
REFINING OF PETROLEUM.

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This report presents the statistics concerning the refining of petroleum during the year ending December 31, 1889. The production of crude petroleum is the subject of a separate report, and is not included in the statistics of manufactures. The refining of petroleum was part of a distinct report at the Tenth Census, and the statistics were not included in the report on manufactures.

While the increase in investment and production in this industry has kept pace with the development in other branches of manufacture during the decade from 1880 to 1890, the number of establishments remains practically the same as reported at the census of 1880. The extension to new oil fields of the pipe line systems for the transportation of crude petroleum rendered unnecessary a change in the location of refineries, this location being governed generally not so much by proximity to the sources of the raw materials as by its availability for the distribution of the refined product to domestic and foreign markets.

The following comparative summary shows the statistics concerning petroleum refining under the principal heads of the inquiry at the censuses of 1880 and 1890, also the percentages of increase:

COMPARATIVE SUMMARY, PETROLEUM REFINING: 1880 AND 1889.

ITEMS.	1880	1889	Percentage of increase.
Number of establishments reporting	86	94	9.30
Capital	\$27,325,746	\$77,410,206	183.31
Miscellaneous expenses (a)		\$2,069,208	
Average number of employes (aggregate)	9,809	12,471	26.37
Total wages	\$4,381,572	\$6,989,478	59.52
Officers, firm members, and clerks: (b)			
Average number		1,068	
Total wages		\$1,117,011	
All other employes: (b)			
Average number		11,403	
Total wages		\$5,872,467	
Cost of materials used	\$34,999,101	\$37,918,723	94.06
Value of products (d)	\$43,705,218	\$85,001,198	94.40

a This item was not reported at the Tenth Census and at the Eleventh Census some establishments failed to furnish information as to miscellaneous expenses.

b Not reported separately at the census of 1880.

c The value of packages made is included in this amount, instead of, as in 1889, the cost of materials used in making them.

d The value of packages made at the refinery is not shown as a distinct item of product in the report for 1880, and does not appear to have been included in the value of products.

The number of establishments given in the above summary and in the appended tables should not be taken as the total number of refineries, for when 2 or more refineries owned by the same corporation, firm, or individual are located in the same county or city, they are considered and counted in the tabulations of this office as 1 establishment. There appear to have been 106 separate refineries in operation in the United States during the year 1889, and they are covered by the returns of the 94 establishments.

Previous census reports show no items entering into the cost of manufacture other than wages paid and cost of materials. The present inquiry was intended to cover as far as possible the entire cost of production except interest on capital and depreciation of plant. The cost of selling and mercantile losses are not included. It, therefore, would be erroneous to assume that the difference between the cost as shown by the sum of miscellaneous expenses, wages, and materials and the value of product represents the profit or earnings of capital invested.

Confined as the industry is to a comparatively few states, and several of these states having less than 3 establishments, it is possible to publish separately totals only for the states of New Jersey, New York, Ohio, Pennsylvania, and West Virginia without disclosing the operations of individual establishments. The statistics published at the census of 1880 were confined to the totals for the United States. The only comparison possible for the industry in the several states is presented in the statement on the following page, showing the number of refineries in operation in each state and in the United States at the two census periods.

MANUFACTURING INDUSTRIES.

COMPARATIVE STATEMENT OF NUMBER OF REFINERIES, PETROLEUM REFINING, BY STATES: 1880 AND 1889.

STATES.	NUMBER OF REFINERIES.	
	1880	1889
The United States.....	89	106
California.....		2
Colorado.....		2
Kentucky.....	1	
Maryland.....	3	3
Massachusetts.....	5	1
Maine.....	1	
New Jersey.....	2	5
New York.....	21	10
Ohio.....	18	15
Pennsylvania.....	33	58
West Virginia.....	5	1

CAPITAL.

The following statement shows the number of establishments and the detailed items of capital for both active and idle establishments, as reported at the Eleventh Census:

STATEMENT OF CAPITAL, ACTIVE AND IDLE ESTABLISHMENTS, PETROLEUM REFINING: 1889.

ITEMS.	Active establishments.	Idle establishments.
Number of establishments reporting.....	94	7
Capital—aggregate.....	\$77,416,296	\$423,508
Land.....	7,886,668	81,700
Buildings.....	6,403,994	215,690
Machinery, tools, and implements.....	20,837,038	104,889
Raw materials.....	3,089,803	12,429
Stock in process and finished products on hand.....	10,386,521	
Cash, bills and accounts receivable, and all sundries not elsewhere reported.	28,812,272	8,800

The average amount of capital to each idle establishment is \$60,501 as compared with \$823,578, the average capital of active establishments. There were 101 active and idle establishments in the United States during the year with an aggregate capital of \$77,839,804. The amount of idle capital is but 0.54 per cent of the total amount invested in the industry. The total number of refineries in the United States, both active and idle, during the year was 113. The following statement presents the statistics concerning capital in idle establishments in the different states:

STATEMENT OF CAPITAL, IDLE ESTABLISHMENTS, PETROLEUM REFINING, BY STATES: 1889.

STATES.	Number of establishments reporting.	CAPITAL.							
		Aggregate.	Value of plant.				Live assets.		
			Total.	Land.	Buildings.	Machinery, tools, and implements.	Total.	Raw materials.	Cash, bills and accounts receivable, and all sundries not elsewhere reported.
The United States.....	7	\$423,508	\$402,279	\$81,700	\$215,690	\$104,889	\$21,229	\$12,429	\$8,800
California.....	1	28,118	27,789	600	400	20,789	329	329	
Ohio.....	2	12,600	12,600	800	2,700	9,100			
Pennsylvania.....	3	372,790	351,800	79,800	204,590	67,500	20,900	12,100	8,800
West Virginia.....	1	10,000	10,000	500	8,000	1,500			

The amount of capital required to produce \$100 worth of product was \$62.52 in 1880 and \$91.08 in 1889; while the value of raw materials entering into \$100 worth of product in 1880 was \$80.08, and \$79.90 in 1889. If we look at the wage cost necessary to the production of \$100 worth of product in this industry we find that in 1880 it was \$10.03, while in 1889 it was only \$8.22. The investment of capital to secure a given value of product increases, while the wage cost of the like product decreases, the value of the materials remaining practically the same.

EMPLOYÉS AND WAGES.

In making comparisons of employés and wages at the two censuses it should be remembered that the schedule of inquiry used at the Eleventh Census provided for a more thorough exposition of the different classes of employés and wages. The classification of employés made at the Tenth Census was that of males above 16 years, females above 15 years, and children.

The classification used at the Eleventh Census was as follows: first, operatives, engineers, and other skilled workmen, overseers, and foremen or superintendents (not general superintendents or managers); second, officers or firm members; third, clerks; fourth, watchmen, laborers, teamsters, and other unskilled workmen; fifth, pieceworkers not included in the foregoing.

A further division of the above classes into males above 16 years, females above 15 years, and children was required.

The following statement presents the average number and total wages of employés reported for each class, and the percentage, the number and wages, in each class is of the totals reported for the industry:

STATEMENT OF EMPLOYÉS AND WAGES, BY CLASSES, WITH PERCENTAGE OF EACH CLASS TO TOTAL, PETROLEUM REFINING: 1889.

CLASSES OF EMPLOYÉS.	Average number.	Percent- age.	Total wages.	Percent- age.
Total	12,471	100.00	\$6,989,478	100.00
Officers or firm members	87	0.70	202,120	2.89
Clerks	981	7.87	914,891	13.09
Skilled	3,821	30.64	2,703,904	38.69
Unskilled	5,908	47.37	2,456,270	35.14
Pieceworkers	1,674	13.42	712,293	10.19

The following statement shows the proportion of males above 16 years, females above 15 years, and children to the whole number of employés reported for the industry:

STATEMENT OF MALES ABOVE 16 YEARS, FEMALES ABOVE 15 YEARS, AND CHILDREN, AND PERCENTAGE OF EACH CLASS TO TOTAL, PETROLEUM REFINING: 1889.

CLASSES OF EMPLOYÉS.	Average number.	Percent- age.
Total	12,471	100.00
Males above 16 years	11,920	95.58
Females above 15 years	35	0.28
Children	516	4.14

The following statement, obtained from Table 3, shows the average number of males, females, and children reported at the different weekly rates of wages. The number includes officers, firm members, and clerks, but not those employed on piecework.

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS, BUT NOT THOSE EMPLOYED ON PIECEWORK, PETROLEUM REFINING: 1889.

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.		
	Males above 16 years.	Females above 15 years.	Children.
Total	10,262	35	500
Under \$5	204		439
\$5 and over but under \$6	39	3	18
\$6 and over but under \$7	288	1	43
\$7 and over but under \$8	506	1	
\$8 and over but under \$9	361	23	
\$9 and over but under \$10	2,477	2	
\$10 and over but under \$12	1,924	1	
\$12 and over but under \$15	2,216	3	
\$15 and over but under \$20	1,199		
\$20 and over but under \$25	375	1	
\$25 and over	473		

MANUFACTURING INDUSTRIES.

From the foregoing statements it appears that 95.58 per cent of all the employes reported for the industry are men, and that of the 10,262 men reported as receiving wages according to time, 7,816, or 76.16 per cent, received \$9 and over but under \$20 a week. The number of females reported is insignificant, being but 35 as compared with 25 shown at the Tenth Census. Of the 35 females, 33 are reported as clerks, 23 of whom received from \$8 to \$9 a week.

The schedule of inquiry called for a statement showing distinctive classes of employes according to their occupations and the daily rates of wages in each class.

The answers to these questions were not complete; they accounted for only 2,804 employes, or 22.48 per cent of the total number of employes reported for the industry. It is believed, however, that the number of employes reported is sufficient to warrant the use of the figures as an indication of the average daily wages for the different classes of employes in this industry, and the following statement presents the number of employes reported for each class, also the range and average daily rates of their wages:

STATEMENT OF THE EMPLOYEES REPORTED BY OCCUPATIONS, WITH RANGE OF DAILY WAGES AND AVERAGE DAILY WAGES, PETROLEUM REFINING: 1889.

OCCUPATIONS.	Number of employes.	Range of daily wages.	Average daily wages.
Barrel house men.....	37	\$1.25 to \$2.75	\$1.08
Boiler makers.....	31	2.25 to 2.65	2.62
Boiler men.....	20	1.50 to 3.00	2.06
Bone burners.....	17	1.60 to 2.50	2.26
Bookkeepers.....	9	2.31 to 4.00	3.66
Carpenters.....	93	2.25 to 3.00	2.57
Clerks.....	155	1.20 to 5.77	2.94
Compounders.....	4	2.00 to 6.00	3.44
Coopers.....	248	1.25 to 2.75	2.16
Drivers.....	43	1.50 to 4.50	2.11
Engineers.....	36	1.75 to 3.85	2.34
Filter house men.....	24	1.75 to 3.00	2.22
Firemen.....	52	1.20 to 2.50	1.99
Foremen.....	78	1.92 to 5.00	3.22
Laborers.....	982	0.96 to 2.50	1.61
Machinists.....	22	2.00 to 3.00	2.55
Pipe fitters.....	48	1.75 to 3.00	2.18
Pressmen.....	59	1.50 to 2.69	1.87
Stillmen.....	261	1.20 to 3.75	2.26
Superintendents.....	15	2.56 to 9.62	5.31
Tinners.....	8	2.00 to 3.33	2.39
Treaters.....	34	1.75 to 4.00	2.15
Various mechanics.....	403	1.75 to 4.00	2.15
Watchmen.....	31	1.00 to 2.25	1.77
Yardmen.....	44	1.20 to 2.00	1.69

MATERIALS USED.

During the year covered by this report there were 1,287,830,402 gallons of crude petroleum, or 30,662,629 barrels of 42 gallons each used by petroleum refiners, costing \$44,879,783, an average cost of \$1.46 per barrel. The cost of the crude petroleum is the cost at the refinery, including all charges for transportation. Of this quantity of crude petroleum, by far the greatest proportion, 1,232,868,858 gallons, was reported by the refineries as obtained through transportation companies, either by pipe lines or tank cars, 52,732,849 gallons being obtained direct from the wells and 2,228,695 gallons from all other sources, in barges and barrels.

The distillates were treated principally by the use of sulphuric acid, 95,916 tons of this acid being used, valued at \$1,516,728. Hydrochloric and other acids and sulphur were also used. An effort was made to ascertain the disposition that was made of the resultant sludge acid, but the returns were so deficient in that respect as to make the data obtained far from complete. According to the returns, 33,911 tons were disposed of to manufacturers of fertilizers and chemicals, 19,962 tons to sulphuric acid manufacturers for restoration, and 7,701 tons were permitted to run to waste.

The cost of fuel constituted 3.35 per cent of the total cost of materials used in petroleum refining. The following statement shows the kinds, quantities, and cost of fuel used during the year 1889:

STATEMENT OF KIND, QUANTITY, AND COST OF FUEL, PETROLEUM REFINING: 1889.

KINDS OF FUEL.	Quantity.	Cost.
Total		\$2,275,468
Anthracite coal..... tons..	324,303	566,114
Bituminous coal..... do...	351,355	750,041
Coke..... bushels..	82,970	6,225
Naphtha..... barrels..	116,762	111,328
Residuum (not produced at works)..... do...	468,374	544,281
Wood..... cords..	1,948	2,601
Crude oil..... barrels..	73,567	36,330
Distillate..... do...	6,174	8,864
Natural gas.....		249,594

Anthracite coal in the form of culm is used largely in refineries on the Atlantic coast. Anthracite coal is reported at an average cost per ton of \$1.75 as compared with \$2.13 per ton for bituminous coal. Of the residuum reported as fuel, 399,243 barrels were consumed in the refineries located in the state of New York. The amount paid for natural gas, \$249,594, represents approximately the consumption of 209,658,960 gallons of crude oil, as refiners, except those having their own supply, were generally charged for its use at the rate of 5 cents per barrel of crude oil used.

The manufacture and repair of barrels and cases at the refineries required an outlay of \$6,856,308 for staves, heading, lumber, iron hoops, shooks, and sundries, and the manufacture of tin cans \$5,639,292. The total expenditure for packages, ready made barrels, tin cans, and cases was \$4,340,274, making an aggregate expenditure for packages of \$16,835,874, or 24.79 per cent of the total cost of materials. This amount is exclusive of the wages of coopers, tanners, and carpenters and other employes engaged in this work.

PRODUCTS.

The general products obtained by the distillation of crude petroleum are naphthas or the lighter hydrocarbons, illuminating oils, heavy oils, or lubricants, residuum, and paraffine. Owing, however, to the marked differences in the composition of crude petroleum obtained from different districts and in the methods of refining, the distillates obtained vary widely in character and quantity. The following statement shows for the United States the average percentage that each product is of the total quantity of crude material consumed:

Total.....	100.00
Naphthas.....	12.73
Burning oils.....	65.64
Heavy oils or lubricants.....	4.99
Paraffine.....	3.59
Residuum.....	4.62
Residual products and loss.....	8.43

The following statement shows the average percentages of the several products obtained from the crude oil of western Pennsylvania, as returned by a refiner drawing his entire supply of crude oil from that field:

Total.....	100.00
Naphthas.....	10.07
Burning oils.....	70.54
Heavy oils or lubricants.....	8.94
Paraffine.....	3.24
Residual products and loss.....	7.21

As compared with the crude oil obtained from western Pennsylvania, eastern Ohio, New York, and West Virginia, the crude oil of the Lima district distills a smaller proportion of illuminating oil, as shown by the following statement, which is the result obtained by a refiner using Lima oil during the year:

Total.....	100.00
Naphthas.....	39.27
Burning oils.....	51.64
Paraffine.....	7.39
Loss.....	1.70

The base of California oil is usually asphaltum, in this respect differing from the petroleum obtained from other states, of which generally paraffine is the basis. The average percentages of the several products obtained during the year by refiners in California are as follows:

Total.....	100.00
Naphthas.....	5.25
Burning oils.....	6.94
Lubricants.....	5.58
Residuum.....	68.47
Maltha.....	13.76

The percentages of products obtained from the crude oil of the Florence field in Colorado, as returned by a refiner in that district, are as follows:

Total.....	100.00
Burning oils.....	32.21
Lubricants.....	1.58
Residuum.....	64.29
Loss.....	1.92

The oils of Texas, so far as reported during the year, are natural lubricating oils requiring only filtration to fit them for use, and are therefore not included within the scope of this report.

The foregoing statements of products are taken from the reports of individual refineries, as returned to this office, except that for the United States, which is the average of the whole number of returns. They can not be taken as a correct indication of the crude oils obtained from the several districts cited as, owing to the varied requirements of the different refineries and the wide difference in the methods employed, the percentages of the several products manufactured are capable of innumerable variations.

Owing to a difference in the classification of the refined products reported at the censuses of 1880 and 1889, it is not possible to make a complete comparison of the several products. The following comparative statement presents the items common to the two census reports. Rhigolene, mineral sperm, and deodorized lubricating oils for 1880, and neutral filtered oils, filtered cylinder oils, ointments, and greases for 1889, are included in all other petroleum products.

The following statement presents the quantities and values and the average value of the several products for 1880 and 1889, with the percentage of increase or decrease in quantity and value:

COMPARATIVE STATEMENT, QUANTITY, TOTAL VALUE OF PRODUCTS, AVERAGE VALUE PER BARREL, AND THE PERCENTAGE OF INCREASE IN QUANTITY AND IN TOTAL VALUE, PETROLEUM REFINING: 1880 AND 1889.

PRODUCTS.	1880			1889			PERCENTAGE OF INCREASE.	
	Number of barrels.	Total value.	Average value per barrel.	Number of barrels.	Total value.	Average value per barrel.	In quantity.	In total value.
Burning oils.....	11,002,249	\$36,830,613	\$3.35	10,907,397	\$47,842,537	\$2.82	54.22	29.87
Residuum.....	229,133	297,529	1.30	1,194,967	1,235,490	1.03	421.52	315.25
Paraffine oils.....	79,465	408,023	5.13	684,849	3,022,048	4.41	761.82	640.66
Paraffine wax.....	a7,889,026	631,944	70.08	241,951	2,904,902	12.01	.....	359.68
Reduced oils.....	230,859	1,395,037	6.04	856,730	2,333,923	2.72	271.11	67.30
Gasoline.....	289,555	1,128,100	3.90	101,064	394,076	3.91	65.10	65.02
Naphtha.....	1,212,626	1,833,395	1.51	3,189,398	6,720,712	2.11	163.02	200.57
All other petroleum products.....	.....	1,171,511	.....	.....	5,288,856	.....	.....	351.46

a Pounds.

b Average value per pound.

c Decrease.

The schedule of inquiry required a more complete and detailed description of the different products manufactured than is presented in the tables accompanying this report, such as the fire test of illuminating oils, the color and specific gravity of other products, but the replies received to these questions were so incomplete as to render the information of no value for statistical purposes.

With the manifold uses to which the refined products of crude petroleum are put in the manufacture of mixed lubricants, pharmaceutical preparations, wool cleansing oils, and other articles, this investigation has no direct connection, and they are not considered in this discussion.

The following statement shows the quantities of the several petroleum products manufactured during the census year for domestic consumption and for export, as returned by refineries, with the percentage that each class is of the whole quantity of such product manufactured:

STATEMENT OF PRODUCTS MANUFACTURED FOR HOME CONSUMPTION AND FOR EXPORT, WITH PERCENTAGE OF TOTALS, PETROLEUM REFINING: 1889.

PRODUCTS.	For home consumption. (Barrels.)	Per cent- age of total.	For export. (Barrels.)	Per cent- age of total.
Total	12, 946, 112	54. 60	10, 724, 634	45. 31
Burning oils	6, 026, 256	40. 88	10, 031, 141	59. 12
Residuum	1, 189, 564	99. 55	5, 403	0. 45
Paraffine oils	357, 653	52. 22	327, 196	47. 78
Reduced oils	763, 752	89. 15	92, 978	10. 85
Neutral filtered oils	109, 832	97. 43	2, 892	2. 57
Filtered cylinder oils	269, 058	96. 58	9, 515	3. 42
Ointments and greases	28, 389	65. 88	14, 704	34. 12
Gasoline and naphtha	3, 199, 709	97. 24	90, 753	2. 76
Paraffine wax	91, 890	37. 98	150, 052	62. 02

EQUIPMENT OF PLANT.

The following statement presents by totals for the United States and the several states having 3 or more establishments the equipment of plant as regards power, buildings, storage, and transportation facilities of petroleum refineries:

EQUIPMENT OF PLANT, PETROLEUM REFINING, BY STATES: 1889.

STATES.	STEAM POWER.			BUILDINGS (NUMBER).							STORAGE AND TRANSPORTATION (NUMBER).								
	Boil- ers. (Num- ber.)	En- gines. (Num- ber.)	Horse power.	Cooper shops.	Tin shops.	Stills.			Agi- tators.	Chill- ing houses for paraf- fine.	Presses. (Num- ber.)	Storage tanks.		Tank cars.	Tank wagons.	Barges.	Steam- ships or other tank boats.	Tow- boats or light- ers.	Horses and mules.
						Heated by steam.	Heated by super- heated steam.	Heated by fire.				For crude petro- leum.	For refin- ed pe- tro- leum.						
The United States	578	545	30, 281	31	20	217	61	997	306	30	767	292	1, 801	893	75	19	6	26	361
New Jersey	99	220	11, 036	4	1	23	.....	188	52	6	86	22	375	50	.....	1	5	14	.....
New York	131	77	8, 372	6	10	50	3	260	72	7	370	41	446	30	5	11	.....	7	115
Ohio	89	63	5, 997	4	2	34	17	163	54	6	174	28	172	357	19	2	.....	3	63
Pennsylvania	213	164	8, 223	12	3	86	36	305	98	17	133	161	707	351	34	1	.....	1	140
West Virginia	18	10	975	4	1	8	.....	20	12	2	2	16	18	.....	1	.....	.....	.....	4
All other states (a)	28	11	1, 678	1	3	10	5	61	18	1	2	24	143	96	17	3	1	1	30

a Includes states in which there are less than 3 establishments, distributed as follows: California, 2; Colorado, 2; Maryland, 2; Massachusetts, 1.

TABULAR STATEMENTS.

The statistical tables accompanying this report are as follows:

Table 1 is a comparative statement for the United States of items common to both census periods.

Table 2 is a statement showing in detail the statistics concerning petroleum refining by totals for the United States and for the respective states. In addition to the various subdivisions of capital, miscellaneous expenses, employes and wages, materials and products, this table shows the source from which the crude petroleum was received, whether direct from wells or through transportation companies or other sources, also the quantity manufactured for domestic consumption and for export.

Table 3 is a presentation of the statistics of employes and wages. It shows the employes classified as (1) officers or firm members; (2) clerks; (3) operatives and skilled; (4) unskilled, and their further division by males, females, and children, with the actual wages paid to each class and the average weekly earnings per employe; (5) pieceworkers. It also shows the weekly rates of wages paid and the average number of employes, males, females, and children at each rate, not including pieceworkers.

The number of employes reported is the "average number employed during the year", that is, the average number having continuous employment for the full time reported by individual establishments. Upon this basis the computations are made to obtain the "average weekly earnings". The average number of employes reported

for each establishment is multiplied by the number of weeks the establishment was in operation; the result is the number of weeks required for 1 employé to perform the labor. Aggregating such results of individual reports, the number of weeks required for 1 employé to perform the entire labor is obtained. This number, used as a divisor for the total wages reported, produces the true average weekly earnings.

In the appended tables and in all statements embodied in the text the barrel of crude oil is 42 gallons and that of the refined product is 50 gallons.

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TABLE I.—COMPARATIVE STATEMENT, PETROLEUM REFINING: 1880 AND 1889.

ITEMS.	1880		1889	
	Number or quantity.	Amount.	Number or quantity.	Amount.
Number of establishments reporting.....	86		94	
Capital.....		\$27,325,740		\$77,416,206
Miscellaneous expenses (a).....				2,069,268
Average number of employes.....	9,860		12,471	
Males above 16 years.....	9,498		11,920	
Females above 15 years.....	25		35	
Children.....	346		516	
Total wages.....		4,381,572		6,989,478
Cost of materials used.....total.....		34,999,101		67,918,723
Crude petroleum.....gallons.....	731,533,127	16,340,581	1,287,830,402	44,879,783
Naphtha.....do.....			100,000	4,000
Residuum.....do.....			4,530,000	123,205
Fuel.....total.....		1,819,008		2,275,468
Anthracite coal.....tons.....	179,997	446,922	324,393	566,114
Bituminous coal.....do.....	504,067	589,983	351,355	750,041
Wood.....cords.....	1,471	0,355	1,948	2,691
Coke.....bushels.....	303,596	13,218	82,976	6,225
Naphtha.....barrels.....	57,843	42,315	116,762	111,328
Residuum.....do.....	235,314	220,215	468,374	544,281
Oil.....do.....			73,567	36,330
Distillate.....do.....			6,174	8,804
Natural gas.....do.....				240,594
Acids.....total.....		1,206,300		1,530,065
Sulphuric acid.....tons.....	45,814	1,206,052	95,916	1,510,728
All other acids.....do.....		248		13,337
Packages bought, and coopers, carpenters, and tinners' materials.....total.....		15,964,627		16,895,874
Barrels.....number.....	6,424,008	7,577,805	3,701,010	3,885,344
Tin cans.....do.....	344,173	93,367	434,383	88,789
Cases.....do.....	4,845,504	717,400	2,770,479	366,141
Coopers, carpenters, and tinners' materials.....do.....		67,576,055		12,495,600
All other materials.....do.....		168,585		2,270,328
Value of products (c).....total.....		43,705,218		85,001,198
Burning oils.....barrels.....	11,002,240	36,899,613	16,907,397	47,842,597
Residuum.....do.....	229,133	297,529	1,194,967	1,235,490
Paraffine oils.....do.....	79,465	408,022	684,840	3,022,048
Reduced oils.....do.....	240,859	1,305,037	850,730	2,333,923
Gasoline.....do.....	280,555	1,128,166	101,064	394,676
Naphtha.....do.....	1,212,026	1,835,395	3,189,398	6,720,712
Paraffine wax.....do.....	27,889,626	631,944	241,951	2,904,902
All other petroleum products.....do.....		1,171,511		5,288,856
All other petroleum products.....total.....		6,030,643		15,258,054
Packages made.....number.....	4,899,095	4,230,013	32,945,323	8,024,025
Barrels and cases.....do.....	23,496,916	2,700,639	50,566,576	6,332,429
Tin cans.....do.....				

a This item was not reported at the Tenth Census, and at the Eleventh Census some establishments failed to furnish information as to miscellaneous expenses.

b This item includes the value of packages made instead of the cost of materials used in making them, as in 1889.

c The value of packages made at the refinery is not shown as a distinct item of product in the report for 1880, and does not appear to have been included in the value of the product.

d Pounds.

MANUFACTURING INDUSTRIES.

TABLE 2.—DETAILED STATEMENT,

STATES.	Number of establishments reporting.	CAPITAL.									
		Aggregate.	Value of plant.				Live assets.				
			Total.	Land.	Buildings.	Machinery, tools, and implements.	Total.	Raw materials.	Stock in process and finished products on hand.	Cash, bills and accounts receivable, and all sundries not elsewhere reported.	
1 The United States...	94	\$77,416,296	\$35,127,700	\$7,886,698	\$6,403,994	\$20,837,038	\$42,288,596	\$3,089,803	\$10,380,521	\$28,812,272	
2 New Jersey	4	16,500,730	9,295,985	2,605,740	1,678,545	5,011,700	7,204,745	612,385	2,093,871	4,498,489	
3 New York	9	24,166,205	10,153,412	2,395,743	1,007,786	6,149,883	14,012,793	1,123,201	3,370,924	9,518,668	
4 Ohio	15	15,871,138	6,320,591	1,269,143	1,216,585	3,834,833	9,550,577	550,898	1,937,303	7,062,376	
5 Pennsylvania	55	17,082,006	7,284,850	1,180,508	1,464,680	4,639,692	9,797,756	668,837	2,578,599	6,550,320	
6 West Virginia	4	1,348,322	636,079	208,368	161,999	266,312	711,643	51,037	135,111	525,495	
7 All other states (a)	7	2,447,295	1,436,213	227,166	274,399	934,048	1,011,082	83,445	270,713	656,924	

STATES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES—continued.								MATERIALS USED.			
	Operatives, skilled and unskilled—Continued.				Pieceworkers.				Aggregate cost.	Crude petroleum, naphtha, and residuum.		
	Females above 15 years.		Children.		Males above 16 years.		Children.			Total cost of crude petroleum, naphtha, and residuum.	Crude petroleum.	
	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.			Gallons.	Cost.
1 The United States....	2	\$622	500	\$81,035	1,658	\$708,820	16	\$3,473	\$67,918,723	\$45,006,988	1,287,830,402	\$44,879,783
2 New Jersey					500	224,594			16,474,022	11,864,375	280,816,913	11,364,375
3 New York			88	15,765	339	131,499	8	1,024	20,979,247	12,448,191	350,095,305	12,448,191
4 Ohio			84	16,502	165	114,810	8	1,849	12,517,255	8,587,114	261,606,290	8,496,114
5 Pennsylvania	2	622	316	48,478	487	224,514			15,006,919	10,437,988	319,285,879	10,401,783
6 West Virginia			10	600	35	11,531			951,576	646,901	19,325,848	646,901
7 All other states			2	300	3	1,872			1,989,704	1,522,419	48,200,158	1,522,419

STATES.	MATERIALS USED—continued.												
	Fuel.												
	Total cost.	Coal.				Coke.		Naphtha.		Residuum (not produced at works).		Wood.	
		Tons.	Cost.	Tons.	Cost.	Bushels.	Cost.	Barrels.	Cost.	Barrels.	Cost.	Cords.	Cost.
1 The United States....	\$2,275,468	324,393	\$566,114	351,355	\$750,041	82,976	\$6,225	116,762	\$111,328	468,374	\$544,281	1,948	\$2,691
2 New Jersey	411,847	219,021	357,365	4,666	14,098	14,820	1,871	18,966	36,913			400	1,600
3 New York	1,042,140	89,085	178,294	156,232	298,544	24,718	1,579	79,596	39,702	399,243	507,039	634	158
4 Ohio	210,086	334	1,000	73,007	158,381	23,814	1,522	9,976	19,030	40,000	6,000	698	153
5 Pennsylvania	522,974	15,953	29,455	82,122	205,999	16,033	1,024	6,717	12,813	29,131	31,242	209	477
6 West Virginia	25,460			20,788	23,944	1,744	111	733	1,394			44	11
7 All other states	62,991			14,510	49,075	1,847	118	774	1,476			53	292

a Includes states having less than 3 establishments, in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: California, 2; Colorado, 2; Maryland, 2; Massachusetts, 1.

REFINING OF PETROLEUM.

PETROLEUM REFINING, BY STATES: 1889.

MISCELLANEOUS EXPENSES.							AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.								
Total.	Rent paid for tenancy.	Taxes.	Insur- ance.	Repairs, ordinary, of buildings and machinery.	Interest paid on cash used in the business.	All sundries not elsewhere reported.	Aggregates.		Officers, firm members, and clerks.				Operatives, skilled and unskilled.		
							Average num- ber.	Total wages.	Males above 16 years.		Females above 15 years.		Males above 16 years.		
									Num- ber.	Wages.	Num- ber.	Wages.	Num- ber.	Wages.	
\$2,069,268	\$70,525	\$188,439	\$110,104	\$600,323	\$174,466	\$925,411	12,471	\$6,089,478	1,035	\$1,102,892	33	\$14,119	9,227	\$5,077,917	1
241,188	10,958	14,348	41,201	112,674	29,352	32,565	2,703	1,618,501	93	148,913	.....	.....	2,011	1,244,994	2
576,161	17,459	60,567	6,831	151,023	37,141	303,140	3,490	2,015,544	367	378,240	27	11,239	2,661	1,477,187	3
590,858	18,828	55,884	24,148	103,147	46,803	282,048	2,281	1,290,991	302	271,610	3	1,520	1,689	884,700	4
543,068	17,649	43,931	36,050	144,898	42,387	258,744	3,496	1,735,257	209	230,305	3	1,360	2,479	1,229,978	5
42,834	3,937	4,883	411	10,852	2,032	20,719	221	96,992	22	18,474	.....	.....	154	66,887	6
74,550	1,694	8,826	1,364	17,729	16,751	28,195	280	232,193	42	55,350	.....	.....	233	174,071	7

MATERIALS USED—continued.														
Crude petroleum, naphtha, and residuum—Continued.											Acids.			
Crude petroleum—Continued.						Naphtha.		Residuum.		Total cost.	Sulphuric.		All other.	
From transportation com- panies.		From wells.		From all other sources.		Gallons.	Cost.	Gallons.	Cost.		Tons.	Cost.		Cost.
Gallons.	Cost.	Gallons.	Cost.	Gallons.	Cost.					Gallons.			Cost.	
1,232,868,858	\$43,406,070	52,732,840	\$1,314,269	2,228,695	\$69,435	100,000	\$4,000	4,530,000	\$123,205	\$1,530,065	95,916	\$1,516,728	\$13,337	1
289,316,913	11,864,375	.....	.....	.....	.....	.....	.....	.....	.....	342,514	23,445	342,514	.....	2
350,695,305	12,448,191	.....	.....	.....	.....	.....	.....	.....	.....	444,035	30,794	440,526	3,509	3
252,786,799	8,353,114	8,820,000	143,000	.....	.....	100,000	4,000	2,900,000	87,000	316,189	19,071	311,680	4,009	4
299,967,779	9,864,627	17,089,405	497,721	2,228,695	69,435	.....	.....	1,630,000	30,205	351,305	19,045	347,904	3,311	5
18,267,448	627,917	1,058,400	18,084	.....	.....	.....	.....	.....	.....	20,113	1,281	20,090	53	6
32,435,114	807,855	25,765,044	714,504	.....	.....	.....	.....	.....	.....	55,909	2,280	54,054	1,855	7

MATERIALS USED—continued.														
Fuel—Continued.					Packages.									
Crude oil.		Distillate.		Natural gas.	Total cost of coopers, carpenters, and tinners' materials, and packages bought.	Total cost.	Coopers and carpenters' materials.							
Barrels.	Cost.	Barrels.	Cost.				Pieces.	Cost.	Staves.		Heading.		Lumber.	
Barrels.	Cost.	Barrels.	Cost.	Cost.	Cost.	Pieces.	Cost.	Sets.	Cost.	Feet.	Cost.	Feet.	Cost.	
73,567	\$36,330	6,174	\$8,804	\$249,504	\$16,835,874	\$6,856,308	91,314,885	\$2,838,464	9,015,078	\$814,021	376,103	\$12,783	.....	1
.....	.....	.....	.....	.....	4,295,287	2,826,396	35,489,260	1,263,128	3,767,311	337,833	.....	.....	.....	2
.....	.....	.....	.....	10,824	6,202,619	2,040,114	19,396,126	568,535	1,894,774	170,108	109,800	8,640	.....	3
64,667	23,700	.....	.....	300	2,736,143	880,235	14,602,302	450,593	1,604,247	130,288	105,415	1,760	.....	4
900	630	6,174	8,864	232,470	3,001,520	963,259	19,485,264	483,681	1,499,593	154,945	144,977	2,118	.....	5
.....	.....	.....	.....	.....	211,245	70,576	1,214,996	37,567	125,286	10,648	7,724	128	.....	6
8,000	12,000	.....	.....	.....	299,080	75,728	1,132,937	34,960	124,467	10,109	8,178	137	.....	7

TABLE 2.—DETAILED STATEMENT, PETROLEUM

STATES.		MATERIALS USED—continued.									
		Packages—Continued.									
		Coopers and carpenters' materials—Continued.				Tinnern's materials.					
		Iron hoops.		Shooks.	Sundries.	Total cost.	Tin.		Solder.		Sundries.
		Pounds.	Cost.	Cost.	Cost.		Boxes.	Cost.	Pounds.	Cost.	Cost.
1	The United States...	49,388,619	\$1,120,376	\$1,360,365	\$710,299	\$5,639,292	1,068,653	\$5,139,595	2,594,933	\$284,706	\$214,991
2	New Jersey	20,068,626	461,800	444,258	319,377	838,976	159,484	777,035	425,922	48,072	13,869
3	New York	11,023,418	240,435	916,107	136,199	2,814,743	539,983	2,584,754	1,257,235	137,625	92,364
4	Ohio	8,396,148	179,293	.....	118,331	1,077,152	200,244	964,842	489,203	52,702	59,608
5	Pennsylvania.....	8,588,604	210,844	.....	111,671	724,652	134,825	649,647	329,392	35,435	39,520
6	West Virginia.....	608,757	14,281	.....	7,952	78,847	14,672	70,699	35,846	3,861	4,287
7	All other states.....	643,669	13,753	.....	16,769	104,922	19,445	92,618	57,935	6,961	5,348

STATES.		PRODUCTS—continued.											
		Residuum.				Paraffine oils.				Reduced oils.			
		Total.		Home consumption. (Barrels.)	Exported. (Barrels.)	Total.		Home consumption. (Barrels.)	Exported. (Barrels.)	Total.		Home consumption. (Barrels.)	Exported. (Barrels.)
		Barrels.	Value.			Barrels.	Value.			Barrels.	Value.		
1	The United States...	1,194,997	\$1,235,490	1,189,564	5,403	684,849	\$3,022,048	357,653	327,196	856,730	\$2,333,923	763,752	92,978
2	New Jersey	192,746	343,847	192,746	.....	139,975	642,443	52,676	87,299	145,856	537,143	91,282	54,574
3	New York	284,340	315,070	281,463	2,877	284,714	1,297,213	140,219	144,466	203,767	458,981	189,963	13,804
4	Ohio	237,696	144,995	236,851	815	139,434	573,393	87,091	52,348	164,795	365,668	151,485	13,310
5	Pennsylvania.....	208,619	195,443	207,067	1,552	103,238	436,937	68,062	35,176	290,230	861,206	239,949	9,281
6	West Virginia.....	11,229	4,803	11,167	62	7,798	30,873	3,970	3,828	31,165	75,433	30,190	975
7	All other states.....	260,337	229,732	260,270	67	9,690	41,189	5,635	4,055	11,917	35,407	10,883	1,034

STATES.		PRODUCTS—continued.											
		Naphtha.				Paraffine wax.				Residuum products.			
		Total.		Home consumption. (Barrels.)	Exported. (Barrels.)	Total.		Home consumption. (Barrels.)	Exported. (Barrels.)	Coke. (Home consumption.)		Naphtha black. (Home consumption.)	
		Barrels.	Value.			Barrels.	Value.			Bushels.	Value.	Barrels.	Value.
1	The United States...	3,189,398	\$6,720,712	3,098,654	90,744	241,951	\$2,004,902	91,899	150,052	494,221	\$56,997	437	\$946
2	New Jersey	524,954	1,319,284	476,005	48,940	62,604	832,611	8,365	54,239	176,284	13,849	.....	.....
3	New York	836,086	1,674,730	818,743	17,343	77,772	911,284	32,397	45,465	129,723	13,399	158	342
4	Ohio	758,598	1,625,044	745,194	13,404	41,392	489,767	16,020	25,372	108,822	18,407	152	329
5	Pennsylvania.....	943,369	1,792,176	934,344	9,025	54,200	601,592	32,837	21,363	67,441	9,704	104	225
6	West Virginia.....	48,135	99,214	47,153	882	2,700	29,643	946	1,754	5,805	795	11	24
7	All other states.....	78,250	210,264	77,215	1,041	3,283	39,705	1,424	1,859	6,147	843	12	26

REFINING OF PETROLEUM.

REFINING, BY STATES: 1889—Continued.

MATERIALS USED—continued.								PRODUCTS.					
Packages—Continued.								Aggregate value.	Burning oils.				
Packages bought.									Total.		Home consumption. (Barrels.)	Exported. (Barrels.)	
Total cost.	Barrels.		Tin cans.		Cases.		Cost.		Barrels.	Value.			
	Number.	Cost.	Number.	Cost.	Number.	Cost.							
\$4,340,274	3,791,010	\$3,885,344	434,383	\$88,789	2,770,479	\$366,141	\$2,270,328	\$85,001,198	16,967,307	\$47,842,537	6,936,256	10,031,141	1
629,895	800,828	605,851	88,174	17,744	42,000	6,300	60,019	20,711,826	3,930,584	12,257,048	797,743	3,192,841	2
1,347,702	1,214,300	1,239,168	118,169	22,105	607,755	86,489	842,202	25,780,841	4,877,785	12,908,111	1,970,897	2,907,888	3
778,750	677,692	675,274	68,200	13,645	676,399	89,837	607,723	16,343,483	3,508,331	9,900,262	1,730,506	1,772,735	4
1,403,609	1,137,857	1,198,330	159,681	35,276	1,285,777	170,003	603,132	18,498,777	3,995,347	10,657,400	2,104,010	1,890,737	5
61,822	53,874	55,704	76	12	47,144	6,106	47,857	1,171,374	255,689	695,002	125,601	120,898	6
118,430	106,459	111,011	83	13	51,464	7,406	49,335	2,488,887	404,761	1,334,654	267,210	137,542	7

PRODUCTS—continued.

Neutral filtered oils.				Filtered cylinder oils.				Ointments and greases.				Gasoline.			
Total.		Home consumption. (Barrels.)	Exported. (Barrels.)	Total.		Home consumption. (Barrels.)	Exported. (Barrels.)	Total.		Home consumption. (Barrels.)	Exported. (Barrels.)	Total.		Home consumption. (Barrels.)	Exported. (Barrels.)
Barrels.	Value.			Barrels.	Value.			Barrels.	Value.			Barrels.	Value.		
112,724	\$435,351	100,832	2,892	278,573	\$1,526,096	269,058	9,515	43,099	\$789,089	28,389	14,704	101,004	\$394,676	101,055	9
58,640	251,659	55,748	2,892	78,379	530,531	72,190	6,189	.....	.....	.....	.....	143	841	143	.....
6,392	10,477	6,392	.....	28,175	126,633	28,175	.....	33,535	747,025	18,937	14,578	25,600	104,143	25,600	.....
4,738	13,549	4,738	.....	27,048	120,192	27,048	.....	4,543	12,206	4,543	.....	20,844	89,026	20,839	5
42,348	156,874	42,348	.....	126,041	656,205	122,715	3,320	4,400	28,272	4,274	120	50,510	180,714	50,517	2
149	628	149	.....	1,908	8,515	1,908	.....	297	770	297	.....	1,528	6,523	1,527	1
457	2,164	457	.....	17,022	84,020	17,022	.....	318	816	318	.....	2,430	13,429	2,429	1

PRODUCTS—continued.

All other products.

Total value.	Value of by-products manufactured directly from petroleum.	Of cooper and carpenter shops.					Of tin shops.				
		Cases. (Number.)	Barrels. (Number.)	Half barrels. (Number.)	Less than half barrels. (Number.)	Value.	10-gallon cans (Number.)	5-gallon cans. (Number.)	Less than 5-gallon cans. (Number.)	Value.	
\$17,738,431	\$2,480,377	27,392,964	4,593,270	358,984	105	\$8,924,625	239	50,029,001	537,336	\$6,333,429	1
3,982,570	113,631	3,660,714	1,970,568	.....	.....	2,967,030	.....	7,324,329	34,722	901,909	2
7,218,833	725,152	14,908,901	987,368	55,749	.....	3,015,642	87	25,227,599	280,769	3,478,039	3
2,900,660	583,401	4,774,281	741,486	53,715	.....	1,263,035	83	9,449,181	115,077	1,054,224	4
2,920,939	752,340	3,256,801	774,486	241,415	105	1,455,588	56	6,445,807	78,014	713,005	5
218,791	35,424	349,839	61,833	3,936	.....	106,777	6	682,396	8,476	76,590	6
496,638	270,423	442,428	57,529	4,169	.....	116,553	7	889,689	9,778	109,662	7

MANUFACTURING INDUSTRIES.

TABLE 3.—CLASSIFICATION OF EMPLOYÉS AND WAGES AND AVERAGE NUMBER OF EMPLOYÉS

STATES.		AVERAGE NUMBER OF EMPLOYÉS IN EACH CLASS AND AVERAGE WEEKLY EARNINGS.											
		Aggregates.		Officers or firm members actively engaged in the industry or in supervision.			Clerks.						
				Males above 16 years.			Males above 16 years.			Females above 15 years.			
		Average number.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	
1	The United States...	94	12,471	\$0,989,478	87	\$48.51	\$202,120	948	\$19.07	\$900,772	33	\$8.74	\$14,119
2	New Jersey	4	2,703	1,618,501	7	156.59	57,000	86	20.50	61,913			
3	New York	9	3,490	2,015,544	3	80.77	12,600	364	20.34	365,640	27	8.62	11,230
4	Ohio	15	2,281	1,290,901	14	38.65	26,125	288	16.55	245,485	3	9.74	1,520
5	Pennsylvania	55	3,496	1,735,257	52	34.68	83,175	157	20.31	147,130	3	8.72	1,300
6	West Virginia	4	221	96,092	3	65.51	10,220	19	8.58	8,254			
7	All other states (a)	7	280	292,103	8	31.25	13,000	34	24.07	42,350			

STATES.		Average number of hours in ordinary day of labor.		WEEKLY RATES OF WAGES PAID AND AVERAGE NUMBER OF EMPLOYÉS AT EACH RATE, INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS, BUT NOT THOSE EMPLOYED ON PIECEWORK. (b)											
				Males above 16 years.											
		May to November.	November to May.	Total number.	Under \$5.	\$5 and over but under \$6.	\$6 and over but under \$7.	\$7 and over but under \$8.	\$8 and over but under \$9.	\$9 and over but under \$10.	\$10 and over but under \$12.	\$12 and over but under \$15.	\$15 and over but under \$20.	\$20 and over but under \$25.	\$25 and over.
1	The United States...	10.20	10.14	10,262	294	89	288	590	361	2,477	1,024	2,216	1,199	375	473
2	New Jersey	10.00	9.88	2,104	105	27	51	29	20	440	377	469	396	131	59
3	New York	10.00	9.89	3,028	104	42	130	78	49	321	432	703	316	71	232
4	Ohio	10.13	10.00	1,991	51	17	45	134	123	359	553	392	153	88	76
5	Pennsylvania	10.20	10.25	2,688	29		59	199	192	796	474	584	248	62	75
6	West Virginia	10.00	10.00	176		1		125		32	4	1	7	3	3
7	All other states	10.14	10.14	275	5	2	3	1	7	29	34	67	79	20	28

a Includes states having less than 3 establishments, in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: California, 2; Colorado, 2; Maryland, 2; Massachusetts, 1.

AT THE DIFFERENT WEEKLY RATES OF PAY, PETROLEUM REFINING, BY STATES: 1889.

AVERAGE NUMBER OF EMPLOYÉS IN EACH CLASS AND AVERAGE WEEKLY EARNINGS—continued.																		
Operatives and skilled.						Unskilled.						Pieceworkers.						
Males above 16 years.			Females above 15 years.			Males above 16 years.			Children.			Summary.		Males above 16 years.		Children.		
Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Total wages.	Number.	Total wages.	Number.	Total wages.	
3,819	\$14.05	\$2,703,282	2	\$5.98	\$622	5,408	\$8.94	\$2,374,635	500	\$3.59	\$81,635	1,674	\$712,293	1,658	\$708,820	16	\$3,473	1
1,165	14.53	878,690				840	8.41	366,304				599	224,594	599	224,594			2
834	14.40	620,325				1,827	0.09	856,862	88	3.45	16,755	347	133,123	339	131,499	8	1,024	3
817	12.00	508,880				872	8.38	375,820	84	3.78	16,502	203	116,050	195	114,810	8	1,849	4
871	14.39	580,348	2	5.98	622	1,008	9.32	649,630	316	8.68	48,478	487	224,514	487	224,514			5
26	8.77	11,400				128	8.39	54,987	10	1.15	600	35	11,531	35	11,531			6
106	19.36	103,639				127	10.87	71,032	2	2.88	300	3	1,872	3	1,872			7

WEEKLY RATES OF WAGES PAID AND AVERAGE NUMBER OF EMPLOYÉS AT EACH RATE, INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS, BUT NOT THOSE EMPLOYED ON PIECEWORK—continued.													
Females above 15 years.									Children.				
Total number.	\$5 and over but under \$6.	\$6 and over but under \$7.	\$7 and over but under \$8.	\$8 and over but under \$9.	\$9 and over but under \$10.	\$10 and over but under \$12.	\$12 and over but under \$15.	\$20 and over but under \$25.	Total number.	Under \$5.	\$5 and over but under \$6.	\$6 and over but under \$7.	
35	3	1	1	23	2	1	3	1	500	430	18	43	1
27	1			23	1		1	1	88	88			2
3			1			1			84	74	9	1	3
5	2	1			1		1		316	265	9	42	4
									10	10			5
									2	2			6
													7

b In comparing the weekly rates of wages and number of employés at each rate with the average weekly earnings, it must be remembered that it is not practicable to obtain true average weekly earnings from the table of weekly rates, because the term of employment varies for employés reported at the respective rates.

GLUE.

GLUE.

BY R. W. POWELL.

The manufacture of glue in the United States is frequently so closely allied with other industries, such as slaughtering and meat packing, the manufacture of fertilizers, bone, ivory, and lamp black, and curled hair, that it is not practicable to keep the accounts so as to show specifically the items of capital, expenses, labor, and product that directly pertain to the production of glue. For this reason it was found impossible to compile complete statistics for the manufacture of glue as a distinct industry. The following figures, however, fairly represent the conditions of the industry as conducted during the census year ending May 31, 1890.

Complete returns were obtained for 57 establishments that reported the manufacture of glue as a sole or predominating product, and the following summary presents the data for these establishments under the general heads of the inquiry used at the Eleventh Census. The number of establishments shown in this statement does not agree with the number given in the general tables on manufactures in Part 1, because those tables include establishments engaged in the manufacture of ground glue and glue stock.

SUMMARY, GLUE MANUFACTURE: 1890.

Number of establishments reporting	57
Capital.....	\$4, 719, 741
Miscellaneous expenses	\$392, 565
Average number of employés (aggregate)	1, 795
Total wages	\$788, 099
Officers, firm members, and clerks:	
Average number	120
Total wages	\$121, 588
All other employés:	
Average number	1, 675
Total wages	\$666, 511
Cost of materials used	\$2, 284, 455
Value of products	\$3, 932, 781

Table 1 accompanying this report gives in detail, by totals for groups of states, the data concerning capital, miscellaneous expenses, employés and wages, materials and products, embraced by the foregoing summary, the arrangement by groups being necessary in order to obviate a disclosure of the operations of individual establishments.

In addition to the data presented in Table 1, returns were received for 20 establishments engaged in other industries, but containing specific statements respecting the quantity and value of glue manufactured as a by-product. These establishments manufactured during the census year 7,641,948 pounds of glue, valued at \$745,159. Adding these amounts to the 27,442,680 pounds, valued at \$2,871,935, obtained from the tabulation of the complete reports presented in Table 1, we have a total of 35,084,628 pounds, valued at \$3,617,094. It is evident, however, that these figures do not fully represent the quantity and value of the glue manufactured in the United States during the census year. In the returns for some of the establishments which are known to have manufactured glue as a by-product, neither its quantity nor its value was specifically stated, but the value was included with that of other by-products.

After an extended correspondence with manufacturers and others familiar with the industry, the special agent has obtained additional data which enables him to estimate that 5,637,291 pounds of glue, valued at \$386,648, should be added to the preceding figures, making the total production during the census year 40,721,919 pounds, valued at \$4,003,742. These figures have been carefully verified by every means which an experience of many years in the industry enabled the compiler to use.

The universal adoption of artificial methods of drying has removed from the business the principal element of uncertainty, and, while these methods add somewhat to the direct expense of manufacturing, they prevent the great waste formerly caused by bad weather. Their adoption has also had much to do with the tendency to concentrate the industry in the hands of extensive manufacturers and near large cities. The prejudice against glue making, which still exists, to some extent, is largely due to conditions which have long since passed away. The competition between glue makers now compels a degree of care which removes from the industry those elements

MANUFACTURING INDUSTRIES.

which made it obnoxious to an adjacent population. There is nothing connected with the proper treatment of fresh hide or neat's foot stock or the boiling of fresh bones which constitutes a nuisance, but the business is often unjustly confounded with other industries which may exist in the same neighborhood.

The quantity and value of glue manufactured, as shown by the returns and the preceding estimate, are distributed in the following statement, by totals for groups of states, according to the kind of materials used:

STATEMENT INCLUDING ESTIMATED PRODUCTION AND ESTIMATED CAPITAL, ACCORDING TO KIND OF MATERIALS USED, GLUE MANUFACTURE, BY GROUPS OF STATES: 1890.

