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In the official comment upon the figures presented in the Tenth Census as the result of the investigation into telephony, the remark was made that neither the census nor any other statistical agency can deal satisfactorily with anything subject to rapid and violent changes, and that, as to telephony: "At the beginning of 1879–80 this business amounted to little or nothing; at the end of the year it represented one of the great interests of the country." Not only is this again singularly true of the present condition of telephony, twenty years later, as to its sudden expansion, but it applies forcibly along the whole range of electrical industries and applications. In 1850 it would have had equal pertinency with respect to the telegraph; in 1860 it would have described the industrial beginnings of dynamo construction; in 1870 it would have found its application in the stock ticker, burglar alarm, and other electrical conveniences now familiar; in 1880, concurrent with the development of telephony, came the great advance in electric lighting; in 1890 the vast exploitation of the electric railway would once more have justified the sagacious comment; and in 1900 the unprecedented adoption of the electric motor for power transmission, factories, etc., as well as for the automobile, would have offered further proof of the rapidity of movement which it is sought to reduce to analysis, and to that statistical treatment which underlies all modern economical and political advance.

The present bulletin is the first in which, through the agency of the governmental mechanism of any country, an attempt has been made to reach a definite idea of electrical manufactures whose product subserves the immediate needs of the great agencies supplying the public with electric intelligence, light, heat, power, transportation, etc., entering into the service of mankind through innumerable channels of comfort and convenience. It is obvious that the task presents many difficulties. The United States Census Office has dealt with telegraphy, telephony, electric railways, and to some extent with electric lighting, in previous decades, and its efforts in these branches have been supplemented from time to time by excellent statistical work undertaken by technical journals, financial concerns, and other authorities; but at the present moment the street railway industry is the only one with regard to which it can be justly asserted that a trustworthy basis of figures exists. All this work has dealt with public-service corporations or with municipal plants of various kinds. In regard to "electrical manufactures," it may be fairly said that it is wholly new ground.

In submitting the statistics of electrical manufacture, it is necessary to point out a few considerations. One of these has to do with the scope of the inquiry and the nature of the industries tabulated. The instructions under which the writer has acted have been such as to exclude a large quantity of material for which only an electrical use can be predicated, but which might come within the scope of other census inquiries, and would, therefore, be included elsewhere in other statistics. Hence it may be safely asserted that the figures are singularly free from duplication, and represent a minimum rather than a maximum of actual electrical product. A few instances may be cited here, and others will be noted in later sections of this report. For instance, there is probably no more conspicuous object in the average American landscape than the ubiquitous pole employed for the telegraph and telephone line, for the arc-light circuit, or for the trolley car. No poles, whether of wood, iron, or steel, are included in the accompanying statistics, it being considered that even if specifically made for such work, they are already embraced in the totals of the lumber and metal industries. There are some concerns, however, which make a feature of wooden cross-arms for poles, and insulator pins, and these, when reporting such product separately, have been included as being legitimately and undeniably electrical.

In the same manner, of a large amount of glass and porcelain used for electrical purposes—for battery jars, globes, tubes, knobs, insulators, etc.—only those products have been recognized that were reported by concerns with which this is a distinct branch of business. Under the same generic rule the statistics include neither steel rails employed only for the construction of trolley systems, nor bare iron and copper wire of any kind or size. It is a noteworthy fact that the annual consumption of bare iron and copper wire in the electrical arts runs into millions of pounds, most of it being of such diameter that outside of electrical applications it has no use whatever. It is equally true that in electric railway work heavy steel rails, unknown to steam railroad work, are often used, associated with special frogs

and switches built for each case. But so far as can be determined, none of this material has here been brought to account, and the only bare copper wire of which the value is given is that worked up into the form of "rail bonds" manufactured and used solely with the object of increasing at rail joints the conductivity of trolley tracks when serving as part of the return circuit.

It is true, of course, that some part of the total value shown is counted twice, but that is unavoidable. The duplication would appear to occur chiefly in regard to insulated wire. There is practically no form of electromagnetic apparatus, consisting of coils of wire associated with other coils and with iron or steel cores, in which it is not necessary to depend upon insulated wire. Every telegraph and telephone, every lighting circuit, every trolley car, every current-generating plant, bears witness to this principle, through discoveries due mainly to the genius of Michael Faraday and Joseph Henry; and hence the use of insulated wire in the electrical arts is very large. The item is set apart, therefore, by itself, but owing to the enormous range of size of wire covered, as well as to the fact that much of the wire is also laid up in cables, the value is not accompanied by any length in feet or weight in pounds. It would have been very interesting to know the actual consumption of copper by the electrical industries, but there are no data available as to the wire drawn for that purpose, and if there were, the figures would still be very incomplete, owing to the large electrical use of copper rods, bars, drop forgings, commutator segments, strips, leaf, etc.

On the other hand, anticipating a later part of this report, it may be here noted that virtually the whole American industry of copper refining is a branch of electrical manufacture. The production of copper in the United States was 275,000 metric tons in 1900. According to the best authorities,[1] in 1899 no less than 198,600 short tons were produced electrolytically. Mr. Charles Kirchhoff, expert special agent of the Twelfth Census for copper smelting and refining, states that so far as the employment of the electrolytic refining process is concerned, it is now applied to practically all copper produced in the United States, excepting that made from Lake Superior ore, but even a part of this is also electrolytically treated at the Buffalo works of the Calumet & Hecla Company.

Offsetting and far outweighing any possible reduction, on the score of duplication, of the total here given for American electrical manufactures, is the vast and incalculable amount of work done by many large industrial concerns for themselves. To how great an extent this may be carried is evidenced by the figures of the Union Iron Works, of San Francisco, Cal., builders of the battleship *Oregon* and other men-of-war. In 1896 this establishment began manufacturing the electrical apparatus required in every line of its work, with the result that at times 300 hands have been employed in its electrical department, and at the present time all that is required in the line of generators, motors, switchboards, steering gear, ammunition hoists, turret turning, ventilating apparatus, bells, annunciators, signals, telltales, etc., is designed and built in the yards. Nor is this all, for the supersession of steam in the operations of shipbuilding has been attended by the introduction of electric cranes, etc., all of which also have been designed and built on the spot. An establishment of this kind is quite outside the electrical field, in public estimation, but it is obvious that if it were not thus self-centered a corresponding product from regular electrical manufacturing concerns would have been demanded, and would, to that extent, have swollen the figures for California and other states. Within the electrical field, the public-service companies that do their own "custom and repair work" are numerous, and from the Western Union Telegraph Company, the New York Edison Company, the Boston Elevated Railroad Company, the Pacific States Telephone Company, down through thousands of local lighting, trolley, telephone, and power companies, it would be difficult to find one of any magnitude that does not maintain its own shop, with an invisible line of demarcation between new custom work and repairs.

It is interesting and important to note that the proportion of the electrical product reaching the public directly, treated in this report, is by no means large. So far as telegraphy is concerned, there is to-day practically no private or individual work. Telegraphic service, such as is rendered for conveying messages, for stock-ticker work, for fire alarms, for burglar alarms, for district-messenger calls, is all in the hands of corporations organized to do these respective classes of work, or employing the apparatus as a necessary adjunct in other fields. There is nothing more universal or less generally familiar than the Morse alphabet. In telephony the public has a better opportunity to buy the apparatus directly and employ it for varied purposes, and a considerable percentage of the telephones now made go into hotels, offices, mills, yards, etc., superseding speaking tubes and irrespective of connection with central exchanges. In electric lighting, it would appear that the apparatus produced is absorbed in about equal proportions by the central station companies and by isolated plants installed simply to supply some large building or factory. It is a rare thing for the average American citizen to-day to buy over the counter an arc lamp or an incandescent lamp as he would a typewriter

[1] The Mineral Industry for 1899, Vol. VIII, page 185.

or a fountain pen; and there are not many cities where he would even attempt it. He looks to a local company or to the owner of an isolated plant to renew these electrical supplies, however freely he uses them.

In electric railway work the distance between the manufacturer and his ultimate patron is even more remote, for nobody dreams of possessing his own trolley car, as he would a buggy or bicycle. At the same time, there are notable exceptions to this rule, for in respect to such articles as fan motors, or electric heating and cooking apparatus, the customer is left usually to make a selection for himself, and to buy the appliances in the open market. In the aggregate, the consumption of current by these devices is appreciable, and there are indications that electric current supply companies are becoming more logical, limiting their efforts entirely to that portion of their system which lies on the generating side of the meter, and leaving to the consumer the selection and purchase of everything on the registering side of the meter.

For the reasons just indicated, it is apparent that electrical manufactures are not only limited as to the number of possible purchasers, but that those who buy must of necessity be chiefly dwellers in urban centers. The extensions of the trolley and the telephone during the decade here reviewed have been of great and unexpected benefit to rural communities, but the telegraph and the electric light have found little scope for reaching the farmer, and very few of the motors now enumerated are employed on any kind of farm work. This is simply because there is no current available on the farm, and because even where current can be obtained by harnessing some convenient waterfall, the scattered areas and the shifting nature of the work to be done render it preferable to still employ, as for thousands of years past, costly animal labor and human toil. The tendency in farming to centralize is, however, giving electricity an opportunity in farming regions, with results that will be apparent in the next census. Meantime, many of the smaller electrical supplies have found their way into modern farm-houses, and the remarkable development of cooperative telephony among farmers in the Middle and Northern states is responsible in no small degree for the figures of manufacturing activity in that field.

While certain leading lines of American manufacture are subject to limitations imposed by the demand for or competition of foreign goods, it can be said that the electrical industries are not subject to any check of this kind. On the contrary, there has grown up a steady export trade, which would be very much larger but for the fact that the American apparatus sent abroad having at once proved popular and attractive, the patent rights for its manufacture in Europe have been purchased, or arrangements made for drawings and patterns. Hence, American electrical factories are now located all over Europe, under one name or another, in Paris, Berlin, Havre, London, Antwerp, and other cities, and their product embodies American ideas, or capital, or direction, or labor, sometimes all four. These factories employ thousands of men, and it is only fair to point out that the increase in the export of American electrical manufactures would be enormous but for this natural and inevitable restriction. The export of electrical apparatus in the census year 1900, amounting to $5,000,000, might easily have been five times as much but for the facts just noted. On the other hand, the electrical importations have been checked by corresponding conditions in the United States, though in much lesser degree, and are confined to but one or two specialties.

We must return once more to the subject of electrochemistry and electro-metallurgy to note a very large class of products which are essentially of electrical manufacture, but for which no figures are here included. The reason for their exclusion is of the same nature as that applying to the exclusion of electrolytically refined copper, which has been shown to mean almost all the copper refined in the United States. But this branch of the electrical art can not be overlooked, and a few figures in regard to it have been collated during the course of the inquiry. Some idea of its extent may be gained from the fact that while this report has been in preparation, an American electro-chemical society has been formed, with no fewer than 350 charter members. Perhaps a better idea can be gathered from the statement that already, at Niagara Falls, about 35,000 horsepower is used electrically in twenty different processes for reducing metals or chemicals; all of this work having grown up in the period between the Eleventh and Twelfth censuses. Among these industries may be mentioned the production of aluminum, which, owing to its electrical manufacture, has become so cheapened that it competes with copper as a conductor, and has found its way into a great many arts.

An aluminum wire, replacing one of copper, both of the same current-carrying capacity, is one-fourth larger in diameter, but will weigh only one-half as much, and at recent prices has cost 10 per cent less. The production of aluminum by electricity in America, in the census year 1899–1900, was 6,500,000 pounds, valued at $2,112,500. Another article is calcium carbide, from which acetylene gas is obtained, and which was first made commercially about 1895, in the United States. The quantity of this manufactured in the census year at Niagara was, it is stated, at the rate of about 12,000 tons per annum. Another notable product

is that known as carborundum, in which silicon and carbon are doubly united by the electric current, and result in an artificial abrasive that vies with the diamond in cutting power. Carborundum is now being sold in all the civilized countries of the world, and in 1900–1901 the American production was not less than 3,800,000 pounds, at 10 cents per pound. Incidental to this process has been that of producing graphite electrically, and one plant at Niagara, in 1900–1901, turned out over 1,400,000 pounds. These examples will suffice to indicate the importance of a field of electrical manufacture quite unknown to the public, by no means familiar to the electrician, and in no wise included in the present statistics.

In the report on the chemical industry, to which those interested must be referred for fuller details, Professor Munroe, expert special agent, states that by means of electricity, sodium and other metals, caustic soda, bleaching powder and other bleaching agents, bromine and potassium bromide, potassium chlorate, litharge, graphite, calcium carbide, carborundum, carbon disulphide, and phosphorus were being produced in the census year to a value of $2,045,535 in 14 establishments with a capital of $9,173,000, and employing 739 wage-earners. These figures are exclusive of those relating to aluminum.

The status or activity of a manufacturing industry may be fairly gauged as to progressiveness by the number of patents issued in regard to its processes. Viewed from this standpoint, the electrical arts are seen to have maintained for fifty years past, and particularly during the last quarter of a century, a steady stream of new and radical ideas, demanding the protection of the United States Patent Office for the investments of capital during those earlier years of effort required to reduce a crude primitive device to a perfected piece of apparatus. According to the interesting report of the Hon. J. S. Seymour, United States Commissioner of Patents, for the year ending December 31, 1895, it would appear that in the class of electrical generation up to that time 3,117 patents had been issued in a period of twenty-five years. In the class of electric railways, 2,010 patents had been issued; in that of motive power, 1,183; in electric lighting, 3,622; in telegraphy, 3,205; in telephony, 2,459; in electrical signaling, 1,934. It would thus appear that in these seven principal classes 17,539 patents have been taken out in a period of twenty-five years. These classes are, however, not entirely comprehensive of electrical work, which ramifies into so many other branches of industry.

It would appear from the later records of patents issued in the more specific electrical classes that during the four and a half years from 1896 to June 30, 1900, no fewer than 6,796 patents were issued, evidencing a great rise in the activity with which electrical inventors were still prosecuting their endeavors in these newer fields of discovery and application. It is also interesting in this connection to note that electrical inventors are at the head of the list of those who had taken out more than 100 patents during the years 1871–1895, inclusive, Thomas A. Edison being credited with 711 and Elihu Thomson with 394, these two heading the list of the 25 most prolific inventors in all fields. Others of great activity are enumerated as follows: Edward Weston, 274; Charles E. Scribner, 248; Charles J. Van Depoele, 244; Rudolph M. Hunter, 228; Rudolf Eickemeyer, 158; Hiram S. Maxim, 131; and Sidney H. Short, 111. These are but typical, however, of the work being carried on, for since the period named other men have come to the front in the electrical field under whose numerous patents a very large amount of the manufacturing of the day is done.

The amount of money spent each year by each member of the community for the necessities of life and its luxuries affords a measure of the extent to which the various arts and industries rank in importance in promoting the comfort and welfare of the public. It would seem, from the foregoing investigation as well as from the statistics that follow, that the average annual expenditure on electricity in the United States for each individual of a population not far from 75,000,000 was $7. Of this amount about $1.25 per head would represent the demand for electric apparatus and supplies; the income of the electric traction companies would reach not less than $3 per head; while that from electric lighting would reach about $1.50. The returns available would also indicate that not less than 75 cents per head would represent the expenditure on telephone service, and 50 cents per head the outlay for telegraph, fire alarms, and kindred work. These values, which are conservatively put, are, however, rapidly increasing. At least one explanation of the rapid rise of the United States to its present position in international affairs and among the manufacturing nations may be found in this manifest willingness of its people to pay as much for electricity as for bread.

Up to the period of dynamo development and utilization, electrical manufacture depended for its resources of current upon primary batteries. When it is considered that the zinc consumed in a battery costs about twenty-five times as much as the coal burned under a boiler, some of the harsh limitations imposed by the earlier conditions will be perceived; for with the battery there is no possible production of current economically, either in great volume or at high pressure. With the perfection of the dynamo, and its production as an ordinary piece of manufactured apparatus, great new arts at once sprang into being, the transition being so sharp and sensational that in the figures of the present report, covering $100,000,000 of apparatus, at least 75 per cent of the manufactured goods belong in classes that were unavailable to the public in the days of the primary battery, and would still be inaccessible if it were still the sole source of current supply.

Table 1 presents the comparative statistics of the industry for the censuses of 1880, 1890, and 1900.

TABLE 1.—ELECTRICAL APPARATUS AND SUPPLIES: COMPARATIVE SUMMARY, 1880, 1890, AND 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

	DATE OF CENSUS.			PER CENT OF INCREASE.	
	1900	1890	1880	1890 to 1900.	1880 to 1890.
Number of establishments	580	189	[1] 176	206.9	148.7
Capital	$83,130,943	$18,997,337	$1,509,758	337.6	1,158.3
Salaried officials, clerks, etc., number	4,987	[2] 683	[3]	630.2	.....
Salaries	$4,563,112	[2] $849,138	[3]	437.4	.....
Wage-earners, average number	40,890	8,802	1,271	364.6	592.5
Total wages	$20,190,344	$4,517,050	$683,164	347.0	561.2
Men, 16 years and over	34,150	7,289	1,132	368.5	543.9
Wages	$18,369,228	$4,082,847	[3]	349.9	.....
Women, 16 years and over	6,158	1,469	72	319.2	1,940.3
Wages	$1,701,110	$426,660	[3]	298.7	.....
Children, under 16 years	582	44	67	1,222.7	[4] 34.3
Wages	$120,006	$7,543	[3]	1,491.0	.....
Miscellaneous expenses	$6,788,314	$1,154,462	[5]	488.0	.....
Cost of materials used	$48,916,440	$8,819,498	$1,116,470	454.6	689.9
Value of products, including custom work and repairing	$91,348,889	$19,114,714	$2,655,036	377.9	619.9

[1] Includes 36 establishments reported as "electrical apparatus and supplies," and 40 reported as "telegraph and telephone apparatus."
[2] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. (See Table 26.)
[3] Not reported separately.
[4] Decrease.
[5] Not reported.

In 1900 there were 580 establishments, with a capital invested of $83,130,943, and with a total output, including custom work and repairing, of $91,348,889. It has been pointed out above how these gross figures are susceptible of enlargement for various reasons; and it should be added here that in the course of the investigation the returns of 712 establishments were considered, all of which embraced some product of an electrical nature, bringing the value of such product up to an apparent total of $104,738,719. The supplementary concerns thus noted have not, however, been included, nor their output, as there would be serious difficulty in apportioning to electricity the part of capital, labor, charges, etc., that might be fairly due that item as compared with other items of output from the same factory. It is indeed essential to point out that of the material used in electrical manufacturing establishments, very little is purchased in "raw" or crude form. The returns show that materials valued at no less than $46,272,533 were purchased in partially manufactured form.

The 580 establishments report 384 proprietors and firm members, but do not give the number of stockholders. There were 516 officers of various corporations and 4,471 superintendents, managers, clerks, and salesmen. All these are salaried employees, as distinguished from wage-earners. In the latter category the greatest number employed at any one time during the census year was 50,389, and the least number 32,582. To avoid misconception it should be stated distinctly that these statistics do not include management of workers in the fields of telegraphy, telephony, electric railways, electric lighting, etc., in which the apparatus produced is put into operation. Of the factory wage-earners thus employed the largest number of men, 16 years and over, was 37,298; of women, 16 years and over, 6,975; and of children, under 16 years, 679. The last two months of the year appear to be the most active in the factories, although very steady work the year round is indicated, the growing variety of electrical apparatus tending to equalize the output throughout all seasons, although outdoor construction of lines and connections ceases in many states during the winter. While the demand for lighting may fall off in the summer months, that for fan motors comes in, for example, and while factories equipped with electrical power make a lesser use of current when the days are long, the trolley car has then its heaviest burden of excursion travel.

It is to be noted that 19 states are separately enumerated in the general returns, New York leading the list with 134 establishments, Illinois coming second with 82, and Ohio and Pennsylvania closely contesting third place with 64 and 63, while Massachusetts has no fewer than 54. On the other hand, in gross value of output Pennsylvania heads the list with $20,967,587, as compared with $17,697,352 for New York, $11,641,177 for Illinois, and $8,259,612 for Massachusetts. New Jersey has also an excellent standing as a producer of electrical apparatus, with 35 establishments showing a value of $7,380,139, or more than Ohio, with $7,036,103. The preponderance of the Eastern states in the field of electrical manufacturing is shown by the fact that the 6 states—Pennsylvania, New York, New Jersey, Massachusetts, Rhode Island, and Connecticut—with 316 establishments, produced goods to the value of $59,470,637. The industry, however, is apparently not undergoing any process of consolidation so far as plants are concerned, for while control and management center chiefly in New York, Philadelphia, Boston, and Chicago, there are only 6 establishments reported of over 1,000 hands, while 322 employ between 5 and 50, widely scattered all over the Union.

The general figures do not reveal any tendency to excessive capitalization, for the capital of $83,130,943 is actively employed in producing a yearly product greater than itself in the census period by $8,000,000. This may be explained in part by the fact that the largest producing company had reduced its capital by about one-half not long prior to the census year, but has since restored to the present stockholders the amount thus mulcted, on account of the reparation of losses and the steady earning of a profitable income. It has been asserted in economic circles that electrical development has done its share in the creation of "securities" and "values" as a result of the combination and consolidation tendencies of the time, but the statistics of electrical manufacturing would appear to be quite clear from such criticism.

DYNAMOS.

There are no previous complete statistics with which to compare the production of dynamos, or "dynamo-electric" generators, as shown in Table 2.

TABLE 2.—DYNAMOS: NUMBER, HORSEPOWER, AND VALUE, BY STATES, 1900.

