	1	768,000	60,000	140		245,000
Gas Fittings	1	7,000	2,000	13		15,000
Glue and Oil	2	12,500	57,000	60		80,840
Hardware—Files	1	2,000	1,062	3		4,320
Hats and Caps	4	10,400	10,930	12	4	24,780
Hay Pressing	1	25,000		22		13,000
Iron Founding	0	120,000	89,075	95		221,000
Iron, Rolled	1	200,000	445,000	195		660,000
Iron Work, Ornamental	1	2,000	1,950	10		6,000
Ivory Turning	1	1,000	2,600	1		3,700
Jewelry	5	4,800	15,257	10		27,000
Leather	3	31,500	16,020	12		25,728

CHICAGO—*Continued.*

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male hands.	Female hands.	Value of Product.
Lime	1	$18,000	$9,9[illegible]0	10	.....	$37,822
Liquors, Rectified	6	92,000	119,3[illegible]0	37	.....	271,480
Liquors, Malt	14	438,500	214,882	140	.....	572,240
Liquors, Bottled	1	10,000	27,000	0	.....	40,000
Champagne	1	60,000	110,300	36	.....	216,000
Lightning Rods	1	10,000	5,100	12	.....	20,000
Looking-glass and Picture Frames	2	2,500	1,200	6	.....	4,800
Lumber, Planed	6	49,000	356,875	74	.....	417,828
Malt	1	2,000	9,240	2	.....	10,250
Machinery, &c	16	346,600	249,034	597	.....	582,500
Marble and Stone Cutting	4	177,000	131,000	182	.....	227,000
Masonic Regalia	1	1,000	4,500	1	4	7,000
Matches	2	1,800	487	6	.....	4,375
Mattresses	1	800	840	1	.....	1,280
Meats, Cured	1	10,000	6,000	2	.....	10,000
Millinery	12	26,600	72,075	3	72	133,400
Mineral Water	1	3,000	10,000	5	.....	15,000
Morocco	1	10,000	20,000	7	.....	34,000
Musical Instruments, Pianos	2	15,500	7,0[illegible]0	7	.....	23,600
Plaster Work (Ornamental)	2	1,400	2,280	10	.....	9,000
Painting	4	4,[illegible]00	4,531	19	.....	22,805
Pottery-ware	1	300	250	1	.....	1,000
Printing and Publishing	19	307,700	190,716	351	5	525,022
Rope and Cordage	1	100	1,340	3	.....	2,500
Saddlery and Harness	13	26,025	21,681	52	.....	50,707
Sash, Doors, and Blinds	13	188,800	124,104	278	.....	373,247
Scales	1	5,500	945	10	.....	10,000
Sewing Machines	2	2,800	440	4	.....	3,050
Shingles	4	35,000	27,300	72	.....	61,000
Shirts	3	1,600	7,064	1	26	23,581
Silver Ware	1	20,000	25,520	9	.....	24,000
Silver Plated Ware	1	2,000	2,500	6	.....	11,000
Soap and Candles	11	48,300	121,337	43	.....	242,080
Staves	1	5,500	14,0[illegible]0	12	.....	32,500
Sugar Refining	1	13,000	727,000	75	.....	800,000
Tin and Sheet Iron Ware	10	20,1[illegible]0	22,092	28	.....	57,983
Trunks and Valises	3	15,000	11,6[illegible]6	26	.....	47,020
Type Founding	1	25,000	6,210	10	6	24,600
Upholstering	2	350	400	2	.....	1,320
Vinegar	2	3,000	6,000	4	.....	12,840
White Lead	2	24,000	153,000	29	.....	233,000
Wigs and Hair-work	2	3,000	4,000	7	.....	18,700
Wood Turning, &c	3	2,[illegible]00	1,2[illegible]0	4	.....	4,800
Total	467	$5,420,725	$6,591,445	[illegible],225	228	$11,954,220

(1) Pork and Beef Packing, except the above small establishment, not returned by Marshals. There are fifty packers, whose annual product in 1859-60 was about five millions, making the whole value of products of industry in Cook County nearly $17,000,000.

MANUFACTURES OF DETROIT, MICHIGAN.

[The following are the Statistics of Manufactures of Wayne County, Michigan, of which Detroit is the capital, for the year ending June 1, 1860, as prepared for this work at the Census Office, in advance of official publication.]

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male hands.	Female hands.	Value of Annual Product.
Agricultural Implements	8	$27,000	$10,043	46		$35,268
Baking Powder	1	600	6,049	1		870
Blacksmithing	25	15,350	10,672	58		39,487
Blocks and Spars	1	4,000	7,000	5		15,290
Boots and Shoes	35	42,000	52,758	132		125,702
Bread	11	10,000	63,396	39		99,200
Bricks	10	56,610	10,942	265		98,960
Brooms	1	500	4,000	3		6,250
Carpentering	5	9,300	10,512	45		37,228
Carriages	5	3,000	4,151	16		12,700
Charcoal	1	100	75	2		540
Churns (patent)	1	2,000	450	4		5,400
Cigars and Tobacco	1	2,300	6,000	3		7,000
Clothing	11	36,300	43,530	51	42	77,800
Coffins	1	4,000	1,800	3		6,000
Coopering	8	36,400	11,027	90		48,115
Copper smelting	1	100,000	1,521,000	40		1,500,000
Cordage	2	1,800	2,195	5		3,720
Cutlery and Edge Tools	1	1,500	2,114	4		7,000
Fisheries	5	57,144	3,108	105		30,796
Fish Nets	1	100	2,132		25	5,000
Flour	15	109,300	274,821	35		313,837
Furniture	12	55,125	25,451	121		67,280
Furs	1	47,700	75,000	48		143,000
Glue and Varnish	1	400	4,599	8		16,100
Gold Pens	1	200	510	3		2,800
Gun making and repairing	2	3,000	2,050	9		8,000
Hats	3	4,100	5,660	5	8	17,125
Ice	2	3,800	5,830	9		13,000
Iron, Bar and Railroad	1	252,000	323,300	300		585,000
Iron Forging	1	20,000	3,900	12		5,000
Iron Founding	3	58,000	42,905	66		9,000
Iron, Pig	2	210,000	77,972	120		145,000
Jewelry and Silver Ware	1	1,200	3,000	3		4,500
Leather	9	223,000	242,045	108		380,225
Lime	4	43,000	19,475	10		21,638
Liquors, Malt	21	225,150	113,604	93		301,163
" Spirituous	1	500	1,600	2		3,200
Lumber, Sawed	43	901,950	318,701	466		619,049
Machinery, Steam Engines, &c	12	1,152,800	228,261	505		608,478
Marble Cutting	5	31,500	23,103	45		50,000
Melodeons	1	10,000	1,200	15		15,000
Milk Safes	1	2,000	400	7		4,500
Millinery	1	1,000	200		3	1,800
Morocco	1	4,000	1,000	5		19,000
Peppermint, Distilled	1	200	275	4		600
Pianos	1	5,000	852	4		5,000
Picture Frames	1	1,000	240	3		2,800
Plaster Ornaments	1	500	50	1		750
Potash	8	8,075	11,305	26		35,020
Pottery Ware	2	2,425	1,445	11		12,475
Printing and Publishing	3	102,000	37,000	135		130,100
Saddlery and Harness	5	2,500	6,091	10		19,716
Sashes, Doors, &c	16	41,007	27,497	157		125,929
Saws and Files	1	3,000	40,850	20		70,000
Shingles	5	1,850	1,710	9		3,800
Ship and Boat Building	3	60,980	20,800	65		71,100
Shirts	1	400	600	4		1,650
Shoe Findings	1	4,000	2,605	10		12,000
Soap and Candles	4	52,700	95,495	52		137,915
Stone Quarrying	1	10,000		25		5,000
Sugar Boxes	1	1,500	100	4		1,200
Tin Ware	12	35,400	34,005	43		82,950
Trees Hoops	1	1,000	500	4		1,600
Wheelwrighting	10	18,200	7,003	52		37,005
Wool Carding	1	1,700	200	2		2,400
Wool Pulling	1	10,000	18,569	10		25,000
Total	368	$4,132,206	$3,711,512	3565	78	$6,400,013

MANUFACTURES OF ST. LOUIS.

[The following are the Statistics of Manufactures in St. Louis county, Missouri, for the year ending June 1, 1860, as prepared for this work at the Census Office.]

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male hands.	Female hands	Value of Annual Product.
Agricultural Implements	3	55,090	67,513	63		123,200
Alcohol, Camphine, &c.	3	30,000	160,050	10		187,596
Bags	1	8,000	71,500	6		76,000
Bakers' Bread	26	40,100	110,517	64		190,230
Baskets	11	710	350	17	10	8,950
Billiard Tables	1	4,000	3,200	2		8,000
Blacksmithing	22	22,275	24,372	69		71,080
Blocks and Pumps	1	2,500	350	2		2,850
Bookbinding	4	7,500	7,974	14	3	15,100
Boots and Shoes	167	149,215	161,658	501	30	452,581
Boxes, Packing	2	2,700	9,550	16		24,000
" Paper	3	1,400	1,274	6		5,355
Brass and Bell Founding	7	28,500	31,002	30		110,020
Brick	50	205,700	99,095	1,213		629,700
Brooms	3	2,600	3,175	9		7,125
Brushes	2	10,000	4,700	34		24,000
Carpenters' Tools	2	3,000	2,215	6		6,100
Carpentering	28	113,000	250,900	386		542,778
Carriages	5	70,500	27,538	98		123,050
Cars	2	38,000	100,100	60		188,000
Carving	2	700	660	2		2,700
Chemicals	1	90 000	27,250	18		86,000
Cigars	57	98,210	114,075	278	3	354,273
Clothing	148	300,880	406,631	585	261	830,575
Coffins	2	2,350	2,205	0		8,325
Confectionery	5	15,200	71,147	39	3	100,685
Coopering	48	58,700	120,140	378		475,589
Cotton Goods	2	160,000	110,000	85	85	230,000
Cow-bells	1	4,000	2,250	5		11,000
Dentistry	1	1,100	4,550	4		10,000
Drugs and Medicines	6	51,100	68,190	48		116,000
Engraving	2	1,500	900	10		4,000
Flour and Meal	18	999,000	4,260,080	230		4,979,845
Furniture	31	93,650	47,204	139		153,167
Gas	1	600,000	46,750	60		416,206
Gas Fittings	3	47,000	25,250	34		58,200
Glass Ware	2	50,000	27,300	140		282,000
Grates, Enamelled	1	1,000	4,375	3		8,000
Hair-work	4	10,000	4,150	12	3	21,200
Hats and Caps	10	34,550	14,850	25	8	43,070
Hosiery	2	11,000	8,200	10		14,880
Ice	1	10,000	200	15		25,000
Ink	1	3,000	555	4		1,000
Iron Forging	2	47,000	29,980	27		70,000
" Founding	6	177,000	174,010	217		347,000
" (Stoves)	4	785,000	278,700	402		810,000
" Machinery	23	1,071,000	595,070	1,332		1,509,110
" Pavements	1	5,000	16,032	25		49,000
" Rolled	2	275,000	132,052	126		335,000
" Railing	3	2,350	1,350	0		8,160
Jewelry	9	17,750	15,800	22	5	40,338
Lamps	1	2,500	1,543	5		6,050
Lead	1	5,000	100,000	12		130,000
Leather	9	108,100	165,280	70		311,250
" Currying	2	3,500	5,644	4		8,400
" Belting	1	15,000	25,000	0		32,500
Lightning-rods	1	1,200	2,537	4		4,800
Lime	6	39,800	39,400	63		151,100
Lithography	1	1,000	134	4		900
Locks	3	830	1,120	6		6,075
Malt	1	80,000	15,000	12		27,000
Marble	6	55,000	50,900	175		167,037

ST. LOUIS—*Continued.*

Manufactures.	No. of Establishments.	Capital Invested.	Cost of Raw Material.	Male hands.	Female hands.	Value of Annual Product.
Matches	1	$100	$75	2	1	$900
Mathematical Instruments	1	2,700	1,200	3	.....	4,000
Malt Liquors	85	705,800	427,110	258	.....	1,155,000
Mills, Portable	1	25,000	10,450	.....	.....	25,000
Millinery	9	17,150	26,228	5	.....	88,469
Mustard	2	17,000	30 970	11	.....	72,000
Oil, Coal	1	30,000	50,000	9	.....	80,000
" Lard	1	100,000	120,000	10	.....	135,000
" Cotton Seed	1	40,000	43,000	30	.....	66,000
Organ	2	11,500	3,600	12	.....	14,000
Perfumery	1	1,000	600	1	.....	1,800
Pianos	4	5,300	2,079	4	.....	8,900
Picture-frames	1	23,000	18,000	12	.....	25,000
Planed Lumber	4	85,000	78,000	95	.....	161,000
Plumbing	1	7,370	10,305	10	.....	35,000
Pork, Packing	7	1,090,000	1,255,529	264	9	1,587,686
Pottery	2	2,700	205	5	.....	5,000
Printing	6	83,000	61,552	130	.....	195,054
Rope and Bagging	14	474,130	1,029,100	277	187	1,189,018
Roofing	3	47,500	17,175	23	.....	37,800
Saddle trees	3	3,000	3,955	39	.....	27,428
Saddlery	32	102,350	132,823	208	2	330,244
Saws	2	53,000	30,800	20	.....	87,000
Safes	1	15,000	39,205	25	.....	60,000
Sashes, Doors, and Blinds	7	124,000	121,495	214	.....	304,847
Sawed Lumber	26	372,088	260,938	150	.....	453,820
Scales	2	6,000	1,865	12	.....	17,000
Show-cases	1	5,000	2,200	5	.....	10,000
Sausages	11	3,500	3,820	12	.....	11,420
Shirts	3	1,900	3,572	.....	13	10,893
Silver-plating	1	3,000	1,800	7	.....	11,000
Soap and Candles	2	22,500	50,000	31	.....	75,000
Spokes and Hubs	10	590,800	1,254,778	232	55	1,586,280
Spices (ground)	1	140,000	67,500	80	.....	160,000
Stair-building	1	30,000	25,600	15	.....	60,000
Steamboat-building	2	600	344	4	.....	2,050
Stone-quarrying	3	12,000	18,805	87	.....	45,825
Stucco-work	30	92,300	3,251	225	.....	227,376
Sugar-refining	2	1,500	1,100	4	.....	10,000
Tents and Awnings	1	1,000,000	1,409,000	216	.....	1,800,000
Tin and Sheet-iron Ware	1	3,000	4,000	4	4	6,000
Tobacco	43	179,740	158,634	186	.....	322,825
Trunks	6	109,700	143,693	279	12	263,709
Trusses	3	42,500	8,085	40	.....	46,000
Turning	2	4,500	1,381	5	4	8,600
Trimmings	2	108,000	237,000	55	.....	311,500
Upholstery	8	3,000	3,725	11	.....	10,357
Vinegar	6	36,950	56,450	40	42	126,070
White Lead	7	14,500	38,443	11	.....	61,760
Whips	3	158,000	270,500	65	.....	351,500
Wooden-ware	2	700	1,200	5	.....	4,500
Wool-carding	1	75,000	47,500	60	.....	150,000
Wagons, Carts, &c	1	500	750	1	.....	1,050
	41	118,600	71,773	215	.....	265,710
Total	1,125	$12,636,508	$15,005,012	11,352	752	$27,637,423

MANUFACTURES OF WILMINGTON, DELAWARE.

[Between Philadelphia and Baltimore, about twenty-eight miles from the former place, is the important manufacturing town of Wilmington, Delaware. We are informed by Joseph Lea, Esq., of Philadelphia, that there is now in the possession of Edwin Mitchell, of the same city, a sample of calico which was made in Wilmington before 1795, by a French Marquis, and which is a highly creditable specimen of calico printing. At the present time there are several very important manufacturing establishments in Wilmington and its vicinity, including Dupont's Powder-mills, Harlan & Hollingsworth's Car-works and ship-yards, Lobdell's car-wheel works, Betts' Engine and boiler-works, Pennock's Agricultural implement works, and others.

The following are the Statistics of Manufactures of New Castle County for the year ending June 1, 1860, the greater part belonging to Wilmington.]

Manufactures.	No of Establishments.	Capital Invested.	Cost of Raw material.	Male hands.	Female hands.	Value of Annual Product.
Agricultural Implements	7	38,500	20,878	62		63,571
Axes	2	10,500	5,855	17		15,650
Bolts, Nuts, &c	1	8,000	20,100	17		30,650
Bone Dust	1	3,000	3,950	3		5,713
Boots and Shoes	42	79,075	95,855	223	54	196,241
Brass-founding	3	12,000	7,225	7		10,225
Bread and Crackers	4	19,500	56,780	26	4	80,360
Brick	4	59,000	17,650	210		73,000
Cabinet Furniture	13	60 100	21,707	53	4	49,347
Cars	1	50,000	54,500	100		100,000
Car Springs	1	8,000	15,775	18		24,750
Carriages	16	204,850	236,260	522	1	553,250
Cigars	8	10,000	20,410	52		44,080
Clothing	19	68,675	100,708	62	167	177,340
Confectionery	2	11,000	16,130	9	4	27,460
Cotton Goods	11	582,500	590,102	520	589	941,703
Drain Tile	1	6,000	1,625	8		6,300
Fire Brick	1	4000	1,500	3		15,000
Flour and Meal	30	471,762	1,297,061	92		1,537,266
Gunpowder	1	500,000	358,640	225		600,000
Horse-shoe Nails	1	100	935	3		2,496
Hoop-skirts	1	2,000	800	2	3	4,125
Iron-founding	5	312 000	436,090	264		658,750
Iron, Rolled	4	100,000	112,254	83		102,600
Leather	5	122,900	168,066	51		237,080
Leather Hose and Belting	1	100	4,500	1		5,500
Machinery, Steam-engines, &c	5	237,000	136,650	325		348,500
Machinists' Tools	1	30,850	7,100	22		22,142
Malt	1	7,000	11,650	3		15,000
Masts and Spars	1	1,000	2,000	3		4,170
Metallic Kegs	1	5,000	6,000	12		15,000
Morocco	7	160,000	329,962	204	32	461,650
Paper	2	280,000	286,439	66	27	345,000
Patent Leather	1	95,000	111,400	100		100,750
Plaster, Ground	2	4,800	4,945	6		7,600
Pottery-ware	3	7,300	2,615	12		12,187
Quercitron Bark	1	2,000	4,800	2		8,100
Sails	1	1,000	4,130	3		6,530
Saddlery and Harness	7	32,225	22,078	40		48,245
Sashes, Doors, and Blinds	4	34,000	11,886	27		29,436
Sewing-machines	1	10,000	2,875	15		15,000
Ship-building	6	293,500	327,300	558		574,650
Ship-smithing	3	5,000	5,300	12		13,925
Shirts	1	2,000	1,295	1	8	4,250
Snuff	2	25,000	11,600	12		47,200
Soap and Candles	1	25,000	24,730	8		41,500
Spokes and Felloes	1	16,000	7 000	14		12,000
Spices, Ground	1	60,000	40,000	8	2	60,000
Stone and Marble-cutting	8	17,700	14,755	18		25,990
Tin, Sheet-iron, and Copper-ware	10	49,300	40,069	61		70,795
Turning	3	3,500	9,850	12		10,068
Wool-carding	2	1,000	3,000	3		3,600
Woolen Goods	4	117,000	75,807	76	38	153,035
Total, including Miscell's Manufactures, not above specified.	380	$4,863,472	$5,513,066	4,809	948	$8,963,440
Aggreg. of State of Delaware in 1860,	615	$5,452,887	$6,028,016	5,465	956	$8,892,902
" " " 1850,	531	$2,978,945	$2,864,607	8,237	651	$4,649,296

ARE.

LAWARE.

les from the former
Delaware. We are
ow in the possession
h was made in Wil-
ghly creditable spe-
eral very important
, including Dupont's
yards, Lobdell's car-
icultural implement

County for the year

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le ds.	Female hands.	Value of Annual Product.
2.....	.....	63,571
7.....	.....	15,650
7.....	.....	30,650
3.....	.....	5,713
3.....	54.....	190,241
7.....	.....	10,225
5.....	4.....	80,360
5.....	.....	73,000
3.....	4.....	49,347
0.....	.....	100,000
8.....	.....	24,750
2.....	1.....	553,250
2.....	.....	44,080
2.....	167.....	177,340
9.....	4.....	27,460
0.....	589.....	941,703
8.....	.....	6,300
3.....	.....	15,000
92.....	.....	1,637,260
25.....	.....	600,000
3.....	.....	2,496
2.....	3.....	4,125
94... ..	.....	658,750
33.....	.....	192,600
51.....	.....	237,080
1.....	.....	5,500
25.....	.....	348,500
22.....	.....	22,142
3.....	.....	15,000
3.....	.....	4,176
12.....	.....	15,000
04.....	32.....	461,650
06.....	27.....	385,000
00.....	.....	100,750
0.....	.....	7,600
12.....	.....	12,187
2.....	.....	8,100
3.....	.....	6,530
40.....	.....	48,245
27.....	.....	29,436
15.....	.....	15,000
58.....	.....	574,650
12.....	.....	13,925
1.....	8.....	4,250
12.....	.....	47,200
8.....	.....	41,700
14.....	.....	12,000
8.....	2.....	60,000
18.....	.....	25,990
61.....	.....	70,795
12.....	.....	16,068
3.....	.....	3,600
76.....	38.....	153,035
309	948	$8,963,440
,465	956	$9,892,902
,237	651	$4,649,296

DAVID REEVES
PHOENIXVILLE PA

JOSEPH H SCRANTON
SCRANTON PA

DAVID THOMAS
CATASAUQUA PA

REPRESENTATIVE MEN IN THE IRON MANUFACTURE

HORACE ABBOTT
BALTIMORE

JOHN A WRIGHT
PHILAD'A

HON [illegible] A [illegible] WOLF
TROY N Y

V.D. THOMAS
ATASAUQUA PA

N. A. WRIGHT
PHILAD'A

THE GREAT IRON WORKS OF THE UNITED STATES.

In proceeding to give some further account of the Great Iron Works of the United States than has already been given, attention is naturally attracted, first, to Pennsylvania, which produced, in 1866, sixty per cent. of all the Pig Iron made, during that year, in the United States. The total product of the State, as given in reliable statistics, was seven hundred and seventy-two thousand four hundred and seventy-nine tons, valued at thirty-five millions of dollars; and, of this amount, four hundred and fifty thousand tons were made east of the Alleghenies, of which three fourths was Anthracite Iron, made in the Lehigh and Schuylkill valleys. In this district, there are Iron Works which travellers and competent judges have declared to be unsurpassed by any similar works in England and Wales. Probably the largest and most productive Furnaces in the United States are those of

The Thomas Iron Company,

Situated at Hockendauqua, Lehigh county, four miles above Allentown. They were built in 1855, and are managed by Samuel Thomas, the son of David Thomas, who first successfully introduced the manufacture of iron by means of anthracite coal. The original furnaces were built together, and alike, eighteen feet across the bosh and sixty feet high, and are blown at the extraordinary pressure of eight and a half pounds to the square inch, by two large engines constructed at the West Point Iron Foundry, the steam cylinders being fifty-six inches in diameter, and the blowing cylinders ninety inches diameter. In 1862 and 1863 these twin stacks made twenty-seven thousand tons of iron, a larger production than was ever before attained. Recently two additional furnaces were erected, eighteen by fifty-five feet, which are blown by two very large beam engines constructed by I. P. Morris & Co., of Philadelphia, the steam cylinders being sixty-six inches in diameter, and the blowing cylinders one hundred and eight inches, and ten feet stroke. The materials are conveyed to the top of the stacks by atmospheric pressure—and in all their appointments they may be said to be the model furnaces of America.

Next to these, the most productive furnaces are those of

The Lehigh Crane Company,

Situated about a mile below the Thomas Works, on the eastern side of the Lehigh river. These consist of five furnaces, the first stack

having been built in 1840, the second in 1842, the third in 1846, and the remaining two in 1850. The first three are forty-seven feet high, but of different bosh widths—namely, eleven, thirteen, and sixteen feet. The last two are eighteen feet wide by fifty-five feet high, and are blown by four engines. The principal one, built by I. P. Morris & Co., has a steam cylinder fifty-eight inches in diameter, and a blowing cylinder ninety-three inches, both ten feet stroke of piston. The beam of this engine works on a column of cast-iron thirty feet high, and the whole is set upon a heavy cast-iron bed plate. In 1862 the five furnaces made nearly fifty thousand tons of anthracite iron. The Superintendent or manager of these Works is Mr. JOHN THOMAS, a son of the gentleman who is accredited with having been the first who introduced successfully the use of anthracite coal in the manufacture of iron. This was accomplished in Wales, by David Thomas, in 1837; and in June, 1839, he superintended the blowing in the Pioneer Anthracite Furnace in Pottsville, the first of the kind in America. When we reflect that now sixty per cent. of all the iron made in the United States is anthracite, and look upon the magnificent furnaces that abound in the Lehigh and Schuylkill vallies, the name of DAVID THOMAS stands forth as one of America's benefactors.

The Lackawanna Iron and Coal Company,

have at Scranton, in Luzerne County, very large and important works for manufacturing Iron.

There are four Blast furnaces, built in 1848, 1852, and 1854; Nos. 1 and 2 being eighteen feet each in the bosh; No. 3, nineteen feet; and No. 4, twenty feet; all fifty feet high. They are blown by four low-pressure beam engines; Nos. 1 and 2 having steam cylinders fifty-four inches in diameter, and blowing cylinders eighty-six inches in diameter; and Nos. 3 and 4, steam cylinders fifty-eight inches in diameter, and blowing cylinders ninety-three inches in diameter—all ten feet stroke—built by I. P. Morris & Co., of Philadelphia—the steam being generated entirely by waste heat.

Two of the furnaces, Nos. 3 and 4, are now in blast, the former of which made, in ten months of 1862, twelve thousand six hundred and seventeen tons; and the latter made, in 1863, fourteen thousand three hundred and seventy-seven tons; and in twenty and a half months of the present blast, twenty-five thousand tons. No. 3 furnace made in one week, in February, 1862, three hundred and seventy-five and a half tons pig metal, the largest week's produce ever made by any Anthracite furnace in this country.

The aggregate productive capacity of all these furnaces is about sixty thousand tons per annum.

The Puddling and Rolling-Mills of the Company comprise, the former, one building, one hundred and fifty by ninety feet, containing twenty furnaces; one building, three hundred by ninety feet, containing thirty-two furnaces; one building, four hundred and fifty by eighty-two feet, containing twenty-eight furnaces, and three high train puddle rolls—in all eighty furnaces, with steam boilers over each; and the main Rolling-mill building is five hundred by one hundred and forty feet, with fifteen heating furnaces, six trains of three high rolls, ten steam-engines, and one seven ton Nasmyth steam hammer. These mills have a productive capacity of thirty-five thousand tons finished iron, principally Railroad bars.

The purchase of the present site of the town of Scranton, was made by several of the members of the present Lackawanna Iron and Coal Company in July, 1840. The place at that time consisted of five small dwellings, a saw-mill, grist mill, school-house and cooper shop. Now the town contains about fifteen thousand inhabitants.

The foundations of the first blast furnace—now in ruins—were laid in September, 1840, and after several ineffectual attempts in 1841, was finally blown on January 18, 1842, blowing about two weeks without making any iron of consequence; after that, the furnace began to work fairly, and the blast was continued till February 26, when the heating oven gave out, having run five and a half weeks, making in all seventy-five and a half tons of pig-iron. The Rolling-mill buildings were commenced in May, 1844; and it was here that in July, 1847, the first stationary steam-engine was started in the Lackawanna and Wyoming valleys, from Carbondale to Wilkesbarre, a distance of about thirty-five miles, comprising the greater part of this celebrated Anthracite coal field, where now not less than five to six hundred stationary steam-engines are constantly running. This Company have now in operation thirty different stationary steam-engines in the prosecution of their business. Attached to the Works are about seven thousand acres of coal and timber lands, with two hundred and fifty tenement houses for workmen. About one hundred and twenty thousand tons of coal are mined annually, nearly all of which is consumed at the works.

The officers of the Lackawanna Iron and Coal Company, at present, are Joseph H. Scranton, President; David S. Dodge, Treasurer; Edward C. Lynde, Secretary; Edward P. Kingsbury, Assistant Treasurer; Joseph C. Platt, Real Estate Agent and Storekeeper; and Charles F. Mattes, General Superintendent.

The Phœnix Iron Works,

At Phœnixville, Chester county, twenty-seven and a half miles from Philadelphia, are one of the oldest and largest establishments for manufacturing iron in the United States. The works originally consisted of a Rolling-mill and Nail Factory, the power for driving which was derived from the damming of French Creek, just above the present foundry, the old site of the Rolling-mill, and date their operations as far back as May 3, 1783.

In the year 1827, they came into the possession of Reeves and Whitaker, and during the period of their ownership a new Rolling-mill was built on the site of the present North Mill, and puddling introduced as a process in the manufacture of iron. The old Rolling-mill was pulled down, and on its site a charcoal furnace was built in 1838, which again, in 1841, was converted into an Anthracite furnace. This was one of the earliest of the experimental Anthracite furnaces which marked the era of the introduction of Anthracite coal as a fuel in the process of smelting iron. The nail factory of the firm was burned down in 1847, and on its site was erected one of the extensive machine shops now belonging to the Phœnix Iron Company.

In the year 1846, Reeves, Buck & Co. became proprietors of the Phœnix Iron Works, and, during their proprietorship, very extensive improvements were made. They built, in 1846, the present Rail mill, the dimensions of which are two hundred and sixty feet by one hundred and sixty feet. Also, a new puddling and re-heating mill, one hundred and eighty-five feet by one hundred and ninety-two feet, with a wing thirty-two feet by one hundred and thirty feet. Besides these, they erected new Smith shops, Pattern shops, Foundry, machine shop, offices, and warehouses. The offices, pattern and drawing rooms of the company are probably the most complete of any in the country, and cost, we understand, $26,000. In 1855, the firm of Reeves, Buck & Co. procured an Act of the Legislature incorporating them as The Phœnix Iron Company, and under this name the present extensive operations of the Works are managed.

During the last four years, the Company have spent a large sum of money in remodelling and readjusting their Works, and in increasing their capacity, which, at this time, amounts to twenty thousand tons of railroad iron and fifteen thousand tons of bar iron, iron beams and girders, angle iron, wrought-iron columns, rolled railroad chairs and spikes, axles, and many other shapes. Rounds have been turned out of the Merchant Mill of twelve inches in diameter, and squares up to eight

inches by twenty-five feet long. During the late Rebellion, thirteen hundred wrought-iron guns were made at these Works.

This establishment produces a greater variety of work than any other in the country. In addition to their regular business of manufacturing iron, the Company have lately erected a very extensive machine shop, specially appropriated to framing, iron rafters, flooring, and bridge work. This building is two hundred and six feet by ninety feet, and is filled with tools and machinery of the latest improved styles suited to the business. The manufacturing of wrought-iron columns and beams for fireproof structures has become one of their great specialities, and the framing for the roofs and floors of the new buildings lately erected by the United States Government, at the Frankford and Allegheny Arsenals, which are entirely fire-proof, was all made at the Phœnix Iron Works.

This Company also possess three Blast furnaces, capable of turning out about twenty-three thousand tons of pig-iron per annum. The mills contain twenty-four heating and twenty-two double and twelve single puddling furnaces.

The officers of the Company are as follows: DAVID REEVES, President, Phœnixville; SAMUEL J. REEVES, Vice President and Treasurer, Philadelphia; ROBERT B. AERTSEN, Secretary, Philadelphia; GEORGE H. SELLERS, General Superintendent, Phœnixville; GEORGE WALTERS, Engineer, Phœnixville.

The Cambria Iron Works,

At Johnstown, Cambria County, Pennsylvania, are the largest manufacturers of Railroad iron in the country.

The company commenced the erection of the Works in 1853; but becoming embarrassed for want of means before they were fully completed, made a lease of their entire property, in the spring of 1855, to Wood, Morrell & Co. This firm not only carried out the original plans of the company, but, during their lease, greatly enlarged the Works and increased their capacity. In 1862, the Company was reorganized —C. S. WOOD of Philadelphia, President—with a capital of $1,500,000, since which time it has carried on the business of mining and manufacturing under its charter. It owns about thirty thousand acres of land—mostly mineral—has four large Blast furnaces, Rolling-mills, Machine shop, Foundry, etc., with numerous dwelling houses for its operatives. The original mill building was burned down in 1857, and rebuilt the same year by the lessees—it is six hundred and twelve feet

long, by one hundred feet wide, with cross wings three hundred and seventy-two feet by seventy-four feet.

In 1863, an additional mill building, three hundred feet by one hundred feet, with a connecting wing seventy-four feet by thirty feet was erected, and in 1865, a further extension of the building three hundred and fifty feet by an average of one hundred feet, was made.

The mill, when completed, will contain forty-eight double—equal to ninety-six single—Puddling furnaces, twenty-four Heating furnaces, seven trains of rolls, four squeezers, and other machinery to correspond.

Its production, in 1865, was near one thousand tons per week, and when the extensions and improvements now in progress are completed, its capacity will be equal to the production of from sixty to seventy thousand tons of finished Railroad iron per annum.

The stock is principally owned in Philadelphia, where the office of the Company is located.

The Freedom Iron Company's Works,

About three miles from Lewistown, in Mifflin county, are notable from the fact that they were the first successful American manufacturers of locomotive Tires. The first Iron works here, were built in 1811, to use the Greenwood ore, a hydrated oxide of iron, generally called pipe ore. The iron made from this ore was highly celebrated, and first gave the distinctive title of "Juniata" to iron from this region. In 1847, the Works, with the Greenwood furnace, came into the possession of Messrs. John A. Wright & Co., under whose ownership they were largely increased; making for years the celebrated Spring Wire Blooms, produced by the admixture of the Greenwood ore with a peculiar fossil ore found near their furnace in Huntingdon county.

In 1856, the Freedom Iron Company was organized, purchasing the property of Messrs. John A. Wright & Co., and under the direction of the senior partner, entered upon the manufacture of Railway axles, bars for machinery uses, and locomotive Tires. Many attempts had been made to produce these Tires in the United States previously, but without success. This Company have been remarkably successful, not only producing them equal to, but, as the Superintendents and master machinists of many of the principal railroads testify, decidedly superior to the English brands; thus demonstrating that this country has not only the material but the skill to produce whatever may be desired. The processes adopted by this Company in making these Tires, include five successive forgings under large steam hammers before the straight tire bar is produced, which is then heated and bent

by machinery into a hoop, the ends welded, and the hoop again heated and rolled for the first and only time by heavy and costly machinery, to its true dimensions and finish.

The Works now comprise three charcoal furnaces, and two large forges, with about forty thousand acres of land and all needed buildings. The President of the Company is JOHN A. WRIGHT, ESQ., of Philadelphia, and the Superintendent is R. H. LEE, formerly of the Fort Pitt Iron-Works at Pittsburgh.

At Allentown, are probably the most picturesque Iron Furnaces in the United States. They consist of four stacks, two of them twelve feet wide, and two sixteen feet; while three of them are forty-five feet high, and the fourth fifty feet. They are owned by the ALLENTOWN IRON COMPANY.

At Phillipsburgh, are the furnaces of the TRENTON IRON COMPANY, consisting of three stacks, being respectively twenty by fifty-five feet, eighteen by forty-two, and twenty-two by fifty-five feet. The Rolling-mill of this Company, at Trenton, is probably the largest single building in the United States, having three and a half acres enclosed under one roof.

At Danville, Montour county, are the Works of WATERMAN & BEAVER, where the first Railroad iron in this or any other country was made by means of Anthracite coal. They consist of three Blast furnaces, two Rolling Mills, and a landed estate of three thousand acres with three hundred tenement houses.

The McCullough Iron Company,

Whose Galvanizing Works in Philadelphia were noticed among the remarkable manufactories of that city, have very important works in Cecil county, Maryland, for the manufacture of Sheet Iron. They comprise five Rolling Mills, three of them being at North East, styled respectively the NORTH EAST, the SHANNON and the STONY CHASE; the fourth, about two miles north of Elkton, called the WEST AMWELL Mill, and the fifth, the OCTORARO, at Rowlandsville, a village about five miles North of Port Deposit.

Of these mills, four are driven by water power, and one, the largest, a bar Mill, by steam power, where the bar is manufactured and prepared for rolling into sheets. The latter operation is done by water power.

They have also "a forge," with six refinery fires for the manufacture of Charcoal Blooms, with what is termed a "run-out" fire, where

all the Pig Metal is melted and "run out" with charcoal, a process of refining through which the iron passes before going to the forge. All of these are located in Cecil County, Md., with water powers, yet unemployed, sufficient to drive additional works when required.