GROUPS OF STATES.	Estab-lish-ments.	Total quantity. (Pounds.)	Glue made from hide, fur, or neat's-foot stock. (Pounds.)	Glue made from bone, bone liquor, or pigs' feet. (Pounds.)	Total value.	Estimated capital used in glue manu-facture.
The United States.....	89	40,721,919	30,210,553	10,511,366	\$4,003,742	\$5,691,821
New England states (a)	20	6,797,206	4,976,753	1,820,453	745,137	913,213
Middle states (b)	38	18,005,342	15,540,619	2,465,223	1,732,078	2,641,066
Western states (c)	24	14,672,871	8,447,181	6,225,690	1,428,615	2,003,967
Pacific states (d)	7	1,246,000	1,246,000	.....	97,912	132,975

a Includes 20 establishments located as follows: Maine, 1; Massachusetts, 16; New Hampshire, 2; Rhode Island, 1.

b Includes 38 establishments located as follows: Maryland, 1; New York, 17; New Jersey, 6; Pennsylvania, 13; West Virginia, 1.

c Includes 24 establishments located as follows: Illinois, 5; Indiana, 3; Kentucky, 1; Michigan, 3; Minnesota, 1; Missouri, 4; Ohio, 6; Wisconsin, 1.

d Includes 7 establishments located as follows: California, 6; Oregon, 1.

The product of the 89 establishments, including estimates, is indicated by the following statement:

PRODUCT, INCLUDING ESTIMATES, BY GROUPS OF ESTABLISHMENTS: 1890.

	POUNDS.
Total.....	40,721,919
Quantity of glue produced in 11 establishments, each making 1,000,000 pounds or over	24,121,445
Quantity of glue produced in 10 establishments, each making 500,000 to 1,000,000 pounds	6,659,955
Quantity of glue produced in 40 establishments, each making 100,000 to 500,000 pounds	8,804,635
Quantity of glue produced in 28 establishments, each making less than 100,000 pounds	1,135,884

During the past decade 32 new establishments have engaged in the manufacture of glue, and in the census year 1890 these new establishments produced 8,007,461 pounds of glue, or 19.66 per cent of the total product, nearly three-quarters of the 8,007,461 pounds being composed of the various kinds of hide glue.

The average value of glue per pound in the United States and in the various sections of the country is shown as follows:

AVERAGE VALUE OF GLUE PER POUND AT THE FACTORY, BY GROUPS OF STATES: 1890.

GROUPS OF STATES.	All classes of glue. (Cents.)	Hide, fur, or neat's-foot glue. (Cents.)	Bone, bone liquor, or pigs' feet glue. (Cents.)
The United States.....	9.83	.....	.....
New England states.....	10.96	13.23	4.75
Middle states.....	9.62	10.41	4.60
Western states.....	9.74	.....	.....
Pacific states.....	7.86	7.86	.....

EMPLOYÉS AND WAGES.

The questions used at the Eleventh Census concerning employés and wages called for the average number of males, females, and children for the entire time that the establishment was in operation during the census year, by classes of (1) officers or firm members; (2) clerks; (3) operatives and skilled workmen; (4) unskilled workmen; (5) pieceworkers; also the average number employed at specified weekly rates of pay. Table 2, following this plan, presents the statistics of employés and wages as reported by the 57 establishments engaged in the manufacture of glue as a sole or principal product. In order to avoid disclosing the operations of individual establishments it is necessary in this table to present the data by groups of states.

TABLE 1.—DETAILED STATISTICS OF 57 ESTABLISHMENTS ENGAGED IN THE MANUFACTURE OF GLUE AS A SOLE OR PRINCIPAL PRODUCT, BY GROUPS OF STATES: 1890.

GROUPS OF STATES.	Number of establishments reporting.	CAPITAL.								
		Aggregate.	Value of plant.				Live assets.			
			Total.	Land.	Buildings.	Machinery, tools, and implements.	Total.	Raw materials.	Stock in process and finished products on hand.	Cash, bills and accounts receivable, and all sundries not elsewhere reported.
The United States	57	\$4,719,741	\$1,961,638	\$564,275	\$718,831	\$678,562	\$2,758,073	\$644,414	\$1,170,010	\$943,649
New England states (a)	14	807,762	363,900	131,250	123,100	109,550	443,862	128,400	175,288	140,174
Middle states (b)	26	2,951,777	985,198	203,725	416,731	359,742	1,960,579	443,308	832,643	690,630
Western states (c)	13	856,927	534,570	201,300	159,500	173,770	322,357	72,308	152,429	97,620
Pacific states (d)	4	103,275	78,000	23,000	19,500	35,500	25,275	400	9,650	15,225

GROUPS OF STATES.	MISCELLANEOUS EXPENSES.						
	Total.	Rent paid for tenancy.	Taxes.	Insurance.	Repairs, ordinary, of buildings and machinery.	Interest paid on cash used in the business.	All sundries not elsewhere reported.
The United States	\$392,565	\$13,450	\$21,416	\$33,903	\$75,758	\$109,928	\$198,110
New England states	66,671	2,050	4,602	5,861	17,078	5,489	31,537
Middle states	267,917	8,080	13,121	19,307	42,326	90,645	88,438
Western states	50,991	2,960	3,287	8,205	14,004	7,800	14,735
Pacific states	6,986	360	346	530	2,350		3,400

GROUPS OF STATES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.													
	Aggregates.		Officers, firm members, and clerks.		Operatives, skilled and unskilled.						Pieceworkers.			
	Average number.	Total wages.	Males above 16 years.		Males above 16 years.		Females above 15 years.		Children.		Males above 10 years.		Females above 15 years.	
			Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
The United States	1,795	\$788,099	120	\$121,588	1,513	\$628,985	34	\$8,256	67	\$9,470	45	\$18,200	16	\$1,000
New England states	387	108,958	16	13,075	354	151,561	17	4,322						
Middle states	1,011	446,415	78	78,223	804	338,152	7	1,434	61	8,806	45	18,200	16	1,600
Western states	361	150,797	23	27,700	322	119,933	10	2,500	6	664				
Pacific states	36	21,929	3	2,590	33	19,339								

GROUPS OF STATES.	COST OF MATERIALS USED.					PRODUCTS.			
	Total.	Principal materials.	Fuel.	Mill supplies.	All other materials.	Total value.	Glue.		All other products.
							Pounds.	Value.		Value.
The United States	\$2,284,455	\$1,916,996	\$180,620	\$59,591	\$127,248	\$3,932,781	27,442,080	\$2,871,935	\$1,060,846
New England states	391,864	311,981	36,214	18,227	25,442	705,438	5,696,230	644,791	60,647
Middle states	1,412,826	1,189,772	98,614	40,164	84,276	2,461,614	15,027,671	1,519,140	942,474
Western states	442,109	389,309	35,960	1,200	15,640	681,817	5,752,859	634,092	47,725
Pacific states	37,656	25,034	9,832		1,890	83,912	905,920	73,912	10,000

a Includes establishments located as follows: Maine, 1; Massachusetts, 11; New Hampshire, 2.

b Includes establishments located as follows: Maryland, 1; New Jersey, 3; New York, 12; Pennsylvania, 9; West Virginia, 1.

c Includes establishments located as follows: Illinois, 1; Indiana, 3; Kentucky, 1; Michigan, 1; Missouri, 1; Ohio, 5; Wisconsin, 1.

d Includes establishments located as follows: California, 4.

MANUFACTURING INDUSTRIES.

TABLE 2.—CLASSIFICATION OF EMPLOYÉS AND WAGES AND AVERAGE NUMBER OF EMPLOYÉS AT THE DIFFERENT WEEKLY RATES OF PAY FOR 57 ESTABLISHMENTS ENGAGED IN THE MANUFACTURE OF GLUE AS A SOLE OR PRINCIPAL PRODUCT, BY GROUPS OF STATES: 1890.

GROUPS OF STATES.	Number of establishments reporting.	AVERAGE NUMBER OF EMPLOYÉS IN EACH CLASS AND AVERAGE WEEKLY EARNINGS. (a)													
		Aggregates.		Officers or firm members actively engaged in the industry or in supervision.			Clerks.			Operatives and skilled.					
		Average number.	Total wages.	Males above 16 years.			Males above 16 years.			Males above 16 years.			Females above 15 years.		
				Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.
The United States.....	57	1,705	\$738,009	72	\$23.96	\$73,885	48	\$21.44	\$47,703	628	\$10.61	\$283,868	26	\$5.38	\$6,510
New England states.....	14	387	168,958	15	10.99	12,475	1	15.38	600	211	9.94	94,885	16	4.00	4,010
Middle states.....	26	1,011	446,415	42	24.03	43,220	36	20.50	35,003	193	11.43	97,207	.....	.....	.....
Western states.....	13	361	150,797	13	28.96	16,500	10	26.11	11,200	213	10.85	84,696	10	6.41	2,500
Pacific states.....	4	86	21,929	2	18.14	1,690	1	18.06	900	11	13.12	7,080	.....	.....	.....

GROUPS OF STATES.	AVERAGE NUMBER OF EMPLOYÉS IN EACH CLASS AND AVERAGE WEEKLY EARNINGS—continued.													
	Operatives and skilled—Continued.			Unskilled.						Pieceworkers.				
	Children.			Males above 16 years.			Females above 15 years.			Children.				
	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Average weekly earnings per employé.	Total wages.	Number.	Total wages.
The United States.....	2	\$2.23	\$116	885	\$8.29	\$345,117	8	\$5.13	\$1,740	65	\$2.92	\$9,354	61	\$10,800
New England states.....	.....	.....	.....	143	9.17	56,070	1	6.00	312	.....	.....	.....	.....	.....
Middle states.....	2	2.23	116	611	8.15	240,945	7	4.98	1,434	59	2.98	8,690	61	19,800
Western states.....	.....	.....	.....	109	7.37	35,237	.....	.....	.....	6	2.52	664	.....	.....
Pacific states.....	.....	.....	.....	22	11.12	12,259	.....	.....	.....	.....	.....	.....	.....	.....

GROUPS OF STATES.	Average number of hours in ordinary day of labor.		WEEKLY RATES OF WAGES PAID AND AVERAGE NUMBER OF EMPLOYÉS AT EACH RATE, INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS, BUT NOT THOSE EMPLOYED ON PIECEWORK. (b)									
	May to November.	November to May.	Males above 16 years.									
			Total number.	Under \$5.	\$5 and over but under \$6.	\$6 and over but under \$7.	\$7 and over but under \$8.	\$8 and over but under \$9.	\$9 and over but under \$10.	\$10 and over but under \$12.	\$12 and over but under \$15.	
The United States.....	9.61	9.53	1,633	43	133	66	277	123	402	312	102	
New England states.....	10.00	10.00	370	.....	12	21	40	46	134	66	23
Middle states.....	9.96	9.88	882	11	117	36	175	41	203	159	44	
Western states.....	10.00	9.77	345	32	4	9	62	26	63	86	22	
Pacific states.....	9.75	9.67	36	.....	.....	.....	.....	10	2	1	13

GROUPS OF STATES.	WEEKLY RATES OF WAGES PAID AND AVERAGE NUMBER OF EMPLOYÉS AT EACH RATE, INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS, BUT NOT THOSE EMPLOYED ON PIECEWORK—continued.										
	Males above 16 years—Continued.			Females above 15 years.				Children.			
	\$15 and over but under \$20.	\$20 and over but under \$25.	\$25 and over.	Total number.	Under \$5.	\$6 and over but under \$7.	\$7 and over but under \$8.	\$12 and over but under \$15.	Total number.	Under \$5.	\$5 and over but under \$6.
The United States.....	107	23	46	34	20	11	2	1	67	65	2
New England states.....	18	4	6	17	15	1	.....	1	.....	.....	.....
Middle states.....	63	8	25	7	5	.....	2	.....	61	61	.....
Western states.....	17	9	15	10	.....	10	.....	.....	6	4	2
Pacific states.....	9	1	.....	.....	.....	.....	.....	.....	.....	.....	.....

a The average weekly earnings per employé are computed from individual reports. The average number of employés reported by each establishment is multiplied by the number of weeks embraced by the term of operation; the result is the number of weeks required for 1 employé to perform the labor. Aggregating such results of individual reports, the number of weeks required for 1 employé to perform the labor is obtained. This number used as a divisor for the total wages produces the true average weekly earnings.

b In comparing the weekly rates of wages and the number of employés at each rate, with the average weekly earnings, it must be remembered that it is not practicable to obtain true average weekly earnings from the table of weekly rates, because the term of employment varies for employés at the respective rates.

IRON AND STEEL MANUFACTURE.

IRON AND STEEL MANUFACTURE.

BY WILLIAM M. SWEET.

The branches of the iron and steel industry included in this report comprise only the operations of blast furnaces, rolling mills and steel works, iron ore forges, and pig iron and scrap iron bloomeries. The products of blast furnaces embrace pig iron, including spiegeleisen and a few castings made direct from the furnace. The products of steel works embrace all kinds of steel in the form of ingots or castings. The products of iron and steel rolling mills embrace all rolled or hammered iron and steel made by such works, and also the products of rolling mill establishments which continue the manipulation of the iron and steel until more highly finished products, such as nails and spikes, bolts, nuts, and wire, are produced, these latter articles, in some instances, constituting the principal portion of the finished products. The products of forges and bloomeries embrace blooms and hammered bar iron made directly from iron ore or from pig iron and scrap iron. In giving the tonnage of these products, and of the materials used in their manufacture, the net ton of 2,000 pounds will be used.

The period covered by this report is the year beginning July 1, 1889, and ending June 30, 1890. The subject-matter of the report is presented under 4 heads, as follows:

1. The iron and steel industry in its entirety.
2. Blast furnaces.
3. Rolling mills and steel works.
4. Iron ore forges and pig iron and scrap iron bloomeries.

The first division comprises the data pertaining to the entire industry. The statistics are subsequently shown for each of the various branches of the industry, and these branches are also considered by totals for groups of states. The following summary shows the leading statistics of the industry, by totals, for the United States, as ascertained at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, IRON AND STEEL INDUSTRY, 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments.....	808	792	719
Capital	\$121,772,074	\$209,904,905	c\$414,044,844
Miscellaneous expenses.....	(d)	(d)	\$18,214,948
Average number of employes (aggregates)	77,555	e140,798	176,506
Total wages	\$40,514,981	e\$55,461,510	\$95,736,192
Officers, firm members, and clerks:			
Average number.....	(f)	(f)	4,325
Total wages			\$6,462,236
All other employes:			
Average number.....	(f)	(f)	171,181
Total wages			\$89,273,956
Cost of materials used.....	\$135,526,132	\$191,271,150	\$327,272,846
Value of products (g)	\$207,208,696	\$296,557,685	\$478,687,519
Tons of products	3,655,215	7,265,140	18,216,215

a In addition to the data shown in this statement there were reported at the census of 1880, 200 idle plants, with a capital of \$18,930,983, and 13 plants in course of construction, valued at \$2,126,931. At the census of 1890, 119 idle plants reported a capital of \$12,869,058, and 34 plants in course of construction, valued at \$4,091,678. The capital in idle works and those in course of construction was not reported separately at the census of 1870.

b For explanation of the apparent discrepancies in the data for 1870 and 1880 see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employes, and wages relating to mining and other operations in the figures for 1880.

c Includes hired property, valued at \$8,273,058. This item was not reported separately at previous censuses.

d Not reported.

e Does not include 130 employes and \$25,275 wages reported by an idle establishment in Minnesota, and included in the totals published at the census of 1880. These employes were engaged in making repairs to plant.

f Not reported separately.

g Includes values for which tonnage was not reported.

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The following comparative statement exhibits the leading statistics for the iron and steel industry, by states and territories, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, IRON AND STEEL INDUSTRY, BY STATES AND TERRITORIES: 1880 AND 1890. (a)

STATES AND TERRITORIES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The United States	1880	702	\$200,004,005	140,798	\$85,451,510	\$191,271,150	\$200,557,685
	1890	719	2414,041,844	175,506	293,736,192	327,272,845	478,687,519
Alabama	1880	8	2,757,196	1,026	571,713	601,073	1,452,856
	1890	35	17,987,583	5,878	2,522,008	7,425,344	12,544,227
California	1880	1	1,000,000	319	177,722	535,500	780,000
	1890	4	4,656,611	1,152	749,849	1,938,333	3,097,155
Colorado	1880	1	100,000	125	7,000	131,700	225,000
	1890						
Connecticut	1880	17	2,557,000	685	331,184	1,341,225	1,908,698
	1890	13	2,180,521	690	418,189	1,324,078	2,037,618
Delaware	1880	8	1,341,460	807	344,476	1,214,050	2,847,177
	1890	7	2,558,865	1,690	849,219	1,540,539	2,608,670
District of Columbia	1880	1	80,000	18	7,528	2,264	10,970
	1890						
Georgia	1880	9	973,800	1,303	185,489	631,707	990,850
	1890	5	908,243	357	112,170	321,728	471,757
Illinois	1880	16	5,795,620	5,253	2,508,718	14,977,145	20,545,289
	1890	24	34,689,910	8,864	5,490,191	30,039,674	39,011,051
Indiana	1880	12	2,283,000	2,048	864,021	3,293,073	4,551,403
	1890	15	4,099,095	2,717	1,254,161	3,075,056	4,742,760
Kansas	1880	2	450,000	630	166,500	734,245	1,004,100
	1890						
Kentucky	1880	18	4,610,035	4,095	1,344,400	3,223,799	5,000,029
	1890	9	2,310,655	1,483	734,178	1,703,144	2,725,603
Maine	1880	3	450,000	700	141,494	380,511	583,328
	1890						
Maryland	1880	18	4,402,125	2,763	905,090	2,888,574	4,470,050
	1890	10	4,217,674	1,272	306,351	2,217,173	2,869,208
Massachusetts	1880	24	6,163,408	6,513	2,576,539	6,657,232	10,288,921
	1890	15	9,005,555	5,337	2,652,039	6,951,018	11,201,149
Michigan	1880	15	3,842,380	3,089	922,507	3,270,420	4,591,613
	1890	19	6,696,541	1,509	896,117	4,135,901	5,829,843
Missouri	1880	12	5,698,000	3,139	734,575	3,249,558	4,660,530
	1890	9	3,495,913	1,314	720,901	2,079,254	3,237,542
Nebraska	1880	1	100,000	100	50,000	114,500	82,000
	1890						
New Hampshire	1880	2	650,000	290	127,690	523,355	807,340
	1890						
New Jersey	1880	37	3,764,050	4,792	1,808,448	6,556,283	10,341,896
	1890	28	11,697,362	5,206	2,784,974	7,031,046	11,018,575
New York	1880	74	19,752,471	11,444	4,099,451	13,395,220	22,219,219
	1890	44	16,282,435	7,034	3,605,654	10,424,852	15,849,537
North Carolina	1880	9	190,400	63	7,907	11,792	41,085
	1890						
Ohio	1880	103	22,807,006	20,071	8,205,070	23,997,915	34,918,360
	1890	101	37,642,887	24,166	14,126,669	44,551,301	65,206,828
Oregon	1880	1	100,000	250	46,822	33,073	78,393
	1890						
Pennsylvania	1880	321	102,956,223	57,952	25,095,850	92,267,030	145,576,268
	1890	311	226,294,407	94,572	52,680,180	180,220,237	264,571,624
Rhode Island	1880	1	350,000	275	130,909	375,347	488,040
	1890						
Tennessee	1880	29	2,862,826	3,077	659,773	1,370,059	2,274,203
	1890	15	4,613,355	1,557	775,521	2,943,671	4,247,808

a This statement includes only active establishments.

b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employés, and wages relating to mining and other operations.

c Does not include 180 employés and \$25,275 wages reported by an idle establishment in Minnesota and included in the totals published at the census of 1880. These employés were engaged in making repairs to plant.

d Includes hired property valued at \$3,273,058. This item was not reported separately at the census of 1880.

e Includes 4,325 officers, firm members, and clerks and their wages, amounting to \$6,462,230, distributed as follows: Alabama 193, \$319,044; California 33, \$56,549; Connecticut 41, \$55,784; Delaware 53, \$73,061; Georgia 18, \$23,125; Illinois 179, \$269,308; Indiana 69, \$103,013; Kentucky 48, \$63,689; Maryland 25, \$24,358; Massachusetts 127, \$182,964; Michigan 82, \$130,756; Missouri 45, \$65,802; New Jersey 146, \$238,183; New York 180, \$301,343; Ohio 620, \$864,528; Pennsylvania 2,009, \$3,129,515; Tennessee 85, \$118,446; Virginia 100, \$145,908; West Virginia 76, \$103,445; Wisconsin 30, \$50,754; all other states 65, \$128,161. These classes were not reported separately at the census of 1880.

f See note a at end of table.

COMPARATIVE STATEMENT, IRON AND STEEL INDUSTRY, BY STATES AND TERRITORIES: 1880 AND 1890—Continued.

STATES AND TERRITORIES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYEES AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
Texas	1880 α1890	1	\$40,000	140	\$27,720	\$23,580	\$36,000
Vermont	1880 1890	2	320,000	191	50,035	240,000	392,300
Virginia	1880 1890	21 21	2,294,713 6,330,993	2,522 3,110	665,432 1,263,360	1,490,151 4,404,452	2,585,999 6,320,084
West Virginia	1880 1890	16 12	3,712,616 6,458,924	4,121 3,833	1,541,816 1,838,209	3,484,625 7,906,030	6,054,032 10,556,865
Wisconsin	1880 1890	8 9	2,708,218 6,461,531	2,153 1,920	1,004,931 1,032,541	3,830,667 4,613,753	6,580,391 6,501,761
Wyoming	1880 α1890	1	212,003	184	79,650	403,568	491,345
All other states	α1890	13	5,446,875	1,755	839,711	2,417,165	4,031,794

α Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 2; Iowa, 1; Maine, 2; Minnesota, 1; New Hampshire, 1; North Carolina, 1; Oregon, 1; Rhode Island, 1; Texas, 1; Washington, 1; Wyoming, 1.

In comparing the statistics of the Eleventh with those given at previous censuses, the following facts must be constantly borne in mind. The values reported at 1870 were expressed in a currency which was at a great discount in gold. The average premium on gold during the 12 months (June 1, 1869, to May 31, 1870) which constituted the census year was about one-fourth (25.3 per cent). A premium on gold of one-fourth is equal to a discount on currency of one-fifth. For purposes of comparison, therefore, the values of 1870 should be reduced in that ratio. The statistics for 1880 include not only the investment in blast furnace plants and machinery, and the labor directly employed in pig iron production, but also the capital and labor employed in mining and other operations conducted in direct connection with these works. Notwithstanding this fact, the cost of materials reported was apparently the cost at the furnace. There is a duplication to this extent in the cost of production, and this accounts in a measure for the inconsistencies in the figures published for the Tenth Census. In order that the census of 1890, so far as practicable, should show data relating to the manufacture of pig iron separate from other industrial operations, the statistics for that year relating to iron ore and coal mining, coke making, limestone quarrying, charcoal burning, and other similar industries dependent on the manufacture of pig iron, whether conducted in direct connection with the blast furnaces or operated independently and at remote distances, have been eliminated from the tabular statements contained in this report, these data being included in the statistics of other branches of census investigation. On the other hand, the statistics of "Live assets", such as cash, bills and accounts receivable, and similar items of capital, are believed to have been more fully reported at 1890 than at previous censuses.

The increased demands of the country for all forms of iron and steel have stimulated production during the past 20 years, while the tendency to the concentration of special branches of manufacture in large and well equipped works, and the economy brought about by the introduction of modern machinery and better furnace and mill practice have greatly reduced the selling prices of products during this period. For this reason a comparison of the aggregate tonnage of products more accurately indicates the growth in the industry than does the total value of products. From 1870 to 1880 the value of products increased from \$207,208,696 to \$296,557,685, or 43.12 per cent, and the tons of products from 3,655,215 to 7,265,140, or 98.76 per cent. During the decade from 1880 to 1890 the value of products increased from \$296,557,685 to \$478,687,519, or 61.41 per cent, while during the same period the tons of all products increased from 7,265,140 to 18,216,215, or 150.73 per cent.

COMPARATIVE PRODUCTION BY STATES.

Pennsylvania continues to be the leading iron and steel producing state in the country. In 1890 it contributed 53.02 per cent to the aggregate tonnage of all forms of iron and steel produced in that year, as compared with 49.78 per cent in 1880, and 50.25 per cent in 1870. From 1880 to 1890 it increased its production from 3,616,668 tons to 9,657,474 tons, or 167.03 per cent, while the increased output of the whole country was 150.73 per cent, or from 7,265,140 tons to 18,216,215 tons. From 1870 to 1880 the aggregate production of the whole country increased 98.76 per cent, while that of Pennsylvania increased 96.90 per cent. Ohio was the second state in production in both 1890 and 1880, increasing its production from 930,141 tons in 1880 to 2,475,532 tons in 1890, or 166.15 per cent. New York, which was third in rank in 1880, occupied fifth place in 1890, while Illinois advanced from fourth in rank in 1880 to third place in 1890. Alabama produced 6,550 tons in 1870, occupying the twentieth place in that year. In 1880 it advanced to fifteenth in rank, producing 62,986 tons, while in 1890 it was the fourth in prominence, the output in the latter year being 967,814 tons. West Virginia advanced from seventh in rank in

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1880 to sixth place in 1890, while Virginia and Tennessee, which were, respectively, the sixteenth and fourteenth in rank in 1880, were seventh and eighth, respectively, in 1890. Vermont, Nebraska, and the District of Columbia have abandoned the manufacture of iron and steel since 1880. All the other States in which iron and steel were made in 1880 increased their production in 1890 except Kansas, Kentucky, Georgia, Wyoming, New York, and New Hampshire. The following statement shows the relative rank of the states and territories in 1880 and 1890, in the aggregate output of all forms of iron and steel:

COMPARATIVE STATEMENT OF PRODUCTION, STATES RANKED ACCORDING TO QUANTITY OF PRODUCT, IRON AND STEEL INDUSTRY: 1880 AND 1890.

STATES AND TERRITORIES.	RANK.		PRODUCTION.		STATES AND TERRITORIES.	RANK.		PRODUCTION.	
	1880	1890	1880	1890		1880	1890	1880	1890
Total			<i>Tons.</i> 7,265,140	<i>Tons.</i> 18,216,215	California.....	21	18	14,000	56,747
Pennsylvania.....	1	1	3,616,608	9,657,474	Connecticut.....	17	19	38,061	49,982
Ohio.....	2	2	930,141	2,475,532	Colorado.....	27	20	4,500	33,832
Illinois.....	4	3	417,967	1,657,325	Georgia.....	18	21	35,152	30,049
Alabama.....	15	4	62,986	967,814	Maine.....	22	22	10,866	14,000
New York.....	3	5	598,300	599,712	Rhode Island.....	24	23	8,134	13,066
West Virginia.....	7	6	147,487	389,207	Wyoming.....	23	24	9,790	9,305
Virginia.....	16	7	55,722	364,809	Texas.....	30	25	1,400	8,950
Tennessee.....	14	8	77,100	316,540	Oregon.....	28	26	3,200	8,411
New Jersey.....	5	9	243,860	303,430	New Hampshire.....	25	27	7,978	6,650
Wisconsin.....	6	10	178,935	280,838	Washington.....		28		4,787
Michigan.....	8	11	142,716	268,415	North Carolina.....	31	29	439	3,377
Massachusetts.....	9	12	141,321	159,091	Minnesota.....		30		2,565
Missouri.....	10	13	125,758	128,738	Iowa.....		31		1,183
Indiana.....	13	14	96,117	126,661	Kansas.....	20		19,055	
Maryland.....	12	15	110,934	122,178	Vermont.....	26		6,620	
Kentucky.....	11	16	123,751	93,390	Nebraska.....	29		2,000	
Delaware.....	19	17	38,918	58,437	District of Columbia.....	32		264	

CAPITAL.

The aggregate capital reported for the iron and steel industry, both in active and idle establishments, and those in course of construction, including hired property, amounted to \$230,971,884 in 1880 as compared with \$430,505,580 reported at the census of 1890, an increase of 86.39 per cent. The following comparative statement shows the distribution of capital for the industry as reported at the censuses of 1880 and 1890.

Idle establishments embrace such establishments as were not in operation during any part of the census year, but were likely to be put in operation at some future period. Establishments that have been abandoned for iron and steel making purposes are not embraced in this report.

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, IRON AND STEEL INDUSTRY: 1880 AND 1890.

CLASSES OF ESTABLISHMENTS.	Year.	Number of estab-lish-ments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock and finished products on hand, cash and bills receivable.
Total	1880 1890	1,005 872	<i>a</i> \$230,971,884 \$430,505,580	\$122,004,227 212,595,672	\$108,967,657 217,909,908
Establishments in operation	1880 1890	792 719	209,904,905 414,044,844	112,320,428 200,197,208	97,594,537 213,847,036
Idle establishments	1880 1890	200 119	18,939,988 12,360,058	9,094,349 9,185,667	9,845,639 3,183,391
Establishments in course of construction	1880 1890	13 34	2,126,931 4,091,678	589,450 3,212,797	1,537,481 878,881

a See remarks in regard to inclusion of capital relating to mining and other operations in the figures for 1880.

b Includes hired property valued at \$8,273,058; also hired property valued at \$18,000 invested in idle establishments. This item was not reported separately at the census of 1880.

The value of land, stock in process, and finished products on hand, cash, bills receivable, unsettled ledger accounts, were not reported separately at the census of 1880, consequently in comparative statements only the totals of these items are given. The value of hired property was not reported separately at the Tenth Census, and is included in the aggregate capital for both periods.

In the following statement a similar presentation is made of the aggregate capital in each of the 3 branches of the iron and steel industry:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN DIFFERENT BRANCHES OF THE IRON AND STEEL INDUSTRY: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	BLAST FURNACES.		ROLLING MILLS AND STEEL WORKS.		FORGES AND BLOOMERIES.	
		Number of establishments.	Capital.	Number of establishments.	Capital.	Number of establishments.	Capital.
Total	1880 1890	400 400	^a \$105,151,176 \$143,633,926	397 440	\$121,424,745 \$265,796,684	118 32	\$4,395,968 1,074,970
Establishments in operation.....	1880 1890	341 304	89,531,362 134,608,543	358 395	116,458,300 278,559,831	93 20	3,915,213 876,470
Idle establishments.....	1880 1890	142 73	14,394,883 6,458,865	33 34	4,064,355 5,711,693	25 12	480,750 198,500
Establishments in course of construction.....	1880 1890	7 23	1,224,931 2,566,518	6 11	902,000 1,525,160	.....	.....

^a See remarks in regard to inclusion of capital relating to mining and other operations in the figures for 1880.

^b Includes hired property valued at \$5,061,058. This item was not reported separately at the census of 1880.

^c Includes hired property valued at \$3,212,000; also hired property valued at \$18,000 invested in idle establishments. Hired property was not reported separately at the census of 1880.

The amount of capital invested in active and idle establishments and those in course of construction in the different states and territories, with the number of establishments reported in 1880 and 1890, is given in the following statement:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, IRON AND STEEL INDUSTRY, BY STATES AND TERRITORIES: 1880 AND 1890.

STATES AND TERRITORIES.	Year.	AGGREGATES.		ESTABLISHMENTS IN OPERATION.		IDLE ESTABLISHMENTS.		ESTABLISHMENTS IN COURSE OF CONSTRUCTION.	
		Number of establishments.	Capital.	Number of establishments.	Capital.	Number of establishments.	Capital.	Number of establishments.	Capital.
The United States.....	1880 1890	1,005 872	^a \$230,971,884 \$430,505,580	792 719	\$209,904,965 \$14,044,844	200 110	\$18,939,988 12,809,058	13 34	\$2,126,931 4,091,978
Alabama.....	1880 1890	14 45	3,369,106 19,070,976	8 35	2,757,106 17,987,563	5 3	399,000 297,393	1 7	153,000 780,000
California.....	1880 1890	1 4	1,000,000 4,656,611	1 4	1,000,000 4,656,611	.....	.....	.....	.....
Colorado.....	1880 ^c 1890	1	100,000	1	100,000.....	.....	.....	.....	.....
Connecticut.....	1880 1890	19 15	2,682,000 2,317,821	17 13	2,557,000 2,189,521	2 2	125,000 128,300	.....	.....
Delaware.....	1880 1890	9 9	1,431,469 2,960,722	8 7	1,341,469 2,558,865	1 2	90,000 401,857	.....	.....
District of Columbia.....	1880 1890	1	89,600	1	89,600.....	.....	.....	.....	.....
Georgia.....	1880 1890	14 7	1,135,900 991,243	9 5	973,800 908,243	5 1	162,100 43,000	1	40,000
Illinois.....	1880 1890	21 30	6,460,620 35,473,169	16 24	5,795,620 34,689,919	4 4	490,000 513,250	1 2	175,000 270,000
Indiana.....	1880 1890	12 18	2,283,000 4,387,095	12 15	2,283,000 4,099,095	.....	288,000	.....	.....
Kansas.....	1880 ^c 1890	2	450,000	2	450,000.....	.....	.....	.....	.....
Kentucky.....	1880 1890	29 15	5,493,035 3,044,555	18 9	4,610,035 2,310,655	11 4	883,000 380,000	2	351,000
Maine.....	1880 ^c 1890	3	450,000	3	450,000.....	.....	.....	.....	.....
Maryland.....	1880 1890	23 14	4,902,125 5,170,574	18 10	4,402,125 4,217,574	5 3	560,000 385,000	1	508,000

^a See remarks as to inclusion of capital relating to mining and other operations in the figures for 1880.

^b Includes hired property valued at \$3,273,058; also hired property valued at \$18,000 invested in idle establishments. This item was not reported separately at the census of 1880.

^c See note ^a at end of table.

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COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, IRON AND STEEL INDUSTRY, ETC.—Continued.

STATES AND TERRITORIES.	Year.	AGGREGATES.		ESTABLISHMENTS IN OPERATION.		IDLE ESTABLISHMENTS.		ESTABLISHMENTS IN COURSE OF CONSTRUCTION.	
		Number of establishments.	Capital.	Number of establishments.	Capital.	Number of establishments.	Capital.	Number of establishments.	Capital.
Massachusetts.....	1880	30	\$6,738,408	24	\$6,163,408	6	\$575,000		
	1890	16	9,068,555	15	9,005,555	1	63,000		
Michigan.....	1880	22	4,175,386	15	3,342,386	6	813,000	1	\$20,000
	1890	20	7,225,241	19	6,696,541	6	373,700	4	155,000
Minnesota.....	1880	1	150,000			1	150,000		
	1890								
Missouri.....	1880	22	9,152,472	12	5,698,600	8	3,104,500	2	349,372
	1890	13	5,890,428	9	3,495,913	4	2,394,515		
Nebraska.....	1880	1	100,000	1	100,000				
	1890								
New Hampshire.....	1880	2	650,000	2	650,000				
	1890								
New Jersey.....	1880	40	9,099,050	37	8,764,050	3	335,000		
	1890	37	12,649,162	28	11,607,302	9	951,800		
New York.....	1880	80	21,543,221	74	19,752,471	15	1,790,750		
	1890	55	17,330,190	44	16,282,435	11	1,047,755		
North Carolina.....	1880	20	750,400	9	100,400	11	560,000		
	1890								
Ohio.....	1880	134	25,141,294	103	22,807,606	30	2,244,688	1	89,000
	1890	118	39,927,290	101	37,642,887	16	2,197,013	1	87,300
Oregon.....	1880	1	100,000	1	100,000				
	1890								
Pennsylvania.....	1880	366	107,304,782	321	102,056,223	41	3,608,000	4	740,559
	1890	344	228,194,361	311	226,294,407	30	1,332,175	3	567,779
Rhode Island.....	1880	3	630,000	1	350,000	2	280,000		
	1890								
Tennessee.....	1880	43	3,681,776	29	2,862,826	14	818,950		
	1890	20	5,051,154	15	4,613,355	3	256,500	2	181,299
Texas.....	1880	1	40,000	1	40,000				
	1890								
Utah.....	1880	3	150,000			2	90,000	1	60,000
	1890								
Vermont.....	1880	4	410,000	2	320,000	2	90,000		
	1890								
Virginia.....	1880	44	4,329,713	21	2,294,713	22	1,535,000	1	500,000
	1890	39	7,508,093	21	6,330,993	9	253,800	9	923,300
West Virginia.....	1880	20	3,913,616	16	3,712,616	3	161,000	1	40,000
	1890	13	6,488,624	12	6,458,924	1	30,000		
Wisconsin.....	1880	9	2,843,218	8	2,768,218	1	75,000		
	1890	11	6,582,031	9	6,461,531	1	6,500	1	114,000
Wyoming.....	1880	1	212,603	1	212,603				
	1890								
All other states.....	1890	20	6,517,375	13	5,446,875	6	1,025,500	1	45,000

^a Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 3; Iowa, 1; Kansas, 1; Maine, 2; Minnesota, 2; New Hampshire, 1; North Carolina, 1; Oregon, 1; Rhode Island, 1; Texas, 5; Washington, 1; Wyoming, 1.

The figures contained in this report furnish only a partial exhibit of the amount of capital invested in the iron and steel industries of the United States. The statistics here given are intended to exhibit, as accurately as the ramifications of the industry will permit, the actual capital directly employed in the production of crude and finished forms of iron and steel by blast furnaces, rolling mills, steel works, and forges and bloomeries. A large number of iron and steel manufacturers not only operate blast furnaces, rolling mills, and steel plants, but also control the iron ore and coal mines, coke ovens, and timber lands which supply the works with the larger part of the raw materials consumed. The census statistics for 1890 of the iron ore, coal, coke, and similar industries were embraced by other branches of census investigation, whether operated by iron and steel manufacturers or by separate concerns, and it therefore became necessary, in order to prevent duplications, to eliminate from the statistics for 1890 the data pertaining to such operations. Were the statistics of the employes in these various industries dependent either wholly or in part on the manufacture of iron and steel included in this report, the number of persons shown to be supported by our iron and steel industries would be considerably increased.

MISCELLANEOUS EXPENSES.

In the inquiry relating to the iron and steel industry at the census of 1880, no attempt was made to determine the various elements entering into the cost of manufacture, excepting the expenditure for labor and materials. The inquiry in 1890 contained questions designed to obtain information as to the entire cost of manufacture, but took no cognizance of selling and other mercantile expenses. The questions concerning miscellaneous expenses were generally answered and the data are apparently consistent when considered by individual reports and in connection with the conditions under which each particular establishment was operated, but when aggregated with similar data for other works, operated under entirely different conditions, the totals obtained are misleading. Many furnace companies in addition to manufacturing pig iron, quarry the limestone, mine the coal, manufacture the coke, and mine a large part of the iron ores consumed by them, in addition to operating a railroad in connection with some of the mines and quarries. Other concerns, while selling a large part of the pig iron they produce, manufacture a considerable portion of their crude product into more highly finished articles. While the expenditures for labor and materials in these various operations are kept as separate as if they belonged to different companies, manufacturers claimed that it was impossible to determine what part of the amount paid for taxes, interest on cash used in the business, and other sundry expenditures should be charged to each of the several branches of industry. Consequently the amounts reported for these different items by many of the establishments included not only the expenses connected with the manufacture of iron and steel, but expenses properly chargeable to classes of industry covered by other census investigations.

DEPRECIATION OF PLANT.

The interrogatory in the schedules relating to the average annual depreciation of plant was not answered by the manufacturers to a sufficient extent to obtain comprehensive results, because comparatively few establishments kept distinct accounts of the cost of labor and materials entering into the necessary repairs and additions to the works. During the last decade competition has been so active in the manufacture of iron and steel that extraordinary expenditures for remodeling old and adding new machinery and appliances have been necessary to meet the changing conditions of manufacture. Many of the blast furnaces which were in operation in 1880 have since been torn down and entirely rebuilt, with the addition of new machinery. The substitution of steel for iron has compelled rolling mill establishments to remodel their plants and add more powerful machinery of improved design.

The necessity for such changes has been so constant that it is only those establishments which have been foremost in the judicious expenditure of capital for keeping their plants fully equipped with the best appliances for manufacturing according to the most approved methods that have been able to successfully cope with the changed conditions and continue as large producers.

These remarks apply especially to the manufacture of steel rails. Establishments which were equipped with the most efficient machinery in 1880 found it necessary to entirely remodel their mills a few years later, and subsequently to replace these improvements by even more modern and economical methods of manufacture.

EMPLOYÉS AND WAGES.

The inquiry at the Eleventh Census respecting employés and wages called for the average number of males, females, and children, and the total wages paid, respectively, by classes: first, officers or firm members; second, clerks; third, operatives, engineers, and other skilled workmen, overseers, and foremen or superintendents (not general superintendents or managers); fourth, watchmen, laborers, teamsters, and other unskilled workmen. The average number of males, females, and children respectively, at specified weekly wages, was also requested, and the time the establishment was in operation, with the number of hours constituting a day's labor.

The inquiry concerning employés and wages used at the Tenth Census did not require the employés to be reported by classes.

The total number of employés reported at the census of 1890 in the branches of the iron and steel industry comprised in this report, exclusive of officers, firm members, and clerks, was 171,181, receiving \$89,273,956 as wages. By dividing the number of employés into the aggregate wages there is obtained \$521.52 as the average amount paid to each employé. A moment's consideration, however, will show that these figures in no respect exhibit the average yearly earnings of the employés engaged in the iron and steel industry, nor do they supply any basis upon which to determine this information. The iron and steel establishments reporting were not all in operation throughout the entire year. Some establishments did not start up until toward the close of the census year; the employés needed to operate them being drawn from other branches of industry. Many concerns, during periods when the establishments are not in operation, employ the workmen in making repairs, preparing materials for the works, or in other labor, the amount so expended, although contributing to the yearly earnings of each employé, is not charged to iron and steel manufacture, and consequently is not included in the aggregate wages. It is only by a full knowledge of the labor performed by employés during periods when they are not in demand for iron and

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steel making that a showing of the average annual earnings for each person engaged in the iron and steel industry may be made.

As the statistics of employes at the blast furnaces in 1880 include not only those engaged in the manufacture of pig iron, but also in many cases the workmen employed in mining and other operations conducted in connection with these establishments, exact comparisons can not be made with the figures for 1890, which excludes the labor employed in the production of materials consumed by the furnaces. This will account for the apparent decrease in the number of employes in blast furnaces.

The following is a comparative statement of the average number of employes in the various branches of the iron and steel industry, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, AVERAGE NUMBER OF EMPLOYÉS, IRON AND STEEL INDUSTRY: 1880 AND 1890.

CLASS OF WORKS.	AVERAGE NUMBER OF EMPLOYÉS.							
	Aggregate.		Males above 16 years.		Females above 15 years.		Children.	
	1880 (a)	1890 (b)	1880 (a)	1890 (b)	1880	1890 (b)	1880	1890
Total	c140,798	175,506	c133,023	173,212	45	114	7,730	2,180
Blast furnaces	c11,695	34,483	c40,503	34,402	9	7	1,183	74
Rolling mills and steel works	96,164	140,537	89,645	138,327	33	107	6,486	2,103
Forges and bloomeries	2,930	486	2,875	483	3	.....	61	3

a In many cases the employes reported for 1880 included those at work in mines and other operations not covered by this report.

b Includes officers or firm members and clerks. These classes were not reported separately at the census of 1880.

c Does not include 180 employes reported by an idle establishment in Minnesota and included in the totals published at the census of 1880. These employes were engaged in making repairs to plant.

The following statement presents the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employes, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, IRON AND STEEL INDUSTRY: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number	Wages.	Number.	Wages.
All classes	175,506	\$95,736,192	173,212	\$95,273,168	114	\$46,816	2,180	\$416,208
Officers or firm members	1,407	3,820,848	1,407	3,820,848	.....	.....	.....	.....
Clerks	2,918	2,641,388	2,862	2,611,078	56	29,710	.....	.....
Skilled	87,049	57,095,737	86,914	57,958,147	2	1,040	133	36,550
Unskilled	84,132	31,278,210	82,029	30,882,495	56	16,066	2,047	379,058

The following statement presents the average number of employes at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, IRON AND STEEL INDUSTRY: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.		
	Males above 16 years.	Females above 15 years.	Children.
Total	168,943	58	2,180
Under \$5	1,643	28	1,533
\$5 and over but under \$6	3,424	12	347
\$6 and over but under \$7	10,198	8	282
\$7 and over but under \$8	20,265	4	16
\$8 and over but under \$9	25,041	3	2
\$9 and over but under \$10	23,727	1	.....
\$10 and over but under \$12	24,516	2	.....
\$12 and over but under \$15	24,458	.....	.....
\$15 and over but under \$20	17,974	.....	.....
\$20 and over but under \$25	10,502	.....	.....
\$25 and over	7,195	.....	.....

MATERIALS USED.

CONSUMPTION OF FUEL.

Of the total cost of materials used by iron and steel works in 1890, amounting to \$327,272,845, the expense for fuel was \$55,561,749, or 16.98 percent, as compared with 18.81 per cent in 1880.

The following is a comparative statement of the quantity and cost of each kind of fuel used in the different branches of the iron and steel industry in 1880 and 1890:

COMPARATIVE STATEMENT, QUANTITY AND COST OF FUEL CONSUMED IN THE DIFFERENT BRANCHES OF THE IRON AND STEEL INDUSTRY: 1880 AND 1890.

KINDS OF FUEL.	Year.	AGGREGATES.		BLAST FURNACES.		ROLLING MILLS AND STEEL WORKS.		FORGES AND BLOOMERIES.	
		Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.
Total	1880		\$35,060,873		\$21,017,002		\$13,202,597		\$850,274
	1890		55,561,749		37,884,383		17,397,434		270,932
Anthracite coal.....tons..	1880	3,322,498	9,880,037	2,615,182	8,012,755	706,976	1,875,002	340	1,220
	1890	2,973,914	6,054,420	2,012,477	5,165,761	961,039	1,487,713	398	946
Bituminous coal.....tons..	1880	5,659,055	12,010,440	1,051,753	2,095,887	4,605,689	10,510,255	1,613	4,298
	1890	5,723,400	10,420,030	551,007	759,522	5,171,102	9,663,208	1,300	3,300
Coke.....tons..	1880	2,277,555	8,743,382	2,128,255	8,120,240	142,605	582,901	6,695	31,241
	1890	9,632,390	28,752,072	9,237,935	27,435,780	393,050	1,311,588	1,405	5,604
Charcoal.....bushels..	1880	60,592,091	4,726,114	53,900,828	3,679,120	2,667,902	234,379	13,014,861	812,015
	1890	74,490,202	5,037,175	67,072,156	4,523,320	2,770,611	243,773	4,056,435	270,082
Oil used for fuel.....barrels..	1880	853	900					853	900
	1890	1,859,138	1,124,206			1,859,138	1,124,206		
Natural gas.....	1880								
	1890		3,560,946				3,560,946		

The aggregate consumption of iron ore, mill cinder, and fluxing material, and the total cost of these materials used in the census years 1880 and 1890, are shown in the following statement:

COMPARATIVE STATEMENT, QUANTITY AND COST OF IRON ORE, MILL CINDER, AND FLUXING MATERIAL CONSUMED IN THE DIFFERENT BRANCHES OF THE IRON AND STEEL INDUSTRY: 1880 AND 1890.

CLASS OF MATERIALS.	Year.	AGGREGATES.		BLAST FURNACES.		ROLLING MILLS AND STEEL WORKS.		FORGES AND BLOOMERIES.	
		Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.
Total	1880	11,232,005	\$39,974,700	10,779,881	\$36,663,281	373,414	\$2,779,879	79,610	\$531,540
	1890	24,332,783	74,254,942	23,732,473	70,789,216	581,503	3,355,139	18,807	110,587
Iron ore	1880	7,709,708	36,516,697	7,256,684	33,205,278	373,414	2,779,879	79,610	531,540
	1890	17,425,422	66,971,256	10,825,112	63,505,530	581,503	3,355,139	18,807	110,587
Mill cinder	1880	354,048	910,667	354,048	910,667				
	1890	1,283,071	3,086,808	1,283,071	3,086,808				
Fluxing material	1880	3,169,149	2,547,336	3,169,149	2,547,336				
	1890	5,624,290	4,190,878	5,624,290	4,190,878				

OTHER MATERIALS.

The materials not mentioned in the preceding statements consist of different forms of iron and steel, and the following comparative statement gives the tonnage of this class of materials consumed in the iron and steel industry during the census years 1880 and 1890. The old or scrap material presented in this table includes only the old or waste materials purchased and consumed by the iron and steel works and takes no account of the scrap iron and scrap steel which are the constant product of rolling mills and steel works, and usually consumed by the works producing them.

COMPARATIVE STATEMENT, QUANTITY AND COST OF IRON AND STEEL USED AS MATERIAL, IRON AND STEEL INDUSTRY: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Tons.	Cost.	Tons.	Cost.
Aggregate.....	4,268,643	\$113,424,247	9,784,052	\$179,288,771
Old and scrap iron and steel (total).....	1,351,636	37,908,350	1,957,301	36,460,815
Old iron rails.....	708,534	20,701,099	392,495	9,109,765
Other old or scrap iron.....	447,078	11,708,274	907,623	10,778,388
Old steel rails and steel rail ends.....	85,653	2,435,263	145,837	2,627,610
Other old or scrap steel.....	110,371	3,003,714	451,346	7,945,013
All other materials (total).....	2,917,007	75,515,897	7,826,751	142,827,956
Spiegeleisen and ferro manganese.....	80,138	2,868,519	248,536	7,588,784
Pig iron.....	2,596,635	59,945,032	6,308,226	97,903,934
Hammered iron ore blooms.....	43,411	2,588,140	16,936	590,983
Hammered pig and scrap blooms.....	49,511	2,549,829	23,452	720,457
Purchased muck bar.....	53,754	2,369,544	234,078	6,252,594
Purchased bessemer steel.....	252,155	2,808,497	838,118	24,117,921
Purchased open-hearth steel.....	24,993	1,530,560	141,342	4,635,585
Swedish billets and bars.....	10,410	855,176	15,463	1,008,698

^a Sixteen thousand four hundred and ninety-six tons of "Other billets and bars" costing \$908,407, shown separately under classified materials in report for 1880, for comparative purposes are distributed as follows: 9,216 tons, \$507,509, with purchased bessemer steel, and 7,280 tons, \$400,898, with purchased open-hearth steel.

No section of the United States contains all the raw materials essential to the development of an extensive iron and steel industry. The southern states are endowed with a wealth of iron ore, coal, and limestone deposits in close proximity to each other, which permits the manufacture of pig iron at a cost considerably below that possible in other sections. This pig iron, however, is unsuitable for the manufacture of steel by the process most largely in use at the present time. Michigan and Wisconsin, although containing immense deposits of high grade ores for steel making purposes, have no mineral fuel economically available for iron making purposes, and in parts of these states there is a deficiency in the supply of wood for charcoal. Pennsylvania is rich in both anthracite and bituminous coal, but the iron ores with few exceptions carry only small percentages of iron and are suitable only for foundry and mill purposes. The wide separation of the materials for iron manufacture in the northern states necessitates the transportation of the ore and fuel long distances. The iron ore from Lake Superior is carried a distance of over 1,000 miles to the furnaces in central Pennsylvania, while the coke from the Connellsville region in Pennsylvania is used in the furnaces as far west as Chicago. The payment of freight on the various raw materials constitutes an important item in the cost of iron and steel manufacture.

PRODUCTION OF IRON AND STEEL.

The following is a comparative statement of the aggregate tonnage of iron and steel products in 1880 and 1890, with the percentages of increase or decrease in each class:

COMPARATIVE STATEMENT, CLASS, QUANTITY, AND PERCENTAGE OF INCREASE OR DECREASE OF PRODUCTS, IRON AND STEEL INDUSTRY: 1880 AND 1890.

CLASS OF PRODUCTS.	TONS.		PERCENTAGE OF INCREASE OR DECREASE.	
	1880	1890	Increase.	Decrease.
Total.....	7,265,140	18,216,215	150.73	.....
Pig iron, including castings direct from furnace.....	3,781,021	9,906,607	162.01	.....
Rolled and hammered products and direct steel castings:				
Iron.....	2,353,248	3,225,140	37.05	.....
Bessemer steel.....	869,896	4,385,365	392.80	.....
Open-hearth steel.....	93,143	590,198	533.65	.....
Crucible steel.....	70,810	69,903	.....	0.59
Miscellaneous steel.....	4,956	4,227	.....	14.71
Products of forges and bloomeries.....	72,557	34,775	.....	52.07

The counties showing the greatest production of iron and steel during the census year 1890, compared with the same counties for 1880, are presented in the following statement. These counties are divided into two classes, arranged in order of largest production in 1890. In one class are included those which produced in 1890 over

100,000 tons of pig iron and finished forms of iron and steel; the second class includes all counties producing over 60,000 tons, but less than 100,000 tons in 1890. In the first list are 31 counties, representing 8 states, and in the second list 19 counties, representing 11 states.

COMPARATIVE STATEMENT, PRODUCTION OF IRON AND STEEL, COUNTIES PRODUCING 60,000 TONS AND OVER IN 1890: 1880 AND 1890.

COUNTIES PRODUCING OVER 100,000 TONS OF PIG IRON, ROLLED AND HAMMERED IRON AND STEEL, AND BLOOMS.