STATES.	Number.	Horse-power.	Value.
United States	10,527	770,832	$10,472,576
California	57	1,925	33,297
Colorado	40	875	18,000
Connecticut	408	13,182	263,590
Georgia	23	155	5,210
Illinois	1,102	59,696	808,640
Indiana	521	22,827	355,759
Kentucky	38	536	8,901
Maine	81	925	16,516
Massachusetts	711	53,930	757,486
Michigan	20	772	13,030
Minnesota	135	1,950	30,500
Missouri	25	2,500	35,000
New Hampshire	13	400	5,700
New Jersey	1,147	37,090	612,459
New York	1,220	269,708	3,280,871
Ohio	3,292	38,096	771,164
Pennsylvania	1,236	255,285	3,126,453
Rhode Island	10	400	8,000
Texas	15	600	15,000
Wisconsin	433	9,950	247,000
Direct current	9,182	428,601	6,297,925
Alternating current	1,345	342,231	4,174,651

The only basis of reference is that afforded by the separate statistics for the state of New York in the Eleventh Census, which revealed that in 1890, the dynamos installed up to that time in the state for electric lighting numbered 1,080 in isolated plants and 1,264 in central stations, those in isolated plants averaging about 20 horsepower and those in central stations averaging nearly 40 horsepower. There has been an enormous increase in the electric-lighting industry since that time, but it is believed that the relative proportion indicated between isolated plants and central stations has been maintained, while the size of the unit employed has risen considerably. A glance at the table herewith presented shows that in 1900 the average size of the dynamo produced had risen to nearly 75 horsepower. The reports summarized above include 1,345 alternating-current generators of a total of 342,231 horsepower, valued at $4,174,651; so that the output of direct or continuous-current apparatus would represent 9,182 machines of 428,601 horsepower, valued at $6,297,925. Hence it would appear that while the average size of the alternating-current machine was 254 horsepower, that of the direct current, considered alone, was but 47 horsepower.

These latter figures are a further guide to the changes going on in the manufacture of dynamos in the United States. The electric lighting art in this country began about thirty years ago with small machines to furnish current for arc lamps, and a very little more than twenty years ago with machines of equally modest capacity for incandescent lighting; and all were of the direct-current type. An ordinary arc lighter would carry from 25 to 40 lamps, requiring a 50-horsepower engine to drive it; while an incandescent-lighting dynamo feeding 1,000 lamps of 16 candlepower, and driven by a 150-horsepower engine was of very respectable size. The dimensions of these units grew steadily until about 1885, when the adoption of practical methods for utilizing the alternating current changed the whole aspect of affairs, although it was not until the Eleventh Census that any marked difference in the constitution of lighting plants could be ascertained. At that time, 1890, in the state of New York, only 3,340 incandescent lamps in isolated plants were operated with alternating currents; while in central stations, of the 1,264 dynamos in service, only 189 were of the newer, alternating-current type.

The figures presented for 1900, therefore, reveal in definite form the striking revolution that the dynamo art has undergone since 1890, and such limitations as a closer study in the plants themselves would impose can but emphasize these more recent conditions.

So far as the consumer is concerned, the current which reaches him for whatever purpose he may require it is still very largely of the direct type, but if it comes from a central station it is, in its origin, increasingly of the alternating type. As the above figures show, the direct-current machines average much smaller, and this is due to their use for isolated plants. Unless such isolated plants are intended for power-transmission purposes, they are invariably of the direct-current form. Isolated lighting plants with alternating-current dynamos are practically unknown, and the number of isolated power plants in mills and factories using alternating current is still very small; so that the great advance indicated in the returns is almost wholly due to the greater flexibility and availability given by the alternating current to central station work. This, in fact, was the vital claim made for it upon its introduction into the electrical-engineering practice of the country; and it is seen to have fully justified such arguments.

Before passing on, it should be noted here that the large output of direct-current apparatus, despite this radical and successful innovation, is due to the demand from many minor fields where direct current is still needed. Among these may be mentioned that of electroplating, where, moreover, the machines are quite small, usually of but a few horsepower capacity. Since 1890, it has also become the practice to utilize dynamos instead of primary batteries in busy telegraph and telephone offices. In the same period there has been developed the vast electric street-railway system, for which until lately all the generating apparatus has been of the direct-current type. More recently, plants for charging the batteries of electric automobiles have sprung up, and all these have required machines that will deliver direct current to the cells.

Owing to the trend of the arts depending upon the use of current in large volume, the size of direct-

current dynamos has apparently touched its upper limit, but the size of alternating-current dynamos exhibits a marked growth, the apparent average named above, 254 horsepower, being in reality a minimum. The peculiarity of the alternating current is that in conjunction with transformers for raising and lowering its pressure, it can be economically delivered at points very remote from the generating plants, whereas the direct current is by its nature limited in quantity, in pressure, and in distance. The later developments of the alternating current have been instrumental in accentuating the difference. The earlier work with it was done with what is known as single-phase current, but the great bulk of apparatus included in the total herewith given is of two-phase and three-phase type. The huge dynamos at Niagara are of 5,000 horsepower two-phase, and the latest machines contracted for there are of 10,000 horsepower, by far the largest ever built. Nor is this all. The 5,000-horsepower alternators there develop current at 2,200 volts, which is raised to 11,000 or 22,000 volts for the line to Buffalo, etc., by means of transformers.

In these newer 10,000-horsepower machines, the current is generated at a potential of 12,000 volts in the machine itself, dispensing with the "raising" transformers entirely, unless a higher line voltage is desired, and thus effecting a signal saving as to cost of plant. Another element of significance is that whereas the average price per horsepower of machine indicated by the figures given in the above table is nearly $14, these 10,000-horsepower dynamos have been sold at a price approximating only $7 per horsepower. To this it should be added that these machines built in the United States for an American company are to be employed in Canada, although the Dominion has excellent dynamo factories of its own.

There are some industries which, by reason of the location of raw material, the availability of skilled labor, the enterprise of capital, or the existence of a special demand, are centered strongly at some given spot. The accompanying table shows that in 1900 the manufacture of dynamo-electric apparatus was carried on in no fewer than 20 states, and was not limited to any section of the country. This may seem surprising, but in view of the general diffusion of electrical knowledge, there is no reason why good dynamos of medium capacity should not be as readily producible anywhere as engines, boilers, and water wheels, at least in the smaller sizes not dependent upon a large investment of capital.

A special feature of the production of dynamos has been its effect upon the whole range of social conditions and functions affected by public service supply. The broadening tendencies indicated by the above table are unmistakable. The pioneer electric lighting and electric railway companies began operations within a limited sphere of occupation, and each was devoted to its own branch of the work or specialty. In electric lighting this was more particularly the case. A class of companies came into being about 1880 to exploit arc lighting and nothing else. They were soon followed by another class, whose object was solely to supply incandescent lighting. Sharp rivalry sprang up and intensified for some years, when it was found economically expedient to consolidate their interests, a movement in this direction being organized at the time of the Eleventh Census. The electric railway and the stationary electric motor came into prominence at this juncture, but while the power motor could be supplied with the same current as that used for either arc or incandescent circuits, the railway motor demanded a distinct supply of its own at a pressure—550 volts—which still remains a standard for that work.

The electric railway system thus developed separately, and grew side by side with the lighting, but independent of it, until the advantages offered by the alternating current for annexing new territory and for purposes of economical consolidation became too apparent to be disregarded. The result is that both systems have settled down to a common basis of operation, the principle of which is that of generating current by alternators of the polyphase type at strategically convenient points in each community, transmitting it thence at high pressure to district substations, where the pressure is lowered, and where the current is converted into direct for distribution at the local points, the current being also reservoired by means of large storage batteries. This method is applied under exactly the same conditions to electric lighting and to electric railway work, and this has been a powerful incentive to the further consolidation under one management of these interests in each community. Of this state of affairs, the data as to alternating-current apparatus manufactured in 1900 is an interesting and valid indication.

Table 3 presents the number, horsepower, and value of dynamotors, motor generators, and boosters, by states, 1900.

TABLE 3.—DYNAMOTORS, MOTOR GENERATORS, AND BOOSTERS: NUMBER, HORSEPOWER, AND VALUE, BY STATES, 1900.

STATES.	Total value.	ESTABLISHMENTS REPORTING QUANTITIES AND VALUES.			Establishments reporting values only.
		Number.	Horsepower.	Value.	
United States	$379,747	649	14,397½	$354,747	$25,000
Connecticut	50	1	½	50	.....
Illinois	18,037	194	325	18,037	.....
Indiana	1,287	7	43	1,287	.....
Massachusetts	2,112	36	50	2,112	.....
Missouri	2,000	20	100	2,000	.....
New Jersey	82,091	245	3,450	82,091	.....
New York	201,665	39	8,584	201,665	.....
Ohio	20,850	11	1,054	20,850	.....
Pennsylvania	51,655	96	791	26,655	25,000

The class of dynamotors, motor generators, boosters, etc., shown in Table 3, represents as fully as could be

ascertained the product of these varieties of dynamo-electric apparatus built in 1900, but it would appear from inquiries that the manufacturers were not able to segregate these items; and that a large horsepower of "rotary converters" is also included in the dynamo output given above, for which no exact details are obtainable. The figures herewith presented serve to show, however, a marked development in this class of apparatus, designed to manipulate and transform current received at substation points from main stations, and employed not only in lighting and power enterprises, but in telegraph offices and telephone exchanges. As will be observed, the value is given at about $25 per horsepower, and the average size is 22 horsepower. The range of size and of winding is, however, so wide that no special significance can be attached to either item. Such apparatus has come into very large demand for changing direct current of one pressure or voltage into that of another; for changing alternating current from the transmission line into direct for the consumption circuits; for assisting in the regular charging of storage batteries; for maintaining the pressure at the points on a trolley road or transmission line where the distance from the power house results in its reduction below the degree of proper efficiency and economy; for use in telegraph offices to receive current from large dynamos and deliver small currents of varying voltages to different telegraph circuits, where previously large groups of batteries were necessary; and for use in telephone exchanges in connection with the storage batteries, "ringers," etc.

TRANSFORMERS.

As an auxiliary piece of electrical apparatus, the transformer has come to occupy an important place in the art of transmitting and distributing current, its cheapness, its high efficiency, and the fact that after installation it needs virtually no attention, being material elements in its favor. It consists essentially of a core of iron plates or wire surrounding or encircled by two coils of copper wire, one coil being of fine wire and the other of thick wire. The alternations of current in the primary coils connected to the line from the generator cause equivalent magnetic alternations in the core, and thus a secondary current is induced in or transferred to the other coils. If the pressure is to be lowered, the fine wire coil is connected to the line and the current is "stepped down." If the pressure is to be raised, the coarse wire coils are connected to the generator line, and the current is "stepped up" in the fine wires connected to the line. The ratio of "transformation" is broadly in proportion to the ratio of the number of turns of wire in the two coils, so that if the current is to be "stepped up" and is received at 1,000 volts, to be put on the line at 20,000, the turns of wire in the two coils will be in the proportion of 1 to 20. Similarly, if the current is generated by a distant alternating-current dynamo at 2,000 volts, and is to be delivered through the transformer to the local circuit of the consumer at 100 volts, it will be in the like proportion of 20 to 1 as to the turns of wire in the two sets of coils. These sets of coils inclosed in an iron case constitute the modern transformer, which is otherwise little more or less than the induction coil familiar for three-quarters of a century.

Prior to 1885 no alternating-current dynamos were built in the United States, but a system of alternating-current series distribution having been developed in Europe during the years immediately preceding, Mr. W. Stanley, who had studied the subject since 1883, constructed, so far as is known, the first lighting transformers built in the United States, and in 1886 these were set in operation in parallel at Great Barrington, Mass. The subject had also attracted the attention of Mr. Edison and of Prof. Elihu Thomson; while at the first electrical exhibition in 1884 in Philadelphia, some Diehl incandescent lamps were shown with transformer coils in series around the bases of the lamp, so that each lamp had its own tiny transformer. The first transformers built by Mr. Stanley were wound to reduce the 500-volt main line potential from the dynamo to 100 volts in the secondary, consumer's circuit; the primary and secondary layers being separated in those early days merely by the layers of shellacked paper. As a result of the work at Great Barrington, Mr. George Westinghouse took up the system, and the first large plant on a regular commercial scale was installed in the fall of 1886 at Buffalo. Such "single-phase" apparatus could, however, operate lights successfully, but not motors. The following year, under the same auspices, Mr. Nikola Tesla's polyphase apparatus for electric motors was brought forward, and thus by 1890 all the conditions were ripe for the great development with transformers of the modern alternating-current system, to operate lights and motors alike and for long-distance transmission purposes.

For the greater part of the last decade transformers were spoken of among electricians as "converters," but by general agreement, about 1900, that designation was limited to apparatus in which the change in the characteristics of the current is effected by the intervention of rotating members. In a transformer nothing moves, so far as the eye can determine, although a humming noise is an indication that work is being done. In 1890 transformers were of very small capacity, and able to furnish current to only a few lights. The census report of that year for New York enumerates specifically 7,282 transformers of a total capacity of 129,896 amperes, or about 18 amperes each, equal to, perhaps, 35 or 40 lamps. The returns here presented show the production in the census year of 36,513 transformers of 407,451 horsepower, or about 11 horsepower each, equal to at least 135 lamps, an indication of the fact that the average size is now about five times greater than in 1890.

Table 4 presents the number, horsepower, and value of transformers, by states, 1900.

TABLE 4.—TRANSFORMERS: NUMBER, HORSEPOWER, AND VALUE, BY STATES, 1900.

STATES.	Total value.	ESTABLISHMENTS REPORTING QUANTITIES AND VALUES.			ESTABLISHMENTS REPORTING VALUES ONLY.
		Number.	Horsepower.	Value.	
United States	$2,962,871	36,513	407,451	$2,960,171	$2,700
Illinois	37,516	1,234	5,185	37,166	350
Indiana	94,730	2,400	12,250	94,730	.....
Massachusetts	951,014	28,799	120,190	951,014	.....
Missouri	270,600	3,775	37,600	270,600	.....
New Hampshire	600	2	60	600	.....
New York	723,908	436	103,366	723,908	.....
Ohio	100,850	2,505	12,900	98,500	2,350
Pennsylvania	783,653	2,362	115,900	783,653	.....

As a matter of fact, however, the increase in size of this class of apparatus far transcends such figures. During the census year 7 transformers of 3,000 horsepower each were manufactured at Pittsburg and installed in 1901 by the Cataract Power and Conduit Company, of Buffalo, N. Y. They are believed to be the largest in the world. They are arranged in two groups of three each, one being retained as a reserve unit, and are placed in a substation near Buffalo for the purpose of reducing the voltage of the Niagara Falls current from 22,000 to 11,000 volts for distribution throughout the city to other transforming apparatus, which again lowers it in pressure for actual consumption.

Although these transformers are intended for use ordinarily, as above stated, on a 3-phase circuit, they are so arranged that they may be connected up for a number of other voltages. Thus the low-tension winding is arranged for either 2,200 or 11,000 volts and the high-tension winding for either 11,000 or 22,000 volts. The cases for these huge transformers, which stand considerably higher than a man, are made of riveted boiler iron with all the seams and rivet parts thoroughly calked. This case rests upon a cast-iron base and at the top has a cast-iron cover, through which two large manholes permit a ready inspection of the interior of the apparatus. These transformers are what is known as "oil-cooled," just as others are "air-cooled," and enormous ducts are provided between the coils which permit a free circulation of the oil through all the parts of the winding. To cool the oil in turn, water is circulated through four spirals of brass tubing placed inside the case below the surface of the oil. A thermometer is fastened to the side of the case with one end immersed in the oil, the temperature of which can not exceed a certain predetermined value without closing the circuit of an electric alarm. Provision is also made for gauging the height of the oil in the case and for quick removal of the oil in an emergency. The iron core of one of these transformers weighs 6½ metric tons. The efficiency of the apparatus is such that the transformation at the full load is effected with a loss of only about 1.3 per cent.

SWITCHBOARDS.

Table 5 shows the number and value of switchboards for light and power, by states, 1900.

TABLE 5.—SWITCHBOARDS FOR LIGHT AND POWER: NUMBER AND VALUE, BY STATES, 1900.

STATES.	SWITCHBOARDS.	
	Number.	Value.
United States	6,422	$1,846,624
California	20	10,000
Colorado	60	8,000
Connecticut	15	3,700
Delaware	1	1,500
Illinois	180	75,367
Indiana	30	14,944
Louisiana	2	50
Massachusetts	143	230,602
Michigan	3	380
Minnesota	10	500
Missouri	35	67,500
New Jersey	12	1,890
New York	2,506	1,055,288
Ohio	46	21,660
Pennsylvania	3,354	353,943
Rhode Island	1	200
Wisconsin	4	2,000

The production of switchboards for light and power is but one branch of a very large industry comprising the production of similar apparatus for telegraphic, telephonic, and electric railway work. The range of size in switchboards, particularly for light and power, is extremely wide, running upward from the small panelboards of a substation or a small office building to those which receive the current from the largest dynamos in central stations, some of which boards are so extensive and complicated as to be built three or four stories high, with stairways and even with electric elevators passing from floor to floor to facilitate swift manipulation. In the early days of electric lighting these switchboards were often built of wood, from which frequent destruction by fire resulted. Under the stricter requirements of the underwriters, as well as the rules formulated by national electric bodies, these important structures are now built throughout of fireproof material, almost invariably of slate or marble slabs upheld by steel and brass framework, the indicating instruments being set in the face, with the handles of the switching mechanism carefully guarded, while the cables from the machines and to the outgoing circuits end in heavy copper busbars, and are brought to the rear of the board heavily insulated and usually through protective metal conduits.

While some of these boards are double-decked, as stated above, others are arranged one section in height across the wall of the plant building, section being added to section until at last the total face may reach the extreme length of 100 feet.

To a certain extent the total of values given under the head of switchboards for light and power represents a duplication, since to the cost has frequently been added that of the indicating and measuring instruments from which readings are taken by those in attendance. So far as the small boards are concerned, a bulk contract

is usually taken to furnish a board inclusive of certain specified instruments. Some of the large manufacturing companies, however, have their own switchboard department, in which they plan and construct boards for various installations, and the measuring instrument equipment of which is chiefly, if not wholly, their own product, reported elsewhere in these statistics under other heads. An important development belonging to the census period, and marking a further advance in the safety and ease of manipulation of high-tension switchboards, has been the design of what are known as "dummy bench boards" in front of the main switchboard, with a diagram of the circuits, and the switch-operating handles incorporated into the diagram, the instruments being carried on separate sets of panels. The attendant thus not only operates low-voltage direct-current circuits, which in turn operate the main oil switches in the dangerous high-voltage circuits, but in the apparatus of this newer type the risk of making mistakes in throwing the switches, from which costly damage might ensue, is reduced to a minimum. With such diagrammatic pilot switchboard arrangements, it becomes easy to interlock mechanically the circuit-breaking and noncircuit-breaking switches in such a manner that the attendant is compelled to open and close them in their proper sequence. The method may be compared broadly with that applying to the interlocking railway switches handled from the switch towers in the railway yards and depots. Apparatus of this kind has been introduced with satisfactory results in such large plants as that of the Kansas City Electric Light Company, in the Manhattan Railway Power Plant, New York city, and in the power station at Niagara Falls.

Table 6 shows the number and value of switches, by states, 1900. This table includes the number and value of switches reported separately from switchboards, and embracing all the smaller varieties of switches used either on boards or employed to operate a single piece of apparatus directly, without the intervention of a board.

TABLE 6.—SWITCHES: NUMBER AND VALUE, BY STATES, 1900.

STATES.	SWITCHES.	
	Number.	Value.
United States	1,723,387	$1,129,891
California	700	1,125
Colorado	42,000	28,500
Connecticut	1,415,000	382,810
Illinois	2,000	3,000
Massachusetts	20,000	287,762
Missouri	108	1,380
New Jersey	31,200	21,932
New York	7,435	191,027
Ohio	1,286	7,515
Pennsylvania	203,458	254,340
Rhode Island	200	500

MOTORS.

Table 7 shows the number, horsepower, and value of various kinds of motors, by states, 1900.

TABLE 7.—MOTORS: NUMBER, HORSEPOWER, AND VALUE OF VARIOUS KINDS, BY STATES, 1900.

STATES.	Aggregate value.	DIRECT AND ALTERNATING CURRENT.			FOR RAILWAYS.			FOR AUTOMOBILES.		
		Number.	Horse-power.	Value.	Number.	Horse-power.	Value.	Number.	Horse-power.	Value.
United States	$19,505,594	35,604	515,705	$7,551,480	15,284	666,669	$7,568,841	3,017	8,220	$192,030
California	56,500									
Colorado	12,000									
Connecticut	97,597	455	4,328	86,560				290	638	11,037
Georgia	6,000	30	200	6,000						
Illinois	970,701	1,688	7,780	167,638				1,440	2,870	156,823
Indiana	105,904	643	4,613	96,364						
Iowa	750	6	50	750						
Kentucky	18,060	98	655	15,620						
Louisiana	60									
Maine	40,174	121	2,200	35,910				3	15	375
Massachusetts	1,892,500	6,393	23,754	410,176	4,078	94,791	1,095,069	2	2	200
Michigan	318,304	114	584	9,796						
Minnesota	13,500	64	700	13,500						
Missouri	175,180	598	6,110	91,705						
Nebraska	23,200	110	1,100	19,600						
New Hampshire	13,149									
New Jersey	2,073,555	9,268	86,873	1,501,755						
New York	4,470,881	3,996	80,990	1,222,255	4,746	214,749	2,120,000	52	120	12,000
Ohio	1,370,412	1,414	21,279	366,766	1,100	35,629	432,051	1,230	4,575	11,595
Pennsylvania	7,503,791	9,067	263,202	3,204,058	5,360	321,500	3,921,721			
Wisconsin	343,286	1,589	11,287	303,027						
Direct current		29,615	378,329	5,786,052						
Alternating current		5,989	137,376	1,765,428						

TABLE 7.—MOTORS: NUMBER, HORSEPOWER, AND VALUE OF VARIOUS KINDS, BY STATES, 1900—Continued.

STATES.	FOR FANS.			FOR ELECTRIC ELEVATORS.					MISCELLANEOUS.		
	Number.	Horsepower.	Value.	Total value.	Establishments reporting quantities and values.			Establishments reporting values only.	Number.	Horsepower.	Value.
					Number.	Horsepower.	Value.				
United States	97,577	12,766	$1,055,369	$2,523,901	385	6,730	$515,446	$2,008,455	7,913	11,392	$613,883
California				35,000	30	1,500	35,000		270	1,085	21,500
Colorado	150	2,005	2,000						100	570	10,000
Illinois	15,046	755	130,281	506,359	153	1,500	40,000	466,359	480	450	9,600
Indiana	15	65	1,300						206	103	3,240
Kentucky	90	100	900						20	16	1,540
Louisiana	3	(1)	60								
Maine				3,889	7	115	3,889				
Massachusetts	18,330	1,760	183,120	152,335	120	3,240	152,335		172	1,474	51,600
Michigan	131	178	12,508	296,000				296,000			
Missouri	5,195	(1)	82,500						200	20	975
Nebraska									80	8	3,600
New Hampshire	1,200	100	10,449						45	36	2,700
New Jersey	22,357	2,525	251,208	300,592				300,592	2,000	100	20,000
New York	14,560	2,333	152,051	945,504				945,504	212	571	19,071
Ohio	13,200	1,595	153,000						2,960	6,050	407,000
Pennsylvania	6,800	1,350	75,992	261,722	60	(1)	261,722		697	884	40,298
Wisconsin				22,500	15	375	22,500		471	25	17,759

[1] Horsepower not reported.