The site for the works at North East was selected over one hundred and fifty years ago, by a company composed chiefly of English capitalists, consisting of Messrs. WILLIAM and THOMAS RUSSELL, WILLIAM CHETWYND, SAMUEL and OSGOOD GEE, and WILLIAM WHITEWICK, together with AUGUSTINE WASHINGTON, the father of the illustrious GEORGE WASHINGTON. This seems to have been an old company in England, of some of the substantial and enterprising men of that age. They were succeeded by THOMAS RUSSELL, and his heirs, who inherited the property, and held it until some twenty years ago, when it was purchased by the present owners.

Adjacent to the works at North East, the company own from four to five thousand acres of land, a portion of which is laid off in fine farms, the remainder being woodland, from which they obtain the charcoal consumed in the manufacture of a superior quality of iron, which they use almost exclusively for Galvanizing purposes. The consumption of charcoal alone amounts to over one hundred thousand bushels annually.

The works known as the OCTORARO, (on the Creek of that name,) at Rowlandsville, some five miles from Port Deposit, were formerly owned by JOSEPH ROMAN, and are among the oldest Sheet Iron Works in our country. They have been the property of this Company for a number of years.

The WEST AMWELL Mill was built in 1840, and in common with the Company's other mills, enjoys a fine reputation for the quality and finish of its sheets. With the enlarged facilities which they possess, the Company is now able to produce many thousands of tons of Sheet Iron annually.

The McCullough Iron Company are the successors of McCullough & Co., a firm established about twenty years since by Jethro J. McCullough, Delaplaine McDaniel, and Edmund A. Harvey, of Wilmington, Delaware. These gentlemen obtained workmen from England, skilled in the art of galvanizing sheet iron, and from a small beginning have become the largest manufacturers of thin black and galvanized iron in the United States.

The officers of the McCullough Iron Company, at present, are DELAPLAINE MCDANIEL, President; JOHN H. ADAMS, Vice President; WM. S. HAGANY, Treasurer; J. J. MCCULLOUGH, Managing Director; W. B. SPEAR, Secretary; E. A. HARVEY, Gen'l Sup't of Manufacture.

The Samsondale Iron Works—John Peck, Proprietor.

Near Haverstraw, Rockland County, New York, are celebrated for the manufacture of a superior quality of thin Sheet Iron. They consist of two Rolling Mills, which contain seven single Puddling Furnaces, four Heating Furnaces, four trains of Rolls, one Jaw Squeezer, two Engines, and one Waterwheel. The old mill was built in Wales, at the foundry of Ottawa, Wennington & Co., and brought to the United States, by Elisha Peck, in 1832. At that time, it was regarded as one of the finest rolling mills in the country. It is constructed of iron, and has recently been thoroughly repaired. The Sheet Mill is new, and nearly doubles the former capacity of the Works.

The old Sheet Train is run by an overshot wheel made entirely of iron, twenty-four feet in diameter and fourteen feet face. The shaft is of cast-iron, about two feet in diameter, and hollow, the base of the shaft being about fifteen inches. The arms and frame are of cast-iron, the gudgeons of wrought-iron, and the buckets of plate-iron, curved. The bar and new Sheet Train are run by a horizontal high-pressure engine, rated at two hundred horse-power. The cylinder is thirty inches in diameter, and the stroke of the piston six feet. The guide mill train is run by a forty-horse high pressure beam-engine of eighteen inch cylinder and three feet stroke. Blowing is done either by steam or by water. The steam is supplied by ten boilers, four of them being from thirty-two to thirty-six feet long, forty-four inches in diameter, and the others are plain cylinders, twenty feet long and thirty inches in diameter, all connected with the furnaces.

Though the specialty of these Works is the manufacture of thin Sheet Iron, all grades can be rolled, from No. 29 wire gauge up to boiler-plate if necessary. The bar train is now used for rolling bars to be afterward rolled into sheets. The capacity of the mill for thin sheet is about twenty-eight hundred tons a year, and for heavy sheet and bar about forty-five hundred tons.

The iron used is chiefly Anthracite Pig No. 1, with a little Charcoal Pig. The coal for puddling is generally Cumberland, and Anthracite for heating. In 1864, the consumption was about thirteen hundred tons iron, five hundred and fifty tons Cheever ore, and twenty-five hundred tons Cumberland coal.

Mr. JOHN PECK, the proprietor, has been connected with the Works since their erection.

The Ulster Iron Works—J. & L. Tuckerman, Proprietors,

At Saugerties, New York, are celebrated for the excellent quality of Bar, Band, and Hoop Iron made there, and known as the ULSTER IRON. These Works were built by Henry Barclay, in 1824, who adopted the style and carried on business as the Ulster Iron Company. In 1844, they passed into the hands of Horace Gray & Co., as lessees, and in 1847 they were leased by Joseph and Lucius Tuckerman, who not long afterward purchased them, and by whom they have been owned ever since. In 1863, Mr. William Mulligan became connected with the Works as Manager, and since 1864 the manufacturing operations have been carried on under the name and style of Tuckerman, Mulligan & Company.

The principal Mill is of stone, brick, and frame, two hundred and thirty-five feet long, and one hundred and seventy-three feet wide. It contains eight double and one single Puddling and five Heating Furnaces, six Trains of Rolls, and one Hammer. All the rolls are run by an Overshot Wheel of twenty-five feet in diameter and eighteen feet face. A large Breast Wheel, thirty feet in diameter and nine and a half feet face, which was built for other works, drives the Hammer. This hammer weighs, perhaps, four tons, is raised by a cam lift, and is used for hammering puddle balls. There is also in the mill a very large Burden Squeezer of the old pattern, which is used only in case the hammer is out of order. The Blast for the furnace is obtained by means of three Dimpfel's Blowers, which are run by a Turbine wheel.

The Works have the first right upon the creek to water, and have never been stopped for want of water. The great flood of February, 1857, destroyed the dam, and consequently stopped the Works about four months, but during this time a new and more substantial structure was erected, which gives them one among the very best water powers in the country.

The iron consumed is chiefly Anthracite Pig No. 1, with some Charcoal Pig. No Scrap, except that made in the Works, is used. The ore used in the puddling furnaces is known as the Cheever ore, and the coal is Cumberland, Pictou, and Blossburg, mixed. The annual product is six thousand five hundred tons of manufactured Iron, distinguished for its high grade, and the uniformity with which the quality has always been maintained. About two hundred and eighty hands are employed in these Works.

The West Point Foundry—R. P. Parrott, Proprietor,

At Cold Spring, New York, was established by Gouverneur Kemble, who, with others, were incorporated under the name of the West Point Foundry Association. The first Works were erected in 1817, and were designed for the casting and boring of Cannon for the Navy and Army requirements of the United States, official assurances of support and encouragement having been given, should Ordnance for the government be satisfactorily made.

From the expiration of the time for which the charter of the Association was given, the Works have been conducted as a private establishment by one of the proprietors, who leased the shares of the others. They were carried on in this manner by Mr. Gouverneur Kemble until 1851, and from that date to the present time by Mr. R. P. Parrott, who had become connected with the Foundry in 1836, and continued in it during the lease of Mr. Kemble, upon the expiration of which Mr. Parrott became the sole lessee, and has conducted the establishment up to the present time, assisted in its management by Mr. Gouverneur Paulding. Mr. Parrott was a graduate of West Point, and Captain in the Ordnance Department of the United States.

It was found by experience that the Cannon called for were not ordered in such quantity, or with such regularity, as to give steady employment, and other work was necessarily sought for. By degrees, general Castings, Steam-engines and Boilers, and all heavy machinery, were introduced, with a forging department capable of executing the heaviest pieces.

Among the products of this Foundry were the Engines of the United States Steamers "Missouri," and of the well-known "Merrimac," the Cornish Pumping Engine at Belleville for the Jersey City Waterworks, and the Pumping Engine of the Dry Dock at Brooklyn. Sugar-mill Machinery, with Steam-engines, Hydraulic Presses, and Blowing Engines of the largest size, have been turned out in large quantities. Much of this machinery has been exported from the United States, and has borne a high reputation in competition with that of other countries.

The establishment, though limited originally to a Cannon Foundry of moderate extent, costing about $90,000, has grown, entirely by the application of means earned by itself, to one of immense capacity, not only for Cannon, but heavy Machinery, Steam-engines, and general Castings and Forgings. The facilities for finishing and fitting up work, although very large, are exceeded by those for casting and forging, and at times large quantities of Water Pipes, Wrought-iron Shafts, and other forgings, have been added to the ordinary work.

The position of the West Point Foundry at Cold Spring was determined by two considerations; one, the desire of the Government, at that time, that a Gun foundry should not be too near the coast, and the other, to obtain water power from a stream entering the Hudson at Cold Spring. This, though quite insufficient for the power now required, is still useful in the boring of Guns. Cold Spring having, at the commencement of the Foundry, consisted of only a small landing-place of three houses, and West Point being the only well-known place in the vicinity (although on the opposite side of the river), the name of West Point Foundry was given to the new establishment.

Mr. Gouverneur Kemble, the original proprietor, still lives to enjoy the vigorous growth of the Foundry and of the Village, which may almost be said to have been founded with it, as well as to receive the tribute of universal regard for a conspicuous display of qualities commanding respect throughout a long succession of years.

This Foundry has recently been brought prominently into notice in connection with the manufacture of RIFLED CANNON, a subject which has been much discussed since the Crimean war, although such cannon were not used successfully at that time. Numerous experiments in their manufacture have been made in Europe, and in 1858 and 1859 many trials of Rifled Cannon were made in this country, chiefly with Guns ordered by the Ordnance Department, according to plans devised and brought forward by different inventors. The Cannon were the usual Cast-iron Guns, bored somewhat smaller and rifled. A projectile frequently used at that time was that of Dr. J. B. Read, of Alabama, in which a cup or flange of wrought-iron is cast in the projectile, and it was expected that the force of the powder would cause the rim of this cup to take the grooves. Better forms of projectiles have since been devised, although this was made to work moderately well in small Guns; owing in some degree to an improvement made by Mr. Parrott of swaging out the cup partially to the form of the grooves, and thus facilitating the "taking" of them by the projectile.

In 1860, Mr. Parrott introduced the first of the Guns now known as "*Parrott Guns.*" It was the smallest size of bore, and called the ten pounder, and this Gun has since been increased from two and nine tenth inches to three inches bore, and is called the three-inch Gun. The principles upon which it was constructed have been observed in all, so that the same system has prevailed throughout. One peculiarity of the Parrott Gun is the band or reinforce of wrought-iron, made by coiling a bar of iron upon a mandril, and then welding this coil into a cylinder, which is afterward bored and turned and shrunk upon the Gun. The manner of attaching the band to the Gun is another

peculiarity, and the rifling is another. The thickness, length, and position of the wrought-iron band, and thickness of the cast-iron are also arranged by a regular rule.

In 1860, was also made the Parrott twenty-pounder Rifle, and before April, 1861, the thirty-pounder Gun and the *Parrott projectile*, first and exclusively used for this Gun, as well as for all the larger calibres afterward made, and subsequently adopted for the ten and twenty pounder Guns.

This projectile is cylindrical, with a flat base, and rounded but pointed end. It is made to "take" the grooves by the expansion of a brass ring cast upon the projectile near the base. The ring being so disposed as to be "flush" with the sides and bottom of the projectile, no irregularity whatever is presented, and the projectile can be entered with perfect freedom into the Gun. For the larger calibres, the Parrott projectiles appear to be peculiarly well suited, and have performed well up to six hundred pounds in weight from a Gun of twelve inch bore.

Before April, 1861, Mr. Parrott had made the ten, twenty, and thirty-pounder Guns. This he had done without any order from the Government, and entirely according to his own views of the principles to be followed in Rifled Ordnance. At the commencement of the late Rebellion all those he had on hand were taken by the Ordnance Department, and to their performance alone is he indebted for the pressing orders which flowed in, and the very large number supplied in consequence.

Late in 1861, Mr. Parrott made the one-hundred-pounder, and early in 1862 the eight inch or two-hundred-pounder Gun. These Guns were in each case made and offered for trial without any order, and the large calls for them were the result of the impression made by the Guns themselves. Both were mounted in the batteries at Yorktown, and their powers, as there exhibited, were highly commended. An interesting account of them was given by the Prince de Joinville, an eye-witness, showing that they were in advance of any other attempt at making heavy Rifled Cannon.

In pursuance of the same course of action, Mr. Parrott made, in 1862, a ten-inch or three-hundred-pounder Rifle. This was only tried in service at Charleston; the first one was unfortunately disabled by the bursting of a shell, which carried off about three feet from the end of the Gun. It was, however, used to a considerable extent after the accident; while another Gun of the same kind was fired twelve hundred rounds, and then only failed from the same cause as the first.

The Parrott Guns continued to be largely used in the war, both in

the Navy and Army, and while it was not claimed that they were perfect in their results, or that disappointments did not occur, yet when due allowance is made for the novelty of the subject in actual war, the immense extent of the demand, and the necessary want of experience under the circumstances, it may be fairly concluded that the system, so often doing that well which had never been accomplished before, must be based on correct principles, and only required a reasonable measure of practical experience and care to make it equally successful at all times.

In the capture of Fort Macon the Parrott Guns were singularly distinguished, and they also contributed largely to the success at Fort Pulaski. At the bombardment of Fort Sumter from Morris Island, as well as in the shelling of Charleston, the Parrott Guns were almost wholly used.

The performance of these Guns and projectiles at the destructive bombardment of Fort Sumter, at distances over four thousand yards, after the assault upon Fort Wagner had failed, was a most brilliant as well as a timely success, and may almost be said to have inaugurated a new era in siege warfare.

So important had the success of these Guns made them, that Mr. Parrott was called on for about three thousand Cannon, more than half of which were of the thirty-pounder and larger calibres, together with Projectiles, Iron Carriages for Fortifications, Fuzes, etc., constituting chiefly the Rifled Ordnance of the country.

The Bridgewater Iron Manufacturing Company,

At Bridgewater, Mass., on the line of the Old Colony and Fall River Railroad, is one of the oldest and most remarkable Iron Works in America. As early as 1785, there is a record of Iron Works at this place and, as has been elsewhere stated, the first Locomotive crank axle made in America, was forged here for the Locks and Canal Company of Lowell. From 1810, to 1816, the Proprietors of these Works were Lazell, Carey & Co., but in 1816, Mr. Carey having died, a new partnership was formed under the style of Lazell, Perkins & Co., which continued until June 18, 1825, when the Bridgewater Iron Manufacturing Company was incorporated.

These are now, no doubt, the largest Iron Works in New England, and have tools and facilities for executing heavy forgings, not excelled, and we believe not equaled, by any in America. The land attached to the works is about seventy acres, of which ten acres are covered with buildings. They have two Rolling mills, of which the largest is two

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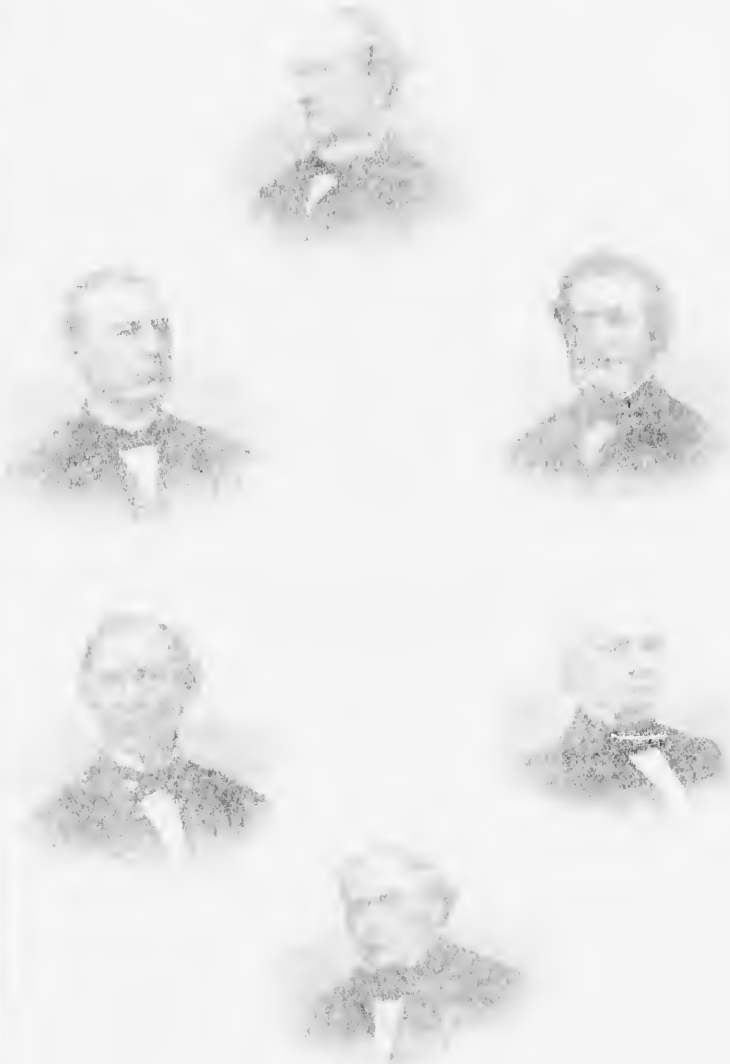

hundred and forty-four by one hundred and thirty-two feet, two Machine shops, of which the largest is two hundred by one hundred and fifty feet, two Forges, of which the largest is one hundred and forty by one hundred feet, an Iron Foundry one hundred and thirty by ninety feet, a Brass Foundry, and numerous Storehouses, Smith shops, Pattern shops, etc., comprising in all twenty-eight buildings. The machinery is propelled by five Steam Engines, and eleven Water Wheels, and the Works consume about fifteen thousand tons of Anthracite and Bituminous Coal, and forty-eight thousand bushels of Charcoal annually.

The Iron Foundry has two Cupola Furnaces, capable of melting thirty tons of iron, one Air Furnace that will melt twelve tons, and all the requisite facilities for producing the largest class of castings. As an illustration of its capacity we may state, that the castings for several sloops-of-war were made here, of which the cylinders weighed fifteen thousand pounds each, the condensers twenty-eight thousand pounds, and the channel plates thirty-four thousand pounds. The Brass Foundry is equally well provided for producing ship-castings, and has turned out a four bladed propeller fifteen feet in diameter, that weighed six tons.

In the Machine shops the tools are of a magnitude unprecedented in this country. The Company have a Lathe that will bore and face thirty feet diameter, swing eight feet and turn thirty-seven feet long, another that will turn a shaft sixty feet long, another, forty-seven feet long, and still others that will turn thirty-eight and thirty-two feet, respectively; also, a monster machine, just completed, for boring or facing, with a revolving table of sixteen feet in diameter, besides a Planing Machine that will take a piece, twelve feet square, and any length, working two cutters at the same time, and cut off more Iron in a day than any tool of the kind in America. Among the planers in the establishment, there is one which will take a piece, thirty-five feet long and nine feet square; and there are four slotting machines, one of which, it is believed, is the largest in this country, and another, only one size smaller, built for the Company, by Whitworth, in England.

But the distinctive feature of the Bridgewater Iron Works, which gives them preëminence, is the Forge Department. In facilities for producing heavy forgings, no works in America, yet constructed, equal them. They have one hammer of the Nasmyth pattern, which weighs over *eleven tons*, with ten feet stroke of piston, and worked by a Rotary valve, that enables the operator to govern it with such precison, that the shell of a walnut may be cracked off without hurting the meat, or a bar of iron, three feet square, can be brought

down six inches by a single blow. In fact, it is said, that on full stroke, the blow of this hammer is equal to the fall of one hundred and thirty-five tons. They have also another hammer on the same principle of seven tons weight, and seven feet nine inch stroke, and one of six tons, and six feet stroke, and two of the Patent Willard Helve Hammer, each of two thousand pounds weight, for smaller work, and another of the same pattern of fifteen hundred pounds. They have nine furnaces or gangs expressly for making forgings, and a crane capable of handling seventy-five tons, by which a shaft forty feet long and eighteen inches in diameter may be placed beneath the hammer and swung from the anvil to the furnace with the utmost facility. At these works were forged the anchors of the old "Constitution," the shafts and other wrought iron work, amounting to some two hundred and fifty thousand pounds, for the new "Constitution," the large forgings for the Iroquois, Narragansett, Pawnee, Kearsarge, Ossipee, Sacramento, Juniata, Adirondac, Canandaigua, Sagamore, Cayuga, Kanawha, Unadilla, Ottawa, Seneca, Pembina, Kennebec, Owasgo, Aroostook, Tahoma, Pinola, Sebago, Lenora, Conewaugh, Maratanza, Tioga, Octarora, Port Royal, Paul Jones, Mississippi and Merrimac, the wrought-iron work for the Golden City, Colorado, Arizona, Henry Chauncey, Montana, Great Republic, China, Japan, Alaska and America,—in fact, every Steamer comprising the new fleet of the Pacific Mail Steamship Company, running on both Atlantic and Pacific Oceans, and acknowledged to be the largest and finest ships in the world. The shafts, alone, for some of them, weigh over forty tons in the Forging, and are twenty-four and a half inches diameter, by thirty-nine feet, seven inches, in length. They have also completed the famous Truss work for the Iron-clad Frigates now building by Government at their Navy Yards; and are now finishing the Wrought-iron work for the four Wooden Frigates for the Navy, known as the Geared-engine Ships, and, undoubtedly, to be the fastest in the world. The Forgings for the original "Monitor" were made here, and the greater part of all those for the Iron-clad Navy of the United States, and including those for the Italian Iron-clad Frigate "Re di Italia." In fact, the largest forgings ever made in America have been produced at these works.

Less imposing than the forge with its great hammers, but scarcely less important, is the scrap heap from which the material is selected for the various articles manufactured. The yards and buildings devoted to the scrap, present a most remarkable sight; there is hardly a branch of the iron and steel manufacture that is not represented in the scrap heap; boilers, wheels, axles, tires, engines, knives, forks, button plates, turnings and planings from the machine shop, and even dis-

carded hoop skirts turn up here at last to be decarbonized and converted into anchors, steamboat shafts, and monster guns. Practical persons are employed in this department to assort and arrange the various qualities of metal, so that the kind suited to each particular purpose may be had. The utmost attention is given to the assorting, cutting, piling, balling, hammering and rolling of these scraps into bars or billets to be used in the large forgings, and every thing depends on faithful work in this department. The best of iron only, worked with the greatest care, is put into shafts, guns, and other work where great strength is needed. It is by good material, thoroughly worked under the large hammers, that the deservedly high reputation of the forgings of this Company has been earned.

The Bridgewater Iron Company employ in the various departments of their works about six hundred men. Among the employees are two men who have been connected with the Works for nearly fifty years. The Superintendent is MR. JAMES FERGUSON, a man of rare mechanical skill, and who is the designer of the greater portion of the novel and extraordinary machinery which has been alluded to; and for the large number of contracts for work during the last eight years, and close attention to business, the Company are greatly indebted to Mr. GEORGE B. STETSON, the resident Agent in New York. But the remarkable success which has attended this Company is, no doubt, due in great measure to the energy, sound judgment and great executive ability of the Treasurer, NAHUM STETSON.

Mr. Stetson was appointed to the position he now occupies as chief executive officer, after the decease of Mr. Lazell, in 1835. Under his administration the Works have grown to their present importance, and notwithstanding the onerous duties imposed upon him by this connection, he has also discharged the trusts of Treasurer of the Parker Mills, Wareham, and the Weymouth Iron Company, to the entire satisfaction of those corporations, as has been more than once acknowledged by valuable testimonials.

Probably the oldest Iron Works now in operation in the United States are those of

M. Ellis & Co., South Carver, Mass.

As early as 1756, some fifteen or twenty of the citizens of Plymouth county resolved to associate their capital and labor, and erect a Blast Furnace at the mouth of Assawampset Pond, about ten miles from the town of Plymouth. Though distant from navigable waters, the reasons that influenced them in the selection of this site for their infant enterprise, seem to have been proximity to bog ore beds; the abundance of Pine forests in the immediate vicinity, from which an unlimited supply of charcoal could be obtained, and thirdly, good water power. The bottom of this Lake, or Pond, covering about seven hundred acres, contained a rich deposit of sedimentary or bog ore, which was dragged from the water by an instrument similar to an oyster dredge, and with such facility, that, for a time, one man could fish up two tons per day. At these Works, subsequently called the Charlotte Furnace, was made a variety of ordinary Iron Hollow Ware, and about 1760, the first cast iron Tea-kettle made in America. This important utensil had previously been made of wrought iron and was imported from England. During the Revolutionary war they supplied the Colonial Government with solid sh[illegible] also furnished the shot and shell which were used by the Frigate "Constitution" in her memorable engagement with the "Guerriere." This Furnace continued in operation every year, until about 1832, when it was converted into a Cupola Furnace.

Among the first contributors to the erection of the Charlotte Furnace were the Ellises and Murdocks, ancestors of the present proprietors. Previous to the beginning of the present century, Mr. Benjamin Ellis leased the Works and subsequently purchased the interests of the other shareholders. He became a large landed proprietor, owning ten or twelve thousand acres of land in Plymouth county, besides three or four Blast Furnaces, among them the "Federal Furnace," which was described with some detail in the first volume of this History. Since his decease, the Works have been owned by his son, Matt. Ellis, and his brother-in-law, Jesse Murdock, trading under the firm style of Matt. Ellis & Co.

The buildings, which are mostly of wood, comprise a Foundry, Machine shop, Warehouse, and sundry auxiliary structures. The products now consist principally of Cooking stoves, Cabooses, and fine Parlor grates, which for many years had almost exclusive preference in the Boston market. Farmer's Boilers are also made here, which are favorably known and extensively in demand throughout New England.

The Works furnish employment to about seventy-five men, nearly all of whom own their dwellings, and some occupy houses in which their ancestors for five generations lived. There are moulders employed here whose great grandfathers followed the same occupation in the same place and in this respect the works present an anomaly entirely exceptional in the manufacturing experience of this country.

Mr. Ellis is also interested in Iron Works and Collieries in other sections of the country. He is Treasurer and one of the Directors of the "Kentucky Improvement Company," an association of capitalists of New York and Boston, who own a tract of nearly thirty thousand acres of land in Greenup county, Kentucky, abounding in Iron ore and Cannel Coal. There are two Blast Furnaces on this estate, one of them in operation, capable of making seven thousand tons of the best Charcoal pig iron annually. All the material, needful to the reduction of the ores, and repair of Furnaces, is supplied from the neighborhood of the Works in the greatest abundance. A solid block of upwards of five feet of Cannel Coal underlies the greater part of these lands, above water level, and containing in the aggregate a quantity, estimated to be equal to one hundred millions of tons. A railroad is now completed from the mines to the Ohio river, and as the facilities for mining at a minimum cost are remarkable, the drift being nearly horizontal and above water line, this Company will soon supply not only the markets of Cincinnati and its vicinity, but those of New Orleans and even the Atlantic coast with this valuable mineral, the finest ever discovered for use in grates, besides being an oil producing Coal.

Mr. Ellis is also Treasurer and Manager of the *Fisher Iron Company* on Lake Champlain, which produces a remarkably pure magnetic ore, that is consumed largely by the Furnaces along the Hudson river, and by forges for making Charcoal blooms.

The Reading Iron Works, Reading, Pa.,

Owned by SEYFERT, MCMANUS & Co., incorporated by special act of the Legislature, are among the most extensive and important in the United States. They comprise a Rolling Mill, Tube Mills, Furnace, Forges, Foundry and Machine Shop, and Sheet Mill, and the operations are so comprehensive that they may be said to embrace almost every branch of the general Iron Manufacture. When in full operation, they give employment to about two thousand men.

The ROLLING MILL which formed the nucleus of these works, was built in 1836, and went into operation in 1837. It comprised a merchant mill, Puddle-ball mill, and a small guide mill, six puddling fur-

naces, three heating furnaces, twenty-four nail machines, and one spike machine,—driven by one horizontal engine twenty-four inch cylinder, and six feet stroke. The capacity was then twenty-five hundred tons per year. In 1847 the mill was enlarged and remodelled, and farther enlarged in 1858, since which time additional enlargements and improvements have been made, until now it is one of the most complete Rolling mills in the country, with a capacity of five thousand tons a year. Its products comprise Round, Square, and Flat Bar Iron, Flat Bar Railroad Iron, Half Round and Oval Iron, Hoop, Band, and Scroll Iron, Horse Shoe Iron, Rivet and Tank Iron, of the very best quality; also the celebrated "Crescent" brand of Cut Nails and Spikes, Ship and Railroad Spikes, and Boiler and Tank Rivets.

The TUBE MILL, is one of the most important features connected with the Reading Iron-Works. It was erected in 1848, with a capacity for manufacturing one million eight hundred thousand feet of Gas, Steam and Water Tubing; and has been annually enlarged, until, at present, it is capable of producing six million feet of wrought-iron gas, steam and water tube, from one eighth inch to eight inches diameter; and two and a half million feet of Lap-welded Boiler Flues, from one to ten inches diameter. These Boiler Flues are made of the best Pennsylvania Refined Charcoal Iron.

Besides this mill, the company own the CAMDEN TOOL and TUBE WORKS, located in Camden, New Jersey. These works are adapted to the manufacture of Wrought-iron Gas, Steam and Water Tubes, and all kinds of Machines and Tools as well as Fittings, used in Steam and Gas Fitting. The manufacture of these constitutes the chief business prosecuted at these works. The capacity of this Tube Mill is about two millions of feet per year.

THE READING FURNACE, owned by this company, was built in 1853 and 1854. The stack is fifty by fifty feet at base, and forty by forty feet at top, forty-nine feet high, with boshes eighteen feet. The capacity is about ten thousand tons of metal a year.

THE SCOTT FOUNDRY AND MACHINE SHOP went into operation in 1861, and had been used until 1867 almost exclusively for the manufacture of Ordnance and Projectiles for our own and foreign governments. Guns weighing forty tons and of fifteen inch calibre have been cast and finished here, and fitted up with carriages. The Air Furnaces have a capacity of sixty tons of melted metal, the cupola furnaces of ten tons. Within the last few years, the Foundry has been very extensively employed in the manufacture of Car Wheels, and chilled and soft Rolls for Rolling and Plate mills.

THE STEAM FORGE of this company, which has been in operation

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since 1852, has produced the heaviest class of Forgings. Among its important tools and machines are three Nasmyth Steam Hammers, one of ten tons, one of seven and one of two and a half tons, two Kirk Hammers, one of fifteen hundred pounds, and one of seven hundred and fifty pounds, and Lathes, and Slotting Machines of the largest capacity for forging and finishing Shaftings for Marine Engines, Armor Plates, Turret Beams, Point-Stoppers, Locomotive Frames, Car axles, etc. The Shaftings for the "Adriatic," one of which weighed over *forty tons*, were made at this Forge, and also the Armor Plates used in the construction of the celebrated Ram, the "Dunderberg." As will be inferred, these works have the capacity for producing every kind of forging required for the largest vessels in the Naval or Merchant service.

The company also own the GIBRALTAR FORGES AND PLATE MILL, located a few miles southeast of Reading. At these forges are made the Charcoal Blooms used in the manufacture of the celebrated American Boiler Flues. The Plate Mill is employed almost exclusively in manufacturing Boiler Plate. Its capacity is fifteen hundred tons a year.

They have also recently put in operation one of the most complete SHEET IRON MILLS in the country, for rolling all kinds of Sheet Iron, Tank and Plate Iron; a Puddle bar mill, and a large merchant mill, for rolling all kinds of flat iron. They own the exclusive right of using the celebrated Lauth Patent system of Rolls, which enables them to imitate successfully, if not to equal, Russia Sheet Iron. The capacity of this mill is about thirty-eight hundred tons per year.

In addition to the above operations, this company is very extensively engaged in mining iron ores and coal.

Mr. JOHN MCMANUS, the president of the company, is actively interested in the construction of the Union Pacific Railway (Eastern Division), and is one of its directors.

THE GREAT HAT MANUFACTORIES OF THE UNITED STATES.

THE manufacture of Hats was one of the first industrial pursuits prosecuted in America. Dependent upon the enterprise and cupidity of the mother country for nearly every article of use, and many of the richer articles of wear, doubtless the Colonists thought themselves fortunate in the small resources of the "spinning wheel" and the "hand loom," the "bow," "block," and "set kettle," which at least furnished them with body-apparel and head-covering. Necessity certainly favored the production, at that early day, of such simple articles of use—as the s. ip from London or Hull was not even a monthly arrival, and the venture on the part of the owner at home not always so comprehensive as the wants of the new market demanded. In addition to necessity, however, it would seem that there was other encouragement or incentive for the colonial Hat manufacture. By reference to any full abstract of the colonial legislative annals, it may be seen how prompt was the foresight of our ancestors, and with what clear recognition of the merits of home production they fostered at least one branch of manufacture by public enactment and bounty. In 1662, for instance, the Colony of Virginia, through its House of Delegates, offered a premium of ten pounds of tobacco for every good Hat, made of wool or fur, within the bounds of the Old Dominion. By reference to the first volume of this History, it will be seen that other colonies advanced, through their Assemblies, similar encouragement, though the nature of the bounties may not have been the same. The result was, that the following century had not passed its first quarter before the production of Domestic Hats became a conspicuous and remunerative industry. Not only was the home market entirely supplied from home sources, but a very considerable exportation of Hats was growing up to countries beyond the sea, and the handiwork of the colonists beginning to compete with the work of the London craftsmen even in London streets. In 1731, it became known to the Feltmakers Company of London, that the New England Colonies were turning out ten thousand Hats per year. The policy of Great Britain was nowise different at that day from what it is now, though circumstances then gave her the power to illustrate it in a more effective manner. Appreciating the beneficence of this policy, the suffering feltmakers petitioned Parliament to prohibit all exportation of Hats from the colonies in America. Parliament listened to the address, and acceded to the request; but it is not believed that the enterprise of the provincial Hatters was entirely balked by this

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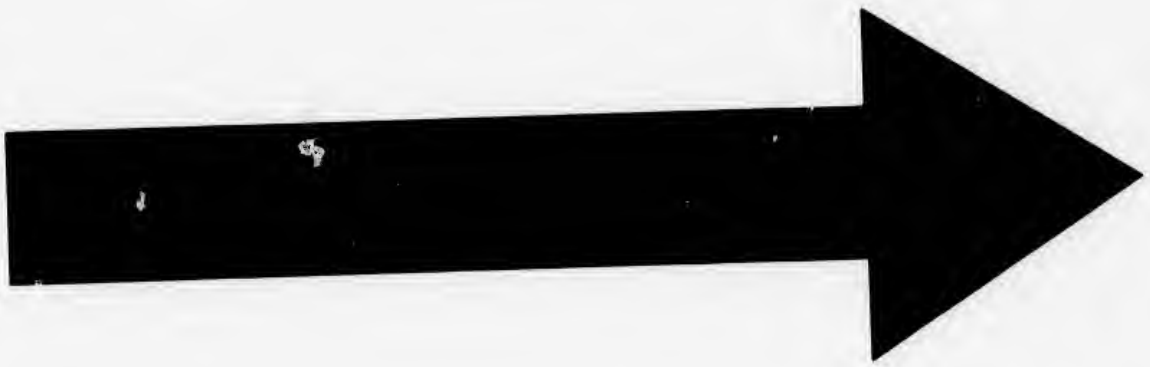

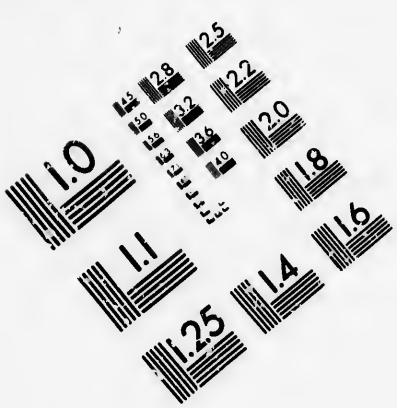

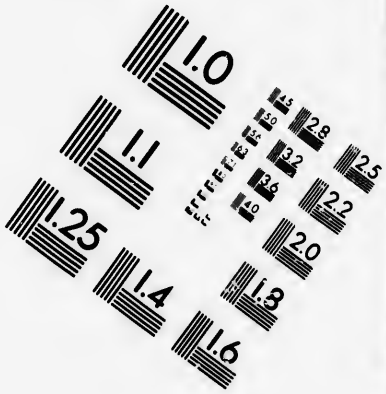

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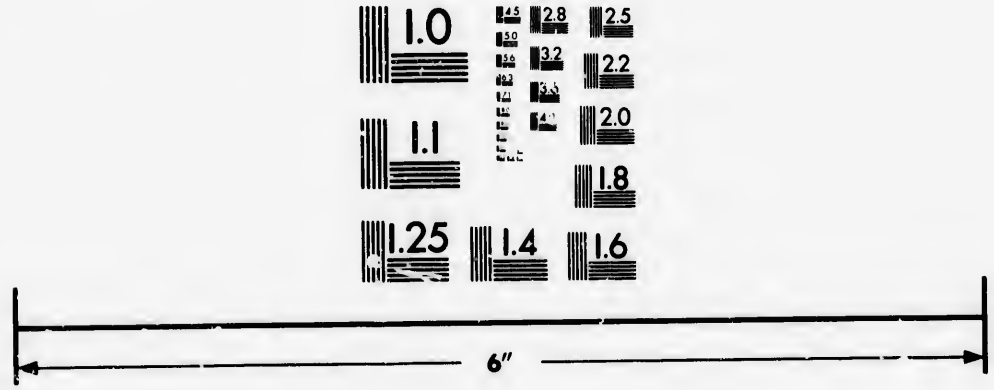

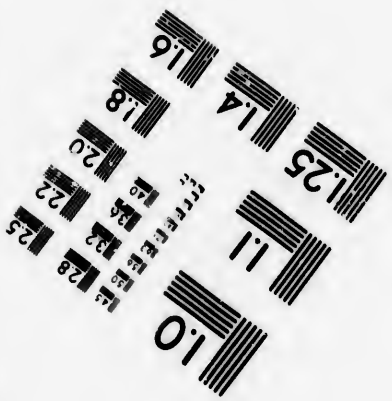

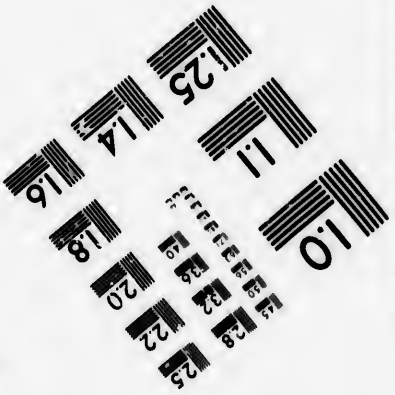

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summary exclusion from market, though they may not have dared any longer to exhibit its results in the streets of London.