COUNTIES.	NET TONS.		COUNTIES.	NET TONS.	
	1880	1890		1880	1890
Allegheny, Pa.....	848, 146	3, 706, 048	Lawrence, Pa.....	88, 443	262, 315
Cook, Ill.....	248, 479	1, 154, 259	Trumbull, Ohio.....	73, 369	247, 165
Jefferson, Ala.....	26, 052	684, 055	Marshall, W. Va.....	37, 700	206, 417
Mahoning, Ohio.....	210, 057	626, 282	Belmont, Ohio.....	56, 193	181, 876
Dauphin, Pa.....	223, 076	573, 853	Milwaukee, Wis.....	128, 191	174, 678
Cambria, Pa.....	260, 140	570, 330	Ohio, W. Va.....	84, 767	174, 305
Cuyahoga, Ohio.....	210, 354	554, 847	Rensselaer, N. Y.....	177, 967	172, 135
Lackawanna, Pa.....	151, 273	550, 132	Chester, Pa.....	78, 363	150, 886
Northampton, Pa.....	322, 882	500, 487	Lancaster, Pa.....	87, 019	127, 811
Morcer, Pa.....	182, 881	493, 022	Montour, Pa.....	79, 789	121, 455
Lehigh, Pa.....	324, 875	411, 187	Wayne, Mich.....	63, 548	115, 167
Lebanon, Pa.....	73, 149	403, 130	Albany, N. Y.....	40, 611	111, 150
Will, Ill.....	84, 094	369, 275	Columbiana, Ohio.....	44, 110	105, 773
Montgomery, Pa.....	168, 628	340, 874	Delaware, Pa.....	9, 988	104, 149
Berks, Pa.....	213, 580	395, 593	Fayette, Pa.....	37, 108	100, 628
Jefferson, Ohio.....	40, 561	202, 871			

COUNTIES PRODUCING OVER 60,000 BUT UNDER 100,000 TONS OF PIG IRON, ROLLED AND HAMMERED IRON AND STEEL, AND BLOOMS.

COUNTIES.	NET TONS.		COUNTIES.	NET TONS.	
	1880	1890		1880	1890
Worcester, Mass.....	30, 180	98, 492	Blair, Pa.....	68, 039	71, 013
Warren, N. J.....	76, 022	97, 595	Marion, Tenn.....	17, 958	70, 795
Lawrence, Ohio.....	70, 794	95, 444	Roanoke, Va.....		69, 916
Baltimore city and Baltimore county, Md.....	69, 944	94, 581	Hamilton, Tenn.....	35, 045	67, 907
Colbert, Ala.....		92, 395	St. Clair, Ill.....	26, 650	67, 794
St. Louis city and St. Louis county, Mo.....	102, 614	91, 252	Rhea, Tenn.....		64, 453
Armstrong, Pa.....	9, 300	88, 069	Perry, Ohio.....	34, 534	63, 259
Philadelphia, Pa.....	65, 983	82, 094	Oneida, N. Y.....	21, 108	61, 785
Alleghany, Va.....	8, 437	80, 423	Center, Pa.....	17, 411	61, 628
Essex, N. Y.....	66, 725	73, 699			

In the compilation of the statistics relating to the manufacture of iron and steel there is a partial duplication of some of the items that contribute to the aggregate tonnage and value of all products. In a number of instances the finished product of one establishment becomes the raw material of another, and after further manipulation appears again in the table of products. This duplication is unavoidable. The finished products of each individual establishment must be considered to comprise the various articles produced and sold by it, whether the articles are of the most highly finished character or are only suitable for remanufacture by the establishment purchasing them. Thus, "muck bar produced for sale" and steel sold by the bessemer and open-hearth steel works to other rolling mill establishments in the form of billets or slabs are unavoidable duplications, as these materials appear a second time as bars, plates, or other articles as the finished products of the establishments purchasing the crude metal.

Similar methods of tabulation were necessarily employed in presenting the results of previous censuses, so that accuracy of comparison of tonnages and values at different periods is not invalidated.

MANUFACTURING INDUSTRIES.

MACHINERY.

The following statement gives the number, equipment, and capacity of the iron and steel works in the United States, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, NUMBER, EQUIPMENT, AND CAPACITY OF ESTABLISHMENTS, IRON AND STEEL INDUSTRY: 1880 AND 1890.

[Including idle establishments.]

ITEMS.	1880	1890
Blast furnaces:		
Number of establishments	483	377
Number of completed furnaces	681	559
Total daily capacity in tons of pig iron	19,248	42,436
Rolling mills and steel works:		
Number of establishments	391	420
Total daily capacity in net tons of finished products	22,098	46,565
Number of single puddling furnaces, each double furnace counted as 2 single furnaces.	4,376	4,853
Number of heating furnaces	2,622	2,912
Number of hammers	458	625
Number of cut-nail machines	3,775	5,909
Number of trains of rolls	1,342	1,557
Number of bessemer steel converters (including Clapp-Griffiths and Robert-Bessemer).	24	97
Total daily capacity in tons of ingots	4,467	21,599
Number of open-hearth steel furnaces	37	120
Total daily capacity in tons of ingots	827	4,041
Number of pots which can be used at each heat in crucible steel works	2,691	2,636
Forges and bloomeries:		
Number of establishments	118	32
Number of fires	495	202
Number of hammers	141	39
Total daily capacity in tons of blooms, billets, or bars	520	295

At the census of 1890 the whole number of establishments reported, including those that were idle and in course of construction, was 872, as compared with 1,005 in 1880 and 808 in 1870. The decrease in the number of establishments from 1880 to 1890 is due largely to the decline in the manufacture of blooms and hammered bar iron direct from iron ore and from pig and scrap iron in forges and bloomeries, to the dismantling of many of the smaller blast furnace plants, to the erection of fewer but larger works, and to the many consolidations of existing establishments under one management which have taken place since 1880. The 483 blast furnace establishments in 1880, controlling 681 furnaces, had a total daily capacity of 19,248 tons of pig iron, while the 377 establishments in 1890, with only 559 furnaces, reported a total daily capacity of 42,436 tons. There is an increase in both the number and the capacity of establishments engaged in the manufacture of crude steel and of finished forms of iron and steel, the great expansion in the capacity being largely caused by improvements in machinery and methods of manufacture, the more general substitution of steel for iron, and greater rapidity in the working of plant.

MANUFACTURE OF PIG IRON—BLAST FURNACES.

The production of pig iron in the United States during the census year 1890 amounted to 9,906,607 tons of 2,000 pounds, as compared with an output of 3,781,021 tons in 1880, and 2,052,821 tons in 1870. From 1870 to 1880 the increase in production amounted to 1,728,200 tons, or 84.19 per cent, while from 1880 to 1890 the increase was 6,125,586 tons, or 162.01 per cent.

The following comparative summary indicates the growth of the pig iron industry since 1870:

COMPARATIVE SUMMARY, BLAST FURNACES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments	386	341	304
Capital	\$56,145,326	\$89,531,302	c\$134,008,543
Miscellaneous expenses	(d)	(d)	\$9,342,075
Average number of employes (aggregate)	27,554	e41,605	34,483
Total wages	\$12,475,250	e\$12,655,428	\$16,226,145
Officers, firm members, and clerks:			
Average number	(f)	(f)	1,068
Total wages			\$1,611,687
All other employes:			
Average number	(f)	(f)	33,415
Total wages			\$14,614,458
Cost of materials used	\$45,498,017	\$58,619,742	\$110,008,015
Value of products	\$69,640,498	g\$89,315,569	g\$145,643,153
Tons of products	2,052,821	3,781,021	9,906,607

a This statement includes only active establishments for the censuses of 1880 and 1890; such establishments were not reported separately at the census of 1870.
 b For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870, also in regard to the inclusion of capital, employes, and wages relating to mining and other operations in the figures for 1880.
 c Includes hired property valued at \$5,061,058. This item was not reported separately at previous censuses.
 d Not reported.
 e Does not include 180 employes and \$25,275 wages reported by an idle establishment in Minnesota, and included in the totals published for the census of 1880. These employes were engaged in making repairs to plant.
 f Not reported separately.
 g Includes values for which tonnage was not reported.

The following comparative statement exhibits the leading statistics of the blast furnace industry, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, BLAST FURNACES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The United States	1880	341	\$89,531,302	e41,605	e\$12,655,428	\$58,619,742	\$89,315,569
	1890	304	d134,008,543	e34,483	e16,226,145	110,008,015	145,643,153
Alabama	1880	7	2,707,196	1,566	553,713	575,073	1,405,366
	1890	28	15,778,786	4,139	1,783,700	6,493,884	10,915,091
Connecticut	1880	6	1,172,000	139	65,974	471,407	644,011
	1890	5	940,002	129	66,881	412,743	574,438
Georgia	1880	5	712,000	754	77,415	241,796	466,800
	1890	4	748,845	260	64,076	237,836	330,422
Illinois	1880	3	950,000	498	185,054	1,762,609	2,391,850
	1890	5	9,855,274	1,431	919,145	8,088,163	10,138,310
Indiana	1880	3	455,000	308	54,840	335,606	400,535
	f 1890						
Kentucky	1880	9	2,098,035	1,890	420,988	801,410	1,248,052
	1890	4	826,199	278	105,520	461,608	605,768
Maine	1880	1	150,000	300	44,950	23,560	60,375
	f 1890						

a This statement includes only active establishments.
 b For explanation of the apparent discrepancies in the data for 1880 see remarks in regard to the inclusion of capital, employes, and wages relating to mining and other operations.
 c Does not include 180 employes and \$25,275 wages reported by an idle establishment in Minnesota and included in the totals published for the census of 1880. These employes were engaged in making repairs to plant.
 d Includes hired property valued at \$5,061,058. This item was not reported separately at the census of 1880.
 e Includes 1,068 officers, firm members, and clerks and their wages, amounting to \$1,611,687, distributed as follows: Alabama 150, \$262,396; Connecticut 12 \$16,247; Georgia 15, \$19,175; Illinois 11, \$23,115; Kentucky 16, \$17,038; Maryland 3, \$7,530; Michigan 57, \$95,312; Missouri 27, \$37,763; New Jersey 15, \$22,386; New York 52, \$91,181; Ohio 107, \$200,890; Pennsylvania 355, \$561,407; Tennessee 64, \$87,616; Virginia 60, \$30,207; West Virginia 13, \$16,768; Wisconsin 16, \$30,154; all other states 29, \$42,512. These classes were not reported separately at the census of 1880.
 f See note a at end of table.

MANUFACTURING INDUSTRIES.

COMPARATIVE STATEMENT, BLAST FURNACES, BY STATES: 1880 AND 1890—Continued.

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
Maryland	1880	12	\$2,197,125	1,443	\$339,978	\$956,806	\$1,700,339
	1890	5	3,108,222	639	151,342	1,316,539	1,632,004
Massachusetts	1880	2	632,000	390	176,000	169,026	312,810
Michigan	1880	13	2,071,386	2,164	561,870	2,091,224	3,145,062
	1890	15	5,250,001	732	416,334	2,935,233	3,982,278
Missouri	1880	4	2,450,000	1,185	227,111	1,685,124	2,275,017
	1890	5	1,883,470	654	298,966	1,247,688	1,716,983
New Jersey	1880	12	\$3,644,500	1,174	\$365,639	\$2,488,670	\$3,428,747
	1890	8	3,131,366	655	262,538	1,679,937	2,228,724
New York	1880	30	8,836,471	2,518	902,929	4,166,622	6,816,241
	1890	16	6,443,208	1,462	672,288	4,212,888	5,182,606
Ohio	1880	62	13,002,586	8,944	2,725,157	9,149,620	13,038,193
	1890	46	11,750,497	4,224	2,057,127	15,696,065	19,800,268
Oregon	1880	1	100,000	250	46,822	33,073	78,393
Pennsylvania	1880	137	41,488,294	13,460	4,752,838	20,675,075	45,573,750
	1890	116	59,321,570	15,907	7,645,715	57,222,481	75,239,263
Tennessee	1880	9	1,422,626	1,579	261,897	489,440	840,022
	1890	11	3,085,806	1,076	525,992	2,450,882	3,366,464
Texas	1880	1	40,000	140	27,720	23,580	36,000
Vermont	1880	1	20,000	26	2,035	13,800	24,800
	1890						
Virginia	1880	8	1,391,500	1,221	255,986	205,548	440,695
	1890	15	4,156,206	1,328	558,312	2,820,167	3,925,481
West Virginia	1880	8	1,322,425	893	240,158	1,158,611	1,631,096
	1890	4	1,416,082	424	198,933	1,503,847	2,000,505
Wisconsin	1880	7	2,068,218	853	357,354	2,101,393	3,295,835
	1890	8	3,546,340	611	307,041	2,378,006	3,114,892
All other states	1890	9	2,727,579	465	191,635	940,058	1,411,121

^a Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 1; Indiana, 2; Maine, 1; Massachusetts, 1; North Carolina, 1; Oregon, 1; Texas, 1; Washington, 1.

In 1880 blast furnaces were located in 24 states and 1 territory, but pig iron was produced in only 22 states, the furnaces in Minnesota, North Carolina, and Utah territory being idle in that year. In the census year 1890 there were 25 states that contained completed blast furnaces, and pig iron was made in that year in each of these states except Minnesota. Since 1880 the manufacture of pig iron has been abandoned in Vermont and Utah, and during the same period 2 states, namely, Colorado and Washington, have engaged in its production. California does not appear among the pig iron producing states in either 1880 or 1890. A charcoal furnace was completed and put in operation in that state in 1881, but it has made no pig iron since 1886, and is practically abandoned.

The relative rank of the various states has undergone many changes since 1880. Pennsylvania still retains its leadership as the producer of pig iron, being credited with 51.05 per cent of the total production in 1880 and 49.13 per cent in 1890. Ohio was second in rank in both 1880 and 1890, the output of pig iron in this state in the former year being 14.51 per cent of the total production, and in the latter year 13.60 per cent. Alabama, which occupied tenth place in 1880, now occupies third place, the production of this state in 1890 amounting to 915,609 tons, as compared with 62,336 tons in 1880. Illinois, which was seventh in rank in 1880, is fourth in 1890, and New York, which was third in rank in 1880, occupies fifth place in 1890. Virginia, which was seventeenth in rank in 1880, is now sixth, while Tennessee has advanced from the thirteenth to the seventh place.

CAPITAL.

The aggregate capital reported for this branch of the iron and steel industry, including active and idle establishments and those in course of construction, was \$105,151,176 at the census of 1880, as compared with \$143,633,926 at the census of 1890, an increase of \$38,482,750, or 36.60 per cent.

The comparative statement on the following page shows the distribution of capital in active and idle establishments and those in course of construction in the blast furnace industry as reported at the censuses of 1880 and 1890.

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, BLAST FURNACES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash, and bills receivable.
Total	1880	490	^a \$105,151,176	\$18,000,081	\$57,151,005
	1890	460	^b 143,633,926	77,989,605	65,644,231
Establishments in operation.....	1880	341	89,531,362	41,208,481	48,262,881
	1890	304	134,608,543	71,230,048	63,372,495
Idle establishments.....	1880	142	14,394,883	0,277,150	8,117,733
	1890	73	6,453,865	4,095,150	1,763,715
Establishments in course of construction.....	1880	7	1,224,931	454,450	770,481
	1890	23	2,566,518	2,058,497	508,021

^a See remarks in regard to the inclusion of capital relating to mining and other operations in the figures for 1880.
^b Includes hired property valued at \$5,061,058. This item was not reported separately at the census of 1880.

As the item of "Buildings, machinery, tools, and implements" more accurately represents the direct investment in the blast furnace industry common to the two periods than does the item of land and cash assets, the figures presented for both years for the first item may be taken as a fairly true index of the growth of this branch of manufacture since 1880. The increase in the total capital invested was 36.60 per cent, while the investment in buildings and machinery has increased 62.48 per cent, and the land and cash and stock on hand 14.86 per cent. The value of land was not reported separately in 1880. Statements accompanying this report present in detail the statistics concerning capital in the blast furnaces of the different states as reported at the Eleventh Census.

EMPLOYÉS AND WAGES.

The following statement presents the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES, BY CLASSES, BLAST FURNACES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
All classes.....	34,483	\$16,226,145	34,402	\$16,209,335	7	\$3,010	74	\$13,800
Officers or firm members.....	506	1,174,212	506	1,174,212				
Clerks.....	562	437,475	555	434,465	7	3,010		
Skilled.....	9,094	5,261,191	9,094	5,261,191				
Unskilled.....	24,321	9,353,207	24,247	9,339,467			74	13,800

The following statement presents the average number of employés at the different weekly rates of wages.

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, BLAST FURNACES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years.	Children.
Total	33,341	74
Under \$5.....	235	46
\$5 and over but under \$6.....	269	28
\$6 and over but under \$7.....	2,163	
\$7 and over but under \$8.....	4,867	
\$8 and over but under \$9.....	5,613	
\$9 and over but under \$10.....	0,351	
\$10 and over but under \$12.....	6,576	
\$12 and over but under \$15.....	4,722	
\$15 and over but under \$20.....	1,750	
\$20 and over but under \$25.....	541	
\$25 and over.....	245	

During the census year 1890 the blast furnace establishments were in operation an average of 9.23 months each, and the average term of employment for labor was 10.62 months, the excess of the latter period over the former being due to the fact that establishments reporting the maximum term of operation also reported the greatest number of hands. In 1880 the blast furnace establishments were in operation an average of 8 months.

MATERIALS USED.

The total quantity and cost of each class of materials consumed by the blast furnaces as reported at the censuses of 1880 and 1890, with the aggregate cost of all materials, is shown in the following statement. With the exception of charcoal, which is reported in bushels, the quantities are given in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, BLAST FURNACES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total		\$58,619,742		\$110,098,615
Domestic iron ore	7,256,684	33,205,278	15,734,400	57,607,945
Foreign iron ore	(a)		1,090,712	5,897,585
Fluxing material	3,169,149	2,547,336	5,624,290	4,196,878
Anthracite coal	2,615,182	8,012,755	2,012,477	5,165,761
Bituminous coal	1,051,753	2,095,887	551,007	759,522
Coke	2,128,255	8,129,240	9,237,935	27,435,780
Charcoal	53,909,828	3,679,120	67,672,156	4,523,320
Mill cinder and scrap	354,048	910,667	1,283,071	3,086,808
All other materials		39,459		1,425,016

a Domestic and foreign iron ore were not reported separately at the census of 1880.

The foreign iron ores consumed in 1890 were obtained almost wholly from Cuba, Spain, Algiers, and Elba, a small quantity being imported from Canada. The consumption of foreign iron ores has been increasing in recent years, the purity of the material, its adaptability for steel making purposes, and its relatively low cost commending it to the blast furnace establishments along the Atlantic seaboard, in Maryland, Pennsylvania, New Jersey, and New York.

RICHNESS OF IRON ORES.

In addition to 15,734,400 tons of domestic iron ore and 1,090,712 tons of foreign iron ore consumed by blast furnaces in 1890 there were smelted for iron making purposes 1,283,071 tons of the waste materials of other industrial operations. These waste materials included mill cinder and roll and hammer scale obtained in the puddling, heating, and rolling of iron; residuum from the smelting of franklinite in the production of zinc, which was employed by 2 furnaces in New Jersey, and 1 in Pennsylvania in the production of spiegeleisen; and blue billy, or purple ore, a product of the manufacture of sulphuric acid from iron pyrites. The aggregate consumption of iron ore and these waste materials in 1890 was 18,108,183 tons, producing 9,906,607 tons of pig iron, while in 1880 the total output of pig iron was 3,781,021 tons, with a consumption of iron ore and other materials used as iron ore of 7,610,732 tons. Considering that the average yield of metal in the blast furnaces from foreign iron ore, mill cinder, rolling mill scale, zinc residuum, etc., is 57 per cent, as estimated by Mr. John Birkinbine, special agent in charge of the investigation on the mining of iron ore in 1890, there was obtained an output of pig iron from this source in 1890 of 1,353,056 tons. This leaves 8,553,551 tons of pig iron as the approximate quantity produced from the 15,734,400 tons of domestic iron ore in 1890, or an average yield of metal from ores mined in the United States of 54.36 per cent. No statistics are available of the consumption of foreign iron ores by the blast furnaces in the census year 1880, but assuming the 416,174 tons imported in that year to have entered into consumption during that period, there remains a total of 6,840,510 tons as the quantity of domestic iron ore smelted in 1880. Assuming that the foreign iron ore, mill cinder, etc., consumed in 1880 yielded 439,027 tons of pig iron, we have 3,341,994 tons as the quantity of pig iron produced from the 6,840,510 tons of domestic iron ore consumed, or an average yield of metal to the ton of ore of 48.86 per cent. The increased yield in 1890 over 1880 is largely due to the more general employment of the rich ores of the Lake Superior region as a substitute for the leaner local ores consumed in 1880 by many northern and western blast furnaces.

PRODUCTS.

Aggregate figures such as are obtained in the tabulation of the individual reports for a number of establishments in any particular district supply no accurate data to determine the cost of producing a given manufactured article. Even at 2 furnaces situated in the same locality, employing the same number of men, and consuming the same character of materials, the cost of production may vary as much as \$2 to \$3 a ton. At 1 establishment the cost of the ore, limestone, and coal used is calculated according to the expense incurred in mining and assembling these materials at the furnace, while the other concern, although owning and operating its own mines, may charge the material to the furnace at the market price. In the first instance the cost of producing a ton of pig iron is considerably below the cost at the second works, where the materials charged into the furnace already carry a profit for the mining operations, which element is not included in the cost reported for the other plant.

The following comparative statement shows the total tonnage production of pig iron in 1880 and 1890, classified according to the fuel used, with the proportion each kind bears to the aggregate output in the 2 years. The figures include the quantity of spiegeleisen and castings made direct from the furnace.

COMPARATIVE STATEMENT, PRODUCTION OF PIG IRON, INCLUDING DIRECT CASTINGS, CLASSIFIED ACCORDING TO KIND OF FUEL USED, WITH PERCENTAGE EACH CLASS IS OF TOTAL, BLAST FURNACES: 1880 AND 1890.

CLASS OF PRODUCTS.	TONS.		PERCENTAGE OF TOTAL PRODUCTION.	
	1880	1890	1880	1890
Total	3,781,021	9,906,607	100.00	100.00
Mixed anthracite coal and coke pig iron	714,590	1,893,241	18.90	19.11
Coke and bituminous coal pig iron	1,517,553	7,017,769	40.14	70.84
Charcoal pig iron	435,318	664,711	11.51	6.71
Anthracite coal pig iron	1,113,560	330,886	29.45	3.34

^a Four thousand two hundred and twenty-nine tons of direct castings shown in the report for blast furnaces, 1880, have been distributed in this statement among the several kinds of pig iron; hence the quantities of pig iron do not agree with the data shown in the report for the Tenth Census.

The production of spiegeleisen in the census year 1890, which is included in the figures of total production of pig iron, amounted to 133,704 tons, as compared with 12,875 tons produced in the census year 1880. Four states made spiegeleisen in 1890, namely, New Jersey, Pennsylvania, Illinois, and Colorado, while in 1880 only New Jersey and Pennsylvania were engaged in its manufacture. The production of castings direct from the furnace amounted to 6,066 tons in 1890 and 4,229 tons in 1880.

The following comparative statement shows the quantity and value of pig iron produced in the United States in 1880 and 1890, classified according to fuel used. The figures include the quantity and value of spiegeleisen and castings made direct from the furnace.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF PRODUCTS, CLASSIFIED ACCORDING TO KIND OF FUEL USED, BLAST FURNACES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Tons.	Value.	Tons.	Value.
Total		\$89,315,569		\$145,643,153
Mixed anthracite coal and coke pig iron	714,590	16,627,201	1,893,241	28,105,990
Coke and bituminous coal pig iron	1,517,553	35,513,233	7,017,769	100,687,256
Charcoal pig iron	435,318	12,488,744	664,711	11,957,710
Anthracite coal pig iron	1,113,560	23,574,742	330,886	4,772,021
Total tonnage and value	3,781,021	88,204,010	9,906,607	145,612,983
All other products		1,111,559		30,170

^a Four thousand two hundred and twenty-nine tons of direct castings shown in the report for blast furnaces, 1880, have been distributed in this statement among the several kinds of pig iron; hence the quantities of pig iron do not agree with the data shown in the report for the Tenth Census.

MANUFACTURING INDUSTRIES.

MACHINERY.

The following statement gives the production of pig iron in the different states in tons of 2,000 pounds, including castings made direct from the furnace, during the census years 1880 and 1890, with the number of completed furnace stacks at the close of each year, and the relative rank of each state, in quantity of product and its percentage of the total production:

COMPARATIVE STATEMENT, NUMBER OF STACKS AND PRODUCTION, INCLUDING ACTIVE AND IDLE ESTABLISHMENTS, STATES RANKED ACCORDING TO QUANTITY OF PRODUCT, BLAST FURNACES: 1880 AND 1890.

STATES.	Year.	Completed furnace stacks.	Production of pig iron in tons.	Percentage of total production.	Rank.	STATES.	Year.	Completed furnace stacks.	Production of pig iron in tons.	Percentage of total production.	Rank.
Total	1880 1890	681 559	3,781,021 9,906,607	100.00 100.00		Kentucky	1880 1890	22 6	58,108 44,278	1.54 0.45	12 14
Pennsylvania.....	1880 1890	269 221	1,930,311 4,867,504	51.05 49.13	1 1	Georgia.....	1880 1890	10 5	23,099 28,111	0.61 0.28	14 15
Ohio.....	1880 1890	103 71	548,712 1,347,519	14.51 13.60	2 2	Connecticut.....	1880 1890	8 9	18,779 22,255	0.50 0.22	15 16
Alabama.....	1880 1890	15 48	62,336 915,609	1.65 9.24	10 3	Indiana.....	1880 1890	4 2	18,237 16,460	0.48 0.17	16 17
Illinois.....	1880 1890	10 15	95,408 746,677	2.53 7.54	7 4	Colorado.....	1880 1890	..... 2	..... 12,949	..... 0.13	..... 18
New York.....	1880 1890	57 37	313,368 344,359	8.20 3.48	3 5	Texas.....	1880 1890	1 3	1,400 8,950	0.04 0.09	21 19
Virginia.....	1880 1890	31 31	17,906 312,367	0.47 3.15	17 6	Oregon.....	1880 1890	1 1	3,200 8,411	0.08 0.09	19 20
Tennessee.....	1880 1890	21 19	47,873 295,889	1.27 2.99	13 7	Massachusetts.....	1880 1890	6 4	9,543 8,380	0.25 0.08	18 21
Michigan.....	1880 1890	27 26	119,586 227,827	3.16 2.30	5 8	Washington.....	1880 1890	..... 1	..... 4,787	..... 0.05	..... 22
Wisconsin.....	1880 1890	14 10	118,282 215,143	3.13 2.17	6 9	Maine.....	1880 1890	1 1	2,015 3,700	0.05 0.04	20 23
New Jersey.....	1880 1890	20 18	157,414 145,040	4.16 1.46	4 10	North Carolina.....	1880 1890	7 1	..... 3,377	..... 0.03	..... 24
West Virginia.....	1880 1890	11 5	80,050 120,369	2.12 1.31	9 11	Minnesota.....	1880 1890	1 1	..........	..........	..........
Missouri.....	1880 1890	17 8	95,050 101,030	2.51 1.02	8 12	Vermont.....	1880 1890	1	620	0.02	22
Maryland.....	1880 1890	22 14	59,664 96,636	1.58 0.98	11 13	Utah.....	1880 1890	2.....	..........	..........	..........

^a Includes 4,229 tons of castings made direct from furnace.

^b Includes 6,066 tons of castings made direct from furnace.

Notwithstanding the fact that the production of pig iron has increased from 3,781,021 tons of 2,000 pounds in 1880 to 9,906,607 tons in 1890, the total number of completed furnaces has decreased during the 10 years from 681 to 559. Many furnaces which were active in 1880 have since been abandoned, owing to their inability to compete profitably with the larger, better located, and more modern furnaces. The majority of these abandoned furnaces were of small capacity, and were able to produce and market pig iron only during periods of great demand and consequent high prices. The large number of improved furnaces which have been built during recent years favorably located for the supply of materials at low cost, and within easy access to a market for the finished products, has rendered the operations of these older furnaces unremunerative even in periods of great activity.

Pennsylvania shows a decrease of 48 furnaces from 1880 to 1890, and during the same period the total number of furnaces in Ohio has decreased by 32. These figures merely exhibit the net decrease in the number of furnaces, as many large furnaces have been erected during this period in these, as well as in other states, to take the place of small stacks abandoned. Since 1880 286 furnaces have been abandoned in the United States, either owing to unfavorable location or to give place to larger and more modern plants, while during the same period 164 new furnaces have been built, in addition to a large number of plants that have been remodeled and supplied with new machinery.

IRON AND STEEL MANUFACTURE.

The following comparative statement presents by states the number, class, and daily capacity of blast furnaces, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, NUMBER, CLASS, AND CAPACITY OF BLAST FURNACE STACKS, INCLUDING ACTIVE AND IDLE ESTABLISHMENTS, BY STATES: 1880 AND 1890.

STATES.	Year.	Total number of completed furnaces.	Total daily capacity in tons of 2,000 pounds.	CHARCOAL FURNACES.		ANTHRACITE AND MIXED ANTHRACITE AND COKE FURNACES.		COKE AND BITUMINOUS COAL FURNACES.	
				Number of stacks.	Daily capacity in tons.	Number of stacks.	Daily capacity in tons.	Number of stacks.	Daily capacity in tons.
The United States.....	1880 1890	681 559	19,248 42,486	251 140	3,306 3,783	231 170	7,572 10,471	100 249	8,370 23,182
Alabama.....	1880 1890	15 48	330 4,237	10 14	159 606			5 34	180 3,631
Colorado.....	1880 1890	2	220					2	220
Connecticut.....	1880 1890	8 9	91 129	8 9	91 129				
Georgia.....	1880 1890	10 5	144 259	8 3	69 84			2 2	75 175
Illinois.....	1880 1890	10 15	603 2,772					10 15	603 2,772
Indiana.....	1880 1890	4 2	73 60	1	15			3 2	58 69
Kentucky.....	1880 1890	22 6	302 323	18 1	205 17			4 5	187 306
Maine.....	1880 1890	1 1	18 18	1 1	18 18				
Maryland.....	1880 1890	22 14	281 713	13 7	113 112	5 3	111 75	4 4	57 526
Massachusetts.....	1880 1890	6 4	81 55	5 4	53 55	1	28		
Michigan.....	1880 1890	27 26	844 1,216	25 26	709 1,216	2	135		
Minnesota.....	1880 1890	1 1	40 150	1	40			1	150
Missouri.....	1880 1890	17 8	749 550	9 3	240 120			8 5	500 430
New Jersey.....	1880 1890	20 18	691 926			20 18	691 926		
New York.....	1880 1890	57 37	1,054 2,109	15 9	172 106	42 24	1,482 1,253	4	690
North Carolina.....	1880 1890	7 1	39 15	7 1	39 15				
Ohio.....	1880 1890	103 71	3,201 5,713	33 11	434 184			70 60	2,767 5,579
Oregon.....	1880 1890	1 1	12 42	1 1	12 42				
Pennsylvania.....	1880 1890	269 221	8,490 19,093	36 15	242 179	158 125	4,940 8,217	75 81	3,308 10,097
Tennessee.....	1880 1890	21 19	388 1,109	16 7	165 193			5 12	223 916
Texas.....	1880 1890	1 3	10 130	1 3	10 130				
Utah.....	1880 1890	2	18	2	18				
Vermont.....	1880 1890	1	11	1	11				
Virginia.....	1880 1890	31 31	287 1,200	24 18	165 160			7 13	122 1,040
Washington.....	1880 1890	1	30	1	30				
West Virginia.....	1880 1890	11 5	319 625	5	29			6 5	290 525
Wisconsin.....	1880 1890	14 10	473 842	11 6	288 377	3	185	4	465

Of the 559 furnaces at the close of the census year 1890, which were active or likely to be some day active, 170 were anthracite coal or anthracite coal and coke furnaces, 249 coke and bituminous coal furnaces, and 140 charcoal furnaces. Of the 681 furnaces at the close of 1880 there were 231 anthracite coal or anthracite coal and coke furnaces, 199 coke and bituminous coal furnaces, and 251 charcoal furnaces. In the decade from 1880 to 1890 there is shown a decrease of 61 in the number of furnaces using anthracite coal or a mixture of anthracite coal and coke for fuel, a decrease of 111 in the number of furnaces using charcoal and an increase of 50 in the number of furnaces using coke and bituminous coal.

MANUFACTURE OF PIG IRON WITH MINERAL FUEL.

The phenomenal growth of the manufacture of pig iron during the past 10 years has been largely due to the increased use of coke as a blast furnace fuel. In 1880 anthracite coal was extensively employed alone and also as a mixture with coke in the blast furnaces, but the tendency since that date has been toward a more general employment of coke. Of the 3,345,703 net tons of pig iron produced in 1880 by the use of mineral fuel, 1,113,560 tons were produced with anthracite coal for fuel, 1,517,553 tons with coke, or in some instances with a mixture of coke and bituminous coal, and 714,590 tons with a mixed fuel of anthracite coal and coke. Very few furnaces are now run on anthracite coal alone, and a number of the furnaces that used anthracite coal in part in 1880 have since either abandoned the use of anthracite coal or increased the percentage of coke in the mixed fuel. In 1890 there were produced 330,886 tons of pig iron with anthracite coal for fuel, 1,893,241 tons with mixed anthracite coal and coke, and 7,017,769 tons with coke alone or, in a few instances, with a mixture of coke and bituminous coal.

The following comparative summary exhibits the leading statistics of the manufacture of pig iron with mineral fuel, as reported at the censuses of 1880 and 1890:

COMPARATIVE SUMMARY, MINERAL FUEL BLAST FURNACES: 1880 AND 1890. (a)

ITEMS.	1880 (b)	1890
Number of establishments	225	221
Capital	\$70,202,615	^c \$116,894,982
Miscellaneous expenses	(d)	\$5,330,381
Average number of employés (aggregate)	25,025	30,908
Total wages	\$8,654,152	\$14,666,130
Officers, firm members, and clerks:		
Average number	(e)	807
Total wages		\$1,256,742
All other employés:		
Average number	(e)	30,101
Total wages		\$13,409,397
Cost of materials used	\$51,254,711	\$101,699,485
Value of products	\$76,739,573	\$133,653,050
Tons of pig iron	3,345,703	9,241,896

^a This statement includes only active establishments.

^b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employés, and wages relating to mining and other operations.

^c Includes hired property valued at \$4,807,470. This item was not reported separately at the census of 1880.

^d Not reported.

^e Not reported separately.

The following comparative statement exhibits the leading statistics of the manufacture of pig iron by the use of mineral fuel, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, MINERAL FUEL BLAST FURNACES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The United States	1880 1890	225 221	\$70,202,615 \$116,894,982	25,025 250,908	\$8,554,152 \$14,000,139	\$51,254,711 101,099,485	\$76,739,573 133,058,050
Alabama	1880 1890	2 17	955,800 12,394,767	300 3,425	60,257 1,482,021	233,353 5,182,180	554,102 8,374,816
Georgia	1880 1890	2 2	252,000	274	14,750	188,983	310,150
Illinois	1880 1890	3 5	950,000 9,855,274	408 1,431	185,054 919,145	1,762,609 8,088,153	2,391,850 10,138,310
Indiana	1880 1890	2 2	355,000	95	48,610	332,481	450,535
Kentucky	1880 1890	3 3	550,000	190	77,550	504,974	793,800
Maryland	1880 1890	4 4	1,160,000	770	163,499	433,000	758,850
Massachusetts	1880 1890	1 1	50,000	40	18,500	68,226	144,000
Missouri	1880 1890	2 3	2,050,000 1,262,475	479 393	169,111 172,303	1,410,124 900,319	1,765,017 1,191,502
New Jersey	1880 1890	12 8	3,644,500 3,131,366	1,174 655	365,030 262,538	2,488,670 1,679,937	3,428,747 2,228,724
New York	1880 1890	22 13	8,059,384 5,850,119	2,050 1,385	762,210 634,309	3,712,100 3,964,464	6,009,097 4,850,543
Ohio	1880 1890	45 37	10,022,586 10,985,403	5,514 3,939	1,752,741 1,971,691	8,233,013 15,387,430	11,646,754 19,355,162
Pennsylvania	1880 1890	116 105	30,048,294 58,494,262	11,975 15,752	4,368,502 7,592,226	20,087,348 56,922,660	44,385,123 74,837,755
Tennessee	1880 1890	3 7	810,620 2,827,085	623 855	145,807 417,080	393,685 2,018,044	640,957 2,702,548
Virginia	1880 1890	1 10	500,000 3,874,606	200 1,216	94,781 527,178	76,179 2,720,195	178,920 3,755,051
West Virginia	1880 1890	6 4	1,254,425 1,446,082	608 424	211,484 193,093	1,131,173 1,503,847	1,583,806 2,000,505
Wisconsin	1880 1890	1 3	600,000 2,284,509	235 336	115,537 159,448	1,198,070 1,204,123	1,088,055 1,620,117
All other states	1890	9	4,489,044	1,097	328,208	2,038,133	2,593,417

a This statement includes only active establishments.

b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employés, and wages relating to mining and other operations.

c Includes hired property valued at \$4,807,470. This item was not reported separately at the census of 1880.

d Includes 807 officers, firm members, and clerks, and their wages, amounting to \$1,256,742, distributed as follows: Alabama 102, \$183,686; Illinois 11, \$23,115; Missouri 10, \$16,343; New Jersey 15, \$22,386; New York 47, \$84,381; Ohio 138, \$176,115; Pennsylvania 341, \$545,070; Tennessee 44, \$60,106; Virginia 49, \$71,177; West Virginia 13, \$16,753; Wisconsin 8, \$12,294; all other states 29, \$45,311. These classes were not reported separately at the census of 1880.

e Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 1; Georgia, 2; Indiana, 2; Kentucky, 2; Maryland, 2.

CAPITAL.

The following comparative statement shows the distribution of capital in active and idle establishments and those in course of construction, as reported for blast furnaces using mineral fuel at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, MINERAL FUEL BLAST FURNACES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total	1880 1890	275 277	\$77,161,257 \$123,610,211	\$40,933,422 68,880,895	\$30,227,835 54,729,316
Establishments in operation	1880 1890	225 221	70,202,615 116,894,982	36,005,322 63,733,797	33,657,293 53,161,185
Idle establishments	1880 1890	46 40	5,833,083 4,411,010	3,898,050 3,304,000	1,934,483 1,107,010
Establishments in course of construction	1880 1890	4 16	1,065,559 2,304,219	429,450 1,843,098	636,109 461,121

a See remarks in regard to the inclusion of capital relating to mining and other operations in the figures for 1880.

b Includes hired property valued at \$4,807,470. This item was not reported separately at the census of 1880.

The total capital reported for 1880 included in a number of cases the investment of blast furnace companies in mining and other operations, so that comparison with the amount reported for 1890, which excluded data of this character, will not be a correct indication of the increase in capital during the decade.

In the few instances where establishments operated both mineral fuel and charcoal furnaces separate returns were obtained for each branch of manufacture, so that the details for the two branches could be presented independently.

In 1880 there were 430 completed furnace stacks equipped for the use of mineral fuel, with a total daily capacity of 15,942 tons of 2,000 pounds, as compared with 419 stacks in 1890 with a daily capacity of 38,653 tons. The average daily capacity per furnace was 37.07 net tons in 1880 and 92.25 net tons in 1890. The increase in daily capacity, notwithstanding the reduction in the number of stacks, is due to larger furnaces in 1890, together with more powerful blowing machinery, improved hot blast stoves, and better furnace practice.

EMPLOYÉS AND WAGES.

The following statement presents the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés in the manufacture of pig iron with mineral fuel, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, MINERAL FUEL BLAST FURNACES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
All classes.....	30,908	\$14,066,139	30,858	\$14,651,424	5	\$2,350	65	\$12,365
Officers or firm members.....	362	893,489	362	893,489				
Clerks.....	445	368,253	440	360,903	5	2,350		
Skilled.....	8,270	4,839,439	8,270	4,839,439				
Unskilled.....	21,831	8,569,958	21,796	8,557,593			65	12,365

The following statement presents the average number of skilled and unskilled employés at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, MINERAL FUEL BLAST FURNACES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years.	Children.
Total.....	30,036	65
Under \$5.....	147	42
\$5 and over but under \$3.....	164	23
\$6 and over but under \$7.....	1,745	
\$7 and over but under \$8.....	4,184	
\$8 and over but under \$9.....	4,937	
\$9 and over but under \$10.....	5,903	
\$10 and over but under \$12.....	6,143	
\$12 and over but under \$15.....	4,447	
\$15 and over but under \$20.....	1,662	
\$20 and over but under \$25.....	565	
\$25 and over.....	199	

In the best coke practice at the present time the direct labor cost in a ton of pig iron averages about 15 per cent of the total cost. This is labor employed at the furnace, and does not include the indirect labor which is embraced in the cost of the raw materials and fuel. When the entire cost of the labor entering into the production of 1 ton of pig iron is considered, including the labor paid for the mining of the ore, limestone, and fuel, and the labor cost entering into the transportation of these materials to the furnace, it is found that fully 80 per cent of the cost of making a ton of pig iron is paid for labor. The complete labor cost varies according to the distance the materials have to be transported, the richness of the ores, and the efficiency of the furnace plant. In the southern states the ease with which the various raw materials are mined and the low cost of assembling them at the furnace

furnishes a lower aggregate labor cost in a ton of pig iron than in the north, although the direct labor cost per ton is greater in the former section than in the latter. Wages of furnace hands in the two sections vary within narrow limits for the same class of labor, but the richer ores used in the northern furnace insure a larger daily product, which gives a lower rate of direct labor cost per ton than is possible in the southern furnace, where a smaller product per man is made with the lower percentage of iron in the ores.

MATERIALS USED.

The following comparative statement presents the quantity and cost of the various raw materials used by the mineral fuel blast furnaces, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, MINERAL FUEL BLAST FURNACES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Tons.	Cost.	Tons.	Cost.
Total		\$51,254,711		\$101,699,485
Domestic iron ore.....	6,319,633	29,089,649	14,428,520	54,000,703
Foreign iron ore.....	(a)		1,081,630	5,860,349
Fluxing material.....	3,054,482	2,446,767	5,470,107	4,037,699
Anthracite coal.....	2,615,182	8,012,755	2,012,477	5,195,791
Bituminous coal.....	1,051,753	2,095,887	551,007	750,522
Coke.....	2,128,255	8,129,240	9,234,522	27,422,751
Mill cinder and scrap.....	338,392	841,451	1,282,371	3,084,391
All other materials.....		38,962		1,368,300

a Domestic and foreign iron ore were not reported separately in 1880.

During 1880 there was consumed by 1 anthracite furnace in New York 5,000 bushels of charcoal, costing \$350, and by 1 bituminous furnace in Ohio, 1,600 bushels of charcoal, costing \$112. As neither of the furnaces reported the production of any charcoal pig iron in that year, the quantity and cost of the charcoal consumed is excluded from the presentation of the charcoal pig iron industry and included in the above table under the head of "All other materials".

During 1890 1 charcoal furnace in Alabama and 1 in North Carolina ran a short time on coke for fuel. As these establishments are properly classified as charcoal furnaces, the leading items of investment, labor, and materials are included in the tabular statements for the charcoal blast furnace industry. The exclusion of the 3,413 tons of coke valued at \$13,029 from the above table causes an apparent discrepancy between the tons and cost of the coke as here given and the aggregate consumption for the whole country in the manufacture of pig iron as previously presented.

The development of the extensive deposits of high grade ores in the Lake Superior district, in response to the demands of a rapidly growing steel industry, and the economies made possible by the more extended use of coke in the manufacture of pig iron have led to an important change in the character of the raw materials consumed by blast furnaces since 1880. Throughout the southern states the more careful selection and preparation of iron ores and the employment of better coke has increased to a considerable extent the efficiency of furnaces in that section, while in many districts in the north and west the use of local ores containing a low percentage of iron has been abandoned for the richer Lake Superior iron ores. In addition there has taken place a more general substitution of coke for the bituminous coal which was largely employed in 1880 either alone or as an important constituent of a mixed fuel of bituminous coal and coke. At the census of 1880 25 furnaces reported the use of bituminous coal exclusively as a blast furnace fuel, these works consuming 369,976 tons of bituminous coal in producing 113,778 tons of pig iron. In 1890 only 6 furnaces used bituminous coal alone, and the quantity of pig iron made by them was 47,837 tons, with a fuel consumption of 152,456 tons. There has also been a marked decline during the decade in the number of furnaces using a mixed fuel of bituminous coal and coke, and the proportion of coal to coke, where they are still used together, has also decreased. In addition to the above quantities, there were consumed in 1880, principally as a mixture with coke in the blast furnaces, 681,777 tons of bituminous coal, but in 1890 only 398,551 tons of this kind of coal were so consumed. These figures include coal used under the boilers in cases where the waste gases from the furnace were not sufficient to supply the requisite amount of heat for the production of steam. In 1880 a considerable quantity of anthracite coal was mixed with coke in furnaces in Illinois and Wisconsin, but no fuel of this character was used in producing pig iron in these states in 1890.

MANUFACTURING INDUSTRIES.

PRODUCTS.

The following comparative statement shows the quantity and value of pig iron produced, classified according to the fuel used by blast furnaces using mineral fuel, as reported at the censuses of 1880 and 1890. The quantities and values of castings produced direct from furnaces are included in the production of pig iron for the two periods.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF PRODUCTS, MINERAL FUEL BLAST FURNACES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Tons.	Value.	Tons.	Value.
Total		\$76,739,573		\$133,658,050
Mixed coke and anthracite coal pig iron	714,500	16,627,291	1,893,241	28,105,996
Coke and bituminous coal pig iron	1,517,553	35,513,233	7,015,547	100,659,028
Anthracite coal pig iron	1,113,500	23,574,742	330,886	4,772,021
Total tonnage and value	3,345,703	75,715,266	9,239,674	133,627,945
All other products		1,024,307		30,105

a Does not include 2,222 tons of coke pig iron, valued at \$27,328, reported by charcoal furnaces.

MANUFACTURE OF CHARCOAL PIG IRON.

The abundant deposits of iron ores in sections of the country remote from sources of supply of mineral fuel, but containing extensive forests available for the production of charcoal, combined with the excellent character of the metal produced by the use of this fuel, are influences which have resulted in maintaining for the manufacture of charcoal pig iron an important position in the iron industry. These conditions are especially prominent in Michigan and Wisconsin. The former state uses charcoal fuel exclusively in its blast furnaces, and produced in the census year 1890 over one-third of all the charcoal pig iron made in the United States during that period.

The following comparative summary exhibits the leading statistics of the charcoal pig iron industry, as reported at the censuses of 1880 and 1890:

COMPARATIVE SUMMARY, CHARCOAL BLAST FURNACES: 1880 AND 1890. (*a*)

ITEMS.	1880 (<i>b</i>)	1890
Number of establishments	116	83
Capital	\$19,268,747	<i>c</i> \$17,713,561
Miscellaneous expenses	(<i>d</i>)	\$1,012,294
Average number of employes (aggregate)	16,670	3,575
Total wages	<i>e</i> \$4,101,276	\$1,500,006
Officers, firm members, and clerks:		
Average number	(<i>f</i>)	261
Total wages		\$354,945
All other employes:		
Average number	(<i>f</i>)	3,314
Total wages		\$1,205,061
Cost of materials used	\$7,365,031	\$8,399,130
Value of products	\$12,575,996	\$11,985,103
Tons of pig iron	435,318	664,711

a This statement includes only active establishments.

b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employes, and wages relating to mining and other operations.

c Includes hired property valued at \$253,588. This item was not reported separately at the census of 1880.

d Not reported.

e Does not include 180 employes and \$25,275 wages reported by an idle establishment in Minnesota and included in the totals published at the census of 1880. These employes were engaged in making repairs to plant.

f Not reported separately.

Notwithstanding the decline in the value of products from 1880 to 1890, as indicated by the above figures, the output of charcoal pig iron has increased during the decade from 435,318 net tons in 1880 to 664,711 net tons in 1890, or 52.70 per cent. The decrease in the number of establishments arises from the fact that many of the small charcoal furnaces included in the presentation for 1880 have been abandoned and fewer, but much larger and better equipped stacks, have been erected in locations more favorably situated for securing an abundance of low priced materials. The decrease in capital, number of employes, and wages is largely due to the different methods pursued in obtaining the data for the two census periods, the figures for 1880, as previously explained, including the operations of other branches of industry which are excluded in the presentation for 1890.

There are a few manufacturers who operate anthracite coal or coke furnaces in addition to stacks running on charcoal pig iron. In such cases the operations of the charcoal furnaces only are included in the figures presented, the accounts of the two departments enabling a separation to be made.

The following comparative statement exhibits the leading statistics of the charcoal pig iron industry, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, CHARCOAL BLAST FURNACES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The United States	1880 1890	116 83	\$19,268,747 \$17,713,501	e16,670 e3,575	e\$4,101,276 e1,560,006	\$7,365,031 8,399,130	\$12,575,006 11,985,103
Alabama	1880 1890	5 11	1,751,396 3,384,029	1,266 714	493,456 301,079	342,320 1,311,704	851,194 1,940,875
Connecticut	1880 1890	6 5	1,172,000 940,092	139 129	65,974 66,881	471,467 412,743	644,911 574,438
Georgia	1880 f 1890	3 .	460,000 .	480 .	62,605 .	52,813 .	147,740 .
Indiana	1880 1890	1 .	100,000 .	213 .	6,230 .	3,125 .	10,000 .
Kentucky	1880 f 1890	6 .	1,518,035 .	1,700 .	352,438 .	296,436 .	454,852 .
Maine	1880 f 1890	1 .	150,000 .	300 .	44,050 .	23,569 .	60,375 .
Maryland	1880 1890	8 3	1,037,125 457,650	673 127	176,479 47,017	523,746 221,887	941,489 333,613
Massachusetts	1880 f 1890	1 .	582,000 .	350 .	157,500 .	100,800 .	163,750 .
Michigan	1880 1890	13 15	2,671,386 5,259,001	2,104 732	501,870 416,334	2,091,224 2,035,233	3,145,062 3,982,278
Missouri	1880 f 1890	2 .	400,000 .	706 .	58,000 .	275,000 .	510,000 .
New York	1880 1890	8 3	777,087 593,089	463 77	140,719 37,889	454,402 248,424	507,144 332,003
Ohio	1880 1890	17 9	2,930,000 765,004	3,430 285	972,416 85,436	916,007 309,235	1,391,439 445,106
Oregon	1880 f 1890	1 .	100,000 .	250 .	40,822 .	33,073 .	78,393 .
Pennsylvania	1880 1890	21 11	2,440,000 827,308	1,485 215	384,276 53,489	587,727 299,821	1,188,027 401,443
Tennessee	1880 1890	6 4	612,000 858,721	956 221	116,030 108,003	95,765 432,838	199,065 603,016
Texas	1880 f 1890	1 .	40,000 .	140 .	27,720 .	23,580 .	36,000 .
Vermont	1880 1890	1 .	20,000 .	26 .	2,035 .	13,800 .	24,800 .
Virginia	1880 1890	7 5	891,500 281,000	1,021 112	161,205 31,134	129,369 99,072	261,775 169,830
West Virginia	1880 1890	2 .	68,000 .	285 .	28,674 .	27,435 .	47,200 .
Wisconsin	1880 1890	6 5	1,468,218 1,261,831	618 275	241,817 147,593	902,723 1,083,883	1,607,189 1,494,775
All other states	f 1890	12	3,085,146	688	264,551	1,043,390	1,646,771

a This statement includes only active establishments.

b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employés, and wages relating to mining and other operations.

c Does not include 180 employés and \$25,275 wages, reported by an idle establishment in Minnesota, and included in the totals published at the census of 1880. These employés were engaged in making repairs to plant.

d Includes hired property valued at \$253,588. This item was not reported separately at the census of 1880.

e Includes 261 officers, firm members, and clerks, and their wages amounting to \$354,945, distributed as follows: Alabama 48, \$78,710; Connecticut 12, \$16,247; Maryland 5, \$5,530; Michigan 57, \$95,312; New York 5, \$6,800; Ohio 29, \$24,775; Pennsylvania 14, \$16,337; Tennessee 20, \$27,510; Virginia 11, \$9,030; Wisconsin 8, \$17,860; all other states 52, \$56,834. These classes were not reported separately at the census of 1880.

f Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Georgia, 2; Kentucky, 2; Maine, 1; Massachusetts, 1; Missouri, 2; North Carolina, 1; Oregon, 1; Texas, 1; Washington, 1.

During the decade from 1880 to 1890 the charcoal blast furnace establishments, including active and idle, in Kentucky declined in number from 15 to 2; those in Massachusetts from 3 to 2, and those in North Carolina from 5 to 1. Maine and Oregon had 1 establishment in each year, while the establishment located in the state of Washington commenced operations during the past decade. Since 1880 the manufacture of charcoal pig iron has been abandoned in Indiana, Minnesota, Vermont, West Virginia, and Utah, but Indiana, Minnesota, and West

Virginia continue to manufacture pig iron with mineral fuels. A charcoal blast furnace was put in operation in California in 1881, but was abandoned prior to the census year 1890.

CAPITAL.

The following comparative statement shows the distribution of capital in active and idle establishments and those in course of construction, as reported for charcoal blast furnaces at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, CHARCOAL BLAST FURNACES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished product on hand, cash, and bills receivable.
Total	1880	215	^a \$27,989,919	\$7,066,659	\$20,923,260
	1890	123	^b 20,023,715	9,108,800	10,914,915
Establishments in operation	1880	116	19,268,747	4,663,159	14,605,588
	1890	53	17,713,561	7,502,251	10,211,310
Idle establishments	1880	99	8,561,800	2,378,500	6,183,300
	1890	33	2,047,855	1,391,150	656,705
Establishments in course of construction	1880	3	159,372	25,000	134,372
	1890	7	262,299	215,399	46,900

^a See remarks in regard to the inclusion of capital relating to mining and other operations in the figures for 1880.