There are no records available prior to the present census as to the manufacture of electric motors in the United States, nor is there much data in the previous censuses as to their utilization. In the present investigation, the results of which are shown in Table 7, an attempt has been made to ascertain as fully as may be the different main groups into which electric motors are divided in their manufacture or use. Broadly speaking, motors are of two kinds—direct-current and alternating—and in their employment they constitute two classes, one for locomotion and the other for stationary work. It is a remarkable fact that, in spite of the enormous extension of alternating current and the production of alternating-current motors for stationary work, up to the time of the taking of the Twelfth Census virtually no alternating-current motors had been built in this country for purposes of traction.

Electric motors have been known for three-quarters of a century, and at least seventy years ago were applied experimentally to the propulsion of boats and cars and to the operation of machinery.[1] But as they depended for their supply of current upon primary batteries consuming zinc, costly chemicals, etc., they could assume no place in the industries of the world. The perfection of the dynamo, and the discovery of the fact that the dynamo was reversible, i. e., that if current were supplied to it, it would run as a motor, released electric power from the trammeling conditions that had hindered its development, and the art made an immense stride forward, particularly in America; so that when the first electrical exhibition was held at Philadelphia in 1884, the electric motors shown compared in number, efficiency, and commercial practicability with the arc and incandescent lamps, the telephones, the telegraphs, and other devices. When the Eleventh Census was taken, such motors were beginning to appear upon the circuits of electric lighting companies, and hopes were entertained that independent power plants for mills and factories would multiply. The returns for New York show that in 1890 there were being used in New York city, in isolated plants, 360 motors of a total of 310 horsepower, and that in all the state outside there were only 99 motors of 862 horsepower.

In the central stations of the state, outside the city of New York, there were 1,178 motors of 1,276 horsepower, and in the city of New York (Manhattan Island) there were 1,185 of 1,678 horsepower. No statistics that would indicate growth are available as to the state, but in New York city (Manhattan Island) the New York Edison Company reported for 1900 a total of 50,634 horsepower of motors connected to its circuits, showing a motor capacity in 1900–1901 thirty times as great as in 1890, considering only figures of one company. A corresponding increase is observable in most of the other large cities in the Union, and serves to explain in part the large production of this class of apparatus. In the city of Boston alone there are now connected to central-station power and lighting mains no fewer than 4,470 motors of a total capacity of 16,059 horsepower, which number, relative to population, appears larger than can be claimed for New York city.[2]

The relations of electric motors to the general subject of power distribution and transmission are discussed in considerable detail in the separate report on "Power Employed in Manufactures," prepared by Mr. Edward H. Sanborn and the writer. It may be here stated that of the total horsepower in manufacturing establishments, 11,300,081, only 311,016 horsepower owned, represented by 16,923 motors, and 183,682

[1] The Electric Motor and Its Applications, 1886, pages 8–13 et seq.

[2] Seventeenth Annual Report Gas and Elec. Light Comm., Com. Mass., 1902, page 170.

horsepower rented, was electrical. In other words, 4.4 per cent of manufacturing power was electrical. It is, however, to be observed that the increase in electrical power plant owned, from 1890 to 1900, was not less than 1,897 per cent, the amount in the earlier year being only 15,569 horsepower. This is an enormous increase, but the régime of electric power in factories had barely begun before 1900; while every increase in the number and capacity of motors will be generally represented by a corresponding capacity in the steam or hydraulic generating plant, as the motor does not displace these, but is adopted as a better means of distributing their energy than long lines of shafting, belts, and pulleys. Moreover, there is an illimitable use of electric motors outside manufacturing plants, as, for instance, in operating the auxiliary apparatus of large steam plants, in mines, in waterworks, on docks, in warehouses, on steamships, in office buildings, etc.

As to electric power transmission, this is also discussed at length in the power report referred to above, and its influence on the design of dynamo electric apparatus is treated in other portions of the present report. An effect of the improvement in electrical manufacturing and a better grasp of its underlying principles is seen in the notable results as to the development of waterpower. Apparently, the use of waterpower for manufacturing purposes has decreased relatively in thirty years from nearly one-half of the motive power to less than one-sixth, but the figures of manufacturing industry do not do, and can not be expected to do, justice to the growth of the utilization of waterpower as a means of obtaining electric current for light, heat, electro-chemical processes, electro-metallurgical work, etc. A small proportion of the energy of Niagara, for example, is used in factories; much of it is used to propel street cars at Niagara Falls, Tonawanda, and Buffalo, as well as to feed arc and incandescent lamps. The longest power transmission in the world, that in California, of 220 miles, from the Sierras to San Francisco, as well as intervening points, is not intended by any means as much for factories as for mines, street cars, lights, sewing machines, etc. The same remarks apply pertinently in many other places, where waterpowers have been developed to operate central lighting stations and street railways at a distance which had previously depended wholly upon local steam plants. In this category Richmond, Va.; Portland, Oreg.; Salt Lake City, Utah; Los Angeles, Cal.; Colorado Springs, Colo.; Ogden, Utah; Seattle and Tacoma, Wash.; Stockton and Sacramento, Cal.; Hartford, Conn.; Springfield, Mass.; Syracuse, N. Y.; and many others might be mentioned.

ELECTRIC RAILWAY WORK.

The statistics as to the production of motors for electric railways are striking and interesting, especially when viewed from the standpoint of the returns of electric railway work gathered by the Eleventh Census, when, for the first time, the industry made its appearance in the national records, none of the roads then enumerated having been in operation prior to 1886. In 1890 the street railway companies of the United States in operation numbered 789, of which 144 were electric. At that time there were 2,895 electric cars in use out of 32,505 of all kinds, and 1,262 miles of track out of 8,123. By 1899 the number of cable cars had declined from 5,089 in 1890 to 4,250, and horse cars from 22,408 to 1,489; but in the meantime electric cars had increased to the number of 50,658, and the number of miles of track to 17,969. The stimulus given the industry is further brought out by the fact that whereas in 1890 the total capital and funded debt for all roads appears to have reached $363,150,000, in 1900 the total for 871 street railway systems, chiefly electric, was $1,023,819,987 capital stock and $777,862,571 funded debt, making a total of slightly over $1,800,000,000, or just five times the figures of ten years before. On this vast capitalization the returns from the operation would indicate a net earning capacity of from 4 to 5 per cent.

The saving introduced by the adoption of electricity is indicated sufficiently by the annual report of the Metropolitan Street Railway Company, of New York, for the census year ending June 30, 1900. This system employs the most expensive method of electrical operation known, the trolley running in a slot under the car. It appears from the Metropolitan figures that the cost of operating with the cable per car mile was 17.76 cents; with the horse, 18.98 cents; and with the electric motor 13.16 cents. Corresponding figures were obtainable generally, and indicate a notable advance over the census data of 1890, when both cable and steam showed a lower percentage of operating expenses to earnings than did the crude young science of electricity. At that time, however, as was pointed out, the electric roads had for the most part just begun operation.

In the earlier days, such as those of 1890, a car with a pair of small motors of 15 horsepower each was well equipped, but it will be noticed that the average per motor in 1900 is apparently over 40 horsepower, while more motors were produced than the new cars would require if equipped with but 2 motors each. This discrepancy is explained not only by the large exports of electric-railway apparatus, but by the tendency to renew the old motors and increase steadily the capacity of the motors under the newer cars. Moreover, there was a notable extension of rural and elevated railway work, calling for heavier motors, and frequently involving the putting of 4 motors under each car, 1 on each axle. Not included in this report are 158 electric locomotives, valued at $288,071, nearly all for mining purposes, included in the report on locomotives by Mr. Edward H. Sanborn.

No separate itemization has been made in the present report of the dynamos—i. e., "generators" built for

street railway work—and no attempt has been made to keep separate the supplies required by this large industry. To differentiate between dynamos built for railway work and those built for other work is becoming daily more difficult, especially where all classes of service depend, as they now frequently do, upon the utilization of some distant waterpower. The requirements of the industry are, however, enormous, and the data in hand show that in the ten years between 1890 and 1900, the railway power plants of the United States had installed, available for traction purposes, about 1,000,000 horsepower of dynamos to feed current to motor cars of a capacity of somewhat over 2,000,000 horsepower. In the same ratio, the 660,000 horsepower produced in 1899–1900, as shown by the present figures, would require about 330,000-horsepower dynamo capacity in the station plant, or a little less than half the dynamo production for that period, as shown by the table of dynamo manufacture. These figures appear reasonably consistent with the state of the electrical industry as gathered from observation of its evolution and tendencies.

MOTORS FOR AUTOMOBILES, ETC.

The statistics of electrical manufacturing embodied in this report do not include the manufacture of automobiles, as the returns for builders of motor vehicles are included in the report of the carriage and wagon industry. It would appear, however, from the report of Mr. Edward H. Sanborn, expert special agent for that industry, that the production of electric automobiles in the census year was 1,575 vehicles, of a value of $2,873,464, out of a total of 4,192, valued at $4,899,443, of all classes. The statistics now given in Table 7 would include part of this electrical product, as the figures given of 3,017 motors for electric automobiles, of 8,220 horsepower, and valued at $192,030, are in general reported by concerns not in the carriage field. In other words, the motors are built by regular electrical manufacturers to meet the necessities of carriage builders and miscellaneous automobile manufacturers. Some of the automobile concerns have built their own motors, but many, even of the largest, have bought from outside motor makers, or have had the motors constructed in separate electrical shops which they owned or controlled, The noninclusion of electrical automobiles, while giving the figures as above, avoids any possible duplication, although it may err conservatively by not including motors built by those who are enumerated specifically in the carriage schedules. The same remark would, indeed, apply to the manufacture of motors for electric launches, no account being taken of the launch or electric submarine-boat industry in the present report.

The application of electricity to the propulsion of vehicles not running upon tracks is by no means a new idea, but dates back as far as 1835, while a French patent of 1852 shows a complete electric carriage, with motor connected with the axles by a chain of gears, and deriving current from a sulphate of copper battery. But as in other arts demanding current in relatively large volumes, there was no hope for the electric automobile under a régime of primary batteries; and it was not until the storage battery became available that this branch of electrical industry took definite shape. A period of pronounced activity in invention and practical development was seen from 1895 to 1900, resulting in the establishment of this well-defined branch of electrical manufacture, which was, however, attended at first by unreasoning and disastrous speculation. That an impression on street conditions has been made in cities, where the electric railroads have also been more generally introduced, is seen from the fact that during 1900–1901 the number of horses in Paris decreased about 6 per cent, and in London about 10 per cent. In 1897 a typical electric-cab service, the first of the kind in America, was inaugurated in New York city, with an equipment of 12 hansoms and 1 surrey, which has since grown into a business requiring about 300 vehicles in daily operation, running on the average a total of nearly 5,000 cab miles per day. The ordinary motive power for such vehicles consists of two motors, a storage battery of 44 cells, and a lever controller by means of which the driver regulates speed, etc. The mileage capacity of a charge of the battery on ordinarily clean streets is 28 to 30 miles.

There are, however, many heavier and many lighter electric automobiles built than are found in livery service. Some of them are used for dray work, and even for transporting and hoisting safes. For Washington, D. C., a line of electric buses has been built to ply between the hotels and railroad depots, while in every city and town light electric runabouts have been a familiar sight for the past three or four years.

FAN MOTORS.

The statistics as to electric fan motors are especially interesting, as illustrative of the development of a distinctively American industry that has grown up during the last census period. The records show that in the early eighties Dr. S. S. Wheeler, an electrical engineer, of New York, hit upon the idea of connecting a "screw propeller" fan to a small motor which he had been developing, to be operated from primary batteries. At that time there were few circuits available for incandescent lighting, and some of the fans were placed upon the series arc-lighting circuits, a combination that was at once dangerous and economically undesirable. Little advance was made until in 1888, when a successful attempt was made to introduce such fans upon the low potential, constant current circuits for incandescent lighting, each taking the place of a lamp. Battery current had been so expensive as to limit the use of this ventilating device, but as soon as central-station current was available the fan became popular, and about 1890 the industry as such took definite shape. A couple of years later the well-known electric ceiling fan was intro-

duced, and since that time the production of desk, bracket, ceiling, rotating, and other fans for domestic and foreign trade has grown by leaps and bounds, and American fan motors are now supplied to every quarter of the globe.

One improvement consisted in putting a guard around the fan to protect unwary fingers; another, in inclosing the motor by the field magnets and frames so that none of the working parts were exposed. Fans to work on trunnions, to hang in chains, or to swivel so as to throw the breeze evenly all around a large area are among the modifications; while an ingenious variety has resistance heating strips so arranged in front of the fan blades that in winter warm air is projected from them. The use of ordinary resistances in the base in connection with the fans enables the speed to be closely regulated, so that the velocity of the breeze is under the control of the user. The popularity of these fans has been so great that during the census year the supply was far short of the demand. In the aggregate the consumption of current by this apparatus is considerable, and it will be noted that the capacity of the 98,577 reported during 1899–1900 was 12,766 horsepower. The steady operation of these through the summer months would make a notable consumption of current, to some extent replacing that due to incandescent lamps. In fact, the average daily use of an incandescent lamp is barely an hour or two, but it is by no means unusual for a fan motor to be started at 8 or 9 a. m. and to run steadily through the summer day until 5 or 6 p. m. As a fan consumes on an average about the same current as an incandescent lamp, the fans that have been put on the circuits during the last ten years do much to equalize the winter and summer "load" on central stations and isolated plants.

ELECTRIC ELEVATORS.

The statistics of electric elevators in Table 7 are extremely interesting, but are not sufficiently comprehensive to admit of many deductions being drawn from them. This class of apparatus has been known to the industry for the past twenty-five years, but has made its greatest advances within the last census period. In New York city alone there are now approximately 3,000 electric elevators operated by direct current and 300 by alternating current. The amount of work that can be done by a modern electric elevator is exhibited by those installed during 1898–99 in the Park Row Building, New York, the tallest office building in the world—a vertical city with an average population of 4,000 people in daylight hours, exclusive of visitors. The contract for this edifice included 15 elevators. Five of these, passenger elevators, rise to the twenty-sixth floor, a vertical lift of 308 feet. One intended for safes, heavy freight, etc., runs from the subbasement to the twenty-fifth floor, a lift of nearly 424 feet. Each elevator equipment is complete in itself, comprising an electric motor, with vertical armature, a vertical screw about 23 feet long, a set of traveling sheaves attached to a nut running on this screw, a corresponding set of fixed sheaves suspended part way up the shaft, a moving counterweight, a pair of counterbalance chains attached to the weight, and overhead deflecting sheaves.

One other instance to be cited is the installation of an electric elevator in the Washington Monument at the national capital, rising to a height of 555 feet. Taking the place of steam hoisting machinery, the electric service has enabled the Government engineers to double the speed of the elevator with the same load, and have power to spare for lighting the Monument and its approaches. There is an average daily attendance of 500 people, and about 400 of these use the elevator, which, traveling formerly at 50 feet per minute, now rises at 100 feet per minute, thus making the trip in 5 minutes as against 10 formerly. The elevator is driven by a 35-horsepower multipolar motor.

STORAGE BATTERIES.

Table 8 shows the number and value of storage and primary batteries, by states, 1900.

TABLE 8.—BATTERIES, STORAGE AND PRIMARY: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Aggregate value.	STORAGE.				PRIMARY.							
		Total value.	Establishments reporting quantities and values.		Establishments reporting values only.	Total value.	Liquid.				Dry.		Value of parts.
			Number.	Value.			Total value.	Establishments reporting quantities and values.		Establishments reporting values only.	Number.	Value.	
								Number.	Value.				
United States	$3,679,045	$2,559,601	11,012,035	$2,482,228	$77,373	$1,119,444	$571,370	708,077	$569,870	$1,500	1,946,688	$316,013	$232,061
Connecticut	500					500							500
Illinois	425,479	97,538	200,400	21,000	76,538	327,941	247,588	214,135	247,588		41,500	7,875	72,478
Indiana	41,252					41,252	39,552	133,561	39,552		5,000	700	1,000
Iowa	12,000					12,000	12,000	15,000	12,000				
Maryland	47,969	1,200	600	1,200		46,769					10,000	46,769	128,125
Massachusetts	134,461	835			835	133,626	5,501	2,887	4,001	1,500			
Missouri	61,610	5,610	323	5,610		56,000	56,000	40,000	56,000				
New Jersey	116,524					116,524	5,000	50,000	5,000		1,100,000	100,000	11,524
New York	432,692	104,848	6,619	104,848		327,844	195,010	241,700	195,010		451,000	116,000	16,834
Ohio	280,330	225,311	7,563	225,311		55,019	10,350	[1]10,200	[1]10,350		339,188	44,669	
Pennsylvania	2,126,228	2,124,259	10,796,530	2,124,259		1,969	369	594	369				1,600

[1] Includes 1,200 testing batteries, with a value of $1,350.

As shown in Table 8, the production of storage batteries during the census year reached a valuation of $2,559,601, representing the manufacture of cells in which lead is the constituent metal. The data as to number of cells or weight are not easy to determine, but it is a well-known fact that Pennsylvania has long been the chief center of the industry; and the value for that state, reaching $2,124,259, is reported by the manufacturers to represent 10,796,530 pounds of lead plate. This amount of lead plate, however, accounts for only about five-sixths of the value given.

The storage battery of to-day of the lead-lead type is based upon observations a century old, and upon practical discoveries by Planté, in France, in 1860, when that inventor constructed the first practical storage cell out of two spirally-wound sheets of thin lead, which he separated from each other by strips of gutta-percha or a septum of canvas. This roll of lead he immersed in water with a 10 per cent solution of sulphuric acid. To render the cell active, he "formed" the plates by passing a current of electricity through them several times, changing the direction of polarity frequently and then discharging the cell between each charge. As a result, the "positive" plate became peroxide of lead, while the "negative" plate became "spongy;" and Planté thus had "active material" on the surface of the two plates for receiving or storing a charge, and for giving it up again when required to furnish current for any purpose; the spongy lead and the peroxide of lead becoming lead sulphate or oxide again, and ready for another charge.

The process of "forming" Planté plates was, however, extremely slow, the whole operation of manufacture requiring about two months. Another distinguished French inventor named Faure, whose first patent was issued in 1881, lifted the art to a new plane by showing that it was not necessary to manufacture the plates by the tedious method of "forming," but that the active material could be mechanically applied, in the form of a paste or powder, to thin, flat lead plates so constructed as to receive and retain the substance. With plates thus made the battery is virtually ready for immediate use. The paste is usually red lead for the positive plate, and litharge for the negative, combined with sulphuric acid. As to the manner of association, the support plates to which the paste is applied have, like the paste itself, undergone numerous modifications in the course of years, the object being to prevent the paste under the action of the current from falling out of the pockets or bridging across between the support plates, thus short-circuiting them; while another object has been to prevent the plates from buckling, etc., under the strain of work. The plates have therefore been generally stamped into grids with minute partitions, active material being pressed into the interstices, to which an endless variety of shapes has been given. After the plates have been grouped together in a cell they are formed in about a day by the passage of current as before, peroxide of lead appearing on the positive plates, and spongy lead on the negatives. The number of plates in any cell thus prepared for market varies, 15 or 23 not being unusual in average sizes, with one more negative than positive. Such a lead-lead cell has a pressure when fully charged of about 2.2 volts, which falls during discharge; and its working range may be said to run down to about 1.8 volts. The output of these cells is rated in ampere hours, the amperage of any cell depending upon the nature, number, and size of its plates—in other words, on the amount of active surface exposed to the effect of the current received; so that, for example, a 120-ampere hour cell would be one built to give a discharge of 12 amperes for ten hours or equivalent proportions, at a normal steady rate of output. Great ingenuity has been shown by manufacturers in improving on the Planté process, shortening the time required in formation, and in increasing the contact surface that can be secured in a Faure cell, giving it a greater capacity.

The lead-lead battery, as represented in the accompanying figures of manufacture, is often spoken of as very heavy, and the hope is expressed that it can be lightened. It has been pointed out, however, that as a matter of fact compressed air yields, weight for weight, only 27 per cent of the energy that is obtainable from a modern lead-lead storage battery. There are and have been a great many modifications and improvements, not only in the lead-lead form itself, but in other combinations of plates, such as the lead-zinc, the lead-copper, the alkaline-zincate, and some others, of which the Edison iron-nickel may be taken as a type. As none of these are known to have been manufactured in the United States during the census year, they are not further considered here.

The batteries are usually placed in jars of glass, pottery, hard rubber, or celluloid, if intended for light work, but if employed in central stations (to assist in furnishing current, which is charged into them by the dynamos at times when the plant is not busy), they are contained in large tanks, usually of wood lined with sheet lead, associated with heavy copper bars to convey the current, and with intricate controlling mechanism to protect the batteries from overcharging, and to allow them to come into play automatically when their service is needed. Special types of battery are manufactured for different classes of work, the great bulk of them being made at present to go into central stations for light and power, isolated lighting plants, and street railway power houses. It appears from careful investigation that the investment in storage batteries for such purposes has reached, all told, the amount of $11,000,000, with a capacity of 300,000-horsepower hours.

The work of the New York Edison Company may be taken as illustrative of the use now made by central stations of storage batteries to facilitate their work of

supplying current to the public. This company has in operation on Manhattan Island no fewer than 16 rotary-converter substations, and at nearly all of these storage batteries are installed, performing three important functions. They insure continuity of the service, despite any trouble or accident at the generating plants; they smooth out the irregularities of local demand; and they assist in the regulation of the system so that the lights burn steadily without flicker. The standard battery used in these substations contains 150 cells, each cell having a capacity of 4,000 ampere hours at a ten-hour rate of discharge. Connections from 20 cells at each end of the battery are brought out to the positive and negative end cell switches, which are operated by a small motor controlled from the main switch, each battery having two end cell switches on each side of the system, permitting simultaneous connection to bus-bars. These batteries are charged by what is known as a booster set. A further illustration of this class of work is furnished by the operation of electric locomotives in the Baltimore tunnel of the Baltimore and Ohio Railroad. The passenger trains are hauled over the Belt Line from Camden Station to Mt. Royal Station, and the freight trains are pushed from Mt. Royal Station to the end of the line. In order to facilitate the work of handling such heavy trains, a storage battery of no fewer than 320 cells was installed in tanks each able to hold 51 plates. This battery has a present capacity of 1,520 amperes at the hour rate of discharge, and has done such heavy work that even when the main power station was out of service for four hours the entire load was carried by the battery without trouble.