Probably there is no other staple industry in which so great a revolution in the processes of manufacturing has been effected, within a few years, as in that of Hats. The appurtenances of shops in the old time, "bows," "catguts," "blocks," and "smoothing irons," are not even suggestive of the "pickers," the "screens," the "formers," the "battery," and the other details of the patented "plant" of an establishment of the present day. In 1780, the earliest noticeable date of the Danbury Hat manufacture, *one journeyman and three apprentices turned off three hats per day.* Now, one machine, which does the work of forming the body, tended by four persons, furnishes daily four hundred hats to be finished, substantially effecting what fifty pairs of hands were required to accomplish. Up to as late a date as 1845, the entire process of hat-making was hand work. The skins, having been purchased in the "original package," were first assorted, next made into "bats" by the hand-movement of the "bow," "pin," and "catgut," and the "bats" blocked into hat bodies. There were various intermediate dippings and douches in kettles—now full of hot, now of cold water—and now of one or another dye. The hat, once formed, was transferred to the finishing care of the gentler sex, whose fingers, in the vicinage of a factory, found regular employment in picking out with tweezers the unequal and rougher hairs from the nap. During the last century and the commencement of the present, the domestic material, and about the only one for hats, was the fur of the Beaver. When that animal began to disappear, Nutria, Muskrat, and Rabbit's fur came in vogue. An attempt, unfortunately abortive, was made in Danbury to breed the rabbit from imported stock, after the mode of the English Warrens. At present, but an insignificant proportion of the material worked up in our manufacture of fur hats, is of domestic production, at least nine tenths of the supply (fine skins of the Hare and Cony) coming from England and Germany.

The first application of machinery in the actual formation of a fur hat in America, is of no earlier date than 1845. In 1821, a patent was issued to a Rhode Island inventor for a machine for forming wool hat bodies, which, after improvements by other parties, was capable of turning out three hundred per day. The invention of 1845, with important improvements patented the next and succeeding years, turns out four hundred fur hat bodies daily, and has revolutionized the manufacture, reducing the cost from fifty-six cents, to at most ten cents in the production of a single body. A few of the larger establishments have this machine in use upon the premises; by far the larger part,

however, send their stock to the original location of the machines, in New York City, where it is made into bodies and returned to be finished at the factory. In 1860, the owners of this process, then running thirty machines, were, for months, forming ten thousand bodies per day, and doubtless their present production is not lower than that figure, notwithstanding the fact above cited, that several establishments have the invention in immediate use. In addition to the formation of the body, the subsequent operations of "pouncing," "blocking," and "finishing" are likewise now performed by machinery, and quite recent experiments have also met with a promising result in the attainment of a method of "sizing," which materially advances the quality of the production.

The fact that more than one house in the country, yearly sells, of its own manufacture, upward of five hundred thousand hats, and that one establishment supplies from three hundred thousand to four hundred thousand of bodies to the finishing shops, is clearly illustrative of the progress of this great industry, from the day when the "lean-to" of a New England or New Jersey farm house with its set kettles and dyeing ovens, generally worked only after harvest and before planting time, furnished by the handiwork of the farmer and his family, the head gear for a whole district. Not less marked in the quality of the production than in its quantity, however, is this progress. The fine dress silk hats, of domestic manufacture, rarely exceed three ounces in weight; the old "castors," only in exceptional cases, were as light as eight ounces, and generally weighed from ten to twelve ounces.

The Dress-Silk Hat was first manufactured in this country about 1835. Its origin is Chinese, and its introduction to the Christian World was in 1830, through the enterprise of a Parisian modist. Its production is confined to hatters in the large cities, who purchase the felt bodies from the forming establishments and cover them with the imported plush as trade demands. In point of finish, the American silk-hat is the recognised superior, foreigners invariably conceding the greater elegance and delicacy of our manufacture. The only feature in which our producers have found serious difficulty to obtain the superiority is that in which French experience and taste had for years with justice excelled all competitors—the delicacy and beauty of color. Even in this respect, however, domestic enterprise has within one or two years made such advance, that it is not a question of equality but rather of superiority of which our manufacturers now claim the favorable decision.

As an article of head covering the silk hat is much less worn than it was anterior to the visit of Kossuth to this country, whose patronage

of the wide brimmed soft hat gave an immense impetus to the wool hat manufacture. Previous to this period however, as early as 1845, a citizen of Yonkers, New York, Mr. JOHN T. WARING, had made such improvements upon the old style wool hats of that time as to commend them greatly to popular favor. After consultation with his brother, he took his sample hat to New York and the result was an order at once for fifty dozen at a large advance on the price of hats of the old fashion and the final result, after years of successful labor and judicious improvement, was the erection of the great hat manufactory of

The Waring Manufacturing Company, at Yonkers, New York.

This is undoubtedly the largest and finest Hat manufactory in the United States, and, in point of architectural beauty, is scarcely surpassed by any manufacturing establishment that has as yet been erected in this country. Standing on an eminence, the first impression of the stranger, as he views it, is, that it is some great public institution. The main building or factory proper is two hundred and twenty-five feet by forty-five feet in the clear, is five stories in height, with an L thirty by forty-five feet, four stories high. The walls are two feet in thickness, the Boiler-house is thirty-five by forty-five feet, the Machine shop is forty by fifty-six feet, the Store-house ninety by forty feet two stories high, and the Dye-house is twenty-four by seventy-five feet, with a chimney one hundred and eighteen feet high. All the buildings are of brick with iron columns and provided with hose in every room by which, in case of fire, the whole can be flooded with water in a few moments. The premises occupy an acre of ground and those portions not covered by buildings are tastefully laid out in grass plots.

Passing through a neatly arranged office the visitor enters first the room where the wool is washed on the first floor. The only notable feature is a large tank with a fine wire screen at the head and through which the water from the Nepperhan river flows continually from a four inch pipe, washing the wool thoroughly and quickly. From the scouring room the washed wool is transferred to the Drying Department. This is a large room, forty by ninety feet, in which the washed wool is spread, and underneath which there is a current of hot air carried from the boiler-room through a perforated floor. By an elevator, which runs from the bottom to the top of the building, the dried wool is hoisted to the Picking room, which is in the fourth story. This is divided into two compartments, in the larger of which is the Picking machine,

which relieves the wool from its extraneous matter and transfers the picked wool to the smaller compartment, where it falls on the floor like flakes of snow. The Carding Room runs the whole length of the main factory, and is furnished with twenty-six sets of machinery, which are arranged along the room in two parallel lines. The first line is called the "Breakers." They break up the wool, and card it into thin square bats, which may be said to be the very first formation of the felt. These pieces are then taken to the second line of "Cards," called "Finishers," from which, more perfectly carded, they roll off upon a curious and beautiful piece of machinery called a "Former." The "Former" is a double cone of wood made to revolve at the proper angle to the end of the "Finisher," and receiving therefrom the carded wool it forms it into a double cone of that material, which, when finished, is cut in the middle, and taken from the cone, each half forming the body of a felt hat. This machine is one of the greatest improvements introduced in the manufacture of hats. At one moment, we saw some carded wool rolling out from the end of the "Breaker;" the next was heard the clip of a pair of scissors on the "Former," and two hat bodies in their first state of formation were held up before us!

Descending to the first floor the next process takes place in what is called the "Hardening Room." On entering this room we are met at first by a whirring noise which proceeds from a number of machines called "Jiggers." Of these "Jiggers" there are three sets for the first hardening of the hat bodies as they come from the "Formers," and three sets to finish the process. This "jiggering" of the hat bodies is produced by placing them flat between cloths, on a metal plate perforated with holes through which steam issues from a box below, and under a small plate of wood which is made to vibrate over them with the rapidity of lightning, the vibration causing the before flimsy hat body to become more hardened and compact. The term "Jigger" is peculiarly appropriate for this process, for when once under it the little hat body is danced over with a "quick step," imparted by steam in comparison with which all common jigs performed by the feet are but the slowest kind of walking.

The "hardened" hat body is then taken by the workmen, and in the same room sprinkled with fuller's soap, folded and thrown into the large "Crank Mills," of which there are four, and into which thirty dozen of the hat bodies are cast at one time. The operation of the "Crank Mills" is to start the felt. The hat bodies are then thrown into the "Fulling Mills," which are large boxes provided with two immense hammers each, which pound the material cast in them until it becomes of the consistency of leather, forms in fact the perfect com

pact body of felt designed for the hat. When taken from these "Fulling machines," where they have endured such gigantic pounding from the combined power of steam and wooden hammers each of over two hundred pounds weight, the hat bodies, which we saw come from the "Jiggers" in sugar loaf shape of a size large enough to cover and hide three of the largest heads ever set on human shoulders, have shrunk to a size approaching "fit" for ordinary heads. Of these "Fulling Mills," there are eight in the Waring Factory, working in all thirty-two hammers. They are of the latest and most approved patent and were manufactured by Eickmeyer & Osterheld, Machinists, of Yonkers.

Thus pounded into consistency and proper size, the hat bodies are next taken to the "Wash Room," where they are thoroughly cleansed from the soap, and then being stiffened with a certain preparation, they are run through rollers.

The stiffened sugar loaf shaped bodies are then transferred to the "Plank Room," where they pass through the hands of the "blockers," and the crown and brim assume shape and form. Here may be seen a large number of what resembles octagonal wash tubs, but which are technically called "Batteries." Around each "Battery" stand several workmen with the little block for the crown of the hat ready at hand. They dip the hat body in the hot water in the "kettle" in the centre of the "Battery," pull it up on the inclined shelf, or "plank" as it is technically called, before them, clap it over and fit it quickly on the little hat block, whirl their hands as swiftly around the edge of the bottom of the block, stretching out thence, flatly, at the same time, the overplus felt not wanted for the crown, give two or three more wipes around the edge, pull the whole from the little block, and a Felt Hat, complete in crown and brim, makes its appearance, although both may be somewhat flimsy and need a little more manipulation. This is the old fashioned way of blocking hats, but in this factory there are also a number of ingenious machines for the purpose, each of which will block one hundred dozen hats a day.

After being dried in a room heated to a temperature of one hundred and thirty degrees, and assorted into sizes, the hats pass to the finishing room. Here the first operation is to remove the fuz and superfluous wool or, in other words, to polish it. This was formerly effected by placing the hat on the block and rubbing it sharply with sand paper by hand. This process was slow and tedious and never entirely satisfactory. In 1853 Mr. Waring applied his mind to the subject with the view of discovering a better plan and found that by applying the hat to a lathe with sand paper affixed to it, the result could be attained much more expeditiously. From that time to the present the lathe has

been used and Mr. John T. Waring has the credit of having been the first to introduce the process. Coming from the lathe, a touch of the smoothing iron is given to the hat and then it passes into the binders' and trimmers' hands, by whom it is finished and made ready for packing.

The machinery in this vast establishment is driven by an engine of two hundred and fifty horse-power. There are six boilers of fifty horse-power each, which not only supply the steam for the engine, but the hot air for the drying rooms and all other purposes for which hot air or steam is required in the factory. About five tons of coal are consumed daily.

The average force of hands employed is three hundred men and boys, and two hundred girls, to whom twenty-five thousand dollars are paid monthly. About three thousand pounds of wool are consumed daily and nearly five hundred paper boxes are required for packing hats. The factory has a capacity to produce six hundred dozen of wool hats and one hundred dozen fur hats per day.

The Waring Manufacturing Company was organized under the general Manufacturing law of the State of New York in 1866, and succeeded to the business established by John T. Waring in 1849, and which was carried on by him and his brother, Charles Edward Waring, since 1856, under the firm style of John T. Waring & Co. The officers of the Company are at present JOHN T. WARING, President; CHARLES E. WARING, Treasurer; who with W. C. WARING, SAMUEL SHETHAR, and EDWARD A. NICHOLS, are the Trustees.

All the hats manufactured by this company, are sold through the house in New York of

Shethar, Nichols & Co., 548 Broadway,

The original and we believe the only commission house for the sale of Hats in the United States. This firm are the successors of Swift, Hurlbut & Co., who for many years held a leading position in the trade. Mr. Shethar entered this house as a lad and displayed such aptitude for the calling, that, after passing through the successive grades of commercial advancement, he became a partner. Mr. Nichols has the advantage of being a practical hatter, and was also a member of the firm of Swift, Hurlbut & Co. In 1861 this firm was dissolved and was succeeded by that of Shethar & Nichols, who commenced business at 65 Broadway, from which they removed to 265 Canal street.

It had been the practice of their predecessors to employ Hat manufacturers in Newark, New Jersey, and in Connecticut, to work up mate-

rials and stock, which they supplied to them, but Messrs. Shethar & Nichols revolutionized the business by establishing a house for the sale of Hats on commission, the first house of the kind in the United States, and, we believe, there is none like it in Europe. They also formed connections with traders who procure Buffalo Robes direct from the Indians on the Western Plains, and effected arrangements by which they could secure regularly consignments of Hatters' furs, from France and Germany. These far-reaching plans, and their popular style of dealing, were attended with great commercial prosperity, and, in 1866, they leased the ground on Broadway, occupied by Dr. Chapin's church, and erected, on the site, the most spacious and magnificent store ever provided for the sale of Hats. The building has a front of white marble five stories in height, with arched windows, and extends back, at a uniform width of thirty feet, for one hundred feet, where it connects with another building on the rear one hundred feet square, making the total length of the store-room two hundred feet. The first floor, which is seventeen feet in the clear, and contains an area of thirteen thousand square feet, is appropriated to the sale of Hats, while the basement, which is of equal dimensions, is filled with Hatters' Furs and Buffalo Robes. The store is, no doubt, the largest and the finest ever erected by any firm in the Hat Trade.

The enterprise of Messrs. Shethar, Nichols & Co. has been felt in all the ramifications of the trade with which they are connected. Adopting in part the system which has been found to operate beneficially in the Dry Goods Trade, in establishing an agency through which manufacturers can dispose of their products, they have added to it a great depot for the supply of Hatters' materials, thus accommodating both sellers and buyers, merchants and manufacturers.

James H. Prentice's Hat Factories,

In Brooklyn, New York, employ even a larger force than the one just noticed, though the buildings are less imposing in external appearance. They consist of two factories, one of which occupies the block bounded by Raymond, Willoughby, Navy, and Bolivar streets, with a half block opposite, on which there is an extensive warehouse and sales-room, and the other is located on Nostrand Avenue and Sanford street, and covers fourteen lots of ground. In the latter are performed all the preliminary operations of forming the bodies of wool hats. It is in fact a regularly organized and well arranged woollen factory, with the most complete machinery. The Carding machines are of the latest construction, with iron frames, and extend in a line the entire length

of the building, two hundred feet, presenting, when in full operation, a scene of great beauty, even of thrilling animation. The wool, which is principally Cape Wool, on account of its superior fulling and felting properties, is brought into the factory in bales, washed, passed through the pickers, dyed, and carded in the same manner as wool which is intended for cloth. In this factory we noticed the same ingenious machines before described, which take the carded wool from the end of the finisher, and transform it into a double cone of that material, which, when finished, is cut in the middle, and taken from the cone, each half forming the body of a felt hat. Here are also the Jiggers, and the Crank mills before noticed, and Fulling machines with twenty hammers. In the blocking room are four of those beautiful machines invented by Rudolph Eickmeyer, of Yonkers, which are superseding, in large manufactories, the old hand process of blocking hats. It consists of a small upright iron frame in which two pieces of mechanism are at the same time performing two distinct operations. The one stretches the sugar loaf shaped hat body, as it came from the "Fulling Mill," to the proper extent to put it on the block and form the brim; the other blocks it and forms its brim. Two workmen only, both of which may be boys, are required to tend the machine. The first workmen takes the hat body to be stretched, places it on a small metal groved pyramid on the machine before him; the pyramid then rises, inserts its apex in a cover of rollers which descends to meet it, and which runs down over the felt in the grooves, thus stretching the felt as far as required. Rollers and pyramid then part, and the workman removes the stretched hat body, and lays it on the table beside him. It is immediately taken up by the second workman, who places it on a metal rim in the machine before him, and then sets the hat block on a fixture below. The block immediately rises in the rim, into the hat body; another fixture comes down and covers the whole, and the next sight you have is a gliding apart of all the fixtures, and the Hat complete on the block is before you. The bodies, when completed, are transported to the Raymond street factory, to be finished.

This factory is divided into a number of rooms, and is a bee-hive of industry. The trimming rooms, where there are thirty-two sewing machines, and several hundred girls employed, present a picture of busy life that is rarely seen elsewhere. In the upper rooms of this factory, Fur Hats are finished, the bodies of which are formed in a factory owned by Mr. Prentice at Norwalk, Connecticut.

On the opposite side of the street, and connected with the factory by a covered bridge, is the warehouse where the raw materials are stored. Here may be seen immense quantities of silks and other trimmings

for hats, and Beaver, Nutria, Hare and Cony furs, the last being imported from Europe without the skin. Here also is a room where the products of these factories are sold by auction at semi-weekly Trade Sales.

The statistics of this factory for the year 1866, were as follows:—

Wool used	960,000 lbs.
Fur used	100,000 lbs.
Wool Hats, manufactured per day	500
Fur " " " "	125
Hands employed, Men and Boys	1,083
" " Females	294
Amount paid for labor	$505,000
Aggregate Sales	$2,250,000

Mr. James H. Prentice, the proprietor of these factories, is a native of St. Lawrence County, New York, where he was born June 29, 1817. He was employed, while a lad, in the fur establishment of Packer, Prentice & Co , in Albany, who were manufacturers of fur caps, which were greatly in fashion some thirty years since. In 1849, he removed to Brooklyn, and embarked in the manufacture of Hats, as one of the firm of J. H. Prentice & Co., continuing the same on his own account since 1857. In 1862 he originated the plan of disposing of his products by auction at periodical sales, which was an entire novelty in the Hat trade. These sales were at first semi-monthly, but as business extended, and their popularity became established, they were held, as now, semi-weekly, and attended by the principal dealers throughout the country, who watch them with interest, as the barometer of their market.

Moore & Sealy Brothers' Hat Factory.

In Newark, is fairly entitled to rank among the great Hat manufactories in the United States. Organized in 1851, it occupies a conspicuous structure on Railroad avenue, which if in one line would be about five hundred feet in length, with a uniform height of four stories. The equipment and direction of this establishment are exemplary, strongly indorsing the practical character of the firm, each member of which has served an apprenticeship in all the different branches of the business. Moore & Sealy Brothers, are one of the few firms in the United States, that manufacture both Fur and Wool Hats. The two materials necessitate an extraordinary investment in machinery, as the processes of manufacturing are entirely diverse, and the machinery of this firm, if destroyed, could not be replaced at the present time for $100,000.

The firm, which has undergone no personal change since its forma-

tion in 1851, is composed of four partners, each of whom has well-defined duties, for which his special qualifications best fit him, in the administration of its affairs. From the beginning, the members of this firm have manifested a progressive spirit, and the influence of their mental activity has been felt in all the wide ramifications of the Hat manufacture. They were the first in this country, it is said, who discovered the art, in which the French excel, of producing the various fancy dark colors, such as dark maroons, wine and plum colors, browns, etc., and Hats of this description are now universally colored by the process which they were the first to apply. Producing largely of those choice styles adapted to the requirements of the trade of large cities, they have been prolific in originating those novelties in style which constitute the fashion of a season. In the Wool Hat branch, especially, they have introduced, from time to time, new features which attained such extensive popularity, that, if patented, they would have resulted in great pecuniary advantage to the firm. Of these probably the most important was the use of an appliance by which any desired shape can be given to the brims of soft fur and wool Hats. Their process insures permanency, as well as beauty, in the form of brim, and has contributed greatly to increase the popularity of wool hats for children and youths' wear. This firm were the first to succeed in making "thread mix" wool hats—which, though produced in France had not been made in this country until they introduced them. They were also but few, if any, Children's Wool Hats made in this country until they had created a demand for them by the improvements which they had introduced in style and methods of manufacture. Of the various novelties originating with this firm, we believe the only one secured by patent, is an inlaid hat, in which figures and designs of wool are felted in with the body. A still greater novelty, pertaining to the class of inlaid hats, has been invented by them, but not as yet introduced into the market, because of the present prevailing preference for plain colors. While this firm have attained a reputation mainly as manufacturers of choice styles of Hats for children, youth, and young men, in both fur and wool, for the best retail trade of the large cities, they have not neglected the production of those staple goods adapted to the wants of jobbers, and the wholesale trade generally.

The facilities of Messrs. Moore & Sealy Brothers, in machinery adequate to the production of two hundred and fifty dozen of Hats daily; and for several years their sales have amounted to three quarters of a million of dollars. They employ about four hundred persons, and pay for labor nearly two hundred thousand dollars per year. Their products are sold to all parts of the United States, from Maine to California, and from the Lakes to the Gulf of Mexico, including the Canadas.

Yates, Wharton & Co.,

Are another firm, in Newark, who have attained celebrity in the manufacture of Fine Hats, and occupy extensive buildings on South Market street.

Mr. Henry J. Yates commenced the business as a member of the firm of Vail & Yates, in the year 1843. The specialties by which they were most favorably known, were in the production of gentlemen's Cassimere Hats, then coming into general use, and the attainment of a high finish in the texture and colors of their goods. The first to successfully reproduce the delicate shades of colors for which the French fabricants had been for years famous, they soon won a high position with the trade. By assiduous experimenting, and with their growing knowledge of the chemical constituents of color, they were able, in no long time, to so far improve the style and character of their productions as to fully equal, if not surpass, the finest specimens of foreign manufacture, and to very largely reduce the importation of French wares into this country.

A second improvement in the finish of Hat fabrics, now adopted generally by our manufacturers, was soon after borrowed from the French by this enterprising house, it being the system of "pouncing," through which a softer texture and purer surface were obtained in all varieties of material.

In 1857, the firm of Vail & Yates was dissolved, and Mr. Yates made his present prosperous connection with Mr. John Wharton, well known as one of the most skilful of practical manufacturers, at that time in the business. The energy and discrimination displayed by the old Firm, were not wanting to the new one, Mr. Wharton's accession contributing, in a marked manner, to the prosperity of the business. The careful regard to material and finish, with the special study of chemical effects, was rather increased than neglected, and not only tended to the profit of the establishment, but likewise to the advancement of the national industry which was thus represented In 1861, the operations of the firm, by the growing demand for its specialties, justified a move, of which the wisdom has been amply evidenced in the greatly enlarged sale of their productions. This was the establishment of a central depot in New York, through which the market could be more directly and conveniently reached. The store of Yates, Wharton & Co. is now at 130 Grand Street, New York, a part of the city about which the hat trade seems to be congregating; and the business is under the direction of Mr. William D. Yocom, the financial partner, one of the most intelligent and enterprising men in the trade.

The number of hands employed by this firm, which varies with the fluctuations of business, is never less than two hundred, and at times reaches five hundred. The machinery operated by them comprehends every improvement known, though no patents for specialties have recently issued to them, notwithstanding the fact that some of the most important innovations in this manufacture have originated in their factories.

Orrin Benedict & Co., Bethel, Conn.,

Have been selected as a representative of the firms engaged exclusively in the manufacture of Fur Hats. Their factory is situated on the main thoroughfare from Danbury to Bethel, Connecticut, hardly more than quarter of a mile from the latter place. The present principal, Orrin Benedict, Esq., established the business in 1845, in a building of insignificant size and capacity, with a force of twenty workmen. The bodies were not made on the spot, but purchased from "forming" establishments. No machinery was employed, and even up to as late a date as 1866, every detail of the work was performed by hand—with how great excellence the extraordinary growth of the firm and the popularity of its wares, furnish ample demonstration. Year by year, stimulated by his success, Mr. Benedict made additions to his factory and labor-roll, till the premises at last became an extensive, though incongruous and rambling mass of buildings. In 1865, his first and only partner in the business, Mr. Wm. H. Barnum, who, for several years previous, had been attached to the establishment, was taken into the firm.

The amount of Mr. Benedict's production, in 1845, did not exceed thirty thousand dollars; in 1867, it exceeded six hundred thousand dollars.

A conflagration, in October, 1866, which made a complete wreck of the factory, wrought a change in the operations of the firm, altogether radical. Out of the ashes of the old establishment, rose speedily, a structure which, in capacity of mechanical means, general adaptedness for quick and economical production, and propriety of design, cannot well be surpassed. The new factory of Benedict & Co., completed and in operation in April, 1867, is a well built wooden edifice, four stories in height, comprising a main building one hundred and seventy-six feet long by thirty-eight feet in breadth, with an L, one hundred and thirty-six feet in length. That portion of the building containing the boilers and engines, is constructed of brick, with unusual solidity and strength. Two engines, of peculiar simplicity of design, of Earle's patent, having each some seventy-five horse power, with

three enormous boilers, in all costing some $15,000, now furnish the motive force of the establishment.

The firm no longer restricts its operations to "finishing," but turns out its work from the raw material. To effect this, the enterprise of the partners, at an expenditure exceeding $100,000, has filled the new factory with the very finest specimens of all the improved machinery at present in use. Among the latest improvements adopted in this establishment, a new process for "sizing" promises to be of especial value, though further experiment will still more develop its importance. At present, it has been used in but one other factory. A material economy of labor is anticipated from its perfect working; but the principal result regards rather the quality than the quantity produced.

As suggested above, Benedict & Co. manufacture Fur Hats exclusively. Their production is mainly of the fancy styles, several of which have originated with them. In April, 1865, the firm first opened a store in New York, at 257 Canal Street, since removed to 510 Broadway, a move which soon resulted in a manifest increase of their business. Selling principally to the trade of the large cities, it has been and is their especial aim to sustain the character of excellence in their goods, that has won for them a reputation so merited. To this end very particular attention is given to the material consumed in the manufacture, none but the finest skins of the imported Hare and Cony being worked up.

The number of hands now employed in the operations of the firm, is never less than two hundred, and occasionally as high as three hundred. The new establishment, with its perfect organization, is capable of producing $1,000,000 worth of Hats per annum.

K. C. Gleason, Methuen, Massachusetts,

Has been selected as a representative of the successful Hat manufacturers of Massachusetts. For many years, his factories were the leading ones in New England, and he prosecuted a uniformly successful business amidst all the vicissitudes of the trade, which involved in disaster hundreds of his competitors. He was among the first in New England to embark in the Soft or Felt Hat manufacture, and reaped the benefit of the impetus, which the visit and popularity of Kossuth, who wore this style of Hat, gave to this branch of the general trade.

Mr. Gleason is a native of Haverhill, Massachusetts, and served a regular apprenticeship with his father, who was also a practical hatter. He commenced the business, on his own account, in Methuen, in 1838,

and pursued it for twenty-one years, with remarkable diligence and success, supplying the Boston and other markets, and ever foremost in adopting improvements in styles and methods of manufacturing. In 1859, he purchased, in association with others, the Belknap Mills, at Laconia, New Hampshire, and since that period, has gradually withdrawn from his former pursuit, and devoted his attention principally to the manufacture of various kinds of Textile Fabrics.

In all his enterprises Mr. Gleason has displayed a sound judgment, and his popular and frank manners have attracted and attached to him a large circle of devoted friends.

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REPRESENTATIVE
TOBACCO
MANUFACTURERS
A E LAWRENCE
NEW YORK
JOSEPH HALL
NEW YORK
C BRONSON
TOLEDO OHIO

DAVID H. MCALPIN
NEW YORK

THE GREAT TOBACCO MANUFACTORIES.

The Tobacco Plant is indigenous to almost every latitude of the globe. More than forty varieties have already been discovered, every variety possessing qualities and characteristics peculiar to itself, and singularly adapted to the preferences of those among whom it is found. When or where its cultivation began it is not now possible to determine; nor is it positively known at what time it began to be extensively used. The only reliable records on these points date from the period when it became a commercial staple, and even these are meagre, and for that reason unsatisfactory. Columbus, as most persons are aware, observed it growing in abundance in the West Indies when he landed there; and, twenty-five years later, Cortez found the subjects of the Inca, almost to a man, indulging in the practice of smoking; and, if tradition can be relied upon to any extent, its growth had been encouraged and its use indulged in throughout the whole of South America for many years before the Spanish conquest. Sir Walter Raleigh is said to have been the first to introduce the practice of smoking into England; but this assertion lacks confirmation. Francisco Hernandez De Toledo, a physician sent to Mexico by Philip II. of Spain, on his return to Court, brought with him a quantity of the seeds of the tobacco plant from that country, and the cultivation and use of the article commenced in Spain immediately afterwards. This was in 1559; while Sir Walter Raleigh did not make his appearance in England with the exotic until 1584, twenty-five years later. The intercourse between England and Spain at this time was such as to preclude the supposition that the article had not made its way into the former from the latter country prior to its introduction by Sir Walter. The most, it would seem, that can reasonably be claimed in behalf of Sir Walter in this connection is, that he was the first among the nobility and higher order of people to sanction by example the use of the article, and by this means to bring it into favor.

The cultivation of this plant was commenced at a very early period in our colonial history and the various efforts that were made to foster and stimulate its growth were alluded to in the first volume of this History.

Though not positively demonstrated, it seems probable that the various kinds of tobacco raised in this country have all emanated from the same stock, and the difference observable in them is traceable solely to the influence of climate, soil, and varying modes of culture. The Macrophylla, or Orinoco tobacco, of Virginia, is doubtless the source

whence have sprung every variety of native Tobacco seen in the United States to-day. And what is scarcely less singular, the Tobacco of the West India Islands is of the same species as that raised in this country. From Tobago it is supposed the seeds of the plant were first brought to Virginia, but by whom, or when, no one at present can tell. Within a period of little more than a century, the tobacco trade has developed into a business of vast proportions. EDWARD BURKE Esq., of New York, late Editor of the "Tobacco Leaf," has prepared some interesting statistics on the subject, and states, that in 1855, the production of crude tobacco throughout the world was estimated at 955,039,000 pounds, distributed as follows:—Asia, 399,900,000; Europe, 281,844,500; America, 248,280,500; Africa, 24,300,000; Australia, 714,000. In 1860, the United States alone produced 429,390,771 pounds. In 1840 Virginia raised 75,347,006 pounds; Kentucky, 53,436,909; Tennessee, 29,550,432; Maryland, 24,846,002. In 1860 these States produced, first: Virginia, 123,968,000; Kentucky, 108,102,000; Tennessee, 38,911,000; Maryland, 38,411,000. In 1840 the production of Ohio amounted to 5,942,275 pounds; in 1860 it reached 29,529,000. In 1850 Connecticut raised 1,267,624 pounds; Pennsylvania, 912,651; Indiana, 1,044,449. In 1860 their product was—Connecticut, 6,000,000; Pennsylvania, 3,182,000; Indiana, 4,658,000. The exports of Tobacco from this country from 1772 to 1775, were 397,512,687 lbs.

The following was their distribution:—

	Great Britain. Pounds.	Other Countries. Pounds.
1772	97,799,263	7,458
1773	3,695,564	96,776,443
1774	18,698,337	78,676,915
1775	27,623,451	74,265,156
Totals	147,716,615	249,796,072

From 1776 to 1782 they were 86,649,533 pounds:

	Great Britain. Pounds.	Other Countries. Pounds.
1776	—	14,498,500
1777	—	2,441,214
1778	6,520,550	4,440,783
1779	10,982,890	6 173,008
1780	11,474,791	5,950,176
1781	7,600,296	5,738,872
1782	6,364,813	3,463,431
Totals	42,943,340	42,715,984
Annual average	12,235,619.	

Of the total exportation, England, during the Revolution (which event is embraced within this period), captured about 33,974,949 pounds.

From 1787 to 1789, inclusive, the exports were:

To Great Britain. Pounds.	To Other Countries. Pounds.
45,379,795	44,661,205
39,600,404	48,995,186
48,831,232	39,843,768
Total	267,311,590

The total number of hogsheads of tobacco exported from the United States, from 1821 to 1840, were 1,792,000, the value of which was $131,347,521.

The exports of manufactured tobacco during the same time were 57,196,254 pounds, and of snuff, 788,477 pounds, the combined value of which was $5,566,581. Between 1821 and 1830 there were exported 824,245 hogsheads, valued at $56,889,291; and during the next ten years, 967,755 hogsheads, valued at $74,458,230.

The total exportation of hogsheads during the seventy-five years intervening between 1790 and 1865 was 7,141,452, or, in pounds, 8,570,742,400; annual average hogsheads, 95,219⅓ nearly; pounds, 114,276,565⅓.

The exports of manufactured tobacco from 1791 to 1865 were: 283,165,765 pounds, annual average 3,826,578 pounds.

Of snuff there were exported from 1817 to 1867, 2,082,734. A partial idea of the magnitude and importance of the tobacco trade of the United States and the other countries mentioned will be derived from these figures. The aggregate is surprising, and shows the permanent and extraordinary fascination which this narcotic exercises upon mankind.

The principal varieties of Tobacco manufactured ready for consumption, may be classified as Fine Cut Chewing and Smoking Tobacco, Plug Tobacco, Snuff and Cigars, each of which has its representative houses. Of Fine Cut Chewing Tobacco, New York is the great centre of the manufacture; four of the concerns employing one thousand five hundred operatives. One of the oldest houses in that city, now engaged in this branch, is that of

A. H. Mickle & Sons,

Successors to Mrs. G. B. Miller, who achieved the distinction, rare for a woman, of identifying her name with an article that is now a commercial staple, and whose influence is still felt in a trade that is now not only a source of vast individual wealth, but of national revenue.

In the year 1776, George Benjamin Miller came to the city of New York from Philadelphia, the place of his birth, and commenced the manufacture of Plug Tobacco and Snuff at No. 110 Water street, near Wall. He had two brothers who entered the army of the Revolution under Washington, one of whom fell at the battle of Trenton, the other, after the war, was for a time associated with George Benjamin Miller in business. About the year 1790, George Benjamin Miller died, leaving a wife and one son, the latter inheriting his father's name.

On the death of her husband, Mrs. Miller assumed the management; commencing at the same time the manufacture of those brands of Fine Cut chewing and smoking Tobacco, which have made the establishment so famous, and so continued under her own name until her second marriage, when, her son being of age, the business was conducted in his name, Mrs. Miller retaining her interest and control as before. The second G. B. Miller married Miss Rachel Navaro, whom, at an early age, he left a widow with one daughter, Miss Caroline Augusta Miller, afterwards the wife of Mr. A. H. Mickle, late Mayor of New York. Mr. Mickle having become interested in the business, the firm name became Mrs. G. B. Miller & Co., and so continued until the death of Mrs. Miller, which happened in 1848, when it was changed to A. H. Mickle, successor to Mrs. G. B. Miller & Co., and subsequently to A. H. Mickle & Sons, under which style the business is now conducted by William E. Lawrence, son-in-law, and George Benjamin Mickle, who is now the sole representative of the family, and son of Mr. A. H. Mickle.

As will be seen by the genealogy here given, the founder of this house was singularly fortunate in her family connections; her successors being near relations, and all trained under her immediate supervision, and to this fact, as well as to the fidelity with which they have uniformly followed her practice and precepts, the perpetuity for such a length of time and the unparalelled success of the establishment are in some degree attributable. Though not the originator of Fine Cut Chewing Tobacco, Mrs. Miller was one of the first to adopt the new discovery, and but for the improvements introduced by her in the mode of manufacture and the quality of the material employed, it is a question if, with the opposition which the innovation encountered, it would

ever have become popular. When Mrs. Miller commenced the manufacture of Fine Cut, there were not more than six persons in the country engaged in the same business, and those that were so engaged, made only an inferior article. The Tobacco manufacture of that day consisted, with these few exceptions, of the most ordinary specimens of Plug Tobacco, the various brands bearing titles as ordinary as the material of which they were composed, and she was obliged to contend not only with the difficulties usually incident to the development of a new art, such as imperfect knowledge, poor machinery, want of experience, and public prejudice, but also with numerous and wealthy competitors in the other branch of the trade. Talent and energy, however, enabled her to overcome all opposition, and so popular did her productions in a short time become, that for several years she had the field almost exclusively to herself.