^b Includes hired property valued at \$253,588. This item was not reported separately at the census of 1880.

The value of buildings, machinery, tools, and implements more nearly represents the direct investment in the charcoal blast furnace industry than that shown for land and cash assets, for the reason that the aggregate for these latter items for 1880 also includes the value of ore and wood lands. Thus, while there was an increase during the last decade of 23.90 per cent in the value of the plant and equipment of furnaces, the remaining items of investment show an apparent decrease of 47.83 per cent. The value of land was not separately reported in 1880, therefore a true comparison can not be made.

Of the 123 establishments reported in 1890, 33 remained idle during the census year, and 7 were in course of construction, while 96 of the 215 establishments reported in 1880 were not in operation at any time during that period, and 3 plants were building.

Notwithstanding the fact that the number of establishments equipped for the production of charcoal pig iron has decreased from 215 in 1880 to 123 in 1890, and the furnace stacks at the close of the census year 1890 number but 140, as compared with 251 10 years ago, the daily productive capacity increased from 3,306 tons of 2,000 pounds in 1880 to 3,783 tons in 1890. This increase in capacity is due in part to the much larger size of the new furnaces and in part to the adoption in recent years of more efficient machinery and better furnace practice.

EMPLOYÉS AND WAGES.

The following statement shows the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, CHARCOAL BLAST FURNACES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
All classes	^a 3,575	\$1,560,000	3,504	\$1,557,911	2	\$600	9	\$1,435
Officers or firm members	144	280,723	144	280,723				
Clerks	117	74,222	115	73,562	2	600		
Skilled	824	421,752	824	421,752				
Unskilled (^a)	2,490	783,309	2,481	781,874			9	1,435

^a Includes convict laborers at the Texas penitentiary receiving an average of 50 cents per day.

The following statement presents the average number of employés at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, CHARCOAL BLAST FURNACES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years.	Children.
Total	3,305	9
Under \$5	688	4
\$5 and over but under \$6	105	5
\$6 and over but under \$7	418	
\$7 and over but under \$8	683	
\$8 and over but under \$9	676	
\$9 and over but under \$10	448	
\$10 and over but under \$12	433	
\$12 and over but under \$15	275	
\$15 and over but under \$20	97	
\$20 and over but under \$25	36	
\$25 and over	46	

^a Includes convict laborers at the Texas penitentiary receiving an average of 50 cents per day.

In 1880 the charcoal furnaces were in operation an average of 6.45 months each during the year. During the census year 1890 the charcoal furnaces were in operation an average of 8.04 months each; the average term of employment for men was 8.87 months.

The excess of the average term of employment for labor over the average term of operation is due to the fact that the works reporting the maximum term of operation also report the largest number of hands. Furnace hands were employed 12 hours per day 7 days each week, while yard hands worked 10 hours daily for 6 days of the week.

MATERIALS USED.

The following comparative statement shows the quantity and cost of the various materials consumed by charcoal blast furnaces, as reported at the censuses of 1880 and 1890. Iron ore and fluxing materials are stated in tons of 2,000 pounds, charcoal in bushels.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, CHARCOAL BLAST FURNACES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total		\$7,365,031		\$8,399,130
Domestic iron ore	937,051	3,515,620	1,305,880	3,607,242
Foreign iron ore	(^a)		9,082	37,236
Fluxing material	114,607	100,569	154,183	159,179
Charcoal	653,903,228	63,678,658	67,672,156	4,523,320
All other materials, including mill cinder and scrap		70,175		72,153

^a Domestic and foreign iron ore were not reported separately at the census of 1880.

^b There is a difference of 6,000 bushels of charcoal, costing \$462, between the figures published in the census report for 1880 and those given in the above statement. This is due to the fact that 1 anthracite furnace in New York used 5,000 bushels of charcoal, costing \$350, and 1 bituminous furnace in Ohio used 1,000 bushels of charcoal, costing \$112. Neither of these establishments reported the production of any charcoal pig iron during the census year 1880, and the quantity and cost of charcoal consumed by them are therefore not included in the presentation of the statistics of the charcoal pig iron industry.

MANUFACTURING INDUSTRIES.

PRODUCTS.

The following comparative statement shows the quantity and value of hot and cold blast charcoal pig iron, including the quantity and value of direct castings and other products made by the charcoal furnaces, as reported at the censuses of 1880 and 1890, the quantities being stated in tons of 2,000 pounds:

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF PRODUCTS, CHARCOAL BLAST FURNACES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Tons.	Value.	Tons.	Value.
Total		\$12,575,996		\$11,985,103
Hot or warm blast charcoal pig iron	355,647	10,090,244	627,865	11,243,119
Cold blast charcoal pig iron	79,671	2,398,500	36,846	714,591
Total tonnage and value	435,318	12,488,744	664,711	11,957,710
All other products		87,252		27,393

^a Includes \$27,328, the value of 2,222 tons coke pig iron.

The increase in tonnage shown in this table was entirely in hot or warm blast pig iron, the production of cold blast iron showing a decline of 53.75 per cent. Two charcoal furnaces produced a small quantity of coke pig iron in 1890, one in Alabama producing 1,645 tons, valued at \$15,788 and one in North Carolina producing 577 tons valued at \$11,540. The tonnage of this coke pig iron is not included in the column of quantities in the above table, but the value appears under the head of "Value of all other products". The employes, total wages, and materials consumed by these 2 charcoal furnaces in the production of this coke pig iron, are also included in the statements concerning the charcoal blast furnace industry. In the report for the blast furnace industry, 1890, these items are included in the statement showing the output of coke and bituminous coal pig iron.

ROLLING MILLS AND STEEL WORKS.

Of the total tonnage of products of the rolling mills and steel works of the United States in 1880 less than one-third was of steel, and up to that time the manufacture of rails was the only branch of the iron industry that had been seriously affected by the manufacture of steel. The steel industry has made a steady and rapid advance since 1880. During 1890 the total output of iron and steel products by the rolling mills and steel works was 8,274,833 tons, of which 5,049,693 tons, or 61.02 per cent, were of steel. The activity in the erection of bessemer and open-hearth steel making plants since 1880 has been especially marked.

Notwithstanding the increase of the steel industry during the past 10 years, the manufacture of finished forms of iron has not declined. The number of puddling furnaces has increased from 4,376 in 1880 to 4,853 in 1890, and the increase in the tonnage of iron products has been from 2,353,248 tons to 3,225,140 tons. In the manufacture of boiler plates, sheets, and bridge material iron is still largely used, and in many instances preferred to steel.

In 1880 the statistics of rolling mills and steel works were presented under three general classifications, namely, (1) iron rolling mills, (2) bessemer and open-hearth steel works, and (3) crucible and miscellaneous steel works. Where establishments operated both an iron rolling mill and a steel producing plant, a separate return was required for each department; but manufacturers found it difficult, and in some instances impossible, to report accurately the leading items relating to capital and labor for each branch of manufacture. The steel was often rolled by the same workmen and upon the same machinery as the iron, while the capital was employed both in manufacturing and marketing the products of the rolling mill whether of iron or of steel. With the ramifications of the iron and steel industry during the past decade, the difficulty of making any separate showing of the rolling mills and steel producing works has been correspondingly increased, and the returns received indicated that the only separation practicable in the presentation of the statistics of iron and steel rolling mills, and bessemer, open-hearth, and crucible steel works was in the tonnage and value of iron and steel products. Even this separation was not made without considerable difficulty on the part of the manufacturers.

It has not been possible to present in detail the statistics which relate to special branches of iron and steel manufacture, such as nails, bars, structural material, and steel rails. Establishments producing rails, bars, or plates make other products, and a separation of the capital, employes, wages, and materials pertaining to the manufacture of each article was impracticable.

BESSEMER STEEL.

Bessemer steel was first produced in this country in commercial quantities in 1867, but for many years the material was used only in the manufacture of rails. At the date of the Tenth Census there were but 11 establishments engaged in the production of bessemer steel, all of which had been built to manufacture steel for rails, many of them having been added to existing iron rail mills. These works were located in Illinois, Missouri, New York, Ohio, and Pennsylvania. In 1890 the number of establishments containing bessemer converters, including the works prepared to manufacture Clapp-Griffiths and Robert-Bessemer steel, had increased to 51. They were located in Colorado, Illinois, Indiana, Massachusetts, Michigan, Missouri, New York, Ohio, Pennsylvania, Virginia, and West Virginia. The production of bessemer steel ingots or direct castings in the United States in the census year 1890, including steel made by the Clapp-Griffiths and Robert-Bessemer processes, amounted to 4,051,262 tons of 2,000 pounds, an increase of 311.21 per cent over the production of 985,208 tons in 1880. Pennsylvania produced 56.47 per cent of the total output in 1880, Illinois 25.73 per cent, and New York and Ohio each over 8 per cent. Of the total production in 1890, Pennsylvania contributed 61.12 per cent, Illinois 21.49 per cent, Ohio 9.41 per cent, West Virginia 4.46 per cent, New York 2.60 per cent, and Colorado, Massachusetts, and Michigan each less than 1 per cent.

While the demand for steel rails has forced a practical discontinuance of the manufacture of iron rails, there has been also rapidly increasing use of steel for nails, bars, plates, rods, wire, forgings, and other miscellaneous products. During 1880 and the few succeeding years, the crude steel consumed by the iron rolling mills in the production of finished forms of steel other than rails was purchased from foreign sources or from the domestic steel works, the latter turning the product of their converters into billets and slabs during periods when the demand for rails was not sufficient to absorb the entire steel production. With the increasing demand for steel for miscellaneous purposes, many of the iron rolling mill establishments erected plants for the production of the crude steel required by them, some works adopting the bessemer process, while others added open-hearth plants, the character of the products to be made largely influencing the choice of the process employed. The increased quantity of bessemer steel manufactured into miscellaneous forms other than rails is approximately shown by a comparison of the ingots and rail production in the two years, over 75 per cent of the ingots made in 1880 being converted into rails, while in 1890 the percentage of rails made to the total output of ingots was only 51 per cent.

As a material for use in the manufacture of products requiring strength with resistance to ordinary wear, bessemer steel has proved its superiority as compared with malleable iron. The question of quality is not, however, the only factor which has influenced the relative consumption of the products of the bessemer converters and the puddling furnace. The two processes, presenting as they do characteristics entirely dissimilar, are nevertheless very much alike in principle. In the puddling furnace, the constituents of the pig iron are oxidized by the severest kind of labor on the part of the workmen, the process occupying considerable time and resulting in the expenditure of a large amount of fuel. In the bessemer process the pig iron taken in a molten state from the blast furnace is run directly into the converter, the passage of air through the material achieving the same results as secured by the work of the puddler, while the oxidizing influences of the blast furnish all the heat that is required to effect the conversion. The only fuel consumed is, therefore, the amount employed to furnish power for the blowing engine. The time required to complete the process of steel making, as carried on in the bessemer converter, is so much less than that consumed in the puddling of iron, that the cost for labor per ton of steel is considerably below the cost per ton of iron when produced from the same materials.

Since 1880 2 modifications of the bessemer process have been introduced into this country: the Clapp-Griffiths process from England in 1884, and the Robert-Bessemer process from France in 1888. In the decarbonization and desilicization of the molten metal by the use of air, these processes do not differ from the ordinary bessemer method of producing steel, but certain modifications of the converters are claimed to have an important effect upon the character of the product. In the Clapp-Griffiths process the converter ranges in capacity from 2 to 3 tons, while the Robert-Bessemer converter is designed for the production of from 1 to 2 tons of steel at each operation.

The first steel made in this country by the Clapp-Griffiths process was produced at Pittsburg, Pa., on March 25, 1884. During 1890 there were 6 works which contained converters for the production of steel by this process, 4 of which were in operation in that year, producing 77,632 tons of steel ingots, or direct castings. No new plants have been built since 1887. The first steel produced in this country by the Robert-Bessemer process was made at experimental works at Springfield, Ohio, in September, 1888. During 1890 there were 5 completed works containing converters for the production of steel by this process, and 1 plant was in course of construction. The production of Robert-Bessemer steel during 1890 amounted to 4,884 tons, principally in the form of castings.

OPEN-HEARTH STEEL.

The Siemens-Martin or open-hearth process of steel making has shown a continuous growth since its introduction in the United States in 1867. The production of open-hearth steel in the form of ingots or direct

castings during 1890 amounted to 537,639 tons of 2,000 pounds, as compared with 84,302 tons made during 1880. In 1880 there were 25 establishments containing open-hearth steel plants located in 10 states, and in 1890 there were 58 establishments containing open-hearth steel plants located in 12 states. Since 1880 the manufacture of open-hearth steel has been abandoned in 2 states, Vermont and Rhode Island, and 4 states have engaged in its manufacture, New York, Alabama, Indiana, and California. During the past few years great activity has taken place in the erection of open-hearth steel plants.

The open-hearth furnace consists of a shallow, dish shaped vessel, varying in capacity from 8 tons to 30 tons, in which is prepared a bath of melted pig iron, to which either scrap steel or iron ore is added as a reducing agent, the whole contents of the furnace being subjected to a high temperature by the passage of highly heated artificial gas or of natural gas. The percentage of carbon required in the finished steel is replaced, as in the bessemer process, by the addition of spiegeleisen or ferro-manganese. The process of conversion occupies from 6 to 8 hours, and by reason of the time thus required it does not admit of the heavy daily tonnage of steel, which is one of the important characteristics of works employing the bessemer process. So perfectly, however, is the process under control that the contents of several furnaces may be combined in the production of heavy masses of metal of uniform composition for steel castings or forgings. The recognized superiority in strength and the uniformity of steel forgings as compared with those made of wrought iron has led manufacturers since 1880 to erect the necessary plant and machinery for the production and manipulation of the large masses of steel required in the manufacture of heavy shafting, armor plates, gun forgings, and parts of marine engines and war vessels.

BASIC STEEL.

The first basic steel made in the United States was produced experimentally at Steelton, Pa., by the Pennsylvania Steel Company, on May 24, 1884, in a bessemer converter. The beginning of the manufacture of basic steel in this country as a commercial product, however, was on the 28th of March, 1888, when the first basic open-hearth steel was produced at the Homestead Steel Works, near Pittsburg, Pa. Since that date the manufacture of basic open-hearth steel has been continued at these works. Many other works throughout the country experimented with the basic process, but, except as above stated, very little progress has been made in the introduction of this method of steel making.

The total production of basic steel in the United States during 1890 amounted to 62,173 tons of 2,000 pounds, nearly all of which was made by the basic open-hearth method, a small part being produced by the duplex process, a combination of the bessemer and open-hearth methods.

CRUCIBLE AND MISCELLANEOUS STEEL.

The crucible steel industry has shown moderate progress since 1880, the production of that year amounting to 76,201 net tons of ingots or direct castings, as compared with an output of 82,748 tons in 1890. In 1880 there were 37 establishments containing crucible steel plants, located in 9 states, while in 1890 the number of establishments had increased to 47, located in 11 states. For purposes requiring a high grade of steel, the product of the crucible process will always be in demand, but in many instances the high cost of manufacture prevents it from successfully competing in price with the product of the open-hearth or bessemer processes.

A small quantity of blister, puddled, and other kinds of miscellaneous steel is annually made by a few establishments. During 1880 the total output of miscellaneous steel was 4,956 tons, produced by works in Connecticut, New Jersey, and Pennsylvania. The production in 1890 amounted to 3,961 tons, made in New Jersey and Pennsylvania.

IRON AND STEEL RAILS.

Of the total production of 1,217,497 net tons of iron and steel rails in the census year 1880, 741,475 tons were of bessemer steel, 466,917 tons of iron, and 9,105 tons of open-hearth steel. Practically all the rails at present consumed by the railroads of the country are of bessemer steel, the few tons of iron rails annually made being of light section for mine purposes. During the census year 1890 the output of bessemer steel rails was 2,076,325 tons, and of iron rails 15,361 tons.

A notable increase has taken place since 1880 in the capacity of the country for the production of steel rails, both by the remodeling and enlarging of the works in existence at that time and by the erection of new plants. Notwithstanding the great demand for steel rails, the requirements have been almost entirely supplied from American mills, the quantity imported during each year since 1880 being insignificant. The bessemer steel rails produced in 1880 were made almost entirely by the bessemer steel works, which had been built from 1865 to 1876 especially for this branch of manufacture, a small quantity being rolled by the iron rail mills from purchased steel blooms.

The developments of the past few years have been toward a concentration of the steel rail industry into a few establishments of large capacity, the production of rails to any considerable extent at the present time being possible only in works favorably located for the supply of cheap raw materials, and operated under the most improved methods of manufacture. So active has been the competition among the different mills that only those concerns which have been foremost in the adoption of improved labor-saving machinery are large producers at the present time. The destruction of capital in the steel rail industry during the past decade by the improvements in mechanical appliances has been enormous, costly machinery becoming obsolete long before worn out.

The total production of bessemer steel rails in 1890 was made by 18 firms or companies, 7 concerns contributing 1,984,394 tons, or 95.57 per cent of the total output in that year. These 7 concerns were engaged in the manufacture of standard sections of steel rails as a leading branch of their business, and were located as follows: 5 in Pennsylvania, controlling 7 plants; 1 in Illinois, with 4 plants, and 1 in Colorado with 1 plant. Practically the entire quantity of standard or heavy sections of steel rails made in 1890 were produced by these 12 plants. The 91,931 tons of steel rails made by the other 11 producers in 1890 were mostly light sections for street railway and mine purposes. Of these 11 establishments 4 were in Pennsylvania, 2 in Ohio, and 1 each in California, Indiana, West Virginia, Illinois, and Wisconsin.

Of the total production of iron and steel rails in 1880, Pennsylvania produced 46.81 per cent; Illinois, 22.50 per cent; Ohio, 8.90 per cent; New York, 7.57 per cent. The production in the remaining states was small. Indiana and Wisconsin produced 3.17 per cent and 2.43 per cent respectively. Kansas, Kentucky, and Tennessee slightly exceeded 1 per cent each, while the other 9 rail producing states and territories produced less than 1 per cent each. Of the rails of all kinds produced in 1890, Pennsylvania made 68.79 per cent; Illinois, 29.54 per cent; and Ohio 0.24. New York produced no rails during the census year 1890.

A large business was done in 1890 in the manufacture of light rails for street railways. The quantity produced in 1880 was less than 15,000 tons, while during 1890 the requirement amounted to over 100,000 tons.

Since 1880 the demands of the leading railroads of the country have been for heavier rails, necessitated by the greater rate of speed of both freight and passenger trains, increased weight of locomotives and cars, and the increased weight of freight per car. Rails weighing 56 pounds per yard were for many years the standard size, but these are rapidly being removed from the tracks of the principal roads and replaced by heavier sections. During the past few years 80, 85, and 90 pound rails have composed a considerable part of the tonnage of the various mills, while in a few instances rails weighing 100 pounds to the yard have been rolled for use at points where the traffic is particularly heavy.

CUT NAILS AND SPIKES.

Next to rails the most notable example of the substitution of steel for iron during the past 10 years is shown by the statistics of nail production. In 1880 the aggregate output of cut nails and spikes by the rolling mills and steel works was 5,056,600 kegs of 100 pounds each, all of which were made of iron. In 1890 the total production of cut nails and spikes amounted to 5,857,030 kegs, of which 3,704,604 kegs were of bessemer steel, 2,139,086 were of iron, and 13,340 kegs were of open-hearth steel.

The iron nail business has not only seriously felt the competition of the steel nail, but manufacturers of both iron and steel cut nails have been confronted with a new rival in the wire nail, the manufacture of which has made rapid progress during recent years. The production of iron and steel cut nails and wire nails in 1880 and 1890 was as follows:

QUANTITY OF IRON AND STEEL CUT NAILS AND WIRE NAILS MANUFACTURED: 1880 AND 1890.

ITEMS.	1880 (Kegs of 100 pounds.)	1890 (Kegs of 100 pounds.)
Total	5,056,600	8,750,346
Iron cut nails	5,056,600	2,139,086
Steel cut nails		3,717,944
Wire nails		2,893,316

Almost the entire quantity of iron and steel cut nails produced in 1880 and 1890 was made by establishments which rolled the nail plate; whereas of the total output of wire nails in 1890 1,142,927 kegs were made by 9 works, which rolled the rods and drew the wire consumed by them, while 1,750,389 kegs were made by 40 works which purchased either the rods or wire. These 40 establishments not operating rolling mills are not included in this report. Their nail production is shown in the foregoing statement for purposes of the comparison of the output of cut nails with wire nails. With the exception of 1,040 kegs, the entire quantity of wire nails produced in 1890 was of steel.

The Wheeling district is an important center of the cut nail industry. It includes the mills at Wheeling and its vicinity, in Ohio and Marshall counties in West Virginia, and in Belmont and Jefferson counties in Ohio. This district contributed 1,497,380 kegs of the total production of cut nails in 1880, and 1,814,069 kegs in 1890.

COMPARISONS.

In 1880 there were 397 rolling mills and steel works (including idle establishments and those in course of construction) in the United States, of which 324 were classed as iron rolling mills, 36 as bessemer and open-hearth steel works, and 37 as crucible and miscellaneous steel works. The 73 steel works of all kinds contained 24 bessemer converters, 37 open-hearth steel melting furnaces, and a capacity in the crucible steel works of using 2,691 pots at each heat.

Including idle establishments and those in course of construction, there were 440 rolling mills and steel works reported at the census of 1890. Of this number 299 were iron and steel rolling mills which were not connected with steel producing works, 130 were equipped for the production of crude steel, and 11 establishments in course of construction which were not classified. The 130 establishments which were prepared to manufacture steel comprised 51 bessemer steel plants (including 6 Clapp-Griffiths and 5 Robert-bessemer plants), 58 open-hearth steel plants, 44 crucible steel plants, and 7 plants for producing blister or other kinds of steel. Of these 130 steel producing establishments 16 controlled both bessemer and open-hearth steel plants, 1 controlled both bessemer and special steel plants, 10 controlled both open-hearth and crucible steel plants, and 3 controlled both crucible and blister steel plants. With the exception of 23 works, all the establishments engaged in the production of crude steel contained trains of rolls.

The steel works in 1890 contained 80 standard bessemer converters, 9 Clapp-Griffiths converters, 8 Robert-Bessemer converters, 129 open-hearth steel melting furnaces, and a capacity in the crucible steel works of employing 2,606 pots at each heat.

The following summary exhibits the leading statistics of rolling mills and steel works, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, ROLLING MILLS AND STEEL WORKS: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880	1890
Number of establishments	340	358	395
Capital	\$61,120,015	\$116,458,390	c\$278,559,831
Miscellaneous expenses.....	(d)	(d)	\$11,817,593
Average number of employes.....	47,099	96,164	140,537
Total wages	\$26,813,767	\$41,880,687	\$79,293,073
Officers, firm members, and clerks.....	(e)	(e)	.....
Average number.....	.....	.....	3,242
Total wages .....	.....	.....	\$4,833,240
All other employes	(e)	(e)	.....
Average number .....	.....	.....	137,295
Total wages .....	.....	.....	\$74,460,483
Cost of materials used.....	\$84,342,649	\$130,104,493	\$216,269,022
Value of products	f\$120,921,144	\$203,274,042	\$331,860,872
Tons of products	1,491,586	3,411,562	8,274,833

a This statement includes only active establishments for the censuses of 1880 and 1890. Such establishments were not reported separately at the census of 1870.

b See remarks in regard to the depreciated currency of 1870.

c Includes hired property valued at \$3,212,000. This item was not reported separately at previous censuses.

d Not reported.

e Not reported separately.

f Includes values for which tonnage was not reported.

The comparative statement on the following page presents the leading statistics of rolling mills and steel works, by states and territories, as reported at the censuses of 1880 and 1890.

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COMPARATIVE STATEMENT, ROLLING MILLS AND STEEL WORKS, BY STATES AND TERRITORIES: 1880 AND 1890. (a)

STATES AND TERRITORIES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The United States	1880 1890	358 395	\$116,458,390 \$278,559,831	96,164 110,537	\$41,880,087 \$79,293,673	\$130,104,403 216,209,022	\$203,274,042 331,860,872
Alabama	1880 1890	1 7	50,000 2,208,797	60 1,739	18,000 738,398	25,400 931,400	47,500 2,228,536
California	1880 1890	1 4	1,000,000 4,656,611	319 1,152	177,722 740,849	535,500 1,938,333	780,000 3,097,155
Colorado	1880 1890	1 1	100,000	125	7,000	131,700	225,000
Connecticut	1880 1890	11 8	1,385,000 1,249,429	546 551	295,210 351,308	869,758 911,335	1,353,787 1,403,180
Delaware	1880 1890	8 7	1,341,469 2,558,805	807 1,690	344,476 843,210	1,214,059 1,549,539	2,347,177 2,608,070
District of Columbia	1880 1890	1	89,600	18	7,528	2,264	10,970
Georgia	1880 1890	1	250,000	500	102,230	373,276	486,700
Illinois	1880 1890	13 19	4,845,020 24,834,645	4,755 7,433	2,323,004 4,571,040	13,214,536 21,951,521	18,153,439 28,872,741
Indiana	1880 1890	9 13	1,828,000 3,888,254	1,740 2,644	810,081 1,215,792	2,957,467 2,880,615	4,090,868 4,505,530
Kansas	1880 1890	2	450,000	630	166,500	734,245	1,004,100
Kentucky	1880 1890	9 5	2,512,000 1,484,456	2,295 1,295	914,412 628,658	2,422,389 1,241,536	3,841,377 2,059,840
Maine	1880 1890	2	300,000	400	96,544	356,942	522,953
Maryland	1880 1890	5 4	2,145,000 1,071,352	1,253 573	540,974 211,009	1,829,042 766,840	2,550,051 1,062,204
Massachusetts	1880 1890	21 14	5,526,408 8,344,394	6,115 5,290	2,399,975 2,629,699	6,486,372 6,786,610	9,973,911 10,981,649
Michigan	1880 1890	2 4	671,000 1,437,540	925 777	360,727 479,783	1,188,196 1,200,758	1,446,551 1,847,565
Missouri	1880 1890	5 4	3,020,000 1,612,443	1,789 660	447,464 421,935	1,412,934 831,566	2,185,513 1,520,559
Nebraska	1880 1890	1	100,000	100	50,000	114,500	82,000
New Hampshire	1880 1890	2	650,000	290	127,690	523,355	807,340
New Jersey	1880 1890	18 19	5,005,550 8,525,996	3,495 4,027	1,412,622 2,514,404	3,914,970 5,326,401	6,704,054 8,750,431
New York	1880 1890	24 19	8,702,000 9,321,793	7,437 5,418	2,725,191 2,872,316	8,264,186 5,932,461	13,924,622 10,310,988
Ohio	1880 1890	41 55	9,805,020 25,892,300	11,127 16,942	5,539,913 12,069,542	14,848,295 28,854,036	21,860,167 45,406,560
Pennsylvania	1880 1890	158 186	60,489,920 166,601,801	43,832 78,347	20,099,576 44,921,173	61,564,150 122,530,544	98,445,700 188,714,190
Rhode Island	1880 1890	1	350,000	275	130,960	375,347	488,040
Tennessee	1880 1890	5 4	1,401,000 927,549	1,350 481	376,786 249,529	859,965 492,789	1,369,400 881,404
Vermont	1880 1890	1	300,000	165	48,000	227,100	367,500
Virginia	1880 1890	5 6	838,000 2,174,787	1,134 1,782	352,539 705,048	1,199,608 1,584,285	1,980,416 2,400,603
West Virginia	1880 1890	8 8	2,390,191 5,012,842	3,228 3,409	1,301,658 1,639,276	2,320,014 6,402,189	4,422,930 8,547,360
Wisconsin	1880 1890	1	700,000	1,300	647,577	1,729,274	3,284,556
Wyoming	1880 1890	1	212,603	184	79,650	403,568	491,845
All other states	1890	9	6,665,887	2,807	1,481,779	4,146,595	6,596,601

a This statement includes only active establishments.

b Includes hired property valued at \$3,212,000. This item was not reported separately at the census of 1880.

c Includes 3,242 officers, firm members, and clerks and their wages, amounting to \$4,833,240, distributed as follows: Alabama 43, \$56,648; California 38, \$59,549; Connecticut 29, \$39,537; Delaware 53, \$78,061; Illinois 168, \$246,193; Indiana 63, \$95,013; Kentucky 32, \$46,651; Maryland 16, \$16,823; Massachusetts 122, \$175,604; Michigan 25, \$44,444; Missouri 18, \$28,039; New Jersey 129, \$212,812; New York 127, \$199,802; Ohio 453, \$663,638; Pennsylvania 1,738, \$2,564,584; Tennessee 21, \$30,830; Virginia 40, \$65,701; West Virginia 63, \$89,687. All other states, including Colorado, Georgia, Iowa, Minnesota, Maine, New Hampshire, Rhode Island, Wisconsin, and Wyoming, 64, \$125,499. These classes were not reported separately at the census of 1880.

d Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 1; Georgia, 1; Iowa, 1; Minnesota, 1; Maine, 1; New Hampshire, 1; Rhode Island, 1; Wisconsin, 1; Wyoming, 1.

MANUFACTURING INDUSTRIES.

CAPITAL.

The aggregate capital reported by rolling mills and steel works (including idle mills and those in course of construction) increased 98.67 per cent from 1870 to 1880 and 135.37 per cent from 1880 to 1890, the total increase in the 20 years amounting to 367.60 per cent.

The following comparative statement shows the distribution of capital in active and idle establishments and those in course of construction in rolling mills and steel works, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, ROLLING MILLS AND STEEL WORKS: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash, and bills receivable.
Total	1880	307	\$121,424,745	\$71,702,590	\$40,722,149
	1890	410	α285,706,684	134,143,477	151,653,207
Establishments in operation	1880	358	116,458,390	69,033,147	47,425,243
	1890	305	278,559,831	128,623,160	149,936,671
Idle establishments	1880	33	4,004,355	2,534,449	1,529,906
	1890	34	5,711,693	4,366,017	1,345,676
Establishments in course of construction.....	1880	6	902,000	135,000	707,000
	1890	11	1,625,160	1,154,300	370,860

α Includes hired property valued at \$3,212,000. Also hired property valued at \$18,000 invested in idle establishments. This item was not reported separately at the census of 1880.

The statistics of live assets, such as cash, bills and accounts receivable, and similar items of capital, were more fully reported in 1890 than at previous census inquiries. The increase from 1880 to 1890 in the total capital invested by the rolling mills and steel works is shown by the above figures to have been 135.37 per cent, while the gain in the value of buildings, machinery, tools, and implements was 87.08 per cent. The value of land was not reported separately in 1880.

EMPLOYÉS AND WAGES.

The following statement presents the average number and total wages of officers or firm members and clerks, and the average number and total wages of skilled and unskilled employés, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES, BY CLASSES, ROLLING MILLS AND STEEL WORKS: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
All classes.....	140,537	\$79,293,673	138,327	\$78,847,810	107	\$13,806	2,103	\$402,048
Officers or firm members	890	2,630,536	890	2,630,536				
Clerks	2,352	2,202,704	2,303	2,176,004	49	26,700		
Skilled	77,638	52,583,603	77,503	52,546,013	2	1,040	133	36,550
Unskilled.....	59,657	21,876,830	57,631	21,495,266	56	16,066	1,970	365,498

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The following statement presents the average number of employes at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, ROLLING MILLS AND STEEL WORKS: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.		
	Males above 16 years.	Females above 16 years.	Children.
Total	135,134	58	2,103
Under \$5	1,402	28	1,484
\$5 and over but under \$6	3,144	12	319
\$6 and over but under \$7	8,000	8	282
\$7 and over but under \$8	15,333	4	16
\$8 and over but under \$9	19,370	3	2
\$9 and over but under \$10	17,340	1	
\$10 and over but under \$12	17,827	2	
\$12 and over but under \$15	19,634		
\$15 and over but under \$20	16,173		
\$20 and over but under \$25	9,901		
\$25 and over	6,950		

MATERIALS USED.

The following comparative statement presents the quantity and cost of the principal raw materials consumed by the rolling mills and steel works, as reported at the censuses of 1880 and 1890. With the exception of charcoal, which is stated in bushels, and of oil used for fuel, which is stated in barrels, the quantities given are in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, ROLLING MILLS AND STEEL WORKS: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total		\$130,104,403		\$216,269,022
Iron ore	373,414	2,779,879	581,503	3,355,139
Spiegeleisen and ferro-manganese	86,138	2,868,519	248,536	7,588,784
Pig iron	2,558,522	59,000,257	6,299,999	97,758,067
Old iron rails	708,534	20,701,099	392,495	9,109,765
Other old or scrap iron	438,145	11,552,698	943,023	16,418,611
Old steel rails and steel rail ends	85,953	2,435,203	145,837	2,627,649
Other old or scrap steel	110,371	3,003,714	451,346	7,945,013
Hammered iron ore blooms	43,411	2,588,140	16,936	599,983
Hammered pig or scrap blooms	49,511	2,549,829	23,452	720,457
Purchased muck bar	53,754	2,309,544	234,678	6,252,594
Purchased bessemer steel	252,155	2,808,497	838,118	24,117,021
Purchased open-hearth steel	624,993	61,530,560	141,342	4,635,585
Swedish billets and bars	10,410	855,176	15,403	1,008,698
Anthracite coal	704,976	1,875,002	961,039	1,487,713
Bituminous coal	4,605,689	10,510,255	5,171,102	9,663,208
Coke	142,605	582,901	393,050	1,311,588
Charcoal	2,667,902	234,379	2,770,611	243,773
Oil for fuel			1,859,138	1,124,206
Natural gas				3,596,940
All other materials		1,858,721		16,763,322

a Includes 9,216 tons other billets and bars, costing \$507,500.

b Includes 7,280 tons other billets and bars, costing \$400,898.

Scrap iron and scrap steel are largely used by the rolling mills and steel works. With the exception of old iron rails the consumption of scrap material has considerably increased since 1880, although not bearing the same ratio to the consumption of pig iron in 1890 as in 1880. The substitution of steel rails for iron rails in the tracks of the leading railroads of the country is gradually exhausting the supply of old iron rails, although the miles of railroad track in the United States still laid with iron rails in 1890 was about one-fifth of the total mileage.

FUEL CONSUMED.

The total expenditure for fuel in the heating and other operations connected with the manufacture of rolled and hammered iron and steel by the rolling mills and steel works amounted to \$17,397,434 in 1890, and \$13,202,597 in 1880. The consumption of anthracite coal increased from 706,976 tons in 1880 to 961,039 tons in 1890; of bituminous coal, from 4,605,689 tons to 5,171,102 tons; of coke, from 142,605 tons to 393,050 tons, and of charcoal, from 2,667,902 bushels to 2,770,611 bushels in 1890.

Since 1880 the use of natural gas for fuel exerted for a time an important influence on the manufacture of iron and steel in certain sections of the country. This fuel was employed as early as 1874 in puddling and heating furnaces in a rolling mill at Leechburg, Pa., but it was not until the discovery of the extensive gas fields in the vicinity of Murrysville, in Westmoreland county, Pennsylvania, in 1883, and the subsequent opening up of other wells in this county and in various parts of Washington county, that attention was prominently directed to the advantages of the new fuel in the manufacture of iron and steel. Following the developments in Pennsylvania wells were drilled in other states. The opening up in 1886 of the gas fields in northwestern Ohio, in Hancock county, and the subsequent discovery of deposits in eastern and central Indiana, led to the erection of numerous industrial establishments in these sections.

In 1880 the use of natural gas as fuel in iron and steel works was restricted to a few mills which obtained their supply from wells that had been driven for oil but developed gas. According to the records of the American Iron and Steel Association there were 6 rolling mills and steel works which used natural gas wholly or in part as fuel in September, 1884, which number increased to 68 in August, 1886; 96 in November, 1887, and 104 in November, 1889. In the census year, 1890, there were 85 rolling mills and steel works which reported the use of natural gas for fuel exclusively or in part. Of these works 68 were in Pennsylvania, 54 in Allegheny county, and 14 in the western part of the state outside of Allegheny county; 8 were in Ohio, 4 in the eastern part of the state, piped from wells in Pennsylvania, and 4 in the northwestern part of that state, supplied from local wells; 5 were at Wheeling and in its vicinity in West Virginia, and 4 were in Indiana.

During 1890 the cost of the natural gas used for fuel by iron and steel works was \$3,566,946. This is the amount reported as expended by various mills for natural gas, but it is not the total value of this fuel consumed in iron and steel manufacture, as many plants in Ohio and Indiana were furnished with gas free as an inducement to the location of the works in the towns controlling the supply.

As early as 1889 the diminished pressure of gas at the various iron and steel plants indicated an early exhaustion of the supply, at least for purposes requiring the enormous quantity consumed by industrial establishments. The greatly increased rates charged for gas for manufacturing purposes by the companies controlling the supply led many iron and steel manufacturers to build private pipe lines to the gas fields. Even this course has failed in many instances to give the quantity of gas required for both steam raising and iron and steel making purposes, and many plants during 1890 used the natural gas for manufacturing processes while employing other fuel under the boilers.

No figures are available of the extent to which natural gas has displaced bituminous coal as a fuel in the manufacture of iron and steel. In 1890 many of the mills, which had during the few years prior to this date employed natural gas exclusively, returned in part to the use of coal. The following is a comparative statement of the consumption of bituminous coal in 1880 and 1890 by the states which used natural gas, with the cost of the latter fuel in 1890:

COMPARATIVE STATEMENT, FUEL CONSUMED IN STATES IN WHICH NATURAL GAS IS USED IN ROLLING MILLS AND STEEL WORKS: 1880 AND 1890.

STATES.	CONSUMPTION OF BITUMINOUS COAL. (Tons.)		COST OF NATURAL GAS CONSUMED.
	1880	1890	1890
Pennsylvania.....	2,214,939	1,727,403	\$3,391,468
Ohio.....	676,084	1,459,482	151,403
Indiana.....	150,097	130,026	(a)
West Virginia.....	161,191	171,774	24,075

a Natural gas supplied free.

Pennsylvania, where most of the gas was consumed, exhibits a marked decrease in consumption of bituminous coal in the 10 years.

Numerous experiments have been made in recent years with various forms of gaseous fuel produced from coal or petroleum, but the cost has not been sufficiently favorable to result in the extended introduction of any of the processes suggested. One establishment in 1890 employed water gas, while numerous plants throughout the country have found a cheap and efficient fuel in the vast deposits of bituminous slack and anthracite culm at the

various coal mines, which had generally been considered as waste material by the mine owners. Crude oil was extensively employed in 1890 for fuel purposes, the ease with which the degree of heat may be regulated commending it favorably to the attention of iron and steel manufacturers. It was used either in special devices in the heating of iron or steel, or sprayed under boilers for steam raising purposes. The rolling mills and steel works made no report of the use of oil for fuel purposes in 1880, but the consumption in 1890 for heating and steam raising purposes amounted to 1,859,138 barrels, costing \$1,124,206, or an average of a little over 60 cents per barrel.

PRODUCTS.

The following comparative statement presents the tonnage of the iron and steel products, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, QUANTITY OF PRODUCTS, ROLLING MILLS AND STEEL WORKS: 1880 AND 1890.

CLASS OF PRODUCTS.	1880	1890
Total	3,411,502	8,274,833
Iron	2,353,248	3,225,140
Bessemer steel.....	889,806	4,385,305
Open-hearth steel.....	93,143	590,198
Crucible and miscellaneous steel.....	75,275	74,130

The following comparative statement presents the values of the different iron and steel products and the percentage that each class bears of the total, for the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, VALUE OF PRODUCTS, WITH PERCENTAGE EACH CLASS IS OF TOTAL, ROLLING MILLS AND STEEL WORKS: 1880 AND 1890.

CLASS OF PRODUCTS.	VALUE.		PERCENTAGE.	
	1880	1890	1880	1890
Total	\$203,274,042	\$331,860,872	100.00	100.00
Manufactures of iron.....	135,400,462	132,620,665	66.61	39.96
Manufactures of steel.....	66,300,735	192,992,784	32.62	58.16
Miscellaneous products	1,560,845	6,247,423	0.77	1.88

The increase in the total tonnage of products from 1880 to 1890 was 142.55 per cent, while the value of products increased only 63.26 per cent. This disproportion is due to the decline which has taken place in the selling price of iron and steel products during the past decade, owing to improvement in processes of manufacture and lessened cost of materials. A comparison of the statistics of quantity of production shows more accurately the changes which have taken place in the industry than is possible by a comparison of the value of such products.

The most notable increase in the 10 years was in bessemer steel products, which contributed 53 per cent of the aggregate output in 1890 and 26.08 per cent in 1880. The increase in the tonnage of iron products was 37.05 per cent, although they formed 68.98 per cent of the total production in 1880 and only 38.97 per cent in 1890.

Owing to the decline since 1880 in the selling prices of iron and steel products, there is a decrease in the value of iron products of 2.05 per cent, notwithstanding an increase of 37.05 per cent in the tonnage. The percentage of increase in the value of all steel products was 191.06, as compared with an increase of 377.15 per cent in the tonnage of these articles. The comparative statement on the following page exhibits the classified tonnage and value of the iron and bessemer steel and open-hearth steel products of the rolling mills and steel works as reported at the censuses of 1880 and 1890. The quantities are stated in tons of 2,000 pounds, except for nails, which are reported in kegs of 100 pounds each.

MANUFACTURING INDUSTRIES.

COMPARATIVE STATEMENT, CLASSIFIED IRON AND BESSEMER STEEL AND OPEN-HEARTH STEEL PRODUCTS,
ROLLING MILLS AND STEEL WORKS: 1880 AND 1890.

CLASS OF PRODUCTS.	Year.	IRON.		BESSEMER STEEL.		OPEN-HEARTH STEEL.	
		Tons.	Value.	Tons.	Value.	Tons.	Value.
Total	1880		\$195,400,462		\$47,495,585		\$8,100,685
	1890		132,620,665		150,655,612		32,934,121
Rails	1880	406,017	20,978,697	741,475	37,408,625	9,105	483,450
	1890	15,361	622,224	2,076,325	60,272,575		
Bars and rods, except wire rods	1880	808,837	44,605,564	125,774	8,513,594	44,430	3,577,521
	1890	1,304,115	50,048,580	340,257	12,864,136	116,657	5,654,689
Cut nails (kegs of 100 pounds)	1880	5,056,600	16,295,300				
	1890	2,139,086	4,577,557	3,704,604	7,676,306	13,340	79,740
Boiler plates	1880	89,560	6,501,298	(a)		(a)	
	1890	60,461	3,158,319	9,065	396,809	89,720	5,019,001
All other plates, except nail plates	1880	94,740	5,688,863	b1,475	148,144	b11,034	1,428,300
	1890	139,540	5,973,520	91,840	4,050,021	87,139	4,587,454
Sheets	1880	94,992	8,473,642			1,700	191,955
	1890	154,521	9,693,061	61,332	4,037,226	31,389	2,437,680
Skelp	1880	128,321	7,910,409				
	1890	465,550	17,621,186	13,919	530,366		
Hoop	1880	96,843	6,069,484				
	1890	123,317	5,076,591	5,429	234,706	3,532	190,000
Structural shapes	1880	96,810	5,520,719	557	63,060	80	8,800
	1890	137,527	6,941,474	95,693	4,529,411	76,298	3,992,074
Roller car axles	1880	2,630	179,154				
	1890	1,500	67,500			1,000	60,000
Hammered car axles	1880	21,884	1,600,104				
	1890	36,545	1,685,345	11,456	609,677	10,445	640,429
Muck bar for sale	1880	64,469	2,440,941				
	1890	282,340	7,411,748				
All other products	1880	134,406	9,136,287	20,615	1,362,162	26,794	2,476,059
	1890	301,400	10,743,547	1,494,819	55,442,379	173,351	10,303,054

a Included with "all other plates, except nail plates", in 1880.

b Includes "boiler plates".

c Includes billets and slabs sold, wire rods, wire and nail plates.

In the above statement, the tonnage of "Bars and rods, except wire rods", does not represent the total quantity of these articles rolled in each year. A number of works produce the bars or rods not for sale but for further manufacture by the same establishment into articles such as bolts, nuts, and spikes. In such instances the tonnage of the completed articles, and not the tonnage of the bars and rods from which they are made, is given, being included with "All other products".

While it has been the endeavor to confine the statistics of the rolling mills and steel producing works as closely as possible to the articles which are strictly the products of such processes of manufacture, there are instances similar to the above, and others which are elsewhere explained, where it has not been practicable for the owners of these establishments to divide all their interwoven operations and accounts so as to determine what part should be credited to the manufacture of bars and rods and what part to the more finished articles made from them. Consequently the capital, labor, materials, and products of such establishments are tabulated as a whole, as was done in 1880.

As previously explained, a number of iron and steel establishments sold muck bar and steel billets or slabs to other rolling mills for manufacture into more finished forms. To this extent there is an unavoidable duplication in the tonnage and value of products, the muck bar and steel billets sold and included in the table of products as the output of certain establishments being considered as materials of the works purchasing them, and appearing as the product of the second establishment in the form of bars, plates, nails, and other products.

During 1890 the bessemer steel works produced 4,051,262 tons of bessemer steel ingots, although the figures in the preceding table show that the aggregate output of bessemer steel finished products was 4,385,365 tons. The apparent discrepancy is due to the unavoidable duplication above referred to, the quantity of steel billets and slabs sold to other works being included in the table of products. In 1890 the iron and steel rolling mill establishments purchased from the steel producing works and rolled into finished forms 838,118 tons of bessemer steel billets and slabs.

IRON AND STEEL MANUFACTURE.

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The following comparative statement presents the total tonnage of the iron and steel products of the rolling mills and steel works, by states and territories, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, QUANTITY OF PRODUCTS, ROLLING MILLS AND STEEL WORKS, BY STATES AND TERRITORIES: 1880 AND 1890.

STATES AND TERRITORIES.	1880			1890		
	Total.	Iron.	Steel.	Total.	Iron.	Steel.
The United States.....	3,411,502	2,353,248	1,058,314	8,274,833	3,225,140	5,049,693
Alabama.....	650	650	-----	52,205	50,550	1,655
California.....	14,000	14,000	-----	56,747	39,303	17,444
Colorado.....	4,500	4,500	-----	20,883	6,507	14,286
Connecticut.....	19,282	16,203	3,079	27,727	17,123	10,604
Delaware.....	33,918	33,918	-----	58,437	57,913	524
District of Columbia.....	264	264	-----	-----	-----	-----
Georgia.....	11,501	11,501	-----	2,838	2,838	-----
Illinois.....	322,490	117,051	205,448	910,648	156,404	754,244
Indiana.....	77,880	77,880	-----	110,201	73,731	36,470
Iowa.....	-----	-----	-----	1,183	1,183	-----
Kansas.....	19,055	19,055	-----	-----	-----	-----
Kentucky.....	65,643	65,293	350	49,082	36,711	12,371
Maine.....	8,851	8,851	-----	10,300	10,300	-----
Maryland.....	47,609	47,609	-----	20,222	8,479	11,743
Massachusetts.....	131,734	109,252	22,482	150,621	42,224	108,397
Michigan.....	23,130	23,130	-----	40,588	33,473	7,110
Minnesota.....	-----	-----	-----	2,565	2,565	-----
Missouri.....	26,708	16,503	10,200	27,708	25,208	2,500
Nebraska.....	2,000	2,000	-----	-----	-----	-----
New Hampshire.....	7,978	4,752	3,226	6,650	3,450	3,200
New Jersey.....	82,617	66,030	16,587	157,276	89,818	67,458
New York.....	253,214	163,538	89,676	240,026	109,472	130,554
Ohio.....	381,429	272,094	109,335	1,128,013	571,334	556,679
Pennsylvania.....	1,661,784	1,071,098	590,686	4,770,970	1,705,202	3,065,774
Rhode Island.....	8,134	8,134	-----	13,006	13,006	-----
Tennessee.....	28,126	25,381	2,745	20,651	20,521	130
Vermont.....	6,000	1,500	4,500	-----	-----	-----
Virginia.....	35,176	35,176	-----	52,442	50,655	1,787
West Virginia.....	67,437	67,437	-----	250,838	39,223	220,615
Wisconsin.....	60,653	60,653	-----	74,695	48,547	26,148
Wyoming.....	9,790	9,790	-----	9,305	9,305	-----

CRUDE STEEL.

The total production of steel in the United States in the form of ingots or direct castings during the census year 1890 amounted to 4,675,610 tons of 2,000 pounds, as compared with 1,150,667 tons produced during 1880, an increase of 3,524,943 tons, or 306.34 per cent. The comparative statement on the following page shows the production of the various kinds of steel in the form of ingots or direct castings, by states, as reported at the censuses of 1880 and 1890.

MANUFACTURING INDUSTRIES.

COMPARATIVE STATEMENT, QUANTITY OF CRUDE STEEL, INGOTS, OR DIRECT CASTINGS, ROLLING MILLS AND STEEL WORKS, BY STATES: 1880 AND 1890.

STATES.	AGGREGATE. (Tons.)		BESSEMER STEEL. (Tons.)		OPEN-HEARTH STEEL. (Tons.)		CRUCIBLE STEEL. (Tons.)		MISCELLANEOUS STEEL. (Tons.)	
	1880	1890	1880	1890	1880	1890	1880	1890	1880	1890
The United States.....	1,150,067	21,675,610	985,208	21,051,262	84,302	537,639	76,201	82,748	4,956	3,961
Alabama.....		309				300				
California.....		8,456				8,456				
Colorado.....		17,952		17,952						
Connecticut.....	2,200	1,743					2,116	1,743	84	
Illinois.....	254,560	873,551	253,514	870,775	925	2,331	130	445		
Indiana.....		1,250				1,000		250		
Kentucky.....	350				275		75			
Maryland.....		1,000						1,000		
Massachusetts.....	9,615	29,425		15,753	9,475	13,140	140	532		
Michigan.....		5,438		3,600				1,838		
Missouri.....	8,409		8,409							
New Hampshire.....	4,521	3,700			4,521	3,700				
New Jersey.....	11,042	23,687			450	15,554	10,492	7,433	1,000	700
New York.....	86,745	113,981	84,160	105,402		1,300	2,585	7,270		
Ohio.....	107,883	443,043	82,811	381,098	24,712	61,945	300			
Pennsylvania.....	637,433	2,971,270	556,314	2,476,018	36,944	429,013	60,303	62,078	3,872	3,261
Tennessee.....	4,000	150			4,000			150		
Vermont.....	3,000				3,000					
West Virginia.....		180,064		180,064						

a Including 77,632 tons of Clapp-Griffiths steel made in Illinois, Massachusetts, and Pennsylvania, and 4,884 tons of Robert-Bessemer steel made in Illinois, Michigan, and Pennsylvania.

During 1880 14 states contained steel making establishments, and steel was produced in that year in each of these states except Rhode Island and Maryland. In 1890 steel works were located in 19 states and steel was made in that year in each of these states except Kentucky, Missouri, and Virginia.

Pennsylvania continues to occupy the position of the leading producer of steel in the United States, producing 57.13 per cent of the total production in 1880 and 63.55 per cent in 1890. Illinois was second in rank in both years, and Ohio was third.

From 1880 to 1890 the increase in production in Pennsylvania was 351.95 per cent, in Illinois, 243.15 per cent, and in Ohio, 310.67 per cent. Since 1880 the manufacture of steel has been abandoned in 2 states, namely, Rhode Island and Vermont, and 7 states have engaged in its production, namely, Alabama, California, Colorado, Indiana, Michigan, Virginia, and West Virginia.

MACHINERY IN ROLLING MILLS AND STEEL WORKS.

The following comparative statement shows the equipment and capacity of the rolling mills and steel works, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, EQUIPMENT AND CAPACITY, ROLLING MILLS AND STEEL WORKS: 1880 AND 1890. (*a*)

MACHINERY.	1880	1890	Increase.
Single puddling furnaces.....	4,376	4,853	477
Heating furnaces.....	2,622	2,912	290
Bessemer converters.....	24	697	73
Open hearth furnaces.....	37	129	92
Crucible pots which can be used at each heat.....	2,601	2,606	5
Hammers.....	458	625	167
Cut nail machines.....	3,775	5,909	2,134
Trains of rolls.....	1,342	1,557	215
Aggregate daily capacity in finished products, net tons.....	22,608	46,565	24,467

a Includes machinery in both active and idle establishments.

b Includes 9 Clapp-Griffiths and 8 Robert-Bessemer converters.

c Decrease.

In addition to the increase in the number of bessemer converters and open-hearth steel melting furnaces from 1880 to 1890, the tendency during this period has been toward the employment of much larger vessels and furnaces. Except in a few instances where bessemer converters of 2 and 3 tons capacity have been added to iron rolling mills for special purposes, the old standard vessel of 5 tons capacity has been superseded in the larger works by

converters of from 10 to 12 tons capacity per heat. In one establishment bessemer converters of 15 tons capacity have been erected. The open-hearth furnaces in 1880 had a capacity ranging from 7 to 10 tons per heat, but in 1890 many works contained steel melting furnaces with a capacity of from 20 to 30 tons each.