In automobile work the requirements have been such as to stimulate the ingenuity of the manufacturers to the utmost, with the result that an export trade in completely equipped American electric vehicles has been established. The heaviest steady work of this kind has been that done by the electric livery and express system in New York city, where the earlier standard brougham or hansom battery consisted of 44 cells, which, complete in the tray, with all connecting straps, weighed 1,790 pounds, the total weight of such a vehicle with driver and two passengers being 5,300 pounds. The battery of the vehicle described would, under average conditions, attain a radius of 28½ miles. The later equipment of 44 cells has weighed 1,650 pounds only, and the mileage capacity has reached 42.7 miles. Of 75 batteries of the latter type in steady service, it is stated that in about a year they had made an average of 3,742 miles each, and seven of them had made 4,500, the maximum being 4,958. The average capacity was then 4¼ hours at an output of 39 amperes. These and other figures of automobile work indicate steady improvements in manufacture from which the extension of the industry is predicable, entirely aside from central-station work or the introduction of newer and revolutionary types.

The storage battery has also been manufactured for electric launches and for street railway work. The number of launches thus equipped is not known, a separate report not having been taken, but they are increasing all over the country, particularly in connection with parks reached by trolley circuits, from which they can be charged with current. The largest fleet of this kind manufactured was that furnished for the World's Fair at Chicago in 1893, consisting of 50 launches, each about 36 feet in length and equipped with 66 cells of battery. During the fair the number of passengers carried reached 1,000,000, and on Chicago Day the 50 boats made 622 trips, each of 3 miles, and carried 25,000 passengers, an effective illustration of possibilities in that direction. Storage-battery boats of this type have now become quite common and are being built for various classes of work, including floating-hospital service, police patrol, etc.

As to storage-battery street cars, upon the development of which, during the past decade, manufacturers built high hopes, very few remained in operation at the close of the period, and the only notable instance of present work in America is that furnished by one of the short cross-town lines of the Metropolitan system in New York. At one time the objections entertained in many cities to the overhead trolley favored the belief that storage-battery street cars were destined to enjoy general adoption in spite of the costliness of their operation and maintenance; but the success of the underground trolley, deriving current through a slot beneath the car, came in time to prevent this development.

A little work has been done in the construction of portable equipments for use in such places as mines, etc., where it is difficult or dangerous to introduce wires carrying live current, but the results are trivial, and have made no impression on the industry.

PRIMARY BATTERIES.

Table 8, dealing with primary batteries, shows this class of apparatus divided into 3 kinds—liquid, testing, and dry—and indicates a total output of $1,119,444, inclusive of $232,061 for battery parts. Work in the field of primary batteries, during the period covered by the two census reports, has been subject in a notable degree to restrictions arising from the more general resort in the telegraph and telephone office to the use of current generated by dynamo electric apparatus, and to the substitution of storage batteries. At one time it was impossible to visit any large telegraph office, for example, without being confronted by the spectacle of a large battery room occupied by several hundred cells connected to the different circuits. At the present time the untidy battery room, with its numerous jars, its acids, and its incessant handling of the cells for cleansing and renewal has practically disappeared from all the large telegraph centers, and has been replaced by dynamo rooms occupying much less space, free from fumes and gases, and furnishing cur-

rent in the widest possible range of pressure and volume. In the same manner the changes in the telephonic art have lessened the call for batteries, while even in the ordinary bell and annunciator work there is a tendency to employ dynamo current wherever the equipment runs above a few circuits and bells. On the other hand, however, the perfection and greater cheapness of the dry battery during the last few years have given an enormous stimulus to its utilization, so that many varieties are now on the market, and they have, by their great cleanliness and convenience, led to the installation of hundreds of thousands of small electric bells and other appliances throughout the country.

The cells included under the liquid class in this report, as returned by the manufacturers, are of both the open and the closed circuit type, largely of the former, and might also be divided into single and two fluid cells. The statistics of the closed circuit, or gravity, or constant type, would undoubtedly be larger, but for the fact that large telegraph companies using them do not usually go into the open market to make purchases, but execute their own installations and renewals, shipping the crow-foot zincs and other elements to the various offices in accordance with the demand. The gravity battery, or the ordinary telegraphic type, is a glass jar about 6 inches in diameter and 8 inches high, with a copper plate at the bottom of the cell and one of crow-foot zinc at the top, suspended from the rim by a notched bracket or hanger. Sulphate of copper, or blue stone, is placed at the bottom of the cell around the copper plate, and sufficient water poured in to cover the zinc at the top, the blue stone dissolving rapidly and forming the sulphate of copper solution. After the cell has been in action a short time, sulphate of zinc is formed in solution in the water at the top, and the heavier sulphate of copper remains at the bottom; and owing to their respective specific gravity the two fluids do not mix. The other familiar type of primary battery, called the open circuit, of which the best known is the Leclanché, is in reality much more an article of manufacture, and has been very largely supplied in the past for electric bells and for telephone work. It is a zinc-carbon battery, in which the exciting liquid is a solution of sal-ammoniac and not diluted acid. The varieties of such open-circuit cells are, however, almost endless, and their production would still be multiplied, but for the check interposed, as already noted, by the changes in telephonic operation and by the use of the dynamo in telegraphy.

The manufacture of primary testing batteries is quite small, but should be presumably larger than is indicated by the returns, the schedule from only one state itemizing this product. Testing batteries as manufactured in this country are usually of the chloride of silver type; the elements in a very small glass tube consisting of a rod of chloride of silver and silver wire, a rod of chemically pure zinc, and sal-ammoniac liquid, the whole being sealed by means of paraffin wax. A number of these cells are packed in a small box and so arranged that any given portion of them can be switched into circuit; and their use in such portable state is usually to test the insulation resistance of electric wires and cables. Cells of the same class are also used for medical purposes.

The word "dry" in connection with the third class of batteries, which has come into very large use within the last ten years, is a misnomer, the batteries not being actually "dry," but having, instead of liquid solutions around the carbon or zinc, paste-like substances which are capable of retaining moisture for a long time, or which are hygroscopic, or which can be furnished occasionally with a small amount of liquid. The fact that in these batteries there are no free liquids to spill and damage the surroundings, and that practically no attention whatever is required, has given them immense popularity, especially for portable purposes, as in electric gas lighting and in small pocket lanterns; also for push buttons in carriages, trains, steamboats, houses, etc. The reduction in price has also greatly assisted in the popularization of this article, the cost per cell being to-day only a little more than 10 cents, while only a few years ago it was three or four times that amount. The value and importance of this minor piece of apparatus in assisting many other applications can not be too strongly emphasized.

Some of the primary batteries included in the above table are in successful use for the propulsion of fan motors and other small power devices, but the repeated attempts at the perfection of cells adequate to furnish a steady current for driving automobiles, for lighting, or for motors attached to machinery have proved failures, and the only battery of this type included in these returns, so far as the schedules would indicate, is the Edison-Lalande, with elements of zinc, copper-oxide, and caustic-potash solution. At its low voltage, this cell will furnish current steadily in considerable volume, and is employed for the operation of such apparatus as phonographs, in which the motive power employed, while small, is used continuously and amounts in the aggregate to a moderately large figure. As a general thing, however, the cheap production of current by the dynamo, especially during the past decade, has left the economic possibilities of the primary battery far behind, a fact which will be readily understood when it is stated that the unit 1,000 watt-hour of electric energy derived from the primary battery would cost in the consumption of zinc alone nearly 10 cents, to say nothing of all the other items and the enormous depreciation; while in a dynamo central station the cost of coal for the same output will not be one-half cent.

In other words, as already noted elsewhere, electricity depending upon the consumption of zinc in a battery is at least twenty-five times as costly as current obtained from the consumption of coal under a boiler furnishing steam to an engine, which in turn drives the generating dynamo. Current from central stations is supplied to-day at prices ranging from 20 cents down to 5 cents, and possibly even lower for very large quantities.

CARBONS.

Table 9 shows the kind, number, and value of carbons, by states, 1900.

TABLE 9.—CARBONS: NUMBER, KIND, AND VALUE, BY STATES, 1900.

STATES.	Aggregate value.	LIGHTING.				BATTERY.		BRUSHES.		FURNACE.		MISCELLANEOUS.			
		Total value.	Establishments reporting quantities and values.		Establishments reporting values only.	Number.	Value.	Number.	Value.	Number.	Value.	Total value.	Establishments reporting quantities and values.		Establishments reporting values only.
			Number.	Value.									Number.	Value.	
United States..	$1,731,248	$1,263,732	172,955,922	$1,262,623	$1,109	355,583	$30,777	5,701,143	$136,679	41,749	$10,974	$289,086	12,176,522	$283,625	$5,461
Illinois	170											170	20,000	170	
Indiana	182,000	182,000	28,000,000	182,000											
New Jersey	43,067					319,583	27,864	373,294	9,742			5,461			5,461
New York	17,667	2,713	65,118	1,604	1,109	36,000	2,913	120,238	12,041						
Ohio	1,311,560	970,202	132,414,866	970,202				3,959,285	90,129	36,749	8,974	242,255	12,000,000	242,255	
Pennsylvania	176,784	108,817	12,475,938	108,817				1,248,326	24,767	5,000	2,000	41,200	156,522	41,200	

The use of carbon is so closely associated with the development of electrical manufacturing that it has become well-nigh as essential as copper. Hardly a branch of the industry can be named in which carbon in some form is not relied upon as an auxiliary or indispensable factor, and this is true of the latest developments no less than of the earliest. This was evidenced at one of the recent exhibitions, where a single carbon company displayed in the smaller forms of its manufacture no fewer than 1,000 different shapes of the material, the forms and sizes ranging all the way from small globules less than one thirty-second of an inch in diameter to large electrodes used in smelting, of which the weight reaches as much as 600 pounds. At one end of the scale of utility is the tiny granule used in a telephone transmitter, while at the other are solid carbons 60 inches long and 9 inches in diameter, or blocks 10 by 10 inches, employed in electrolytic and smelting work.

Carbon has long been a material used in primary battery manufacture, and electrodes of it are part of the most efficient forms of cells of the wet and dry types. But it is in electric lighting that its value has been most appreciated, for both in the arc light and in the incandescent lamp it is a vital feature. The arc light depends upon its consumption, and hence even in "inclosed" arc lamps its renewal is a matter of importance. Details of these different items are given in Table 9.

Early in the century, following up kindred experiments, Sir Humphry Davy showed that small cubical sticks of carbon, whose points were separated from each other about the sixteenth of an inch, would emit a brilliant flash of light when a current of electricity was passed through them. His carbons were composed of powdered wood charcoal mixed with a little sirup of tar, molded into shape under a pressure of about a hundred pounds to the square inch, and baked in a crucible in a very hot fire. During the next seventy years numberless experiments were made in Europe and in this country to produce carbons from a variety of mixtures. The electric dynamo and arc lamp not having been perfected until the closing years of the decade 1870–1880, the demand for carbon electrodes was very limited. Consequently they were made only by hand in two or three continental laboratories, on the smallest scale and at a very high cost. In 1876 the principal maker, Carré, sold his carbons at from 35 to 40 cents each.

With the introduction of the Brush dynamo and arc lamp a large commercial demand was quickly created, and how to supply carbons of high quality at a low cost for these lamps became a problem for electricians, second only in importance to the invention of the arc lamp. Mr. B. F. Miles, who was engaged for some years in the industry, notes that the first step in this problem was to find suitable raw materials. Search had been made on both continents with comparative failure. Carbon produced in gas retorts seemed the most feasible, but the varying impurities and refractory nature of this material made it at best a makeshift. Till the fall of 1878, however, it was the principal source of supply, and carbons were still made in rectangular form with blunt ends. Philadelphia has a large number of arc lamps with such carbons in use at the present time, notably at Fairmount Park. The first American carbon manufacturer was David Thompson, of Newark, N. J., whose plant was only about 20 feet broad by 30 feet long, comprising a hand mortar, a rude brick oven and mixing pan, a hand bolting and grinding outfit, and a few iron and steel molds, with which he made the first arc-light carbons produced in this country.

The development of the American carbon industry is due largely to two men, the celebrated inventor, Charles

F. Brush, and the late Washington H. Lawrence, of Cleveland, Ohio. While engaged in the invention of his arc dynamo, Mr. Brush had necessarily been investigating the nature of carbons and planning for their manufacture. In 1877, with Mr. Lawrence, he began a series of experiments on petroleum coke, and located the desired supply of commercial carbon in its raw state within a mile of the Brush Electrical Company's factory. The Standard Oil Company for years had been burning the last product of the distillation of crude oil, formed at the bottom of its paraffin stills. Shoveled from the stills in great lumps, like the largest anthracite coal, it resembled the latter at a little distance in its shiny black appearance. This refuse product of oil was to give to the world, by electricity, its most brilliant light.

Mr. Brush was puzzled over some properties of the raw material, which is pure carbon, it is true, but also, like the purest anthracite coal, a nonconductor of electricity in the raw state. After having heated the coke in a little crucible in a forge fire, he found that the nonconductor changed into a conductor, and the main result was gained. Experiments were then conducted to ascertain the grain best adapted for burning in the electric current. These results attained, it was decided that the best adhesive material to bind the particles of carbon together was coal-tar pitch, and the bases of the new manufacture were then broadly laid, to continue down to the present time, with such other slight additions as the experience of manufacturers has found to be advisable, and with a greater resort to automatic and labor-saving machinery. One of these improvements in manufacture was plating the carbons with a very thin deposit of copper, to add to their conductivity, etc.

Out of the product thus created sprang a notable industrial development, which resulted after due time in the consolidation of 12 plants, representing three-quarters of the carbon industry of the entire globe. One plant alone, in the period covered by this report, had a factory covering 25 acres, with 18 acres of floor space, employing 500 men, with a capacity of over 4,000,000 carbons for arc lamps per week, not to mention carbons of great variety in other branches. It will be noted that the returns account for a production in 1900 of 172,955,922 carbons for arc lamps. The production would have been larger but for the steady supersession of open arcs by inclosed, the latter requiring a new set of carbons but once in 100 hours, whereas the older open type required new carbons once a day. Nevertheless, the inclosed arc lamps have stimulated the production of a higher grade of "soft core" carbons, commanding a better price.

Next to the arc-light carbon industry in the census period comes that of carbon brushes. The use of these is now universal, especially in electric railway work, the copper brushes previously used, with the action of dust and grit from the street, cutting too deeply into the collecting commutators of the motors under the car. To quote the language of one distinguished authority who studied the problem at close quarters:[1]

"In the early days of electric railway work one of the chief setbacks was the enormous wear and tear of certain parts of the machinery, chiefly those known as commutators. This difficulty was solved by the invention and application of carbon blocks in place of metal brushes. The carbon brush thenceforth became almost as essential to the railway motor machinery as the carbon stick is to an arc lamp, and did more than anything else to change the prospect of failure into inevitable success."

This is true not only of street railway motors, but of the largest generators and the smallest office fans, upon the commutators of which will also be found carbon brushes, imparting a smooth glaze to the metal instead of cutting deep, destructive furrows into it, as did the copper wedge strips previously used.

GRAPHITE.

This section of the report as to carbons would not be complete without reference to the production, artificially by means of electricity, of graphite in large quantities, permitting its greater utilization at lower cost in the electrical and other arts. Mr. E. G. Acheson, to whom is due the development of the now familiar abrasive carborundum, experimented in 1895 with a process for the purification of coke by direct heating with the electrical current. This volatilized the impurities and left the carbon in a practically pure state, with greatly increased electrical conductivity—in other words, there was at least a conversion to the graphite state. Later in the same year he applied for a patent for the conversion of carborundum into graphite by subjecting it to heat that would be sufficient to volatilize the silicon out of the compound, leaving the graphite. In this process the regular charge of coke, sand, salt, and sawdust employed in making carborundum is packed around a carbon core, the current through the core regulated so as to first form, and then decompose the crystalline carbid of silicon. The result of this and later practical developments was the formation of a manufacturing company to put the product on the market, so that as early as 1897 there was an output of 162,382 pounds. The methods and processes experimented with and perfected include a wide variety of graphite articles, such as electrodes for metallurgical and chemical work, graphite in bulk for grains or powders, rheostats, the "lead pencils" of commerce, and other products.

In connection with this work it should be recalled that Moissan, the Frenchman, who has pushed the employment of the electric arc so far as to produce minute fragmentary diamonds in his furnaces, noted in 1896 the production of graphite from a diamond heated in the arc and from the similar treatment of sugar charcoal purified by chlorine and of purified wood charcoal.

[1] Elihu Thomson, The Forum, January, 1898.

It was, in fact, due to his investigation in this field that he was led to his celebrated observations on the formation of diamonds by the sudden cooling in mercury or lead of molten iron saturated with carbon. Out of all such work it was but natural that fanciful speculations should arise as to the possibility of establishing factories for the regular manufacture of genuine diamonds at Niagara Falls, where the cheap current and other essentials would be available, but nothing has resulted within the period under consideration from these plausible and sanguine theories. The fact remains, however, that in our modern electrical furnaces diamond dust has been produced, and the steps leading to the manufacture of larger crystals will be but sequential.

As to the use of electrically manufactured graphite, a characteristic feature which distinguishes it from other forms of graphite, is that it can be easily cut up by machines. This makes it possible to cut easily artificial graphite electrodes of any form required in the arts. Some interesting results and comparative tests with amorphous carbon electrodes and with graphite electrodes in practical furnace work in the industrial processes on a large scale, show the much greater resistivity to oxidation of the graphite electrodes. Their efficiency was found to be from four to eight times as great as that of amorphous carbon, while their price was only three times as great. Graphite anodes are highly recommended for the electrolysis of chlorides, in which work they are practically indestructible, but they are not recommended for the electrolysis of sulphates.

ARC LAMPS.

Table 10 shows the number and value of open and inclosed arc lamps, by states, 1900.

TABLE 10.—ARC LAMPS, OPEN AND INCLOSED: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Total value.	OPEN.		INCLOSED.	
		Number.	Value.	Number.	Value.
United States	$1,827,771	23,656	$276,481	134,531	$1,551,290
Connecticut	18,093	1,391	18,093	.....	.....
Illinois	120,361	6,297	57,307	6,025	63,054
Indiana	91,980	2,193	30,696	5,322	61,284
Massachusetts	729,815	8,291	100,000	56,874	629,815
New Jersey	126,705	222	1,880	8,180	124,825
New York	281,367	2,612	89,605	18,655	191,762
Ohio	311,500	950	12,200	26,100	299,300
Pennsylvania	195,950	1,500	14,700	13,375	181,250
Rhode Island	2,000	200	2,000	.....	.....

The arc lamp has been so long before the public, conspicuous on every main thoroughfare, that it is one of the best-known products of electrical industry. It is a familiar fact that in arc lamps the light is created by the passage of current between two slightly separated sticks or pencils of carbon, the consequent consumption of the carbon producing and maintaining an "arc" of bluish-white flame at the gap between the two points. The light is thrown downward from the "crater" of the upper carbon. The manufacture of arc-light carbons has been treated under another section of this report, in which were also discussed applications of the arc to metallurgical processes. The arc is also applied to welding metals together, and, being the most intense source of artificial heat that is known, its uses in this respect are increasing rapidly. But no consideration is given here to melting, fusing, or welding operations with the arc, although the electro-magnetic and other mechanism for controlling the "feed" of the carbons is virtually similar in all instances. Such mechanism in lamps is made to bring the carbons together in order to complete the circuit and strike the arc, to keep the carbons at a suitable distance apart, and then to feed the carbons together as they become consumed.

Arc lighting began with but one or two lamps supplied with current from the dynamo, but the machines were soon developed, especially in America, to carry 10, 25, or 40 arc lamps in one series circuit, each lamp being provided with shunting devices to continue the operation of the circuit should trouble develop in one lamp; and currents of 10 amperes and 40 or 50 volts to the arc were used, the current being furnished from direct current dynamos. All the circuits without exception were carried overhead on poles, and as the voltage was high, the frequent breakage of the wires by storm, accident, etc., resulted in many interruptions of service, deaths, and fire. For many years the manufacture of arc lamps and all that pertained to their operation was continued on the direct current, constant current, series, open arc basis, but the census period under review witnessed a remarkable change to constant potential, multiple, inclosed arc methods, with current supplied not from dynamos built specifically for arc lighting, but from direct or alternating dynamos feeding incandescent lamps also. Throughout the earlier period, from 1880 to 1890, arc lighting was conducted as a separate industry. Many concerns built only arc lamps or arc dynamos, licensing central station companies, which furnished only arc lamps for street and commercial purposes; but from 1890 began a great development of modern lighting methods, under which the same companies undertake to operate lights and motors of all classes over the same common circuits and to sell current for all uses whatsoever. This revolution was largely fostered by the introduction of the alternating current. The arc lighting systems had covered large territories with a few series circuits, along which lamps were sparsely scattered. The incandescent lighting companies had occupied limited areas, within which current at low voltage was supplied over heavy copper mains, chiefly underground. The flexibility and range of reach of the alternating current brought the two methods together with irresistible power, and by 1900 the work of unification, accompanied very generally by that of financial consolidation, had been almost universally effected. Statistics carefully compiled during the

second quarter of 1899 showed 2,360 central stations owned and operated by private corporations, reporting 280,439 arc lamps, 2,679,432 direct incandescent, and 5,380,932 alternating incandescent lamps on their circuits, with 1,159,788 horsepower of motive machinery in their generating plants. To this should be added the municipal plants owned by communities and the isolated plants, in order to get an accurate idea of the field to which manufacturers have had to supply apparatus. With regard to municipal plants, it may be noted that in the fourteenth annual report of the Commissioner of Labor, for 1899, published in the census year, it was stated, as the result of the investigation into water, gas, and electric light plants in the United States, that there were 460 municipal plants, of which 320 reported an investment of $10,908,929, these plants being almost wholly employed for arc lighting service. As to isolated lighting plants, their number and magnitude is a subject of mere conjecture; but there are probably over 20,000 of all kinds, and the lamps, with those in municipal plants, have been estimated to number nearly as many as those furnished by private companies giving public service.