Her success gradually attracted the attention of others to the same pursuit, the number of which has been constantly increasing, and now Fine Cut Tobacco is one of the most important manufacturing interests in the United States. Being a woman of remarkable social, as well as business qualifications, 110 Water street early became a resort of the most distinguished politicians and literary gentlemen of the period. From the old Tontine Coffee House, where the celebrities of the day were accustomed to assemble, and which was located on the northwest corner of Wall and Water streets, to Mrs. Miller's counting room was but a few steps, and thither, it was customary for the chosen ones to repair daily to procure their supplies of Snuff and Tobacco, and discuss politics and public topics generally.

Here might have been found, at almost any time, when not engaged in their regular duties, such men as John Lang, editor of the old New York Gazette, whose office was on the south-east corner of Wall and Water streets, since occupied for so many years by the Journal of Commerce newspaper, the Maxwells, Whitneys, Wickoffs, Suydams, Irelands, and a host of other prominent old Knickerbockers. It was on an occasion, when several of these gentlemen were assembled, that one of the many brands of Snuff, for which this establishment is celebrated, received its appellation. A customer entered and asked for some "Irish Blackguard"—a kind of Snuff then, and now, extensively used by some classes; whereupon, Mr. Lang inquired of Mrs. Miller, why she did not have a distinctive name for the Snuff used by the party present, to which Mrs. Miller replied, "I will," and instantly gave it the name of the "American Gentleman," by which name it has been known from that day to this.

The great fire of 1835, which destroyed so many memorable places,

also reduced this one to ashes; but it was immediately rebuilt, and with greater capacity and more completeness of detail than before. It would be an interesting exhibit to show the total transactions of this house between the years 1836 and 1860, during which time the business reached its maximum, but to present such exhibit, would demand more space than the nature of this article will allow; it will, therefore, be sufficient to state that, they far exceed those of any similar house in the world.

There is scarcely an individual in the United States acquainted with manufactured Tobacco, who is not familiar with the blue packages, which originated in and have been continuously prepared by this house, and it will hardly be deemed an exaggeration to assert, that very few who have become accustomed to their contents, have ever relinquished them for the purpose of obtaining something superior.

The patronage of the house has been regular and continuous. Throughout its entire career, it has been distinguished for the purity and excellence of its production, and in no instance have her successors more rigidly adhered to the aim of the founder than in reference to these particulars. An article of Chewing Tobacco made of the very best material and wholly free from adulterations of every kind was what she relied upon for success at the outset, and although introducing many new and desirable brands since her time, her successors have never in the slightest degree deviated from this principle. Neither sweetening nor other foreign substances are or ever have been used in the manufacture of the leading brands of Chewing Tobacco in this establishment.

The present senior partner, Mr. WILLIAM E. LAWRENCE, is one of the most prominent and popular members of the trade. He is the President of the Tobacconists' National Association, and is distinguished both in public and in private life.

The operations in manufacturing Fine Cut Chewing Tobacco are interesting, though simple—but a few hours being required to transmit the crude material into the finished article—and with some slight exceptions are alike in all the factories. To describe them, we shall select the

Island City Tobacco Works, New York,

Of which DAVID H. MCALPINE is proprietor, and which possesses machinery as perfect and complete as any.

In McAlpine's establishment, the operation commences in the *Assorting room*, a commodious appartment on the ground floor, into which the hogsheads containing the crude material are rolled by a spacious

entryway leading from Sixth street. Here the hogsheads are broken open and their contents carefully examined by a number of skilful workmen, who separate the leaves one after another, laying those intended for the finer quality of Tobacco in one pile, and those intended for inferior grades in another. When this has been done, the various parcels are taken to the *Casing room* adjoining and there separately immersed in a huge cauldron containing a solution of warm water and licorice, and afterwards laid upon a slightly elevated inclined plane to drain. Thence the material is carried to the *Stripping room*, located on the third floor of the factory, where are usually found about seventy-five juvenile and adult female operatives seated upon stools in small box-like compartments, who open out each leaf and extract the stem, after which the strips are transmitted, by means of a dummy, to the *Cutting* department, located on the second floor, and embracing, as does the Stripping room, the entire floor, which measures fifty by forty feet. Here the strips in given quantities are laid lengthwise in the feed-box of the cutting machine, which is a kind of trough about four feet in length, twelve inches wide, and eighteen inches in depth. An ingeniously contrived chain, or rather series of chains, called an "endless chain," now carries the mass forward to a wheel revolving at one end of the feed-box at the rate of four hundred revolutions per minute (which revolutions can be indefinitely increased), in which are adjusted a number of knives that cut the leaves or strips into the fibrous form in which it is seen when ready for use. The cutting machines used here are called the "Dayton Machines," being manufactured exclusively at Dayton, Ohio, and differ from those formerly in use in that they are self-supplying through the operation of the chains. With the old style of machine the material had to be first pressed solidly into the form required, and when put into the feed-box so manipulated by hand as to present a proper basis for the action of the knives, but with the Dayton Machine the operator has only to lay the material in properly and the chains at once carry it forward; so compressing it during the movement that when it reaches the wheel it is of the exact density demanded. There are four of these machines in this room, each one of which is capable of cutting one thousand pounds a day. One man is kept constantly engaged sharpening the knives, and this occupation wears out from eight to ten grindstones per annum, the stones usually weighing over a ton each.

After the Tobacco has been cut it is taken to the *Drying rooms*, of which there are five, three above the stripping apartment and two in another building, all heated by steam, at a temperature ranging from ninety to one hundred and twenty degrees. Distributed through these

rooms are five or six hundred canvas racks, so arranged that the heat affects all parts alike.

On these racks the Tobacco is carefully spread to dry. The length of time required for drying varies with the temperature and the character of the Tobacco. When the desired condition has been attained the mass is gathered up, and shaken to eliminate the "shorts," or non-fibrous particles, of which there is always a considerable quantity. The selected portion is then put into a large bin in the *Dressing room*, where it is left until what little moisture there may be remaining has permeated every fibre alike, when it undergoes what is called the process of "Dressing," which is a closer and more elaborate manipulation than the one preceding, when it is transferred to the *Packing rooms*, where the final process takes place. The *Packing rooms* of this house are large, and present many features of interest. From seventy-five to eighty young woman, ranging from thirteen to twenty years of age, are constantly employed in packing throughout the year.

At regular intervals the packers stand before a series of forms or tables elevated to a convenient height, in which hoppers are constructed, designed to contain sufficient Tobacco to fill a gross or a gross and a half of the ordinary sized packages of Chewing Tobacco. The Tobacco is all weighed in the *Dressing room*, and each packer receives only enough at a time for a single gross. At her right hand each packer has a number of sheets of tin-foil and paper, cut so as to exactly envelope the proper quantity of Tobacco. In front of her is a wooden-mould of the exact size of a paper of Tobacco, into which, after covering the extreme end with a sheet of the paper and then a sheet of foil, and turning down the corners of these, a tin mould is inserted, into which the Tobacco is put and pressed down by means of a "follower." The tin mould is then withdrawn, leaving the Tobacco inclosed in the envelope, which is subsequently taken from the wooden mould, the ends fastened down, and the article is ready for the market. As in every other department of labor, there is in this considerable diversity in the capability of individuals, some being able to pack more than others in a given time. There are some females here who will pack in this way twenty gross a day.

The principal brands of Tobacco manufactured in these Works are known as the John Cornish, Virgin Leaf, and Navy Fine Cut Chewing Tobaccos. The first paper of the Cornish Tobacco was offered for sale in June, 1849. Mr. McAlpine became a partner of the original proprietor in 1857, at which time, also, John W. French became associated with him, under the style of John Cornish & Co. In 1862, Mr. Cornish retired, when the firm-name was changed to that of D. H.

McAlpine & Co. Upon the withdrawal of Mr. French, which occurred in 1865, Mr. McAlpine, perceiving that the business was becoming too large for a single management, called to his aid Mr. John H. Reid as special partner, with whom he is now associated, the title of the firm continuing as before. Though permanently established when Mr. McAlpine entered upon his duties here, it was not until he had assumed entire control that the house attained its greatest popularity. From 1862 until the present time, its career has been onward and upward, and to-day it is entitled to rank with the best establishments of the kind in the United States.

Combined with a thorough knowledge of the Tobacco trade in all its branches, great aptitude for business generally, quick perception, and a resolute will, Mr. McAlpine possesses in an eminent degree that faculty of determining future results from the symptoms of to-day—in other words, of knowing just when, where, and in what manner to make a venture or investment—which faculty enables him to control, rather than follow events; and to the judicious exercise of this rare gift may be attributed, in some measure at least, his remarkable success as a manufacturer and business man.

The Works comprise quite a number of buildings, and cover an area equal to seven or eight city lots, having a frontage of fifty feet on Avenue D, by one hundred and fifty feet on Sixth street. About three hundred persons are employed in the various departments.

In the Western States, within a few years, the manufacture of Fine Cut Chewing Tobacco has taken root and made considerable progress. One of the pioneers in this branch, in the West, was

C. Bronson, of Toledo, Ohio,

Who commenced the business in 1836, in Centreville, St. Joseph county, Michigan, and whose establishment, up to 1847, was the only one west of Detroit where this article was made. His capital at the commencement was quite limited, and the machinery of his factory was of the simplest kind, being operated entirely by horse power. In 1851 he removed to Toledo, Lucas county, Ohio, and there founded the Works which bear his name, and which have become quite famous.

Mr. Bronson was the originator of bright Fine Cut Tobacco, and to this valuable discovery, it may be assumed, he mainly owes the signal success which has attended his efforts. The Bronson Tobacco Works comprise three handsome and substantial brick buildings, each five stories high, with a frontage of eighty and a depth of one hundred and

fifty feet, and are located on the south side of Summit street, between Madison and Jefferson streets. Another large edifice, situated on Lynn street, is devoted to the storage of the Leaf Tobacco used in the manufactory, as are also several extensive sheds located in the vicinity of the corner of Cherry and Summit streets.

In the manufactory there are eleven first-class Cutting Machines, capable of cutting eleven thousand pounds of Chewing, or eighteen thousand pounds of Smoking Tobacco per day, all operated by an engine of about twenty horse-power. Ordinarily the number of hands employed averages from one hundred and twenty-five to one hundred and fifty. The revenue tax paid by this establishment is probably larger than that of any other house in the West, amounting in 1865 to $250,322.81. The value of the goods sold the same year was $560,400. The leading product of the establishment is Bright Chewing Tobacco, but it has achieved an enviable reputation in the manufacture of Smoking Tobacco of all kinds. Some of the best brands of Chewing, among which may be mentioned "C. Bronson's Indian Brand," have attained a widespread celebrity, and are found in the hands of the trade in all parts of the country. Mr. Bronson at first disposed of his goods through the instrumentality of travelling agents, who drove about the country in wagons; but as his business increased, and the popularity of his goods became firmly established, he found it necessary to dispense with this inadequate mode of distribution and avail himself of the facilities afforded by modern improvements. Besides being a man of indomitable energy, and excellent business qualifications, Mr. Bronson is possessed of considerable mechanical ability, and to him belongs the credit of inventing some of the most valuable improvements made in cutting and handling Tobacco. To his discernment and example the West owes its high position in this department of trade; for soon after he commenced the manufacture of bright goods, his style was copied, and his system followed by other enterprising men in the various cities of that section; and now, the West not only supplies its own demand, and that in an article peculiarly adapted to its requirements, but also furnishes the greater portion of the same material consumed elsewhere.

On January 1st, 1866, Mr. Bronson retired from active business, having sold his establishment and trade to his brother David Bronson and Charles R. Messinger. These gentlemen, having graduated under the supervision of the former proprietor, are well qualified to sustain the exalted prestige of the house, and, judging by their sales during the first year of their occupancy of the premises, they are destined to add materially to its popularity and usefulness.

It has been remarked, that the inhabitants of the higher latitudes of the globe demand stronger artificial stimulants than those of the lower; and in respect of no other article that enters into the domestic economy, perhaps, are local, or rather climatic influences more noticeable than in connection with Tobacco. Scotland and Ireland mainly prefer the Tobacco of Western Virginia, Kentucky, and Tennessee; while England manifests a preference for the milder products of Maryland, Kentucky, Missouri, and other Western States. Germany, like England, demands a lighter variety than the States north of her, but heavier than France, Italy, Spain, or the other countries bordering on the Mediterranean. In this country, the order of progression is not so regular as it is abroad. Consumption does not appear to correspond so nearly with the different ranges of latitude as in Europe, Asia, or even Africa; but there is, nevertheless, the same diversity of taste and practice here that is observable there. Just as in Austria and Turkey, totally distinct varieties are used, and deemed essential to the fullest enjoyment from this source, so here, the various sections of our country exhibit a varied preference for divergent species and styles. The Northern, Eastern, and Middle States, manifest a close resemblance to the kindred tier of States in Europe, using, generally, the rich, fatty varieties; while the Southern, in their practice, approximate more nearly the custom and habit of Southern Europe. It is in the custom of our Western States that we perceive the first real departure from that order of adaptation which, from its universality and undeviatingness, appears to give validity to the assumption that there is a natural law which makes certain parallels of latitude at once the boundaries and the exponents of human appetite; for there, light, or as it is called, Bright Tobacco, is the rule, as in the Middle and Northern States it is the exception. The exception to the principle here presented, is however, after all, more apparent than real. The adaptability of certain portions of Western territory and soil to the production of light manufacturing Leaf, and the accessibility of the whole to the Bright Tobacco producing regions of the South, is probably the actual reason why both manufacturers and consumers are predisposed to this variety.

Mr. Bronson's sagacity is shown in the celerity with which he discerned the opportunity presented, by the tendency of his section, for the introduction of an entirely new element into the Tobacco Trade of the country; and the many advantages accruing to the trade everywhere from this addition to its previous resources, entitles him to be ranked among its most honored and deserving members.

The Lewis Tobacco Works, St. Louis,

And at Glasgow, Missouri, were for many years the leading ones in the West. They were founded by Benjamin W. Lewis, who emigrated to the State of Missouri from Rockingham county, Virginia, in the year 1831, when eighteen years of age, and the eldest of five children, the maintenance of whom, and a widowed mother, mainly devolved upon him. From the product of a rented farm he succeeded in making a comfortable support for his mother's family, and by great industry and energy found himself, in 1837, possessed of about six hundred dollars in money. With this small sum he formed a copartnership with Mr. William D. Swinney, for the purpose of manufacturing Tobacco at Glasgow, under the style of Swinney & Lewis. Leaf Tobacco that year averaged in price about two and a half cents a pound, and it was estimated that the labor of manufacturing it, and the cost of materials used in the same, were equal to the value of the Leaf; and the terms of the copartnership provided that Mr. Swinney should purchase the Leaf, and Mr. Lewis manufacture and prepare it for market—the products being equally divided between them, and each disposing of his own share as he thought proper. This copartnership continued, with some modifications, the business constantly growing more and more profitable and extended, until 1849, when the factory, which was the property of Mr. Lewis, was destroyed by fire, involving a loss to him of about twenty-five thousand dollars. The factory was immediately rebuilt, on a larger and more extensive scale, and was completed in January, 1850, when the firm of Swinney & Lewis was dissolved, the former withdrawing. After which, Mr. Lewis associated with himself his two brothers, James W. and William J. Lewis, under the style of B. W. Lewis & Brothers.

James W. and William J. Lewis, in 1847, commenced the business of manufacturing Tobacco in St. Louis—their establishment being managed by William, James being in the employ of Swinney & Lewis at Glasgow, for a salary—and when Benjamin admitted them into the Glasgow house, he became a partner in the St. Louis house—and the style of this house was changed to Lewis & Brothers. In January, 1855, Mr. John D. Perry was admitted a partner in the St. Louis house, the style of which was then changed to Lewis, Perry & Co.; and at the same time, Mr. Thomas J. Bartholomew became a partner in the Glasgow house. These accessions contributed materially to the influence and means of the respective firms, and in a short time their business had so increased that the Lewis brands of Tobacco were known and eagerly sought for in almost every State and Territory of the

Union. The great Valley of the Mississippi, California, the Indians of the Plains, New England, and Texas, were all large consumers. These firms were now working into Plug and Fine Cut Tobacco from three to four million pounds annually, besides exporting large quantities of Leaf and Strips to Great Britain and the Continent of Europe. When the late war commenced they were employing between four and five hundred operatives—those at Glasgow being for the most part colored people held to service, about one hundred and twenty-five of whom were owned by the partners. In May, 1862, the Glasgow manufactory was again destroyed by fire, and its destruction at this time was thought by many to have been caused by those in sympathy with the Rebellion, the unswerving loyalty of Mr. Lewis and his partners being considered, by the more unscrupulous of those who had thrown off their allegiance to the government, sufficient justification for a resort to extreme measures. The destruction of the manufactory, and the advance of the Confederate forces under General Sterling Price, induced the Glasgow firm to transfer to St. Louis and New York all the remaining stock saved from the fire, where it was subsequently disposed of at a considerable sacrifice. The loss by this fire was between one hundred and fifty and two hundred thousand dollars. The unsettled state of affairs prevented the immediate rebuilding of the Works.

On the 18th of August following, Governor Gamble commissioned Mr. Thomas J. Bartholomew a Colonel, and ordered him to organize a regiment of militia in Howard and Randolph counties, and to put it into immediate service. Mr. James W. Lewis at once enlisted and organized Company A of this regiment, and was commissioned Captain. By the 25th of September the regiment was mustered into service, and subsequently rendered valuable aid to the Union cause. In December Colonel Bartholomew was promoted to be a Brigadier-General, and assigned to the command of a district comprising twenty-five counties in Northeast Missouri, with headquarters at Glasgow. Captain Lewis was also at the same time promoted to be Major, and assigned to duty on General Bartholomew's staff. So devoted were these gentlemen to the service of the country, that for nearly two years they absented themselves entirely from their regular pursuit.

In January, 1863, General Bartholomew retired from the firm. The remaining partners then rebuilt the factory, and prosecuted the business until the death of Mr. Benjamin W. Lewis, when Major James W. Lewis, the surviving partner, assumed the entire control, and is now conducting the business in the same name and style as before—B. W. Lewis & Brothers—and is the sole owner of the business, besides

being one of the executors of his brother's estate, now worth over seven hundred and fifty thousand dollars. About this time, Mr. Perry also withdrew from the firm of Lewis, Perry & Co. in St. Louis. B. W. Lewis, Jr., son of the founder of these houses, then became a partner—the firm again assuming the title of Lewis & Brothers—and was thus continued until 1865, when Mr. William J. Lewis retired, the style then becoming Lewis Brothers & Co.; and on the first of January, 1867, Mr. B. W. Lewis, Jr. purchased the interests of his remaining partners, and is now the sole proprietor of the house.

Mr. Perry, on withdrawing from the firm of Lewis, Perry & Co., retired from mercantile pursuits, and became largely interested with a number of Eastern and Western capitalists in the construction of the Union Pacific Railroad, and has been for several years the President of the Company owning and controlling the Eastern Division of that great work. William J. Lewis, on retiring from the Tobacco business embarked in the Commission trade in St. Louis, and, in conjunction with his partners, has built up one of the largest establishments devoted to this pursuit in the city. On the 1st of January, 1867, Theodore Bartholomew, Thos. J. Bartholomew, James W. Lewis, and John D. Perry, commenced the business of Banking in St. Louis, under the name and style of Bartholomew, Lewis & Co. The several members of these firms were all related to each other by blood or marriage, and hence, perhaps, the unity of aim and effort which constitutes so important a feature in the career of this remarkable family.*

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* Benjamin W. Lewis, the Founder of these Works, whose demise occurred on the 1st of February, 1866, was in many respects a remarkable man. A friend, who knew him well, furnishes the following analysis of his business career, and tribute to his memory:—

"He was a man of indomitable will and energy, though an exemplary Christian, and enjoyed the respect of all who knew him; while his numerous charities, and the institutions of benevolence that he founded and mainly sustained, are a guarantee that his memory will be revered. Early in life he adopted, among others, the following maxims for the better government of himself—1st. Keep good company, or none. 2d. Never be idle; if your hands cannot be usefully employed, attend to the cultivation of your mind. 3d. Live up to your engagements. 4th. Good company, and good conversation, are the very sinews of virtue. 5th. Good character is above all things else; your character cannot be essentially injured except by your own acts. 6th. If any speak evil of you, let your life be so that none will believe them. 7th. Drink no kind of intoxicating drinks. 8th. Never play at any game of chance. 9th. Avoid temptation, through fear you may not withstand it. 10th. Never speak evil of any one. 11th. Keep yourself innocent if you would be happy.

"One of his most important benefactions to the town of Glasgow, was the 'Lewis Library,' for which he made provision in his Will, and which has been built and furnished since his death by his widow, son, and brother James W. Lewis. This building is a very fine and substantial structure, located in the centre of the town, and of the modern Italian style of architecture. A prosperous and numerous School is now occupying a portion of

In the manufacture of *Plug Tobacco*, we presume all connected with the trade would point to

James Thomas, Jr., of Richmond, Virginia,

As the representative man. Though a manufacturer of all kinds of plug Tobacco, Mr. Thomas has specially devoted himself to the production of the lighter, or as they are termed, the bright assortments, and his numerous brands and inventions are as well and favorably known in Europe as they are on this continent.

He is the inventor of Light-pressed tobacco in all its varieties; many of his brands being exceedingly beautiful, and all of them have been copied and imitated to an extent beyond that of any other articles known; which fact seems to be indubitable proof of the extraordinary merit and popularity of his productions. So ample were his

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the building—the scholars of this and all other schools in the city, as well as the public generally, having access to the Library.

"He also, a short time before his decease, purchased and fitted up, in connection with his brother, James W. Lewis, a Church edifice, and generously donated its use to the benefit of the Methodist Episcopal Church, of which he was a life-long member.

"Mr. Lewis was a thorough business man. He held, with Franklin, that 'What is worth doing at all, is worth doing well;' and no man could finish up and complete, 'with all the points guarded,' as he used to remark, a transaction better than he. Devoting his whole time and talents to business himself, he required the same assiduity of his copartners and operatives; and his splendid success has demonstrated that, in a business point of view, such devotion is sure to meet with its reward, for there is scarcely a man now living who was connected with him, either as partner or employee, but has established himself as a successful business man, many of them having acquired considerable wealth. He was a most excellent judge of human nature, and was rarely mistaken in his conclusions respecting the capacity or motives of men. His memory was such, that he had no need to look into the books of his firm, or examine the details connected with them, to understand the state of his affairs; but when the balances were made, at the close of the year, his estimates of the results were almost invariably sustained by the books, and he knew within a fraction the amount due him from any of the larger customers. It was customary with him to ascertain the amount of the invoices when goods were being put up for shipment, and, twelve months afterward, he could tell the amount of any large invoice shipped to a given party.

"Mr. Lewis received personal injuries during the war from which he never fully recovered. These injuries were doubtless the cause of his death. He rejoiced that he had lived to see the government and country rescued from its perils, and the national flag waving once more over every inch of the national soil. He believed that the spirit of slavery was the principal cause of the Rebellion, and that slavery itself was its chief support; which opinions were shared by his brother James; and desirous of doing all in their power to save the life of the Republic, they, at the very commencement of the struggle, emancipated all the slaves owned by them—providing those of them who desired to remove with means for that purpose, and allowing wages to those who remained in their service."

facilities, and so remarkable his skill and ingenuity, it is said he sometimes required only fifteen or twenty minutes to design and execute a given style or sample brand when requested. Mr. Thomas' Manufactories, which were the largest in the United States, and for the purposes to which they were devoted, the most complete of any in the world, were totally destroyed by fire in July, 1853, and again on the memorable second of April, 1865, when a large portion of the city of Richmond was consumed in the conflagration of that year. By the destruction of his buildings and the derangement of his business during the confederate occupancy of the city, his losses were very heavy, being estimated at from seven to eight hundred thousand dollars.

Notwithstanding this enormous loss he is still possessed of ample means, and although at this time to some extent an invalid, the opinion of those familiar with his qualifications favors the assumption that he will, by his industry, yet recover all that he has lost. The average number of operatives formerly employed in his establishment was about three hundred, and the annual production upwards of one million pounds.

Rich as is the State of Virginia in natural and artificial wealth, her broad domain has few fairer or more fruitful veins than her Tobacco fields and factories. Essentially superior both on account of the varieties cultivated and the greater perfection which long experience has enabled her manufacturers to impart to the finished product, Virginia plug tobacco has attained a reputation in the markets of the world which no rivalry has ever succeeded in impairing, and which will probably endure as long as this staple continues to be used The State in this, as in many other respects, has achieved a distinction which will not readily depart from her. Even when in a Colonial condition her traffic in tobacco, both crude and manufactured, was considerable, and the amount has been steadily augmented until tobacco raising and tobacco manufacturing have become one of the leading industries of the State, and for many years have constituted one of its principal sources of revenue. The total production of crude Tobacco in the United States in 1860 was 429,390,771 pounds, of which the State of Virginia raised more than one fourth; while of manufactured she produced, prior to the war, seventy-five per cent. of the country's aggregate. To the State of Virginia the commercial world is indebted for the rise and progress of the Tobacco trade, and to Virginia manufacturers, the trade owes whatever of good there is to be found in the manifold improvements that have been made in the form and quality of the various brands embraced under the general name of Plug Tobacco.

Sixty years ago this article consisted of rudely fashioned lumps of

tobacco leaves resembling twisted skeins of flax. It was called "Negrohead twist," and was packed in kegs, five or six to the pound. The mode of sampling was similar to that now pursued in sampling sugar; a hole was made in the centre of the keg, to which the inspector applied his nose, and if the contents smelled fresh and sweet they were pronounced prime and merchantable. Soon after this the size of the lumps was reduced so that it required from twelve to sixteen to make a pound, and more attention was bestowed upon the formation of them; a smoother surface and more uniform shape being sought and obtained. "Thirty-two's" followed, and were deemed a marked improvement upon their predecessors. These were succeeded by the present flat, oblong lumps known as "Tens," and were packed in neatly constructed square boxes; the first lot of which was shipped to New York, by Mr. Samuel Shields Saunders of Richmond, and received by Cornelius Dubois & Co., of 37 Water street. The art of sweetening tobacco with mass licorice was discovered about this time by Mr. Jesse Hare, also of Richmond, and this discovery may be said to have been the first step taken towards elevating the business to one of national importance. "Honey Dew" tobacco, as the several varieties containing this ingredient were afterwards called, yielded its supremacy at length to the bright-assortments subsequently introduced, and of which James Thomas, Jr., may be considered the pioneer and founder. The progress that has since been made in the trade through the instrumentality of this gentleman has been rapid and brilliant. Thirty years and more have elapsed since Mr. Thomas discovered the adaptability of the products of certain sections of the State to those grades and styles of goods which more than any or all others have tended to give it pre-eminence in this department of trade.

Mr Thomas has not yet rebuilt his manufactories; although he has erected several fine buildings in the neighborhood of his former field of operations, which are at present occupied as stores. He was for many years largely engaged in the shipment of leaf tobacco and cotton, and at the close of the war entered extensively into the cultivation of the former upon plantations purchased by him in the vicinity of Danville and in Hanover County, Virginia. His success in this enterprise is stated to have been proportionably equal to that attending his efforts as a manufacturer, having realized upon his last year's crop not less than thirty thousand dollars. Owing to the impaired condition of his health he does not now take an active part in the conduct of his business, but he is the principal owner as well as the guiding spirit of two of the most popular manufacturing establishments in the State—one being located at Danville, under the management of Thomas C.

Williams, Esq., a former bookkeeper, but now a partner of Mr. Thomas, and the other at Richmond, directed by himself and some experienced assistants.

Mr. Thomas has been for many years a member of the Baptist Church, and has rendered almost incalculable service to the cause of Religion by his disinterested labors and magnificent charities at home and abroad.

For the manufacture of *Snuff*, the largest factory in this country, and it is said in the world, is that of

P. & G. Lorillard, New York.

Whose mills are located on the river Bronx in Westchester county. Tobacco for Snuff is first run through a cutting machine, which divides it into coarse pieces; these are then taken to the curing rooms, of which there are a large number in this factory. The Tobacco is placed in immense bins, and moistened with salt water, where it is left for a long time to cure or ferment. It has to be turned every week or two, and when the curing process has progressed far enough, it is taken to the Pan House, a large brick building, with furnaces under the floor. The house is filled with iron screens, upon which the Tobacco is placed to dry. A very hot fire is made in the furnaces, and the temperature of the brick room raised to a high degree. The steam and fumes from these pan houses are almost intolerable to those unaccustomed to them. Having been dried (and in the pan house the tobacco is toasted before a hot fire), it is packed in bags, where the coarse is separated from the fine on batting cloths, and it is then reduced to a powder, and sent to the factory in New York city to be scented and packed.

When the snuff returns from the Bronx, it is dry and in lumps, and has to go through the process of rubbing down, as it is denominated, being run through a machine sieve. It is then put into large bins, and wet with a very strong brine, sprinkled upon it as a gardener would water his flowers. Being mixed until it is all of the same moisture, it is then taken to the store-rooms, and put away in bins six feet deep by four wide, and nine feet high, where it remains until it is scented and ready to be packed.

For scenting some kinds of snuff the Otto of Roses is largely employed, Maccaboy especially being always scented with this article. It takes but a very small quantity of this powerful scent to perfume a large quantity of tobacco, and yet three thousand ounces are annually consumed, which cost twelve dollars an ounce, amounting to the sum of thirty-six thousand dollars a year in gold. These roses, of which

the otto is made, are grown at Smyrna and in the Kisanlik district of Turkey. It is estimated to take ten thousand roses to make one ounce of the otto—thus it will be seen that for the single item of scenting one kind of snuff no less than thirty millions of roses are annually consumed. The Messrs. Lorillard have endeavored to grow these roses in America, but without success, as they are not fragrant enough to produce the oil in sufficient quantities.

When the Snuff has been scented, it is packed in jars, bottles, or bladders. In the Snuff room, a man stands before a large trough of the material, and with his hands he fills a five or ten pound stone jar, packing it in very solidly. One man can fill one hundred and fifty of these a day.

After the jars are ready for the market, they are put up in cases of six or one dozen each, being packed in so tight with shavings that it is often necessary to break the box or barrel before they can be taken out. This is called the muscular department, and men with iron-armed mauls drive the shavings to their places with as much force as the smith forges his iron.

Maccaboy and Rappee Snuff contain a certain amount of moisture, but the Yellow Scotch Snuffs are very dry, and the powder is so fine and light that it flies all over the room, consequently it has to be packed in a separate room. A great deal of Snuff is put up in half pound bottles. The bottles are placed in a large box, the mouths opening upward; the Snuff is then passed into the box, and a slight shaking serves to fill the bottles.

It has been found impossible to get bladders enough in the United States to pack Snuff in, and thousands have to be imported from Europe. American butchers will not save them. In one storeroom we saw fifty thousand bladders, each holding ten pounds of Snuff, all varnished and labelled, piled up in great heaps. After they have been packed with Snuff, they are sent out to what is called the steam house, where the bladders are cured by steaming. The bladders of calves, cows, and bullocks are used. One man can pack five hundred pounds of Snuff per day in bladders.

Besides Snuff, this firm are large manufacturers of Fine Cut Chewing and Smoking Tobacco. During the year 1866 they paid a Revenue Tax of over one million of dollars. Their printing bill, for Labels, amounted to over one thousand dollars a month. The average amount of stock on hand, for six years, reaches the enormous figure of one million three hundred thousand pounds. The amount of stock on hand for the year 1866, reached three millions of pounds. In 1860, over one million pounds of Snuff alone were packed by this house, no less

than forty-one thousand eight hundred and seventy-five stone jars—averaging four, eight, fifteen and twenty-five pounds of Snuff each—being turned out, besides three millions of bottles.

Joseph Hall's Cigar Manufactory,

Located at 76 Barclay street, New York, may be fairly considered a representative establishment in the Cigar branch of the Tobacco Manufacture, its proprietor having contributed as much toward the development of the Cigar Trade in the United States as any one engaged in the pursuit.

Mr. Hall commenced business, in a small way, May 1st, 1836, in Second street, and on the third day after, his place was totally destroyed by fire. For about nine months, subsequent to this event, he worked as a journeyman cigar-maker in various parts of the city, and then opened a small retail store at No. 80 Barclay street, a door or two west of his present location, the site of which is now occupied by a section of C. H. Lilienthal's Tobacco Manufactory. As in the former instance, he started here with exceedingly limited means, himself working constantly at the table, and neither the premises nor its unattractive surroundings indicating in any manner the favorable changes which a few years were destined to witness in their appearance and magnitude. He continued in this place several years, all the while improving and enlarging his field of operations, and finally purchased and moved into the large five-story building now occupied by him. At the period referred to, Cigar making in this country, though quite extensively prosecuted, and not without claims to recognition as a distinct and respectable manufacturing art, was far from having reached the high position to which it has since attained. There were a few manufacturers who seemed to possess a true appreciation of the requirements and capabilities of the trade, and who sought to elevate it to the rank it occupied abroad, and more especially in Havana, where it had reached its greatest perfection; but, for the most part, the efforts of manufacturers were confined to the production of the coarser and cheaper varieties, and it was a rare thing to see in any establishment a specimen of really choice goods, or of finished workmanship.

A superior workman himself, and endowed, moreover, with excellent judgment, discrimination, and taste, Mr. Hall early conceived the idea that it was possible not only to equal the best foreign productions, but in many respects to surpass them; and to this end he diligently applied himself—with what success, the history of the trade in this city and elsewhere, during the past quarter of a century, amply testi

Through his influence, a higher standard of excellence was at once inaugurated. To accomplish the object in view, he conceived the essential requisites to be, the selection in all cases of good material—extra attention in its preparation for use—the employment of thoroughly-trained and skilful operatives—and the adoption of fixed rules for their observance and government. His system of manufacture has been extensively copied, and there are now few large manufactories in which will not be found some rule of practice or procedure that had its origin in his practical mind. Among his most important and valuable contributions to the trade, may be mentioned his early discovery and demonstration of the virtues and adaptability of Connecticut Tobacco to fine Cigars. Prior to his appropriation of this material for this purpose, a considerable prejudice existed against it, and it was thought suitable only for common domestic goods; but when it had been shown by him that it was available for the finest quality also, when properly handled, and associated with Spanish Tobacco, it immediately rose in public estimation, and became a popular substitute for some varieties of the latter. The unparalleled advance of the Tobacco interest in Connecticut, within a decade or two, is in a measure due to the impetus given to it by his judicious example.

Mr. Hall has risen to wealth and eminence, and the secret of his art lies mainly in his careful selection and distribution of material. With a precision little less than that of the practical compositor in disposing of his types, he distributes and classifies his material—devoting this parcel to the finer grades, that to the medium, and another to the common; and so, is enabled to appropriate every portion of his stock to advantage. The progress of this house, like that of every other commencing under like circumstances, was of gradual growth. The old story, of success delayed and hope deferred, is written here as well as elsewhere; but the triumph finally came. In no other similar establishment, perhaps, are the beneficial effects of systematized labor seen to better advantage than here. Each operative seems to be keenly alive to the obligations resting upon him, and yet so discreetly are the rules enforced, that no one appears to be conscious of any restraint other than such as is imposed by his own sense of responsibility. In its busiest seasons this house employs nearly one hundred operatives, and its average labor force is fifty men. The average production is two million Cigars per annum, embracing almost every variety, from the choicest to the most ordinary brands, although the greater portion of the trade is in the former qualities.

The patronage of the house is peculiar, consisting chiefly of regular dealers, whose intercourse, in many instances, dates from its inception;

and though varied, and extending to every section of the country, the transactions are seldom of a speculative character. It therefore differs from that of several other leading houses, whose traffic is confined to supplying orders from agents and factors, and which, accordingly, is more or less ephemeral and uncertain. As a consequence of this peculiarity, as well as owing to the acknowledged reputation of the establishment, its products are said to command better prices than similar ones emanating elsewhere.

Mr. Hall is President of the Cigar Manufacturers' Association of the City of New York, and Vice President of the Tobacconists' National Association, and during the last four or five years has devoted considerable time and attention to the interests and welfare of those organizations.

A LIST OF PRINCIPAL MANUFACTURERS OF COTTON GOODS IN THE UNITED STATES.

Maine.