The daily capacity of the rolling mills and steel works in tons of finished products has more than doubled since 1880. This great expansion has been largely due to the use of more extensive plants and greater efficiency in the handling of the improved machinery employed, although the substitution of steel for iron has contributed to this growth in an important degree, the rolling of steel insuring a larger output than is possible in the manufacture of iron products. The heavy output of bessemer steel works are not so much the result of greater rapidity in the completion of the various processes of manufacture as they are to the shorter period of idleness which is allowed to intervene between the completion of one operation and the beginning of another.

FORGES AND BLOOMERIES.

The manufacture of charcoal blooms and hammered bar iron direct from iron ore and of charcoal blooms from pig and scrap iron is rapidly succumbing to the competition of modern processes of iron and steel making, the industry in 1890 occupying an insignificant position as compared with its importance a decade or two ago.

In 1880 the establishments engaged in the manufacture of wrought iron direct from iron ore were located in 8 states, the works in Missouri, New Jersey, New York, and Pennsylvania producing blooms and billets, while those in Georgia, North Carolina, Tennessee, and Virginia made hammered bar iron. The forges in the southern states were of small size, usually containing 2 forge fires, and were able to produce in a day about 250 pounds of hammered bar iron to each fire. Many of these quaint iron making enterprises were to be found in the mountainous districts of eastern Tennessee and western North Carolina. They were operated only at irregular intervals, depending upon the wants of the neighboring blacksmiths, and also upon the supply of water in the mountain streams which furnished the power to operate the blast and hammer. The ancient "trompe" or water blast was employed by these works, furnishing a fairly steady blast for the forge fires. With the advent of railroads into these districts, bringing the cheaper products of more modern methods of manufacture, the necessity which called into existence these primitive works has passed away. One by one the forges have been abandoned and dismantled, and the industry in the southern states may be considered as practically extinct. Primitive as these forges were in character, the bar iron produced was of good quality, and the passage of these works from activity to idleness marks an important step in the progress and advancement of the iron and steel industry.

Of the production of charcoal blooms and billets from iron ore in 1880, New York contributed 83.92 per cent; Pennsylvania, 0.47 per cent; New Jersey, 1.39 per cent; and Missouri, 10.63 per cent. Since 1880 the decline in the prices of iron and steel products has led to the substitution of other forms of material for the products of these small enterprises, and the majority of the works which were active at that date have been abandoned. In 1890 New York was the only state producing wrought iron blooms made direct from iron ore, the forges being located in the Lake Champlain district, where an abundant supply of rich iron ore was obtainable. The product of these works consisted of charcoal blooms and billets, which were highly esteemed for use in the manufacture of plate and sheet iron and fine grades of steel.

Blooms from pig and scrap iron were made in 8 states in 1880, the larger part of the production of that year being the output of works in Pennsylvania, Maryland, New Jersey, and Virginia. These blooms were used in the manufacture of plate and sheet iron wire, and for other purposes requiring a high grade of material. The production of blooms from pig and scrap iron has also seriously felt the competition of the products of less costly processes of manufacture.

MANUFACTURING INDUSTRIES.

The following comparative summary presents the leading statistics relating to the forge and bloomery industry, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, FORGES AND BLOOMERIES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880	1890
Number of establishments.....	82	93	20
Capital.....	\$4,500,733	\$3,915,213	\$876,470
Miscellaneous expenses.....	(c)	(c)	\$54,080
Average number of employes (aggregate).....	2,902	2,939	480
Total wages.....	\$1,195,964	\$915,395	\$216,374
Officers, firm members, and clerks.....	(d)	(d)	
Average number.....			15
Total wages.....			\$17,309
All other employes.....	(d)	(d)	
Average number.....			471
Total wages.....			\$109,065
Cost of materials used.....	\$5,685,466	\$2,546,915	\$905,208
Value of products (e).....	\$7,647,054	\$3,068,074	\$1,183,494
Tons of products.....	110,898	72,557	34,775

a This statement includes only active establishments for the censuses of 1880 and 1890; such establishments were not reported separately at the census of 1870.

b See remarks in regard to the depreciated currency of 1870.

c Not reported.

d Not reported separately.

e Includes values for which tonnage was not reported.

The following comparative statement presents the leading statistics of the forges and bloomeries, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, FORGES AND BLOOMERIES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The United States.....	1880	93	\$3,915,213	2,939	\$915,395	\$2,546,915	\$3,068,074
	1890	20	876,470	486	216,374	905,208	1,183,494
Georgia.....	1880	3	11,800	49	5,835	16,635	37,200
	1890						
Maryland.....	1880	1	60,000	67	18,138	102,726	219,660
	1890						
Massachusetts.....	1880	1	5,000	8	564	1,834	2,200
	1890						
Missouri.....	1880	3	228,000	165	60,000	151,500	200,000
	1890						
New Jersey.....	1880	7	114,000	123	30,187	152,643	209,095
	1890						
New York.....	1880	20	2,214,000	1,489	471,831	964,421	1,478,356
	1890	9	517,434	154	61,050	279,503	356,843
North Carolina.....	1880	9	190,400	63	7,907	11,792	41,085
	1890						
Pennsylvania.....	1880	26	978,000	660	243,436	1,027,805	1,556,809
	1890						
Tennessee.....	1880	15	39,200	148	21,090	26,654	64,781
	1890						
Virginia.....	1880	8	65,213	167	56,907	90,905	158,888
	1890						
All other states.....	1890	11	359,036	332	155,324	625,705	826,651

a This statement includes only active establishments.

b Includes 15 officers, firm members, and clerks and their wages, amounting to \$17,309, distributed as follows: New York 7, \$10,800; Pennsylvania, Maryland, and New Jersey 8, \$6,509. These classes were not reported separately at the census of 1880.

c Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Maryland 1, New Jersey 1, and Pennsylvania 9.

IRON AND STEEL MANUFACTURE.

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CAPITAL.

The following comparative statement shows the different items of capital in active and idle establishments in forges and bloomeries, as reported at the censuses of 1880 and 1890. There were no plants reported in course of construction.

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL, ACTIVE AND IDLE ESTABLISHMENTS, FORGES AND BLOOMERIES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of estab-lish-ments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total	1880	118	\$4,305,903	\$2,901,550	\$2,094,413
	1890	32	1,074,970	462,500	612,470
Establishments in operation.....	1880	93	3,915,213	2,018,800	1,896,413
	1890	20	876,470	338,000	536,470
Idle establishments.....	1880	25	480,750	282,750	198,000
	1890	12	198,500	124,500	74,000

EMPLOYÉS AND WAGES.

The following statement shows the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, FORGES AND BLOOMERIES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.					
	Aggregates.		Males above 16 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.
All classes.....	486	\$216,374	483	\$216,014	3	\$360
Officers or firm members.	11	16,100	11	16,100	.....	.....
Clerks.....	4	1,200	4	1,200	.....	.....
Skilled.....	317	150,943	317	150,943	.....	.....
Unskilled.....	154	48,122	151	47,762	3	360

The following statement presents the average number of employés at the different weekly rates of wages:

AVERAGE NUMBER OF SKILLED AND UNSKILLED EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, FORGES AND BLOOMERIES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years.	Children.
Total	468	3
Under \$5.....	6	3
\$5 and over but under \$6.....	11	.....
\$6 and over but under \$7.....	35	.....
\$7 and over but under \$8.....	65	.....
\$8 and over but under \$9.....	58	.....
\$9 and over but under \$10.....	36	.....
\$10 and over but under \$12.....	113	.....
\$12 and over but under \$15.....	102	.....
\$15 and over but under \$20.....	42	.....

MANUFACTURING INDUSTRIES.

MATERIALS USED.

The following comparative statement presents the total quantity and cost of each class of materials consumed by the forges and bloomeries, as reported at the censuses of 1880 and 1890. With the exception of charcoal, which is reported in bushels, the quantities are given in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, FORGES AND BLOOMERIES: 1880 AND 1890.

CLASS OF MATERIAL.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total		\$2,546,915		\$905,208
Iron ore.....	79,610	531,540	18,807	110,587
Pig iron.....	38,113	945,375	8,227	145,867
Old scrap iron	8,933	215,576	24,000	359,777
Charcoal.....	13,014,361	812,615	4,056,435	270,082
Anthracite coal.....	340	1,220	398	946
Bituminous coal.....	1,613	4,298	1,300	3,300
Coke.....	6,655	31,241	1,405	5,604
All other materials		5,050		9,045

The production of wrought iron from ore has decreased from 37,633 tons in 1880 to 9,347 tons in 1890, while the production of blooms from pig and scrap iron has decreased from 34,924 tons in 1880 to 25,428 tons in 1890.

PRODUCTS.

The following comparative statement presents the production of the iron ore forges and pig iron and scrap iron bloomeries, as reported at the censuses of 1880 and 1890. The quantities are stated in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF PRODUCTS, FORGES AND BLOOMERIES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Tons.	Value.	Tons.	Value.
Total.....		\$3,968,074		\$1,183,494
Blooms and bar iron direct from iron ore.....	37,633	1,812,330	9,347	350,843
Blooms from pig and scrap iron.....	34,924	2,129,933	25,428	821,168
Other products		25,761		5,483

In 1870 there were produced 110,808 tons of charcoal blooms and hammered bar iron.

MACHINERY.

The following comparative statement presents the equipment and total daily capacity of the forges and bloomeries, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, EQUIPMENT AND TOTAL DAILY CAPACITY, FORGES AND BLOOMERIES: 1880 AND 1890.

ITEMS.	1880	1890	Decrease.
Number of fires	495	202	293
Number of hammers	141	39	102
Total daily capacity, in tons of blooms, billets, or bars.....	520	295	225

THE INDUSTRY CONSIDERED GEOGRAPHICALLY.

In the presentation of the iron and steel industry of the various sections of the United States, the states may be regarded as comprising four grand divisions: the New England states; the middle states, including New York, New Jersey, Pennsylvania, and Delaware; the southern states, including the iron making states of Maryland, Virginia, West Virginia, North Carolina, Georgia, Alabama, Kentucky, Tennessee, and Texas; and the western states, including all states west of Pennsylvania not included in any of the other grand divisions.

The following comparative summary presents the leading statistics of the iron and steel industry by totals of these grand divisions, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, IRON AND STEEL INDUSTRY, BY GEOGRAPHICAL DIVISIONS: 1880 AND 1890. (a)

GEOGRAPHICAL DIVISIONS.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products. (b)	Tonnage of products.
				Employés.	Wages.			
The United States.....	c1880 1890	792 719	\$209,904,965 \$414,044,844	d140,798 f175,506	d\$55,451,510 f95,736,192	\$191,271,150 327,272,845	\$296,557,685 478,687,519	7,205,140 18,216,215
New England states.....	1880 1890	49 32	10,400,408 13,224,150	8,654 6,844	3,357,911 3,521,475	9,518,570 9,286,050	14,558,627 15,105,441	212,980 242,639
Middle states.....	1880 1890	440 300	122,814,213 256,833,069	75,055 108,592	31,348,225 59,914,027	113,432,592 199,225,674	180,484,560 294,048,406	4,492,746 10,613,053
Southern states.....	1880 1890	130 109	21,942,311 43,051,652	19,728 17,601	5,916,868 7,600,600	13,739,624 27,047,767	23,006,674 39,982,152	615,255 2,297,184
Western states.....	1880 1890	173 188	44,658,033 100,935,973	37,361 42,469	14,828,506 24,631,000	54,580,364 91,713,354	78,508,424 129,551,520	1,944,179 5,063,339

a This statement includes only active establishments.

b Includes values for which tonnage was not reported.

c For explanation of the apparent discrepancies in the data for 1880 see remarks in regard to the inclusion of capital, employés, and wages relating to mining and other operations.

d Does not include 180 employés and \$25,275 wages reported by an idle establishment in Minnesota and included in the totals published at the census of 1880. These employés were engaged in making repairs to plant.

e Includes hired property valued at \$8,273,058, distributed as follows: New England states, \$115,000; middle states, \$3,188,000; southern states, \$1,283,000; western states, \$3,687,058. This item was not reported separately at the census of 1880.

f Includes 4,325 officers, firm members, and clerks, and their wages, amounting to \$6,402,236, distributed as follows: New England states 199, \$297,157; middle states 2,484, \$3,747,602; southern states 550, \$806,415; western states 1,092, \$1,611,062. These classes were not reported separately at the census of 1880.

NEW ENGLAND STATES.

In 1880 each of the New England states contained establishments engaged in the manufacture of iron and steel, but in 1890 this industry is reported in but 5 of these states. The 4 establishments in Vermont engaged in the manufacture of iron and steel in 1880 have been abandoned.

The following comparative summary presents the leading statistics relating to the iron and steel industry in the New England states, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, IRON AND STEEL INDUSTRY IN THE NEW ENGLAND STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments.....	48	49	32
Capital.....	\$5,909,000	\$10,490,408	e\$13,224,150
Miscellaneous expenses.....	(d)	(d)	\$413,578
Average number of employés.....	3,815	8,654	6,844
Total wages.....	\$2,168,719	\$3,957,911	\$3,521,475
Officers, firm members, and clerks:			
Average number.....	(e)	(e)	199
Total wages.....			\$297,157
All other employés:			
Average number.....	(e)	(e)	6,645
Total wages.....			\$3,224,318
Cost of materials used.....	\$7,398,150	\$9,518,570	\$9,286,050
Value of products.....	f\$10,824,603	\$14,558,627	\$15,105,441
Tons of products.....	134,529	212,980	242,639

a This statement includes only active establishments for the censuses of 1880 and 1890; such establishments were not reported separately at the census of 1870.

b For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employés, and wages relating to mining and other operations in the figures for 1880.

c Includes hired property, valued at \$115,000. This item was not reported separately at previous censuses.

d Not reported.

e Not reported separately.

f Includes values for which tonnage was not reported.

MANUFACTURING INDUSTRIES.

Notwithstanding the decrease shown in the number of establishments in 1890 as compared with 1880, there has been an increase in the amount of capital and in the value of products. It is proper, however, to state in this connection, that the growth of the New England iron and steel industry during the past 20 years, as shown by a comparison of the total value of products in 1870, 1880, and 1890, is due mainly to the development of a single concern engaged in the manufacture of the more highly finished products of iron and steel.

The following comparative statement presents the leading statistics of the iron and steel industry of each of the New England States, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, IRON AND STEEL INDUSTRY IN THE NEW ENGLAND STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The New England States	1880 1890	49 32	\$10,460,408 \$13,224,150	8,654 26,844	\$3,357,911 \$3,521,475	\$9,518,570 9,286,050	\$14,558,627 15,105,411
Connecticut.....	1880 1890	17 13	2,557,000 2,180,521	685 690	\$31,184 418,189	1,341,225 1,324,078	1,998,098 2,037,618
Maine.....	1880 1890	3	450,000	700	141,494	380,511	583,328
Massachusetts.....	1880 1890	24 15	6,163,408 9,005,555	6,513 5,337	2,576,539 2,652,039	6,657,232 6,951,018	10,288,021 11,201,149
New Hampshire.....	1880 1890	2	650,000	200	127,600	523,355	807,340
Rhode Island.....	1880 1890	1	350,000	275	130,069	375,347	488,040
Vermont.....	1880 1890	2	320,000	191	50,035	240,000	392,300
All other states.....	1890	4	2,029,074	817	451,247	1,010,954	1,866,674

a This statement includes only active establishments.

b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employés, and wages relating to mining and other operations.

c Includes hired property valued at \$115,000. This item was not reported separately at the census of 1880.

d Includes 199 officers, firm members and clerks, and their wages amounting to \$297,157, distributed as follows: Connecticut 41, \$55,784; Massachusetts 127, \$182,904; all other states 31, \$58,469. These classes were not reported separately at the census of 1880.

e Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Maine, 2; New Hampshire, 1; and Rhode Island, 1.

CAPITAL.—The following comparative statement shows the different items of capital in active and idle establishments in the iron and steel industry in the New England states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS, IRON AND STEEL INDUSTRY IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash, and bills receivable.
Total.....	1880 1890	61 35	\$11,560,408 \$13,415,150	\$6,305,435 4,958,545	\$5,254,973 8,456,905
Establishments in operation.....	1880 1890	49 32	10,490,408 13,224,150	5,700,435 4,830,545	4,789,073 8,398,005
Idle establishments.....	1880 1890	12 3	1,070,000 191,000	605,000 128,000	465,000 63,300

a See remarks in regard to inclusion of capital relating to mining and other operations in the figures for 1880.

b Includes hired property valued at \$115,000. This item was not reported separately at the census of 1880.

BLAST FURNACES.

During the census year 1890 there were produced by the blast furnaces of New England 34,335 net tons of pig iron, valued at \$886,438, as compared with 30,957 net tons of pig iron, valued at \$1,020,896, reported at the census of 1880. In 1890 the pig iron industry of New England, including active and idle establishments, was confined to Maine, Massachusetts, and Connecticut; Maine contained 1 establishment with 1 furnace, Massachusetts contained 2 establishments with 4 furnaces, and Connecticut contained 7 establishments with 9 furnaces. The pig iron industry of Massachusetts and Connecticut is located in the western parts of these states, in what is known as the Salisbury district, charcoal constituting the fuel used in the furnaces. The iron manufactured is consumed chiefly in the manufacture of car wheels, for which purpose it is especially adapted.

The following comparative summary presents the leading statistics of the blast furnace industry of the New England states, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, BLAST FURNACES IN THE NEW ENGLAND STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments.....	13	10	7
Capital	\$1,505,000	\$1,974,000	\$1,751,253
Miscellaneous expenses	(c)	(c)	\$110,073
Average number of employés (aggregates)	613	855	216
Total wages	\$437,035	\$288,950	\$100,581
Officers, firm members, and clerks:			
Average number.....	(d)	(d)	18
Total wages			\$24,547
All other employés:			
Average number.....	(d)	(d)	198
Total wages			\$76,034
Cost of materials used	\$1,202,031	\$677,862	\$634,052
Value of products.....	\$1,737,350	\$1,042,896	\$886,438
Tons of products	34,471	30,957	31,325

a This statement includes only active establishments for the censuses of 1880 and 1890. Such establishments were not reported separately at the census of 1870.

b For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employés, and wages relating to mining and other operations in the figures for 1880.

c Not reported.

d Not reported separately.

e Includes values for which tonnage was not reported.

CAPITAL.—The following statement shows the different items of capital in active and idle establishments in blast furnaces in the New England states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS, BLAST FURNACES IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total	1880	14	\$2,149,000	\$429,500	\$1,722,500
	1890	10	1,042,553	689,794	1,261,759
Establishments in operation.....	1880	10	1,974,000	376,500	1,597,500
	1890	7	1,751,253	552,794	1,198,459
Idle establishments	1880	4	175,000	50,000	125,000
	1890	3	191,300	128,000	63,300

a See remarks in regard to the inclusion of capital relating to mining and other operations in the figures for 1880.

Of the 4 establishments that have been abandoned since 1880, 1 was located in Vermont, 2 were in Massachusetts, and 1 was in Connecticut.

EMPLOYÉS AND WAGES.—It is impracticable to make a correct comparison of the number of employés and wages for blast furnaces in 1880 and 1890; the figures for 1880, as previously explained, often including not only the labor directly employed at the furnaces, but also the labor engaged in mining and other operations conducted in direct connection with these establishments.

The following statement presents the average number and total wages of officers or firm members and clerks, and the average number and total wages of skilled and unskilled employés, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, BLAST FURNACES IN THE NEW ENGLAND STATES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES. (Males above 16 years.)	
	Employés.	Wages.
All classes	216	\$100,581
Officers or firm members	11	18,500
Clerks	7	6,047
Skilled	76	32,948
Unskilled.....	122	43,086

MANUFACTURING INDUSTRIES.

The following statement shows the average number of employes at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, BLAST FURNACES IN THE NEW ENGLAND STATES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	Average number of employes. (Males above 16 years.)	WEEKLY RATES OF WAGES.	Average number of employes. (Males above 16 years.)
Total	198	\$9 and over but under \$10	63
Under \$5		\$10 and over but under \$12	37
\$5 and over but under \$6	2	\$12 and over but under \$15	7
\$6 and over but under \$7	3	\$15 and over but under \$20	1
\$7 and over but under \$8	38	\$20 and over but under \$25	
\$8 and over but under \$9	41	\$25 and over	6

During the census year 1890 the blast furnaces of New England were in operation an average of 8 months each, and the average term of employment for labor was 9 months. Furnace employes worked 12 hours per day, 7 days each week; yard hands worked 10 hours daily for 6 days of the week.

MATERIALS USED.—The following comparative statement presents the quantities and cost of the materials consumed by the blast furnaces of the New England states, as reported at the censuses of 1880 and 1890. Quantities are stated in tons of 2,000 pounds, except charcoal, which is reported in bushels.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, BLAST FURNACES IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF MATERIAL.	1880		1890	
	Quantities.	Cost.	Quantities.	Cost.
Total		\$677,862		\$634,052
Iron ore	73,019	345,361	75,608	268,880
Fluxing materials	12,604	11,033	11,168	10,330
Anthracite coal	5,900	23,240		
Charcoal	2,955,827	295,292	3,691,504	354,388
Mill cinder	132	2,936	45	454

PRODUCTS.—The following comparative statement presents the quantity and value of pig iron, including castings direct from the furnace, according to fuel used, produced by the blast furnaces of the New England states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF PRODUCTS CLASSIFIED ACCORDING TO KIND OF FUEL USED, BLAST FURNACES IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Tons.	Value.	Tons.	Value.
Total		\$1,042,896		\$886,438
Charcoal pig iron	26,554	888,836	34,335	886,438
Anthracite pig iron	4,403	132,060		
Total tonnage and value	30,957	1,020,896	34,335	886,438
All other products		22,000		

ROLLING MILLS AND STEEL WORKS.

The census of 1880 credited the New England states with 35 iron rolling mills, 5 open-hearth steel works, and 4 crucible steel works. In 1890 there were 25 rolling mills and steel works, of which 16 were iron and steel rolling mills not connected with steel producing works, and 9 establishments were equipped for the manufacture of crude steel. The 9 steel making establishments comprised 3 bessemer steel plants (one of which was Clapp-Griffiths), 3 open-hearth steel plants, 4 crucible plants, and 1 blister steel plant. One establishment contained both bessemer and open-hearth steel plants, and one made both crucible and blister steel. With the exception of one establishment all the works contained trains of rolls.

Establishments engaged in the manufacture of rolled iron or steel were reported in all the New England states at the census of 1880, and in 1890 each state, except Vermont, contained rolling mills or steel works which were in operation at some time during the year, although the business of several of the establishments was confined chiefly to the working of material furnished by their customers.

The following comparative summary presents the leading statistics relating to rolling mills and steel works in the New England states, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870	1880	1890
Number of establishments	34	38	25
Capital	\$4,238,000	\$8,511,408	\$11,472,897
Miscellaneous expenses	(d)	(d)	\$303,505
Average number of employes (aggregate)	3,195	7,791	6,628
Total wages	\$1,728,684	\$3,068,388	\$3,420,894
Officers, firm members, and clerks:			
Average number	(e)	(e)	181
Total wages			\$272,610
All other employes:			
Average number	(e)	(e)	6,447
Total wages			\$3,148,284
Cost of materials used	\$6,124,910	\$8,838,874	\$8,051,998
Value of products (f)	\$9,070,253	\$13,513,531	\$14,219,003
Tons of products	99,808	181,979	208,304

- a This statement includes only active establishments for the censuses of 1880 and 1890. Such establishments were not reported separately at the census of 1870.
- b See remarks in regard to the depreciated currency of 1870.
- c Includes hired property valued at \$115,000. This item was not reported separately at previous censuses.
- d Not reported.
- e Not reported separately.
- f Includes values for which tonnage was not reported.

The following comparative statement presents the leading statistics relating to rolling mills and steel works in the New England states, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The New England states	1880 1890	38 25	\$8,511,408 \$11,472,897	7,791 6,628	\$3,068,388 \$3,420,894	\$8,838,874 8,051,998	\$13,513,531 14,219,003
Connecticut	1880 1890	11 8	1,985,000 1,249,429	546 561	265,210 351,308	809,758 911,335	1,353,787 1,463,180
Maine	1880 d1890	2	300,000	400	96,544	359,942	522,953
Massachusetts	1880 1890	21 14	5,520,408 8,344,394	6,115 5,290	2,399,975 2,629,699	6,486,372 6,780,610	9,973,911 10,981,619
New Hampshire	1880 d1890	2	650,000	290	127,090	523,355	807,340
Vermont	1880 1890	1	300,000	165	48,000	227,100	367,500
Rhode Island	1880 d1890	1	350,000	275	130,969	375,347	488,040
All other states	d1890	3	1,879,074	777	439,887	954,053	1,774,174

- a This statement includes only active establishments.
- b Includes hired property valued at \$115,000. This item was not reported separately at the census of 1880.
- c Includes 181 officers, firm members, and clerks, and their wages, amounting to \$272,610, distributed as follows: Connecticut 20, \$39,537; Massachusetts 122, \$175,064; all other states 39, \$57,409. These classes were not reported separately at the census of 1880.
- d Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Maine, 1; New Hampshire, 1; Rhode Island, 1.

MANUFACTURING INDUSTRIES.

CAPITAL.—The following statement shows the different items of capital in active and idle establishments in rolling mills and steel works in the New England states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash, and bills receivable.
Total	1880	44	\$0, 316, 408	\$5, 800, 435	\$3, 515, 973
	1890	25	11, 472, 897	4, 277, 751	7, 195, 146
Establishments in operation.....	1880	38	8, 511, 408	5, 320, 435	3, 190, 973
	1890	25	11, 472, 897	4, 277, 751	7, 195, 146
Idle establishments.....	1880	6	305, 000	480, 000	325, 000
	1890				

^a Includes hired property valued at \$115,000. This item was not reported separately at the census of 1880.

Of the 38 active and 6 idle establishments that were in existence at the census of 1880, 17 were abandoned before the census of 1890. There is an apparent discrepancy in this statement of 2 establishments, which is accounted for by the fact that in 1880 where a rolling mill was operated in connection with a steel plant the works were tabulated as 2 establishments. In 1890 works consisting of a rolling mill and steel plant have been considered as 1 establishment.

The 17 establishments reported at the Tenth Census, and since abandoned, represented an invested capital of \$2,932,000, reported 2,262 employes and wages amounting to \$763,599, and produced various manufactures of iron and steel valued at \$3,759,499. There were erected during the decade 2 other establishments which have also been abandoned, and do not appear in the census reports for either period. Several of the establishments which have continued in operation have abandoned portions of their plant and are now running on a smaller scale than formerly.

The increase of capital shown in the foregoing table is due in a great measure to the form of inquiry used in 1890, which tended to develop more fully the true amount of capital.

EMPLOYEES AND WAGES.—The following statement presents the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employes, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYEES AND TOTAL WAGES BY CLASSES, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYEES AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
All classes.....	6, 028	\$3, 420, 894	6, 509	\$3, 390, 302	43	\$13, 212	76	\$17, 380
Officers or firm members.....	46	115, 866	46	115, 866				
Clerks.....	135	156, 744	134	156, 224	1	520		
Skilled.....	3, 703	2, 031, 398	3, 645	2, 017, 398			58	14, 000
Unskilled.....	2, 744	1, 116, 886	2, 684	1, 100, 814	42	12, 602	18	3, 380

The following statement presents the average number of employes at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYEES AT DIFFERENT WEEKLY RATES OF WAGES, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYEES.		
	Males above 16 years.	Females above 15 years.	Children.
Total	6,329	42	76
Under \$5.....	46	15	48
\$5 and over but under \$6.....	149	12	21
\$6 and over but under \$7.....	362	8	7
\$7 and over but under \$8.....	657	4	
\$8 and over but under \$9.....	1,305	3	
\$9 and over but under \$10.....	1,259		
\$10 and over but under \$12.....	889		
\$12 and over but under \$15.....	787		
\$15 and over but under \$20.....	541		
\$20 and over but under \$25.....	205		
\$25 and over	129		

The rolling mills and steel works of the New England states were in operation an average of 10 months during the census year 1890. The average term of employment for men was 11 months, for women 12 months, and for children 10.5 months.

In 3 mills 9 hours constituted the day of labor, and in the remaining establishments the men worked 10 hours per day (6 days per week) throughout the year. In 1880 the rolling mills and steel works of this section employed 7,791 hands, and were in operation an average of 9.75 months during the year.

MATERIALS USED.—The following comparative statement presents the quantities and cost of materials used by the rolling mills and steel works of the New England states, as reported at the censuses of 1880 and 1890. Quantities are stated in tons of 2,000 pounds, except oil, stated in barrels, and charcoal, which is stated in bushels.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED IN ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantities.	Cost.	Quantities.	Cost.
Total		\$8,838,874		\$8,651,998
Iron ore.....	20,212	141,154	2,277	14,981
Spiegel Eisen and ferro-manganese.....	855	21,500	623	44,511
Pig iron.....	56,918	1,352,553	17,565	350,661
Old iron rails.....	36,593	1,048,414	20,279	655,762
Other old or scrap iron.....	78,267	2,108,820	71,939	1,168,528
Old steel rails.....	1,400	35,000	2,668	50,092
Other old or scrap steel.....	5,008	156,750	20,145	343,531
Hammered iron ore blooms.....	8,187	435,150	170	7,200
Hammered pig or scrap blooms.....	2,226	89,010		
Purchased muck bar.....	4,648	285,801	9	243
Purchased bessemer steel.....	16,600	964,000	82,284	2,446,782
Purchased open-hearth steel.....	23,690	278,700	10,825	305,207
Swedish billets or bars.....	565	39,280	1,596	109,080
Anthracite coal.....	44,095	200,046	16,829	81,702
Bituminous coal.....	213,055	1,037,413	186,900	760,288
Coke.....	3,545	10,410	5,350	35,571
Charcoal.....	673,786	50,113	919,303	76,289
Oil used for fuel.....			2,160	3,510
All other materials.....		584,751		2,128,510

a Includes 250 tons "other billets and bars", costing \$12,500.

While the consumption of old scrap iron of all kinds has not varied greatly in the two census years, there is shown a considerable decrease in the quantity of pig iron used. Most of the pig iron consumed in 1880 was used by the rolling mills in the production of the various iron products, while in 1890 almost the entire quantity was converted into steel. The most notable increase in the consumption of materials in 1890, as compared with 1880, was in purchased bessemer steel.

MANUFACTURING INDUSTRIES.

PRODUCTS.—The following comparative statement presents the tonnage of rolled and hammered iron and steel products, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, QUANTITY OF PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880	1890
Total	181,979	208,304
Iron	148,692	86,103
Bessemer steel.....	16,406	93,746
Open-hearth steel.....	14,676	25,702
Crucible steel.....	2,205	2,753

The following comparative statement presents the values of the different iron and steel products and the percentage that each class bears of the total, for the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, VALUE OF PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	VALUE.		PERCENTAGE.	
	1880	1890	1880	1890
Total	\$13,513,531	\$14,219,003	100.00	100.00
Manufactures of iron.....	9,610,982	4,177,051	71.12	29.38
Manufactures of steel.....	3,376,883	7,863,514	24.99	55.30
Miscellaneous products.....	525,666	2,178,438	3.89	15.32

The total value of all iron and steel products of the rolling mills and steel works in the New England states was \$13,513,531 in 1880 and \$14,219,003 in 1890. The value of the manufactures of iron in 1880 was \$9,610,982 and constituted 71.12 per cent of the total value of all products, while in 1890 the value of the iron manufactures was \$4,177,051 and formed 29.38 per cent of the total value of all products. The value of the manufactures of steel increased from \$3,376,883 in 1880 to \$7,863,514 in 1890, constituting 24.99 per cent of the total value of all products in 1880, and 55.30 per cent in 1890. The value of all other products was \$525,666 and \$2,178,438 for 1880 and 1890, respectively, and the percentage of the total value of all products was 3.89 per cent in 1880 and 15.32 per cent in 1890.

The following comparative statement presents the tonnage and value of classified products of the rolling mills and steel works of the New England states, so far as they can be separately enumerated. All quantities are stated in tons of 2,000 pounds, except nails, which are reported in kegs of 100 pounds.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF CLASSIFIED PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Quantities.	Value.	Quantities.	Value.
Total		\$13,513,531		\$14,219,003
Iron:				
Rails.....	7,100	368,000		
Bar and rod.....	65,239	4,218,239	47,407	1,876,352
Hoop.....	4,358	252,062		
Skelp.....	7,163	504,513		
Structural shapes.....			600	24,000
Plates, except nail plate.....	25,389	1,500,461		
Hammered car axles.....	1,370	92,440		
Cut nails.....	495,360	1,789,929	116,840	260,624
All other finished products.....	13,305	879,338	32,254	2,016,075
Steel, bessemer:				
Rails.....	1,500	112,500		
Bar and rod.....	14,906	1,500,000	1,070	56,500
Plates, except nail plate.....			12,255	534,480
Cut nails.....			100,710	227,084
All other finished products.....			75,385	4,960,862

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF CLASSIFIED PRODUCTS, ETC.—Continued.

CLASS OF PRODUCTS.	1880		1890	
	Quantities.	Value.	Quantities	Value.
Steel, open-hearth:				
Rails	3,000	\$195,000		
Bar and rod.....	3,938	355,000	7,335	\$370,000
Plates.....	3,578	472,260	2,700	168,000
All other finished products	4,160	422,000	15,667	1,076,414
Steel, crucible:				
Finished products	2,205	318,923	2,753	470,171
All other products		525,606		2,178,438

In order to avoid disclosing the operations of individual establishments, it has been necessary to group a considerable portion of the products under the heads of "All other" iron, bessemer or open-hearth steel products, inasmuch as several important items among the products are made only by a single concern, and to enumerate these items would reveal the identity of the establishment.

The quantities of bars and rods stated exclude all bars and rods manufactured into bolts, nuts, and other products by the same establishment, the quantities and values of these finished products being stated as "all other products".

The rod iron reported for 1880 probably included the quantity and value of all wire rods produced. This item for 1890 includes only rod iron sold in that form. The larger part of the wire rods produced in 1890 was drawn into wire and sold in the form of wire or manufactures of wire. The steel wire rods, of which a large quantity was rolled in New England in 1890, were also largely finished into wire and other products at the works where they were rolled. As the rods so consumed were only an intermediate product, and almost exclusively the output of a single establishment, they are not given separately; the quantity and value of the finished products made therefrom, together with the rods sold to other works for the manufacture of screws, rivets, and other finished forms, appear as "All other" bessemer, open-hearth, and crucible products. The items of "All other" iron, bessemer and open-hearth steel products, also include nail plate produced for sale, billets, car wheels, forgings, and car springs, which were manufactured by the rolling mills and steel works. All Clapp-Griffiths steel products are included with bessemer steel.

The quantities and values of finished steel products include all articles made either from steel produced by the steel works of this section, or from purchased steel billets, slabs, or bars. In addition to the large quantity of steel that was obtained from outside sources, and consumed by the rolling mills and steel works, the bessemer steel works of the New England states produced 15,753 net tons of ingots during the census year 1890, and the open-hearth steel works made 16,840 net tons of ingots, all of which was worked into finished forms and so reported in the foregoing statement. At the census of 1880, the open-hearth steel works of this section reported 16,996 net tons of ingots. No steel ingots were made in the New England states by the bessemer process in that year. The crucible steel works reported a production of 2,275 net tons of ingots, or direct castings, at the census of 1890, and 2,256 net tons at the census of 1880.

Several of the iron and steel rolling mills also roll copper and brass, and the value of these products, together with the amounts received from sales of roll scale, cinder, scrap, and other by-products, is given under the head of "Value of all other products".

MACHINERY.—The following statement shows the equipment of the rolling mills and steel works of the New England states and the increase or decrease of the same, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, EQUIPMENT AND CAPACITY, ROLLING MILLS AND STEEL WORKS IN THE NEW ENGLAND STATES: 1880 AND 1890. (a)

MACHINERY.	1880	1890	Increase.	Decrease.
Single puddling furnaces	220	48		172
Heating furnaces	302	162		140
Bessemer converters.....		64	4	
Open-hearth furnaces.....	7	3		4
Crucible pots, which can be used at each heat	202	188		14
Hammers	49	30		14
Cut nail machines.....	801	311		400
Trains of rolls	134	77		57
Aggregate daily capacity in finished products (net tons)...	1,200	1,448	248	

a Includes machinery in both active and idle establishments.
 b Includes 1 Clapp-Griffiths converter.

Although the returns show that there are 48 puddling furnaces in the rolling mills and steel works of the New England states, it should be explained that the greater number of these furnaces were idle during the census year 1890. Only 2 of the rolling mills puddled pig iron during that year, the total quantity thus worked being less than 2,000 net tons. It appears that 3 mills worked cast scrap iron in their puddling furnaces, nearly 14,000 net tons of this material being thus consumed. The remaining mills rolled their iron products from wrought scrap almost exclusively, a small amount of imported Swedish billets and purchased muck bar being used.

Notwithstanding the decrease shown in the number of heating furnaces and trains of rolls reported for 1890 as compared with 1880, there is an increase in the daily capacity of finished products. This is explained by the fact that many of the works which formerly produced their finished products from pig iron now use scrap iron, rendering a larger output possible, while at the same time a considerable quantity of finished steel is rolled from purchased billets or slabs.

The decline in the iron rolling mill industry of New England has been due chiefly to conditions peculiar to locality rather than to causes affecting the industry at large. The rapid growth of the iron and steel industry in other sections of the country, where pig iron and fuel can be obtained at much lower cost, has gradually narrowed the market of most of the New England iron mills to the limits of local demand, and even much of this trade has been absorbed by manufacturers in more favored localities. The natural resources that are required for the profitable operation of rolling mills and steel works are lacking in New England. There is no local supply of either fuel or pig iron. Although considerable pig iron is made in Massachusetts and Connecticut, the entire product is used for foundry purposes. The small quantity of pig iron that is consumed by the New England rolling mills and steel works is brought from other sections of the country, and all the coal and coke is similarly obtained. At the present time scrap iron constitutes the chief dependence of the rolling mills of New England, and this is the only raw material of which there is a local supply, the railroads and diversified manufacturing industries furnishing it in considerable quantity.

The rapid progress that has been made in this country in the manufacture of steel, the cheapening of the product, and its consequent substitution for iron for many uses have been important factors in the decline of the iron rolling mill industry of New England. The conditions in New England being generally unfavorable for the economical manufacture of the crude forms of steel, most of the iron manufacturers have been reluctant to assume the risks attendant upon the establishment of steel plants in connection with their works to meet the increasing demand for this class of material, preferring to depend upon a supply of crude steel obtained from works more advantageously located in other sections of this country or from abroad. The rerolling of imported Norway and Swedish iron was formerly an important branch of the iron industry of New England, but within the past decade it has dwindled to small proportions, owing chiefly to the substitution of steel for uses to which this class of iron was formerly applied.

FORGES AND BLOOMERIES.

At the census of 1880 there were reported 3 establishments in the New England states equipped for the manufacture of blooms from iron ore and from pig and scrap iron. The total capital invested in these works amounted to \$95,000. The 1 establishment in operation reported a capital of \$5,000, employed 8 hands, paying \$564 in wages during the year, expended \$1,834 for materials, and produced blooms valued at \$2,200. Since 1880 2 establishments were built in this section, but at the census of 1890 all of these works were idle and considered by their owners as abandoned iron making plants.

MIDDLE STATES.

The prominent position occupied by the middle group of states, comprising Delaware, New Jersey, New York, and Pennsylvania, in the manufacture of iron and steel, is largely due to the growth of the industry in Pennsylvania. The extension of the manufacture of iron and steel in the southern and western sections of the country has not deprived this state of its leadership in the production of crude and finished forms of products. In 1890 it produced 49.13 per cent of the total quantity of pig iron made in the United States during that year; 52.87 per cent of the finished iron products; 61.12 per cent of the bessemer steel ingots; 69.17 per cent of the bessemer steel rails; 79.96 per cent of the open-hearth steel ingots; 75.02 per cent of the crucible steel ingots, and 53.02 per cent of the total tonnage of all iron and steel products. The manufacture of iron and steel in New Jersey and New York exhibited a larger and more general expansion from 1870 to 1880 than from 1880 to 1890, and in some branches of the industry in these states there has been a decline during the past decade. Delaware has made considerable progress from 1880 to 1890 in the production of the more highly finished products of iron and steel, although producing neither the pig iron nor steel consumed by its rolling mills.

The comparative summary on the following page presents the leading statistics relating to the manufacture of iron and steel in the middle states as reported at the censuses of 1870, 1880, and 1890.

IRON AND STEEL MANUFACTURE.

COMPARATIVE SUMMARY, IRON AND STEEL INDUSTRY IN THE MIDDLE STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments.....	437	440	390
Capital.....	\$77,696,741	\$132,814,213	\$256,833,069
Miscellaneous expenses.....	(d)	(d)	\$11,324,830
Average number of employes (aggregate).....	46,000	75,055	108,592
Total wages.....	\$24,436,722	\$31,348,225	\$59,914,027
Officers, firm members, and clerks:			
Average number.....	(e)	(e)	2,484
Total wages.....			\$3,747,602
All other employes:			
Average number.....	(e)	(e)	106,108
Total wages.....			\$56,166,425
Cost of materials used.....	\$91,792,204	\$113,432,592	\$199,225,674
Value of products.....	\$134,720,519	\$180,484,560	\$294,048,406
Tons of products.....	2,408,634	4,462,746	10,613,053

a This statement includes only active establishments for the censuses of 1880 and 1890. Such establishments were not reported separately at the census of 1870.

b For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employes, and wages, relating to mining and other operations in the figures for 1880.

c Includes hired property valued at \$3,188,000. This item was not reported separately at previous censuses.

d Not reported.

e Not reported separately.

f Includes values for which tonnage was not reported.

The following comparative statement presents the leading statistics of the iron and steel industry of the middle states, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, IRON AND STEEL INDUSTRY IN THE MIDDLE STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The Middle States.....	1880	440	\$132,814,213	75,055	\$31,348,225	\$113,432,592	\$180,484,560
	1890	390	\$256,833,069	108,592	\$59,914,027	199,225,674	294,048,406
Delaware.....	1880	8	1,341,469	867	344,476	1,214,050	2,347,177
	1890	7	2,558,865	1,690	843,210	1,549,539	2,608,670
New Jersey.....	1880	37	8,764,050	4,792	1,808,448	6,556,233	10,341,896
	1890	23	11,607,362	5,296	2,784,974	7,031,046	11,018,575
New York.....	1880	74	19,752,471	11,444	4,000,451	13,305,229	22,219,219
	1890	44	16,282,435	7,034	3,005,654	10,424,752	15,849,537
Pennsylvania.....	1880	321	102,956,223	57,952	25,005,850	62,267,030	145,576,268
	1890	311	226,294,407	94,572	52,680,180	180,220,237	264,571,624

a This statement includes only active establishments.

b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employes, and wages relating to mining and other operations.

c Includes hired property valued at \$3,188,000. This item was not reported separately at the census of 1880.

d Includes 2,484 officers, firm members, and clerks and their wages, amounting to \$3,747,602, distributed as follows: Delaware 53, \$78,061; New Jersey 145, \$238,183; New York 186, \$301,843; and Pennsylvania 2,099, \$3,129,515. These classes were not reported separately at the census of 1880.

CAPITAL.—The following statement shows the different items of capital in active and idle establishments and those in course of construction, reported for the iron and steel industry in the middle states at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, IRON AND STEEL INDUSTRY IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total.....	1880	504	\$130,378,522	\$77,463,914	\$61,914,608
	1890	445	\$261,134,455	124,621,343	136,513,092
Establishments in operation.....	1880	440	132,814,213	73,011,414	59,202,799
	1890	390	256,833,069	121,401,973	135,431,066
Idle establishments.....	1880	60	5,823,750	3,852,500	1,971,250
	1890	52	3,733,587	2,750,272	983,315
Establishments in course of construction.....	1880	4	740,559	(c)	740,559
	1890	3	507,779	469,098	98,681

a See remarks in regard to the inclusion of capital relating to mining and other operations in the figures for 1880.

b Includes hired property valued at \$3,188,000; also hired property valued at \$18,000 invested in idle establishments. This item was not reported separately at the census of 1880.

c Not reported separately.

BLAST FURNACES.

Pennsylvania ranked first in the production of pig iron in 1880 and 1890. In 1880 New York and New Jersey ranked third and fourth, respectively, among the pig iron producing states in the quantity of pig iron made, but with the rapid development of the industry in other sections of the country during the past decade New York receded to fifth and New Jersey to tenth place.

The following comparative summary exhibits the growth of the blast furnace industry in the middle states since 1870:

COMPARATIVE SUMMARY, BLAST FURNACES IN THE MIDDLE STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments	181	179	140
Capital	\$33,513,175	\$53,969,265	^c \$68,896,144
Miscellaneous expenses	(d)	(d)	\$3,163,843
Average number of employes (aggregate)	13,342	17,152	18,084
Total wages	\$6,351,516	\$6,021,406	\$8,580,541
Officers, firm members, and clerks:			
Average number	(e)	(e)	422
Total wages			\$674,974
All other employes:			
Average number	(e)	(e)	17,662
Total wages			\$7,905,567
Cost of materials used	\$20,312,678	\$56,330,367	\$63,115,306
Value of products	\$42,105,838	^f \$55,818,738	^f \$82,650,533
Tons of products	1,311,649	2,401,093	5,356,883

a This statement includes only active establishments for the censuses of 1880 and 1890, such establishments were not reported separately at the census of 1870.

b For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employes, and wages relating to mining and other operations in the figures for 1880.

c Includes hired property valued at \$2,210,000. This item was not reported separately at previous censuses.

d Not reported.

e Not reported separately.

f Includes values for which tonnage was not reported.

The following comparative statement presents the leading statistics of the manufacture of pig iron in the middle states, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, BLAST FURNACES IN THE MIDDLE STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The Middle States	1880	179	\$53,969,265	17,152	\$6,021,406	\$56,330,367	\$55,818,738
	1890	140	^c 68,896,144	18,084	^d 8,580,541	63,115,306	82,650,533
New Jersey	1880	12	3,644,500	1,174	365,639	2,488,670	3,428,747
	1890	8	3,131,366	655	262,538	1,679,937	2,228,724
New York	1880	30	8,836,471	2,518	902,929	4,166,622	6,816,241
	1890	16	6,443,208	1,462	672,288	4,212,888	5,182,606
Pennsylvania	1880	137	41,488,294	13,460	4,752,838	29,675,075	45,578,750
	1890	116	59,321,570	15,987	7,645,715	57,222,481	75,230,203

a This statement includes only active establishments.

b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employes and wages relating to mining and other operations.

c Includes hired property valued at \$2,210,000. This item was not reported separately at the census of 1880.

d Includes 422 officers, firm members, and clerks, and their wages amounting to \$674,974 distributed as follows: New Jersey 15, \$22,386; New York 52, \$91,161, and Pennsylvania 355, \$561,407. These classes were not reported separately at the census of 1880.

New Jersey shows a small decrease in output during the past decade, although there is an increase in the manufacture of spiegeleisen, all of which is made from zinc residuum. The quantity of spiegeleisen made in this state in 1890 was 11,555 net tons, against 3,392 tons in 1880. The total quantity of pig iron, including spiegeleisen, made in New Jersey in 1890 was 145,040 tons, valued at \$2,228,724, against 157,414 tons in 1880, valued at \$3,410,663, and other products valued at \$18,084.

The total production of pig iron in New York in 1890 was 344,339 net tons, valued at \$5,182,606, as compared with 313,368 tons in 1880, valued at \$6,697,349, and other products valued at \$118,892.

Notwithstanding a net decrease of 48 in the number of blast furnace stacks in Pennsylvania from 1880 to 1890, the production of pig iron has shown a phenomenal increase during this period. In 1880 the output of pig iron, including castings produced direct from the furnace was, 1,930,311 tons, as compared with a production of

4,867,504 tons in 1890. The most notable increase has been in the production of coke and bituminous coal pig iron, which amounted to 674,668 tons in 1880 and 2,982,800 tons in 1890.

In the above figures castings made direct from the furnaces are counted as pig iron.

CAPITAL.—The following statement shows the different items of capital in active and idle establishments and those in course of construction, reported for blast furnaces in the middle states at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, BLAST FURNACES IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products, on hand, cash and bills receivable.
Total	1880	219	\$58,419,574	\$30,895,173	\$27,524,401
	1890	172	671,802,943	38,429,719	53,373,224
Establishments in operation	1880	179	53,969,265	28,281,173	25,688,092
	1890	140	68,806,144	36,311,656	32,584,488
Idle establishments	1880	38	4,059,750	2,614,000	1,445,750
	1890	31	2,434,880	1,730,905	703,915
Establishments in course of construction	1880	2	390,550	(c)	390,550
	1890	1	471,919	387,098	84,821

a See remarks in regard to the inclusion of capital relating to mining and other operations in the figures for 1880.
 b Includes hired property valued at \$2,210,000. This item was not reported separately at the census of 1880.
 c Not reported separately.

EMPLOYÉS AND WAGES.—The following statement presents the average number and total wages of officers or firm members and clerks, and the average number and total wages of skilled and unskilled employés in the blast furnace industry of the middle states, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, BLAST FURNACES IN THE MIDDLE STATES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
Total	18,084	\$8,580,541	18,049	\$8,571,721	2	\$1,000	33	\$7,730
Officers or firm members	181	482,670	181	482,670				
Clerks	241	192,304	239	191,214	2	1,090		
Skilled	5,540	3,106,454	5,540	3,106,454				
Unskilled	12,122	4,799,113	12,089	4,791,383			33	7,730

The following statement presents the average number of employés at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, BLAST FURNACES IN THE MIDDLE STATES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years.	Children.
Total	17,029	33
Under \$5	115	17
\$5 and over but under \$6	72	16
\$6 and over but under \$7	1,396	
\$7 and over but under \$8	2,138	
\$8 and over but under \$9	2,511	
\$9 and over but under \$10	4,173	
\$10 and over but under \$12	3,617	
\$12 and over but under \$15	2,414	
\$15 and over but under \$20	853	
\$20 and over but under \$25	234	
\$25 and over	106	

MATERIALS USED.—The extent to which coke has superseded anthracite coal as blast furnace fuel is well shown by the statistics of the consumption of this fuel for the 2 census years in New Jersey and New York. The furnaces of New Jersey consumed 225,713 tons of anthracite coal and 17,000 tons of coke in 1880, and 173,067 tons of anthracite coal and 37,856 tons of coke in 1890. In 1880 the furnaces in New York used 396,864 tons of anthracite coal and 34,237 tons of coke, as compared with the consumption by the furnaces of this state in 1890 of 185,348 tons of anthracite coal and 241,824 tons of coke. In 1880 a large number of the blast furnaces in New York and New Jersey employed anthracite coal exclusively.

Of the northern states Pennsylvania contains the richest coal suitable for the manufacture of pig iron, whether used in the raw state or in the form of coke, but the advantages which the state enjoys in the vast fields of anthracite coal and the superior character of the coke made from the coal found in the Connellsville region are partially neutralized by an insufficient supply of iron ores of the requisite purity and richness. With the exception of the Cornwall and a few other deposits, the general character of the iron ores of Pennsylvania is unsuitable for steel making, and the blast furnaces are compelled to look to other states or to foreign sources for a large part of the iron ore required. Notwithstanding this dependence on other sections for much of the iron ore consumed by her blast furnaces, the excellent fuel and a large demand from the diversified manufacturing industries within her own borders has placed Pennsylvania in the foremost rank of pig iron producing states.

The following comparative statement presents the quantity and cost of materials used by blast furnaces in the middle states, as reported at the censuses of 1880 and 1890. With the exception of charcoal, which is given in bushels, the quantities are reported in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, BLAST FURNACES IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Value.	Quantity.	Value.
Total.....		\$30,330,367		\$63,115,306
Domestic iron ore.....	4,762,290	21,547,883	7,697,520	33,658,807
Foreign iron ore.....	(a)	(a)	942,435	5,171,611
Fluxing material.....	2,272,473	1,706,794	3,410,243	2,560,450
Anthracite coal.....	2,544,165	7,663,007	2,012,432	5,165,620
Bituminous coal.....	215,849	520,488	50,985	70,405
Coke.....	1,105,689	3,854,538	4,688,974	13,208,527
Charcoal.....	7,690,586	581,224	4,729,720	317,294
Mill cinder and scrap.....	156,417	417,158	866,853	1,079,593
All other materials.....		33,675		974,103

a Domestic and foreign iron ore were not reported separately at the census of 1880.