Arc-lamp manufacture for many years was governed by the fact that the carbon was burned very quickly. Operating on direct-current circuits, the positive, upper carbon had to be fed down steadily to maintain the arc, the consumption of a one-half inch carbon stick in a nominal 2,000-candlepower lamp being about 1 inch every hour and the negative carbon about half as fast. This fact led at first to the development and manufacture of lamps with narrow, flat carbons, instead of pencils, so as to give the arc plenty of material to work upon, but with all these forms the arc was unsteady, and this resulted in the evolution of the double-carbon lamps, in which two sets of pencils or cylindrical carbons are placed in the same globe, with clutches and other devices for causing the arc to burn first in one pair and then in the other pair of carbons, or to switch in one set of carbons after the other pair has been consumed. In this manner the necessity of frequent trimmings is obviated, and lamps are secured which will burn through the longest winter night or for more than one night without renewal of carbons by the lamp trimmer. These remarks as to carbon consumption in direct-current series lamps apply to alternating-current lamps, except that in the latter, as each carbon is alternately negative and positive, the two pencils burn away equally. Such lamps also have to be supplied with current through transformers, and another point is that the number of reversals of current per second has a good deal to do with the steadiness of the light. Even the very best of the old open arc lamps had a tendency to flicker, and below 35 "periods" or double reversals per second, the unsteadiness of the alternating arc is apparent. On the other hand, above 70 periods, the alternating arcs make a disagreeable humming; and 60 cycles is the frequency that has therefore been adopted in lamps of this class.

A third class of arc lamps in regular manufacture of late years are those of the direct current, constant potential type, which are put not on separate circuits, like the earlier series form, but on the same circuits as incandescent lamps, motors, and trolley cars. As the voltage of incandescent circuits is, say, 110 and 250 volts, and as each arc lamp requires but 45 to 50 volts, they are put in groups of two or four across the mains, while in trolley work, where the voltage is 500, they will be put eight or nine in such a series; in all cases with a resistance to help equalize the voltage and render the system commercially operative, the resistance being placed either in the lamp hood or at some convenient place near by.

The significant development in arc lighting of the last few years is indicated, however, by the fact that of the 158,187 lamps reported as manufactured in 1900, only 23,656 represented all the various open types. One of the chief drawbacks in arc lighting has been the fact that, in spite of the volume, brilliancy, and cheapness of the light itself, the labor item due to the necessity of frequent renewals of the carbons has always been a serious one. Hence at the very beginning, on the principle that when air is kept away from the carbon it burns longer, being deprived of oxygen, the attempt was made to inclose the arc. But these efforts, though renewed, were not successful until, about midway in the present census period, 1890–1900, the work of various inventors resulted in the production on a commercial basis of excellent inclosed arc lamps, in which the gradual disappearance of the carbons is due rather to volatilization in the glass chamber than to combustion, their life being so prolonged that the lamps, instead of requiring the daily services of a trimmer, can go at least one hundred hours, or even two or three weeks of average duty. The annual saving effected has been estimated at $12 to $15 per lamp. The carbon points in these lamps are housed by a small opalescent inner globe, which is very nearly air-tight, and which again is surrounded by a tightly fitting outer globe. The arc burns, therefore, in a residual atmosphere of carbon monoxide and nitrogen in a heated, rarefied condition; inflow of the outer air is checked, and in a direct-current inclosed lamp the consumption of the negative carbon will not exceed one-fiftieth of an inch per hour, while the positive carbon will not burn away faster than one-twentieth of an inch. Initial difficulties and objections to these lamps have been rapidly overcome, different types for various forms of current have been successfully introduced, and while arc lighting for over twenty years depended upon the "open" lamp for its great development, it will be noted that in 1900 the production of "inclosed" arc lamps was nearly six times as large as that of "open," or 134,531 as compared with 23,656. A great stimulus has also been given to

alternating-current arc lighting, which was not previously a very brisk part of the industry, and it appears from a recent inquiry that whereas street lighting with direct-current series inclosed arcs is done in 73 cities, in no fewer than 326 it is done with series alternating inclosed lamps, deriving current from constant current transformers. The census figures are eloquent as to the dwindling demand for the old open arc lamp fed with current from direct-current dynamos.

SEARCH-LIGHTS AND PROJECTORS.

Table 11 shows the number and value of search-lights and projectors, by states, 1900.

TABLE 11.—SEARCH-LIGHTS AND PROJECTORS: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Number.	Value.
United States	8,283	$225,635
Illinois	475	46,050
Louisiana	1	30
Michigan	4	400
New Jersey	30	6,500
New York	7,689	162,655
Ohio	80	8,000
Wisconsin	4	2,000

An auxiliary branch of the arc-lighting industry is noted in Table 11, showing the manufacture of 8,283 search-lights and projectors in 1900, of a value of $225,635. These lamps are of various classes, chiefly for stage lighting, ship lighting, use in photographic night work, and military operations. Special forms are also manufactured for lighthouses and for advertising uses. Such lamps are generally of the focussing type, where the crater of the arc is kept at the focus of the reflector or lens, the positive carbon being fed twice as fast as the negative. Lamps of the search-light type attain a great size, and one exhibited at Chicago in 1893 had a reflector 5 feet in diameter, and required nearly 14 horsepower of current to consume carbons of 1½ and 1¼ inches in diameter, the ordinary lamp taking less than 1 horsepower. Even larger reflectors are used. At the other extreme of the scale are the projectors used in electric stereopticons for lecture purposes, the manufacture of which is rapidly increasing. As to search-lights for marine work, hardly an American river steamboat, coasting or ocean steamship, steam yacht, etc., can be found without such an equipment.

INCANDESCENT AND MINIATURE LAMPS, X-RAY BULBS, VACUUM TUBES, ETC.

Table 12 shows the number and value of incandescent lamps, by states, 1900.

TABLE 12.—INCANDESCENT LAMPS: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Aggregate value.	16 CANDLEPOWER.		BELOW 16 CANDLEPOWER FOR LIGHTING SERVICE.		ABOVE 16 CANDLEPOWER.		SOCKETS, BASES, ETC.			Establishments reporting values only.
		Number.	Value.	Number.	Value.	Number.	Value.	Total value.	Establishments reporting quantities and values.		
									Number.	Value.	
United States	$4,036,112	21,191,131	$2,910,023	2,906,817	$308,626	1,222,250	$223,534	$593,929	12,099,400	$468,279	$125,650
Colorado	32,000	196,200	29,500	6,750	1,000	4,050	1,500				
Connecticut	428,357	395,980	63,357					365,000	8,876,400	365,000	
Illinois	101,850	571,919	94,850	10,000	2,500	9,000	4,500				
Kentucky	20,400	120,000	20,400								
Massachusetts	663,278	3,269,615	491,415	2,000	200	90,000	61,663	110,000	15,000	10,000	100,000
Missouri	159,280	796,403	159,280								
New Jersey	1,130,803	8,019,787	813,067	2,176,951	200,510	872,420	91,576	25,650			25,650
New York	46,956	220,000	31,956			30,000	15,000				
Ohio	1,034,580	5,738,044	880,869	711,116	104,416	216,780	49,295				
Pennsylvania	325,329	1,863,183	325,329								
Rhode Island	93,279							93,279	3,208,000	93,279	

While arc lamps, whether open or inclosed, depend upon the consumption of carbon by the passage of current between two slightly separated points, the incandescent lamp involves the use of a nonconsuming carbon filament sealed in a bulb from which the air has been thoroughly exhausted. The incandescent, also, is made in small units, usually of 16 candlepower and often of 1 or 2 candlepower, whereas the arc light has never been finely subdivided, and the smallest manufactured in any quantity are nominally of 1,200–2,000 candlepower. At one time efforts were put forth to introduce incandescent lamps of as high as 500 candlepower, but they never became popular or cheap. The largest obtainable now are 50, 100, and 150 candlepower, these sizes being rarely seen. Hence the arc lamp has been adopted for outdoor use or for large interior spaces, and the incandescent lamp has found its best employment in doing the ordinary work of illumination to which candles, oil lamps, and gas jets are commonly applied. It is due to the popularity of the incandescent lamp that electric lighting has been so rapidly adopted during the past twenty-five years, and has reached a basis of parity with gas as to investment and income. The census report by Mr. Hunt for the American gas industry in 1900 showed 877 establishments, with a capital of $567,000,506, and a product valued at $75,716,693.

The figures of central station electric lighting receipts, aside from isolated plants, in which it is esti-

mated as many arc and incandescent lamps are employed as in stations, are already equal to those of gas, and the rate of growth appears to be much larger. The introduction of electricity has given a marked stimulus to the illuminating art in general, and it is universally admitted that cities, villages, factories, residences, etc., are better lighted than ever. The arc light has proved the cheapest illuminant of all for the streets, and is the only form employed for the thoroughfares in hundreds of communities; but gas has still somewhat the advantage of the electric incandescent in cheapness, although the price of current is being steadily lowered as the power houses grow larger and the facilities for generation and distribution are improved. A most notable financial tendency has been the consolidation in a great many cities and towns of the gas and electric light plants in the hands of one local company. The incandescent lamps themselves also cost less, the price per lamp being 15 or 18 cents compared with 75 cents and $1 upon their introduction twenty years ago.

The first notable improvements toward commercialism in the incandescent lamp were made about 1878, when the use of a special filament of platinum wire in the air-exhausted bulb was found feasible, although many previous attempts in this direction were recorded. The great advance came with the substitution of carbon for platinum and other metals. The carbon used as the filament to be rendered incandescent by the passage of the current was speedily brought to its present thread-like form, and a variety of fibrous carbon materials were selected as the best, such as paper, bamboo, cotton and silk, and amorphous "cellulose," the latter substance being that employed for the great majority of the lamps reported in the census year, although bamboo, once universal in Edison lamps, is still employed in certain special kinds. The raw substance, after being squirted through dies into filamentary shapes, is carefully carbonized in crucibles, and then these threads are treated or "flashed" in a "hydrocarbon" or gasoline vapor. Graphitic carbon deposits in a shell integrally around each, so that it becomes smooth and steely and has the required resistance to develop the given candlepower with the predetermined pressure and amount of current.

The processes of preparing the filaments vary with different manufacturers, as do also the steps involved in jointing the filament ends to platinum, etc., mounting, inserting, and sealing them in the glass bulbs, which are then exhausted of air. The "occluded" gases are also worked out of the filament and bulb. Special pumps, in connection with a chemical process for taking up the residual gases, are employed for creating the vacuum, and now are doing their work with such rapidity that a few minutes suffice for exhaustion where hours were formerly necessary. The base of the lamp from which emerge the copper ends of the short platinum wires to which the ends of the filament have been joined inside the bulb is next provided with a cap which is secured to the glass, sometimes by a plaster-of-paris cement, and these cap bases have had numerous shapes, some of which still remain in use, although the irresistible tendency toward standardization has reduced the number to three distinct types, these being the Edison, Sawyer-Man, and Thomson-Houston. At one period of the decade lamps with glass stoppers at the base were made in large quantities, and a familiar form of base cap was that in which the lamp locked into the socket by means of a bayonet catch, but one rarely encounters now any lamp save that which has a helical thread to its brass cap, and screws firmly into the socket, making contact on the brass shell as one terminal, and on a small brass stud at the top of the base as the other, thus completing the circuit when the current is turned on. Where it is desired to fit lamps with a certain style of cap into sockets designed for another kind, "adapters" have been made which allow this to be freely done.

The glass bulbs into which the filaments are sealed are blown in molds and bought by incandescent lamp manufacturers from glass concerns making a specialty of that work. The little tip at the end of the lamp as it hangs downward is due to the "sealing off" at that point after the air is exhausted, and has no useful function. In fact, many lamps are made with the bulbs entirely smooth. There has been, unnoticed possibly by the public, a gradual change in the shape of the bulbs during the past ten years, economizing the amount of glass, just as the platinum "leading in" wires connected to the filament have been made shorter and therefore less costly. The bulbs of the average 32-candlepower lamp are now not much, if any, larger than were those of the 16 candlepower a few years ago; although the bulbs of the Edison 16-candlepower lamps are larger in diameter now than at any time previous, but are shorter. The bulbs of European lamps are even smaller than ours for equivalent candlepower. It is certainly true that in Europe ordinary lamps are of 8 and 10 candlepower, people there being apparently satisfied with illuminants of a lower power, if electrical. In general, it may be said that among American lamp manufacturers the tendency has been toward producing lamps of a higher brilliancy while useful, and central station managers aim to replace lamps that have grown dim. Good lamps, burning at the ordinary current pressure of 110–115 volts, ought to last at full power for at least 600 to 800 hours. Lamps for 250-volt circuits are now coming more into use than formerly.

The filaments in the lamps have always been put into various shapes in the bulbs, like the "horseshoe" in the early Edison lamps, or the form that suggested the initial of the inventor in the first Maxim lamps. A common form with manufacturers is a long filament looped up in the middle and held by a nickel-wire anchor at the base, between the two leading-in wires. This is sometimes repeated on itself in shorter, rounder bulbs, by means of two anchors at the base, or with three loops, an anchor holding the central one. In some

lamps the filament is twisted so as to form a figure "8," while in most of the smaller lamps the filament is without anchor and is in varied convolutions. In lamps for street railway service, or places where there is a good deal of vibration and jolting that might throw the hot filament against the glass, an anchor is inserted at the tip to hold it firmly in position there.

Lamps are now usually manufactured of 4, 6, 8, 10, 16, 20, 32, 50, 100, and 150 candlepower, but it will be noted how the 16 preponderates in the returns, reaching over 21,000,000 out of a total of 25,000,000; while of decorative miniature lamps, barely 400,000 are reported, the fact being that 4 and 8 candlepower are the common sizes for decorative work; and it is understood that all the splendid effects in such work as that at the Omaha and Pan-American expositions were obtained with 8-candlepower lamps. In the 16-candlepower lamps enumerated some are of 4 watts to the candlepower, or 64 watts to the lamp, or about 12 lamps for each electrical horsepower of current. There is exhibited, however, a growing use of lamps of 3.5 watts, and even 3.1 to the candlepower, and the economy or efficiency does not stop even there. A great many of the lamps are made with frosted glass, and there is quite an industry in coloring the globes either "artificially," with collodion compounds, etc., or by "natural" coloring, which involves the use of tinted glass, in all cases with corresponding diminution of radiancy. One form of lamp has the interior of its flat bulb silvered, the upper half of the bulb thus treated serving as a reflector. Various other special forms of the incandescent lamp are of the "regulating" type, aiming to secure a greater or less degree of illumination at will. In some of these, the regulation is exterior to the bulb, using resistance in steps to control the amount of current admitted to the filament. In others, two filaments are used in the lamp, so that full candlepower can be obtained with one filament and a much lower degree by the use of the other. The largest new use of incandescent lamps is on telephone switchboards, in the very small sizes, but in such enormous quantities for signaling purposes that already a consumption of several millions has been reached.

Table 13 shows the number and value of decorative miniature lamps, X-ray bulbs, vacuum tubes, etc., by states, 1900.

TABLE 13.—DECORATIVE MINIATURE LAMPS, X-RAY BULBS, VACUUM TUBES, ETC.: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Number.	Value.
United States	397,432	$72,935
California	4,825	2,800
Connecticut	10,450	3,800
Illinois	125	285
Maryland	200	50
Massachusetts	250	1,000
New Jersey	214,082	12,500
New York	150,000	46,000
Ohio	7,500	1,500
Rhode Island	10,000	5,000

Of incandescent lamps of all kinds there are over 10,000 varieties. A number of small incandescent lamps are made for sign and decorative purposes, or for dental or surgical use. The latter are of such shape that they can be inserted in the cavities of the human body for purposes of examination. Another analogous class of work is that of the manufacture of tubes to be employed in Roentgen-ray work, a branch of science and industry which only became known toward the close of the census period, based on the fact that certain dark rays from these tubes have the power to penetrate opaque substances like the human body, and can be caught photographically, so as to reveal internal, concealed tissues, objects, etc., or can be observed by means of fluorescent materials. Other forms of vacuum-tube lighting, but recently coming into use, give a white luminescence due to the action of the current, not on filaments, but on gases. In the Hewitt form, already adopted for indoor industrial photographic purposes, the "vacuum" tube incloses a cathode or negative pole of liquid mercury, and an anode or positive pole of iron, the mercury vapor constituting virtually an arc throughout the chamber. Lights of the Moore vacuum-tube kind have been made several feet in length, and a small chapel was lit for weeks by several of them at the electrical exhibition in New York city in 1898, showing that a room could be illuminated by its picture moldings or architectural structures, such as the arches, employing continuous stretches of glass tube. These tubes are made to connect like incandescent lamps to the mains of the alternating or direct current supplied from any electric lighting plant. Mr. Nikola Tesla has been working for years on this class of electric lighting.

One other form of lamp remains to be mentioned which belongs in the incandescent class, and which was already introduced in the census period under consideration, a large exhibit of them being made at the Paris Exposition in 1900. This lamp, known as the Nernst, the invention of a distinguished German scientist, differs from both the arc and the incandescent in the fact that unlike the arc it has no carbon points to burn away through the action of the current, and therefore requiring renewal; and that unlike the incandescent it does not need a perfect vacuum, but burns virtually in the open air, with merely a frosted globe to prevent the glare from directly affecting the eye. In the Nernst lamp the light-giving member is a small white rod composed in part of rare earths. When cold, this rod is absolutely nonconducting to the current, but when warm, its conductivity rises as the heat increases, and after a few seconds the glower bursts into full incandescence, giving a remarkably pure white light, lacking the blue tints of the arc and the yellower tints of the incandescent. The glower is brought up to the incandescent point by various ingenious automatic means, and the lamp is made in a variety of sizes, filling the gap from the incandescent at 150 candlepower to the arc light at 1,200 candlepower. Another feature of advantage is the uniformity of the light and

its superior distribution for many purposes, 90 per cent of the illumination being well below the horizontal line. Practically the only part of the lamp requiring renewal is the glower, which, at the time of writing, is credited with a life of 800 hours, while the small electric heater employed to bring it to the point of incandescence is said to have a life of not less than 2,500 hours. In this country single glower lamps of the smaller sizes are made with the Edison helical screw base, while the multiple glower lamps of higher candle-power are suspended from an eyebolt after the style of a chandelier. These lamps are already coming into general use in central stations and occupy a large sphere noted as hitherto untouched by electric illuminants.

ELECTRIC LIGHT FIXTURES.

Table 14 shows the value of electric light fixtures, by states, 1900.

TABLE 14.—ELECTRIC LIGHT FIXTURES: VALUE, BY STATES, 1900.

STATES.	Value.	STATES.	Value.
United States	$2,665,124	Minnesota	$6,625
		Missouri	21,350
California	60,000	New Jersey	94,327
Connecticut	14,986	New York	1,551,051
Illinois	254,362	Ohio	193,795
Massachusetts	79,081	Pennsylvania	426,297
Michigan	9,500	Rhode Island	13,750

The introduction of the arc and the incandescent lamp involved many radical departures in the method of treating illumination and in the principles of constructing "fixtures." The items included in Table 14 relate almost entirely to fixtures employed in interiors for incandescent work. Arc lamps were at first carried on wooden poles, although some were mounted on very tall towers of metal lattice, which still remain, as in Detroit. Latterly metal poles with wooden base, or wholly of iron, and quite ornamental, have become general; and Fifth avenue, New York, may be instanced as a good example of this character. Other kindred fixtures are structural effects constituting "isles of safety" in the center of broad street crossings. Among ordinary fixtures used for arc lighting are mast arms, wall brackets and outriggers, boards, hoods for suspension, and frequently appliances permitting the lamps to be slung across roadways, especially at the junction of thoroughfares, with cords and weights enabling the trimmer to recarbon the lamp. More recently, the installation of low-voltage arc lamps on interior incandescent circuits has led to the manufacture of new and handsome fixtures for ceiling suspension.

It is, however, in connection with incandescent lighting that the fixture art, as embraced in the accompanying statistics, has taken its greatest development. For the first time in history, the fixture designer and manufacturer has been dealing with a light that could be burned upside down, sidewise, or at any desired angle; under water, within a block of ice even. It was not likely that such opportunities would remain unimproved; but radical advances were checked at first by the timidity or uncertainty as to the trustworthiness of the new illuminant. Some of the earliest fixtures were, in fact, chandeliers or gasoliers around which the wires were wound, red and blue to show the two polarities; and then the lamp sockets were attached underneath the gas burners. Improvements due to Mr. Luther Stieringer and others next allowed the wires to be run within the stems of the gasoliers with safety and out of sight, and there soon appeared a device which remains permanently in the art, "the combination fixture," giving service for both gas and electricity. For years this appliance has reigned supreme, and indeed during the whole of the last ten years it has enjoyed universal vogue, not merely because it affords the consumer a choice of illumination, but because in case of a failure of electricity he still has the gas to fall back upon.

The growing reliability of incandescent lighting, however, gave confidence to the engineers and designers; and, especially in steamship work, the "electrolier" for electric service alone began to make its appearance. A large part of the work done in 1900 comprises fixtures of the electrical class alone. The apparatus ranges through an infinite variety of shapes, sizes, and expense, although the manufacture includes at least five or six distinct groups. One of these is the simple "drop" or pendent light, with "adjuster" to regulate its height. Another is the portable lamp, which can be plugged into any wall receptacle for contact, and carried freely around a room. A third class includes small fixtures for desks, lecterns, etc. A fourth class deals with side or bracket fixtures made for single or clustered lights. A fifth embraces a wide range of standard or newel-post fixtures for entrances, stairways, etc. A sixth class consists of the whole range of electroliers, some of which, as in the Metropolitan Opera House, New York city, carry hundreds of lamps. There is, indeed, a further group of fixtures made for ceiling lights, ships' bull's-eyes, and masked illuminants in general. Release from having to deal with gas burners that must be vertical has enabled the manufacturers of electroliers to treat light as a plastic material, and to indulge an exuberant fancy to which only cost sets the limit. In reality, out of the simple, crude, incandescent lighting electrolier has grown a further art, that of constructing towers, arches, etc., which are nothing more than fixtures on a large scale, combining in a brilliantly decorative manner architectural proportions with the elements of electrical and mechanical manufacture.