Kennebec Co. (sheetings and flannels), Daniel Williams, agent, Augusta.
Laconia Manufac. Co. (drills, sheetings, and shirtings), Andrew Haines, agent, Biddeford.
Pepperell Manufac. Co. (ditto), W. P. Haines, agent, "
Cabot Co. (ditto), Benjamin Greene, agent, Brunswick.
Dana & Co. (warp), Gray.
Hallowell Co. (shirting), B. Mowry, agent, Hallowell.
Bates Manufact'ng Co. (sheetings and pant stuffs), Benj'n E. Bates, treasurer. Lewiston.
Continental Mill (brown sheetings and shirtings), R. A. Budlong, agent, "
Hill Manufacturing Co. (sheetings and shirtings), "
Androscoggin Mills (sheetings, ducks, and bags), "
Franklin Co. (sheetings and silesias), "
Lewiston Mills (colored), Lewiston.
Lincoln Mills (silesias), "
King, Joseph R. (boot and shoe webbing), Monmouth.
Stanton, Thomas L. (ditto), "
York Manufac. Co. (plaids and twills), Samuel Batchelder, treasurer, Saco.
Springvale Manufacturing Co. Oliver D. Boyd, superintendent, Sanford.
Portsmouth Co. (sheetings), Sam'l Hale, treasurer, S. Berwick.
Richardson, Joshua (batting), Saccarappa.
Westbrook Manufac. Co., R. E. Wood, treasurer. Westbrook.
Winthrop Manufacturing Co., Winthrop.
Royal River Manufact'ng Co. (batting, yarn, and twine), H. J. Libby, treasurer, Yarmouth
Libby, H. J. & Co. (yarns, twine, and batting), Portland.

New Hampshire.

Skinner, Barton, Chesterfield.
Briggs, Arnold & Co. (yard-wide cloths for bleaching), Claremont.
Monadnoc Mills Comp'y (jeans and sheetings), "
Brown, H. H. & J. S. (print cloths 64×64), Concord.
Cocheco Manufac. Co. (printing cloths and prints), Dover.
Exeter Manufacturing Co. (No. 24 sheetings), Exeter.
Dodge, George W. (batting), Hampton Falls.
Pepper, J. & W. (hose), Holderness.
Hooksett Mill (print cloths), Hooksett.
Holt & Jones (batting), Hudson.
Bascom, Alonzo & Co. (denims and sheeting), Jaffrey.
Belknap Mills, Bailey & Gleason (cotton cassimeres), Laconia.
Gilford Mechanics' and Manufacturing Co. (cottonades), Laconia.
Winnipisseogee Lake Manufac. Co., Lake Village, near "
Amoskeag Duck and Bag Co., Manchester.
Amoskeag Manufac. Co., E. A. Straw, agent, "
Manchester Print Works, Waterman Smith, agent, "
Stark Mills, Phineas Adams, agent, "
Columbian Manufacturing Co. (denims), G. P. Richardson, agent, Mason.
Souhegan Manufacturing Co. (denims), David Gillis, agent, Milford.
Thompson, Robert (batting), "
Harbor Manufacturing Comp. (sheeting), Nashua.

Jackson Company (shirtings and sheetings), B. Saunders, agent, Nashua.
Nashua Manufac. Company, D. Hussey, agent, "
Colony, S. D. & L. J. (sheetings). Monsonville, Nelson.
Brown, H. W. (tickings), N. Ipswich.
Columbian Manufacturing Co. (denims), "
Haynes, W. (cotton batting), Newmarket.
Newmarket Manufacturing Co. (sheetings, shirtings, and drillings), "
Pembroke Mills (print cloths), Pembroke.
Webster Manufac. Co., "
Livingston & Lynch (batting), Peterboro'.
Peterboro' Manufacturing Co. (drillings). Fred'k L. Livingston, agent, "
Phœnix Factory, D. W. Johnson, agent, "
Union Manufacturing Comp'y (sheetings, shirtings, umbrella cloths, and drillings), J. W. Little, agent, Peterboro'.
Pittsfield Manufacturing Co. (shirtings), Pittsfield.
Portsmouth Steam Factory (yarns and spool-cotton of all numbers), William Stearns, agent, Portsmouth.
Rockingham Mills (narrow tapes and boot-webbing, worsted and mohair braid), Charles Amory, agent, "
Salmon Falls Manufac. Co. (30 and 38-inch drillings, sheetings, and cotton flannels), B. W. Watson, treasurer, Salmon Falls.
Franconia Cotton Manufac. Co. (sheetings), E. Rochester.
Great Falls Manufacturing Co. (sheetings, shirtings, drillings, etc.), Great Falls.
Tioga Mills (yarn, etc.), Upper Gilmanton.
Rockland Manufac. Co. (cotton flannels and batting), Charles Kelly, agent, North Weare.

Vermont.

Boardman & Carpenter (wadding), Bennington.
Essex, Jerem'h (French glazed batting), North Bennington.
Jackson, J. B. (print cloths), "
Robinson & Parsons (ditto), "
Winooski Mill Co., M. Noyes, treasurer, Burlington.
Pitts, H. W. (cotton warps), Middlebury.
Fullerton, Martin & Co, (cotton warp and sheetings), Springfield.
Pope, J. A. (print cloths), Perkinsville
Raymond, M. (chair stuffs), Upper Falls.

Massachusetts.

Anthony & Adams (battings), Adams.
Adams, Brothers & Co. (sheetings), "
Andrews, P. R. (sheetings), "
Clinton, William M. (printing cloths), "
Jenks, Elisha (print cloths), "
Plunkett & Wheeler (warps and sheetings), "
Pollock, William & Co. (cotton warps), "
Arnold, O. & Co. (printing cloth), S. H. Arnold, agent, North Adams.
Bailey, Chester (heavy sheetings), "
Bly, George W., "
Brayton, Thomas A. (jeans and sheetings), "
Jackson, Ray & Co. (print cloths), North Adams.
Johnson, S. & Co. (warps), "
Richardson, A. W. & Co. (print cloths), "
Union Print Works, Arnold & Gaylord, agents, "
Dearborn, David L., Amesbury.
Webster, Jonathan B., "
Whitney Mill, O. Whitney, Jr., Ashburnham.
Cheney, A. L. (batting), Athol Depot.
Snow, C. B. (sheetings), "
Laneville Manufac. Co., Attleboro'.
Foster, S. & W. (sheetings), "
Hebron Manufacturing Comp. (sheetings). "
Mechanics' Mills (sheetings), "
Smith, Edwin (light cloths), Auburn.

Smith, J. W. & C. E. (sheetings), Auburn.
Fay, W. G., Brookfield.
Arnold, Noah, J., Bellingham.
Carey, William H., North "
Aldrich, Andrew J. N., Blackstone.
Blackstone Manufac. Co., "
Clinton Manufac. Co. (yarn), Boylston.
Brookfield Manufacturing Co. (blue denims), East Brookfield.
Kaley, Timothy (tidy cotton), Canton.
Mansfield & Co. (wicking, etc.), "
Neponset Cotton Factory, "
Shepard, J. S. (wicking, etc.), "
Jenkins, Tripp & Co. (lacings), Carver.
Fosdick, Wm. (batting), Charlestown.
Eagle Mills, Chelmsford.
Dwight Manufacturing Comp., S. Adams, agent, Chicopee.
Chicopee Manufacturing Co., E. Blake, agent, "
Clinton Manufacturing Co., Clinton.
Lancaster Mills (ginghams), "
Lancaster Quilt Co. (counterpanes), "
Griswoldville Manufactur'g Co., Colerainc.
Shattuck & Whiting (print goods), "
Wright, B. W. (suspender yarn), Conway.
Tucker & Cook (warps), "
Tucker, R. & Co. (warps), "
Cummings, John, (batting), North Dartmouth.
Dedham Manufacturing Co., Readville, Dedham.
Norfolk Manufacturing Co., Mill Village, "
Lincoln, L. & Co. (yarn), North Dighton.
Shore, T. & Co. (print cloths and thread), "
Whitin, P. & Sons, Whitinsville.
Pearson's Factory (duck, etc.). Dracut.
Nashawannock Manufact. Co. (suspenders, etc.). Easthampton.
Keith, Rotch & Co. (thread), Easton.
Pratt, Amos (thread), "
Morse, E. J. W. & Co. (thread), South Easton.
Morse, S. W. & Co. (cord and wicking), South "
American Linen Company, Fall River.
Annawan Cotton-mills, "
Fall River Cotton-mills, "
Fall River Print Works, "
Massasoit Steam Mill Company, "
Metacomet Mill, Fall River.
Pocasset Manufact. Co., "
Troy Cotton and Woollen Co., "
Union Mill Company, "
Watuppa Cotton-mill, "
Granite Mills (printing cloths), "
Blackburn, George, & Co., Oliliver Ellis, agent, Fitchburg
Gill, J. S. & J. (sheetings, etc.), "
Sherwin, Levi (sheetings, etc.), "
Cottrell, S. H. (printing cloth), Franklin.
Daniels, Adams (batts and wicks), "
Porter, Bradford G. (twine), Freetown.
Pratt, L. S., Grafton.
Fisher, Erastus, Farnumsville, "
Morse, Alfred (shirtings), "
Claflin Mills (printing goods), Asa P. Smith, agent, N. E. Village, "
Davis Mill (sheetings), "
Pratt, L. S., "
Saunders' Cotton-mills, "
Monument Mills (warps), Great Barrington.
Calvin, A. P. (cotton flannel), Holden.
Morse, A. & Co. (cotton cloth), "
Pratt, C. M. (cotton cloth), "
Smith, Asa F. (cotton cloth), "
Walker & Wright (silesias), "
Waterhouse, Joseph, Holliston.
Lyman Mills, Holyoke.
Hampden Mills, "
Hadley Comp'y (spool cotton), "
Holyoke Warp Mills (Union cloths), "
Lawrence & Co. (cotton jeans and hosiery), Ipswich.
Dane Manufac. Co. (drillings), "
Heard, Augustine (light-drillings), "
Newcomb, Thos. & Co. (thread), Kingston.
Wilder, C. L. (sheetings), Lancaster.
Atlantic and other Mills in Lawrence, [see *Manufactures of Lawrence.*]
Beach, Royce & Co. (seamless bags), Lee.
Appleton Company and other Mills in Lowell, [see *Manufactures of Lowell.*]
Ludlow Manufacturing Comp., H Root, agent, Ludlow.
Wood & Merritt, "
East Mansfield Manufacturing Company (sea island cotton thread), East Mansfield.

Mansfield Thread Co., Attleboro'.
Lynch, J. Q. (batting), E. Foxboro'.
Cary, Wm. H. (cloth), Medway.
Medway Cotton Manufacturing Company (yarn), "
Eaton, Edward (batting), "
Pierce & Farrington (warps), "
Wilson, E. C. & Co. (sea island thread), "
Boyd & Walker (thread and wadding), Rockville.
Methuen Manufactur'g Co., Methuen.
Namasket Mill Co., Middleboro'.
Hopedale Machine Co., Milford.
Cordis Manufac. Co. (prints), Millbury.
Brierly, Jas. (print cloths), "
Emerson, Jason (sheetings), "
Greene, Waters & Co., "
Rhodes & Tenney (warps), "
Singleton Mills (sheetings), "
Smith, S., "
Waters, A. H. & Co. (prints), "
Wheeler, J. D. (sheetings), "
Hampden Manufacturing Co. (satinets), Monson.
Wamsutta Mills (sheetings and shirtings), New Bedford.
Globe Steam Mills (jeans, printing cloth, cotton flannels), Newburyport.
Bartlett Steam Mills (No. 40 sheetings, etc.), John Balch, agent, "
James Steam Mills (sheetings and shirtings), Wm. C. Balch, agent, "
Ocean Steam Mills (print cloths), "
Newton Mills (printing cloths), Newton.
Greenville Manufacturing Co. (drills and shirtings), Northampton.
Chapin, Caleb T. (sheetings), Northboro'.
Whitin & Sons (sheetings), Northbridge.
Newcomb, Nath'l (batting), Norton.
Wheaton Manufacturing Co. (cloth and wadding), "
Huguenot Mills (sheetings), Chamberlin, McGaw & Co., Oxford.
Phœnix Mills (sheetings), "
Protection Mills (sheetings), "
Smith, E. W. (sheetings), "
Thorndike Comp'y (ticks, shirtings, etc.), Palmer.
Boston Duck Comp'y (cotton duck), "
Wright, J. S. & E. & Co., (checks), Three Rivers, Palmer.
Palmer Co. (drillings), "
Barrows & Ingraham (shirtings), Pawtucket.
Dunnell Manufacturing Co. (calicoes, etc.), "
French & Read (print cloths), "
Gerauld, H. & Son (print cloths), "
Pratt, Francis & Co. (threads, yarns, and braids), "
Peck, E. & J. S. (cotton warps), Pittsfield.
Plunkett, Clapp & Co. (sheetings), "
Old Colony Batt. Comp'y, Plymouth.
Samoset Mills (thread), "
Jenkins Tripp & Co. (yarn), "
Old Colony Duck Co., Chiltonville.
Russell Mills (duck), "
Brown, Eleazer A. & Co. (twine), Rehoboth.
Orleans Manufac. Co. (print cloths), "
Rockport Steam Cotton-mills, Rockport.
Naumkeag Steam Cotton Co., Salem.
Newmarket Manufacturing Co. (shirtings, sheetings, jeans), J. Webster, treasurer, Salisbury.
Powow River Mills (yarn, etc.), "
Cove Mills, Bowen & Batty, Seekonk.
Mann, G. R. & Wm. R. (duck), Sharon.
Longley & Worcester (sheetings), Shirley.
Lake Cotton-mills (sheetings), "
Longley, I. (sheetings), "
Phœnix Co. (sheetings), "
Cordaville Manufac. Co., Southboro'.
Dresser Manufac. Co., Southbridge.
Leonard & Dresser (sheetings), "
Central Mills Co. (sheetings), "
Columbian Manufacturing Co. (flannels), "
Hamilton Co. (warps,) Globe Village, "
Glasgow Co. (ginghams), South Hadley Falls, South Hadley
Indian Orchard Mills (sheetings, etc.), G. W. Holt, agent, Springfield.
Brown, Nathan G. (carpet warps), Stockbridge.
Sturbridge Cotton-mills (print cloths), Sturbridge.
Munsell, Thomas E. (batts, wicks), Sunderland.

Fay, Warren G. (denims), Spencer.
Manchaug Manufacturing Co. (sheetings), Sutton.
Sutton Manufac. Comp. (print cloths), "
Albro & Anthony (corset jeans), Taunton.
Dean Cotton & Machine Co., "
Dean, Williams & Rouse, "
Shepard, Silas (flannels), "
Whittenton Manufac. Co., "
Westville Manufacturing Co., "
Eagle Cotton Company, "
Hodges, Alexander, "
Whitin, P. & Son (fine sheetings), Uxbridge.
Clapp, Simeon (yarn and wicking), Walpole.
Guild, Geo. (thread and yarn), "
Manning, Glover & Co. (batting), "
Stetson, Joshua, Jr. (yarn), "
Putnam, George (yarn), "
Anderson, J. P. (yarn), "
Boston Manufacturing Co., Waltham.
Otis Company (denims), Ware.
Knowles, Lucien J. (warp), Warren.
Warren Cotton-mills (denims), "
Slater's Mills (print goods), Webster.
Union Mills (print goods), "
Beaman Manufac. Co. (jeans and counterpanes), West Boylston.
Harris, L. M. & Co. (cotton flannels), "
Holbrook & Harris (sheetings), "
West Boylston Manufacturing Co. (sheeting), "
Schouler, John & Brothers, W. Cambridge.
Whitman, W. & Co. (warps), Westfield.
Westport Manufacturing Co. (carpet warp, wrapping twine, and batting), Westport.
Agawam Canal Co. (sheetings and jeans), William Melcher, agent, W. Springfield.
Hayden Manufacturing Comp. (thread, etc.), Williamsburg.
Southworth & Walley, Williamstown.
Elmer & Bro., South Williamstown.
White, Nelson D., Winchendon.
White, Brothers (sheetings), "
Wilson Mills (sheetings), "
Mills & Co. (batts and wadding), Winchester.
Curtis, Albert (drillings and sheetings), Worcester.
Adriatic Mills, "
Sayles, Caleb W. (batting), Wrentham.

Rhode Island.

Ashton Mills, Ashton.
Blackstone Manufac. Co. (sheetings and print cloths), Blackstone.
Bristol Steam Mill, Bristol.
Reynolds Manufacturing Co. (sheetings), "
Pokanoket Mills, Jacob Babbitt, "
Rogg, J. L. (cotton warps), Burrillville.
Whipple, Daniel S. (warps), "
Money, J. W. (plaids), Charlestown.
Chepachet Mill, H. B. Lyman, Chepachet.
Whipple, G. B. & Co. (cotton warps), "
Arkwright Manufac. Co., Coventry.
Chace Mill Co. (print cloths), "
Kilton, John J. (bleached goods), "
Washington Co. (sheetings), "
Coventry Co. (print cloths and sheetings), T. D. Bowen, ag't, "
Harris Manufacturing Co., "
Whitman Mill (yarn), "
Valley Falls Co. (print cloths and sheetings), H. & S. B. Chace, Cumberland.
Earl, T. & Co., "
Fessenden, Benjamin (printing cloths), Cumberland.
Rawson, Wm. M., "
Quinebaug Comp'y, Donaldsonville.
Green, W. R. & Co., Exeter.
Hall, D. J. (cotton goods), "
Harris, James T., "
Greene, C. C. (warps), "
Hope Manufac. Co., S. G. Allen, Fiskville.
Jackson Factory, Chas. Jackson, "
Arkwright Manufacturing Co. (sheetings), "
Winsor, Stephen & Bro's, W. Gloucester.
Union & Wadawannuck Mills, and Kent Printing Company, E. Greenwich.
Bay Mills (sheetings), "
Hopkins, D. (warp and twine), W. Greenwich.
Tripp, Chas. (fluid-wicking), "
Hoxsie, B. R. (lamp-wicking), "
Hope Company, Hope Village.

Chace's Thread Mills, Mt. Hope Village.
Chase, Augustus (wicks and batts), "
Cornell, Wm. (spool cotton), "
Fall River Thread Company, "
Canonchet Manufacturing Co., Hopkinton.
Kenyon, Benj. B. (yarn, etc.), "
Franklin Manufac. Co., Johnston.
Larchar, William, "
Narragansett Mills (warps), N. Kingston.
Manville Mills, Manville.
Newport Manufac. Co. (yarns, batts, wicks, and warp), Newport.
Perry Mill Company, "
Touro Manufacturing Co., "
Atlantic Delaine Co. (print cloths), George W. Chapin, treasurer, Olneyville.
Randall Mill, Wm. A. Pierce, "
Simmonsville Mills, W. S. Simmons, "
Succorhead Mills, L. F. Goodwin, "
Turner's Wadding Works, S. Turner, "
Chappel Mill (carpet warps), "
Dunnell Manufac. Co., Pawtucket.
Dennis, James (print cloths), "
Dexter, N. G. B. (spool cotton), "
Goff, Cranston & Brownell, "
Green & Daniels (spool cotton), "
Joslin, W. H. (wicking), "
Littlefield Brothers (thread), "
Pawtucket Manufact'ng Co., "
Smith, Joseph, Jr. (batting), "
Stafford & Brothers, "
Benedict Stephens (shirtings and yarns), "
Gage, R. B. & Co. (yarns), "
Payne & Taylor (yarns), "
Omega Mills (sheetings), E. Providence.
Allendale Manufacturing Co., N. Providence.
Centerdale Manufacturing Co., "
Dyerville Manufac. Co., Amos N. Beckwith, treasurer, "
Lyman Mill, H. B. Lyman, "
Manton Manufacturing Co., "
Oriental Mills (print cloths), "
Allen, C. & Co., Providence.
Allen, Philip & Sons, "
Arkwright Manufac. Co. (shirtings), "
Barrows, Cornelius (sheetings), "
Burgess, F. S. "
Cutler, Edward A., Providence.
Fletcher & Brothers (lamp-wicks, boot-laces, braids, etc.), "
Greene Manufac. Co. (shirtings and sheetings), "
Graystone Mills (shirtings), "
Harrison Steam Mills (print cloths), F. Burgess, treas'r, "
Heaton & Cowing (shoe braids and lacings), "
Hutchins, S. & Co., "
Pacific Mills (print cloths), "
Parker & Webster (7-eighths and yard wide shirtings), "
Phœnix Mills (sheetings and print goods), C. Lippitt, ag't, "
Randall, Stephen, "
Rhodes, James T., "
Robinson, W. A. & Co., "
Rogers, Joseph, "
Simmons, Samuel R., "
Slater, Samuel & Sons (print cloths), "
Smith, A. D. & J. Y. & Co., "
Sprague, A. & W. (print cloths), "
Williams, A. A. & Co. (yarns, wicks, warps, etc.), "
Woonasquatucket Print Works, G. M. Richmond & Sons, "
Arcadian Manufacturing Co., Richmond.
Harris, Jas. T. & Co., Carolina Mills (pant goods), "
Clark, Charles & Co., " "
Kenyon, E. (linseys), " "
Kenyon, J. H. & A. W., " "
Weeden, G. (linseys), " "
Centreville Manufac. Co., Rockville.
Rockville Manufacturing Co., "
Moscow Manufacturing Co., "
Clayville Mills, D. Remington & Son, Scituate.
Fiskville Factory, C. Jackson, "
Rockland Manufacturing Co., "
Ross, Henry D. (print cloths), "
Harris & Bro. (print cloths), N. Scituate.
Harris, Thomas (drillings), "
Randall, N. & S. (print cloths), "
Scituate Manufac. Co. (print cloths), Wm. M. Bailey, treasurer, "
Ashland Manufacturing Co., S. Scituate.
Slater, J. & W., Slaterville.
Albion Company, Smithfield.
Benedict, Stephen (printing cloths), Central Falls, "

Benedict & Wood (printing cloths), Central Falls, Smithfield.
Granite Mill, W. Vaughan, ag't, "
Manchester Print Works, "
Stafford, R. J., "
Thurber, L. & A. (print cloths), Central Falls, "
Walker, Francis (cotton warps), Central Falls, "
Wood & Adams (printing cloths and sewing thread), Central Falls, "
Allen, Crawford & Co., Georgiaville, "
Smithfield Manufacturing Co. (print goods), "
Lonsdale Company, Lonsdale, "
Dexter & Brother (yarn), Valley Falls.
Abbott Run Company, C. Allen & Co., "
Warren Manufac. Co. (sheetings), J. O. Waterman, Warren.
Arctic Mills, A. & W. Sprague, Warwick.
Bowen Cotton Manufac. Co., "
Crompton Co. (prints), Wm. T. Dorrance, treasurer, "
Centreville Cotton-mill (shirtings), B. Lapham, "
Lippitt Manufac. Co. (shirtings and sheetings), Christopher Lippitt, "
Pontiac Mill (shirtings, etc.), "
Quidnick Co. (print goods), Warwick.
Natick Mills (print cloths), "
White Rock Manufacturing Co., Westerly.
Wheeden, J. E., agent (cottonades), "
Hamilton Mills (yarns), Wickford.
Aldrich, Arnold, Woonsocket.
Wray, J. P. & J. G., "
Pond's Warp Manufac. Co., "
Rathburn, O. J. (sheetings), "
Woonsocket Tape and Binding Co., W. E. Coe, agent, "
Ballou, Geo. C. & Sons (print cloths), "
Bartlett, John (sheetings), "
Branch Warp Manufac. Co., "
Clinton Manufacturing Co., "
Globe Mills, "
Groton Manufacturing Co., "
Harris, Edw. (also woollens), "
Hamilton Manufacturing Co., "
Harrison Mill (sheetings), "
Jenckes, Job & Sons (print cloths), "
Social Manufacturing Co., "
Woonsocket Co. (print works), "
Aldrich, D. L. (yarn, etc.), Wyoming.
Hope Valley Mills (yarns, etc.), "
Locustville Mill (print cloths), Daniel G. Sherman, agent, "
Sheldon, John T. (yarn), "
Tifft Mill (yarns, etc.), "
Wyoming Mill (print cloths), "

Connecticut.

Avon Manufac. Co. (yarns), Avon.
Kent Manufac. Co. (yarns), Bozrah.
Fitch, Asa (sheetings), Fitchville.
Keeler, Fred'k (batting), Brookfield.
Sawyer, Tinker & Co. (bags and duck), Colebrook.
Willimantic Company, Columbia.
Hop River Manufacturing Co. (satinet warp), "
Mason, Isaac, Coventry.
East Haddam Duck Company, East Haddam.
Thompson, Lucius, Ellington.
Law, J. & A. (cotton batting), Enfield.
Goddard & Co. (sheetings, etc.), Fisherville.
Sprague, A. & W., Lord's Bridge, Franklin.
Plunkett, Wyllys & Co., S. Glastenbury.
Post, J. H. & Co., S. Glastenbury.
Ashland Company, Adams, agent, Griswold.
Nichols, S. F. & Bro. (cotton twine), "
Slater, J. & W. (denims and stripes), "
Pope & Carroll (sheetings), "
Weatherhead, G. (sheetings), "
Kimbell & Tiffany, "
Hubbard, Henry G., Haddam.
Thurbur, A. W., "
Dunham, A. & Co., Hartford.
Greenwoods Company (cotton duck), "
Slate, Dwight & Co. (wadding), "
Union Manufac. Co. (plaids), "
Barber, Gardner & Co. (batts), Hebron.
Gray, William (batting), "

Hebron Manufac. Co. (batting and wicks), Hebron.
Attawaugan Manufactur'g Co. (sheetings), Killingly.
Hall, Morrison, "
Jencks, Leavins (prints), Centre Killingly.
Elliottville Manufacturing Co. (print cloths), E. Killingly.
Himes, John L., "
Miller, Mayhue (sheetings), "
Robinson, W. A. & Co. (prints), "
Wescott & Pray, "
Young, E. S., "
Capron, O. M., W. Killingly.
Danielsonville Manufact'ng Co. (sheetings), Danielsonville, "
Quinebaug Co., Danielsonville, "
Whitmore, N., "
Ballou, L. & Co., N. Killingly.
Daniels & Sayles, "
Williamsville Manufac. Co., "
Corey, Joseph, Lebanon.
Bliss, Willard (warps), Lisbon.
Sprague, A. & W. (print cloths), "
Union Manuf. Co. (ginghams, plaids, and stripes), Manchester.
Globe Mills Co. (warps), Joseph Parker, agent, S. Manchester.
Spencer, Son & Co. (warps), "
Mutual Co. (warps and batting), N. Manchester.
Union Manufac. Co., Marlboro'.
Wilcox & Hall (musquito bars), Middletown.
Uncasville Manufac. Co., Montville.
Atlantic Duck Company, Moodus.
Cowdrey, Rogers & Co. (duck), "
Moodus Manufac. Co. (print cloths), "
Smith and Polhemus (duck), "
Williams Duck Company, "
Silliman, J. B. (duck), "
Greenwood Manufacturing Co., New Hartford.
Smith & Brown (ducking), "
Smith, D. B., Pine Meadow, "
Kenyon & Barber, Hopkinton, N. Stonington.
Falls Co. (denims, ticks, and stripes), Gardner Green, treasurer, Norwich.
Hutchins, F. W. (sheetings), "
Shetucket Company, "
Day & Jenks, "
Perkins, Timothy (batts and yarn), Orange.
Almy, Samson, Plainfield.
Wauregan Company, "
Central Company (prints), Plainfield
Webster, Felton H. (sheetings), "
Ames, John B. (print cloths), "
Loomis F. B. (sheetings), "
Thomas, Seth (sheetings), Plymouth.
Morse, M. S. & Co. (sheetings), Pomfret.
Nightingale, George C. & Co., "
Rhodesville Company, "
Wilkinson, Edmund (sheetings), "
Orleans Manufac. Co. (print cloths), Rehoboth.
Stone Mill Company, Rockville.
Glyn Company (warps), M. B. Harvey, agent, Stafford.
Valley Manufac. Co. (warps), "
Granite Mill Co. (bleached cottons), Geo. M. Ives, agent, "
Fairman, John L. (batting), W. Stafford.
Kimball & Aldrich, Sterling.
Sterling Mills, Arnold, Fenner & Co., "
Sterling Stone Factory, Oneca Company, "
Masonville Company, Thompson.
Ross, John E. (twine), "
Walker & Sharpe (duck, shoe linings, etc.), W. Thompson.
Luther Esek (yarns, etc.), Tolland.
Centreville Company (seamless bags), Vernon.
Valley Falls Company, "
Phœnix Mills Co., Vernon Depot.
Jenks, Hiram (wicking), Voluntown.
Ross, John L. (jeans), "
Potter & Dixon (negro cloths), "
Griswold, Martin (braid), Watertown.
Talcott & Brace (batts), West Hartford.
Lee, Thomas R. (carpet warps), Westport.
Wood, William (wadding), "
Natchang Manufac. Co., Windham.
Cotton Sail Twine Co., W. C. Jillson, agent, Willimantic
Dunham Manufacturing Co., "
Smithville Manufac. Co., W. Hayden, agent, "
Willimantic Duck Co. (shirtings), "
Willimantic Linen Co., W. P. Abernethy, agent, "
Windham Cotton Manufac. Co., J. Tracy, agent, "
Eagle Warp Company, "
Merrick Bros. (spool cotton), "

Tunxis Mills (cloths), Windsor.
Connectic't River Mills (thread), "
Harris Brothers (twine), Woodstock.
May, Ezra C. (spool thread), "
Randall, James (twine), Woodstock.
Smith & Stetson, "
Warner, Daniel (twine), "
Warner, Thomas & Son (twine), "

New York.

Buckley, Edw., South Amenia, Amenia.
Nye & Bailey, Auburn.
Union Mills, J. A. Hovey, Ballston.
Ames, Barritt, Craigsville, Blooming Grove.
Carlton & Andrews, Brownsville.
Kent, H. M., Eaton.
Harmony Mills (printing cloths), Cohoes.
Ogden Mills (sheetings), "
Waterford Company, "
Chamberlain & Benton, Cortlandville.
Smith, Eli, "
Demmick, Jeremiah W., Rifton Glen, Esopus.
Morse, Reed & Co., Gilboa.
Potter & Holroyd, Oswego Falls, Granby.
Clinton, Wm. (calico), Hartwick.
Steer, Rufus (sheetings), "
Merritt, M., Hoosick Falls, Hoosick.
Carpenter & Hanna, Valatie, Kinderhook.
Chrysler, Jas. P. & Co. (printing cloths), "
Wild, N's Sons (printing cloths), "
Clark, A. B. & Co., Clark's Mills, Kirkland.
Fields, Wm. C. (sheetings), Laurens.
Little Falls Cotton-mill, Garner & Co., Little Falls.
Buckley, J., Marlborough.
Clinton, Wm. M. (prints), Milford.
B. W. & C. Factory Company (printing goods), Morris.
Ross, Daniel (printing goods), New Berlin.
Newburgh Manufacturing Co. (printing cloths), Newburgh.
Chadwick, G. W. (brown sheetings), New Hartford.
Hurlburt, Chas. (brown sheetings), "
Sherman, J. A. (brown sheetings), "
Wolcott, W. T. (print goods), "
Kenyon, V. S. (sheetings), Middleville, Newport.
Leonard, Jas. S. & Co., New Windsor.
Leonard, Wm. B. & Co. (cotton yarn), "
Home Manufacturing Co., Oswego.
Steere, R. (brown sheetings), Otsego.
Brownell & Co. (sheetings and shirtings), Paris.
Holbrook, E. H. (print cloths), Pittsfield.
Garner & Co., Pleasant Valley.
Franklin Dale Comp. (print cloths), Poughkeepsie.
Dutchess Printing Co., Wappinger's Falls, "
Morse, B. G. (muslin), Red Falls, Prattsville.
Sloatsburg Manufacturing Co., Sloatsburg, Ramapo.
Van Riper & Co. (musquito netting), Spring Valley, "
Akins, Jas. (drawers and shirts), Sand Lake.
Arnold & Co. (cotton), "
Schermerhorn, C. (drawers and shirts), "
Victory Mills, Saratoga.
Briggs, Amos (sheetings), Schaghticoke.
Schnectady Manufacturing Co., Schnectady.
Suffolk Steam Mills, A. J. Richardson (cotton cloths), Sag Harbour.
Hector, Ross & Co. (sheetings, etc.), Sherburne.
Clark, E. (sheetings), Van Hornville, Stark.
Wild, Jos. (print cloths), Stockport.
Van Allen, A. A. & Co. (print cloths), Stuyvesant Falls.
Mount Ida Cotton-mill, Mount Ida, Troy.
Troy Company, Mount Ida, "
Utica Steam Cotton-mills (sheetings and shirtings), E. Chamberlain, agent, Utica.
Utica Cotton-mills, J. A. Sherman, agent, Utica.
Clark, A. B. & Co. (sheetings), Clark's Mills, Whitestown.
Halleck Mills Co., Walesville, "
New York Mills, Walcott and Campbell, New York Mills, "
Oneida Manufacturing Co. (fine sheetings), "

New Jersey.

Belvidere Manufac. Co. (yarns), R. Byington, pres't, A. N. Easton, treasurer, Belvidere.
Wormald, Edwin & Co., Beverly.
Richards, George W. & Son, Crosswicks.
Washington Manufac. Co., David S. Brown, president, Gloucester.
Teal & Ibbettson, Grovesville.
Sharp, Green & Thomas, Mays Landing.
New Jersey Mills (shirtings), Wood & Garret, Millville.
Clark Thread Co., Newark.
Neilson, James, New Brunswick.
Brook, James, Trenton.
Crozer, Edward H., "
Whitehead Brothers, "
Wilson, Samuel K., "
Chamberlain, Wm. H., Paterson.
Malcolm, Wm. S., "
Passaic Mill (duck), E. Boudinot Colt, Paterson.
Wylie, Geo. (cotton flannels), "
Boudinot Mill (yarn), "
Danforth, Cooke & Co. (yarn), "
Dickey & Heathcote (yarn), "
Essex Mill, E. Boudinot Colt (yarn), "
Harmony Mill, Wm. Adams and Co. (yarn). "
Hope Mill, Jno. Oakman (yarn), "
Industry Mill, Henry M. Low (yarn), "
Jefferson Mill, Jacob S. Rogers (yarn), "
Osburn, Buckley & Co. (yarn), "
Prall, Abraham & Co. (yarn), "
Snyder, Rea & Co. (yarn), "
Union Works, Thos. D. Hoxley (yarn), "
Shepherd, P. & J. F. (yarn), Ringoes.

Cotton-mills in Pennsylvania.