PRODUCTS.—In the following statement is shown the total production of pig iron in the middle states in 1880 and 1890, classified according to fuel used. The figures include quantity of spiegeleisen and castings made direct from the furnace:

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF PRODUCTS CLASSIFIED ACCORDING TO KIND OF FUEL USED, BLAST FURNACES IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Tons.	Value.	Tons.	Value.
Total.....		\$55,818,738		\$82,650,563
Mixed anthracite and coke pig iron.....	564,102	12,922,436	1,893,241	28,195,996
Coke and bituminous pig iron.....	674,688	16,764,521	3,099,429	48,922,560
Charcoal pig iron.....	55,686	1,983,901	33,327	733,511
Anthracite coal pig iron.....	1,106,637	23,377,182	330,886	4,772,021
Total tonnage and value.....	2,401,093	55,048,040	5,356,883	82,624,058
All other products.....		770,698		26,445

a Two thousand three hundred and fifty-nine tons of direct castings, shown in the report for blast furnaces, 1880, have been distributed in this statement among the several kinds of pig iron. Of this amount New York contributed 62 tons, New Jersey 80 tons, and Pennsylvania 2,217 tons. There is also included 12,875 tons of spiegeleisen, of which amount New Jersey produced 3,392 tons and Pennsylvania 9,483 tons.

b Includes 111,317 tons of spiegeleisen and ferro-manganese, New Jersey producing 11,555 tons and Pennsylvania 99,762 tons; also 5,313 tons castings direct from the furnace, New Jersey producing 130 tons, New York 10 tons, and Pennsylvania 5,173 tons.

MACHINERY.—While the number of active and idle blast furnace establishments in the middle states has declined from 217 in 1880 to 171 in 1890, and the number of furnace stacks from 346 to 276, the daily capacity has increased from 10,835 tons in 1880 to 22,128 tons in 1890. Larger stacks, improved machinery, with better furnace practice, and the use of more carefully selected ores constitute the chief causes of this great increase in daily capacity, notwithstanding that the decrease in the number of furnaces has been so marked.

In the following table is presented a comparison of the number and daily capacity of the furnaces in the middle states in 1880 and 1890, classified according to the character of fuel used:

COMPARATIVE STATEMENT, NUMBER AND DAILY CAPACITY OF BLAST FURNACES IN THE MIDDLE STATES, BY STATES: 1880 AND 1890.

STATES.	Year.	AGGREGATES.		CHARCOAL.		ANTHRACITE COAL.		MIXED ANTHRACITE COAL AND COKE.		COKE AND BITUMINOUS COAL.	
		Number of stacks.	Daily capacity in tons.	Number of stacks.	Daily capacity in tons.	Number of stacks.	Daily capacity in tons.	Number of stacks.	Daily capacity in tons.	Number of stacks.	Daily capacity in tons.
Total.....	1880	346	10,835	51	414	143	4,187	77	2,926	75	3,308
	1890	276	22,128	24	345	35	1,591	132	8,805	85	11,387
New Jersey.....	1880	20	691	.....	.....	11	251	9	440	.....	.....
	1890	18	920	.....	.....	4	86	14	840	.....	.....
New York.....	1880	57	1,654	15	172	15	450	27	1,032	.....	.....
	1890	37	2,109	0	106	4	122	20	1,131	4	660
Pennsylvania.....	1880	269	8,490	36	242	117	3,486	41	1,454	75	3,308
	1890	221	19,093	15	179	27	1,383	98	6,834	81	10,637

ROLLING MILLS AND STEEL WORKS.

The census of 1880 credited New Jersey with 14 iron rolling mills, 1 open-hearth steel works, and 5 crucible steel works. In 1890 the state contained 12 iron and steel rolling mills not connected with steel producing works, 2 establishments containing open-hearth steel plants, and 7 crucible steel works.

Including active and idle establishments, New York, at the census of 1880, was credited with 28 establishments, 23 being iron rolling mills, 2 bessemer steel works (one producing the crude steel as well as rolling it, the other only rolling bessemer steel from purchased material), and 3 crucible steel producing works. The 20 establishments in this state in 1890 consisted of 12 iron and steel rolling mills not connected with steel producing works, and 8 establishments which were equipped for the manufacture of crude steel. These 8 establishments comprised 1 bessemer steel plant, 2 open-hearth steel plants, 5 crucible steel plants, and 2 plants equipped for the production of blister steel.

In 1880 Pennsylvania contained 131 iron rolling mills, 15 bessemer and open-hearth steel works, and 20 crucible steel works. The bessemer and open-hearth steel works contained 12 bessemer converters and 14 open-hearth steel melting furnaces. In 1890 there were 133 iron and steel rolling mills not connected with steel producing works, and 60 establishments equipped for the manufacture of crude steel. The steel works comprised 22 bessemer steel plants with 46 converters (including 4 Clapp-Griffiths and 2 Robert-Bessemer plants), 32 open-hearth steel plants with 78 steel melting furnaces, 20 crucible steel plants, and 4 works which produced steel by special processes. Of the 60 steel producing works 10 operated both bessemer and open-hearth steel plants, 6 both open hearth and crucible plants, 1 both bessemer and special steel plants, and 1 both crucible and special steel plants. All the establishments engaged in steel production with the exception of 1 bessemer, 2 open-hearth, 7 crucible, and 1 special contained trains of rolls.

The prominence of Delaware in the manufacture of iron and steel is due entirely to its rolling mill industry. The state contains neither blast furnaces nor steel works, and all the pig iron and steel consumed is obtained from other sections.

MANUFACTURING INDUSTRIES.

The following statement shows the leading statistics relating to the rolling mills and steel works in the middle states, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880	1890
Number of establishments	190	208	231
Capital	\$40, 107, 083	\$75, 538, 948	c\$187, 098, 455
Miscellaneous expenses	(d)	(d)	\$8, 107, 807
Average number of employes (aggregate)	30, 159	55, 631	90, 082
Total wages	\$17, 016, 982	\$24, 581, 805	\$51, 151, 112
Officers, firm members, and clerks:			
Average number	(e)	(e)	2, 047
Total wages			\$3, 055, 319
All other employes:			
Average number	(e)	(e)	88, 035
Total wages			\$48, 095, 793
Cost of materials used	\$57, 147, 662	\$74, 057, 356	\$135, 338, 945
Value of products (f)	\$85, 537, 084	\$121, 421, 562	\$210, 389, 379
Tons of products	992, 431	2, 031, 533	\$5, 226, 715

a This statement includes only active establishments for 1880 and 1890; such establishments were not reported separately at the census of 1870.

b See remarks in regard to the depreciated currency of 1870.

c Includes hired property valued at \$978,000. This item was not reported separately at previous censuses.

d Not reported.

e Not reported separately.

f Includes values for which tonnage was not reported.

The following comparative statement presents the leading statistics of rolling mills and steel works in the middle states, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The Middle States	1880	208	\$75, 538, 948	55, 631	\$24, 581, 805	\$74, 057, 356	\$121, 421, 562
	1890	231	2187, 098, 455	90, 082	c51, 151, 112	135, 338, 945	210, 389, 379
Delaware	1880	8	1, 341, 469	867	344, 476	1, 214, 050	2, 347, 177
	1890	7	2, 558, 865	1, 690	843, 210	1, 549, 539	2, 098, 670
New Jersey	1880	18	5, 005, 550	3, 495	1, 412, 622	3, 914, 970	6, 704, 054
	1890	19	8, 525, 996	4, 627	2, 514, 404	5, 320, 401	8, 756, 431
New York	1880	24	8, 702, 000	7, 497	2, 725, 191	8, 264, 186	13, 924, 622
	1890	19	9, 321, 793	5, 418	2, 872, 316	5, 932, 461	10, 310, 988
Pennsylvania	1880	158	60, 489, 029	43, 832	20, 099, 576	61, 564, 150	98, 445, 709
	1890	186	166, 091, 801	78, 547	44, 921, 173	122, 530, 544	188, 714, 190

a This statement includes only active establishments.

b Includes hired property valued at \$978,000. This item was not reported separately at previous censuses.

c Includes 2,047 officers, firm members, and clerks and their wages, amounting to \$3,055,319, distributed as follows: Delaware 53, \$78,061; New Jersey 120, \$212,812; New York 127, \$199,862, and Pennsylvania 1,738, \$2,564,584. These classes were not reported separately at the census of 1880.

During the decade from 1880 to 1890, a great increase is shown in the products of the rolling mills and steel works of the middle states. The tonnage of iron products increased 47.04 per cent, and the steel tonnage increased 368.37 per cent. Of the total tonnage of iron and steel, iron formed 65.69 per cent in 1880 and 37.55 per cent in 1890, while the tonnage of steel which constituted but 34.31 per cent of the total product in 1880 constitutes 62.45 per cent in 1890.

The establishments in Delaware in 1890 were all located in Newcastle county, at Wilmington, and in its vicinity, many of the plants making a specialty of the manufacture of plate and sheet iron. The increase in the tonnage of products from 1880 to 1890 has been almost entirely in iron, the state producing no steel products in 1880, and only a small quantity in 1890. The aggregate production of iron products has increased from 33,918 tons in 1880 to 57,913 tons in 1890, or 70.74 per cent. The steel products in 1890 consisted of 380 tons of bessemer steel and 144 tons of open-hearth steel.

There has been a slight decrease since 1880 in the aggregate tonnage of the products of rolling mills and steel works in the state of New York. The iron products, which in 1880 amounted to 64.58 per cent of the total tonnage, contributed only 45.61 per cent of the total in 1890. On the other hand, the steel products in 1880 amounted to only 35.42 per cent of the aggregate tonnage of that year, but in 1890 the proportion of steel products of all kinds was 54.39 per cent of the total tonnage.

In New Jersey a notable increase has occurred during the past 10 years in the tonnage of both iron and steel products. In 1880 the percentage of the total represented by iron products was 79.92 per cent and by steel 20.08 per cent. In 1890 the proportion of iron was reduced to 57.11 per cent, that of steel increasing to 42.89 per cent.

The substitution of steel for iron in the manufacture of rails, nails, plates, and other forms of finished products has been especially marked in Pennsylvania. The capacity of the state for the production of steel rails has shown a notable increase from 1880 to 1890, besides which there have been erected during this period a large number of bessemer converters and open-hearth steel melting furnaces, many of which have been added to existing iron rolling mill establishments for the production of steel for nail plate, structural material, wire, and many miscellaneous purposes. While the tonnage of iron products has increased 59.20 per cent from 1880 to 1890, the above figures show that they contributed only 35.74 per cent of the aggregate of all products in 1890, although the proportion in 1880 was 64.45 per cent, the quantity of steel products amounted to 35.55 per cent of the total output of iron and steel in 1880 and 64.26 per cent in 1890.

CAPITAL.—The following statement shows the different items of capital in active and idle establishments and those in course of construction, rolling mills and steel works in the middle states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total.....	1880	223	\$77,432,948	\$44,784,241	\$32,648,707
	1890	245	^a 188,306,722	85,818,824	102,547,898
Establishments in operation.....	1880	208	75,538,948	43,676,241	31,802,707
	1890	231	187,008,455	84,782,317	102,316,138
Idle establishments	1880	13	1,544,000	1,108,000	436,000
	1890	12	1,172,407	954,507	217,900
Establishments in course of construction	1880	2	350,000	(<i>b</i>)	350,000
	1890	2	95,860	82,000	13,860

a Includes hired property valued at \$978,000, also hired property valued at \$18,000 invested in idle establishments. This item was not reported separately at the census of 1880.

b Not reported separately.

EMPLOYÉS AND WAGES.—The following statement presents the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés in rolling mills and steel works in the middle states, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES: 1890.

CLASSES.	AGGREGATES.		MALES ABOVE 16 YEARS.		FEMALES ABOVE 15 YEARS.		CHILDREN.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
Total.....	90,082	\$51,151,112	88,808	\$50,910,329	37	\$19,278	1,177	\$221,505
Officers or firm members.....	505	1,631,956	505	1,631,956				
Clerks.....	1,542	1,423,363	1,507	1,404,651	35	18,712		
Skilled.....	49,669	33,909,589	49,669	33,909,589				
Unskilled.....	38,306	14,186,204	37,187	13,964,133	2	560	1,177	221,505

MANUFACTURING INDUSTRIES.

The following statement presents the average number of employes at the different weekly rates of wages:
 AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, ROLLING MILLS AND STEEL WORKS
 IN THE MIDDLE STATES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.		
	Males above 16 years.	Females above 15 years.	Children.
Total	86,856	2	1,177
Under \$5	850	1	1,013
\$5 and over but under \$6	2,005		123
\$6 and over but under \$7	5,904		33
\$7 and over but under \$8	10,047		6
\$8 and over but under \$9	12,945		2
\$9 and over but under \$10	11,012	1	
\$10 and over but under \$12	11,288		
\$12 and over but under \$15	12,575		
\$15 and over but under \$20	10,542		
\$20 and over but under \$25	5,617		
\$25 and over	4,011		

MATERIALS USED.—The total cost of all the materials consumed by the rolling mills and steel works in Delaware was \$1,214,050 in 1880 and \$1,549,539 in 1890; by the works in New Jersey, \$3,914,970 in 1880 and \$5,326,401 in 1890; by the works in New York, \$8,264,186 in 1880 and \$5,932,461 in 1890, and by the works in Pennsylvania, \$61,564,150 in 1880, as compared with a total of \$122,530,544 in 1890.

The following comparative statement presents the quantities and cost of materials consumed by the rolling mills and steel works in the middle states, for the census years 1880 and 1890. With the exception of charcoal, which is stated in bushels, and oil used for fuel, which is stated by barrels, the quantities are reported in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total		\$74,957,356		\$135,838,945
Iron ore	240,980	1,795,093	420,903	2,413,500
Spiegelisen and ferro-manganese	55,194	1,723,890	181,003	5,300,006
Pig iron	1,072,813	37,718,153	4,146,205	64,895,017
Old iron rails	250,017	7,353,501	79,320	1,800,136
Other old or scrap iron	193,056	5,116,841	402,841	8,193,313
Old steel rails	42,977	1,137,290	114,400	1,980,315
Other old or scrap steel	80,639	2,131,335	265,523	4,957,421
Hammered iron ore blooms	27,541	1,719,355	15,615	555,293
Hammered pig or scrap blooms	37,103	2,012,682	21,410	663,419
Purchased muck bar	44,117	1,867,540	217,353	5,793,198
Purchased bessemer steel	a34,855	a1,788,407	430,058	12,535,069
Purchased open hearth steel	b21,303	b1,251,860	119,419	3,909,909
Swedish billets and bars	9,765	800,496	13,553	874,198
Anthracite coal	658,304	1,649,002	942,491	1,398,354
Bituminous coal	2,571,081	5,555,337	2,203,091	4,854,856
Coke	90,483	297,572	210,327	636,443
Charcoal	1,476,716	137,328	1,612,095	146,862
Oil used for fuel			190,813	177,807
Natural gas				3,301,468
All other materials		802,584		10,690,311

a Includes 9,216 tons "Other billets and bars" costing \$507,509.

b Includes 7,030 tons "Other billets and bars" costing \$388,398.

PRODUCTS.—The following comparative statement shows the tonnage of iron and steel products for rolling mills and steel works in the middle states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, QUANTITY OF PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880	1890
Total	2,031,533	5,226,715
Iron	1,334,584	1,902,405
Bessemer steel.....	570,885	2,705,743
Open-hearth steel.....	53,559	491,475
Crucible and miscellaneous steel	72,505	67,692

The following comparative statement presents the values of the different iron and steel products and the percentage that each class bears of the total, for the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, VALUE OF PRODUCTS WITH PERCENTAGE EACH CLASS IS OF TOTAL, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	VALUE.		PERCENTAGE.	
	1880	1890	1880	1890
Total	\$121,421,562	\$210,389,379	100.00	100.00
Manufactures of iron	77,526,376	81,263,706	63.85	38.62
Manufactures of steel.....	43,013,822	125,933,307	35.42	59.86
Miscellaneous products.....	881,364	3,192,366	0.73	1.52

The total value of all iron and steel products of rolling mills and steel works in the middle states was \$121,421,562 in 1880 and \$210,389,379 in 1890. The value of the manufactures of iron in 1880 was \$77,526,376 and constituted 63.85 per cent of the total value of all products, while in 1890 the value of iron manufactures was \$81,263,706 and formed but 38.62 per cent of the total value of all products. The value of the manufactures of steel increased from \$43,013,822 in 1880 to \$125,933,307 in 1890, constituting 35.42 per cent of the total value of all products in 1880 and 59.86 per cent in 1890. The value of all other products was \$881,364 and \$3,192,366 for 1880 and 1890, respectively, and the percentage of the total value of all products was 0.73 per cent in 1880 and 1.52 per cent in 1890.

The following comparative statement presents the quantity and value of classified iron and steel products, as reported at the censuses of 1880 and 1890. With the exception of nails, which are stated in kegs of 100 pounds, the quantities are shown in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF CLASSIFIED PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Quantity.	Value.	Quantity.	Value.
Total		\$121,421,562		\$210,389,379
Iron:				
Bar and rod.....	441,929	24,275,523	556,207	22,501,250
Rails	191,518	8,068,759	2,571	95,590
Plates, except nail plates.....	119,154	7,885,733	170,936	7,500,238
Sheets	60,567	5,833,074	87,188	5,024,872
Muck bar produced for sale.....	56,524	2,160,255	201,846	5,806,421
Hammered and rolled car axles	9,768	731,331	10,059	450,218
Hoop	67,799	4,317,192	95,248	3,929,037
Skelp.....	116,248	7,106,738	437,173	16,532,538
Structural shapes.....	94,025	5,340,619	130,957	6,039,974
Cut nails	1,812,280	5,837,433	1,519,545	3,041,429
All other finished products.....	86,440	5,969,719	194,243	9,633,139
Steel, bessemer:				
Bar and rod.....	87,529	5,443,959	281,314	10,963,256
Rails	467,209	21,653,995	1,433,205	42,321,749
Plates, except nail plates.....	1,475	143,144	57,526	2,550,248
Sheets			34,904	2,412,122

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF CLASSIFIED PRODUCTS, ETC.—Continued.

CLASS OF PRODUCTS.	1880		1890	
	Quantity.	Value.	Quantity.	Value.
Steel, bessemer—Continued.				
Hammered car axles.....			2,620	\$116,395
Hoop.....			2,640	111,803
Skelp.....			9,690	390,183
Structural shapes.....	557	\$63,060	90,756	4,312,183
Cut nails.....			641,130	1,269,626
All other finished products.....	14,115	712,162	757,531	26,310,642
Steel, open-hearth:				
Bar and rod.....	28,845	2,411,310	86,269	4,197,871
Rails.....	3,360	151,200		
Plates, except nail plates.....	2,280	293,200	152,042	7,930,950
Sheets.....	1,050	127,000	29,098	2,233,735
Hammered and rolled car axles.....			9,559	521,895
Hoop.....			3,532	160,000
Structural shapes.....			74,012	3,855,414
Cut nails.....			4,000	37,110
All other finished products.....	18,024	1,740,841	136,763	7,721,978
Steel (crucible and miscellaneous):				
Finished products.....	72,505	10,268,942	67,092	8,507,247
All other products.....		881,364		3,192,366

MACHINERY.—The following comparative statement presents the equipment and capacity of the rolling mills and steel works of the middle states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, EQUIPMENT AND CAPACITY, ROLLING MILLS AND STEEL WORKS IN THE MIDDLE STATES: 1880 AND 1890. (a)

MACHINERY.	1880	1890	Increase.
Single puddling furnaces.....	2,682	3,160	478
Heating furnaces.....	1,538	1,877	339
Bessemer converters.....	14	648	34
Open-hearth furnaces.....	15	84	69
Crucible pots which can be used at each heat.....	2,384	2,258	e126
Hammers.....	299	413	114
Cut nail machines.....	1,041	1,953	312
Trains of rolls.....	776	923	147
Aggregate daily capacity in tons of finished products.....	12,686	27,861	15,175

a Includes machinery in both active and idle establishments.
 b Includes 6 Clapp-Griffiths and 4 Robert-Bessemer converters.
 c Decrease.

FORGES AND BLOOMERIES.

Pennsylvania has always ranked first in the production of charcoal blooms from pig and scrap iron, while New York has occupied a similar position in the production of charcoal blooms direct from iron ore. In 1880 the total production of charcoal blooms and hammered bar iron direct from iron ore and blooms from pig iron and scrap iron was 72,557 tons, of which quantity the middle states produced 60,120 tons, or 82.86 per cent. Since 1880 this industry has seriously felt the competition of modern processes of iron and steel manufacture, and while the number of active and idle establishments in the United States has decreased from 118 in 1880 to 32 in 1890, the output has declined in 1890 to 34,775 tons, of which works located in the middle states produced 29,455 tons. Of the 20 active establishments in the United States in 1890, 19 were located in the middle states, as follows: New York 9, New Jersey 1, and Pennsylvania 9. The details of the industry will be found in the report on forges and bloomerics.

SOUTHERN STATES.

One of the most notable features of the growth of the iron and steel industry during the past decade is the activity displayed in southern states in the erection of iron making plants, particularly large coke blast furnaces. In direct connection with this work there has been an advance almost equally great in the development of the extensive mineral resources necessary to the operation of these iron making establishments. Steel making, although not wholly neglected, has not formed a prominent feature of this metallurgical development.

The progress made by the southern states in the manufacture of iron and steel during the past 20 years is shown in the summary on the following page, the statistics being for the census years 1870, 1880, and 1890.

In compiling the figures of this summary the geographical division of the southern states is considered as comprising the iron making states of Alabama, Georgia, Kentucky, Maryland, North Carolina, Tennessee, Texas, Virginia, and West Virginia; also the District of Columbia, South Carolina, and Mississippi.

COMPARATIVE SUMMARY, IRON AND STEEL INDUSTRY IN THE SOUTHERN STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments.....	171	130	109
Capital.....	\$12,850,885	\$21,942,311	c\$43,051,652
Miscellaneous expenses.....	(d)	(d)	\$2,110,129
Average number of employes (aggregate).....	10,884	10,728	17,601
Total wages.....	\$4,689,159	\$5,916,868	\$7,669,600
Officers, firm members, and clerks:			
Average number.....	(e)	(e)	550
Total wages.....			\$806,415
All other employes:			
Average number.....	(e)	(e)	17,051
Total wages.....			\$6,863,185
Cost of materials used.....	\$10,876,239	\$13,739,624	\$27,047,767
Value of products.....	f\$20,696,665	\$23,066,074	\$30,982,152
Tonnage of products.....	345,572	615,235	2,297,184

a This statement includes only active establishments for the censuses of 1880 and 1890; such establishments were not reported separately at the census of 1870.
 b For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employes, and wages relating to mining and other operations in the figures for 1880.
 c Includes hired property valued at \$1,283,000. This item was not reported separately at previous censuses.
 d Not reported.
 e Not reported separately.
 f Includes values for which no tonnage was reported.

The following comparative statement presents the leading statistics of the iron and steel industry of the southern states, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, IRON AND STEEL INDUSTRY IN THE SOUTHERN STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The Southern States.....	b1880 1890	130 109	\$21,942,311 c43,051,652	10,728 d17,601	\$5,916,868 d7,669,600	\$13,739,624 27,047,767	\$23,066,074 30,982,152
Alabama.....	1880 1890	8 35	2,757,196 17,087,583	1,026 5,878	571,713 2,522,008	601,073 7,425,344	1,452,856 12,544,227
District of Columbia.....	1880 1890	1	80,600	18	7,528	2,264	10,970
Georgia.....	1880 1890	9 5	973,800 908,243	1,303 357	185,480 112,170	631,707 321,728	990,850 471,757
Kentucky.....	1880 e1890	18	4,610,035	4,095	1,344,400	3,223,799	5,090,020
Maryland.....	1880 1890	18 10	4,402,125 4,217,574	2,763 1,272	905,060 396,351	2,888,574 2,217,173	4,470,050 2,860,298
North Carolina.....	1880 e1890	9	199,400	63	7,907	11,792	41,085
Tennessee.....	1880 1890	20 15	2,862,826 4,613,355	3,077 1,557	659,773 775,521	1,376,059 2,949,071	2,274,293 4,247,868
Texas.....	1880 e1890	1	40,000	140	27,720	23,580	36,000
Virginia.....	1880 1890	21 21	2,294,713 6,330,993	2,522 3,110	665,432 1,293,360	1,496,151 4,404,452	2,585,990 6,320,084
West Virginia.....	1880 1890	16 12	3,712,616 6,458,924	4,121 3,833	1,541,816 1,838,209	3,484,625 7,906,936	6,054,032 10,556,865
All other states.....	e1890	11	2,534,980	1,594	761,981	1,829,363	2,966,143

a This statement includes only active establishments.
 b For explanation of apparent discrepancies in the data for 1880, see remarks in regard to the inclusion of capital, employes, and wages relating to mining and other operations.
 c Includes hired property valued at \$1,283,000. This item was not reported separately at the census of 1880.
 d Includes 550 officers, firm members, and clerks and their wages amounting to \$806,415, distributed as follows: Alabama 193, \$319,044; Georgia 13, \$23,125; Kentucky, including 1 establishment in North Carolina and 1 in Texas 53, \$72,089; Maryland 25, \$24,358; Tennessee 85, \$118,446; Virginia 100, \$145,908; West Virginia 76, \$103,445. These classes were not reported separately at the census of 1880.
 e Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: North Carolina 1, Texas 1, Kentucky 9.

The decrease in the number of establishments in 1890 as compared with 1880 is due to the fact that a large number of charcoal furnaces of small size and unfavorably situated for securing cheap materials and distribution of their product have been abandoned during the past decade, while many of the furnaces operated in 1880 by separate firms or companies or built in succeeding years by distinct organizations have since been consolidated under one management and appear in the tabulations for 1890 as single establishments.

CAPITAL.—The following comparative statement shows the different items of capital in active and idle establishments and those in course of construction in the iron and steel industry in the southern states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, IRON AND STEEL INDUSTRY IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total	1880	209	<i>a</i> \$27,714,361	\$12,393,191	\$15,321,170
	1890	159	<i>b</i> 47,884,944	30,756,795	17,128,149
Establishments in operation.....	1880	130	21,042,311	9,843,441	12,098,870
	1890	109	43,051,652	20,950,403	16,101,249
Idle establishments.....	1880	76	5,079,050	1,900,300	3,118,750
	1890	27	1,935,693	1,502,193	433,500
Establishments in course of construction.....	1880	3	693,000	589,450	103,550
	1890	23	2,897,599	2,304,199	593,400

a See remarks in regard to inclusion of capital relating to mining and other operations in the figures for 1880.

b Includes hired property valued at \$1,283,000. This item was not reported separately at the census of 1880.

BLAST FURNACES.

It is in the manufacture of pig iron that the progress and activity of the iron industry of the southern states has been particularly marked during the decade from 1880 to 1890. This section has been long noted for the excellent character of the charcoal pig iron produced within its borders; but prior to 1880 attention was not especially directed to its extensive and easily worked deposits of iron ore, nor to the advantages which the close proximity of coking coal and limestone to these deposits afforded for the production of coke pig iron at low cost. During 1880 the southern states produced 9.27 per cent of the aggregate pig iron yield of the United States, but in 1890 the furnaces in this section contributed 18.52 per cent of the total output, the increase in tonnage over 1880 being 423.52 per cent.

The growth of the blast furnace industry in the southern states is indicated by the following summary, which presents the leading statistics of this branch of the industry, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, BLAST FURNACES IN THE SOUTHERN STATES: 1870, 1880, AND 1890. (*a*)

ITEMS.	1870 (<i>b</i>)	1880 (<i>b</i>)	1890
Number of establishments	91	59	73
Capital.....	\$7,897,325	\$11,890,907	<i>c</i> \$20,074,471
Miscellaneous expenses.....	(<i>d</i>)	(<i>d</i>)	\$1,578,512
Average number of employés (aggregate)	5,488	9,486	8,204
Total wages	\$1,068,100	\$2,186,855	\$3,410,278
Officers, firm members, and clerks:			
Average number	(<i>e</i>)	(<i>e</i>)	332
Total wages.....			\$400,120
All other employés:			
Average number	(<i>e</i>)	(<i>e</i>)	7,932
Total wages.....			\$2,017,158
Cost of materials used	\$3,562,955	\$4,452,804	\$15,410,982
Value of products.....	\$7,008,137	<i>f</i> \$7,760,050	\$22,494,370
Tonnage of products.....	184,540	350,436	1,834,586

a This statement includes only active establishments for 1880 and 1890; such establishments were not reported separately at the census of 1870.

b For explanation of apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employés, and wages relating to mining and other operations in the figures for 1880.

c Includes hired property valued at \$783,000. This item was not reported separately at previous censuses.

d Not reported.

e Not reported separately.

f Includes values for which tonnage was not reported.

The following comparative statement presents the leading statistics of the blast furnace industry in the southern states, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, BLAST FURNACES IN THE SOUTHERN STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The Southern States	b1880 1890	59 73	\$11,890,907 c20,074,471	9,486 d8,264	\$2,180,855 d3,416,278	\$4,452,804 15,410,982	\$7,760,050 22,494,870
Alabama	1880 1890	7 28	2,707,196 15,778,786	1,566 4,139	553,713 1,783,700	575,673 6,493,884	1,405,356 10,315,091
Georgia	1880 1890	5 4	712,000 748,845	754 269	77,415 64,676	241,796 237,896	466,890 339,422
Kentucky.....	1880 1890	0 0	2,098,035	1,890	429,988	801,410	1,248,652
Maryland	1880 1890	12 5	2,197,125 3,198,222	1,443 639	339,978 151,342	956,806 1,316,539	1,700,339 1,632,004
Tennessee	1880 1890	9 11	1,422,026 3,985,806	1,579 1,075	261,897 525,992	489,440 2,450,882	840,022 3,300,464
Texas	1880 e1890	1 1	40,000	140	27,720	23,580	30,000
Virginia.....	1880 1890	8 15	1,391,500 4,150,200	1,221 1,328	255,986 558,312	205,548 2,820,197	440,095 3,925,481
West Virginia	1880 1890	8 4	1,322,425 1,446,082	893 424	240,158 198,938	1,158,611 1,503,847	1,031,096 2,000,595
All other states	e1890	6	1,050,524	389	133,323	587,827	906,303

a This statement includes only active establishments.

b For explanation of apparent discrepancies in the data for 1880 see remarks in regard to the inclusion of capital, employés, and wages relating to mining and other operations.

c Includes hired property valued at \$783,000. This item was not reported separately at the census of 1880.

d Includes 332 officers, firm members, and clerks and their wages amounting to \$499,120, distributed as follows: Alabama 150, \$262,396; Georgia 15, \$19,175; Kentucky (including North Carolina and Texas) 21, \$25,438; Maryland 9, \$7,530; Tennessee 64, \$87,616; Virginia 60, \$80,207; West Virginia 13, \$16,758. These classes were not reported separately at the census of 1880.

e Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: North Carolina 1, Texas 1, Kentucky 4.

Alabama shows the greatest increase in the blast furnace industry during the past decade. Jefferson county in that state, in which the city of Birmingham is located, is now the most important iron making center in the south. In 1880 there were but 2 establishments in the county, operating 3 blast furnaces, with an invested capital of \$1,080,800, but in 1890 this district contained 10 blast furnace establishments with 24 furnaces, the total capital directly invested in the manufacture of pig iron being \$8,938,110. Virginia has long occupied an important position among the iron producing states of the country. In 1880 more than one-half of the pig iron made in that state was produced with charcoal as fuel, but with the development of the Flat Top coke fields an important advance has taken place in the erection of coke furnaces, and Virginia is now second in rank among the southern pig iron producing states. Tennessee has shown considerable progress in the erection of both coke and charcoal furnaces, and is now the third producer of pig iron in the southern section. While West Virginia is classed among the southern states, its pig iron industry at the present time partakes largely of the characteristics of the establishments located in the northern and western sections of the country. During the past decade the manufacture of charcoal pig iron in West Virginia has been abandoned, and by far the larger part of the coke pig iron is produced from Lake Superior ores, the furnaces being located in Ohio and Marshall counties, at Wheeling and in its vicinity. The only furnace in the state using local ores exclusively is situated in Preston county.

While Maryland shows an increase in capital during the past 10 years a slight decrease is shown in the value of products, owing to the decline in the manufacture of charcoal pig iron, and also to the reduction in the prices of all kinds of pig iron. Four large coke furnaces were built at Sparrow Point, Baltimore, in 1890. Two of these stacks were put in operation toward the close of the census year.

The pig iron industry of Kentucky has shown a marked decline during the past decade. In 1880 the state contained 22 blast furnaces, of which number 18 were small charcoal stacks, located principally in Greenup, Boyd, Carter, Estill, and Trigg counties. With the exception of 1 furnace in Greenup county, all these charcoal stacks have been abandoned. During 1890 a number of coke furnaces were under construction, only one of which, however, was completed, but not blown in at the close of the year.

The pig iron industry of Georgia remained practically stationary during the decade from 1880 to 1890. Little progress was made in Texas prior to 1890. In that year, however, 2 charcoal furnaces were completed, but not blown in.

The 7 charcoal furnaces in North Carolina in 1880 were idle in that year, and all have since been considered by their owners as abandoned or classed as long inactive furnaces. The only active furnace in the state was built in 1884 to smelt Cranberry ores, using charcoal as fuel, but during the latter part of the census year 1890 it was run on coke.

MANUFACTURING INDUSTRIES.

CAPITAL.—The following statement shows the different items of capital in active and idle establishments and those in course of construction in the blast furnace industry in the southern states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, BLAST FURNACES IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total.....	1880	121	\$16,964,207	\$6,016,941	\$10,947,266
	1890	110	533,207,370	22,592,812	10,614,558
Establishments in operation.....	1880	59	11,890,907	3,954,841	7,936,066
	1890	73	29,974,471	20,026,113	9,948,358
Idle establishments.....	1880	60	4,533,300	1,607,650	2,925,650
	1890	19	1,309,300	945,800	363,500
Establishments in course of construction.....	1880	2	540,000	454,450	85,550
	1890	18	1,923,599	1,620,899	302,700

^a See remarks in regard to the inclusion of capital relating to mining and other operations in the figures for 1880.

^b Includes hired property valued at \$783,000. This item was not reported separately at the census of 1880.

During the decade from 1880 to 1890 the increase in the total capital invested in blast furnaces was 95.75 per cent, while the investment in buildings and machinery has increased 275.49 per cent. There was a decrease of 3.04 per cent in the remaining items, the causes of this apparent decline having been previously explained.

EMPLOYÉS AND WAGES.—The following statement presents the average number and total wages of officers or firm members and clerks, and the average number and total wages of skilled and unskilled employés, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, BLAST FURNACES IN THE SOUTHERN STATES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years. (a)		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
All classes.....	8,264	\$3,416,278	8,225	\$3,410,628	1	\$360	38	\$5,290
Officers or firm members.....	164	366,731	164	366,731				
Clerks.....	168	132,389	167	132,029	1	360		
Skilled.....	1,426	829,887	1,426	829,887				
Unskilled.....	6,506	2,087,271	6,468	2,081,981			38	5,290

^a Includes convict laborers in the Texas penitentiary receiving an average of 50 cents a day.

The following statement presents the average number of employés at the different weekly rates of wages: AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, BLAST FURNACES, IN THE SOUTHERN STATES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years. (a)	Children.
Total.....	7,894	38
Under \$5.....	106	29
\$5 and over but under \$6.....	150	9
\$6 and over but under \$7.....	437	
\$7 and over but under \$8.....	2,232	
\$8 and over but under \$9.....	1,928	
\$9 and over but under \$10.....	842	
\$10 and over but under \$12.....	881	
\$12 and over but under \$15.....	735	
\$15 and over but under \$20.....	296	
\$20 and over but under \$25.....	111	
\$25 and over.....	76	

^a Includes convict laborers in the Texas penitentiary, receiving an average of 50 cents per day.

The average length of time during which the blast furnaces of the southern states were in operation in 1890 was 8.70 months. Furnace hands were employed 12 hours per day, 7 days each week; yard hands worked 10 hours daily for 6 days a week. In 1880 the blast furnaces of the south were in operation an average of 7.52 months.

The daily rates of wages of blast furnace employes in the south do not differ materially from the wages at most northern establishments. At the southern furnaces colored labor is almost exclusively employed, except in positions where judgment and prompt action in emergencies are required, such as those of founders, stovesmen, engineers, and head iron grader. In the cast house the iron breakers, helpers, keepers, cinder men, and scrap men are colored, one or two white men occasionally working on the shift. In the stock house the work from unloading the stock to the filling in at the top of the furnace is performed by colored labor, the employment of white labor being exceptional.

One of the difficulties encountered by the managers of southern furnaces in the employment of colored laborers is to secure continuous service. For this reason it is found necessary to divide the force into gangs with a "boss", whose duty it is to provide sufficient men to fill the places of those temporarily idle and keep the work moving smoothly. One "boss" looks after the men on the floor of the stock house, another after those engaged in unloading material, another after the cinder men, while still another takes charge of any laborers employed for extra work around the furnace.

In order to show the range of wages for different classes of blast furnace employes, the following statement has been prepared, showing the daily rates of wages paid by six blast furnace companies in the Birmingham, Ala., district in 1890:

DAILY RATES OF WAGES PAID AT 6 BLAST FURNACES IN THE BIRMINGHAM DISTRICT, ALABAMA: 1890.

CLASSES.	DAILY RATES OF WAGES.					
	Establishment. 1	Establishment. 2	Establishment. 3	Establishment. 4	Establishment. 5	Establishment. 6
Breakers	\$1.20	\$1.20	\$1.00	\$1.20	\$1.20	\$1.10
Ore and coke wheelers	1.35	1.70	1.20	1.20	1.35	1.10
Top fillers	1.75	1.75	1.75	1.75	1.75	1.50
Top fillers, helpers	1.50	1.25	1.50	1.50	1.50	1.25
Stove tenders	1.75	1.75	1.75	1.75	1.75	1.50
Weighers	2.00	1.70	1.30	1.20	2.00	1.50
Metal carriers	2.00	2.00	2.00	2.00	2.00	1.75
Founders (excluding boss founders)	2.75	2.16	3.00	3.00	3.00	2.83
Keepers	2.00	2.00	2.00	2.00	2.00	1.75
Engineers	2.50	1.80	2.25	2.25	2.25	2.00
Firemen	1.50	1.40	1.50	1.00	1.25	1.10
Common laborers	1.10	1.00	1.00	1.00	1.10	1.00

Slightly lower rates than those above given are paid at southern furnaces which are not located in close proximity to the large cities.

MATERIALS USED.—The following comparative statement presents the quantities and cost of the materials consumed by the blast furnaces in the southern states, as reported at the censuses of 1880 and 1890. The quantities reported are in tons of 2,000 pounds, except charcoal, which is stated in bushels.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, BLAST FURNACES IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total		\$4,452,804		\$15,410,982
Domestic iron ore	724,136	2,003,250	3,837,409	6,042,537
Foreign iron ore	(a)		136,760	603,422
Fluxing material	250,564	208,114	1,154,006	766,938
Anthracite coal	32,600	139,000		
Bituminous coal	79,202	119,156	148,823	223,326
Coke	334,458	1,034,213	2,228,915	5,039,150
Charcoal	14,961,937	824,842	23,409,733	1,413,452
Mill cinder, etc	60,133	124,280	79,612	152,440
All other materials				209,717

a Domestic and foreign iron ore were not reported separately at the census of 1880.

With the exception of a few establishments in Maryland, West Virginia, and Kentucky, the furnaces of the south obtain their supply of ore from local sources, and almost the entire output of these mines is used by furnaces which are usually located in close proximity. In Maryland a number of furnaces use foreign ores, and in West Virginia almost all the pig iron is produced from Lake Superior ores. Kentucky also uses some ore from the Lake Superior district.

Coke constitutes the principal fuel used in the blast furnaces of the south, although the manufacture of charcoal pig iron continues to occupy an important position in the iron industry of this section. A few of the Kentucky furnaces still use a mixture of raw coal and coke, but in all other states where coke is used as a blast furnace fuel it is employed alone. The Virginia furnaces draw their supply of coke from the Flat Top and New River districts in Virginia and West Virginia. Those of Alabama and Tennessee depend largely on the coke made from coal mined in those states, although obtaining a part of their supply from the Flat Top district.

PRODUCTS.—The following comparative statement shows the quantity and value of pig iron, including castings direct from the furnace, as reported at the censuses of 1880 and 1890, according to fuel used. The quantities are in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF PRODUCTS CLASSIFIED ACCORDING TO KIND OF FUEL USED, BLAST FURNACES IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Tons.	Value.	Tons.	Value.
Total		\$7,769,050		\$22,494,870
Mixed anthracite and coke pig iron.....	26,100	590,000		
Coke and bituminous pig iron.....	214,861	4,117,635	1,029,033	18,966,980
Charcoal pig iron.....	106,955	2,909,750	205,553	3,527,800
Anthracite coal pig iron.....	2,520	65,500		
Total tonnage and value.....	350,436	7,682,885	1,234,586	22,494,870
All other products.....		86,165		

^a Six hundred and eighty-one tons of direct castings shown in the report for blast furnaces, 1880, have been distributed in this statement among the several kinds of pig iron.

While the furnaces of the south are advantageously located for the production of pig iron at low cost, the local development of industries consuming pig iron has not kept pace with the erection of furnaces, consequently at present a large part of the iron must seek purchasers in northern and western markets. The rolling mill industry is, however, steadily growing in the south, and increased activity is shown from year to year in the erection of foundries.

MACHINERY.—The majority of the furnaces abandoned during the past decade were of small capacity, and, owing to antiquated machinery or unfavorable location for supply of materials and marketing products, were unable to compete with the furnaces constructed during recent years.

The number of completed establishments has decreased from 119 in 1880 to 92 in 1890, the number of furnace stacks from 140 to 132, while the daily capacity has increased from 2,199 tons in 1880 to 8,511 tons in 1890.

The following comparative statement shows the number and total daily capacity in tons of 2,000 pounds of the blast furnaces in the southern states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, NUMBER AND TOTAL DAILY CAPACITY OF BLAST FURNACE STACKS IN THE SOUTHERN STATES: 1880 AND 1890.

STATES.	NUMBER OF COMPLETED FURNACE STACKS.		TOTAL DAILY CAPACITY.	
	1880	1890	1880	1890
Total	140	132	2,199	8,511
Alabama.....	15	48	339	4,237
Georgia.....	10	5	144	259
Kentucky.....	22	6	392	323
Maryland.....	22	14	281	713
North Carolina.....	7	1	39	15
Tennessee.....	21	19	388	1,100
Texas.....	1	3	10	130
Virginia.....	31	31	287	1,200
West Virginia.....	11	5	319	525

It appears from the foregoing statement that the increase during the decade in the total daily capacity of the blast furnaces in the southern states is 6,312 tons, or 287.04 per cent.

ROLLING MILLS AND STEEL WORKS.

Including active and idle establishments in 1880, there were situated in the southern states 34 iron rolling mills, 2 open hearth steel works, and 2 crucible steel works. Of the 40 establishments in 1890, 32 were iron and steel rolling mills not connected with steel producing works and 8 were equipped for the production of crude steel. These 8 steel works comprised 5 bessemer steel plants, 3 open-hearth steel plants, and 2 crucible steel plants. There was 1 establishment which operated both bessemer and open-hearth steel plants, and all but 1 establishment contained trains of rolls.

The following comparative summary exhibits the leading statistics of the rolling mills and steel works, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880	1890
Number of establishments	67	35	35
Capital	\$4,592,310	\$9,075,701	\$13,039,181
Miscellaneous expenses	(d)	(d)	\$530,117
Average number of employes (aggregate)	5,150	9,748	9,277
Total wages	\$2,943,009	\$3,620,136	\$4,219,322
Officers, firm members, and clerks:			
Average number	(e)	(e)	218
Total wages			\$307,295
All other employes:			
Average numbers	(e)	(e)	9,059
Total wages			\$3,912,027
Cost of materials used	\$7,102,632	\$9,038,048	\$11,503,000
Value of products (f)	\$13,332,071	\$14,715,410	\$17,312,282
Tons of products	157,228	250,406	457,278

a This statement includes only active establishments for the censuses of 1880 and 1890; such establishments were not reported separately at the census of 1870.
 b See remarks in regard to the depreciated currency of 1870.
 c Includes hired property valued at \$500,000. This item was not reported separately at previous censuses.
 d Not reported.
 e Not reported separately.
 f Includes values for which no tonnage was reported.

The following comparative statement presents the leading statistics relating to rolling mills and steel works in the southern states, by states and territories, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES, BY STATES AND TERRITORIES: 1880 AND 1890. (a)

STATES AND TERRITORIES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The Southern States	1880	35	\$9,075,701	9,748	\$3,620,136	\$9,038,048	\$14,715,410
	1890	35	\$13,039,181	9,277	\$4,219,322	\$11,503,000	\$17,312,282
Alabama	1880	1	50,000	00	18,000	25,400	47,500
	1890	1					
District of Columbia	1880	1	80,000	18	7,528	2,264	10,970
	1890						
Georgia	1880	1	250,000	500	102,239	373,276	486,700
	1890						
Kentucky	1880	9	2,512,000	2,205	914,412	2,422,389	3,841,377
	1890	5	1,484,456	1,205	628,658	1,241,536	2,059,840
Maryland	1880	5	2,145,000	1,253	546,974	1,829,042	2,550,051
	1890	4	1,071,352	573	211,009	766,849	1,062,204
Tennessee	1880	5	1,401,000	1,350	376,786	859,965	1,369,400
	1890	4	927,549	481	249,529	492,789	881,404
Virginia	1880	5	838,000	1,134	352,539	1,199,698	1,980,416
	1890	6	2,174,787	1,782	705,048	1,584,285	2,400,603
West Virginia	1880	8	2,390,191	3,223	1,301,658	2,326,014	4,422,936
	1890	8	5,012,842	3,409	1,639,276	6,402,189	8,547,360
All other states	1880	8	2,368,195	1,827	785,802	1,015,352	2,360,871
	1890						

a This statement includes only active establishments.
 b Includes hired property valued at \$500,000. This item was not reported separately at the census of 1880.
 c Includes 218 officers, firm members, and clerks, with wages amounting to \$307,295, distributed as follows: Alabama (including 1 establishment located in Georgia) 46, \$60,598; Kentucky 32, \$40,651; Maryland 16, \$16,828; Tennessee 21, \$30,830; Virginia 40, \$65,701; West Virginia 63, \$89,687. These classes were not reported separately at the census of 1880.
 d Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Georgia 1; Alabama 7.

The state of West Virginia occupies the leading position in 1890 as regards both capital and value of products. The returns show that Alabama has more capital invested in rolling mills and steel works than Virginia, although the total value of products of the Virginia works, in 1890, slightly exceeded the total of Alabama. Texas had no rolling mill industry in 1880, but in 1890 contained 1 completed rolling mill (idle), and 1 in course of construction. In the remaining states a decrease in the amount of capital invested and in value of products is noted during the decade.

The southern states have made but little progress in the production of steel since 1880, the character of the iron ores of this section being generally unsuitable for use in the older and well-tried processes of steel manufacture. During 1890 steel was produced experimentally by the basic process at an open-hearth establishment in Alabama.^(a) Since 1880 5 bessemer steel plants have been erected in the south, 4 of which were added to existing iron rolling mills. Of this number, 1 is in Virginia, 2 in West Virginia, and 2 in Tennessee. At the close of 1890, large steel works were in course of erection at Sparrow Point, Baltimore, Md., for the manufacture of steel by the bessemer process.^(b)

In 1880 the south was credited with 2 open-hearth and 2 crucible steel works, but in 1890 the open-hearth steel plants had increased to 3, the number of crucible steel works remaining unchanged.

CAPITAL.—The following comparative statement shows the different items of capital in active and idle establishments and those in course of construction for rolling mills and steel works in the southern states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total	1880	39	\$10,233,791	\$6,102,700	\$4,131,091
	1890	45	14,567,374	8,074,283	6,493,091
Establishments in operation.....	1880	35	9,075,791	5,662,300	4,013,491
	1890	35	13,039,181	6,894,290	6,144,891
Idle establishments.....	1880	3	405,000	305,400	99,600
	1890	5	554,193	496,693	57,500
Establishments in course of construction.....	1880	1	153,000	135,000	18,000
	1890	5	974,000	683,300	290,700

^a Includes hired property valued at \$500,000. This item was not reported separately at the census of 1880.

Of the aggregate capital invested in rolling mills and steel works in 1880, \$6,102,700 was credited to buildings and machinery, and the remaining \$4,131,091 to land and cash capital. In the 10 years under consideration, the increase in aggregate capital was 42.35 per cent, while the value of buildings and machinery had increased 32.31 per cent and the investment in land and cash capital 57.18 per cent.

EMPLOYÉS AND WAGES.—The following statement presents the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés in rolling mills and steel works in the southern states, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
Total	9,277	\$4,219,322	8,943	\$4,160,341	1	\$520	333 ^a	\$40,401
Officers or firm members.....	102	215,251	102	215,251				
Clerks	116	92,044	115	91,524	1	520		
Skilled.....	4,907	2,782,641	4,907	2,782,641				
Unskilled.....	4,002	1,129,386	3,750	1,079,925			333	40,401

^a Since the close of the census year, an establishment in Chattanooga, Tenn., has engaged in the manufacture of steel by the same method.

^b This establishment has since been completed and put in operation.

The following statement shows the average number of employes at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years.	Children.
Total	8,726	333
Under \$5.....	156	208
\$5 and over but under \$6.....	481	109
\$6 and over but under \$7.....	812	16
\$7 and over but under \$8.....	954	
\$8 and over but under \$9.....	1,093	
\$9 and over but under \$10.....	1,068	
\$10 and over but under \$12.....	1,067	
\$12 and over but under \$15.....	925	
\$15 and over but under \$20.....	1,238	
\$20 and over but under \$25.....	643	
\$25 and over.....	340	

During 1890 the rolling mills and steel works of the southern states were in operation an average of 8.72 months each, while the average term of employment for men was 9.34 months and for children 8.72 months. In rolling mills and steel works, with but few exceptions, the workmen are employed 10 hours a day for 6 days of the week. In 1880 the rolling mills and steel works of the south employed 9,743 hands and were in operation an average of 9.06 months each.

MATERIALS USED.—The following comparative statement presents the quantities and cost of materials consumed by the rolling mills and steel works in the southern states, as reported at the censuses of 1880 and 1890. The quantities are stated in tons of 2,000 pounds with the exception of charcoal, which is stated in bushels.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total.....		\$0,038,048		\$11,503,000
Iron ore.....	30,738	220,191	32,238	214,746
Spiegeleisen and ferro-manganese.....	119	9,500	1,709	93,007
Pig iron.....	150,938	3,569,251	336,586	4,079,007
Old iron rails.....	88,903	2,474,468	42,271	998,657
Other old or scrap iron.....	44,758	1,165,138	43,311	796,199
Old steel rails.....	250	7,500		
Other old or scrap steel.....	75	2,750	2,488	45,587
Hammered iron ore blooms.....	1,300	83,000	100	5,000
Hammered pig or scrap blooms.....	9,351	426,335		
Purchased muck bar.....	199	7,403	3,816	119,059
Purchased bessemer steel.....			73,377	2,012,310
Purchased open-hearth steel.....			8,509	260,792
Swedish billets and bars.....			200	16,000
Anthracite coal.....	3,080	16,250	1,719	7,657
Bituminous coal.....	454,383	838,878	548,304	747,405
Coke.....	1,160	6,065	20,725	53,981
Charcoal.....	155,500	13,733	20,807	2,157
Natural gas.....				24,075
All other materials.....		197,561		1,122,280

PRODUCTS.—The comparative statement on the following page shows the tonnage of iron and steel products for rolling mills and steel works in the southern states, as reported at the censuses of 1880 and 1890.

MANUFACTURING INDUSTRIES.

COMPARATIVE STATEMENT, TONNAGE OF PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880	1890
Total	250,406	457,278
Iron	253,311	208,977
Bessemer steel.....		241,365
Open-hearth steel.....	3,020	5,806
Crucible and miscellaneous steel.....	75	1,130

The following comparative statement presents the value of the different iron and steel products and the percentage that each class bears of the total, for the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, VALUE OF PRODUCTS, WITH PERCENTAGE EACH CLASS IS OF TOTAL, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	VALUE.		PERCENTAGE.	
	1880	1890	1880	1890
Total	\$14,715,410	\$17,312,282	100.00	100.00
Manufactures of iron.....	14,466,342	8,490,838	98.31	49.08
Manufactures of steel.....	171,000	8,619,508	1.16	49.79
Miscellaneous	78,068	195,936	0.53	1.13

The extent to which steel has superseded iron in the southern states during the decade from 1880 to 1890 is shown in the foregoing statement. In 1880 the tonnage of iron formed 98.79 per cent of the total output and steel but 1.21 per cent, while in 1890, the tonnage of iron formed 45.70 per cent of the total output and steel increased to 54.30 per cent. The value of iron products decreased 41.26 per cent and the tonnage 17.50 per cent.