In the statistics given in this table, the production of "combination fixtures" has been divided, electricity thus being credited with but half the product stated by the manufacturer. Other manufacturers have noted in making their first returns, or in supplementary schedules, the percentage in which their product con-

sists of simple gas fixtures or simple electrical fixtures. Any attempt to give numbers in an art of this kind is obviously out of the question, but the value may be accepted as a fair indication of the development strictly due, in an allied branch of industry, to the growth of electric lighting.

Altogether aside from "electric light fixtures" of the main classes enumerated above, are those which again form a minor industry that can not be overlooked—that of signs and display work. When it is stated that in the city of New York, out of a total of 1,000,000 incandescent lamps on central-station circuits, more than 10 per cent of the current has sometimes been supplied for sign lighting, it will be seen that in the aggregate the product in this line of fixture manufacture is considerable. There has sprung up in the last census period, as the result of the application of electricity to sign lighting, a distinct industry, in which the effects aimed at are attained by differing processes of manufacture. Some of these signs are manufactured with a box blackboard into which the incandescent lamps can be set and wired. Another method is that of building up separate letters with sockets so closely together that they give the outline accurately. A third plan is that of arranging lamps geometrically within a glass box, so that when the lamps are lit by the right combination at the key of the switchboard, any desired numeral or letter is flashed out to the public, spelling words, series of figures, or complete sentences by means of one box, or all together if a number of boxes are used. Yet another plan involves the use of flat cork or other surfaces backed by conducting wires, lamps being stuck into the fibrous material in any desired combination, and readily removed for a change of the information given. A modification of this depends upon cables into which lamps, with a special base with sharp pin contacts, can be stuck so as to furnish streamers and festoons, etc., of light. These and other variations of the "fixture" art have become a marked feature in connection with any celebration, and a component part of the regular street illumination of every large city.

TELEPHONY.

Table 15 shows the number and value of telephones, by states, 1900.

TABLE 15.—TELEPHONES: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Aggregate value.	RECEIVER AND TRANSMITTER SETS.		INTERIOR SYSTEMS.		CENTRAL SWITCHBOARDS.				SUPPLIES.
		Number.	Value.	Number.	Value.	Total value.	Establishments reporting quantities and values.		Establishments reporting values only.	Value.
							Number.	Value.		
United States	$10,512,412	797,246	$3,570,616	217,188	$1,837,266	$3,779,794	1,002	$2,650,396	$1,129,398	$1,324,736
California	296,016					150,301	5	150,301		145,715
Connecticut	105,161	5,000	40,800	8,406	57,161	7,200	5	7,200		
Delaware	3,000			200	2,000	1,000	1	1,000		
Illinois	5,418,528	142,202	1,142,504	203,610	1,687,212	2,282,645	534	2,282,645		306,167
Indiana	189,550	2,000	19,800			62,750	175	62,750		107,000
Iowa	375					375	5	375		
Maryland	120,567	11,000	108,487	400	10,080	2,000	5	2,000		
Massachusetts	503,734	77,511	157,780	554	5,288					340,666
Michigan	270,110	15,000	90,000			35,000	26	35,000		145,110
Minnesota	23,136	3,750	19,536			3,600	20	3,600		
Missouri	89,070	8,000	83,650			5,420	42	5,420		
New Jersey	21,700	21,000	21,700							
New York	2,765,994	460,500	1,523,246	575	52,000	1,159,898	26	30,500	1,129,398	30,850
North Carolina	82,403	5,714	55,000							27,403
Ohio	272,667	22,038	94,578	1,044	6,770	28,600	66	28,600		142,719
Pennsylvania	197,396	10,931	89,790	2,814	15,500	13,000	42	13,000		79,106
Wisconsin	153,005	12,600	123,745	85	1,255	28,005	50	28,005		

Few industries have undergone a more violent transition from a centralized control of production to unlimited manufacture of apparatus than telephony, and the period of greatest activity in this field since 1880 began with the census year 1900. Having after tremendously expensive litigation established the supremacy of its patents, the Bell telephone system enjoyed for some years undisturbed possession of the field, but the moment these patents could be assumed to lapse competition broke in from every quarter, with the result that the industry has of late undergone an extraordinary development, doubling its figures from year to year, and witnessing a very thorough revolution in methods, apparatus, and rates. Since the census year 1879–80, no statistics of telephony have been compiled other than those embodied in the annual reports of the American Bell Telephone Company. Twenty years ago 148 companies and private concerns reported 54,319 receiving telephones, 3,338 employees, and 34,305 miles of wire, with total liabilities of $15,502,135. In 1900 the Bell systems reported about 1,500 exchanges, with 1,080,000 subscribers connected, using 1,254,203 miles

of wire, employing 33,000 persons, and handling 2,000,000,000 conversations per year. The capital for the parent and subcompanies then stood at not less than $300,000,000.

These figures would in themselves indicate the stupendous growth of a distinctively modern industry, but they are far from revealing the actual conditions. Beginning about 1894–95, "independent" telephone exchanges sprang up like mushrooms all over the country, but more particularly in the Middle and Northwestern states, and by 1900–1901 they had attained a total of about 2,750 exchanges, with 700,000 subscribers and an investment of $150,000,000, apparatus being furnished by at least threescore manufacturers. It will be observed that the output of apparatus for telephone purposes in 1900 reached $10,512,412, scattered through nearly a score of states. These figures, however, are strictly those of the manufacturing side of the industry, and do not take any account of the far more striking data to be derived from a study of the subject after this apparatus has gone into service and is in the hands of the public. It will suffice to point out that in 1900 the United States showed a per capita of 1 telephone in 40, while in some places, such as San Francisco, it had reached 1 in 12, a rate that leads the world, and which has since been growing with unprecedented rapidity.

As to the conditions of manufacture, as indicated by the census figures, they are disclosed only in broad relationships. The most important change has been that which deals with switch-board construction and with the consequent modification of apparatus in the hands of the individual subscriber. The central switchboard is the appliance which enables the operator to put any one subscriber into direct communication with the other; and in the "multiple" type this idea has been worked out to such an extent that, at the period covered by this report, an operator at a telephone board could have no fewer than 9,000 "jacks" within her reach, representing a similar number of subscribers, to any one of whom she could "plug in" the subscribers in her own care, provided the specific line was not already in use by a call from some other section of the board. The jacks, with a distance of but three-eighths of an inch between centers, give the face of the board the appearance of huge slices of honeycomb. A further use of the multiple-board principle may even, it is asserted, bring 100,000 subscribers within reach of one girl at "central."

In the earlier forms of central exchanges and switchboards a mechanical signal or "drop" indicated to the operator the call of the subscriber, and the "drops" let loose by the electro-magnets had to be restored by hand. A necessary improvement was the use of "self-restoring" drops, which closed up as soon as the line had been attended to and cleared. The next change in that direction was the substitution of the lamp signal, in which the flashing of small incandescent lamps on the board notifies the operator of the subscriber's wants. This advance has caused the abolition of the local battery at the subscriber's station, and of the personal operation of the magneto-generator, which one had to grind vigorously in order to secure attention at the central office. The manufacture of all the larger boards, it is believed, and many of the smaller ones, in 1900 was of this "common battery," "central battery," or "central energy" type, the battery invariably consisting of a set of storage cells grouped at the main "central" office, sufficing for all purposes.

In the modern common-battery system, to describe the method in broad terms, when the subscriber takes his receiver off the hook of his wall or desk set, a lamp lights up automatically on the section of the switchboard in front of the operator at the central office, in whose care his number happens to belong. When the operator sees this signal, she inserts a listening plug into the spring jack of his line, ascertains his wants, and then connects him with the spring jack of the subscriber wanted by means of a second plug connected with the other, the called subscriber being signaled by the magneto bell at his station. The flashing in and out of the lamps notifies the operator as to the fact that conversation is going on, and informs her when to withdraw the plugs that have connected the two together. Further refinements of this process arise from the grouping of subscribers in any large city into various branch exchanges and the employment of "trunk" lines and "trunk" boards, but in its essentials the method remains the same, involving, however, the employment, with relays, of additional controlling and assisting apparatus.

In connection with the boards at which sit the operators for the duty of putting subscribers directly into intercommunication, each large exchange has usually a number of auxiliary switchboards. The line cables from outside, bringing into the central office the various wires which lead to the switchboards, terminate in cable heads from which, in the interior cables, the wires are led to distributing boards, on one side of which the line cables end, and from the other side of which the wires in switchboard cables are led away to the main switchboards. Thus, lines from any outside cable can be led to any section of a board and given to any operator's care, permitting great ease in grouping subscribers according to the busy character of a wire or the work arising in regard to it. At this distributing point, moreover, the manufacturers introduce the lightning arresters, intended to protect any line from the bad effects of stray currents from outside and of lightning stroke itself. The general idea of all this apparatus is the same, but it differs greatly in manufacture. Another part of the work is the manufacture of the subsidiary boards for an exchange, to be used by monitors, wire chiefs, superintendents, etc.

Next to exchange work comes that of "interior" or "house" systems, the boards manufactured for which are generally quite small, and are intended to put persons into communication with each other in an office, factory, etc., or to enable such persons also to talk from their desks to callers outside, over the common line to the central exchange. There is now a great deal of this class of work, and branch exchanges for offices and hotels in New York have become so numerous that they employ more operators than do the telephone exchanges themselves, through which the ordinary telephone work of the city is done. In hotels and factories the use of this system has already revolutionized the old practice of employing speaking tubes, etc., or of notifying people by annunciator numbers that they are wanted, and the dispatch of social and commercial affairs is greatly facilitated. Just as in its broader field the telephone message has largely taken the place of the telegram and the district messenger, so in interior work, the telephone lessens considerably the sphere of the office boy and hall boy, and is another illustration of the tendency of machinery to release human labor from certain classes of occupation.

This tendency is further exemplified not alone by "selective" or party line telephone systems, which enable persons grouped five or six together on lines where there is no operator at a board to switch them together, to do more or less of this for themselves, but is likewise illustrated in the efforts made during the census period to perfect the manufacture of automatic telephone exchanges, the mechanism of which is intended to reduce to a minimum the number of "central" operators and the work that they have to do. Exchanges on the automatic plan up to 1,000 subscribers have been built, in which the human operator for putting the ends of two subscribers' lines together is replaced by elaborate groups of electro-magnetic devices operated by the subscriber himself from any point and, on a step-by-step principle, ascertaining whether the required line is clear, and if so, interlocking with it and closing the circuit. When the subscriber has ended the conversation, the system is restored ready for another call, and the limit is simply that set by the number of the automatic switches connecting and disconnecting the subscribers. Automatic work has been successfully carried out in regard to smaller work, chiefly for interior service; while a further field has been that in which pay stations have been introduced, the insertion of a small coin into a box on the nickel-in-the-slot principle placing telephone facilities at the disposal of the calling party.

So far reference has been made only to the switchboard system and apparatus. There are, however, a great variety of details that have to be manufactured in the telephone industry, the principal ones being, of course, the hand telephone, or receiver that is placed to the ear, and the transmitter into which speech is delivered. The forms of these are numerous, but the essential elements had come by 1900 to be the same for each form. The receivers now manufactured are usually of the long "butter-stamp" pattern that has persisted these twenty years. The shell is hard rubber or a kindred substance. A single pole or bipolar magnet fills the handle, and in the cap is the small electro-magnet spool, under the influence of whose magnetic field the metallic diaphragm disk is so vibrated as to give back the words spoken into the transmitter system at the other end. Some of these receivers are made in flat watch-case form, and of this type also are those combining receiver with transmitter for compactness and for portable purposes.

The other essential device is the transmitter, depending now, as ever, upon the variable resistance of carbon inserted in block, granular, rod, or other shapes inside the diaphragm against which the sound waves of the voice impinge. Any motion of the diaphragm, by increasing the pressure between the parts of the carbon, lowers its resistance, allowing greater or less flow of current, and this undulatory flow, corresponding to the voice action or impulses, results in the audible reproduction of the same sounds by the distant receiver diaphragm, the current at its outset being assisted by a small induction coil, whose advantages are that it permits the transmitter to work in a circuit of very low resistance, and that, as the currents in the secondary winding of the induction coil are of much higher voltage than those in the primary, caused by the transmitter diaphragm movement, speech, etc., can be transmitted over lines of much greater length and necessarily greater resistance than would otherwise be possible. Modifications in the design and construction of telephone induction coils are numerous. It is now a customary thing to manufacture the transmitter so that the coil can be mounted in the arm; but it can also be seen sometimes on the baseboard of the wall telephone.

A third piece of apparatus made in large quantities is the magneto-generator, a small dynamo in which coils of fine wire are revolved rapidly between poles of a permanent magnet, the current thus produced causing the telephone bell at the other end of the line to ring and attract attention. These are so wound that they will ring their own bell, or the distant one, through a resistance of 10,000 ohms. Such vibrating bells can, of course, also be rung by an ordinary battery, but not over long stretches of line; hence the general adoption of magnetos.

In the figures presented herewith, in Table 15, it will be observed that 797,246 receiver and transmitter sets of telephones are reported, of a value of $3,570,616, or not quite $4.50 per set, the actual price varying greatly, however, according to nature of work, style of finish, etc. There were reported for exchange work 1,002 central switchboards, valued at $2,650,396, together with products for establishments not reporting quantities valued

at $1,129,398, making a total of $3,779,794. The production of interior systems is placed at 217,188, with a value of $1,837,266. No record could possibly be obtained, however, of the manner in which this production would be divided, nor, again, could the figures include the thousands of instances in which individuals have bought separate sets of apparatus and installed their own short lines. The large amount of $1,324,736 is reported for telephone supplies, including telephone lightning arresters and similar protective devices, cable heads, distributing boards, parts, etc.

PHONOGRAPHS AND GRAPHOPHONES.

It had been proposed by the Census Office to issue a separate report upon the manufacture of phonographs, graphophones, gramophones, etc., and some very interesting data was prepared with that end in view by Mr. Harry E. Barbour, of the Census Office. In view of the meagerness of the statistics and the fact that there is no comparative data, the idea of issuing a separate bulletin has been abandoned, but the material is of a very interesting and instructive character, and it has been deemed advisable to add it as a supplement to the bulletin on electrical apparatus and supplies. The invention of this class of apparatus has been closely associated with that of the telephone and telegraph, and has, in fact, been due to men most prominent in the development of telephonic apparatus in America. The art has been in the hands of men connected, to a great extent, with electrical work, and a great deal of the material reaches the public through electrical supply concerns.

The first phonographs which were put upon the market were made by Mr. Edison at Menlo Park, N. J., and in New York city in 1877–78, and passed through the hands of the writer, their use being limited to territorial sections of the country on a royalty basis, a practice which continued for a year or two, and was resumed again some years later with the revival of public interest in the commercial phonographic art and industry.

The statistics presented in the following tables embrace the operations of establishments engaged in the manufacture of talking machines and parts thereof during the year ending May 31, 1900. In 1900 this industry was carried on in 7 states, while at the census of 1890 only 2 establishments—one in Connecticut and one in New York—were reported; and, in order to avoid disclosing the operations of individual establishments, the statistics of the manufacture of talking machines were not published separately, but were included with those of other industries having less than 3 establishments, and issued in one general report. For this reason it is impossible to show comparisons between the returns for 1890 and 1900.

Table 16 presents the principal features of the industry at the census of 1900.

TABLE 16.—PHONOGRAPHS AND GRAPHOPHONES: SUMMARY FOR 1900.

	1900.
Number of establishments	11
Capital	$3,348,282
Salaried officials, clerks, etc., number	144
Salaries	$179,145
Wage-earners, average number	1,267
Total wages	$608,490
Men, 16 years and over	1,114
Wages	$565,076
Women, 16 years and over	146
Wages	$42,914
Children, under 16 years	7
Wages	$500
Miscellaneous expenses	$215,401
Cost of materials used	$827,529
Value of products, including custom work and repairing	$2,246,274

Table 16 shows that 11 establishments were reported as engaged in the manufacture of talking machines and parts thereof. There were reported capital to the amount of $3,348,282, or an average of $304,389 for each establishment; 144 salaried officials, clerks, etc., receiving salaries amounting to $179,145; and 1,267 wage-earners, receiving $608,490. Of the total number of wage-earners, 1,114 were men, receiving $565,076; 146 were women, receiving $42,914; and 7 were children, whose total wages amounted to $500. Miscellaneous expenses amounted to $215,401; materials used cost $827,529; and the value of the products, including custom work and repairing, was returned at $2,246,274.

Table 17 is a detailed statement of the capital as reported in 1900, showing the proportion each item is of the total.

TABLE 17.—PHONOGRAPHS AND GRAPHOPHONES: CAPITAL, 1900.

	1900	
	Amount.	Per cent of total.
Total	$3,348,282	100.0
Land	90,887	2.7
Buildings	239,899	7.2
Machinery, tools, and implements	706,851	21.1
Cash on hand, bills receivable, unsettled ledger accounts, raw materials, stock in process of manufacture, finished products on hand, and other sundries	2,310,645	69.0

The total capital of this industry in 1900 was $3,348,282. The principal item reported was that of cash on hand, bills receivable, unsettled ledger accounts, raw materials, stock in process of manufacture, finished products on hand, and other sundries, representing $2,310,645, or 69 per cent of the total capital. The value of the land was returned at $90,887, or 2.7 per cent of the total; and that of buildings at $239,899, or 7.2 per cent. The amounts reported for land and buildings represent only such as are owned by the establishments engaged in this industry, and do not include the value of leased property which is occupied in the manufacture of talking machines. The sum of $706,851, or 21.1 per cent of the total capital, was invested in ma-

chinery, tools, and implements used in the equipment of plants.

Table 18 shows the cost of materials used in the manufacture of talking machines, the cost of each item and its percentage of the whole amount for 1900.

TABLE 18.—PHONOGRAPHS AND GRAPHOPHONES: COST OF MATERIALS USED, 1900.

	Amount.	Per cent of total.
Total	$827,529	100.0
Purchased in raw state	3,185	0.4
Purchased in partially manufactured form	796,033	96.2
Fuel	16,076	1.9
Amount paid for rent of power and heat	1,485	0.2
Freight	10,750	1.3

Table 18 shows that the total cost of materials for 1900 was $827,529. The largest item is that reported for materials purchased in partially manufactured form, which represents $796,033, or 96.2 per cent of the total cost. Besides materials which actually enter into the product, such as unfinished parts of machines and other equipment, this item includes mill supplies and materials which are necessary accompaniments of the products, such as boxes, packages, etc. Materials purchased in the raw state are those upon which no manufacturing force has been expended. The cost of this class of materials was $3,185. Materials purchased in the raw state, fuel, rent of power and heat, and freight together represent but 3.8 per cent of the total.

Table 19 is a detailed statement by states of the kind, quantity, and value of the products of this industry for the census year.

TABLE 19.—PHONOGRAPHS AND GRAPHOPHONES: KIND, QUANTITY, AND VALUE OF PRODUCTS, BY STATES, 1900.

STATES.	TOTAL.	COMPLETED MACHINES, PHONOGRAPHS, GRAPHOPHONES, AND GRAMOPHONES.		HORNS AND HORN STANDS.		RECORDS.		ALL OTHER PRODUCTS.
	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Value.
United States	$2,246,274	151,403	$1,240,503	28,423	$32,021	2,763,277	$539,370	$434,380
New York	119,980	13,550	85,980	.....	.....	313,350	34,000	.....
All other states[1]	2,126,294	137,853	1,154,523	28,423	32,021	2,449,927	505,370	434,380

[1] Includes establishments distributed as follows: Connecticut, 1; Illinois, 1; Massachusetts, 1; Missouri, 1; New Jersey, 2; Pennsylvania, 2.

The aggregate value of the products of the industry during the census year was $2,246,274. As New York was the only state which reported 3 or more establishments, the products for New York alone are shown separately, while to avoid disclosing the operations of individual establishments the products of the other states, which reported fewer than 3 establishments, are shown collectively under the head of "all other states," and include the products of 1 establishment in Connecticut, 1 in Illinois, 1 in Massachusetts, 1 in Missouri, 2 in New Jersey, and 2 in Pennsylvania. By means of the supplemental reports furnished by the different establishments it is possible to itemize the products, showing the quantity and value of each of the principal kinds of goods manufactured. In Table 20 the product is divided into completed machines, horns and stands, records, and all other products. The completed machine includes the mechanical parts—recorder, reproducer, crank, and small horn—and comprises all of those parts by means of which the sound is recorded and reproduced. This item, including phonographs, graphophones, and gramophones, represents 151,403 machines, valued at $1,240,503, or 55.2 per cent of the total value of products. There were manufactured 28,423 horns and horn stands, valued at $32,021, or 1.4 per cent of the total. Records to the number of 2,763,277 were produced, the value of which was $539,370, or 24 per cent of the total. The item "all other products" comprises all products not reported under any of the foregoing heads, together with the value of the by-products and the custom work and repairing, and includes record holders, slot devices, cases, cabinets, and other necessary accompaniments of the talking machine. The value of this item is $434,380, or 19.4 per cent of the total value of the products.

The mechanical recording and reproduction of sound is an achievement of comparatively recent times. Of the many wonderful inventions during the past quarter century, perhaps none has aroused more general and widespread interest among all classes of people than the machine which talks; and for this reason, together with the fact that it has been widely exhibited, nearly everyone is more or less familiar with the so-called talking machine.

The basic principle of these machines is the undulation of sound. It is a well-established fact that when the equilibrium of the atmosphere is disturbed by some extraneous force the impulse is communicated from one atom to the next, and so on throughout the entire matter, or until the strength of the original disturbance is overcome by the resistance of the mutually repellent forces, which ordinarily maintain a state of equilibrium in all elastic bodies. Sound, as we perceive it, is caused by the vibration of some body, which gives a corresponding vibratory motion to the surrounding atmos-

phere, thereby propagating in all directions what are commonly called sound waves. It is the action of these waves, beating against the tympanic membrane of the ear, and conveyed therefrom by the complicated inner structure of that organ to the auditory nerve and thence to the brain, which produces the sensation of sound; and upon the character of the different waves depends the quality of the sounds which we perceive.