Holmes, Bell & Co., Alleghany.
Hyde, Edmund, "
King & Pennock, "
Park, Painter & Co., "
Blakely, Abraham, Chester.
Crozer, John P. & Sons, "
Green, J. J., "
Lewis, J. William, "
Patterson, R. & Co., "
Riddle, Samuel, "
Wood, Samuel, Chester Valley.
Lees, J. & S., Conshohocken.
Bullock, George, "
Fisher, Nicholas J., Colebrookdale.
Wormald & Son, Conneautville.
Hendrickson, Oliver, Cumberland Valley.
Callaghan Bros., Darby.
Henrys, H. S., "
Lord, Simeon, "
Verlanden, John, "
Whiteley, Brothers & Co., Upper Darby.
Wolfenden, Shore & Co., "
Roberts, James C., Downingtown.
Bowman, Jonathan, Drakestown.
McKeen & Quin, Easton.
Baird, William, Frankford.
Clendenning, John, "
Garsed, Richard & Bro., "
Miller, James & Co., "
Wilde, Solomon, "
Tacony Print Wo Frankford.
Schofield, John, "
Whitaker, William, "
Riddle, Samuel, Glen Riddle.
Riddle and Steen, "
Buggy, James, Gulf Mills.
McFarland, George, "
Burnley, George E., Kellyville.
Kelly, D. & C., "
Kent, Thomas, "
Levis, Samuel G., "
Lewis, Samuel C., "
Wilde, James, "
Ingham, Joseph & Co., Knoxville.
Farnum, John, Lancaster.
Shenk, Boursman, Carpenter & Co., "
Shroder, Francis & Co., "
Buggy, Michael, Leiperville.
Lees, Daniel & Co., "
Trainer, David, Linwood Station.
Bicking, Mordecai F., Lower Merion.
Chadwick, Robert, "
Dixon, James, "
Houldsworth & Humphreys, "
Scanlan, Patrick, "
Campbell, A. & Co., Manayunk.
Gorgas, Matthias, "
Holt, Edward, "
Maxson, John, Jr., "
Patterson, R. & Co., Ripka Mills, "

Preston, J. M.,	Manayunk.	McCune, Clement & Co.,	Philadelphia.
Schofield, S	"		"
Steel, William,	"	Mayer, J. & R.,	"
Sutton, George & Son,	"	Milne & Brothers,	"
Wallace, David,	"	Raby, Samuel,	"
Whitaker, C. & O.,	"	Rose, John,	"
Winpenny, James B.,		Scanlan, John,	"
Leveridge, Thomas,	Matsunk.	Simpson, Hood & Son,	"
Whiteley, Joseph,	New Hope.	Simpson, William,	"
Barstow & Carlisle,	Norristown.	Smyth & Nelson,	"
Cresson, James C. & Co.,	"	Steele, William,	"
Farnum, Peter & Son,	"	Sullivan & Pawley,	"
Simpson, William,	"	Taylor, Yates & Co.,	"
White, Duncan,	"	Wilde, James,	"
Holt Brothers,	Oakdale.	Richards, George. W. & Son,	Phœnixville.
Lewis, Mordecai,	"		
Phillips & Aikins,	Parkesburg.	Banner Cotton-mills,	Pittsburgh.
Arbuckle, Daniel,	Philadelphia.	King & Pennock,	"
Beattie, William,	"	Ashland Mills, W. B. Baker,	Reading.
Bruner, J. P. & Sons,	"		"
Campbell & Pollock,	"	Brooks, Jeremiah M.,	"
Carroll, Peter,	"	Earl, E. W.,	"
Carr, Charles,	"	Gamer & Co.,	"
Clarke, S. & Co.,	"	Bachman, George,	Shunerville.
Craig, Thomas H. & Co.,	"	Fegely, Jesse,	"
Dearie, John & Son,	"	Reinhart, Reuben,	"
Derbyshire, John,	"	Wetzel, George,	"
Dickey, W. J. & J.,	"	Booth, George,	Shippinsville.
Devine, William & Sons,	"	Neer & Gotleib,	"
Donahue, Hugh,	"	Royer, Cyrus,	Smithville.
Dunlap, William,	"	Smith, John,	Springfield Furnace.
Fraser, John,	"	Van Horn, Isaiah,	Stoyestown.
Granlees, Norris & Co.,	"	Maust, Samuel A.,	Summit Mills.
Greer & McCreight,	"	Rice & Watts,	Trucksville.
Heft, J. D.,	"	Katterman, Andrew,	Tulpehocken.
Hill, Joseph,	"	Keagy, John,	Woodbury.
Holt, Richard,	"	Harper, Daniel,	Woodvale.
Irwin & Stinson,	"	Craig & Runnberger,	Worthington.
Keagan & Bryson,	"	Potts, Joseph,	Yocumtown.
Lippincott, A. S., Print Works,	"	Gehly, Daniel L.,	York.
Lodge, Fleetwood,	"	Rouse, Jacob,	"
Lodge, Jonathan & Bro.,	"	Greist, Joel,	York Sulphur Springs.
Long, James & Bro.,	"	Heikes, Lewis,	" "

Delaware.

Clarke & Co.,	Newcastle.	LaMotte, D. & Sons,	Wilmington.
Shaw & Knowles,	"	Levis & Rhodes,	"
Bancroft, Joseph,	Wilmington.	Pusey Brothers,	"
Bond, James,	"	Riddle, James & Son,	"
Griffith, J. & R. S.,	"		

Maryland.

Alberton Mills, Jas. S. Gary & Son,	Ebysville, Howard co.
Franklin and Jericho Cotton Factories. Hugh Simms,	Upper Falls, Baltimore co.
Gray Manufac. Comp., Charles Marean, agent,	Ellicott's Mills, Howard co.
Hanay, Washington,	Pleasantville, Howard co.

Howard Manufacturing Comp.
B. Deford & Sons,
Ellicotts Mills, Howard co.
Hopkins, Jared, Sykesville, Carroll co.
Hooper, Wm. E. & Sons,
Woodbury, Baltimore co.
Laurel Manufac. Co., George. B.
Tiffany, president,
Laurel, Prince George co.
Lord, D. (Jacquard), Elkton, Cecil co.
Mount Vernon Manufac. Co.,
Wm. Kennedy, president,
Mount Vernon, Baltimore co.
Phœnix Manufac. Co., Ed. S.
Meyers, treasurer, Baltimore co.
Powhattan Factory, George
Slothower, Powhattan, Balt. co.
Savage Manufac. Co., Woodward, Baldwin & Co.,
Savage, Howard co.
Shaeffer, A. C. & Co.,
Sykesville, Carroll co.
Thistle Manufac. Co., M. Shannon, ag't, Ellicotts Mills, Howard co.
Triadelphia Co., Thos. Lansdale,
treas'r, Triadelphia, Montgomery co.
Union Man'g, Co., D. B. Banks,
pres't, Ellicotts Mills, Howard co.
Warren Factory, Norris & Baldwin, Warren, Baltimore co.

Western States.

Ohio

8 Mills; 3 of which are in Hamilton county, 2 each in Muskingum and Montgomery, and 1 in Jefferson (one in Montgomery makes batting only).

Indiana

2; one each in the counties of Perry and Wayne.

Illinois

2; both making batting and wadding; one in Cook, the other in Rock Island county. Also one making coverlets.

Kentucky

6; two of which are in the county of Jefferson, one each in the counties of Fayette, Franklin, Mason, and Meade.

Missouri

2; both in St. Louis county.

Utah

1, in Salt Lake county, producing yarn.

Southern States.

Virginia.

There were, in 1860, 17 Cotton-mills in Virginia, distributed in the following counties: Chesterfield, 5; Albemarle and Dinwiddie, 2 each; Alexandria, Brooke, Fluvanna, Henrico, Isle of Wight, Mecklenburg, Ohio, and Stafford, 1 each (Brooke and Ohio counties are in West Virginia).

North Carolina

Had 39, distributed as follows: In the county of Cumberland, 7; Alamance and Randolph, 5 each; Gaston, 3; Catawba, Iredell, and Surry, 2 each; and in Alexander, Cabarras, Caldwell, Cleveland, Craven, Edgecomb, Forsythe, Lincoln, Mecklenberg, Montgomery, Orange, Rockingham, and Richmond, 1 each

South Carolina

Had 17, in the following districts: Spartansburgh, 6; Greenville, 5: Edgefield, 2; and in Anderson, Chester, Lexington, and Union, 1 each.

Georgia

Had 33, in the following counties: Clark, Muscogee, and Upson, 3 each; Campbell, Decatur, Green, Newton, and Richmond, 2 each; Baldwin, Bebb, Butts, Chattooga, Cubb, Elbert, Hancock, Hart, Houston, Putnam, Taylor, Troop, Walton, and Warren, 1 each.

Florida.

Jefferson county, 1.

Alabama

Had 14, distributed as follows: Lan-

derdale county, 3: Autuga and Madison, 2 each; Bibb, Coosa, Dallas, Marion, Mobile, Tallapoosa, and Tuscaloosa, 1 each.

MISSISSIPPI

Had 4; one in each of the countes of Choctaw, Hinds, Tishemingo, and Wilkinson.

LOUISIANA

Had 2; one in each of the parishes of Baton Rouge and Jefferson.

TEXAS

Has no Cotton-mill, but some Cotton Cloth has been made in the State Penitentiary.

ARKANSAS

Had 2; one in each of the counties of Pike and Washington. Both make yarns.

TENNESSEE

Had 30, distributed in the following counties: Lawrence, 6; Franklin, 3; Gibbs, Hardin, Henry, and McMinn, 2 each; Bedford, Blount, Carroll, Gibson, Hardeman, Hickman, Jefferson, Lewis, Lincoln, Meigs, Roane, Sumner, and Warren, 1 each.

WOOL MANUFACTURERS IN THE UNITED STATES.

[As ascertained by the National Association of Wool Manufacturers, February 24, 1865.]

Maine.

Johns, J. Edward,	Alfred.
Clough, Eben,	Bethel.
Boothby & Chadwick,	Bridgton.
Gibbs, Rufus,	"
Taylor & Perry,	"
Cole, Addison G.,	Buckfield.
Buxton Manufac. Co.,	West Buxton.
Johnson, Fuller & Co.,	Camden.
Robinson, Benjamin,	Carmel.
Abbott, A. & Co.,	Dexter.
Campbell, D. M.,	"
Dexter Mills,	"
Harper, J.	Dixfield.
Brown, S. P.,	Dover.
Wheeler & Lawrence,	Farmington.
Barnes, J. C.,	Fort Fairfield.
Mayo & Co.,	Foxcroft.
Jordan, Joshua,	"
Tucker, I. N. & Co.,	Gardiner.
Olfene & Beatty,	Gray.
Howe, Joel,	Hanover.
Linn, A.,	Hartland.
Ayer, D. M. & Co.,	Lewiston.
Bates Manufacturing Co.,	"
Lewiston Falls Manufac. Co.,	"
Holland, Joshua,	Limerick.
Gifford, James R.,	Lincoln.
Farnsworth Manufac. Co.,	Lisbon
Little River Manufac. Co.,	"
Worumbo Manufac. Co.,	"
Robinson, John,	"
Corbet, J. M.,	"
Jumper, Cyrus,	Milo.
Somes, Isaac,	Mt. Desert.
North Berwick Co.,	N. Berwick.
Newichawannic Co.,	S. Berwick.
Cole, Horatio G.,	Norway.
Tucker, John,	"
Robinson Manufacturing Co.,	Oxford.
Libby, H. J. & Co.,	Portland.
Readfield Manufac. Co.,	Readfield.
Miller, Wm. & Son,	Sanford.
Robinson, E. & E. S.,	Sebec.
Hargraves, Edward,	N. Shapleigh.
Faulkner, Dwight F.,	Turner.
Lang, Thomas S.,	N. Vassalboro'.
Johnson, Fuller & Co.,	Warren.
Hirst, James F.,	Webster.
Dimon, Furnel,	Wilton.
Smith & Spaulding,	"
Phelps & Clark,	E. Wilton.
Pope, Isaiah & Co.,	Windham.
Melvin, James,	Windsor.
Chase, Josiah,	Cape Neddock, York.

New Hampshire.

Adams, Nathan,	Ackworth.
Ashuelot Manufac. Co.,	Ashuelot.
Ball, D. & Son,	"
Ball, Pratt & Turner,	"
Babcock, Joshua M.,	Barnstead.
Parker, James C.,	Barrington.
Adams & Bartlett,	Bradford.
Beckford, H. S.,	Bristol.
Beckford & Sons,	"
Dow, George W.,	"
Rice & Brother,	"
Musgrove, John & Co.,	"
Dole, E. & Co.,	Campton.
Monadnoc Mills,	Claremont.
Sullivan Mills, Balcom, G. S.,	"
Messer, John,	Cornish.
Sawyer, F. A. & J.,	Dover.
Cheshire Mills,	Dublin.
Fulton & Manson,	Effingham Falls.
Simpson & Bennett,	" "
Conant, A.,	Enfield.
Stocker & Hayes,	"
Sulloway, I. W.,	"
Norris, C. H. & Co.,	Epping.
Prescott, Jacob E.,	West Epping.
Harris, Almon,	Fisherville.
Aiken, Walter,	Franklin.
Cunningham, James,	"
Sulloway & Daniel,	"
Franklin Woollen Co.,	"
Griffin & Taylor,	"
Gilford M. & M. Co.,	Gilford.
Ward, J. H. & Co.,	Gilsum.
Young, Perley,	Grafton.
Woods, J. & Son,	Henniker.
Nelson, O. F.,	Hillsboro'.
Taggart, William,	"
Smith, John B.,	"
Haile, Frost & Co.,	Hinsdale.
Boyden & Amidon,	"
Milan, Harris & Co.,	Harrisville.
Colney Brothers,	"
Pray & Appleyard,	Holderness.
White & Warner,	"
Pray, E. K.,	"
Morrill, J. & G. W.,	Hopkinton (Contoocook).
Kimball, Stephen,	E. Jaffrey.
Faulkner & Colony,	Keene.
Belknap Mills, Moses Sargent, agent,	Laconia.
Gilford Manufac. Co.,	Laconia.
Appleton, Robert, agent,	"
Appleton, Thomas,	Lake Village.
Hale, E. J. M. & Co.,	Littleton.
Walsh, Jonathan,	Loudon.
Manchester Print Works,	Manchester.
Blandon & Co.,	Marlboro' Depot.
Townsend, James,	Marlboro'.
Henderson, David,	Merrimac (Thornton's Ferry).
Smith & Hall,	Milford.
Jones & Mudge,	Milton.
Gordon, John C.,	New Hampton.
Dean, Solomon,	Newport.
Sullivan Mill,	"
Nourse, William,	"
Dexter, Richards & Co.,	"
Bailey, James W.,	Northfield
Earnshaw, James,	"
Wyman, Charles H.,	Pelham.
Noone & Cochrane,	Peterboro'.
Franconia Manufac. Co.,	E. Rochester.
Cocheco Woollen Co.,	" "
Gonic Manufac. Co.,	Rochester.
Nye & Ballou,	"
Norway Plains Co.,	"
Duston, Thomas,	North Salem.
Hallowell, John,	" "
Austin & Taylor,	Salem.
Austin & Wheeler,	"
Taylor, H. M. & Co.,	"
Tilton, Alexander H.,	Sanbornton Bridge.
Great Falls Woollen Co.,	Somersworth.
Smith, William M., N.	Stewartstown.
Frink, J. W. & Co.,	West Swansey.
Smith, Lane & Co.,	Swansey.
Goodale, Thomas,	Troy.
Hathorn, Levi,	Washington.
Dana, B. F. & Co.,	Walpole.
Sawyer, Moses,	North Weare.
Colby, Shepard & Co.,	Wilmont.
Davis Manufac. Co.,	Wilton
Wilton Manufac. Co.,	"
Soughegan Manufac. Co.,	"
Davis, J.,	"
Fessenden, Stephen,	Windham
S. Wolfboro' Manufac. Co.,	S. Wolfboro'
Springfield, John W.,	Wolfboro'

Vermont.

Ward, J.,	Barnet.
Reynolds & Tilden,	Barre.
Bradford, H. E. & Co.,	Bennington.
Rockwood, George & Co.,	Bennington
Faulkner & Co.,	E. Bethel
Brattleboro' Woollen Co.,	Brattleboro'

Lemmex, William H. & Co., Bridgewater.
Haines, Horace & Son, Cabot.
Wilson, R. C., Calais.
Perry, S. & Co., Cambridgeport.
Fullerton & Co., Cavendish.
Carruth, Benjamin, Charleston.
Waterson, Joseph, Chelsea.
Sawyer, T. & J. F. & Co., Chester.
Kent, Abial, Craftsbury.
Greenbanks, B., Danville.
Kendall, Marshall, Enosburg Falls.
Shepherdson, Ansel, Fairfax.
Ells, Edgar S. & Co., Fairhaven.
Kilbourn, A. & Son, "
Merrill, P. & Co., Felchville.
Daniels, Edward, N. Ferrisburg.
Knowlton, Maynard, Franklin.
Grafton Manufac. Co., S. S. Bailey, treasurer, Grafton.
Gay, M. & Son, Gaysville.
Greenbank, Thomas, "
Merritt, L. H., Hartland.
Sturtevant, C. F., "
Dow, A. & J., Hinesboro'.
Dow & Pearl, Johnson.
Harding, G. W. & Co., Ludlow.
Graham & Miller, "
Harris, J. W. & Son, Manchester.
Bradford, Levi, Manchester (Factory Point).
Hopkins, George S., Middlebury.
Whitney, E. S., Milton.
Moorcroft, William, Montpelier.
Little, H. A., North Montpelier.
N. G. Woollen Man'g Co., Moncton.
Phair, Edward, New Haven.
Fisk, George M. & Co., Northfield.
Gould, Joseph & Co., "
Jordan, Marsh & Co., "
Remick, James K., Passumpsic.
Colvin, E., Paulet.
Wright, Solomon, 2d, Pownal.
Balcom, George L., Proctorsville.
Proctorsville Mills, "
Holmes, Samuel T., Putney.
Dewey, A. G. & Co., Queechy.
Parker, J. C., "
Kingsley, Chester, Salisbury.
Farnsworth & Hoit, Saxtons River.
Hunter, S. N., Sheldon.
Newell, H., Shorcham.
Holmes, Whitmore & Co., Springfield.
Platt, Hiram & Co., Swanton.
Sartwell, T. J., N. Troy.
Cambridge, P. C., Unionville, Thetford.
Thompson & Seabury, Waterbury.
Herren, Robert, Waterville.
Lewis, Benjamin, Wells.
White, S. C., W. Windsor.
Burlington Woollen Co., Winooski.
Woodward, Solomon, Woodstock.

Massachusetts.

Schouler, William, South Acton.
Blackinton, Sanford & Sons, North Adams.
N. Adams Woollen Co., " "
Brayton, S. W. & Co., " "
Perry & Penniman, " "
Briggs & Brothers, " "
Tyler & Bliss, " "
Blackinton & Phillips, South Adams.
Dean & La Monte, " "
Urann & Keyes, Adams.
Agawam Co., Agawam.
Amesbury Woollen Co., Amesbury.
Salisbury Woollen Co., "
Eagle Mills, Athol Depot.
Miller's River Manufac. Co., Athol.
Muskrat River Manufac. Co., "
Pine Dale Woollen Co., "
Daggett, H. M., Attleboro'.
Pond & Larned, Auburn.
Southgate, J. P., "
Hodges Brothers & Co., North Andover.
Stevens, N. & Sons, " "
Sutton Mills, North Andover.
Ballardvale Man'g Co., Ballardvale.
Marland Man'g Co., "
Heywood, Seth P., Barre.
Denny, Edward, Barre Plains.
Aldrich & Cutler, Bellingham.
Scott, John C., "
Faulkner, A. R. & Co., Billerica.
Talbot, C. P. & Co., "
Ballou, F. M. & Co., Blackstone.
Evans, Seagrave & Co., "
Grain Bag Co., "
Millville Manufac. Co., "
Scott, John S., "
Taft, Weeden & Co., "
Morrison, J. & Son, Braintree.
Draper & Sumner, Canton.
Draper & Townsend, "
Harris, Almon, Charlemont.
Whitman, Charles P., "
Baker & March, Charlton City.
Baldwin Co., North Chelmsford.
Sheldon, George T., " "
Eagle Mills, West Chelmsford.

Chelsea Woollen Co., Chelsea.
Bigelow Carpet Co., Clinton.
Damon, Smith & Co., Concord.
Conway Manufac. Co., Edmund Burke, Conway.
Gloyd, Charles, Cummington.
Lovell, D. W., "
Tapley, G. A., Danvers.
Winona Mills, "
Barrows, Thomas, East Dedham.
Merchants' Woollen Co., " "
Dighton Woollen Co., Dighton.
Merrimac Woollen Co., Dracut.
Perry, David, Dudley.
Perry, Charles H. & Co., "
Upham & Pond, "
Swift River Co., Edw. Smith, treasurer, Enfield.
Wamsutta Woollen Mills, J. Eddy & Son, Fall River.
Moonarkies Co., J. C. Robinson, Falmouth.
Fitchburg Woollen Co., W. H. Vose, treasurer, Fitchburg.
Beoli Co., "
Delehanty, C. J., West Fitchburg.
Cowley, John, Foxboro'.
Aldrich, C. C., Granby.
Abbott Worsted Co., Graniteville.
Berkshire Woollen Co., Great Barrington.
Greenfield Manufac. Co., T. Leonard, agent, Greenfield.
Hale, E. J. M., Groveland.
Barker, J. L. & G. W., Hancock.
Clark, G. W. & S. S., "
Sumner, Clark, "
Taylor, John, Jr., "
Gilbert, George H., Hardwick.
Fay & Low, Haverhill (Ayer's Village).
Stevens & Co., Haverhill.
Birmingham & Brother, Hinsdale.
Hinsdale, F. W. & Brother, "
Plunkett Woollen Co., "
Smith, Herbert, Holden.
Chaffin, R. H. & A., "
Howe & Myers, "
Howe & Jefferson, "
Beebe, Jared, Holyoke.
Delabarre, Edward, "
Holyoke Woollen Co., "
Kingsbury, N. & Co., "
Hyde Park Woollen Co., Hyde Park.
Agawam Woollen Co., Ipswich.
Bolton Mill, Henry Dawson, agent, Lawrence.
Everett Mills, D. D. Crombie, agent, "
Lawrence Woollen Co., O. H. Perry, agent, Lawrence.
McAllister, William, "
Pacific Mills, J. W. Edmunds, treasurer, W. C. Chapin, ag't, "
Pemberton Co., F. E. Clark, ag't, "
Washington Mills, E. D. Thayer, agent, "
Woodward, S. C. & Co., "
Smith & Billings, Lee.
Hawes, R. L. & Co., Leicester.
Bottomly & McKinistry, "
Clappville Mills, "
Fay, James, "
Hodges, Samuel L., "
Mann & Marshall, "
Field, Alden C., Leverett.
Belvidere Woollen Man'g Co., Lowell.
Brackett, S. R., "
Dugdale, James, "
Faulkner, L. W., "
Hale, B. S. & Son, "
Holt, John, "
Hosford & Chase, "
Lawrence Manufac. Co., "
Lowell Manufac. Co. (carpets), "
McDonald, John, "
Rhodes, Richard, "
Suffolk Manufac. Co., "
Naylor, George, "
Saydan, John, "
Middlesex Co., "
Tremont Mills, Chas. F. Battles, agent, "
Walker, William & Co., "
Jones, J. H., Jr., & Co., Mansfield.
Methuen Woollen Mills, Methuen.
Walton, Fletcher & Co., "
Starr Mills, T. L. Dunlap, ag't, Middleboro'.
Church, S. U. & Brother, Middlefield.
Chamberlain, H. H. & Co., Millbury.
Crane & Waters, "
Merriam, Simpson & Ray, "
Lapham, M. & S., "
Walling, Nelson, "
Monson Woollen Man'g Co., Monson.
Monson & Bromfield Manufac. Co., "
Reynolds, Joseph L., "
Thompson, James, Nantucket.
Howard, Horatio M., Newbury.
Morrison, Leonard A., Northampton.
Aldrich, R. H. & Co., "
Buffum, M. & Son, Oxford.
Burrough & Bartlett, "
Hodges, George, "
Parks, William & Co., Palmer Depot.
Barker, J. & Brothers, Pittsfield.

Brown, N. G.,	Pittsfield.
Claman, Louisa,	"
Jones, John M.,	"
Hawkins, William J. & Co.,	"
Peck & Kilbourn,	"
Pittsfield Woollen Co., W. F. Bacon, agent,	"
Pomeroy's, L. Sons,	"
Pontoosuc Woollen Co., Geo. Campbell, treasurer,	"
Russell, S. N. & C.,	"
Tillotson & Collins,	"
Taconic Mill, Geo. Y. Learned, agent,	"
West, Charles E.,	"
Stearns, D. & H.,	West Pittsfield.
Streeter, S. C.,	Plainfield.
Plymouth Woollen Mills,	Plymouth.
Day, Stephen P.,	Rowe.
Whitney, George,	South Royalston.
Gleason, B. W.,	Rock Bottom.
Roxbury Carpet Co.,	Roxbury.
Mclntosh, M. & Son,	"
Miller, P. H.,	"
Pranker, E. & Co.,	Saugus.
Scott, F. & Sons,	"
Saxonville Mills,	Saxonville.
Cordaville Mills,	Southboro'.
Hamilton Woollen Co.,	Southbridge.
Shorey, Thomas H.,	Spencer.
Stanley, William,	"
Upham, William,	"
Alden, Caleb,	Springfield.
South Wilbraham Manufac. Co.,	"
Goodrich, J. L. & C. & Co.,	Stockbridge (Glendale).
Comstock, Perry Green,	West Stockbridge.
French & Ward,	Stoughton.
Southwick, A. & Son,	"
Ballard & Merriam,	Sturbridge.
Assabet Manufac. Co.,	Sudbury.
Otter River Manufac. Co.,	Templeton.
Templeton Mills, F. A. Hick, agent,	Templeton.
Cleveland, Henry,	Tisbury.
Davis, William D. & Co.,	Uxbridge
Scott, S. W.,	"
Taft, R. & J.,	"
Taft, Weeden & Co.,	"
Uxbridge Woollen Man'g Co., W. D. Davis & Co.,	"
Wheelock, C. A. & S. M.,	"
Dell Manufac. Co.,	Wales.
Shaw Manufac. Co.,	"
Wales Manufac. Co.,	"
Clark, Henry S.,	Walpole.
Scott, I. R.,	Waltham.
Gilbert, George H. & Co.,	Ware.
Stevens, Charles A.,	"
Sibley, S. H.,	Watertown.
Ætna Mills,	"
Dalby Mills,	Webster.
Chase, O. T. & Co.,	"
Perry, D. & W.,	"
Perry, J. H. & Co.,	"
Slater, Samuel & Sons,	Westford
Craven & Moore,	Whately.
James, H. L.,	Wilbraham.
Ellis, D. L.,	"
Gates, E. B.,	South Wilbraham.
Ravine Mills,	"
Scantic Man'g Co.,	"
Bodman, Lewis,	Williamsburg.
James, H. L.,	"
Nash, Thomas,	Willimanset.
Dimmock, George M.,	Worcester.
Ashworth & Jones,	"
Adriatic Mills,	"
Bottomly, Joseph,	"
Bigelow & Barber,	"
Curtis & Murdock,	"
Darling, Cyrus,	"
Hunt, John A.,	"
James, Benjamin,	"
Messenger & Wright,	Wrentham.
Wrentham Hosiery Co.,	Wrentham.

Rhode Island.

Silver Spring Mill,	Allenton.
Howard, R.,	Apponang.
Ashaway Manufac. Co.,	Ashaway.
Clark Falls Manufac. Co.,	"
Bristol Manufac. Co.,	Bristol.
Hyde, F. B. & Co.,	Carolina Mills.
Waterhouse, James,	Centreville.
Smith & Sayles,	Chepachet.
Peckham, P. S.,	Coventry.
Lamphere, Elisha,	Coventry (Phœnix).
Davis & Sweet,	Davisville.
Reynolds, George W. & Co.,	"
Webster & Blanchard,	Exeter.
Pook & Steere,	Greenville.
Harrisville Woollen Co.,	Harrisville.
Chester, B. F.,	Hopkinton.
Sisson, Saunders,	"
Rodman, Daniel,	Kingston.
Lockwood & Applin,	"
Rodman, Robert,	Lafayette.
Smith, G. W. & J. A.,	Mapleville.

Smith, Joseph B. & Co.,	Mapleville.
Whipple & Co.,	"
Smith & Whitehead,	"
Whipple, Charles H.,	"
Whipple, F. L. & F. W.,	"
Glendall Mill,	Mohegan.
Lovell, George W.,	"
Nichols, J. D.,	"
Reynolds, Lafayette,	"
Rodman & Son,	Newport.
Steere & Tinkham,	Pascoag.
Fiske, J. T.,	"
Hawkins, T. W.,	"
Braman & Turner,	"
Inman, James O.,	"
Emerson, Stephen,	"
Pascoag Woollen Co.,	"
Sayles, H. & Son,	"
Goff & Son,	Pawtucket.
Goodman & Reynolds,	"
Kendall & Co.,	"
Cummings, C. E.,	"
Slater Braid Co.,	"
Sayles, W. F. & F. C.,	"
Peacedale Manufac. Co.,	Peacedale.
Fiske, Stephen C.,	"
Holbertson, W.,	Perryville.
Plainville Woollen Mills,	Plainville.
Wanskuck Co.,	N. Providence.
Atlantic Delaine Co., G. W. Chapin, treasurer,	Providence.
Ballou, F. M. & Co.,	"
Hale & Burrough,	"
Chapin & Downes,	"
Davis, William D. & Co.,	"
Day & Chapin,	"
Dexter Street Mill,	"
Draper, L.,	Providence
Harrison Woollen Co.,	"
Geneva Mill,	"
Evans, Seagraves & Co.,	"
Hudson, William,	"
Reynolds, Gideon,	"
Sayles, J. M. & Co.,	"
Seagraves, J. T. & Co.,	"
Taft & Co.,	"
Taft, Weeden & Co.,	"
Bowen & Batty,	"
Valley Worsted Mills,	"
Webster, Daniel,	"
Rodman, Samuel, Jr.,	Rocky Brook
Durfee, George N.,	" "
Weeden, George,	Shannock Mills.
Kenyon & Coon,	" "
Yorgo Mills,	Slocumville.
Usquepaug Mill,	Usquepaug.
Babcock, E. & H.,	Westerly.
Babcock & Morse,	"
Brown & Co.,	"
Brown, E. R.,	"
Campbell & Brown,	"
Stillman & Brown,	"
Stillman & Co.,	"
Stillman & Clark,	"
Stillman, O. M. & Co.,	"
Stillman, Welcome,	"
Weeden, J. E.,	"
White Rock Manufac. Co.,	"
Chapin, Walter,	Wickford.
Berry & Stanton,	Woodville.
Harris, Edward,	Woonsocket.
Arcadian Manufac. Co., A. & W. Sprague,	Wyoming.

Connecticut.

Plumb, D. W.,	Ansonia.
Lawton, Frederic,	Bethel.
Homer Woollen Co.,	Beacon Falls.
Bird, Theodore,	Bethlehem.
Alling, A. H. & C. B.,	Birmingham.
Bristol Manufac. Co.,	Bristol.
Bristol Knitting Co.,	"
Broad Brook Co.,	Broad Brook.
Hillard & Spenser,	Buckland.
Gaylord, William,	Burlington.
Ensign, Sydney,	Canaan.
Gledhill & Co.,	Chester.
Coventry Satinet Co.,	Coventry.
Fargo, Horace,	"
Sayles, S. & H.,	Danville.
Keith, James M. & Co.,	Eastford.
Windemere Mills,	Ellington.
Plainville Manufac. Co.,	Farmington.
Capron & Son,	Fisherville.
Currier, Andrew J.,	Franklin.
Miller, Samuel,	"
Crosby & Hubbard,	E. Glastenbury.
Luyder, David,	" "
Glastenbury Knitting Co.,	Glastenbury.
Hollister & Glazier,	"
Whitlock, Augustus,	Glenville.
Kingsbury, N. & Co.,	Hartford.
Hartford Carpet Co.,	"
Lathrop & Co.,	Jewett City.
Corey, Joseph,	Lebanon.
Allen, E. & E. M.,	Lisbon.
Lay, O. J.,	Lyme.
Rathbun, A. C. G.,	"
Comstock & Swan,	E. Lyme.
Jones, William H.,	N. Manchester

Otis Manufac. Co.,	N. Manchester.
Keeny Brothers,	" "
Charter Oak Co.,	S. "
Merrow, J. B.,	Mansfield.
Dews, George,	Middlebury.
Pequot Manufac. Co.,	Montville.
Schofield, J. F. & B. F.,	"
Thames Manufac. Co.,	"
Vincent, Harry,	"
Gilson, J. & Co.,	Moodus.
Connecticut Manufac. Co.,	Moosup.
Brown & Clark,	Mystic Bridge.
Taylor, Amos,	" "
Mystic Manufac. Co.,	Mystic.
Lewis, Thomas,	Naugatuck.
Hale, F. M.,	New London.
Loomis, F. B.,	" "
Wells Brothers,	New Milford.
Lounsbury, Bissell & Co.,	Norwalk.
Union Manufac. Co.,	"
Yantic Mills,	Norwich.
Norwich Woollen Co.,	"
Elting Woollen Co.,	"
Alling, L. W.,	Orange.
Perkins, Timothy,	"
Ormsbee, James,	Oxford.
Radcliffe Brothers,	"
Cook, Isaac H.,	Preston.
Cook, D. W.,	"
Hall & Brother,	Poquetanoc.
Lucas, B. & Co.,	"
Lapuse, N. & Co.,	Poquonnock.
Ross, John L.,	Putnam.
Moriarty, M.,	"
Harris Woollen Co.,	"
Glover, Elias N.,	Ridgefield.
Rock Manufac. Co.,	Rockville.
American Mill,	"
Leeds Manufac. Co.,	"
New England Co.,	"
Florence Mill,	"
Springville Co.,	Rockville.
Hockanum Co.,	"
Washinee Co., Salisbury,	"
Beecher, A. B.,	Sandy Hook.
Holmes, Reynolds & Co.,	Somersville.
Bradley, Ira,	South Britain.
Conversville Manufac. Co.,	Stafford Springs.
Fox, Charles & Co.,	" "
Orcutville Man'g Co.,	" "
Mineral Springs Man'g Co.,	Stafford "
Converse & Hyde,	Stafford.
Hydeville Manufac. Co.,	"
Fitch & Bourke,	West "
Staffordville Manufac. Co.,	Staffordville.
Home Co.,	"
Hope Co.,	"
Converse, E. A. & Son,	"
Stillman, O. M.,	Stonington.
Enfield Manufac. Co.,	Thompsonville.
Terry Manufac. Co.,	Thomaston.
Talcot Brothers,	Vernon.
Potter & Dixon,	Voluntown.
East Windsor Woollen Co.,	Warehouse Point.
Whittal, Lefevre & Co.,	Waterbury.
Griswold, W. & C. K.,	Weathersfield.
Adams, J. H.,	Westport.
Daleville Mills,	Willington.
Lincoln, Stowell,	N. Windham.
Smith, Guilford,	S. "
Sequassen Woollen Co.,	Windsor.
Allen, P. C.,	Windsorville.
Union Manufac. Co.,	Walcottville.
Cocking, W. & J.,	S. Woodstock.
Kenyon, Joseph,	" "
Curtis, D. & Co.,	Woodbury.
Dawson & Co.,	"

New York.

Willis, W. P.,	Adams.
Scriptor, Lorin H.,	Addison.
Keefer, W. F.,	"
Sweet, B. A.,	Albany.
Hadsell, N. G.,	Alfred and Almond.
Clark, A. V.,	Albion.
Sanford, Stephen,	Amsterdam.
Greene, W. K.,	"
Kline, A. W.,	"
McDonald, Kline & Co.,	"
Miller, John,	"
Waldo & Son,	Arcade.
McAlooey, A.,	Astoria.
Doty, J. G. & Co.,	Attica.
Hall & Doggett,	Auburn.
Auburn Woollen Co., S. R. Rathbone, agent,	"
Barber, Josiah & Sons,	"
Davis, S. H. & J. T.,	"
Carhart, N. D. & Co.,	"
Chapman, E. H.,	Ballston Spa.
Morse, Wheelock & Co.,	Barton.
Nellis, A. J.,	Bath.
Sweet, Benjamin,	Bethlehem.
Ball & Hochdresser,	Berne.
Peck, Vinton,	W. Bloomfield.
McKay, Porter,	Boston.
Johnster, T. H.,	Bovina.

Higgins, H., Brasher.
Rich, Moses B., Brasher's Falls.
Walker, John, Breakabean.
Reddish, D. M., Broadalbin.
Hulin, Daniel, Brooklyn.
Hall, F. J., Brownville.
Taylor, John B., W. Burlington.
Randall, Harry, Burtonville.
Whitehorn & Son, Burdett.
Betts, John S. & A. Connelly, Cairo.
Ballard, R. S., Camden.
Julian, G. F., Camillus.
Van Duzen, J., Canajoharie.
Ward, William & Sackett, Candor.
Corey, John, Canton.
Vandemark, Jacob, Caroline.
Catskill Woollen Co., Catskill (Leeds).
Waterville Man'g Co., " "
M'Kinley, Alex., Catskill (Palenville).
Williams, Ledyard & Stebbins, Cazenovia.
Goodrich, J., Charlotte.
Young, M., "
Cooper & Hanks, "
Snow, Elanson, Charlotteville.
Paddock, E. & G. A., Chateaugnay.
Steele, Waldo & Co., China.
Phillips, George P., Clay (Phihnont).
Gunon, Christopher, Clay (Smoky Hollow).
Adams, C. H., Cohoes.
Alden, Frink & Weston, "
Bailey Manufac. Co., "
Clifton Mill, "
Troy Manufac. Co., "
Brockway, H., "
Bilbrough, H., "
Thompson, H. & Son, "
Conless & Carter, "
Chadwick & Warhurst, "
Parsons, J. H. & Co., "
Root, J. G. & Sons, "
Smith, Gregory & Co., "
Mansfield, L. W., "
Gugerty, P., "
Hurst, K., "
Fuller & Lafely, "
Jones, T. & Co., Cold Spring Harbor.
Cook, Mrs. Thankful P., Concord.
Atkinson, W. & J., Cornwall.
Montana Mills, Cornwall (Canterbury).
Green, F. M. & J. O., Cropseyville.
Cline, William, Crown Point.
Lockwood, J. C., W. Davenport.
Hathaway & Penfield, Delhi.
Hall, F. J. & Co., Dexter.
Green, Robert, Duanesburg.
Brown, Israel, Durham.