The following comparative statement presents the tonnage and value of the classified products of the rolling mills and steel works of the southern states, as reported at the censuses of 1880 and 1890. The quantities are given in tons of 2,000 pounds, except nails, which are stated in kegs of 100 pounds.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF CLASSIFIED PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Quantity.	Value.	Quantity.	Value.
Total		\$14,715,410		\$17,312,282
Iron:				
Rails	52,086	2,371,770	4,314	168,081
Bar and rod.....	69,590	3,526,239	30,849	3,090,181
Hoop	1,537	102,855	201	12,804
Skelp	3,910	249,158		
Structural shapes.....	2,300	145,000	2,000	85,000
Sheets	12,302	982,505	17,159	1,053,469
Plates (except nail plates).....	18,882	1,374,439	14,368	680,211
Car axles, rolled and hammered	300	21,000	5,900	282,182
Muck bar produced for sale.....	1,091	55,796	38,082	936,654
Cut nails	1,471,720	4,633,960	184,341	437,566
All other finished products	10,827	1,003,530	36,797	1,750,690
Steel, bessemer:				
Rails			536	20,000
Bar.....			5,265	214,085
Sheets			5,159	300,757
Skelp			4,280	140,183
Plates (except nail plates).....			15,220	538,024
Cut nails			1,178,082	2,479,135
All other finished products			151,983	4,536,453
Steel, open-hearth:				
Rails	2,745	137,250		
Bar.....			2,504	100,458
Sheets			31	1,805
Plates			2,971	157,208
All other finished products	275	24,750	300	8,100
Steel, crucible:				
Finished products.....	75	9,000	1,130	115,500
All other products.....		78,068		195,936

The quantities of bars and rods include the bars and rods sold only in those forms. Where such material is converted into bolts, nuts, horseshoes, or other products by the same establishment, the quantities and values of these finished products are tabulated under the item of "All other finished products". Under the same heading are included the quantities and values of several important products made only by a single concern, the presentation of which under their proper classifications would disclose the operations of individual establishments. In the final tabulations for the whole country these products will be entered under the proper headings with similar products for other establishments.

The quantities and values of steel products include all manufactures either made from steel produced in this section or obtained from outside sources in the form of billets, slabs, or bars.

The most notable decline in the tonnage and values of iron products since 1880 has occurred in cut nails and rails. Wheeling, W. Va., has long been an important center of the nail industry of the United States, and the quantity of nails reported as made in the south in 1880 and 1890 was produced almost entirely at works located in this district. In 1890 bessemer steel formed the principal material used in the manufacture of cut nails and spikes, the aggregate quantity of iron and steel nails made in that year not being much below the total tonnage of iron nails made in 1880.

MACHINERY.—The following comparative statement presents the equipment and the total daily capacity of the rolling mills and steel works in the southern states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, EQUIPMENT AND CAPACITY, ROLLING MILLS AND STEEL WORKS IN THE SOUTHERN STATES: 1880 AND 1890. (a)

MACHINERY.	1880	1890	Increase.
Single puddling furnaces	510	503	513
Heating furnaces	205	199	56
Bessemer converters		8	8
Open-hearth furnaces	3	4	1
Crucible pots which can be used at each heat	34	44	10
Hammers	22	34	12
Cut nail machines	562	1,236	674
Trains of rolls	132	151	19
Aggregate daily capacity in tons of finished products	1,662	3,103	1,441

a Includes machinery in both active and idle establishments.
 b Decrease.

FORGES AND BLOOMERIES.

In 1880 the southern states contained 49 establishments equipped for the production of pig and scrap blooms and blooms and bar iron direct from the ore. Most of these establishments produced bar iron, but the annual production was small. With the development of the rolling mill industry in the south and the extension of transportation facilities these primitive iron making establishments have one by one been abandoned. In 1890 but 4 establishments were reported in the southern states, all equipped for the production of blooms from pig and scrap iron, located as follows: Maryland, 2; Virginia, 1; Alabama, 1; and of these but 1, located in Maryland, was in operation.

WESTERN STATES, INCLUDING THE PACIFIC COAST STATES.

This grouping comprises all the states west of Pennsylvania which are not included in the classification of the "Southern states". The term "Western states" in these pages will be understood to embrace the Pacific coast states.

The comparative summary on the following page presents the leading statistics of the iron and steel industry of the western states, as reported at the censuses of 1870, 1880, and 1890.

MANUFACTURING INDUSTRIES.

COMPARATIVE SUMMARY, IRON AND STEEL INDUSTRY IN THE WESTERN STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments.....	152	173	188
Capital.....	\$25,306,448	\$44,658,033	c\$100,935,973
Miscellaneous expenses.....	(d)	(d)	4,366,411
Average number of employes (aggregate).....	16,856	e37,361	42,469
Total wages.....	\$9,220,381	e\$14,828,506	\$24,631,090
Officers, firm members, and clerks:			
Average number.....	(f)	(f)	1,092
Total wages.....			\$1,611,062
All other employes:			
Average number.....	(f)	(f)	41,377
Total wages.....			\$23,020,028
Cost of materials used.....	\$25,519,539	\$54,580,364	\$91,713,354
Value of products (g).....	\$40,966,909	\$78,508,424	\$129,551,520
Tons of products.....	766,460	1,944,170	5,063,359

a This statement includes only active establishments for the censuses of 1880 and 1890; such establishments were not reported separately at the census of 1870.

b For explanation of apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employes, and wages relating to mining and other operations in the figures for 1880.

c Includes hired property valued at \$3,987,058. This item was not reported separately at previous censuses.

d Not reported.

e Does not include 180 employes and \$25,275 wages reported by an idle establishment in Minnesota and included in the totals published at the census of 1880; these employes were engaged in making repairs to plant.

f Not reported separately.

g Includes values for which tonnage was not reported.

The following comparative statement presents the leading statistics of the iron and steel industry of the western states, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, IRON AND STEEL INDUSTRY IN THE WESTERN STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The Western States.....	b1880 1890	173 188	\$44,658,033 c100,935,973	e37,361 e42,469	e\$14,828,506 e24,631,090	\$54,580,364 91,713,354	\$78,508,424 129,551,520
California.....	1880 1890	1 4	1,000,000 4,656,611	319 1,152	177,722 749,849	535,500 1,938,393	780,000 3,097,155
Colorado.....	1880 f1890	1	100,000	125	7,300	131,700	225,000
Illinois.....	1880 1890	16 24	5,795,620 34,689,919	5,253 8,864	2,508,718 5,490,191	14,977,145 30,039,674	20,545,289 39,011,051
Indiana.....	1880 1890	12 15	2,283,000 4,099,095	2,048 2,717	864,921 1,254,161	3,293,073 3,075,056	4,551,403 4,742,760
Kansas.....	1880 1890	2	450,000	630	166,500	734,245	1,004,109
Michigan.....	1880 1890	15 19	3,342,386 6,696,541	3,089 1,509	922,597 896,117	3,279,420 4,135,991	4,591,613 5,829,843
Missouri.....	1880 1890	12 9	5,698,600 3,495,913	3,139 1,314	734,575 720,901	3,249,558 2,079,254	4,600,530 3,237,542
Nebraska.....	1880 1890	1	100,000	100	50,000	114,500	82,000
Ohio.....	1880 1890	103 101	22,807,606 37,642,887	20,071 24,166	8,265,070 14,126,669	23,997,915 44,551,301	34,918,300 65,206,828
Oregon.....	1880 f1890	1	100,000	250	46,822	33,073	78,303
Wisconsin.....	1880 1890	8 9	2,768,218 6,461,531	2,153 1,920	1,004,931 1,032,541	3,830,067 4,613,753	6,580,391 6,501,761
Wyoming.....	1880 f1890	1	212,003	184	79,650	403,508	491,345
All other states.....	f1890	7	3,193,476	827	360,661	1,279,092	1,924,580

a This statement includes only active establishments.

b For explanation of apparent discrepancies existing in the data for 1880, see remarks in regard to the inclusion of capital, employes, and wages relating to mining and other operations.

c Does not include 180 employes and \$25,275 wages reported by an idle establishment in Minnesota and included in the totals published at the census of 1880; these employes were engaged in making repairs to plant.

d Includes hired property valued at \$3,987,058. This item was not reported separately at the census of 1880.

e Includes 1,092 officers, firm members, and clerks, and their wages amounting to \$1,611,062, distributed as follows: California 38, \$56,540; Illinois 179, \$269,808; Indiana 69, \$103,013; Michigan 82, \$139,756; Missouri 45, \$65,802; Ohio 620, \$804,523; Wisconsin 30, \$50,754; all other states 29, \$61,352. These classes were not reported separately at the census of 1880.

f Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 2; Iowa, 1; Minnesota, 1; Oregon, 1; Washington, 1; Wyoming, 1.

The increase in the value of products is seen to have been very great from 1880 to 1890, although not proportionally so large as from 1870 to 1880. The aggregate value of products, however, does not reflect the actual increase in the volume of business so accurately as does the total tonnage of products, owing to the remarkable decline in the selling prices of iron and steel during the past 20 years.

CAPITAL.—The following comparative statement shows the different items of capital in active and idle establishments and those in course of construction for the iron and steel industry in the western states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, IRON AND STEEL INDUSTRY IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total	1880	231	\$52,318,593	\$25,841,687	\$26,476,906
	1890	233	7108,070,751	52,258,089	55,811,762
Establishments in operation.....	1880	173	44,658,033	23,165,138	21,402,895
	1890	188	100,935,973	47,014,287	53,021,066
Idle establishments.....	1880	52	6,067,188	2,676,549	4,290,690
	1890	37	6,508,478	4,805,202	1,703,270
Establishments in course of construction.....	1880	6	693,372	(c)	693,372
	1890	8	626,300	439,500	136,800

a See remarks in regard to inclusion of capital relating to mining and other operations in the figures for 1880.
 b Includes hired property valued at \$3,687,058. This item was not reported separately at the census of 1880.
 c Not reported separately.

BLAST FURNACES.

With the development of the extensive deposits of the rich iron ores of the Lake Superior region, and the better facilities enjoyed for securing coke from the Connellsville region, the western states have fully maintained their relative rank among the other pig iron producing states. In 1880 the furnaces of the western states contributed 26.41 per cent of the total quantity of pig iron produced in the country that year, and in 1890 this section made 27.06 per cent of the total output, the small quantity of castings made direct from the furnaces being included in each year.

The following comparative summary presents the leading statistics of the blast furnace industry in the western states, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, BLAST FURNACES IN THE WESTERN STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880 (b)	1890
Number of establishments.....	101	93	84
Capital	\$13,169,820	\$21,007,190	c\$33,986,675
Miscellaneous expenses.....	(d)	(d)	\$1,490,247
Average number of employes (aggregate).....	8,111	e14,202	7,919
Total wages	\$4,018,539	e\$4,158,208	\$4,128,745
Officers, firm members, and clerks:			
Average number.....	(f)	(f)	296
Total wages			\$413,046
All other employes:			
Average number	(f)	(f)	7,623
Total wages			\$3,715,699
Cost of materials used.....	\$11,420,353	\$17,158,649	\$30,938,275
Value of products	\$18,789,173	g\$24,684,885	g\$39,611,312
Tons of products.....	522,161	998,535	2,680,803

a This statement includes only active establishments for the censuses of 1880 and 1890; such establishments were not reported separately at the census of 1870, b For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks in regard to the depreciated currency of 1870; also in regard to the inclusion of capital, employes, and wages relating to mining and other operations in the figures for 1880.
 c Includes hired property valued at \$2,068,058. This item was not reported separately at previous censuses.
 d Not reported.
 e Does not include 180 employes, and \$25,275 wages reported by an idle establishment in Minnesota and included in the totals published at the census of 1880; these employes were engaged in making repairs to plant.
 f Not reported separately.
 g Includes values for which tonnage was not reported.

MANUFACTURING INDUSTRIES.

The following comparative statement exhibits the leading statistics relating to the blast furnace industry of the western states, by states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, BLAST FURNACES IN THE WESTERN STATES, BY STATES: 1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost-of materials used.	Value of products.
				Employés.	Wages.		
The Western States.....	b1880 1890	93 84	\$21,697,190 d33,986,675	c14,202 e7,919	c\$4,158,208 e4,128,745	\$17,158,619 30,938,275	\$24,684,885 39,611,312
Illinois.....	1880 1890	3 5	950,000 9,855,274	498 1,431	185,054 919,145	1,762,609 8,088,153	2,391,850 10,138,310
Indiana.....	1880 f1890	3	455,000	308	54,840	335,006	460,535
Michigan.....	1880 1890	13 15	2,071,386 5,259,001	2,164 732	591,870 416,334	2,091,224 2,935,233	3,145,062 3,982,278
Missouri.....	1880 1890	4 5	2,450,000 1,883,470	1,185 654	227,111 298,966	1,685,124 1,247,688	2,275,017 1,716,083
Ohio.....	1880 1890	62 46	13,002,586 11,750,497	8,944 4,224	2,725,157 2,057,127	9,149,020 15,696,665	13,038,193 19,800,268
Oregon.....	1880 f1890	1	100,000	250	46,822	33,073	78,393
Wisconsin.....	1880 1890	7 8	2,068,218 3,546,340	853 611	357,354 397,041	2,101,393 2,378,006	3,295,835 3,114,892
All other states.....	f1890	5	1,692,093	267	130,132	592,530	858,581

a This statement includes only active establishments.

b For explanation of the apparent discrepancies in the data for 1880, see remarks in regard to inclusion of capital, employés, and wages relating to mining and other operations.

c Does not include 180 employés and \$25,275 wages reported by an idle establishment in Minnesota and included in the totals published at the census of 1880; these employés were engaged in making repairs to plant.

d Includes hired property valued at \$2,068,058. This item was not reported separately at the census of 1880.

e Includes 296 officers, firm members, and clerks, and their wages, amounting to \$413,046, distributed as follows: Illinois 11, \$23,115; Michigan 57, \$95,312; Missouri 27, \$37,763; Ohio, 107, \$200,800; Wisconsin 16, \$30,154; 'All other states' 18, \$25,812. These classes were not reported separately at the census of 1880.

f Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 1; Indiana, 2; Oregon, 1; Washington, 1.

Ohio continues to occupy the leading position among the western states in the production of pig iron. The erection at Chicago of a number of furnace stacks of large size and modern equipment has brought Illinois prominently forward as a manufacturer of pig iron, nearly the entire quantity of which is a high grade iron for steel making purposes. Since 1880 the manufacture of pig iron has been abandoned in Utah, and during the past 10 years Colorado and Washington have engaged in its manufacture. A charcoal furnace was put in operation in California in 1881, but it has made no pig iron since 1886, and is practically abandoned.

CAPITAL.—The following comparative statement shows the different items of capital in active and idle establishments and those in course of construction for the blast furnaces in the western states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, BLAST FURNACES IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total.....	1880 1890	136 108	a\$27,618,305 b36,681,060	\$10,661,467 16,236,370	\$16,956,928 20,394,690
Establishments in operation.....	1880 1890	93 84	21,697,190 33,986,675	8,055,967 14,345,485	13,641,223 19,641,196
Idle establishments.....	1880 1890	40 20	5,626,833 2,523,385	2,005,500 1,890,385	3,621,333 633,000
Establishments in course of construction.....	1880 1890	3 4	294,372 171,000	(c) 50,500	294,372 120,500

a See remarks in regard to inclusion of capital relating to mining and other operations in the figures for 1880.

b Includes hired property valued at \$2,068,058. This item was not reported separately at the census of 1880.

c Not reported separately.

EMPLOYÉS AND WAGES.—The following statement presents the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, BLAST FURNACES IN THE WESTERN STATES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
All classes.....	7,919	\$4,128,745	7,912	\$4,126,405	4	\$1,560	3	\$780
Officers or firm members.....	150	306,311	150	306,311				
Clerks.....	146	106,735	142	105,175	4	1,560		
Skilled.....	2,052	1,291,902	2,052	1,291,902				
Unskilled.....	5,571	2,423,797	5,568	2,423,017			3	780

The following statement presents the average number of employés at the different weekly rates of wages:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, BLAST FURNACES IN THE WESTERN STATES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years.	Children.
Total.....	7,020	3
Under \$5.....	14	
\$5 and over but under \$6.....	45	3
\$6 and over but under \$7.....	327	
\$7 and over but under \$8.....	450	
\$8 and over but under \$9.....	1,133	
\$9 and over but under \$10.....	1,173	
\$10 and over but under \$12.....	2,041	
\$12 and over but under \$15.....	1,566	
\$15 and over but under \$20.....	609	
\$20 and over but under \$25.....	196	
\$25 and over.....	57	

The average length of time during which the blast furnace establishments of the western states were in operation in 1890 was 9.44 months each, and the average term of employment for labor was 10 months. In 1880 the blast furnace establishments of this section were in operation an average of 8.65 months each.

MATERIALS USED.—The following comparative statement presents the quantity and cost of the materials consumed by the blast furnaces of the western states, as reported at the censuses of 1880 and 1890. The quantities are stated in tons of 2,000 pounds, except for charcoal, which is given in bushels.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, BLAST FURNACES IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total.....		\$17,158,640		\$30,939,275
Domestic iron ore.....	1,697,233	9,308,784	4,123,773	17,637,721
Foreign iron ore.....	(a)	(a)	11,508	62,552
Fluxing material.....	624,508	621,395	1,048,873	859,154
Anthracite coal.....	32,517	186,908	45	141
Bituminous coal.....	756,642	1,456,243	351,199	456,701
Coke.....	688,108	3,240,489	2,320,046	3,288,103
Charcoal.....	28,295,478	1,977,762	35,841,100	2,438,186
Mill cinder.....	137,366	366,284	336,561	954,521
All other materials.....		784		241,106

a Domestic and foreign iron ore were not reported separately at the census of 1880.

The more careful selection of the material consumed in the manufacture of pig iron in 1890 is well illustrated in the increased yield of metal from ores. In 1880 the furnaces of the western states are reported to have used a total of 1,697,233 tons of iron ore and 137,366 tons of mill cinder, roll scale, and other materials, producing 998,535 tons of products, an average yield of metal to the ton of these materials consumed of 54.43 per cent. In 1890 the consumption of iron ore was 4,135,281 tons, and of mill cinder and roll scale 336,561 tons. The production of pig iron and other products during the year amounted to 2,680,803 tons, showing an average yield of metal per ton of materials above mentioned of 59.95 per cent. These quantities are all in tons of 2,000 pounds.

PRODUCTS.—The following comparative statement shows the quantity and value of pig iron, including castings direct from the furnace according to fuel used, produced by the blast furnaces of the western states, as reported at the censuses of 1880 and 1890. The quantities are in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF PRODUCTS CLASSIFIED ACCORDING TO KIND OF FUEL USED, BLAST FURNACES IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Tons.	Value.	Tons.	Value.
Total		\$24,684,885		\$30,611,312
Mixed anthracite and coke pig iron	124,388	3,114,855		
Coke and bituminous pig iron	628,024	14,681,077	2,289,307	32,797,716
Charcoal pig iron	246,123	6,706,257	391,496	6,800,871
Total tonnage and value	998,535	24,452,189	2,680,803	30,607,587
All other products		232,696		3,725

In 1880 there were produced 1,189 tons of direct furnace castings, and in 1890 273 tons. These have been distributed in this statement in accordance with the kind of fuel used. Included in the quantity of coke and bituminous coal pig iron in 1890 are 22,387 tons of spiegeleisen, produced by furnaces in Colorado and Illinois. No spiegeleisen was made in the western states in 1880.

MACHINERY.—The following comparative statement shows the number and total daily capacity in tons of 2,000 pounds of the furnaces in the western states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, NUMBER AND TOTAL DAILY CAPACITY OF BLAST FURNACE STACKS IN THE WESTERN STATES: 1880 AND 1890.

STATES.	NUMBER OF COMPLETED FURNACE STACKS.		TOTAL DAILY CAPACITY.	
	1880	1890	1880	1890
Total	170	137	6,013	11,595
Colorado		2		220
Illinois	10	15	603	2,772
Indiana	4	2	73	60
Michigan	27	20	844	1,216
Minnesota	1	1	40	150
Missouri	17	8	749	550
Ohio	103	71	3,201	5,713
Oregon	1	1	12	42
Utah	2		18	
Washington		1		30
Wisconsin	14	10	473	842

From the above statement it will be seen that the total number of blast furnaces in the western states has decreased by 42 stacks from 1880 to 1890. Ohio exhibits the largest decrease, 103 stacks being credited to that state in 1880, as compared with 71 at the close of the census year 1890. During the past 10 years the furnaces in Missouri have declined in number from 17 to 8 and the Wisconsin furnaces from 14 to 10. These figures, however, only show the net decrease in the number of furnaces, as many modern charcoal and coke furnaces have been built in these as well as in other states during the past 10 years to take the place of the larger number, but far less efficient furnaces, which have been abandoned. The effect of the building of these new and improved furnaces, the remodeling and equipping of the older stacks with more powerful blowing machinery and better stoves, the more general use of coke as a blast furnace fuel in place of bituminous coal, and the substitution of high grade ore for

the local deposits so largely employed at the date of the Tenth Census, is clearly shown in the increase which has taken place in the total capacity of the furnaces in the 10 years. In 1880 the 179 furnaces reported a daily capacity of 6,013 net tons, while the 137 furnaces in 1890 reported a daily capacity of 11,595 net tons.

ROLLING MILLS AND STEEL WORKS.

Of the 88 active and idle rolling mills and steel works located in the western states in the census year 1880, 74 were classed as iron rolling mills, 11 as bessemer and open-hearth steel works, and 3 as crucible steel works. The 11 bessemer and open-hearth steel establishments comprised 5 bessemer and 6 open-hearth steel making plants. In 1880 the rolling of steel was confined almost entirely to establishments which produced the crude material. With the more extended use of steel during the succeeding years many of the iron rolling mills rapidly adapted their machinery for rolling steel as well as iron.

The 121 active and idle establishments situated in the western states in 1890 consisted of 85 iron and steel rolling mills not connected with steel producing works, and 36 establishments which were equipped for the manufacture of crude steel. These 36 establishments comprised 20 bessemer steel plants (including 1 Clapp-Griffiths and 3 Robert-Bessemer plants), 17 open-hearth steel plants, and 6 crucible steel plants. There were 4 of the establishments equipped for producing both bessemer and open-hearth steel, and 3 for making both open-hearth and crucible steel. With the exception of 7 establishments, all the steel producing works contained trains of rolls.

The following comparative summary presents the leading statistics concerning the rolling mills and steel works in the western states, as reported at the censuses of 1870, 1880, and 1890:

COMPARATIVE SUMMARY, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1870, 1880, AND 1890. (a)

ITEMS.	1870 (b)	1880	1890
Number of establishments.....	49	77	104
Capital.....	\$12,082,622	\$22,732,243	c\$66,949,298
Miscellaneous expenses.....	(d)	(d)	\$2,876,164
Average number of employés (aggregate).....	8,505	22,904	34,550
Total wages.....	\$5,155,002	\$10,610,208	\$20,502,845
Officers, firm members, and clerks:			
Average number.....	(e)	(e)	796
Total wages.....			\$1,198,016
All other employés:			
Average number.....	(e)	(e)	33,754
Total wages.....			\$19,304,329
Cost of materials used.....	\$13,907,436	\$37,270,215	\$60,775,079
Value of products (f).....	\$21,981,736	\$53,623,539	\$89,940,208
Tons of products.....	242,119	941,644	2,382,536

a This statement includes only active establishments for the censuses of 1880 and 1890; such establishments were not reported separately at the census of 1870.

b See remarks in regard to the depreciated currency of 1870.

c Includes hired property valued at \$1,619,000. This item was not reported separately at previous censuses.

d Not reported.

e Not reported separately.

f Includes values for which tonnage was not reported.

During the period from 1880 to 1890 the tonnage of products increased 153.02 per cent, although the percentage of increase in the total value of finished products, owing to the decline in the selling prices of iron and steel, was only 67.73.

MANUFACTURING INDUSTRIES.

The following comparative statement presents the leading statistics of the rolling mills and steel works of the western states, by states, as reported at the censuses of 1880 and 1890.

COMPARATIVE STATEMENT, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES, BY STATES:
1880 AND 1890. (a)

STATES.	Year.	Number of establishments.	Capital.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.		Cost of materials used.	Value of products.
				Employés.	Wages.		
The Western States.....	1880	77	\$22,732,243	22,994	\$10,610,298	\$37,270,215	\$53,623,539
	1890	104	666,949,298	c34,550	c20,502,345	60,775,079	89,940,208
California.....	1880	1	1,000,000	319	177,722	535,500	780,000
	1890	4	4,656,611	1,152	749,849	1,938,333	3,097,155
Colorado.....	1880	1	100,000	125	7,000	131,700	225,000
	d1890						
Illinois.....	1880	13	4,845,020	4,755	2,323,664	13,214,536	18,153,430
	1890	19	24,834,645	7,433	4,571,040	21,951,521	28,872,741
Indiana.....	1880	9	1,828,000	1,740	810,081	2,957,467	4,000,808
	1890	13	3,888,254	2,644	1,215,792	2,889,615	4,505,536
Kansas.....	1880	2	450,000	630	166,500	734,245	1,004,100
	1890						
Michigan.....	1880	2	671,060	925	360,727	1,188,196	1,440,551
	1890	4	1,437,540	777	479,783	1,200,758	1,817,505
Missouri.....	1880	5	3,020,000	1,789	447,464	1,412,934	2,185,513
	1890	4	1,612,443	660	421,935	831,566	1,520,569
Nebraska.....	1880	1	100,000	100	50,000	114,500	82,000
	1890						
Ohio.....	1880	41	9,805,020	11,127	5,539,913	14,848,295	21,880,167
	1890	55	25,892,390	19,942	12,069,542	28,854,630	45,409,560
Wisconsin.....	1880	1	700,000	1,300	647,577	1,729,274	3,284,553
	d1890						
Wyoming.....	1880	1	212,603	184	70,650	403,568	491,345
	d1890						
All other states.....	d1890	5	4,627,415	1,942	994,398	3,108,650	4,690,002

a This statement includes only active establishments.

b Includes hired property valued at \$1,619,000. This item was not reported separately at the census of 1880.

c Includes 796 officers, firm members, and clerks, and their wages amounting to \$1,198,016, distributed as follows: California 38, \$56,549; Illinois 168, \$246,193; Indiana 63, \$95,013; Michigan 25, \$44,444; Missouri 13, \$28,039; Ohio 453, \$663,638; all other states 31, \$64,140. These classes were not reported separately at the census of 1880.

d Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 1; Iowa, 1; Minnesota, 1; Wisconsin, 1; Wyoming, 1.

Very few changes have taken place in the relative rank of the different states since 1880. Ohio continues to occupy the leading position, with Illinois second. Next to these two states California has shown the greatest development during the past decade. The prominence of Illinois as an iron and steel producing state is due to the establishment of an extensive bessemer steel industry. In 1890, 82.55 per cent of the total tonnage of iron and steel produced in this state was sold in the form of bessemer steel, principally rails. Ohio is a large producer of sheets, plates, nails, and other of the more highly finished forms of iron and steel, so that the total cost of the labor in that state bears a greater ratio to the total value of the products than is the case with most of the other states. In 1880 this state was a large producer of bessemer steel rails, but has since practically abandoned this branch of manufacture. The decline in the value of products in Missouri during the past decade is caused in part by the lower prices prevailing in 1890 than in 1880.

CAPITAL.—The following statement shows the different items of capital in active and idle establishments and those in course of construction, rolling mills and steel works in the western states, as reported at the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF ESTABLISHMENTS.	Year.	Number of establishments.	CAPITAL.		
			Total.	Buildings, machinery, tools, and implements.	Land, stock, and finished products on hand, cash and bills receivable.
Total	1880	91	\$24,441,598	\$15,015,220	\$9,426,378
	1890	125	\$71,389,691	\$5,972,610	\$5,417,072
Establishments in operation.....	1880	77	22,732,243	14,374,171	8,358,072
	1890	104	66,949,298	32,668,802	34,280,496
Idle establishments.....	1880	11	1,310,355	641,049	609,306
	1890	17	3,985,093	2,914,817	1,070,270
Establishments in course of construction.....	1880	3	399,000	(b)	399,000
	1890	4	455,300	389,000	66,300

a Includes hired property valued at \$1,619,000. This item was not reported separately at the census of 1880.
 b Not reported separately.

In the 10 years from 1880 to 1890 the figures indicate that the value of buildings and machinery increased 139.57 per cent, and the investment in land and cash capital 275.72 per cent.

EMPLOYÉS AND WAGES.—The following statement presents the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés at the rolling mills and steel works of the western states, as reported at the census of 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES, BY CLASSES, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.							
	Aggregates.		Males above 16 years.		Females above 15 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.
All classes.....	34,560	\$20,502,345	34,007	\$20,377,847	26	\$10,706	517	\$113,702
Officers or firm members.....	237	667,463	237	667,463				
Clerks.....	559	530,553	547	523,005	12	6,048		
Skilled.....	19,209	13,859,075	19,222	13,830,385	2	1,040	75	22,560
Unskilled.....	14,465	5,444,354	14,001	5,350,394	12	2,808	442	91,152

The following statement shows the average number of employés at the different weekly rates of wages:

AVERAGE NUMBER OF SKILLED AND UNSKILLED EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1890.

[NOT INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.		
	Males above 16 years.	Females above 15 years.	Children.
Total	33,223	14	517
Under \$5.....	350	12	215
\$5 and over but under \$6.....	509		66
\$6 and over but under \$7.....	862		226
\$7 and over but under \$8.....	3,075		10
\$8 and over but under \$9.....	4,027		
\$9 and over but under \$10.....	4,061		
\$10 and over but under \$12.....	4,533	2	
\$12 and over but under \$15.....	5,347		
\$15 and over but under \$20.....	3,852		
\$20 and over but under \$25.....	3,496		
\$25 and over	2,461		

The rolling mills and steel works of the western states were in operation an average of 9.40 months each during the census year 1890. The average term of employment for men was 10.11 months and for children 9.55 months. The establishments reporting for 1880 employed 22,994 hands, and were in operation an average of 9.09 months each.

MATERIALS USED.—The following comparative statement presents the total quantity and cost of the various raw materials consumed by the rolling mills and steel works of the western states, as reported at the censuses of 1880 and 1890. With the exception of charcoal, which is given in bushels, and oil for fuel, which is given in barrels, all the quantities are reported in tons of 2,000 pounds.

COMPARATIVE STATEMENT, QUANTITY AND COST OF MATERIALS USED, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF MATERIALS.	1880		1890	
	Quantity.	Cost.	Quantity.	Cost.
Total		\$37,270,215		\$60,775,070
Iron ore.....	75,484	623,441	126,085	711,872
Spiegeleisen and ferro-manganese	29,979	1,113,629	64,301	2,085,170
Pig iron.....	677,853	16,360,300	1,709,643	27,523,492
Old iron rails.....	324,111	9,824,691	244,625	5,565,210
Other old or scrap iron.....	122,064	3,161,890	365,532	6,260,680
Old steel rails and steel rail ends	41,026	1,255,473	28,760	590,642
Other old or scrap steel	24,649	712,870	163,100	2,598,474
Hammered iron ore blooms.....	6,383	350,635	1,051	32,490
Hammered pig or scrap blooms	831	21,802	2,042	57,038
Purchased muck bar.....	4,790	203,800	13,500	340,094
Purchased bessemer steel.....	700	56,000	251,799	7,123,760
Purchased open-hearth steel.....			2,580	99,617
Swedish billets and bars.....	80	6,400	114	9,420
Anthracite coal.....	1,497	9,794		
Bituminous coal.....	1,367,170	3,078,627	2,232,207	3,300,659
Coke.....	47,417	263,854	150,648	580,593
Charcoal.....	361,900	33,295	211,806	18,465
Oil for fuel.....			1,666,165	942,889
Natural gas for fuel.....				151,403
All other materials.....		183,825		2,783,221

A number of rolling mills and steel works in the western states used crude oil or natural gas for fuel during the census year 1890. The establishments using natural gas were situated in Ohio and Indiana, those in the eastern part of Ohio receiving the gas from wells in Pennsylvania, while those in the western part of the state and in Indiana were supplied from local wells. With the development of the Indiana gas field, a number of iron and steel establishments have been built in the vicinity of the wells, the offer of free gas being the inducement for the erection of these establishments. The amount reported in the above tables as the cost of natural gas used for fuel does not, therefore, cover the entire consumption of gas by rolling mills and steel works in the western states.

PRODUCTS.—The following comparative statement shows the tonnage of iron and steel products for rolling mills and steel works in the western states, as reported at the census of 1880 and 1890:

COMPARATIVE STATEMENT, QUANTITY OF PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880	1890
Total	941,644	2,382,536
Iron	616,661	967,655
Bessemer steel.....	302,605	1,344,511
Open-hearth steel.....	21,888	67,215
Crucible steel.....	490	3,155

The following comparative statement presents the values of the different iron and steel products and the percentage that each class bears of the total, for the censuses of 1880 and 1890:

COMPARATIVE STATEMENT, VALUE OF PRODUCTS, WITH PERCENTAGE EACH CLASS IS OF TOTAL, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	VALUE.		PERCENTAGE.	
	1880	1890	1880	1890
Total	\$53,023,539	\$89,940,208	100.00	100.00
Manufactures of iron.....	33,796,702	38,083,070	63.03	43.01
Manufactures of steel.....	19,745,080	50,576,455	36.82	56.23
Miscellaneous products.....	81,747	680,683	0.15	0.76

The increase in the tonnage of products during the past 10 years was 1,440,892 tons, or 153.02 per cent. This growth has been principally in steel, iron products having increased only 56.92 per cent, while the steel products increased 335.37 per cent. In 1880 iron constituted 65.49 per cent of the total production and steel 34.51 per cent, while in 1890 the output of steel products was 59.39 per cent and the iron products 40.61 per cent of the total production of that year. The small quantity of Clapp-Griffiths and Robert-Bessemer steel made in 1890 is included in the output of bessemer steel.

The following comparative statement presents the classified tonnage and value of the products of the rolling mills and steel works of the western states, so far as they can be separately enumerated, as reported at the censuses of 1880 and 1890. Quantities are given in tons of 2,000 pounds, except for nails, which are stated in kegs of 100 pounds.

COMPARATIVE STATEMENT, QUANTITY AND VALUE OF CLASSIFIED PRODUCTS, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1880 AND 1890.

CLASS OF PRODUCTS.	1880		1890	
	Quantity.	Value.	Quantity.	Value.
Total		\$53,023,539		\$89,940,208
Iron:				
Rails	216,213	10,170,168	8,476	358,553
Bar and rod	232,079	12,585,563	619,652	22,580,807
Hoop	23,140	1,397,375	27,778	1,134,750
Skelp.....	1,000	50,000	28,377	1,088,648
Structural shapes.....	485	35,100	3,070	192,500
Sheets	22,123	1,657,973	50,174	3,014,723
Plates, except nail plates.....	20,884	1,423,528	20,706	942,300
Hammered car axles.....	13,078	934,487	22,086	1,020,445
Muck bar produced for sale.....	5,054	224,890	42,412	1,108,073
Cut nails	1,277,240	4,033,978	318,360	837,938
All other finished products.....	17,834	1,283,700	128,106	6,343,643
Steel, bessemer:				
Rails	272,766	15,642,130	639,524	17,930,826
Bar and rod.....	23,339	1,569,635	52,108	1,629,395
Hoop			2,780	122,003
Structural shapes.....			4,937	217,228
Sheets			21,209	1,324,347
Plates, except nail plates.....			15,895	820,178
Hammered car axles.....			8,836	403,282
Cut nails			1,784,664	3,790,461
Wire rods			102,102	4,003,921
Wire			87,521	5,044,592
All other finished products	6,500	650,000	320,297	10,585,999
Steel, open-hearth:				
Bar	11,647	810,602	20,549	986,360
Structural shapes.....	80	8,800	2,286	136,690
Sheets	650	64,955	2,260	202,140
Plates, except nail plates	5,176	662,840	19,146	1,350,397
Hammered car axles.....			1,886	178,534
Cut nails			9,940	42,630
All other finished products.....	4,335	288,468	20,021	1,496,562
Steel, crucible:				
Finished products.....	490	47,600	3,155	310,130
All other products		81,747		680,683

The quantities and value of bar and rod iron and steel include only the bars and rods sold in that form. Where bars and rods are converted into bolts, nuts, and other products by the same establishment the quantities and values are included under the heads of "All other finished" iron, bessemer, or open-hearth steel products.

The larger part of the wire rods produced in 1890 were finished into wire and other products at the establishments where they were rolled. As the rods so consumed are an intermediate product the quantities and value of the articles made from them are alone included in the above statement, under the head of "All other finished products." The same is true of the bessemer steel wire reported, this item including only the wire sold in this form. The quantity and value of the wire nails produced by the rolling mills and steel works of the western states in 1890 are included under the head of "All other" finished bessemer steel products. A large number of the wire nail works in this and other sections of the country roll neither iron nor steel, but purchase the rods or wire consumed by them, and their products are therefore not included in the presentation of the operations of rolling mills and steel works.

During the census year 1880 the rolling mills and steel works of the western states produced 344,734 net tons of bessemer steel ingots and direct castings, 25,637 net tons of open-hearth steel ingots, and 490 tons of crude steel, while in 1890 the works of this section produced 1,273,425 tons of bessemer steel ingots (including 1,802 tons of Clapp-Griffiths steel and 4,330 tons of Robert-Bessemer steel), 73,732 tons of open-hearth steel, and 2,533 tons of crucible steel.

Notwithstanding that the total tonnage of products has increased in the 10 years from 941,644 net tons in 1880 to 2,382,536 net tons in 1890, or 153.02 per cent, the increase in the total value of products has been from \$53,623,539 to \$89,940,208, or only 67.73 per cent. The expansion of the manufacture of bessemer steel has been an important factor in the largely increased tonnage since 1880, and also in the decreased prices of the various iron and steel products. The average selling price of all products has declined from \$56.86 a net ton in 1880 to \$37.46 in 1890.

Crude steel was produced and rolled in 3 states only in 1880. In 1890 California, Colorado, Illinois, Indiana, Michigan, Missouri, and Ohio contained steel producing works, and in addition Wisconsin rolled products from steel obtained from Illinois.

MACHINERY.—The following comparative statement presents the equipment and capacity of the rolling mills and steel works of the western states, as reported at the censuses of 1880 and 1890, with the increase during the decade:

COMPARATIVE STATEMENT, EQUIPMENT AND CAPACITY, ROLLING MILLS AND STEEL WORKS IN THE WESTERN STATES: 1880 AND 1890. (a)

MACHINERY.	1880	1890	Increase.
Single puddling furnaces	958	1,142	184
Heating furnaces	577	674	97
Bessemer converters.....	10	637	27
Open-hearth furnaces.....	12	38	26
Crucible pots which can be used at each heat.....	71	116	45
Hammers	88	139	51
Cut nail machines.....	771	2,400	1,638
Trains of rolls	300	406	106
Aggregate daily capacity in finished products (net tons).....	6,550	14,153	7,603

a Includes machinery in both active and idle establishments.

b Includes 2 Clapp-Griffiths and 4 Robert-Bessemer converters.

FORGES AND BLOOMERIES.

In 1880 the western states contained 4 forges and bloomeries for the production of charcoal blooms from iron ore or pig iron. These establishments reported a capital of \$253,600, 165 employes to whom \$60,000 in wages were paid, consuming materials costing \$151,500, and produced blooms valued at \$200,000. Since 1880 all of these works have been abandoned for iron making purposes.

GENERAL TABLES.

The following statements present in detail the statistics for the iron and steel industry, as reported at the census of 1890, by totals for the United States and for each state having 3 or more establishments. States having less than 3 establishments are grouped in order to avoid disclosing the operations of individual establishments. In connection with each table there is an exhibit showing by states the capital invested in idle establishments, together with the equipment and machinery of the same. Only such idle establishments are included as will probably be put into operation at some future period. Table 1 presents the statistics relating to blast furnaces; Table 2, those relating to rolling mills and steel works, and Table 3 the statistics of forges and bloomeries.

MANUFACTURING INDUSTRIES.

TABLE 1.—DETAILED STATEMENT,

STATES.	Number of establishments.	CAPITAL.						AVERAGE NUMBER OF EMPLOYEES AND TOTAL WAGES.	
		Value of fixed property.	Direct investment.				Miscellaneous expenses. (b)	Aggregates.	
			Total.	Land.	Buildings, machinery, tools, and implements.	Live assets (a)		Average number.	Total wages.
1 The United States.	304	\$5,061,058	\$129,547,465	\$9,799,199	\$67,292,490	\$52,455,796	\$6,342,675	34,483	\$16,226,145
2 Alabama.....	28	108,000	15,670,780	1,386,281	11,014,644	3,269,861	932,227	4,139	1,783,700
3 Connecticut.....	5		940,092	108,136	374,794	457,162	39,496	129	66,881
4 Georgia.....	4		748,845	52,000	550,000	146,845	52,770	269	64,676
5 Illinois.....	5	425,000	9,430,274	425,000	3,786,970	5,218,304	215,232	1,431	919,145
6 Kentucky.....	4		826,199	40,900	442,000	343,599	49,655	278	105,520
7 Maryland.....	5		3,108,222	260,000	2,140,202	708,020	23,830	639	151,342
8 Michigan.....	15		5,250,061	461,692	1,412,429	3,384,880	271,067	732	416,334
9 Missouri.....	5	275,000	1,608,470	162,000	554,471	901,999	73,138	654	298,966
10 New Jersey.....	8		3,131,366	522,000	1,536,141	1,073,225	120,384	655	262,538
11 New York.....	10	300,000	6,143,208	327,194	3,246,955	2,566,050	349,788	1,462	672,288
12 Ohio.....	46	1,071,500	10,678,997	946,150	4,480,150	5,252,717	740,283	4,224	2,057,127
13 Pennsylvania.....	116	1,910,000	37,411,570	4,344,824	20,893,560	23,173,186	2,084,671	15,967	7,645,715
14 Tennessee.....	11		3,685,866	129,500	2,331,975	1,224,391	185,574	1,076	525,992
15 Virginia.....	15	675,000	3,481,269	272,768	1,943,446	1,264,992	273,278	1,328	558,812
16 West Virginia.....	4		1,440,082	81,000	717,830	647,252	50,143	424	198,933
17 Wisconsin.....	8	296,558	3,240,782	154,854	1,376,952	1,717,976	175,405	611	307,041
18 All other states (c).....	0		2,727,579	135,200	1,480,901	1,105,368	87,714	465	191,635

STATES.	WEEKLY RATES OF WAGES PAID, AND AVERAGE NUMBER OF EMPLOYEES AT EACH RATE, EXCLUDING OFFICERS, FIRM MEMBERS AND CLERKS.																
	Aggregates.		Males above 16 years.													Children.	
	Average number.	Total wages.	Total number.	Under \$5.	\$5 and over but under \$6.	\$6 and over but under \$7.	\$7 and over but under \$8.	\$8 and over but under \$9.	\$9 and over but under \$10.	\$10 and over but under \$12.	\$12 and over but under \$15.	\$15 and over but under \$20.	\$20 and over but under \$25.	\$25 and over.	Total number.	Under \$5.	\$5 and over but under \$6.
1 The United States.	33,415	\$14,614,458	33,341	235	269	2,103	4,867	5,613	6,551	6,570	4,722	1,739	541	245	74	46	28
2 Alabama.....	3,089	1,521,304	3,962	11	50	169	707	1,235	407	561	468	180	62	46	27	18	9
3 Connecticut.....	117	50,634	117					31	18	39	6	1		6			
4 Georgia.....	254	45,501	254			2	145	49	20	17	0	0	2	1			
5 Illinois.....	1,420	896,030	1,420					96	4	456	479	256	110	19			
6 Kentucky.....	262	88,482	262	1	2		25	84	82	21	29	13	4	1			
7 Maryland.....	630	143,812	630	2	12	7	353	96	67	75	12	4	1	1			
8 Michigan.....	675	321,022	675				25	190	155	144	122	14	10	15			
9 Missouri.....	627	261,203	627	14	7	55	81	74	179	173	62	29	4	2			
10 New Jersey.....	640	240,152	635	4	9	52	162	82	88	126	71	27	9	5	2		
11 New York.....	1,410	581,107	1,408		2	46	163	225	247	360	273	55	24	13	2		
12 Ohio.....	4,057	1,856,237	4,054		34	242	348	715	657	1,068	749	187	42	12	3		
13 Pennsylvania.....	15,612	7,084,308	15,586	111	61	1,208	1,813	2,304	3,838	3,181	2,070	771	201	88	26	13	13
14 Tennessee.....	1,012	438,376	1,012	3		41	447	210	120	68	58	20	21	15			
15 Virginia.....	1,268	478,105	1,257	19	50	218	471	173	168	51	60	24	14	9	11	11	
16 West Virginia.....	411	182,175	411				24	72	78	84	99	46	7	1			
17 Wisconsin.....	595	276,887	595			24	48	50	172	137	85	51	23	5			
18 All other states.....	436	149,123	436	70	36	0	14	31	33	88	70	72	7	6			

a Includes raw materials, stock in process and finished products on hand, and cash, bills and accounts receivable, and sundry items of capital not elsewhere reported.
 b Includes rent, taxes, insurance, interest paid on cash used in the business, and all sundries not elsewhere reported.

IRON AND STEEL MANUFACTURE.

BLAST FURNACES, BY STATES: 1890.

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES—continued.												
Officers or firm members actively engaged in the industry or in supervision.		Clerks.				Operatives and skilled.		Unskilled.				
		Males above 16 years.		Females above 15 years.		Males above 16 years.		Males above 16 years.		Children.		
		Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	
500	\$1,174,212	555	\$434,465	7	\$3,010	9,094	\$5,261,191	24,247	\$9,339,467	74	\$13,800	1
08	183,072	82	78,724	.....	.....	701	443,386	3,261	1,074,528	27	3,390	2
7	12,000	5	4,247	.....	.....	39	19,633	78	31,001	.....	.....	3
10	16,600	5	2,575	.....	.....	44	15,125	210	30,376	.....	.....	4
4	17,500	7	5,615	.....	.....	525	429,628	805	469,402	.....	.....	5
11	14,031	5	3,007	.....	.....	31	17,096	231	71,386	.....	.....	6
3	4,300	6	3,236	.....	.....	113	34,695	517	109,117	.....	.....	7
37	39,470	19	14,542	1	300	267	157,161	408	163,861	.....	.....	8
12	28,523	15	9,240	.....	.....	127	71,358	500	189,845	.....	.....	9
7	17,450	8	4,936	.....	.....	257	127,018	378	111,891	5	1,243	10
27	71,447	25	19,734	.....	.....	514	263,215	804	317,515	2	377	11
76	135,610	89	64,380	2	900	818	454,090	3,236	1,401,367	3	780	12
147	593,773	206	106,544	2	1,090	4,769	2,716,221	10,817	4,361,977	26	6,110	13
28	66,640	35	20,618	1	360	154	106,944	858	331,432	.....	.....	14
32	59,950	28	20,257	.....	.....	215	125,154	1,042	351,051	11	1,000	15
8	13,738	5	3,020	.....	.....	162	83,307	249	98,868	.....	.....	16
9	23,500	6	6,294	1	360	207	130,369	388	146,518	.....	.....	17
20	35,008	9	7,504	.....	.....	151	60,791	285	82,332	.....	.....	18

MATERIALS USED.													
Total cost.	Domestic iron ore.		Foreign iron ore.		Fluxing material.		Anthracite coal.		Bituminous coal.		Coke.		
	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	
\$110,098,615	15,734,400	\$57,607,945	1,090,712	\$5,897,585	5,024,290	\$4,196,878	2,012,477	\$5,165,761	551,007	\$759,522	9,237,935	\$27,435,780	1
6,493,884	2,043,840	2,198,335	65	406	546,655	343,752	.....	.....	29,968	50,475	1,172,471	3,033,258	2
412,743	47,635	182,261	.....	.....	7,300	4,740	.....	.....	.....	.....	.....	.....	3
237,836	65,563	94,089	.....	.....	11,895	5,632	.....	.....	4,000	8,000	41,162	88,987	4
8,088,153	1,071,119	4,802,854	4,323	97,372	218,768	196,562	.....	.....	3,500	6,303	645,287	2,760,009	5
461,608	71,016	147,045	.....	.....	37,308	28,793	.....	.....	91,313	125,738	13,617	37,444	6
1,316,539	46,271	115,005	130,704	663,016	58,311	54,523	.....	.....	1,319	3,404	95,821	343,024	7
2,935,293	392,522	1,451,212	.....	.....	19,096	23,235	.....	.....	56	200	.....	.....	8
1,247,688	178,203	535,365	.....	.....	54,047	33,502	45	141	3,308	4,988	97,992	486,807	9
1,079,937	227,292	838,604	15,288	86,014	94,164	60,573	173,007	486,155	.....	.....	37,856	155,131	10
4,212,888	609,010	1,982,252	12,598	50,811	201,741	178,079	185,348	602,560	50	170	241,824	1,114,536	11
15,606,665	2,051,833	9,385,714	.....	.....	674,281	521,914	.....	.....	303,772	307,759	1,440,483	4,435,255	12
57,222,481	6,861,218	30,837,051	914,549	5,034,786	3,114,338	2,321,804	1,654,017	3,986,905	50,935	79,235	4,409,294	11,038,860	13
2,450,882	676,004	1,110,533	.....	.....	133,477	81,661	.....	.....	8,043	11,025	388,588	622,327	14
2,820,167	698,500	1,325,593	.....	.....	308,007	190,328	.....	.....	12,104	23,208	368,881	1,104,415	15
1,503,847	207,567	1,025,257	.....	.....	54,053	52,563	.....	.....	1,476	1,476	147,008	403,506	16
2,378,006	354,404	1,226,444	.....	.....	54,317	46,011	.....	.....	1,451	3,597	116,024	525,385	17
940,058	132,388	347,431	7,180	25,180	36,532	54,236	.....	.....	30,022	73,944	21,657	86,836	18

* Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 1; Indiana, 2; Maine, 1; Massachusetts, 1; North Carolina, 1; Oregon, 1; Texas, 1; Washington, 1.

MANUFACTURING INDUSTRIES.

TABLE I.—DETAILED STATEMENT, BLAST

STATES.	MATERIALS USED—continued.						PRODUCTS.						
	Charcoal.		Mill cinder and scrap.		Rent of power and heat.	All other materials.	Aggregate value.	Pig iron.					
	Bushels.	Cost.	Tons.	Cost.	Cost.	Cost.		Total. (a)		Cold blast charcoal.		Hot or warm blast charcoal.	
								Tons.	Value.	Tons.	Value.	Tons.	Value.
1 The United States	67,672,156	\$4,523,320	1,283,071	\$3,086,808	\$8,900	\$1,416,116	\$145,643,153	9,906,007	\$145,612,983	36,846	\$714,591	627,865	\$11,243,119
2 Alabama	12,580,690	809,028	16,573	15,260		43,370	10,315,691	915,699	10,315,691	20,426	340,378	88,563	1,584,709
3 Connecticut	2,263,386	225,288	45	454			574,438	22,255	574,438			22,255	574,438
4 Georgia	606,924	39,540				688	939,422	28,111	339,422			5,030	96,598
5 Illinois			42,826	194,508		91,455	10,138,810	746,677	10,138,810				
6 Kentucky	921,264	40,919	30,467	81,660			665,763	44,278	665,763			6,060	109,836
7 Maryland	1,535,460	114,053				22,314	1,632,004	96,636	1,632,004			14,450	333,603
8 Michigan	19,851,038	1,441,489	22	59	3,000	10,038	3,982,278	227,827	3,982,278			227,827	3,982,278
9 Missouri	3,088,122	175,343				11,042	1,716,983	101,036	1,716,983			33,742	525,481
10 New Jersey			38,362	44,368		9,092	2,228,724	145,040	2,228,724				
11 New York	2,259,564	146,069	16,552	27,335		21,076	5,182,606	344,339	5,182,606			15,949	332,063
12 Ohio	3,326,657	172,899	271,198	721,768		91,356	19,890,298	1,347,519	19,890,298	4,149	91,100	18,376	353,941
13 Pennsylvania	2,470,225	171,225	811,939	1,907,690	5,900	938,125	75,239,203	4,807,504	75,212,758	4,355	113,283	13,023	288,165
14 Tennessee	5,152,180	259,028	15,331	24,394		41,914	3,306,464	295,880	3,306,464			51,349	603,916
15 Virginia	1,082,817	72,000	6,700	10,572		93,991	3,925,481	312,367	3,925,481	7,916	169,830		
16 West Virginia			10,541	20,545		500	2,009,505	129,369	2,009,505				
17 Wisconsin	7,256,017	524,728	13,719	24,101		27,740	3,114,892	215,143	3,114,892			94,204	1,494,775
18 All other states	5,217,872	331,051	8,796	14,025		7,355	1,411,121	67,014	1,408,811			37,028	903,296

a Includes 6,066 tons of castings made direct from furnace, also 133,704 tons of spiegel Eisen, valued at \$3,525,042, distributed as follows: Colorado, 752 tons, \$18,168; Illinois, 21,635 tons, \$921,956; New Jersey, 11,555 tons, \$291,481; Pennsylvania, 99,762 tons, \$2,593,437.

CAPITAL, EQUIPMENT, AND DAILY CAPACITY

STATES.	Number of establishments.	CAPITAL.			
		Total.	Land.	Buildings, machinery, tools, and implements.	Live assets. (a)
1 The United States	73	\$6,453,865	\$1,164,839	\$4,695,150	\$598,876
2 Alabama	1	120,000	20,000	100,000	
3 Connecticut	2	128,300	10,300	68,000	50,000
4 Georgia	1	43,000	10,000	30,000	3,000
5 Illinois	1	70,000	15,000	55,000	
6 Kentucky	2	240,000	24,000	166,000	50,000
7 Maryland	2	325,000	35,000	215,000	75,000
8 Massachusetts	1	68,000	3,000	60,000	
9 Minnesota	1	370,000	100,000	250,000	20,000
10 Michigan	6	373,700	38,200	335,500	
11 Missouri	1	15,300	800	14,500	
12 New Jersey	5	453,500	41,000	412,500	
13 New York	8	1,005,755	209,654	619,850	176,251
14 Ohio	10	1,687,885	443,000	1,230,885	14,500
15 Pennsylvania	18	975,625	136,885	698,615	140,125
16 Tennessee	2	31,500	4,500	27,000	
17 Texas	2	270,000	20,000	200,000	50,000
18 Virginia	8	249,800	47,000	182,800	20,000
19 West Virginia	1	30,000	5,000	25,000	
20 Wisconsin	1	6,500	1,500	5,000	

a Includes raw material, stock in process and finished products on hand, and cash, bills and accounts receivable, and sundry items of capital not elsewhere reported.