The first machine to successfully capture sound waves, record them, and release them at the will of the operator, reproducing the exact sounds, was the phonograph, invented by Thomas A. Edison in 1877. It has been asserted that early in the year 1877, Charles Cros, a Frenchman, filed with the secretary of the Paris Academy of Sciences a paper which contained a practicable plan for mechanically reproducing speech which had once been uttered.[1] While this assertion is undoubtedly true, Mr. Edison was, nevertheless, the first to accomplish this result, and it is claimed that his application for a patent thereon was filed prior to the filing of the Cros paper. In discussing the principle of sound reproduction as embodied in the phonograph, Mr. Edison refers to his discovery as having been almost accidental, and describes it in an interesting article in the North American Review for June, 1888, in which he says: "I was engaged upon a machine intended to repeat Morse characters, which were recorded on paper by indentations that transferred their message to another circuit automatically when passed under a tracing point connected with a circuit-closing apparatus. In manipulating this machine I found that when the cylinder carrying the indented paper was turned with great swiftness it gave off a humming noise from the indentations—a musical, rhythmic sound resembling that of human talk heard indistinctly. This led me to try fitting a diaphragm to the machine which would receive the vibrations or sound waves made by my voice when I talked to it, and register these vibrations upon an impressionable material placed upon a cylinder. The material selected for immediate use was paraffined paper, and the results obtained were excellent. The indentations on the cylinder, when revolved rapidly, caused a repetition of the original vibrations to reach the ear through a recorder, just as if the machine itself were speaking. I saw at once that the problem of registering human speech, so that it could be repeated by mechanical means as often as might be desired, was solved."

The first phonograph constructed consisted of a cylinder having a threaded surface, which revolved on a similarly threaded shaft and was operated by turning a crank. Over this cylinder there was placed a covering of tin foil, upon which the record was received. A mouthpiece, resembling that of a telephone, contained a vibrating membrane, attached to the other side of which was a metal stylus which touched lightly the tin foil over the groove. By turning the crank the cylinder was revolved and at the same time moved forward, while the diaphragm, vibrating under the impulse of the sound, caused the stylus to impress upon the foil a record which corresponded to the vibrations of the membrane. When this record was complete, if the stylus was again placed at the point of starting and the cylinder turned at the same rate as before, the stylus would retrace the indentations in the foil, and, as it rose and fell accordingly, would give to the membrane vibrations similar in every respect to those which it underwent when the record was made. These vibrations were transmitted to the air and again to the ear of the listener, with the result that the same sounds were heard which were originally uttered.[2] In 1878 the phonograph was exhibited before the Paris Academy of Sciences, and, even in its crude state, excited the admiration of the scientific world. The early machines were large and heavy, and distinctness was sacrificed in order to obtain a tone of large volume. Only a few of these machines were made, and those were used principally for exhibition purposes. Since that time, however, many improvements have been made in the phonograph, with the result that the machine of the present day differs in many respects from those first constructed.

On the 4th day of May, 1886, there was issued to Dr. Chichester A. Bell and Mr. C. S. Tainter, of Washington, D. C., a patent for a talking machine which was called by them the "graphophone." By this instrument sound records were engraved upon a wax-like cylinder or upon a disk in lines of irregular and varied form, corresponding to the phonetic waves which produced them. This instrument was the result of a long series of experiments by the above-named gentlemen and Prof. Alexander Graham Bell, the inventor of the telephone. The principal distinguishing feature of the early graphophone was to be found in the sound record. The tin-foil records which were first used upon the phonograph had been found incapable of retaining unimpaired the impressions of the recorder, the foil being of such nature that the record was easily obliterated. After experimenting for a long time, Mr. Tainter conceived the idea that the record could be cut in a solid material and thus rendered permanent. The substance finally selected was paper coated with a preparation of paraffin and wax.

The following description of the early graphophone is taken from Harper's Weekly for July 17, 1886:

The graphophone is made in two forms, one to make the records on a cylindrical surface, the other upon a disk or flat surface, the same principles, however, governing each machine. The machines are provided with two diaphragms, one used in making the record, and the other in reproducing the sound. The cylindrical machine stands about five or six inches high by eight wide, and weighs about

[1] Scientific American, July 14, 1888.

[2] The Great Inventions, by F. B. Wilkie, A. M., pages. 522–524.

ten pounds. There is no skill required in the manipulation of the machine, the rotation of the cylinder being accomplished by a crank or automatic motion. * * * Upon a diaphragm three inches in diameter a steel point is attached, which cuts a minute hair line in the surface of the wax cylinder upon the agitation of the diaphragm by a sound. * * * Upon a cylinder six inches in length by an inch and a quarter, one is enabled to record at least five minutes' conversation. The cylinder holder is constructed with a ball joint at one end and can be easily tipped so as to allow the hollow cylinder to be rapidly slipped on or off.

The cylinder of the first graphophone was revolved either by a crank or by foot power somewhat similar to that used in a sewing machine. These machines have been greatly improved, although the fundamental principles remain the same.

Another talking machine, which has proved in every way successful in the recording and reproduction of sound, is the gramophone, patented in 1888 by Emil Berliner, of Washington, D. C. The gramophone is simple in its plan and construction and differs somewhat from the other machines. In this machine a centrally apertured disk of zinc is used for receiving the record. The disk, which is covered with an extremely thin film of wax, is mounted upon a vertical spindle within an etching trough which revolves with the spindle. The recording stylus, the diaphragm, and the mouth tube are mounted on a carriage, which is moved toward the center of the zinc disk by a screw, taking its motion from the spindle carrying the disk. Motion is imparted to the record disk by a friction wheel on a horizontal shaft. This shaft is provided in the present case with a hand crank, by which the plate is revolved. The same shaft is also provided with a pulley for receiving a belt from a suitable motor when it is desired to operate the machine by power. As the record disk is revolved, sounds uttered in the mouth tube cause the diaphragm to vibrate, and the stylus is moved in a direction parallel with the face of the record surface, forming in the wax film a sinuous line representing the sounds uttered in the mouth tube. As the plate revolves the stylus and the parts connected with it are carried forward toward the center of the disk, thus forming a spiral, sinuous line in the wax film. When the record is complete the stylus is removed and acid is admitted to the etching trough from a bottle supported at the right of the machine. As soon as the plate is sufficiently etched the trough is removed, the acid is returned to the bottle, the wax film is dissolved off, and the plate is transferred to the reproducing apparatus. In this apparatus the record plate is mounted on a vertical spindle and revolved as in the other case. The diaphragm of the reproducing instrument carries a stylus which follows the spiral groove in the plate, thus causing vibrations in the diaphragm similar to those produced by the sounds uttered in the mouth tube of the recording instrument. The diaphragm cell and reproducing stylus are carried upon the smaller end of the trumpet, which is delicately pivoted on a standard and counterbalanced so that the reproducing stylus exerts only a slight pressure upon the record plate. The volume of sound issuing from the trumpet is great. Instrumental and vocal music is faithfully reproduced. It is obvious that the records formed by this instrument are permanent and that the plate can be stored in a very small space.

During the past decade many improvements have been made in each of the different kinds of talking machines. While the general principles remain the same, important changes have been made in the records, motive power, mechanism, and general finish. In all, 353 patents have been granted for machines of this kind and parts thereof, to January 1, 1902.[1] All cylindrical machines now use wax records, which are produced in sizes varying in diameter and length. Special attention has been devoted by manufacturers to the improvement of these cylinders, with the result that they have reached a state of great perfection. Disk records have also been improved, and these, after being etched, are coated with a solution of hard rubber. The disks are also made in different sizes, the principal ones being 7 and 10 inches in diameter. The crank and treadle of the early talking machines have given way to spring and battery motors, while still others are so fitted that they may be connected with an ordinary incandescent electric light circuit and receive their motive power therefrom. Two separate diaphragms are used for recording and for reproducing, and each of these has been improved to such an extent that a perfect record of any sound may be secured and reproduced with absolute distinctness. The recorder is not a part of the disk machine, as all disk records are made at the laboratories and factories of the manufacturers. The record is secured upon the zinc plate, as above described, and from this record any number of electrotype copies may be made. These machines are intended only for reproducing and not for recording. Phonographs use the cylindrical records only. Graphophones are constructed to use both cylinders and disks, while the gramophones use entirely the disk records. The result of all these improvements in construction and mechanism has been not only a clearer sound reproduction and a machine which is more compact and easier to handle, but a great reduction during the past decade in the cost of the machines.

The different kinds of talking machines are produced in great variety of styles and types, from the highly finished concert machine to a different type for almost all of the many uses to which the talking machine may be put. Aside from the machine itself, there are records, cabinets, horns for the augumentation of the sounds reproduced, horn stands and cranes, speaking tubes, shaving knives, by which old records are removed from cylinders, and many other appurtenances, all of

[1] United States Patent Office, Supplement, January 1, 1902.

which go to make up the complete outfit. Some machines are fitted with rubber hearing tubes instead of a horn, but either the horn or the rubber tubes may be fitted to the same reproducing arm.

While the talking machine is without doubt one of the most interesting and entertaining of all inventions, it has also its practical features, which are of great benefit to the commercial world. Dictation may be spoken into the machine and recorded upon the cylinder, to be later transcribed by a typewriter, or the cylinder may itself be sent through the mails and the record reproduced at its destination upon another machine. The manufacture of talking machines as an industry may be said to be in its infancy, yet its growth, which has been confined almost entirely to the last decade, has been in many respects remarkable. Agencies have been established in nearly all the principal cities of Europe and America, and the demand for the machines has increased steadily.

Table 20 presents in detail, by states, the statistics for the industry as returned at the census of 1900.

TABLE 20.—PHONOGRAPHS AND GRAPHOPHONES: BY STATES, 1900.

	United States.	New York.	All other states.[1]
Number of establishments	11	3	8
Character of organization:			
Individual	2	1	1
Firm and limited partnership	1	.....	1
Incorporated company	8	2	6
Capital:			
Total	$3,348,282	$77,800	$3,270,482
Land	$90,887	.....	$90,887
Buildings	$239,899	.....	$239,899
Machinery, tools, and implements	$706,851	$46,600	$660,251
Cash and sundries	$2,310,645	$31,200	$2,279,445
Proprietors and firm members	4	1	3
Salaried officials, clerks, etc.:			
Total number	144	2	142
Total salaries	$179,145	$5,000	$174,145
Officers of corporations—			
Number	25	2	23
Salaries	$82,553	$5,000	$77,553
General superintendents, managers, clerks, etc.—			
Total number	119	.....	119
Total salaries	$96,592	.....	$96,592
Men—			
Number	107	.....	107
Salaries	$89,199	.....	$89,199
Women—			
Number	12	.....	12
Salaries	$7,393	.....	$7,393
Wage-earners, including pieceworkers, and total wages:			
Greatest number employed at any one time during the year	1,601	68	1,533
Least number employed at any one time during the year	907	65	842
Average number	1,267	66	1,201
Wages	$608,490	$38,672	$569,818
Men, 16 years and over—			
Average number	1,114	56	1,058
Wages	$565,076	$34,672	$530,404
Women, 16 years and over—			
Average number	146	10	136
Wages	$42,914	$4,000	$38,914
Children, under 16 years—			
Average number	7	.....	7
Wages	$500	.....	$500
Average number of wage-earners, including pieceworkers, employed during each month:			
Men, 16 years and over—			
January	1,197	57	1,140
February	1,213	57	1,156
March	971	57	914
April	1,038	57	981
May	1,106	56	1,050
June	1,104	56	1,048
July	1,028	56	972
August	1,045	56	989
September	1,165	56	1,109
October	1,242	56	1,186
November	1,129	56	1,073
December	1,130	53	1,077
Women, 16 years and over—			
January	134	10	124
February	178	10	168
March	205	10	195
April	194	10	184
May	164	10	154
June	143	10	133
July	113	10	103
Average number of wage-earners, including pieceworkers, employed during each month—Continued.			
Women, 16 years and over—Continued.			
August	126	10	116
September	161	10	151
October	121	10	111
November	113	10	103
December	100	10	90
Children, under 16 years—			
January	8	.....	8
February	5	.....	5
March	5	.....	5
April	2	.....	2
May	10	.....	10
June	8	.....	8
July	5	.....	5
August	5	.....	5
September	8	.....	8
October	8	.....	8
November	8	.....	8
December	12	.....	12
Miscellaneous expenses:			
Total	$215,401	$6,546	$208,855
Rent of works	$7,205	$2,840	$4,365
Taxes	$3,861	$48	$3,813
Rent of offices, interest, insurance, and all sundry expenses not hitherto included	$193,920	$3,658	$190,262
Contract work	$10,415	.....	$10,415
Material used:			
Aggregate cost	$827,529	$46,148	$781,381
Principal materials—			
Total	$572,336	$45,250	$527,086
Purchased in raw state	$3,185	.....	$3,185
Purchased in partially manufactured form	$569,151	$45,250	$523,901
Fuel	$16,076	.....	$16,076
Rent of power and heat	$1,485	$348	$1,137
Mill supplies	$10,557	$50	$10,507
All other materials	$216,325	$500	$215,825
Freight	$10,750	.....	$10,750
Value of products	$2,246,274	$119,980	$2,126,294
Comparison of products:			
Number of establishments reporting for both years	7	.....	.....
Value for census year	$2,075,253	.....	.....
Value for preceding business year	$2,091,147	.....	.....
Power:			
Number of establishments reporting	8	1	7
Total horsepower	1,204	12	1,192
Owned—			
Engines—			
Steam, number	4	.....	4
Horsepower	1,045	.....	1,045
Electric motors—			
Number	11	.....	11
Horsepower	122	.....	122
Rented—			
Electric, horsepower	18	.....	18
Other kind, horsepower	19	12	7
Establishments classified by number of persons employed, not including proprietors and firm members:			
Total number of establishments	11	3	8
Under 5	4	1	3
5 to 20	3	1	2
21 to 50	1	.....	1
51 to 100	1	1	.....
501 to 1,000	2	.....	2

[1] Includes establishments distributed as follows: Connecticut, 1; Illinois, 1; New Jersey, 2; Massachusetts, 1; Missouri, 1; Pennsylvania. 2.

TELEGRAPHS.

Table 21 shows the number and value of telegraph instruments, by states, 1900.

TABLE 21.—TELEGRAPH INSTRUMENTS: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Aggregate value.	INTELLIGENCE (KEY, SOUNDER, ETC.).				POLICE, FIRE, DISTRICT, AND MISCELLANEOUS.				SWITCHBOARDS.			
		Total value.	Establishments reporting quantities and values.		Establishments reporting values only.	Total value.	Establishments reporting quantities and values.		Establishments reporting values only.	Total value.	Establishments reporting quantities and values.		Establishments reporting values only.
			Number.	Value.			Number.	Value.			Number.	Value.	
United States	$1,642,266	$354,212	199,410	$348,912	$5,300	$1,231,167	40,264	$436,756	$794,411	$56,887	9,101	$53,517	$3,370
California	1,000					1,000			1,000				
Connecticut	61,048					61,048			61,048				
Illinois	52,958	5,320	20	20	5,300	41,268	10,000	30,000	11,268	6,370	1,000	3,000	3,370
Kentucky	62,204					62,204	1,200	62,204					
Maryland	85,000					85,000	6,000	85,000					
Massachusetts	215,004					214,904			214,904	100	1	100	
Missouri	14,400					14,400	1,000	14,400					
New Jersey	366,500	25,000	20,000	25,000		336,500			336,500	5,000	1,000	5,000	
New York	634,261	323,892	179,390	323,892		264,952	22,064	245,152	19,800	45,417	7,100	45,417	
Ohio	6,000					6,000			6,000				
Pennsylvania	143,891					143,891			143,891				

As shown in Table 21, the manufacture of telegraphic apparatus in 1900 reached a total production of $1,642,266, which, in view of the magnitude of the statistics of other and younger branches of electrical industry, appears a surprisingly small figure. But the result, as thus barely set forth, is misleading as to the actual production of telegraphic apparatus. There are but few, and only two large, companies engaged in furnishing regular telegraph service to the public, and these are largely self-contained and self-supported in regard to apparatus. Not being manufacturers in the broad sense, and not making apparatus for sale, the figures of the material produced in their own shops for specific uses do not come under review. A great many of the railroad companies also maintain telegraph systems, and having huge shops in which electrical apparatus can be readily and cheaply produced, make some of their own material.

Hence the production of telegraphic apparatus of old, familiar, standard type does not reach half a million dollars, so far as its purchase by the public and its availability in the commercial markets are concerned. On the other hand, special services, such as those connected with fire-alarm apparatus, police, district messenger, etc., show a production of $1,231,167. Among electricians telegraphy is regarded as the least progressive branch of their science and industry, and while this view is fiercely contested by some telegraphers, the fact remains that out of the total production of over a hundred million dollars telegraphy is almost the smallest item of manufactures; unless, indeed, telephony be regarded as part of it, a view taken by more than one government. Curiously enough, it is in this apparently unprogressive branch of the electrical arts that the most striking and brilliant manifestations of discovery and invention have but recently taken place, with a climax in the beautiful and subtle art of wireless telegraphy.

In the field of telegraphy hand labor still prevails to a striking extent, and a very large proportion of the messages are still sent by the key and received by the sounder or register. Systems of duplexing and quadruplexing have been introduced, so that one real wire is converted into a number of "phantom circuits," and two or four messages are sent at the same time over the single stretch of iron or copper circuit between points hundreds of miles apart, through the use of the principle of adjusting the apparatus at each end to send and receive only certain electrical impulses while insensitive to all others passing at apparently the same instant. Mr. Edison has worked at many modifications and improvements of this kind upon the quadruplex, with which his name is chiefly associated, and the sextuplex and phonoplex are well known, while Mr. P. B. Delany is to be credited with the successful and practical development of a multiplex synchronous system, which, by means of a horizontal wheel or disk at each end of the line, with a revolving contact trailer passing over it, will enable as many as 12 independent Morse transmissions to be operated simultaneously over the same wire, each pair of operators getting the use of the line for a very minute space of time, the period of use being long enough for the various distinct current impulses from each Morse key.

But while these systems have gained ground to some extent, type-printing instruments, using keyboards, have virtually disappeared from telegraph offices in America; and it can not be discovered that any have been made for several years for service on this side of the Atlantic. The art of what is known as "machine telegraphy," as distinguished from hand or key telegraphy, is here virtually limited to the Wheatstone system, in which messages are prepared by punching holes in a tape which is afterwards run rapidly through a mechanical transmitter, to be received at the other end of

the line by an ink writing machine, in which the dots and dashes are properly recorded on another tape for subsequent translation into words. It is a feature of such method that several operators can be getting tape ready for transmission; and on long circuits a sending speed of 400 words a minute on the line has been attained, the same punched tape being available moreover for a number of circuits in succession, whereas an ordinary operator is doing well to send 40 words per minute over the one wire to which he is assigned. It would seem that the art of cheap telegraphy, enabling the public to send telegrams at as low a rate as telephone messages or special-delivery letters, could only lie in the direction of machine or automatic telegraphy; and hence inventors have pursued with diligence improvements in this direction, the chief American exponents of such methods being Mr. P. B. Delany and Mr. C. L. Buckingham. The latter has been working for some time past commercially over the Western Union circuits, and at the time of writing this report no fewer than 1,500,000 messages have been transmitted by his apparatus. On one occasion 2,429 words were sent from Chicago to New York in 23 minutes and 24 seconds. The rate at which messages are regularly transmitted between New York and Chicago by the Buckingham printing telegraph, on a duplex circuit, is about 100 average messages on one wire in each direction, or 200 per hour. These messages, moreover, do not need retranslation as received, but come out in regular typewritten form on standard message blanks ready for instant delivery.

Fire-alarm telegraph apparatus has been manufactured for fifty years past and is now in use in every American city of any pretensions, so that a fire-alarm box is a familiar and characteristic object on most streets. The genius of Prof. Moses G. Farmer, Dr. W. F. Channing, and J. N. Gamewell was chiefly instrumental in the early perfection of this system, to which is due the saving of many lives and millions of property. The latest types of fire-alarm boxes are built so as to dispense with any key or access to the interior. A projecting handle can be turned instantly by any passer-by, when the bell in the box rings, showing that the signal for that box determining its location has gone in to the fire department headquarters, where other apparatus equally efficient and instantaneous receives it and assists in spreading the notification throughout the district or over the whole service. When the mechanism of any such box has been started the sender can not stop it, nor can any other subsequent signal coming in from another box on the same circuit dispute or confuse the prior alarm. Modifications of this system, again, consist in auxiliary boxes located in buildings, which, starting automatically, will energize the nearest box alarm, while further refinements include delicate thermostatic arrangements, which, while giving an exterior alarm, also release at once streams of water within the threatened building to put the fire out even before the fire brigade can arrive. An ingenious system in use for some time embodies an electrical conductor, in which is a readily fusible wire whose melting closes the alarm circuit, such wire being movable and flexible so that it can be laid anew nightly on top of goods or packages in store or wharf, etc., and the alarm given at any point desired—even, if desired, in association with the telephone service.

Peculiarly American in their intention and development have been the industries associated with the "stock ticker," the "bank-printer" system, which was in many respects the forerunner of the telephone, and the district-messenger system. At one time the bank-printer system was carried to considerable length in New York city, using apparatus not unlike that employed for stock-ticker work, and some fifty banks were in communication with the clearing house by its means, the mechanism at the switch board being such that the operator there could transmit simultaneously to any group of six banks by means of a multiple switch bar, which plugged into six "jacks" or spring contacts at the same time. As all the single wires from each bank led to the board, there was here in rudimentary form a multiple board, as "central" could obviously connect any two banks also; and it is matter of record that at a very early date the Bell telephone management acquired an interest in this method, although the telephone itself wiped out the printer and private line systems for purposes of bank communication.

The stock ticker dates from about 1867 and originated from the necessities of quick communication between brokers and the exchanges. Before the introduction and manufacture of such apparatus a brokerage house would have a lot of boys, sometimes 12 to 15, plying between exchange and office with the latest quotations for stocks or gold, each boy watching a specialty. To avoid this rush and confusion, Mr. E. A. Calahan devised an indicator with dials for showing the price of gold at each fluctuation, and Mr. T. T. Laws also took up this work, whereupon Mr. Calahan removed the indicating dials from his apparatus and substituted type wheels, which would print their indications step by step on a paper tape, in two lines, one of letters, the other of figures. It was also necessary to provide means for taking the impression of the characters, for inking the wheels, and for feeding the tape. This done, it was deemed best to use three wires to each ticker, one to furnish current for rotating the alphabet wheel, one for the figure wheel, and one for taking the impression from both wheels. Out of these early developments and the evolutional work of several inventors, including Messrs. T. A. Edison, S. D. Field, G. B. Scott, G. M. Phelps, John Burry, and others, the modern stock ticker has sprung, employing in general the step-by-step principle, with at least two lines to work the instruments, and usually inclusive of devices for maintaining unison, winding mechanism, etc. Where it is not necessary to include

figures, obviously one alphabet wheel suffices for the record on the tape. In the more recent stock tickers used in America the winding weight has been dispensed with, Mr. Burry having in the census period added a small, simple, self-winding device to the machine, without any diminution in its speed of working.