Morse, Alpheus & Co., Eaton.
Darrow, A., "
Blakeman, E., "
Churchill & Co., West Eaton.
Ebenezer Society, Ebenezer.
Elba Woollen Mill, Elba.
Allen & Graredin, Ellicott.
Hazeltine & Co., Ellicott (Jamestown).
Elmira Woollen Co., Elmira.
Randel, W. R., Ephratah.
Yanny, Levi & Co., "
Bailey, Joshua, Esopus.
Brooks, James, "
Demmick, J. W., "
Gilbert, B. R., Essex.
Bryant, William, Farmington (Norton's Mills).
Glenham Woollen Co., Fishkill.
Lamb, Samuel & Co., Fort Ann.
Briggs, T. & Son, Fort Covington.
Shannon, J., " "
Brown, Justus, French Creek.
Mulligen, John, Gates.
Rogers & Richardson, Galesville.
Desilva, Ira, Gilboa.
Kellogg, Doratus, Granby.
Stevens, Jonathan, Granville.
Wheeler, Ephraim, Green.
Spawn, Elijah, Guilderland.
Rockwell, C. H., Guilford (Mt. Upton).
Haviland, C. A. & Co., Hamburgh.
Shaw, Alexander, Hamden.
Kilbourn & Son, Low Hampton.
Tolman, William, Hartford.
Rockwell, C. N., Hartwick.
Mather, N. N. & Co., Hemlock Lake.
Spaulding, C. & R. E., North Hoosick.
Akin, Robert, Hudson.
Stott, C. H. & F. H., "
Fox, Samuel, "
Huyck & Trencher, Indian Fields.
Keefer, Nelson, Jackson.
Gardner, Easton, North Java.
Titus, Elias & Co., La Grange.
Cady, George B., Lenox (Clockville).
Hollingsworth, E., Centre Lisle.
Butcher & Lenior, Little Falls.
Mohawk Mills, " "
Saxony Woollen Co., " "
Ward, Robert T., Locke.
Niagara Woollen Co., Lockport.
Edwards, L. N. & Son, "
Willard, J. A. & Son, Lyonsdale.
Bantam, John, McDonough.
Van Sickler, A., Madrid.
McMillan Mills, Malone.
Chadwick, Ward & Chadwick, Malta.
Brown, J. F., Mamakating.
Chester, Moses & Co., Marcellus.

Bright, S. G., Marcellus Falls.
Briggs & Polley, Massena.
Howder & Co., Mellenville.
Phillip, George W., "
Clark, A. L. & Co., "
Aikins, Nelson P., "
Allen & Buggy, Mendon (Howaye Falls).
Gilbert, O. J., " " "
Hayden, W. & Son, Mentz (Pt. Byron).
Erskine, Madison D., Mexico.
Abbot, William B., Middleton.
Newsome, James, "
Randall, A. P. & Co., Milo.
Ellsworth, Thomas, Mimesink.
Andrews, Giles, Montgomery.
Schofield, Capron & Co., "
Mellen, J. & Son, Moravia.
Winton, J. L., Morris.
Lull, H. J., "
Morton, Thomas, Mottville.
Allen, Oliver, Mumfordsville.
Bright, E., "
Haines, P. S. & Co., Newburg.
Harrison, J., "
Haigh, Edward, "
Van Horn, B. & Co., Newfane.
Niles & Van Nostrand, "
Purdy, Ebenezer, Newfield.
Helm & Kernan, New Hartford.
Cranshaw, Samuel, New Windsor.
Leonard, L. W. & Co., " "
Higgins, E. S. & Co., New York.
Little & Dana, " "
Bishop, Ephraim M., Olive.
Johnson, C. E., Orange.
Butcher, William, Oriskany.
Gansevoort Woollen Co., "
Ward & Co., "
Strong & Hubbell, Oswego.
Fletcher, Wentworth & Co., "
Holroyd, James, "
Home Manufacturing Co., "
Briggs, Owen & Co., "
Kellogg, D., Oswego Falls.
Allen & Gibson, Otto.
Edwards, William, Oxford.
Williams, A. J., Paris.
Wiley, Morton & Craven, Perry.
Root, F., Phelps.
Hull, M. A. & Co., Pike.
Crandall, George L., Pitcher.
Gregory & Nichols, Plattsburg.
Petion, C. M. & G. P., Poughkeepsie.
Howe, Alexander, Providence.
Curtis, Quartus, Queensbury.
Johnson, J. M., Raymondville.
Waterbury, Henry, Rensselaerville.

Beardsley, E., Rhinebeck.
Manyri, Orcelon, Richfield.
Winegar, Ashbel, Richmond.
Perkins, John, Riverhead.
Yanney, David, Rochester.
Gordon, Washburn & Co., Rushford.
Van Brocklin, M., Russell.
Lyons & Cleveland, Salem.
Wheeler, Ira, North "
Lyon, B. F. & Co., Sag Harbour.
Schermerhorn, Cornelius, Sand Lake.
Cipperly, George, " "
Aiken & Kidder, East " "
Knowlson, Andrew " " "
Donaldson, J. & Co., West " "
Loveland, M. K., Sardinia.
Hogeboom, P. S., Schodack Landing.
Phœnix Co., Seneca Falls.
Seneca Knitting Mills, " "
Blanvelt, I. C. & Son, Spring Valley.
Blanvelt, I. R., " "
Turner, Sandford, Sherburne.
Kellogg, W. W., Skaneateles.
Howard, A., Solsville.
Evans, Charles & Son, Southport.
Brown, James, Stamford.
Hart, P. W., "
Holcomb, George, Stephentown
Bright & Wiley, Stockbridge.
Stafford, John, West Stockholm.
Van Hoesen, Abraham W., Stuyvesant Falls.
Bradhead, James, Sullivan.
Syracuse Manufac. Co, Syracuse.
Collis, John O. & Son, Theresa.
Hack, J. H., Thompsonville.
Treadway, James W., Ticonderoga.
Copwell, Richard, Troupsburg.
Troy Hosiery Co., Troy.
Troy Woollen Co., "
Roy, James & Co. (shawls), West Troy.
Crain & Son, Truxton.
Dewey, C., Turin.
Griswold, John D., Unadilla.
Utica Steam Woollen Co., Utica.
Globe Woollen Co., "
Empire Woollen Co., "
Kernon & Co., "
Lowry, S. S., "
Rockwell, James & Co., "
Butterfield, S. & Son, Vernon.
Wright, James, Vienna.
Sanders, Stephen, Villanova.
Stark, John, Waddington.
Burkick, Abial, Warrensburg.
Waterloo Woollen Manufac. Co., Waterloo.
Church, James H., Wegatchie.

Calder, W. H.,	S. Westerlo.
Stone, Lester,	Westfield.
Smith, Alexander,	West Farms.
Allen, Oliver,	Wheatfield.
Weaver, Mrs. Betsey,	Williamsville.
Matthew & Hart,	Windham.
Barr, A. F.,	Wolcott.
Champion, J. A.,	E. Worcester.

New Jersey.

Blackwood Manufac. Co.,	Blackwood.
Oakes, David & Son,	Bloomfield.
Dubois, R. & J.,	Bridgton.
Camden Woollen Mills,	Camden.
Nichols, William H.,	Chester.
Demerest, J. J.,	Cresskill.
Duncan, William,	Franklin.
Still, J. W. & Co.,	
Beattie, Robert,	Little Falls.
Crane, Thomas,	Mendham.
Newark Woollen Mills,	Newark.
Duncan, S. R.,	"
Newark Hosiery Co.,	"
Norfolk & New Brunswick Hosiery Co.,	New Brunswick.

Pennsylvania.

Cofferall, Howard & Co.,	Alleghany.
Bradley, Samuel, Son & Co.,	"
Reel, C. & Co.,	"
Houser & Kendall,	Bellefonte.
Bell, B. F.,	Bell's Mills.
Doster, Lewis's Sons,	Bethlehem.
Irvin, J. G. & Co.,	Boulsburg.
Dale Brothers,	"
Richard, Henry H.,	Boyertown.
Fisher, Joseph & Son,	Chandlersville.
Rich, John & Brother,	Chatham's Run.
Shedwick, James,	Chester.
Eccles, Samuel, Jr.,	"
Hall, Robert,	"
Powell & Campbell,	"
Rhodes & Boyd,	"
Martin, R. L.,	"
Carrol & Wigan,	"
Green, John J.,	"
Wood, Samuel,	Chester Valley.
Greenwood, Samuel,	Coatesville.
Kenworthy, J. & H.,	"
Bullock, Benjamin's Sons,	Conshohocken.
Irvin, J. & Son,	Crosbyville.
Irvin & Leiper,	"
Ingraham, Joseph & Son,	Deerfield.
Jackson, James A.,	Delmar.
Webster, Henry,	Doe Run.
Roberts, James C.,	Downington.
McClure, Joseph M.,	"
Craig, James,	Eastbrook.
Neilson, John,	"
French & Keith,	Fairview.
Smith, G.,	Fallstown.
White, A. C.,	Fayetteville.
Good, Michael,	"
Craig & Rumberger,	Franklin.
Fullerton & Co.,	Freeport.
Edelman, John,	Fredensburg.
Perry, H. O.,	Genesee Forks.
McDowell, M.,	W. Greenville.
McFarland, George,	Gulf Mills.
Townsend, John,	" "
Kelley & Co.,	Haverford.
Shimer, J. O.,	Hellertown.
Ball, W. & J.,	Hepburn.
Jones, George,	Hestonville.
Good, Martin,	Highspire.
Kendall & Pletcher,	Houserville.
Halfpenny & Anvle,	Jerseyshore.
Kennedell, John & Co.,	Kittaning.
Kaye, John,	Lawrenceville.
Scatchard, Joseph,	" "
Campbell, A. & Co.,	Manayunk.
Houdekoper, H. S. & F.,	Meadville.
Antrim, Osborn,	Media.
Edleman, Samuel,	Menden Creek.
Broadbent, Ammon,	Mercer.
Bruiser, Solomon,	Middleton.
Cadwallader, Welch & Co.,	Mill Hall.
Hemmilwright, Jos.,	Milford Square.
Glen & Houser,	Millheim.
Johns, J. R.,	Millersburg.
Eves & Brothers,	Muncy.
Smith, A. F.,	New Brighton.
Stewart & Pantifia,	" "
Wilde & Co.,	" "
Levan, George,	New Milltown.
Shaw, James,	Newportville.
Stover, John O.,	Nittany.
Blounts, Shaw & Co.,	Norristown.
Hunter, P. H. & Co.,	"
Hay, E. & Brother,	Oakdale.
Cass, Grimshaw & Co.,	Northeast.
Phillips & Aikens,	Parkesburg.
Brooks, John,	"

Armstrong & Shaw,	Philadelphia.
Allen, J. & B.,	"
Bancroft, Samuel,	"
Beck, Alex.,	"
Birchall, Elias,	"
Bowman, A. H. H., Jr., Baltic Woollen Co.,	"
Blundin, Mrs. Martha,	"
Briggs, John,	"
Bromley, John & Son (carpets),	"
Bruner, J. P. & Sons,	"
Buggy, James,	"
Buggy, J. & W.,	"
Button, J. & Sons,	"
Callaghan & Brothers,	"
Campbell, John,	"
Cattell, Samuel W.,	"
Clegg, Joseph,	"
Creagmill, Charles,	"
Crowson & Brothers,	"
Deacon, Charles T.,	"
Dearie, John,	"
Dicky, W. J. & J.,	"
Divine, William & Sons,	"
Doak, James,	"
Dobson, John,	"
Doerr, Philip,	"
Dolan, Thomas & Co.,	"
Dunlap, John,	"
Dunlap, John, Jr.,	"
Dunlap, William,	"
Erben, Peter C.,	"
Evans, John H.,	"
Evans, George P.,	"
Finley, Thomas,	"
Fling, George,	"
Foster, Israel,	"
France, J. & E.,	"
Fulforth & Lovelidge,	"
Gadsby, John & Sons,	"
Garside, B. & Son,	"
Garside, Joseph,	"
Girard Woollen Manufac Co.,	"
Graham, J.,	"
Halkyard, Mrs. N.,	"
Hey, E. & Brothers,	"
Hilton, James,	"
Hindman, Stuart,	"
Hindman, William A.,	"
Hogg, James,	"
Hogg, William, Jr.,	"
Holmes, T. & Brother,	"
Howarth, James,	"
Hughes, John,	"
Huston, John,	"
Jackson, James,	"
Judge, James,	"
Kennedy, Samuel,	"
Kitchen, William & Son,	"
Klotz, Paul,	Philadelphia.
Landenberger, Martin & Co.,	"
Laycock & Holt,	"
Lecky, John,	"
Lees, James & Son,	"
Levis & Rhoades,	"
Lewis, J. W.,	"
Long, James & Brother,	"
Lord, James, Jr.,	"
McDade, George,	"
McDade, James,	"
McDonald & Holmes,	"
McFetridge, James,	"
McHutton, William,	"
McMullen, David,	"
Martin, Charles,	"
Meadowcroft & Winterbottom,	"
Midnight, J. T.,	"
Moffatt, James R.,	"
Moffatt, M. & J.,	"
Murray, Edward,	"
Nelson, John B.,	"
Osborne, Robert,	"
Porter & Dickey,	"
Pollock, James,	"
Preston, James M.,	"
Rallston, James,	"
Redpath, M. & S. C.,	"
Ring, David,	"
Russell, James,	"
Schofield, Thomas,	"
Schofield, Branson & Co.,	"
Schofield, S.,	"
Scott, Robert,	"
Sonneborn, John P.,	"
Sonneborn, Louis,	"
Soule, H. H.,	"
Spencer, Charles,	"
Steenson, J. & S.,	"
Stewart, Charles,	"
Stewart, William,	"
Sutton, George & Son,	"
Swartz, Joseph,	"
Thurlow & Sons,	"
Tomlinson, William,	"
Wallace, David,	"
Waters, John M.,	"
White, Hugh,	"
Wilde, Solomon,	"
Winpenny, Bolton,	"
Wolfenden, Shore & Co.,	"
Wolfenden, Winterbottom & Co.,	"
Whiteley Brothers,	"
Yewdell, Samuel (heirs of),	"
Young, William,	"
Arthurs, James & Co.,	Pittsburgh.
Gartside, Joseph,	Alleghany Co.
Shaeffe, A. & D.,	" "

Rogers, R. G. & J. A	Plunkett's Creek.
Keefer, William L.,	Porterfield.
Booser & Co.,	Potter's Mills.
Brooks, J. M.,	Reading.
Morrison & Gibboney,	Reedsville.
Shaw & Agnews,	Richland.
Brooks, John,	Sadsburyville.
Blackwell, John,	Salladaysburg.
Evans, Samuel O.,	Thompsontown Station.
Yost, Isaac,	Tulpehocken.
Buckley, John.	Washington.
Bear, Ephraim S.,	Waynesboro'.
Lee, Charles,	Wellsboro'.
Staden, W. & A.,	Williamsport.
Graff & Firth.	Worthington.
Clapham, A. G.,	Woodward.

Delaware.

Griffiths, J. & R.,	Henry Clay Mill.
Bond, James,	" "
Murphy, Thomas,	Middleton.
Dean, Joseph & Son,	Newark.
Clark, H.,	Newport.
Taylor, James,	Stanton.
Worrall, Thomas,	Wilmington.
Shaw, John,	"

Maryland.

Ashland Man'g Co., Wethered, Brother & Nephew,	Wetheredsville, Balt. co.
Allen & Pearson, Bay View, Cecil co.	
Bradshaw, William,	Simpsonville, Harford co.
Chilcoat, Richard & Son,	Jefferson, Frederick co.
Castle, O. B.,	Brownsville, Washington co.
Carroll, Owen,	Bladensburg, Prince George co.
Crawford, James, Northeast, Cecil co.	
Devries & Schofield,	Marriottsville, Carroll co.
Faucett, B. & J.,	Colesville, Montgomery co.
Franklin Mill,	Wetheredsville, Baltimore co.
Hanay, Washington,	Pleasantville, Harford co.
Hibbard, Joseph H. & Brother,	New Windsor, Carroll co.
Jackson, John R.,	Black Horse, Harford co.
Mallien & Brother,	Wellington, Queen Anne co.
Murphy, Thomas, Warwick, Cecil co.	
Sentenan, Lawrence (yarn),	Fair Hill, Cecil co.
Shaeffer, David,	Bohrmansville, Carroll co.
Townshend, Samuel,	Brorhville, Montgomery co.

West Virginia.

Bradlee, Elizabeth, Wheeling.

Ohio.

Tooker & Leonard,	Akron.
Foutz, M. & E.,	West Alexandria.
Dews & Kauffman,	Alpha.
Palmer, Willard D.,	Austinburg.
Bedford Woollen Mill,	Bedford.
McIntosh & Son,	Beverly.
Bucyrus Mill Co.,	Bucyrus.
Clapper, S. & Co.,	"
Alexander, L.,	Canton.
Robbins, John,	"
Glozer, Brothers & Co.,	Cincinnati.
Gillis, S. W., treasurer,	Circleville.
Miller & Fritch,	"
Cleveland Woollen Mills,	Cleveland.
Fitch & Clark,	"
Columbus Woollen Co.,	Columbus.
Cuyahoga Falls Woollen Mill,	Cuyahoga Falls.
Fish, William,	Dayton.
Hummelright & Son,	Delphos
Crewzet, Menager & Co.,	Gallipolis
Le Clercy, A. & F. L. & Co.,	"
Coffin, Alonzo,	Ghent
Johnson, G. B.,	Granville
Pfistner & Halbertson,	Greenville
Shuler & Benninghoffer,	Hamilton

Dyson & Bremen,	Kent.
Olds, L. H.,	Lancaster.
Kaughman & Oberdoffer,	"
Lowery, George,	"
Shaw, Thomas,	"
Parmalee, A. S.,	Liverpool.
Slagle, C. K.,	London.
Sticklei, Edward,	Lowdensville.
Gledhill, Walter,	Lucas.
Pretzinger, J. P.,	Manchester.
Painter, Andrew,	Mansfield.
Rawson & Welch,	Marysville.
Stuart, E.,	Mechanicsburg.
Goodale, J. P.,	Middlebury.
Wise, Jesse,	Midway.
Rutledge, William,	West Milton.
Bracken, E.,	Mt. Pleasant.
Lantzenheizer, Bigger & Co.,	Napoleon.
Wilson & Smith,	Newark.
Williams, T. K. & Co.,	New Philadelphia.
Pardee, Luther,	Northampton.
Roots, P. H. & F. M.,	Oxford.
Messmore, John,	Puncort.
Gledhill, John & Sons,	Ravenna.
Wilson, Thomas,	Roscoe.
Long, A. & Son,	Shelby.
Maxwell & Anderson,	Sidney.
Gibson, W.,	St. Mary's.
Rabbitts, C.,	Springfield.
Paden, James,	"
Barrett, George,	Spring Valley.
Wallace, James & E.,	Steubenville
Smith, Gross & Dorsey,	Tiffin
Troy Woollen Mill,	Troy.
Ross & Hitt,	Urbana.
Stevens & Jones,	Warren.
Clark, Dennis,	Washington.
Cranston, J.,	Wheelersburg.
Barrett, George,	Xenia.
Walker & Lyman,	Youngstown.
Shaw, J. B.,	Preble co.

Indiana.

Broadbent, Stephen,	Anderson.
Adams, Robert,	"
Keller, John,	Brewersville.
Cockefair, J. & Son,	Cambridge City.
Wells, James & Co.,	Clayton.
Carter, Samuels & Co.,	Columbus.
Roots, P. H. & F. M.,	Connersville.
Carter & Blake,	Danville.
Green, John W. & Co.,	Evansville.
Schaeffer, Rimroth & Co.,	"
French, Hanna & Co.,	Fort Wayne.
Sailors, Baldwin & Co.,	Franklin.
Bamter & Winegar,	Goshen.
Test, J. & W.,	Hagarstown.
Solomon & Zeigler,	Hope.
Geisendorff, G. W. & Co.,	Indianapolis.
Merritt & Coughlin,	"
Patterson, S. M.,	Jeffersonville.
Aldrich, William,	Logansport.
Richardson, S. B.,	"
Cammack, Nathan,	Milton.
Palmer & Warden,	Mishawaka.
Comstock, John,	North Manchester.
Wallace, Thomas & Co.,	North Manchester.
Creed, John L.,	New Albany.
Shaws & Kline,	Noblesville.
Van Zant, J. H. & Co.,	Owensville.
Head, T.,	Pittsburg.
Eicher, Alexander,	Pleasant Mills.
Test, A. & Co.,	Richmond.
Aiken & Nixon,	"
Haigh & Hutchinson,	Rising Sun.
Schofield, Joseph & Co.,	" "
Hanna, James T.,	Rochester.
Geisendorf & Co.,	Rome.
Staley & Soury,	South Bend.
Ellis, George F.,	Terre Haute.
Kennedy, S. S. & Co.,	" "
Newton & Schofield,	Vernon.
McClellan, James,	"
Cissna, Robert & Co.,	Wabash.
Whiteside, Steel & Co.,	"
Stearns, H. E. & C. F.,	"
Semans, John L.,	Westfield.

Illinois.

Nichols, F. R.,	Alton.
Stolp, J. G.,	Aurora.
Mayers, Jacob,	Bloomington.
Piper, John,	Canton.
Clark, Charles A.,	Carpentersville.
Robertson, J. T. & Co.,	Carrollton.
Kennedys & Wees,	Charlestown.
Hobson & Aylesworth,	Danville.
Boyd, Haskell & Co.,	Decatur.
Kendrick, G. W.,	Elgin.

Hopper, Trill & Co.,	Hopper's Mills.
Capps, Joseph & Son,	Jacksonville.
Bruner, Thomas H.,	Lewiston.
Wiley & Proctor,	"
Bolger, Samuel,	Logansport.
Hampton, David,	Macomb.
Ross, R. H.,	Mt. Sterling.
Husman, Henry,	Okaw.
Bale & Hill,	Petersburg.
Wike & Co.,	Pittsfield.
Afflick, T. B.,	Richview.
Heitz, J. B. & Co.,	Rushville.
McClurkin, Matthew,	Sparta
Dickerman & Co.,	Springfield.
Gere, J. & Co.,	Urbana.

Michigan.

Bent, W. B.,	Ann Arbor.
Cornwell Brothers,	" "
Osborn & Co.,	" "
Tomlinson & Co.,	" "
McCall & Brother,	" "
Palmer, F. J. & J.,	Atlas.
Wallace, William,	Battle Creek.
Lyman, P. S.,	Corunna.
Thompson, E. W. & Co.,	Dexter.
Gallery, William,	Eaton Rapids.
Alexander, Samuel C.,	Fentonville.
Huntley, G. M.,	Grand Rapids.
Earle, John E. & Co.,	" "
Bliss, Milton,	Ionia.
Brigham, E. B.,	Jackson.
Gardner, H. R. & Co.,	Jonesville.
Avery, Abel,	Lowell.
Huntley, G. W.,	Lyons.
Davis, George,	Milford.
Pitears, Jacob,	"
Norman & Smith,	Munroe.
Parkville Woollen Mill,	Parkville.
Paddack, H.,	Pontiac.
Roberts, Edward & John,	Rochester.
Nichol, John,	St. Clair.
Spencer, Erastus,	Smyrna.
Deaves, R. F.,	Tecumseh.
Ypsilanti Woollen Mill,	Ypsilanti.

Wisconsin.

Hutchinson, J. W.,	Appleton.
Spaulding, J. W.,	"
Drown & Andrews,	Baraboo.
Dean, John & Co.,	"
Stewart, G. H. & Co.,	Beaver Dam.
Richards, S.,	Bentonsport.
Calton, James,	Burlington.
Lawton & Perkins,	"
Roberts, J. D.,	Cambria.
Cedarburgh Woollen Mill,	Cedarburgh.
Carpenter, George W. & Co.,	Fond du Lac.
Fox Lake Woollen Mill,	Fox Lake.
Wheeler, F. A. & Sons,	Janesville.
Whittaker, F.,	"
Madison Woollen Mill,	Madison.
Priest, Daniel,	Menosha.
Nye, H. D.,	Prattsville.
Prentiss & Farnsworth,	Sheboygan Falls.
Krauskoss, Jacob,	Suttonville.
Jones, Daniel & Co.,	Watertown.
Patzer, Vollamer & Semler,	West Bend.

Iowa.

Amana Society,	Amana.
Leible & Co.,	Bentonport.
Meek & Brothers,	Bonaparte.
Smedley, Wheelock & Co.,	Brighton.
Clark, John,	Cedar Rapids.
Talbot & Gardner,	Centreville.
Benedict, J. H.,	Eddyville.
Sawyer, Mrs. Jennette,	Fort Madison.
Thorp & Co.,	Genoa.
Lonsdale, John.	Morrisburg.
Davis & Robinson,	Northfield.
Gross & Smith,	Osceola.
Proudfeit & Bangh,	Oskaloosa.
Zulauf, John & Co.,	Ollumwa.
Cline, Lenon, & Co.,	Penora.
Allender & Ketchum,	Vernon

Minnesota.

Eastman, Gibson & Co.,	Minneapolis.
Veazie, Demeritt & Brown,	"
Wallace & Wheeler,	Preston

Missouri.

Wadkins, ——,	Hainesville.	Elliott, W. H.,	St. Catherine.
Dale, James H.,	Liberty.	Gibbs & Ross,	St. Charles
Colburn, Everett & Jaggers,	Liberty.	Buell, George,	St. Joseph.
Watson, Samuel & Son,	Oregon.	Carding Machine Co.,	Unionville.

Kentucky.

Herold, J. G.,	Covington.	Richardson, L.,	Louisville.
Asherst, J. T. & Brother,	Georgetown.	Davies, D. H.,	"
Steadman, L. C.,	"	Brownell, S.,	"
Marrimon, J. T. & Son,	Harrodsburg.	Lindsey, R. A.,	Orangeburg.
Loud, Richard,	Lexington.	Cate & Warner,	Owensboro'.
Woolley, George,	"	Shelbyville Woollen Mills,	Shelbyville.
Thompson & Van Dalsen,	"	McMillen & Wright,	Stamping Ground.
Edlich, O.,	Louisville.		

California.

Pioneer Woollen Co., San Francisco.

Oregon.

Lynn Manufac. Co.,	Brownsville.	Willimetta Manufac. Co.,	Salem.

STATISTICS OF THE PRODUCTION OF IRON IN THE UNITED STATES IN 1860, AND A LIST OF THE PRINCIPAL BLAST FURNACES AND ROLLING MILLS IN THE NEW ENGLAND, MIDDLE, AND WESTERN STATES.

[Since 1860 there has been a considerable increase both in the number of Blast Furnaces and Rolling Mills. Never was the trade in iron so active and prosperous as now, or its future more hopeful and brilliant. Europe has probably exhausted its capacity for the production of a superior quality of Iron, and the United States, from their inexhaustible resources, are destined to become the source of supply for the world. The ores and the coals of England are both inferior, and it is only by exercise of great skill, and subjection to numerous refining processes, that Iron of a tolerable quality is made. Germany and France have good iron ores, but are deficient in mineral coal, and when the forests cease to supply charcoal, the quality of their iron, inferior as it now is, will still further retrograde. Russia produces a good quality of Iron, but the sources of supply are so distant that it requires nearly two summers to reach a port of shipment. The war has secured to the iron-masters of the United States a protection more reliable and stable than any protective tariff, and they can now proceed to extend their operations with confidence of permanency; and when they have supplied the home demand, they will have acquired skill and advantages that will enable them to compete successfully with other nations in foreign markets.]

TOTAL NUMBER OF IRON WORKS IN THE UNITED STATES.

Anthracite Blast Furnaces	121	
Coke " "	21	
Raw Bituminous Coal Blast Furnaces	15	
Charcoal Blast Furnaces	418	
Total number of Blast Furnaces	—	589
Bloomaries		204
Forges		189
Rolling Mills		209
Total of all kinds running or in running order		1,182
Number of Double Puddling Furnaces in the Mills		203
" Single " " "		1,054
Total number in the Rolling Mills	1,470	
Number in the Forges	34	
Total number in United States	—	1,504
Total number of Bloomery Fires		442
" " Refinery or Forge Fires proper		496
" " Nail Machines		2,645

Pig Iron produced in 1860	Tons, 987,559	Value, $20,870,120
Bar and other rolled Iron	" 509,084	" 31,888,705
Cast Iron		" 36,132,033
Steam Engines and Machinery		" 47,647,964
Coal, Anthracite	Tons, 8,115,842	Value, $11,874,574
" Bituminous	" 6,218,080	" 8,369,063
Aggregate	14,333,922	$20,243,637

A LIST OF THE ANTHRACITE AND CHARCOAL FURNACES AND ROLLING MILLS IN THE NEW ENGLAND, MIDDLE AND WESTERN STATES, IN 1860, WITH NAME OF OWNERS AND MANAGER, AND WHEN BUILT.

Anthracite Furnaces in New England.

Berkshire No. 1, 1853, Gay & Burt, West Stockbridge, Mass.

Berkshire No. 2, 1857, Gay & Burt, West Stockbridge, Mass.

Sharon, 1854, Hiram Weed & Co., Sharon Village, Conn.

Bull's Falls, 1844, D. & E. Wheeler, Kent Station, Conn.

Anthracite Furnaces in New York and New Jersey.

Port Henry No. 1, 1817, Port Henry Furnace Co., John H. Reed, Treas., Essex co.

Port Henry No. 2, 1854, Port Henry Furnace Co., John H. Reed, Treas., " "

Sisco, 1856, 13x42, Westport, " "

Clinton, S. A. Munson, owner, near Utica, Oneida co.

Hudson 1 and 2, 1850, C. C. Alger, Hudson, N. Y.

Poughkeepsie No. 1, 1818, Beck & Kuhnhardt, Supt. A. Town, Poughkeepsie, "

Poughkeepsie No. 2, 1853, Beck & Kuhnhardt, Supt. A. Town, Poughkeepsie, N. Y.

Napanock, F. Bange, owner, Supt. M. S. Brinton, Napanock, Ulster co.

Croton, 1857, Nichols & Co., Supt. D. L. Merrit, Croton Landing, N.Y.

Peekskill, 1854, Warren Murdoch, Peekskill.

Greenwood Nos. 1 and 2, R. P. & P. P. Parrott, Orange co.

Manhattan, 1854, Headley, Leffarts & Co., Supt. M. Brock, Manhattanville

Boonton, Fuller, Lord & Co., W. G. Lathrop, Supt., Boonton, N. J.

Anthracite Furnaces in Pennsylvania.

[For a description of some of the largest blast furnaces in Pennsylvania, see pp. 85–90.]

Cooper Nos. 1, 2, 3, see p. 577.

Durham No. 1, 1848, Cooper & Hewitt, near Easton.

Durham No. 2, 1851, Cooper & Hewitt, " "

South Easton, 1853, Charles Jackson, Jr., " "

Glendon Nos. 1, 2, 3, 1844, '45, and '50, Charles Jackson, Jr., owner, W. Firmstone Supt., " "

Allentown Nos. 1, 2, 3, 4, see p. 577, Allentown.

Lehigh Crane Co. see p. 576, near "

Thomas Iron Co., see p. 576, " "

Lehigh Valley, 1855, B. S. Levan, Supt., " "

Poco, 1855, Carbon Iron Co., Dennis Bowman, Pres., Parryville, Carbon co.

Mauch Chunk, 9x33, Weiss, Lippencott & Co., W. McDowell, manager, Mauch Chunk.

Pioneer 1837, Atkins & Brother, Pottsville.

Leesport 1853, F. S. Hunter., Agent, Supt. T. Cole, Leesport.

Moselem, 1823, F. S. Hunter, Supt. Nicholas Hunter, near Leesport, Berks co.

Robesonia No. 1, 1853, Robeson, White & Co., " "

Robesonia No. 2, 1858, Robeson, White & Co., " "

Reading, 1854, Seyfert, McManus & Co., Reading, " "

Henry Clay No. 1, 1846, Eckert & Brother, Supt. D. E. Benson, Reading, Berks co.

Henry Clay No. 2, 1854, 15x58, Eckert & Brother, Supt. D. E. Benson, Reading, " "

Keystone, 1854, 12x15, Birdsborough, " "

Hopewell, 1857, Clingan & Buckley, Hopewell, " "

Phœnix, see p. 579.

Montgomery, 1854, Miller, Patterson & Hollingsworth, Port Kennedy, Montg. co.

Lucinda, 1856, Wm. Schall, Norristn, "

Swede, Nos. 1 and 2, Joel B. Morehead, near Norristown, "

Plymouth, 1845, Stephen Colwell, Plymouth, " "

Merion, 1848, Joel B. Morehead, " " "

Springmill, 1844, D. Reeves and others, Springmill, " "

William Penn No. 1, 1845, Hitner, Cresson & Co., near " " "

William Penn No. 2, 1853, Hitner, Cresson & Co., near " " "

Shamokin, 1842, H. Longenecker & Co. Shamokin, Northumberland co

Chulasky, 15x42, J. V. L. DeWitt, Supt. R. W. Richardson, " "

Franklin, 1846, David Reeves & Son, near Danville, Montour co

Pennsylvania, see p. 579.

Columbia, 1840, J. P. & J. Grove, " "

Roaring Creek, 1840, E. Reynolds & Bro., Supt. Wm. Kase, Moutour co.
Safe Harbor, 1848, Reeves, Abbott & Co., Supt. Wyatt W. Miller, near Columbia, Lancaster co.
Conestoga, 1853, C. Geiger, Lancaster, " "
Shawnee No. 1, 1844, A. & J. Wright, near Columbia, " "
Shawnee No. 2, 1853, A. & J. Wright, near Columbia, " "
Cordelia, 1848, Kauffman, Shæffer & Co., Supt. C. S. Kauffman, near Columbia, " "
St. Charles, 1853, Clement B. Grubb, near Columbia, " "
Henry Clay, 1845, C. B. Penrose & Co., " " " "
Chickeswalungo, 1846, E. Haldeman & Co., " " " "
Eagle, 1854, Eagle, Beaver & Co., " " " "
Donegal, 1847, Eckert & Myers, " " " "
Marietta No. 1, 1849, Musselman & Watts, Marietta, " "
Marietta No. 2, 1850, Musselman & Watts, " " "
Middletown Nos. 1 and 2, Wood & Stirling, Supt. J. C. Boyle, Middletown, Dauphin co.
Cameron, 1856, Landis & Co., " " "
Harrisburg, 1845, David R. Porter, Supt. W. Keller, Dauphin co.
Paxton, 1855, McCormick & Co., near Harrisburg, " "
Union Deposit, 1854, Gingrich, Balsbaugh & Co. Supt. S. M. Krauser, " "
New Market, 1855, Light & Early, near Millerstown, Lebanon co.
Dudley, 1855, R. W. Coleman, " "
North Lebanon Nos. 1, 2 and 3, George Dawson Coleman, Supt. Charles B. Forney, " "
Cornwall Nos. 1 and 2, R. W. & W. Coleman. Supt. B. Mooney, " "
Stanhope, 1835, Breitenbach & Sheetz, near Pinegrove, Schuylkill co.
Duncannon, 1853, Fisher, Morgan & Co., Perry co.
Lewistown, 1846, Etting, Graff & Co., Supt. Wm. Willis, Lewistown, Mifflin co.
Hope, 1810, J. Murray, near " " "
Bloom, 1847, McKelvy & Neal, Columbia co.
Irondale Nos. 1 and 2, 1844, Bloomsburg Iron Co., Charles R. Jackson, Jr., Supt., " "
Henry Clay, 1847, Samuel Bettle, " "
Williamsburg, 1845, M. McDowell, " "
Hunlach's Creek, 1854, William Koons, Luzerne co.
Lackawanna, see p. 578.
Union, 1854, Beaver, Geddes & Co., Union co
Margaretta, 1855, Bingham, McKinney & Co., Supt. Mr. Kremer, Lycoming co.
Mill Hall, 1830, Mill Hall Iron Co., Clinton co.

Anthracite Furnaces in Maryland.

Rough and Ready Nos. 1 and 2, 9x30, Joseph & George P. Whitaker, Havre-de-Grace.
South Baltimore, 10x33, Daniel M. Reese, Baltimore.
Ashland, 11x32, Ashland Iron Co., Supt. Richard Green, near Baltimore.
Oregon, 11x36, Ashland Iron Co., Supt. Richard Green, near "

Charcoal Furnaces in New England.

Katahdin, 1845, David Pingee, Piscataqua co., Maine.
Dorset, (old), Bennington co., Vt.
Conant, 1820, Brandon Carwheel Co., Supt. George W. Palmer, Brandon, "
Pittsford, 1824, Pittsford Iron Co., Supt. Mr. Granger, Rutland co., "
North Adams, 1845, North Adams Iron Co., Supt. J. E. Marshall, Berkshire co., Mass.
Cheshire, 1848, Cheshire Iron Co., Supt. E. W. Thayer, Berkshire co., "
Briggs, 1847, Samuel Smith, Lanesborough, Berkshire co., Mass.
Lenox, 1839, Lenox Iron Co., Supt. W. A. Phelps, Berkshire co., "
Richmond, 9x31, Richmond Iron Co., Supt. John H. Coffin, Berkshire co., "
Vandusenville, 1834, " " "
Mount Riga, 1845, Salisbury Iron Co., Litchfield county, Conn.
Beckley, 1847, John A. Beckley, Supt. John Dunmore, Litchfield co., Conn.
Forbes, 1832, Forbes Iron Co., " " "
Scovills, 1844, Scovills & Co., " " "
Buena Vista, 1847, Hunt, Lyman & Co., Supt. D. M. Hunt, Litchfield co., "
Cornwall, 1832, Supt. Samuel Scovill, " " "
Cornwall Bridge, 1833, W. Cornwall, " " "
Joiceville and Chapensville, Landon & Co., Chapensville, " " "
Weed's, 7x24, Hiram Weed, Sharon Village, " " "
Kent, 1846, Stewart, Hopkins & Co., Kent, " " "
Limerock, 1825, Canfield & Robbins, Salisbury, " " "
Sharon Valley, 8x34, H. Landon & Co., Sharon Valley, " " "
Macedonia, 1826, C. Edwards, " " "

Charcoal Furnaces in New York and New Jersey.