IRON AND STEEL MANUFACTURE.

FURNACES, BY STATES: 1890—Continued.

PRODUCTS—continued.							EQUIPMENT AND CAPACITY.									
Pig iron—Continued.						Value of all other products.	Completed blast furnace stacks.		Power.							
Anthracite.		Mixed anthracite coal and coke.		Coke and bituminous coal.					Steam.			Water.				
Tons.	Value.	Tons.	Value.	Tons.	Value.		Number.	Total daily capacity in tons of pig iron.	Number of boilers.	Number of engines.	Horse power.	Number of water wheels.	Horse power.	Number of turbine wheels.	Horse power.	
330,886	\$4,772,021	1,893,241	\$28,195,996	7,017,769	\$100,687,256	\$30,170	473	39,411	3,581	966	246,997	19	778	17	1,153	1
				800,020	8,390,604		47	4,162	466	105	40,290					2
				23,072	242,824		7	103	2	1	60	4	155	2	110	3
				746,077	10,136,960	1,350	4	245	32	7	2,110					4
				38,218	555,907		14	2,722	152	20	8,778					5
							4	173	26	12	2,380					6
				82,186	1,298,401		10	628	39	20	2,810					7
				67,288	1,191,502		10	924	80	56	3,880			3	200	8
20,452	542,039	116,588	1,086,685				7	530	47	23	3,123					9
							12	686	97	17	6,710					10
35,922	531,604	175,830	2,520,901				26	1,089	158	34	13,085	2	160	2	150	11
				1,324,904	19,355,162	65	59	5,998	457	147	26,526					12
205,512	3,698,288	1,601,814	23,979,410	2,982,800	47,133,612	26,445	202	18,511	1,632	404	113,104	6	375	2	78	13
				214,540	2,702,548		17	1,094	128	31	6,306					14
				804,451	3,755,651		23	1,124	131	31	7,090	3	25	8	615	15
				120,369	2,009,505		4	495	34	11	2,810					16
				120,939	1,620,117		9	812	59	19	2,855					17
				29,986	505,515	2,310	9	415	41	19	4,180	4	63			18

AND POWER OF IDLE BLAST FURNACES: 1890.

COMPLETED BLAST FURNACE STACKS.		STEAM POWER.			WATER POWER.				
Number.	Total daily capacity in tons of pig iron.	Number of boilers.	Number of engines.	Horse power.	Water wheels.	Horse power.	Turbine wheels.	Horse power.	
80	3,025	333	120	19,169	9	505	2	90	1
1	75	8	1	260					2
2	20				2	75			3
1	14	2	1	100					4
1	50	8	3	350					5
2	150	12	9	900					6
4	85	10	5	800			1	50	7
4	55	2	1	40					8
1	150	8	3	1,050					9
7	292	21	7	650					10
1	20	3	1	125					11
6	240	22	8	2,150	2	250			12
11	420	21	9	1,930					13
12	615	71	29	5,500					14
19	582	119	24	4,219	2	90	1	40	15
2	15	3	1	125	1	30			16
2	100	6	7	280					17
8	76	13	7	365	2	60			18
1	30	2	2	125					19
1	30	2	2	200					20

MANUFACTURING INDUSTRIES.

TABLE 2.—DETAILED STATEMENT, ROLLING

STATES.	Num ber of estab- lish- ments.	CAPITAL.							Miscellane- ous ex- penses. (b)	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.			
		Value of hired property.	Direct investment.					Aggregates.		Officers or firm members actively engaged in the industry or in supervision.			
			Total.	Land.	Buildings.	Machinery, tools, and imple- ments.	Live assets. (c)	Average number.				Total wages.	
										Number.	Wages.		
The United States.	395	\$3,212,000	\$275,347,831	\$24,354,079	\$30,496,512	\$95,700,648	\$124,796,592	\$11,817,593	140,537	\$79,293,673	890	\$2,630,536	
Alabama	7	2,208,797	330,473	858,503	1,024,754	495,067	157,463	1,739	738,308	21	39,843		
California	4	4,656,611	432,000	375,000	1,764,000	2,085,611	208,088	1,152	749,849	12	34,509		
Connecticut	8	1,249,429	239,397	136,070	367,735	506,227	56,627	561	351,308	17	28,850		
Delaware	7	2,558,865	283,500	263,000	706,136	1,306,229	43,291	1,096	843,219	25	61,400		
Illinois	19	271,000	24,563,645	1,861,254	2,995,339	8,661,568	11,045,484	577,876	7,433	4,571,046	38	125,515	
Indiana	13	950,000	2,938,254	196,432	270,615	1,297,888	1,173,319	169,435	2,644	1,215,792	28	62,173	
Kentucky	5	1,484,456	180,000	140,000	605,000	559,456	65,990	1,295	628,658	13	31,000		
Maryland	4	500,000	571,352	110,000	75,000	269,852	116,500	20,747	573	211,000	6	10,250	
Massachusetts	14	115,000	8,229,394	586,665	788,726	2,120,099	4,733,904	169,937	5,290	2,629,699	20	55,800	
Michigan	4	1,437,540	1,437,540	103,650	159,465	543,582	630,843	98,096	777	479,783	10	30,064	
Missouri	4	1,612,443	523,793	157,269	510,181	421,200	102,786	600	421,935	7	15,300		
New Jersey	19	150,000	8,375,996	817,417	864,252	2,673,909	4,020,328	504,967	4,627	2,514,404	43	131,650	
New York	19	9,321,793	833,000	1,143,436	2,313,994	5,031,363	488,805	5,418	2,872,316	32	102,000		
Ohio	55	398,000	25,494,390	2,005,678	2,877,717	9,278,704	11,332,291	1,562,785	19,942	12,069,542	131	351,002	
Pennsylvania	186	828,000	165,863,891	14,740,191	17,942,979	58,194,521	74,986,110	7,072,834	78,347	44,921,173	405	1,336,966	
Tennessee	4	927,549	143,000	143,000	405,555	295,994	91,295	481	249,529	9	21,000		
Virginia	6	2,174,787	410,750	281,000	646,852	836,185	100,471	1,782	703,048	17	49,595		
West Virginia	8	5,012,842	285,000	820,091	1,629,683	2,278,008	88,289	3,409	1,639,276	34	90,563		
All other states (c)	9	6,605,887	271,879	705,050	2,686,545	3,002,413	249,991	2,807	1,481,779	22	83,616		

WEEKLY RATES OF WAGES PAID, AND AVERAGE NUMBER OF EMPLOYÉS AT EACH RATE, EXCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.

STATES.	Aggregates.		Males above 16 years.											
	Average number.	Total wages.	Total number.	Under \$5.	\$5 and over but under \$6.	\$6 and over but under \$7.	\$7 and over but under \$8.	\$8 and over but under \$9.	\$9 and over but under \$10.	\$10 and over but under \$12.	\$12 and over but under \$15.	\$15 and over but under \$20.	\$20 and over but under \$25.	\$25 and over.
The United States.	137,295	\$74,460,433	135,134	1,402	3,144	8,000	15,383	19,370	17,340	17,827	19,634	16,173	9,961	6,950
Alabama	1,696	681,000	1,076	2	25	97	294	155	158	227	220	286	162	50
California	1,114	693,300	1,089	10	47	18	9	21	177	367	108	142	124	66
Connecticut	532	311,771	530	2	1	6	22	90	131	87	83	40	35	21
Delaware	1,037	765,158	1,562	30	103	388	255	114	178	268	154	47	25	25
Illinois	7,265	4,324,853	7,203	7	33	88	379	1,332	953	1,004	890	891	1,042	584
Indiana	2,581	1,120,770	2,517	51	35	40	300	218	449	232	393	315	280	200
Kentucky	1,173	582,007	1,092	5	5	70	148	116	119	145	139	214	76	61
Maryland	557	194,181	557	16	25	76	88	65	71	64	114	22	13	13
Massachusetts	5,168	2,454,035	5,126	34	140	325	592	1,135	1,033	719	580	385	127	80
Michigan	782	435,339	752	19	17	64	187	57	103	83	72	45	68	37
Missouri	642	393,896	641	20	6	22	15	29	144	119	97	88	53	48
New Jersey	4,493	2,301,592	4,468	62	92	416	334	511	648	794	739	550	163	109
New York	5,291	2,672,464	5,227	55	139	253	641	537	750	762	709	737	309	209
Ohio	19,489	11,405,904	19,179	248	371	928	2,679	2,235	1,538	2,291	3,480	2,187	1,778	1,411
Pennsylvania	76,609	42,350,589	75,599	733	1,744	5,192	8,634	11,642	9,494	9,554	10,799	9,101	5,038	3,068
Tennessee	460	218,699	453	70	34	84	34	50	34	40	102	23	10	10
Virginia	1,742	639,347	1,687	65	253	377	215	133	204	154	163	80	29	14
West Virginia	3,346	1,552,589	3,199	84	182	173	182	512	463	422	289	432	328	189
All other states	2,743	1,350,280	2,680	10	2	33	184	227	407	584	441	361	194	137

a Includes raw materials, stock in process and finished products on hand, and cash, bills and accounts receivable, and sundry items of capital not elsewhere reported.
 b Includes rent, taxes, insurance, interest paid on cash used in the business, and all sundries not elsewhere reported.

IRON AND STEEL MANUFACTURE.

MILLS AND STEEL WORKS, BY STATES: 1890.

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES—continued.																
Clerks.				Operatives and skilled.						Unskilled.						
Males above 16 years.		Females above 15 years.		Males above 16 years.		Females above 15 years.		Children.		Males above 16 years.		Females above 15 years.		Children.		
Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.	
2,303	\$2,170,004	49	\$26,700	77,503	\$52,540,013	2	\$1,040	133	\$36,550	57,631	\$21,495,266	56	\$16,066	1,970	\$365,496	1
22	17,305	.....	.....	1,022	535,037	.....	.....	.....	.....	654	144,295	.....	.....	20	2,328	2
26	22,040	.....	.....	434	377,744	.....	.....	.....	.....	655	309,706	.....	.....	25	5,850	3
12	10,687	.....	.....	309	215,035	.....	.....	.....	.....	230	96,356	.....	.....	2	380	4
20	15,881	2	830	1,075	582,108	.....	.....	.....	.....	487	169,250	.....	.....	75	13,800	5
128	119,108	2	1,570	4,250	3,159,542	.....	.....	.....	.....	2,653	1,154,955	.....	.....	62	10,356	6
32	31,320	3	1,520	1,555	830,845	.....	.....	.....	.....	962	280,284	.....	.....	64	9,650	7
19	15,651	.....	.....	721	443,812	.....	.....	.....	.....	371	125,705	.....	.....	81	12,490	8
10	6,578	.....	.....	436	167,633	.....	.....	.....	.....	122	27,148	.....	.....	.....	.....	9
102	119,864	.....	.....	2,788	1,482,070	.....	.....	.....	.....	2,338	959,273	42	12,692	.....	.....	10
15	14,380	.....	.....	423	311,905	.....	.....	.....	.....	329	123,434	.....	.....	.....	.....	11
11	12,730	.....	.....	370	282,768	.....	.....	.....	.....	271	110,978	.....	.....	1	150	12
84	80,122	2	1,040	2,698	1,655,200	.....	.....	.....	.....	1,770	641,268	1	150	20	5,034	13
92	96,302	3	1,560	2,703	1,744,743	.....	.....	.....	.....	2,464	914,619	.....	.....	64	13,062	14
315	308,778	7	3,858	11,549	8,430,199	2	1,040	75	22,550	7,630	2,880,348	12	2,808	221	56,959	15
1,305	1,212,306	28	15,282	43,133	29,927,538	.....	.....	.....	.....	32,466	12,230,056	1	416	1,009	189,579	16
12	9,830	.....	.....	215	138,460	.....	.....	.....	.....	238	78,783	.....	.....	7	1,450	17
23	16,106	.....	.....	760	384,367	.....	.....	.....	.....	927	248,280	.....	.....	55	6,700	18
28	25,604	1	520	1,764	1,081,102	.....	.....	.....	.....	1,432	449,634	.....	.....	150	21,853	19
41	41,303	1	520	1,248	787,499	.....	.....	.....	.....	1,332	532,954	.....	.....	105	21,827	20

WEEKLY RATES OF WAGES PAID AND AVERAGE NUMBER OF EMPLOYÉS AT EACH RATE, EXCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS—continued.													MATERIALS USED.				
Females above 15 years.								Children.					Total cost.	Iron ore.			
Total number.	Under \$5.	\$5 and over but under \$6.	\$6 and over but under \$7.	\$7 and over but under \$8.	\$8 and over but under \$9.	\$9 and over but under \$10.	\$10 and over but under \$12.	Total number.	Under \$5.	\$5 and over but under \$6.	\$6 and over but under \$7.	\$7 and over but under \$8.		\$8 and over but under \$9.	Tons.	Cost.	
58	28	12	8	4	3	1	2	2,103	1,484	319	282	16	2	\$216,269,022	581,503	\$3,355,130	1
.....	20	14	6	.....	.....	.....	931,460	12,046	95,917	2
.....	25	25	.....	.....	.....	.....	1,038,333	339	2,712	3
.....	2	2	.....	.....	.....	.....	911,335	402	2,051	4
.....	75	75	.....	.....	.....	.....	1,540,539	6,827	37,362	5
.....	62	36	26	.....	.....	.....	21,951,521	4,448	25,305	6
.....	64	34	15	15	.....	.....	2,889,615	12,153	72,915	7
.....	81	51	20	10	.....	.....	1,241,536	3,782	23,344	8
.....	700,849	437	2,975	9
42	15	12	8	4	3	.....	.....	.....	.....	.....	.....	.....	.....	6,780,610	1,590	10,214	10
.....	1,200,758	1,180	5,018	11
.....	1	1	.....	.....	.....	.....	831,566	423	2,540	12
.....	29	29	.....	.....	.....	.....	5,326,401	26,257	145,920	13
.....	64	51	18	.....	.....	.....	5,932,461	28,057	103,768	14
.....	296	85	5	190	10	.....	23,854,636	99,892	566,543	15
14	12	.....	.....	.....	.....	.....	.....	1,009	858	110	33	0	2	122,530,544	359,762	2,126,540	16
1	17
.....	7	5	2	.....	.....	.....	402,789	3,099	9,040	18
.....	55	55	.....	.....	.....	.....	1,584,285	3,116	19,070	19
.....	150	73	77	.....	.....	.....	6,402,189	8,382	52,860	20
.....	163	90	45	28	.....	.....	4,146,505	9,311	49,740	20

^c Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Colorado, 1; Georgia, 1; Iowa, 1; Maine, 1; Minnesota, 1; New Hampshire, 1; Rhode Island, 1; Wisconsin, 1; Wyoming, 1.

MANUFACTURING INDUSTRIES.

TABLE 2.—DETAILED STATEMENT, ROLLING MILLS

MATERIALS USED—continued.										
STATES.	Spiegelisen and ferro-manganese.		Pig iron.		Old iron rails.		Other old or scrap iron.		Old steel rails and steel rail ends.	
	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.
1 The United States.	248,530	\$7,588,784	6,299,999	\$97,758,067	392,405	\$9,100,765	943,623	\$16,418,611	145,837	\$2,627,649
2 Alabama.....	2	170	48,303	478,084	1,468	35,275	5,784	90,277		
3 California.....	25	2,000	1,120	29,000	11,985	296,211	35,051	843,690	2,138	42,840
4 Connecticut.....			125	2,980		924	20,700	289,620		
5 Delaware.....			25,350	393,397	14,500	357,500	22,470	405,702		
6 Illinois.....	56,954	1,651,097	816,959	12,742,004	99,856	2,319,904	68,287	1,151,644	8,419	177,018
7 Indiana.....	80	5,600	42,022	635,797	4,125	98,700	43,304	740,848	5,337	125,039
8 Kentucky.....			17,069	241,761	1,792	36,800	21,036	392,413		
9 Maryland.....			4,417	95,400			3,456	58,500		
10 Massachusetts.....	573	41,261	16,401	336,738	10,946	275,656	32,403	487,121	2,268	43,092
11 Michigan.....	32	2,600	10,751	174,088	21,826	488,974	14,265	245,617		
12 Missouri.....			1,852	30,272	1,784	37,464	26,320	474,415		
13 New Jersey.....	452	27,232	74,759	1,027,545	5,641	120,415	19,949	369,825		
14 New York.....	2,242	102,796	205,512	3,126,865	1,331	26,089	31,903	645,016	7,360	168,500
15 Ohio.....	6,208	399,797	873,711	13,057,207	92,712	2,080,646	147,835	2,311,792	12,875	245,745
16 Pennsylvania.....	179,209	5,235,978	3,840,584	60,348,110	57,848	1,377,132	388,510	6,772,770	107,100	1,817,815
17 Tennessee.....			12,638	152,826	9,189	203,338	549	8,211		
18 Virginia.....			21,296	305,377	29,822	723,244	8,900	166,541		
19 West Virginia.....	1,707	92,927	226,847	3,678,599			2,339	48,836		
20 All other states.....	1,052	27,416	55,029	902,017	20,746	602,537	50,027	900,893	400	7,600

MATERIALS USED—continued.													
STATES.	Fuel.											Rent of power and heat.	All other materials.
	Anthracite coal and culm.		Bituminous coal and slack.		Coke.		Charcoal.		Oil.		Natural gas.		
	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Bushels.	Cost.	Barrels.	Cost.	Cost.		
1 The United States.	961,039	\$1,487,713	5,171,102	\$9,663,208	393,050	\$1,311,588	2,770,611	\$243,773	1,859,138	\$1,124,206	\$3,566,940	\$20,910	\$16,712,412
2 Alabama.....			117,834	141,788									59,761
3 California.....			52,551	961,410	10	110							137,359
4 Connecticut.....	7,906	84,452	26,728	93,512	228	1,415	48,450	4,362					44,980
5 Delaware.....	6,975	27,644	74,233	202,347			87,835	8,394					33,023
6 Illinois.....			408,936	539,841	78,469	332,892	4,770	251	637,197	385,992			958,006
7 Indiana.....			130,028	183,503 ^a	345	2,105			20,000	12,000	(a)		29,101
8 Kentucky.....	672	3,600	104,204	133,015			26,707	2,144					18,505
9 Maryland.....	647	2,337	34,258	85,598									38,457
10 Massachusetts.....	8,848	46,837	133,205	551,772	5,122	34,156	870,859	71,927	2,160	3,510			2,042,410
11 Michigan.....			27,932	63,756	1,700	7,011	24,406	1,842	84,952	52,064			75,151
12 Missouri.....			54,850	104,060	2,205	12,019	69,500	6,950	3,090	3,585			56,155
13 New Jersey.....	92,869	228,190	173,216	524,210	3,455	16,876	10,950	1,737	7,421	8,024			1,254,045
14 New York.....	16,700	66,756	223,839	572,806	12,103	48,507	8,428	848	5,465	9,564			349,812
15 Ohio.....			1,459,482	1,764,878	65,356	214,198	113,040	9,422	920,924	489,248	151,403		1,121,472
16 Pennsylvania.....	823,947	1,075,764	1,727,403	3,555,484	200,769	571,080	1,510,984	135,883	177,027	160,219	3,391,468	2,000	9,039,831
17 Tennessee.....			62,750	91,814									22,810
18 Virginia.....	400	1,720	50,137	112,336								16,510	81,463
19 West Virginia.....			171,774	167,020	20,725	58,931	100	13			24,075		884,298
20 All other states.....	75	413	182,694	411,910	2,563	11,478						2,400	445,170

^a Natural gas in Indiana supplied free.

AND STEEL WORKS, BY STATES: 1890—Continued.

MATERIALS USED—continued.													
Other old or scrap steel.		Hammered iron ore blooms.		Hammered pig or scrap blooms.		Purchased muck bar.		Purchased bessemer steel.		Purchased open-hearth steel.		Swedish billets and bars.	
Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.
451,346	\$7,045,013	16,936	\$599,983	23,452	\$720,457	234,678	\$6,252,594	838,118	\$24,117,921	141,342	\$4,035,585	15,463	\$1,008,698
3,873	78,115							3,759	130,210	1,435	30,188		
1,482	33,579	110	4,080					7,731	256,712	434	14,673		
		103	3,850			2,256	61,534	5,447	162,212	2,500	100,482	340	21,120
103,455	1,520,297					400	11,600	250	6,600	361	11,586		
								5,226	134,156	36	1,424		
168	2,560			2,000	56,000			31,743	917,527	60	1,920		
								12,634	379,921	268	9,133		
1,400	28,000	100	5,000			1,308	50,959	5,447	162,212	6,806	221,471	200	16,000
18,063	299,152							74,563	2,190,070	8,325	264,725	1,256	87,960
2,289	39,002							44	1,315	913	34,000	114	9,420
16,702	347,101	336	10,520			1,844	49,436	3,220	103,200				
8,221	149,543	699	27,903			3,940	100,611	22,017	694,073	11,593	384,317	1,248	98,926
52,853	948,921	1,051	32,490			13,100	328,494	3,516	94,846	5,211	192,800	2,024	136,431
240,600	4,460,777	14,477	504,020	42	1,038	209,313	5,572,617	178,857	5,084,452	1,146	47,600	10,281	638,841
				21,410	663,419			404,875	11,739,550	102,254	3,321,266		
200	4,750												
888	12,837					2,508	68,100	2,064	89,334				
1,152	20,379	60	2,520					52,332	1,380,843				
								28,950	752,000				

PRODUCTS.											
Summary of classified products.											
Aggregate value.	Total.		Iron.		Bessemer steel.		Open-hearth steel.		Crucible and miscel lanceous steel.		
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	
	\$331,860,872	8,274,833	\$325,613,440	3,225,140	\$132,620,665	4,385,365	\$150,655,612	590,198	\$32,934,121	74,130	\$9,403,051
2,228,536	52,205	2,194,651	50,550	2,132,721			1,655	61,930			
3,097,155	56,747	3,052,485	39,303	1,950,181	7,513	436,059	9,931	606,245			
1,463,180	27,737	1,462,140	17,123	757,741	6,095	313,750	2,340	143,835	1,569	246,814	
2,008,070	58,437	2,553,942	57,013	2,520,809	380	24,590	144	8,633			
28,872,741	610,648	28,678,000	156,404	6,400,731	751,784	21,830,141	2,015	341,937	445	75,191	
4,505,536	110,201	4,448,290	73,731	2,891,801	35,170	1,471,313	1,050	27,500	250	57,085	
2,059,840	49,082	2,040,101	36,711	1,486,090	12,098	536,874	273	17,128			
1,062,204	20,222	1,098,467	8,479	452,469	6,865	294,885	3,878	188,513	1,000	102,500	
10,931,640	150,621	8,812,273	42,224	1,873,163	87,051	5,465,176	20,102	1,250,579	1,184	223,360	
1,847,565	40,588	1,826,800	33,478	1,296,809	4,250	320,746	400	32,000	2,460	177,254	
1,520,550	27,708	1,509,223	25,208	1,334,223	2,500	175,000					
8,756,431	157,276	8,658,788	80,818	4,334,003	30,689	1,836,992	20,425	1,675,800	7,344	811,993	
10,310,088	240,020	10,241,488	100,472	5,330,587	118,346	3,466,407	4,880	872,770	7,328	1,002,724	
45,406,500	1,128,013	45,032,191	571,334	21,951,752	502,800	19,804,838	53,819	3,325,601			
188,714,190	4,770,976	185,742,795	1,705,202	69,069,307	2,556,328	85,430,308	457,026	24,601,650	52,426	6,632,530	
881,404	20,651	854,058	20,821	841,058					130	13,000	
2,400,693	52,442	2,397,103	50,655	2,283,091	1,737	84,012					
8,547,390	259,838	8,493,356	39,223	1,172,790	220,615	7,320,566					
6,596,601	141,425	6,550,375	97,791	4,531,430	40,434	1,804,945	3,200	220,000			

IRON AND STEEL MANUFACTURE.

AND STEEL WORKS, BY STATES: 1890—Continued.

PRODUCTS—continued.															
Hoop.						Skelp.				Structural shapes.					
Iron.		Bessemer steel.		Open-hearth steel.		Iron.		Bessemer steel.		Iron.		Bessemer steel.		Open-hearth steel.	
Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
123,317	\$5,076,591	5,420	\$234,706	3,532	\$160,000	465,550	\$17,621,186	13,919	\$536,306	137,527	\$6,941,474	95,693	\$4,520,411	76,298	\$3,992,074
201	12,804									2,650	132,500			2,236	134,160
						5,954	242,581								
										1,320	60,000			50	2,500
										2,000	85,000				
100	5,600					9,520	361,760			20,832	1,146,112	840	49,491	10,000	500,000
27,778	1,134,750	2,780	122,903			28,377	1,088,648			2,528	108,217				
95,148	3,923,437	2,640	111,803			421,000	15,928,197	9,630	300,183	107,597	5,385,645	4,937	217,228	64,012	3,355,414
				3,532	160,000							89,916	4,202,692		
								4,289	140,183						
										600	24,000				

PRODUCTS—continued.																	
All other plate, except mail plate.						Rolled car axles.				Hammered car axles.						Muck bar for sale.	
Iron.		Bessemer steel.		Open-hearth steel.		Iron.		Open-hearth steel.		Iron.		Bessemer steel.		Open-hearth steel.		Tons.	Value.
Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
139,549	\$5,973,520	91,840	\$4,050,021	87,139	\$4,587,454	1,500	\$67,500	1,000	\$60,000	30,545	\$1,685,345	11,456	\$609,677	10,445	\$640,429	282,340	\$7,411,748
4,091	239,330			1,098	45,080					4,303	215,150						
		6,000	276,000							1,489	60,912					500	16,000
1,501	66,055															606	17,180
										5,626	298,197					7,175	106,200
5,707	253,450	1,729	92,659	10	596											5,253	137,696
2,400	103,000	4,882	192,240														
										5,097	229,399						
										7,385	313,386						
1,011	91,728	1,287	52,992	5,300	264,400											11,727	311,175
5,286	228,864	1,211	47,094							285	14,229	20	995				
5,199	233,595	15,895	820,178	3,194	208,925					2,489	118,551	8,836	493,282	1,886	178,534	34,631	985,293
112,554	4,747,489	49,487	2,240,473	74,897	3,800,453	1,500	67,500	1,000	60,000	3,274	143,489	2,000	115,400	8,659	461,895	189,619	4,980,240
		11,349	334,385							1,597	67,032						
				2,700	168,000											32,824	798,953

MANUFACTURING INDUSTRIES.

TABLE 2.—DETAILED STATEMENT, ROLLING MILLS

STATES.	PRODUCTS—continued.												Value of all other products, including amounts received for custom work and repairing.
	Cut nails.						All other classified products.						
	Iron.		Bessemer steel.		Open-hearth steel.		Iron.		Bessemer steel.		Open-hearth steel.		
	Kegs of 100 pounds.	Value.	Kegs of 100 pounds.	Value.	Kegs of 100 pounds.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.	
1 The United States.	2,139,086	\$4,577,557	3,704,604	\$7,676,306	13,340	\$79,740	391,400	\$19,743,547	1,494,819	\$55,442,379	173,351	\$10,303,054	\$6,247,423
2 Alabama.....							763	46,115			300	8,100	33,885
3 California.....	222,188	641,000	24,231	74,211	9,340	42,630	590	29,556	1,432	100,542	711	142,200	44,670
4 Connecticut.....							2,942	147,885	40	2,000	830	65,085	1,040
5 Delaware.....							18,670	833,070	180	13,500			54,728
6 Illinois.....			192,985	394,743			56,402	2,860,409	90,321	3,504,602	2,015	341,037	194,741
7 Indiana.....	25,000	50,000	214,832	454,509			10,020	533,740	23,793	991,404	1,000	25,000	57,237
8 Kentucky.....			196,350	412,335			600	41,000					19,739
9 Maryland.....													23,737
10 Massachusetts.....	116,840	260,624	100,719	227,084			15,956	864,043	75,345	4,958,862	14,337	959,329	2,169,371
11 Michigan.....							1,074	56,612	4,250	320,746	400	32,000	20,758
12 Missouri.....							10,226	520,323					11,333
13 New Jersey.....	280,115	550,757	1,245	3,893			20,510	1,813,455	21,818	1,401,556	1,175	80,300	97,643
14 New York.....							7,983	528,321	104,594	2,320,380	1,300	194,800	68,600
15 Ohio.....	68,054	140,613	1,351,251	2,775,440			32,074	1,426,298	372,956	13,798,580	16,495	955,425	324,369
16 Pennsylvania.....	1,233,430	2,484,672	630,894	1,265,733	4,000	37,110	147,080	6,660,293	630,939	22,075,197	134,288	7,437,878	2,071,395
17 Tennessee.....							6,546	301,684					26,146
18 Virginia.....	182,493	433,593	35,750	84,012			29,050	1,233,981					33,500
19 West Virginia.....	1,848	3,973	945,982	1,982,738					151,083	4,530,453			54,004
20 All other states.....	3,118	6,325	765	1,553			33,304	2,042,562	17,108	918,488	500	52,000	40,226

a Two bessemer converters were reported from Virginia, for which the capacity was not given.

CAPITAL, EQUIPMENT, AND DAILY CAPACITY AND

STATES.	No. of establishments.	CAPITAL.					Number of single puddling furnaces.	Number of heating furnaces.	Number of hammers.	Number of cut nail machines.
		Total.	Land.	Buildings.	Machinery, tools, and implements.	Live assets. (a)				
1 The United States.	34	\$5,711,693	\$1,151,119	\$1,250,801	\$3,106,216	\$194,557	159	150	11	314
2 Alabama.....	1	169,193	10,000	50,000	109,193		20	4		68
3 Colorado.....	1	65,500	3,000	2,500	60,000			2		
4 Delaware.....	2	401,857	55,000	113,493	233,364			5		
5 Illinois.....	3	443,250	6,000	337,000	100,250			9	3	52
6 Indiana.....	3	288,000	23,000	47,000	218,000		6	5	1	
7 Kansas.....	1	300,000	75,000	100,000	125,000			12		
8 Kentucky.....	2	140,000	20,000	20,000	100,000			20	1	
9 Missouri.....	3	2,379,215	765,000	225,008	1,248,150	141,057	85	20	3	50
10 New Jersey.....	2	479,000	95,000	122,000	222,000		6	30		
11 New York.....	1	25,000	5,000	5,000	15,000			2	1	
12 Ohio.....	6	509,128	24,219	110,500	341,409	33,000	20	17		132
13 Pennsylvania.....	7	2,266,550	42,400	32,800	170,850	20,500	52	14	1	12
14 Tennessee.....	1	225,000	25,000	50,000	150,000			4	1	
15 Texas.....	1	20,000	2,500	4,500	13,000			3		

a Includes raw materials, stock in process and finished products on hand, and cash, bills and accounts receivable, and sundries not elsewhere reported.

IRON AND STEEL MANUFACTURE.

481

AND STEEL WORKS, BY STATES: 1890—Continued.

EQUIPMENT AND CAPACITY.																				
Number of single puddling furnaces.	Number of heating furnaces.	Number of hammers.	Number of out nail machines.	Converters.		Open-hearth furnaces.		Number of soaking pits.	Number of cementing furnaces.	Number of crucible pots which can be used at each heat.	Number of trains of rolls.	Aggregate daily capacity in tons of finished products.	Power.							
				Number.	Total daily capacity in tons of ingots.	Number.	Total daily capacity in tons of ingots.						Steam.			Water.				
													Number of boilers.	Number of engines.	Horse power.	Number of water wheels.	Horse power.	Number of turbine wheels.	Horse power.	
4,604	2,762	614	5,505	202	20,934	122	3,853	43	48	2,270	1,474	45,181	5,992	3,702	525,836	18	1,755	84	6,477	1
117	31	5	.....	.....	.....	1	15	.....	.....	.....	28	440	62	74	10,395	.....	.....	.....	.....	2
6	35	19	98	.....	.....	2	40	.....	.....	.....	15	303	82	56	5,765	.....	.....	.....	.....	3
12	39	18	.....	.....	.....	.....	.....	.....	2	124	17	141	43	24	2,325	.....	.....	4	425	4
66	33	8	.....	.....	.....	.....	.....	.....	.....	.....	30	266	110	50	5,130	.....	.....	2	90	5
81	70	8	428	16	5,667	8	125	8	.....	30	60	5,626	292	257	31,012	.....	.....	.....	.....	6
117	61	15	342	2	120	2	120	.....	1	16	33	966	121	79	10,480	.....	.....	.....	.....	7
60	23	5	126	.....	.....	.....	.....	.....	.....	.....	19	340	38	33	4,100	.....	.....	.....	.....	8
45	44	10	.....	.....	.....	.....	.....	.....	1	24	24	182	32	27	3,200	5	550	.....	.....	9
32	91	13	311	4	290	2	60	8	.....	64	45	1,099	229	115	13,820	4	90	14	675	10
13	58	19	.....	2	20	.....	.....	.....	.....	30	11	268	44	32	4,300	.....	.....	.....	.....	11
14	28	10	.....	.....	.....	.....	.....	.....	.....	.....	10	156	28	18	2,775	.....	.....	.....	.....	12
141	98	45	216	.....	.....	4	100	.....	14	266	61	739	265	164	23,910	2	280	9	441	13
188	125	28	40	2	700	2	28	.....	7	202	69	1,382	205	103	17,385	1	600	10	1,415	14
821	330	44	1,177	11	1,690	23	642	2	.....	24	219	5,247	715	494	76,624	.....	.....	2	100	15
2,707	1,570	330	1,685	46	11,247	78	2,701	23	23	1,470	738	25,207	3,317	1,937	276,335	6	235	23	1,161	16
33	11	2	74	1	25	.....	.....	.....	.....	20	11	116	35	28	2,200	.....	.....	.....	.....	17
50	26	7	145	2	.....	.....	.....	.....	.....	.....	21	533	41	17	1,060	.....	.....	20	2,170	18
127	31	2	823	4	825	.....	.....	2	.....	.....	26	1,106	111	66	11,225	.....	.....	.....	.....	19
55	58	17	130	2	350	1	22	.....	.....	.....	37	1,064	222	128	23,795	.....	.....	.....	.....	20

POWER OF IDLE ROLLING MILLS AND STEEL WORKS: 1890.

CONVERTERS.		OPEN-HEARTH FURNACES.		Number of crucible pots which can be used at each heat.	Number of trains of rolls.	Aggregate daily capacity in tons of finished products.	STEAM POWER.			WATER POWER.				
Number.	Total daily capacity in tons of ingots.	Number.	Total daily capacity in tons of ingots.				Number of boilers.	Number of engines.	Horse power.	Number of water wheels.	Horse power.	Number of turbine wheels.	Horse power.	
5	665	7	188	336	83	1,384	245	159	20,170	2	150	4	280	1
.....	.....	.....	.....	.....	3	40	8	5	750	.....	.....	.....	.....	2
.....	.....	.....	.....	.....	2	30	6	3	250	.....	.....	.....	.....	3
.....	.....	.....	.....	.....	3	2	6	2	250	.....	.....	.....	.....	4
1	75	.....	.....	.....	4	115	15	11	735	2	150	.....	.....	5
1	30	1	6	4	3	31	11	13	3,040	.....	.....	.....	.....	6
.....	.....	.....	.....	.....	6	50	4	6	1,100	.....	.....	.....	.....	7
.....	.....	.....	.....	.....	12	240	35	22	1,325	.....	.....	.....	.....	8
2	500	.....	.....	.....	10	310	31	21	4,615	.....	.....	.....	.....	9
.....	.....	.....	.....	.....	8	70	23	16	1,545	.....	.....	.....	.....	10
.....	.....	.....	.....	.....	1	8	.....	.....	.....	.....	.....	2	200	11
.....	.....	3	135	12	14	211	48	26	3,450	.....	.....	.....	.....	12
.....	.....	.....	.....	.....	13	187	56	20	2,660	.....	.....	2	80	13
1	60	2	40	.....	2	75	2	5	450	.....	.....	.....	.....	14
.....	.....	.....	.....	.....	2	15	.....	.....	.....	.....	.....	.....	.....	15

b Includes \$18,000 hired property.

MANUFACTURING INDUSTRIES.

TABLE 3.—DETAILED STATEMENT, FORGES

STATES.	Number of establishments.	CAPITAL.						Miscellaneous expenses. (b)	AVERAGE NUMBER OF EMPLOYEES AND TOTAL WAGES.					
		Total.	Land.	Buildings.	Machinery, tools, and implements.	Live assets. (a)	Aggregates.		Officers or firm members actively engaged in the industry or in supervision.		Clerks.			
							Average number.		Total wages.	Males above 16 years.		Males above 16 years.		
										Number.	Wages.	Number.	Wages.	
1 The United States.	20	\$876,470	\$130,700	\$112,500	\$225,500	\$407,770	\$54,680	486	\$216,374	11	\$16,100	4	\$1,200	
2 New York	9	517,434	70,500	52,500	110,000	284,434	40,948	154	61,050	7	10,800	.....	.....
3 All other states (c)	11	359,036	60,200	60,000	115,500	123,336	13,732	332	155,324	4	5,300	4	1,200	

STATES.	Total cost.	MATERIALS USED.														Cost of all other materials.
		Iron ore.		Pig iron.		Old or scrap iron.		Charcoal.		Anthracite coal.		Bituminous coal.		Coke.		
		Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	Bushels.	Cost.	Tons.	Cost.	Tons.	Cost.	Tons.	Cost.	
1 The United States.	\$905,208	18,807	\$110,587	8,227	\$145,867	24,000	\$359,777	4,050,435	\$270,082	398	\$946	1,300	\$3,300	1,405	\$5,604	\$9,045
2 New York	279,593	18,807	110,587	.....	.....	.....	.....	2,733,180	167,221	.....	.....	.....	.....	.....	.....	1,095
3 All other states	625,705	.....	.....	8,227	145,867	24,000	359,777	1,328,255	102,861	398	946	1,300	3,300	1,405	5,604	7,350

a Includes raw materials, stock in process and finished products on hand, and cash, bills and accounts receivable, and sundries not elsewhere reported.
 b Includes rent, taxes, insurance, interest paid on cash used in the business, and all sundries not elsewhere reported.

CAPITAL, EQUIPMENT, AND DAILY CAPACITY AND

STATES.	Number of establishments.	CAPITAL.					Number of forgo fires.
		Total.	Land.	Buildings.	Machinery, tools, and implements.	Live assets. (a)	
1 The United States	12	\$198,500	\$68,000	\$41,300	\$83,200	\$6,000	62
2 Alabama	1	8,200	5,000	2,000	1,200	.....	5
3 Maryland	1	60,000	5,000	7,000	48,000	.....	12
4 New Jersey	2	19,300	4,500	2,300	6,500	6,000	6
5 New York	2	17,000	11,000	2,000	4,000	.....	8
6 Pennsylvania	5	90,000	40,000	27,000	23,000	.....	20
7 Virginia	1	4,000	2,500	1,000	500	.....	2

a Includes raw materials, stock in process and finished products on hand, and cash, bills and accounts receivable, and sundry items of capital not elsewhere reported.

IRON AND STEEL MANUFACTURE.

483

AND BLOOMERIES, BY STATES: 1890.

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES—continued.						WEEKLY RATES OF WAGES PAID AND AVERAGE NUMBER OF EMPLOYÉS AT EACH RATE, EXCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS.													
Operatives and skilled.		Unskilled.				Aggregates.		Males above 16 years.										Children.	
		Males above 16 years.		Children.				Average number.	Total Wages.	Total number.	Under \$5.	\$5 and over but under \$6.	\$6 and over but under \$7.	\$7 and over but under \$8.	\$8 and over but under \$9.	\$9 and over but under \$10.	\$10 and over but under \$12.		\$12 and over but under \$15.
Number.	Wages.	Number.	Wages.	Number.	Wages.	Number.	Wages.											Number.	
317	\$150,943	151	\$47,762	3	\$360	471	\$199,065	468	6	11	35	65	58	36	113	102	42	3	
108	39,099	39	11,151	3	300	147	50,250	147	0	1	8	34	5	10	71	13	5	2	
209	111,844	112	36,611	3	300	324	148,815	321	6	10	27	31	53	26	42	80	37	3	3

PRODUCTS.								EQUIPMENT AND CAPACITY.										
Aggregate value.	Blooms and bars.						Value of all other products.	Number of forge fires.	Hammers.		Power.							
	Total.		From ore.		From pig and scrap iron.				Number.	Total capacity in tons of blooms or bars.	Steam.			Water.				
	Tons.	Value.	Tons.	Value.	Tons.	Value.					Number of boilers.	Number of engines.	Horse power.	Number of water wheels.	Horse power.	Number of turbine wheels.	Horse power.	
\$1,183,494	34,775	\$1,178,011	9,347	\$356,843	25,428	\$821,168	\$5,483	140	27	222	16	9	432	20	715	7	215	1
356,843	9,347	356,843	9,347	356,843	25,428	821,168	5,483	61	13	80				16	500	4	135	2
826,651	25,428	821,168						70	14	142	16	9	432	4	125	3	80	3

^c Includes states grouped in order that the operations of individual establishments may not be disclosed. These establishments are distributed as follows: Maryland, 1; New Jersey, 1; Pennsylvania, 9.

POWER OF IDLE FORGES AND BLOOMERIES: 1890.

HAMMERS.		STEAM POWER.			WATER POWER.				
Number.	Daily capacity in tons of blooms or bars.	Number of boilers.	Number of engines.	Horse power.	Number of water wheels.	Horse power.	Number of turbine wheels.	Horse power.	
12	73	12	8	500	8	280	6	224	1
1	10	2	1	50					2
1	7	4	1	200			1	50	3
2	7	2	2	110					4
2	8				4	160	1	30	5
5	39	4	4	140	3	95	4	144	6
1	2				1	25			7

CAST IRON PIPE INDUSTRY.

CAST IRON PIPE INDUSTRY.

The manufacture of cast iron pipe is confined almost exclusively to establishments devoted to this class of work as a specialty. On account of the distinctive character of the industry it has been possible to separate the statistics of the pipe works from the operations of foundries engaged in the production of miscellaneous castings. A comparatively small amount of iron pipe is made by foundries devoted to general work, but as the pipe thus produced is chiefly for local trade or for specific purposes no account has been taken of the output in this report. The demand for standard sizes of cast iron pipe necessitates its manufacture on a large scale in plants especially equipped for this work, although many of them also produce hydrants, fittings, and connections. A few of the pipe manufacturers make hydraulic and gas machinery, and general foundry and machine shop products, but this work forms only a small part of the aggregate business of these establishments.

The statistics relating to cast iron pipe were included in the totals for the general foundry and machine shop industry at the censuses of 1880 and 1890. For the purposes of this report, however, a separation was made at the census of 1890, which was not done at the census of 1880; therefore comparative data are not available.

There were 33 establishments in the United States reported as engaged principally in the manufacture of cast iron pipe during the census year 1890. The statistics of this industry are given in the following summary:

SUMMARY, CAST IRON PIPE INDUSTRY, BY STATES: 1890.

STATES.	Number of establishments reporting.	Capital.	Miscellaneous expenses.	AVERAGE NUMBER OF EMPLOYEES AND TOTAL WAGES. (a)		Cost of materials used.	Value of products.
				Employees.	Wages.		
The United States.....	33	\$14,179,733	\$622,614	7,579	\$3,792,557	\$9,453,652	\$15,182,052
New York.....	3	589,408	36,850	337	163,244	266,058	516,421
Massachusetts.....							
New Jersey.....	6	4,543,204	197,173	2,284	1,217,813	3,099,052	5,032,571
Pennsylvania.....	6	1,320,407	56,918	709	344,450	984,420	1,510,755
Southern states (c).....	8	3,561,162	160,461	1,964	934,701	2,256,258	3,714,293
Ohio.....	4	1,950,311	84,182	1,067	550,054	1,405,425	2,189,565
Other western states (d).....	6	2,215,186	87,021	1,218	582,196	1,441,239	2,219,047

a Includes 175 officers, firm members, and clerks, and their wages, amounting to \$282,011, distributed as follows: New York and Massachusetts 4, \$6,447; New Jersey 41, \$72,468; Pennsylvania 34, \$32,676; southern states 44, \$90,135; Ohio 24, \$31,320; other western states 28, \$48,965.

b Does not include 2 idle establishments located in Pennsylvania reporting capital amounting to \$68,500.

c Includes establishments located as follows: Alabama, 1; Kentucky, 2; Tennessee, 2; Texas, 1; Virginia, 2.

d Includes establishments located as follows: Colorado, 1; Michigan, 1; Missouri, 2; Oregon, 1; Wisconsin, 1.

Of the 6 establishments in the group of "Other western states" 5 have been built and put in operation since 1880.

The oldest seat of the cast iron pipe industry is in eastern Pennsylvania and the adjoining sections of New Jersey, the largest works being located in the immediate vicinity of Philadelphia, Pa. One establishment, situated in Millville, N. J., has been in operation since 1803, but it did not begin the manufacture of pipe until some years later. Two other establishments in this section were established prior to 1850, and 5 establishments were built and put in operation between 1850 and 1880. During the last decade 5 cast iron pipe foundries have been built in this territory. The older establishments in this section are all of large size, while those recently built are of comparatively small capacity. During the census year 1890 the pipe foundries in Pennsylvania and New Jersey produced 43 per cent of the total output. Until within recent years the establishments in these states supplied the demands of almost the entire country, but the advance in municipal improvement in the west and the southwest, and the growth of the pig iron industry in those sections have resulted in the establishment of large plants nearer to the new markets and at points where pig iron and fuel are cheap.

It has been found impossible to obtain accurate statistics concerning the manufacture of cast iron pipe during the census year of 1880. The growth of the industry during the past 10 years is indicated by the large number of

MANUFACTURING INDUSTRIES.

establishments erected since 1880. Of the 35 establishments reporting, including 2 that were idle during 1890, 19 were built since 1880 and 16 were erected prior to that year. By far the larger number of the establishments built during the past decade are located in the southern and western sections of the country, and the majority of them are of large capacity.

MISCELLANEOUS EXPENSES.

The questions pertaining to miscellaneous expenses were generally correctly answered, though in some cases manufacturers found difficulty in making a proper separation of those items belonging to the mercantile part of the business and those chargeable to manufacturing operations.

The following statement shows the different items of miscellaneous expenses as reported by the manufacturers of cast iron pipe at the census of 1890:

MISCELLANEOUS EXPENSES, CAST IRON PIPE INDUSTRY, BY STATES: 1890.

STATES.	MISCELLANEOUS EXPENSES.						
	Total.	Rent paid for tenancy.	Taxes.	Insurance.	Repairs, ordinary, of buildings and machinery.	Interest paid on cash used in the business.	Sundries not elsewhere reported.
The United States	\$622, 014	\$12, 365	\$41, 164	\$32, 017	\$189, 906	\$150, 283	\$106, 879
New York	36, 859	1, 035	3, 293	2, 018	1, 900	1, 095	27, 428
Massachusetts.....		197, 173	7, 655	14, 607	7, 601	45, 806	48, 872	72, 632
New Jersey.....	56, 918		3, 326	2, 482	25, 790	17, 794	7, 526
Pennsylvania.....	160, 461	1, 475	9, 208	11, 147	29, 081	52, 522	57, 028
Southern states.....	84, 182	1, 200	5, 143	4, 154	28, 380	17, 040	27, 165
Ohio	87, 021	1, 000	5, 587	4, 615	58, 350	12, 360	5, 100
Other western states							

EMPLOYÉS AND WAGES.

In the following statement are given the average number and total wages of officers or firm members and clerks and the average number and total wages of skilled and unskilled employés and pieceworkers for the cast iron pipe industry for the census year 1890:

AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES BY CLASSES, CAST IRON PIPE INDUSTRY: 1890.

CLASSES.	AVERAGE NUMBER OF EMPLOYÉS AND TOTAL WAGES.					
	Aggregates.		Males above 16 years.		Children.	
	Average number.	Total wages.	Number.	Wages.	Number.	Wages.
All classes (a)	7, 579	\$3, 792, 557	7, 540	\$3, 786, 240	33	\$6, 317
Officers or firm members.....	69	187, 465	69	187, 465		
Clerks	106	94, 546	106	94, 546		
Skilled	2, 505	1, 575, 780	2, 505	1, 575, 780		
Unskilled.....	4, 036	1, 785, 812	4, 003	1, 779, 495	33	6, 317
Pieceworkers.....	263	148, 954	263	148, 954		

a Includes convict laborers in the Texas penitentiary receiving an average of 50 cents each per day.

CAST IRON PIPE INDUSTRY.

The following statement shows the weekly rates of wages paid, and the average number of employés at each rate, not including those employed on piecework:

AVERAGE NUMBER OF EMPLOYÉS AT DIFFERENT WEEKLY RATES OF WAGES, CAST IRON PIPE INDUSTRY: 1890.

[INCLUDING OFFICERS, FIRM MEMBERS, AND CLERKS, BUT NOT PIECEWORKERS.]

WEEKLY RATES OF WAGES.	AVERAGE NUMBER OF EMPLOYÉS.	
	Males above 16 years.	Children.
Total (a).....	7,288	53
Under \$5.....	224	22
\$5 and over but under \$6.....	115	10
\$6 and over but under \$7.....	607	1
\$7 and over but under \$8.....	1,260	.....
\$8 and over but under \$9.....	1,322	.....
\$9 and over but under \$10.....	1,018	.....
\$10 and over but under \$12.....	875	.....
\$12 and over but under \$15.....	927	.....
\$15 and over but under \$20.....	665	.....
\$20 and over but under \$25.....	160	.....
\$25 and over.....	110	.....

a Includes convict laborers in the Texas penitentiary receiving an average of 50 cents each per day.

During the census year 1890 the cast iron pipe foundries were in operation an average of 9.45 months each and the average term of employment was 10.97 months, the excess of the average term of employment over the average term of operation being caused by the fact that the establishments having the greatest number of employés also report the maximum term of operation.

MATERIALS USED.

In the following statement are given the total quantity and cost of the pig iron used and the total cost of the fuel and other materials consumed by the cast iron pipe works during the census year 1890:

QUANTITY AND COST OF MATERIALS USED, CAST IRON PIPE INDUSTRY, BY STATES: 1890.

STATES.	MATERIALS USED.					
	Total cost.	Pig iron.		Cost of fuel.	Cost of mill supplies.	Cost of all other materials.
		Tons (of 2,000 pounds).	Cost.			
The United States.....	\$9,453,652	573,226	\$7,926,104	\$652,495	\$65,751	\$800,302
New York.....	} 266,658	11,183	188,825	23,372	480	53,981
Massachusetts.....		190,202	2,677,548	192,712	5,207	224,185
New Jersey.....	3,099,652	57,577	851,077	54,538	20,621	58,184
Pennsylvania.....	984,420	146,263	1,920,200	156,520	4,580	174,958
Southern states.....	2,256,258	90,813	1,156,617	122,537	27,970	98,301
Ohio.....	1,405,425	77,188	1,131,837	102,816	6,893	199,698
Other western states.....	1,441,239					

Most of the establishments used pig iron exclusively in the manufacture of pipe, a few report the consumption of a small quantity of purchased scrap iron, the cost of which is included in the "Cost of all other materials" which also covers the amount paid for miscellaneous foundry supplies and for materials consumed in the manufacture of products other than cast iron pipe.

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PRODUCTS.

The quantities and values of cast iron pipe made during the census year 1890 are given in the following statement, together with the values of other castings and products. The quantities are in tons of 2,000 pounds.

QUANTITY AND VALUE OF PRODUCTS, CAST IRON PIPE INDUSTRY, BY STATES: 1890.

STATES.	PRODUCTS.				
	Total value.	Pipe.		Value of other castings.	Value of all other products.
		Tons.	Value.		
The United States.....	\$15,182,652	513,250	\$13,001,209	\$1,657,525	\$433,918
New York.....	516,421	13,066	412,382	74,008	30,031
Massachusetts.....					
New Jersey.....	5,032,571	185,510	4,800,590	173,499	58,482
Pennsylvania.....	1,510,755	48,800	1,225,440	210,315	75,000
Southern states.....	3,714,293	128,253	3,178,175	401,568	44,550
Ohio.....	2,189,565	73,734	1,829,680	304,080	55,855
Other western states.....	2,219,047	63,827	1,644,942	404,165	170,000

The item of "other castings" is made up chiefly of pipe fittings and specials, and also includes some general foundry products. The "all other products" embrace valves, gates, hydrants, gas and water machinery, and miscellaneous machine work. The gates, valves, and hydrants made by the pipe foundries constitute only a small portion of the aggregate production of these fittings, as the manufacture of this class of products forms in itself an important industry.

No account has been taken in this statement of a number of establishments that were in course of erection during the census year 1890, but which were not completed and put in operation during that year.