Copake, 1845, W. L. Pomeroy & Co., Copake, Duchess co., N. Y.
Benedict's, 1854, Benedict & Co, Millerton, Duchess co., "
North East, 1847, Mr. Dagon, Millerton, " " "
Amenia, 1825, Mr. Gridley, Amenia, " " "
White's Dover, 1846, William White, Dover Plains, " " "
Fishkill, —— Isaac White, Hopewell, " " "
Dover, 1835, L. S. Dutcher & Co., lessees, South Dover, " " "
Beekman's, 9x36, Stirling, Foster & Co., Poughkeepsie, " " "
Greenwood, 1811, R. P. & P. P. Parrott, Greenwood, Orange co. "
Southfield, 1839, Peter Townsend & Co,, Southfield, Orange co., "
Sterling No. 2, 1847, Peter Townsend & Co., Warwick " " "
Mount Hope, 1836, B. F. Woodruff, Fort Ann, Washington co., "
Brasher, 1835, Isaac W. Skinner, St. Lawrence co., "
Fullerville, 1846, Fuller & Peck, St. Lawrence co., "
Rossie, 1844, George Parish, Supt. C. L. Lum, St. Lawrence co., "
Taburg, 1832, E. B. Armstrong, Rome, Oneida co., "
Wolcott, 1846, Leavenworth, Hendrick & Co., Wayne co., "
Ontario, 1847, J. M. French & Co., " " "
Clinton, 1848, George B. Harris, Ontario, Wayne co.,
Adirondack, 1827, Adirondack Iron and Steel Co., Supt J. R. Thompson, Sanford Lake, N. Y.
Crown Point, 1845, E. S. Bouge, Essex co., "
Alpina, 1846, Z. H. Benton, Oxbow, Jefferson co., "
Redwood, 1857, S. C. Sardan, Redwood, Jefferson co., "
Wegatchie, 1846, A. P. Sterling, Antwerp, Jefferson co., "
Sterlingburg, 1846, A. P. Sterling, Jefferson co., "
Sterlingbush, 1848, James Sterling, Jefferson co., "
Sterlingville, 1857, James Sterling, Jefferson co., "
Constantia, 9x35, William A. Judson, Oswego co., "
Norwich No. 1, 1856, Reed, Haynes & Co., Norwich, Chenango co., "
Norwich No. 2, 1856, Andrews, Rider & Co., Chenango co., "
Renton's No. 1, 1854, James Quimby, Supt. Joseph Marteen, Newark, N. J.
Renton's No. 2, 1857, James Quimby, " "
Freedom, 1838, Peter M. Ryerson, near Pompton, Passaic co., "
Pompton, 1837, Wm. C. Vreeland, Pompton, " " "
Mellville, 1853, R. D. Wood, Millville, Cumberland co., "
Wawayanda, 1845, Oliver Ames & Son, Supt. J. A. Brown, Sussex co., "
Franklin, 1770, James H. Holdane, Prest., Franklin Village, "
Oxford, 1755, Charles Scranton & Co., Warren co., "

Charcoal Furnaces in Pennsylvania.

Lehigh, 1826, Levan & Balliott, N. Whitehall, Lehigh co.
Hampton, 1809, Frederick Sigmund, Sheimersville, " "
Maria, 1845, S. Balliott & Co., Carbon co.
Pennville, 1853, John Balliott, " "
Rockland, 1791, J. V. R. Hunter, Supt., J. N. Hunter, near Kutztown, Berks co.
Mount Laurel, 1836, W. H. Clymer & Co., near Reading, " "
Maiden Creek, 1854, George Merkle, " "
Mount Penn, 1827, Shalter & Kauffman, " "
Hampton, 1846, E. & G. Brooke, Birdsborough, " "
Joanna, 1794, Darling & Smith, " "
Mary Ann, 1797, Horace Trexler, " "
Oley, 1770, Markells & Levan, " "
Hopewell, 1759, Clingan & Buckley, Hopewell, " "
Warwick, 1736, David Potts, Jr., Chester co.
Mount Hope, 1785, E. B. & A. B. Grubb, Supt., Wm. Boyd, Lancaster co.
Conowingo, 7½x30, J. M. Hopkins Buck, Lancaster co.
Chestnut Grove, 1830, Charles Wharton, Jr., Adams co
Carlisle, 1815, Peter Ege, Cumberland co
Pine Grove, 1770, Jay Cooke, " "
Big Pond, 1836, Schoch, Sons & Co., Supt., Isaac S. Matthew, " "
Caledonia, 1837, Thaddeus Stevens' Heirs, Supt., Henry Sloat, " "
Mont Alto, 1807, Holker Hughes, Franklin co.
Carrick, 1828, J. R. Brewster, Supt., Wm. Noonan, Fannettsburg, " "
Valley, 5½x28, J. Beaver, Supt., J. Polsgrove, Loudon, " "
Warren, 1833, R. Lewis & Co., lessees, " "
Colebrooke, 1745, Wm. Coleman, Lebanon co
Cornwall, 1845, R. W. Coleman, " "
Manada, 1837, E. B. & C. B. Grubb, Supt., J. Care, Hanover, Dauphin co
Georgianna, 1855, Dr. Lewis Heck, " "

York, 1830, J. B. Bair & Co., Colemanville, York co.
Margaretta, 1837, Himes & Hahn, " "
Penn, 1845, J. Penn Fincher, Columbia co.
Esther, 1836, S. B. Diemer, " "
Shickshinny, 1846, D. B. Koons, Luzerne co.
Forest, 1846, Kaufman & Reber, Union co.
Berlin, 1827, Clement & Charles Brooke, Supt., J. Church, Union co.
Beaver, 1848, Middleswarth, Kerns & Co., Supt., J. C. Wilson, Snyder co.
Washington, 1811, C. & J. Fallon, Supt., Dr. Wm. Irwin, near Lockhaven, Clinton co.
Howard, 1830, John Irwin, Jr. & Co. " "
Hecla, 1826, Gregg & Irwin, Supt., J. Irwin Gregg, Bellefonte, Centre co.
Eagle, 1848, C. & J. Curtin, " "
Logan, 1800, Valentine & Thomas, " "
Centre, 1790, Thompson, McCoy & Co. " "
Juliana, 1835, John Adams, Supt., R. H. McCoy, " "
Martha, 1832, Irwin & Thompson, " "
Monroe, 1846, Gen. J. Irwin, Supt., G. W. Johnson, Huntingdon co.
Huntingdon, 1796, G. & J. Shoenberger, Supt., Hays Hamilton, " "
Pennsylvania, 1813, Lyon, Shorb & Co., " "
Rough and Ready, 1849, S. T. Watson & Co., " "
Greenwood, 1833, J. A. Wright, " "
Mill Creek, 1838, James Irwin and others, Supt., John C. Watson, " "
Edward, 1839, Hugh McNeal, lessee, Supt., James E. Foote, " "
Rockhill, 1830, R. B. Wegton, " "
Mahnda, 1816, J. & A. Sheiller, Supt., Thomas E. Orbison, " "
Brookland, 1838, Juniata Iron Co., Mifflin co.
Matilda, 1838, J. Haldeman, " "
Bald Eagle, 1821, Lyon, Shorb & Co., Blair co.
Ætna, 1805, Isett, Keller & Co., " "
Buena Vista, 1847, Dr. Alexander Johnson, " "
Elizabeth, 1832, Martin Bell, " "
Blair, 1846, H. N. Burroughs, Supt., A. R. Stewart, " "
Allegheny, 1811, Elias Baker, " "
Bennington, 1849, R. M. Lemon, Supt., L. Lowry Moore, " "
Gaysport, 1856, Watson, White & Co., " "
Hollidaysburg, 1856, Gardner, Osterloh & Co., Supt., A. M. Lloyd, " "
Frankstown, 1836, Crawford & Higgens, " "
Gap, 1846, Musselman & Barnitz, " "
Juniata, 1857, Neff, Dean & Co., Williamsburg, " "
Springfield, 1815, D. Good & Co., Supt., H. McAllister, near Williamsburg, " "
Rebecca, 1819, E. H. Lytle, Supt., James Hemphill, " "
Bloomfield, 1846, J. W. Duncan, Supt., James Madard, " "
Sarah, 1847, D. C. McCormick, Supt., M. Simpson, " "
Lemnos, 1841, John King & Co., Supt., Jno. B. Castner, Hopewell, Bedford co.
Spring Hill, 1854, Oliphant & Wilson, Supt., J. K. Duncan, Fayette co.
Fairchance, 1796, F. H. Oliphant, " "
Union, 1796, Baldwin & Cheney, " "
Redstone, 1800, Worthington & Snyder, " "
Somerset, 1847, Hanna & Dyer, Somerset co.
Wellersburg, 1856, E. L. Parker, Prest., Supt., J. P Agnew, " "
Johnstown, 1846, Rhey, Matthews & Co., Cambria co.
Mill Creek, 1856, Wood, Morrell & Co., " "
Ben's Creek, 1846, " " " " "
Old Cambria, 1854, " " " " "
Cambria, see p. —, " " " " "
Astonville, 1855, Wm Thompson, Lycoming co.
Mansfield, 1854, Mansfield Iron Co., Tioga co.
Stewardson, 1851, Alex. Laughlin, Supt., Jos. Steele, Armstrong co.
Mahoning, 1845, J. A. Caldwell & Co., " "
Brady's Bend, 1840, M. P. Sawyer and others, four furnaces, " "
Bed Bank, 1842, Reynolds & Richie, " "
Buffalo No. 1, 1846, P. Gruff, & Co., Supt., Joseph C. King, " "
Buffalo No. 2, 1839, P. Gruff, & Co., Supt., Joseph C. King, " "
Pine Creek, 1846, Brown & Mosgrove, " "
America, 1846, John Jamieson, " "
California, 1852, Mathiot & Commings, Supt. Moses Collins, Westmoreland co.
Valley, 1855, L. C. Hall & Co., Supt. L. C. Hall, " "
Laurel Hill, 1846, John Graff, Supt., E. Hoover, " "
Conemaugh, 1847, Johnstown Iron Co., Supt., J. Rhey, " "
Indiana, 1842, Elias Baker, Indiana co.
Black Lick, 1846, Wood, Morrell & Co., " "
Pike, 1845, Hunter Orr, Clarion co.
St. Charles, 1844, Patrick Kerr, " "
Catfish, 1846, Alex. Miller, Supt., J. H. Kahl, " "
Black Fox, 1844, Jacob Painter and others, Supt., S. Barr, " "
Stapley, 1854, R. & C. Shippen, " "
Richmond, 1846, John Keating, " "
Prospect, 1845, Moore, Painter & Co., " "
Eagle, 1846, Reynolds & Kribbs, " "
Sligo, 1845, Lyon, Shorb & Co., " "
Madison, 1836, " " " " "
Monroe, 1845, W. B. Fetzer & Co., J. E. Clark, Agent, " "
Shippensville, 1832, Shippen & Black, Supt., Robert Montgomery, " "
Lucinda, 1833, Buchanan & Reynolds, Supt., C. A. Rankin, " "
Helen, 1845, Wilson & McKim, " "
Corsica, 1847, J. P. Brown, " "
Forest, 1853, William Cross & Son, Venango co.
Hemlock, 1845, F. & W. M. Faber, " "
Clinton, 1841, S. F. Plumer, Supt., William Holliss, " "
President, 1847, Arnold Plumer, " "

Rockland, 1832, E. W. & H. M. Davis, Supt., H. M. Davis, Venango co.
Bullion Run, 1843, Wm. Cross and others, " "
Jane, 1838, William Cross & Son, " "
Slab, 1831, Wattenan, Larimer & Co., " "
Sandy, 1838, C. M. Reed, " "
Reynilton, 1843, A. W. Raymond, " "
Sharpsburg, 1847, James Pierce, Mercer co.
Sharon, 1846, James B. Curtis, Supt., J. U. Price, " "
Middlesex, 1845, 10x38, " "
Mazeppa, 1846, John J. Spearman & Co., " "
Springfield, 1837, Pardon Sennett Supt., William S. Scollard, Mercer co
Tremont, 1848, Crawford & Co., " "
Willieroy, 1851, Stewart & Foltz, Lawrence co.
Wampum Run, 1857, Childs, Richardson and others, Supt., William Steward, " "
Sophia, 1853, Knapp, Wilkins & Co., " "
Maple, 1843, M. S. Adams, Butler co.
Hickory, 1840, 8x28, " "
Marion, 1848 Case & Co., Harrisville, " "
Dudley, 1857, Reynolds & Richie, " "
Winfield, 1848, D. R. Smith,

Charcoal Furnaces in Maryland.

Principio, 8½x32, J. & G. P. Whitaker, Baltimore RR., 3 miles east of the Susquehanna.
Lagrange, 1836, Rogers & Sons, Harford co.
Sarah, 1851, P. A. & S. Small, Supt., A. P. McCombs, near Belair.
Harford, 1845, Richard Green, Supt., Wm. Carmell, near Perrymansville.
Locust Grove, 1844, Robert Howard, Supt., George R. Burroughs, Baltimore co.
Gunpowder, 1846, Robert Howard, " "
Supt., John S. Hawes,
Muirkirk, 1842, Wm. E. Coffin & Co., Supt., George Cary, Prince George's co.
Chesapeake Nos. 1 and 2, S. S. Lee & Co., Hugh Jenkins, lessee, Baltimore.
Cedar Point Nos. 1 and 2, Peter Mowel, Baltimore
Maryland Nos. 1 and 2, H. W. Ellicott & Bro., " "
Laurel, 1846, D. M. Reese, " "
Cecelia, 1854, John Ahern,
Elk Ridge, 1854, Supt., Jos. D. Pettit, Ann Arundel co
Elba, 1847, James W. Tyson, Carroll co
Catoctin Nos. 1 and 2, Jacob M. Kunkle, Frederick co
Antietam, 1845, John Herine, Supt., Jacob Hewitt, Washington co.
Green Spring, 1848, J. D. Roman & Co., Supt., B. F. Roman, " "

Charcoal Furnaces in Ohio.

Gallia, 1847, Bentley, Campbell & Co., Supt., Mr. Bentley, Gallia co.
Washington, 1852, J. Peters & Co., Supt., Wm. Colvin, Lawrence co.
Pioneer, 1856, Ormsby, Colvin & Reed, Supt., Wm. Colvin, " "
Olive, 1847, Campbell, Peters and others, Supt., Wm. N. McGugin, " "
Buckhorn, 1836, Seeley, Willard & Co., Supt., Boudinot Seeley, " "
Mount Vernon, 1835, Campbell, Ellison & Co., Supt., Robert Scott, " "
Oakridge, 1856, Stetson, Mitchel & Co., Supt., O. M. Mitchell, " "
Centre, 1838, Robert B. Hamilton, Supt., S. McGugin, " "
Pine Grove, 1834, Hamilton, Peebles & Coles, Supt., John F. Peebles, " "
Hecla, 1835, Campbell, McCullough & Co., Supt., John Wilson, " "
Lawrence, 1834, Culbertson, Means & Co. " "
Etna, 1832, J. Ellison and others, Supt., J. Ellison, " "
Vesuvius, 1834, Dempsey & Co., Supt., Washington Boyd, " "
Ohio, 1850, Linton & Means, Supt., George B. Sparks, Scioto co.
Scioto, 1830, J. B. Robinson & Sons, Supt., Charles Gliddon, " "
Harrison, 1853, Spellman & Ross, Supt., H. Spellman, " "
Franklin, 1826, John F. & Oran B. Gould, Supt., Oran B. Gould, " "
Junior, 1828, Gliddon, Murfin & Co., Supt., James Murfin, Jr., Scioto co
Empire, 1847, Gliddon, Murfin & Co., Supt., O. H. Gliddon, Jr., " "
Howard, 1853, Campbell, Woodrow & Co., Supt., H. A. Webb, " "
Clinton, 1832, Gliddon, Crawford & Co., Supt., S. S. Gliddon, " "
Bloom, 1832, G. S. Williams & Co., " "
Mahoning, 1845, A. & J. M. Crawford, Supt., Benj. Crowther, Mahoning co.
Falcon, 1856, —— Howard, " "
Phœnix, 1854, Lemuel Crawford, Supt., N. M. Jones, " "
Eagle, 1854, Crawford & Murray, Supt., T. Polluck, " "
Briar Hill, 1847, W. Richards, Supt., " "
Meander, 1857, Smith, Porter & Co., Supt., Mr. Fuller, " "
Volcano, 1855, Volcano Iron Co., Supt., Charles A. Crandell, Stark co.
Massillon, 1851, Massillon Iron Co., " "
Supt., William Pollock,
Tilden's, 1854, Dr. Tilden, Huron co.
Logan, 1855, Roberts & Co., Supt., F. Case, Hocking co.
Hocking, 1852, Peter Haydn, Prest., " "
Supt., W. H. Haydn,
Fivemile, 1855, Webster & Co., lessees, Supt., Wm. M. Bowen, " "
Bigsand, 1851, Bartlett, Dannar & Co., Supt., S. J. Summinger, Vinton co.

Zaleski, 1858, Zaleski Iron Co., Supt., Mr. Walters, Vinton co.
Vinton, 1854, Means, Clark & Co., Supt., Cyrus Newkirk, " "
Hambden, 1854, Damarin, Tarr & Co., Supt., McKean, " "
Eagle, 1854, Bentley, Benner and others, Supt., William B. Dennis, " "
Cincinnati, 1854, Westfall, Dungan and others, Supt., J. B. Royer, Jackson co.
Iron Valley, 1853, Thompson, Lesley & Co., Supt., S. Churchill, " "
Latrobe, 1854, Bundy, Austin & Co., Supt., Drew Ricker, " "
Buckeye, 1853, Newkirk, Daniels & Co., Supt., Warren Murfin, " "
Keystone, 1848, E. B. Greene & Co., Supt., M. Churchill, Jackson co.
Young America, 1857, Powel, Oakes & Co., Supt., Peter Powel, " "
Diamond, 1856, Grattan, Hoffman & Co., Supt., Peter Cowell, " "
Madison, 1854, Peters, Terry & Co., Supt., Jacob Ricker, " "
Limestone, 1854, Newson, Evans & Co., Supt., Wm. J. Evans, " "
Jefferson, 1854, Jefferson Furnace Co., Supt., George W. Baker, " "
Jackson, 1837, Davis & Tracy, "
Monroe, 1855, McConnell, Bolles & Co., Supt., Mr. Gilbert, " "
Cambria, 1854, David Lewis & Co., Supt., D. T. Lewis, " "

Charcoal Furnaces in the North West.

Illinois, 10x35, C. Wolfe & Co., Supt., C. Henninger, Elizabethtown, Hardin co., Ills.
Martha, 1849, Saline Coal Co., Supt. Chas. Sellers, Elizabeth't'n," " "
Richland, 1844, A. Downing & Co., Bloomfield, Green co., Ind.
Mishawaka, 1833, Mishawaka, St. Josephs co., "
Indiana, 1839, E. M. Bruce & Co., Supt., W. H. Watson, Vermilion co., "
Kalamazoo, 1857, W. Burtt & Son, Kalamazoo co., Mich.
Eureka, 1855, Eureka Iron Works, Wayne co., "
Detroit, 1858, Detroit Iron Co., Detroit, "
Lake Superior Iron Co., (new) " "
Peninsular Iron Co., (new) " "
Quincy, 1855, W. J. Briggs & Enos G. Berry, Branch co., "
Branch, 1854, N. B. Gale, lessee, Quincy, Branch co., Mich.
Pioneer, Nos. 1 and 2, 1858, Charles F. Harvey, Agt., Marquette, Marquette co., "
Northwestern, 1853, Northwestern Iron Co., Supt., F. Wilkes, Mayville, Dodge co., Wis.
Ironton, 1857, Jonas Tower, Ironton, Sauk co., "
Pilot Knob, 1849, John S. McCune, Prest., Supt., J. B. Bailey, Iron co., Mo.
Maramec, 1856, W. James, lessee, Crawford co., "
Iron Mountain, 3, James Harrison, Prest., Supt., John J. Scott, Francis co., Mo
Franklin, 1846, Franklin Iron Co., Supt., T. W. Childs, Franklin co., "

Rolling Mills in New England.

Pembroke, Pembroke Iron Co., Supt., Lewis L. Wadsworth, Pembroke, Me.
Danvers, 1831, C. A. Smith, Danvers, Mass.
Bay State, 1847, Bay State Iron Co., Supt., Ralph Croker, South Boston, "
Norway, Norway Iron Works, Supt., Mr. Gogan, " " "
Weymouth, 1836, Weymouth Iron Co., East Weymouth "
East Bridgewater, 1836, Philips & Sheldon, Plymouth co., "
Bridgewater, 1785, Bridgewater Iron co., " " "
Russell & Co.'s, 1807, Nathaniel Russell & Co., Supt. N. Russell, " " "
Tremont, 1843, Tremont Iron Co., Supt., Andrew S. Nye, " " "
Weweantit, 1854, Lewis Kenney & Co., Supt., Lewis Kenney, " " "
Parker, Parker Iron Co., Supt., Mr. Boyd, " " "
Agawam, 1842, Agawam Nail Co., Supt., Samuel T. Tisdale, " " "
Old Colony, 1844, Crocker & Co., Bristol, " "
Gosnold, 1856, Gosnold Mill Co., Supt., Lemuel Kullock, New Bedford, Mass
Mount Hope, 1857, Fairbanks & Field, Supt., J. C. Leonard, " "
Fall River, 1812, Richard Borden, Fall River, "
Quinsigamund, 1847, Quinsigamund Iron Co., Worcester co., "
American, American Horse Nail Co., Providence, R. I.
Providence, 1845, Providence Iron Co., O. A. Washburn, Agent, " "
Fairhaven, 1820, Israel Davey, Fairhaven, Vt.
Cold Spring, 1846, J. M. Huntingdon & Co., Supt., J. Mitchell, near Norwich, Conn.
Ripley, 1847, Philip Ripley, Supt., G. Neck, Hartford co., "
Birmingham, Birmingham Iron and Steel Co., Supt., Mr. Hawkins, New Haven, " "
Stillwater, 1835, Stillwater Iron Co., Supt., Mr. Wicks, Fairfield co., "
Greenwich, 1836, Holden & Co., Supt., Mr. Hicks, " " "

Rolling Mills in New York.

Rensselaer, 1847, see p. 635, Rensselaer Iron Co., Troy, Rensselaer co.
Burden's, see p. 633, Henry Burden's Sons, Troy, Rensselaer co.
Albany, see p. 361, Corning, Winslow & Co., Troy, Rensselaer co.,
Buffalo, 1847, Buffalo, Erie co.
Jefferson, 1847, Hiram McCollom, Carthage, Jefferson co.
Sable, 1834, J. & J. Rogers, Essex co.
Boquet, 1838, William D. Ross's heirs, Essex Village, " "
Eagle, 1849, E. & J. D. Kingsland & Co., Keesville, Clinton co.
Peru, ——, Saltus & Company, Supt. William Partridge, " "
Ulster, 1825, J. & L. Tuckerman, Supt. John Simmons, Saugerties, Ulster co.
Suffern's, 1849, Andrew Winter, Ramapo, Rockland co.
Ramapo, 1800, Henry L. Pierson, J. Wilson, lessee, " "
Richardson, 1853, Charles Richardson, Auburn, Cayuga co.

Rolling Mills in New Jersey.

Boonton, 1825, Fuller, Lord & Co., Boonton, " "
Pompton, 1838, Charles A. Richter, near Rockaway, Morris co.
Powerville, 1846, T. C. Willis, " " "
Rockaway, 1855, Rockaway Iron Co., " " "
Dover, 1838, Henry McFarland, Supt., G. H. Hinchman, " "
Trenton, 1845, Cooper, Hewitt & Co., South Trenton, Mercer co.
Chrisman & Co., 1852, Chrisman & Co., near Jersey City, Hudson co.
Chrisman & Durben's, 1857, Chrisman & Durben, Jersey City, " "
Charlottenburg, 1840, Geo. H. Rentea,
Cumberland, 1824, Cumberland Iron Co., Supt., Robert C. Nichols, Bridgeton.

Rolling Mills in Pennsylvania.

Kensington, 1840, Nat. Rowland & Co., Philadelphia.
Kensington Iron Works, 1845, James Rowland & Co., "
Penn, 1815, Verree & Mitchell lessees, "
Fountain Green, 1848, Strickland Kneass, Supt., H. McCarty, Jr., "
Oxford, 1855, W. & H. Rowland, "
Treaty, 1846, Leibert & Wainright, "
Fairmount, 1846, Morris, Tasker & Co., "
Grey's Ferry, 1858, M. B. Buckley & Son, "
Pencoyd, 1855, A. & P. Roberts, Flat Rock, Montgomery co.
Cheltenham, 1790, Rowland & Hunt, Milltown, Montgomery co.
Schuylkill, 1838, Alan Wood and others, near Conshohocken, Montgomery co.
White Marsh, 1857, Wood & Lukens, " "
Pennsylvania, 1853, John Wood & Brothers, " "
Norristown No. 1, 1850, Wm. Schall, " "
Norristown Nail Factory, No. 2, Schall & Dowees, " "
Norristown No. 3, 1846, James Hooven, " "
Conshohocken, 1832, John Wood & Brothers, near Conshohocken, " "
Phœnix, 1846, Phœnix Iron Co., Phœnixville, " "
Thorndale, 1847, Horace A. Beale, Chester co.
Rokeby, 1795, Abigail Fisher, Supt. J. G. Fisler, near Coatesville, " "
Brandywine, 1810, Lukens' heirs, " "
West Brandywine, 1840, Samuel Hatfield, Supt. Benj. R. Hatfield, Chester co.
Laurel, 1856, Hugh E. Steele, " "
Valley, 1837, C. E. Pennock & Co., " "
Viaduct, 1838, Steele & Worth, " "
Hibernia, 1833, Charles Brooke, " "
Pleasant Garden, 1845, D. McConkey, Supt. J. Scott, " "
Pine Grove, 1841, Enos Pennock, Lower Oxford, " "
Pottsgrove, 1846, Potts & Bailey, Pottstown.
Pine, 1845, Joseph Bailey & Sons, Douglasville, Berks co.
Birdsborough, 1848, E. & G. Brooke, near Reading, " "
Gibraltar, 1846, H. A. & S. Seyfert, near Reading, " "
Reading, 1836, Seyfert, McManus & Co., Reading, " "
Neversink, 1845, M. A. & S. Bertolet & Co., Reading, " "
McIlvaine's, 1857, Wm. M. McIlvaine, " "
Keystone, 1857, Snell, Mullen, Banford & Co., Reading, " "
Pottsville, 1852, John Burnish & Co., Pottsville.
Palo Alto, 1855, Haywood, Lee & Co., "
Allentown, (new) Allentown, Lehigh co.
Bethlehem, (new) Bethlehem, " "
Weissport, 1854, Weiss & Wentz, Weissport, " "

Lackawanna, 1844, Lackawanna Iron Co., Scranton, Luzerne co.
Danville, 1815, S. P. Case, Danville, Montour co.
Rough and Ready, 1847, Hancock & Foley, near Danville, " "
Pennsylvania (late Montour), Waterman & Beaver, Danville, " "
Duncannon, 1838, Fisher, Morgan & Co., Supt. John Wister, Duncannon, Perry co.
Fairview, 1847, J. Pratt & Son, Supt. Charles Wilbar, Fairview, Cumberland co.
Central, 1853, Charles L. Bailey & Bros., Harrisburg, Dauphin co
Safe Harbor, 1848, Reeves, Abbott & Co., Supt. Wyatt W. Miller, Safe Harbor, Lancaster co.
Columbia, 1851, Smith & Bruner, Supt. James A. Richards, Columbia, " "
Colemanville, 1828, George Dawson Coleman, Supt. M. Hoopes, Colemansville, " "
Hesbbon, 1842, William McKinney, Williamsport, Lycoming co.
Crescent, 1842, H. D. Heelman & Co., " "
Blossburg, 1850, J. H. Gulick, Blossburg, Tioga co.
Howard, 1840, John Irwin, Jr., & Co., near Bellefonte, Centre co.
Heckla, 1846, Gregg, Irwin & Co., Hublersburg, " "
Milesburg, 1849, Irwin, McCoy & Co., near Bellefonte, " "
Eagle, 1831, C. & J. Curtin, near Bellefonte, " "
Bellefonte, 1825, Valentines, Thomas & Co., Bellefonte, " "
Portage, 1839, Burroughs & Higgens, & Co., Supt. Joseph Higgens, Duncansville, Blair co.
Juniata, 1838, S. Hatfield, Jr., Alexandria, Huntingdon co.
Mont Alto, 1832, Holker Hughs, Mont Alto, Franklin co.
Lehigh, 1837, Stewart & Co., South Easton, Northampton co.
Cambria, 1857, Cambria Iron Works, Johnstown, Cambria co
Fairchance, 1834, F. H. Oliphant, Supt. G. W. Paul, Uniontown, Fayette co
McKeesport, 1851, Wood, Morehead & Co., McKeesport, Allegheny co.
American, 1853, Jones, Lauth & Co., near Birmingham, " "
Western Tack, 1854, Chess, Wilson & Co., Supt. David Chess, near Birmingham, " "
Hecla, 1841, J. & W. McKnight, Birmingham, " "
Birmingham, 1857, Porter, Rolph & Swett, Birmingham, " "
Sligo, 1825, Lyon, Shorb & Co., Supt. F. Wernet, Pittsburgh, " "
Clinton, 1845, Graff, Burnet & Co., Supt. Mr. Marshall, Pittsburgh, " "
Pittsburgh, 1837, Zug & Painter, Pittsburgh, " "
Sheffield, 1848, Singer, Hartman & Co., " "
Eagle, 1850, James Wood & Co., Supt. G. Wittengill, " "
Pennsylvania, 1844, Everson, Preston & Co., " "
Kensington, 1845, Miller, Lloyd & Black, Supt. Mr. Nickson, Pittsburgh, " "
Pittsburgh Steel Works, 1835, Isaac Jones, Pittsburgh, " "
Wayne, 1829, Bailey, Brown & Co., Pittsburgh, " "
Sable, 1830, Zug & Painter, " "
Juniata, 1826, Dr. P. Shoenberger, Supts. Crawford & Prother, Pittsburgh, " "
Duquesne, 1846, Coleman, Heilman & Co., Supt. William Varnum, Pittsburgh, " "
Lorenz, 1856, Lorenz, Stewart & Co., Pittsburgh, " "
Etna, 1828, Spang & Co., Supt. A. G. Lloyd, near Pittsburgh, " "
Vesuvius, 1845, Lewis, Dalzell & Co., Pittsburgh, " "
Brady's Bend, 1841, Brady's Bend Iron Co., Supt. D. Dudley, Brady's Bend, Armstrong co
Kittanning, 1848, Colwell, Brown & Floyd, Kittanning, " "
Sharon, ——, Sharon Iron Co., Supt. J. Barber, Sharon, Lawrence co.
Orizaba, 1847, McCormick's Trustees, Supt. Mr. Beshore, Newcastle, " "
Cosalo, 1840, Crawford Brothers, Supt, H. J. Evans, Newcastle, " "

Rolling Mills in Delaware and Maryland.

Wilmington, 1845, Gibbons & Hilles, Wilmington, Newcastle co., Del.
Diamond, 1854, McDaniel, Craige & Co., Wilmington, Newcastle co., "
Delaware, 1812, Alan Wood, near Wilmington, "
Marshall's, 1836, C. & J. Marshall, Newport, "
Elk, 1810, Parke, Smith & Co., Elkton, Md.
West Amwell, 1854, E. A. Harvey, Supt. Geo. Harlan, near Elkton, Md.
Northeast, 1847, McCullough & Co., Supt. Mr. Scott, Northeast, Cecil co., "
Shannon, 1857, McCullough & Co., Supt. Mr. Scott, near Northeast, Cecil co., "
Octarara, ——, McCullough & Co., Supt. Jethro J. McCullough, Rowlandsville, Md.

Joppa, 1851, Edward Patterson & Sons, Supt. S. S. Patterson, Gunpowder, Md.
Baltimore Spike Mill, J. Hopkinson Smith, Baltimore, "
Canton, 1851, H. Abbott & Son. do. "
Baltimore Forge, 1856, Fagely, Hoird & Co., Baltimore, "
Avalon, 1854, Joseph C Manning & Co., Supt. Elijah Spurrier, Relay House, Md.
Antietam, 1831, J. Hewitt, Sharpsburg, "
Mount Savage, 1839, Mount Savage Iron Co., Supt. Samuel Danks, Cumberland, "

Rolling Mills in Ohio.

Mahoning, —— Brown, Bonnell & Co., Supt. James H. Brown, Youngstown, Mahoning co.
Falcon, 1842, James Ward & Co., Nilestown, Trumbull co.
Railroad, 1856, Railroad Iron Co., Supt. A. G. Smith, Cleveland, Cuyahoga co.
Newburg, 1857, Chillon & Jones, Newburg, Cuyahoga co.
Zanesville, 1847, Campbell, Peters & Co., Supts. Baird & Davis. Zanesville.
Columbus, 1846, Peter Haydu, Supt. D. Serles, Columbus, Franklin co.
Jefferson, 1852, Frazer, Kilgore & Co., Supt. F. S. Griesemer, Steubenville

Rolling Mills on the Ohio River.

Missouri, 1854, James M. Tod & Co., Wheeling, Ohio co., Va.
Eagle, ——, E. C. Dewey, Supt. John Hartman, " " " "
La Belle, 1852, Bailey, Woodward & Co., Supt. William Bailey, Wheeling, Ohio co., "
Crescent, ——, Crescent Iron Co., Wheeling, Ohio co., "
Belmont, ——, Norton, Acheson & Co., Supt. T. D. & G. W. Norton, Wheeling, "
Washington, 1853, Drakely & Fenton, Supt. D. Darragh, Wheeling, "
Virginia, 1852, A. Wilson Kelley, Supt. William Taylor, near Wheeling, Ohio co., "
Ironton, 1852, H. Campbell & Co., Supt. Mr. Beason, Ironton, Lawrence co., Ohio.
Star, 1855, Peters, James & Co., Supts. W. H. Powell and T. Pugh, Lawrence co., "
Lawrence, 1853, James Rogers & Co., Supt. W. H. Powell, Ironton, Lawrence co., "
Hanging Rock, 1854, Hempstead & Johnson, Ohio. Lawrence co., "
Blandy, ——, Sturgess & Blandy, Lawrence co., "
Franklin, 1855, James Murfin & Co., Supt. James Evans, Portsmouth, Scioto co., Ohio.
Bloom Forge, 1856, Gaylord & Co., Portsmouth, Scioto co. "
Pomeroy, ——, Horton, Jennings & Co., Pomeroy, Meigs co., Ohio.
Cincinnati, 1847, Shreve, Steele & Co., Cincinnati, "
Globe, ——, Worthington & Co., " "
McNickle, 1830, J. K. McNickle's heirs, Supt. E. W. Stephens, Covington, Ky.
Licking, 1848, Philips & Jordan, Supt. Richard Jordan, " "
Swift's, 1854, Alexander Swift & Co. Supt. Henry Westwood, Newport, Ky.
Newport, ——, D. Wolf, Supt. P. Breith, " "
Louisville, 1851, T. C. Coleman & Co., Supt. J. Dangerfield, Louisville, "
Southern, 1855, Terrell, Clarke & Co., Supts. J. H. & B. Jones, Paducah, "

Rolling Mills of the Northwest.

Laclede, Chouteau, Harrison & Valle, Supt. Mr. Mulligan St. Louis, Mo.
Raynor's, 1858, N. Raynor & Co., Supt. Moore Hardaway, " "
Missouri, 1854, McFall & Kelly, Supt. Michael Lynch, " "
Pacific, 1856. James S. Stewart & Co., Supt. Wm. Perry, " "
Allen, 1855, Thompson, White & Co., Supt. Michael Corcoran, St. Louis, Mo
Wyandotte, 1855, J. Holmes, Prest., W. H Zabriskie, Agent, Wyandotte, Mich
Chicago, E. B. Wood, Supt. T. C. Smith, Chicago, Ills
Indianapolis, 1857. R. A Douglas, Supt. John Thomas, Indianapolis, Ind.

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