The other telegraph or signal system, peculiarly American in its origin, is the district-messenger service. It originated about 1870, in Brooklyn, N. Y., chiefly through the inventive skill of Mr. Calahan, an electrician, already engaged in perfecting the analogous device, the ticker, whose use, however, was to receive and record signals, while the object of the district-messenger box was to send in signals to a central office, calling for a boy, for the police, or giving a fire alarm, etc. The "box" then devised was soon simplified and perfected, and as a standard piece of electrical apparatus, with its buzzing noise when used, it has long been familiar to all the dwellers in large cities all over the country. The earlier boxes required winding up about once a year, whereas those now manufactured are wound up by each person in the act of sending in the signal—a simplification which reduced the cost several times over. The system remains in extensive use for the delivery of letters, packages, etc., but is supposed to have been checked in its development by the telephone.

A variety of telegraph systems have been invented, and some of them manufactured on a small scale, for the actual transmission of handwritten messages in facsimile, the best known being, perhaps, the ingenious "telautograph" of Dr. Elisha Gray, one of the pioneer inventors also of the telephone. A good deal of ingenuity has also been displayed in perfecting apparatus for the transmission by telegraphy of maps, pictures, portraits, etc., in which either electro-magnetic or electro-chemical means are employed.

WIRELESS TELEGRAPHY.

One of the latest and most important developments in telegraphy is that to which the epithet of "wireless" has been attached, although this is neither accurate nor descriptive, as there is more or less wire in the circuit in spite of the fact that none stretches between the transmitting and the receiving apparatus in the old and familiar manner. Wireless telegraphic apparatus still remains to some degree mysterious to the public, but has been in commercial use for several years, and was a regular manufacture during the census year, although the work in America at that time was still largely experimental. The most prominent worker in this field is Mr. G. Marconi, an Anglo-Italian, who has already transmitted signals between the English and North American shores of the Atlantic through the air, a distance of nearly 3,000 miles, and whose commercial work over shorter distance is being rapidly developed as the result of his experiments, beginning as far back as 1895–96.

In passing, it should be noted that wireless telegraph systems of a different nature had already been developed in this country several years ago by Mr. Edison and others, depending upon the principle of induction, and employed more specifically as a means of telegraphing to and from moving trains. In this work inductive signals are jumped across the air space between the ordinary telegraph wire on the track and the metallic roof of the passing car, which contains the receiving apparatus, and the signals are recorded by means of buzzing dots and dashes heard in a telephone in the receiving circuit. In the same manner the operator on the car desiring to send a message depresses his own key, which causes an induction coil to operate by local battery, through a vibrator, to charge and discharge the car roof at a high potential and a rapid rate. These effects, corresponding to dots and dashes, are taken up by the ordinary parallel wires along the track, so that the operator on the line will hear the dots and dashes in his telephone, and thus receive a message. It is recorded that messages have thus been sent over spaces of between 300 and 400 feet from the condenser roof of the car and the telegraph wires, with the train running at 40 miles an hour. Other developments by Mr. Edison in this field include the use of condensing metallic surfaces and static effects to signal at considerable distances, using balloons, the sails of ships, etc.

It remained, however, for Mr. Marconi and other workers in this field to accomplish the feat of transmitting telegraphic signals without wires through distances of hundreds of miles, employing what are known as "Hertzian waves," or influences imposed electrically upon the ether by electro-magnetic apparatus, these waves being detected only by special apparatus of the most delicate character. In Mr. Marconi's work the transmitting apparatus consists essentially of a special induction coil, which has one side of the secondary spark gap in the secondary circuit, connected with the ground; and the other connected with a vertical wire carried up some distance into the air by a pole or by a kite or balloon. The two gap spheres are also connected with the ends of the secondary winding of the induction coil or transformer. The spheres are not always essential. When the operator in transmitting presses his key, the current from the battery energizes the induction or spark coil, which in turn charges the spheres and the vertical wire in such a manner that electrical disturbance is thrown off by the vertical wire in the form of displacement waves in the ether, so that the vertical wire becomes a radiator of electric waves in every direction. The effect produced is the same, roughly, as that caused by dropping a stone into a pool of water, the rings or ripples pursuing each other to the shore, corresponding to the radiations of the electrical discharge through the ether.

The receiving apparatus to catch these impulses con-

sists of the receiving vertical wire running down to the coherer placed in a circuit containing a local battery, and a sensitive telegraph relay actuating in turn another circuit in which are included a trembler or decoherer and a recording instrument. One end of the coherer tube is connected to ground and the other to an insulated conductor, terminating preferably in a "capacity" area exactly the same as that employed in the transmitting station. The coherer or Branly tube which detects these waves in the ether is usually a very small tube, about the size of a gold pencil, and consists of glass with the wire running in at both ends, but separated by a very small space. In this space lie metallic filings, usually a mixture of nickel and silver. It would appear that when the filings are not subject to the influences of the ether waves they are of such a high resistance as to be nonconducting, so that the circuit of the local battery is open. When the ether waves impinge on the tube the filings between the two metallic pole pieces in the tube cohere and are apparently pulled together into such a continuous string or conductor that the current immediately flows in the local circuit from the local battery and the signal is recorded by the receiving telegraph instrument.

At the same instant the little tapper or decoherer in the relay circuit hits the tube a slight blow and causes the filings to fall apart, thus opening the circuit again ready to receive the next etheric impulse, representing a corresponding portion of the message to be received. By this process of cohering and decohering, the signals are received, and in their continuity they constitute a regular telegraphic message, which can be read by the ear or be recorded by a tape register or be heard in the telephone. Other forms of self-restoring coherers are in use, including that employed by the Italian navy, consisting of a glass tube, which contains plugs of carbon or iron, between which is a small globule of mercury. Mr. Marconi also reports the use of coherers with filings of carbon, cobalt, and carbon dust, as well as others of an electro-magnetic nature, which he considers far superior for working in "tuned" circuits or those which are able to receive or reject selective messages which may or may not be intended for them. He has described one such detector based upon the decrease of magnetic hysterisis, which takes place in iron when it is exposed under certain conditions to the effects of high frequency, electrical oscillations, or Hertzian waves. The same principles have been applied to wireless telegraphy. It is impossible to overrate the importance of this new development in telegraphy, particularly in its application to marine work. It has become a question whether at no distant future submarine cables may not cease to be an indispensable requisite for the transmission of intelligence across the ocean. In the meantime, wireless telegraphy systems have been adopted by the United States Signal Service for use in Alaskan waters and coast defense, by the United States Navy for men-of-war, by foreign navies, and for some forty land stations, chiefly controlled by Lloyds, along the coast of Great Britain and Europe. The system is already in commercial use on numerous steamers, and as much as $300 is frequently collected from passengers for wireless messages.

INSULATED WIRES AND CABLES.

Table 22 shows the value of insulated wire and cable, by states, 1900.

TABLE 22.—INSULATED WIRE AND CABLE: VALUE, BY STATES, 1900.

STATES.	Value.	STATES.	Value.
United States	$21,292,001	New Hampshire	$96,793
		New Jersey	4,701,574
California	65,905	New York	6,119,878
Connecticut	1,938,075	Ohio	15,512
Illinois	722,069	Pennsylvania	2,696,155
Indiana	330,000	Rhode Island	3,912,584
Massachusetts	693,456		

With regard to the manufacture of insulated wires and cables, Mr. H. A. Reed, a veteran American leader in the industry, states that no braiding on wires was done prior to 1857. In the early days the wire was wrapped with cotton or silk, which was done in many instances by means of the machines employed to wrap similarly the wires used in women's bonnets, the machinery being also of the class used in wrapping the wire or strips used in crinoline. It appears that this machinery, in its first use on electric wires, was brought to the United States by an Englishman named Moore, who settled in Philadelphia and there founded a very prosperous industry, still in existence. It seems unquestionable that he covered wire for Prof. Joseph Henry in the early thirties, to be used in some of the earliest experiments in telegraphy.

About the year 1857, under a patent for machinery used in braiding whips, an inventor named F. Bridges began to develop the art of putting braid upon wires. In 1859 he was employed by Mr. Bishop, one of the founders of the art of covering wire with gutta-percha, and from that time on the art of braiding wire was generally developed. With regard to insulating wire with gutta-percha, it would appear that in 1846, Siemens began experimenting in Berlin with gutta-percha covered wire, and that in 1847 several miles of it, protected outside with lead, were laid. In the United States, as far back as 1849, a patent for the insulation of electric wires by glass beads was applied for by Mr. G. B. Simpson, who also, in 1858, applied for a patent on applying a solution of gutta-percha over the metallic wire by a brush. It would appear, however, that in 1848 a patent was issued to Professor Durant for a solution of gutta-percha by chloroform for this purpose. According to excellent authority,[1] as early as 1847 a piece of gutta-percha insulated wire was tried

[1] The Telegraph in America, James D. Reid, pages 129, 139, 223.

near Elizabeth, N. J., for telegraphic work, and worked successfully. A similar piece was laid at the drawbridge of the Passaic River.

In 1848 Mr. J. N. Alvord, in place of telegraphic wire strung across the Mississippi at St. Louis, from a shot tower to a mast, laid a gutta-percha covered wire inclosed in lead, on the bed of the river, by means of a fleet of scows. This breaking down, he constructed the following year on the banks of the river, largely with his own hands, another gutta-percha cable armored with No. 9 exterior iron wire, which appears to have served its purpose admirably. Other experiments followed until, in 1856, Mr. S. C. Bishop laid across the Hudson River, from New York to Hoboken, an armored cable with three gutta-percha covered conductors. This was a successful, practical solution of the difficulties in carrying telegraphic circuits—the only electrical circuits then known—across rivers, etc., and touches the period of submarine cable work. Similar cables were at once laid in other rivers; the old masts for aerial wires were abandoned, and there was passed the last of the primitive stages that have led up to the development of an industry to which, in the year ending June 30, 1900, is credited by Table 22 a production of insulated wires and cables to the value of $21,292,001.

So far as known, all the earlier insulated wire manufactured in America was for such cables as are referred to above, and possibly for a small amount of interior work. Mr. Eugene F. Phillips, a veteran manufacturer in this field, referring to his ledgers of 1874, states that he believes he made the first braided wire used for any "outside" purposes in this country, the purchaser being the parent American District Telegraph Company. Similar wire wound with cotton, to run through window frames, was used, however, for telegraphic purposes as early as 1847. Braided office wire was used only to a limited extent until the advent of district telegraph and gold stock tickers. The introduction of the earlier stock-repeating instruments with three circuits, and of hundreds of messenger call-boxes created a brisk demand for such wire, but it was not until the telephone business began to develop, after the invention of the instrument in 1876, that the manufacture of insulated wire, both braided and paraffined, or "waterproof," as it was called, received a genuine impetus. Annunciator wire, which had been used for call-bell work, proved to be very handy for telephonic interior connections, and this was succeeded by an enormous demand for telephone cords.

Out of this in turn, as well as from the desire for grouping together exterior telephone wires, came the manufacture of telephone cables, consisting, however, largely of iron wire No. 12, instead of the copper wire which is now universal. The troubles from induction led to the production of a tin-foil cable in which each conductor, after having been insulated, was inclosed in a strip of tin foil. Another form of insulated cable consisted of cotton-covered wires bunched together to the number of 50 or 100, saturated with paraffin and pulled into a lead pipe. The development of this work led in turn to the gradual abandonment in cities of the aerial cable and its replacement by the insulated underground cable of the present day, to such an extent that while in 1893 the American Bell Telephone Company reported 201,259 miles of wire on poles and only 90,216 miles of wire underground, in 1900, this same company reported 509,036 miles of wire on poles, a large part of which was in insulated cables, and not less than 489,250 miles of wire underground, the whole of which was in insulated cables. To this should be added 3,404 miles of submarine wire, all of it insulated as well.

In the meantime, the development of the electric lighting industry had brought into demand insulated wire, some of which, used for arc lighting, was known as "underwriters," but was more commonly designated as "undertakers," because of its deadly nature. The insulation of cotton, paraffin, etc., exposed to the air not being sufficient to withstand the destructive effects of the elements or the abrasion of tree limbs, its use resulted in a great many deaths. Shortly after the practical development of arc lighting the incandescent lamp was brought to commercial practicability, and its introduction stimulated to an unprecedented extent the manufacture of interior insulated wire. The flexible conductor was found particularly desirable, especially for pendent and movable lamps, and a high insulation was necessary as a protection against fire, although the voltage of the current was too low to endanger life. Phillips, of London, is said to have been the first to apply gum to such wires, which he did in the form of a very thin rubber tape, slightly vulcanized, and wound spirally around the conductors. In this country Balata gum was probably used at about the same time by Mr. W. W. Marks. These wires, being improved in England and America, very rapidly superseded the earlier flexible conductors made by carrying the wires through strips of the textile webbing used in men's suspenders, the wires thus being kept apart from each other. At this period also the demand for wire of finer sizes increased. It will thus be seen that by 1880 a great stride had been made from the earlier ideas of interior insulation, and also from those which, in regard to exterior work, considered that an iron or steel wire galvanized with a thin coat of zinc was sufficiently insulated. Whereas the earlier metallic insulation was intended to preserve the wire itself, the aim of all the later methods has been in addition to prevent the currents of higher pressure and larger voltage known to the modern electrical arts from escaping. The protection of the wire itself is a small thing compared with the protection which the more perfect methods of manufacture afford of life and property.

From the very first, Mr. Edison, in introducing his incandescent lamp system two decades ago, insisted that

the chief circuits should have their mains underground, and the quantity of copper required for such low voltage work produced a condition necessitating such treatment of them. With this began the practice of laying all electric lighting circuits underground, a practice which is now universal in the larger cities, and also carried out in many of the smaller ones. Mr. Edison did not, however, manufacture insulated conductors in the ordinary sense, but ran copper rods through pipes, surrounding the rods with viscous insulating material and also with rope, in such a manner as to keep the sections of different polarity apart, if the two sides of the system were included in one service conductor. This process, however, has been virtually abandoned in favor of what is known as the "drawing-in" system, enabling lead-covered cables to be inserted at manholes along any given street, and drawn through the ducts of the underground conduits. This matter will be referred to in more detail in connection with underground conduits. The cables manufactured for such work for telegraphy and telephony, electric light and power, and electric railway service differ according to the work which they have to perform, but, broadly, consist of copper wires, single or stranded, surrounded by insulated material which is again protected by outer sheathings of lead and iron or steel wire. One notable improvement has been the utilization of paper as a means of insulation; and paper cables are now manufactured in increasing quantities for all classes of work. The results with these cables may be summed up in the following remark:[1]

> Experience has shown that paper thoroughly impregnated with insulating compound, such as the various tars or resins, forms one of the best insulating materials, provided the paper can be kept reasonably dry, as is insured by the use of the lead sheaths. A very large class of distributing cables are now made with paper insulation, and give the highest satisfaction in actual service.

It may be incidentally noted that up to the time of the census report none of the American manufacturers engaged in this industry had produced what are known as deep-sea submarine cables, these cables being produced exclusively in England, Germany, and France. A great deal of work, however, answering to this character, for short lengths of sea and for shallower waters, had already been undertaken successfully in this country, and there is no indication from the returns that the heaviest operations of this character could not be safely undertaken. The equipments of the factories, the magnitude of the industry, and the immense range of the product, as disclosed by the census report, are a full justification of those who believe that America can produce her own submarine cable, if not for international work, at least for service in her own waters and among her own dependencies.

[1] Abbott's Electric Transmission of Energy, 1900, pages 185, 186.

ELECTRIC CONDUITS.

Table 23 shows the number of feet and value of electrical conduits, by states, 1900.

TABLE 23.—ELECTRICAL CONDUITS: NUMBER OF FEET AND VALUE, BY STATES, 1900.

STATES.	Total value.	ESTABLISHMENTS REPORTING QUANTITIES AND VALUES.		Establishments reporting values only.
		Number of feet.	Value.	
United States	$1,066,163	14,875,386	$545,835	$520,328
California	14,160	200,000	14,160	
District of Columbia	21,562			21,562
Massachusetts	353,424	9,936,378	353,424	
New York	521,185	4,739,008	178,251	342,934
Ohio	42,381			42,381
Pennsylvania	113,451			113,451

Table 23 shows for 1900 a total value of electrical conduits of $1,066,163, of which about half, or $545,835, is for establishments reporting an output of 14,875,386 feet. This table embraces two classes of conduits; that employed for exterior work and that used for interior work, and these again subdivide under so many heads that classification would become very difficult.

As to exterior work, it may be noted that at the very inception of telegraphy, sixty years ago, it was proposed in America to lay wires underground; but it was not until they were placed overhead on poles that practical, commercial success attended the beginnings of the art. Twenty-five years ago telegraph lines ramified in every direction through American cities, but when to these were added the new and multitudinous circuits for telephony, electric lighting, etc., blocking the sidewalks with poles, obscuring the sky with wires, and adding perceptibly to the perils to life and property on the streets, a protest went up from the public which soon resulted in a mitigation of the evil by the construction of conduits through which to run the wires. From the very start of his work in incandescent lighting, Mr. Edison, who used currents of low potential and large volume, requiring heavy copper conductors, decided to place his circuits underground, but all the arc lighting and all the early power transmission was done with overhead wires. To this were soon added the trolley circuits, including not only the service wires, but the feeder cables.

The first steps taken in installing underground conduits were intended to clear the streets of telegraph and telephone wires only, as it was asserted that lighting circuits of high potential could not be put safely underground; but in cities like New York and Chicago all circuits were condemned to banishment, except some trolley wires, and in due time every city of any magni-

tude or importance has installed a general conduit system or taken measures to lessen the number of aerial wires. The rapidity with which the movement has proceeded may be inferred from the statement that whereas in 1882 there were not 10 miles of underground conduit in the United States, at the end of 1895 the aggregate length of underground conductors was placed at 200,000 miles. At that time the New York Edison Company had 200 miles of tube underground, with 1,100 junction boxes. The Chicago Edison Company had 99 miles of conductor for direct current, and 400 miles of cable for alternating current, carried in 170 miles of conduit. The peculiarity of the Edison system was and is that it is solid, consisting of short sections of tube joined together, in which the conductors are solidly embedded in insulating compound.

This solid system is in sharp contrast to the modern and prevalent drawing-in method, in which ducts of metal, cement, terra cotta, wood, etc., are laid down and then insulated cables are inserted by pulling in. In the solid system, subsidiary connections are first made from junction boxes; in the drawing-in system there are frequent manholes affording access to the cables for inspection, renewal, extension, etc. At the present time, cement-lined iron pipes, terra cotta conduits, and concrete blocks with holes through them are chiefly in use for underground work, and constitute a large proportion of the value shown in the table. A variation on these two solid and drawing-in methods consists in the subway or pipe gallery, instances of which are found in Detroit and Chicago, where a labyrinth of underground passages gives access to the cables, which are carried along the sides on brackets. The same method is employed at Niagara Falls in distributing current locally, and is also in vogue in many institutions, mills, etc., for carrying the circuits from the power plant to scattered buildings.

Interior conduit work is the product of the last ten or twelve years, and is greatly due to the initiative of two Americans, Messrs. E. H. Johnson and E. T. Greenfield, who developed a complete system of interior tubing for wires of all kinds, and especially for incandescent lighting. They employed, at first, paper wound spirally into a tube and dipped in an insulating compound. This was later sheathed in brass, and then came similar conduits with an outside wall of iron or steel. Previously, wires were laid directly and in a haphazard way in the plaster of the walls of buildings or run in cleats and molding outside the paper and across ceilings; but with interior conduits wiring network became as easy to find and manipulate as that for gas or water. Interior conduits are therefore now in universal use, having been adopted also as standard practice in Europe. Various modifications and improvements of conduits have been developed, including conduits woven of textile fabric and metal pipe dipped in an enameling substance; while bare pipe has also been resorted to in some instances. The transition from underground conduits to interior conduits is natural and almost imperceptible, so that one encounters the same materials and appliances employed for both kinds of work.

ELECTRIC HEATING.

Table 24 shows the number and value of rheostats and resistances, electric heating and cooking apparatus, welding, etc., by states, 1900.

TABLE 24.—RHEOSTATS AND RESISTANCES, ELECTRIC HEATING AND COOKING APPARATUS, WELDING, ETC.: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Total value.	ESTABLISHMENTS REPORTING QUANTITIES AND VALUES.		Establishments reporting values only.
		Number.	Value.	
United States	$1,186,878	94,147	$1,011,997	$174,881
Illinois	29,342	1,410	16,356	12,986
Indiana	60,156	.....	.....	60,156
Louisiana	60	5	60	.....
Maryland	13,200	1,050	13,200	.....
Massachusetts	97,400	.....	.....	97,400
Michigan	32,269	6,200	32,269	.....
Minnesota	4,000	320	4,000	.....
New Jersey	147,349	5,758	147,349	.....
New York	465,836	63,800	465,382	454
Ohio	163,849	1,050	163,849	.....
Pennsylvania	55,210	12,204	51,325	3,885
Wisconsin	118,207	2,350	118,207	.....

When it is considered that electric heat is derived from current sent through a resisting medium and first generated by a dynamo driven usually by a steam engine, which in turn derives steam from the consumption of fuel under a boiler, so that the cycle is a long and costly one, it would be safe to arrive at the conclusion that electric heat as compared with heat obtained direct from a stove should be expensive. Each step is attended with serious losses in the conversion of energy from one form to the other, and the conditions would seem to be wholly adverse to the successful and economical use of electric heat. But the fact remains that during the past ten years electric heating has steadily increased in its demands upon central stations and isolated plants for current, while in electric railway work the cars in northern latitudes which do not employ electricity for heating are now very few. Aside from this class of work—the warming of chambers and cars—there remains a very large industrial field throughout which electric heating apparatus has rapidly come into favor, on account of its superior utility and flexibility of application.

As regards the heating of rooms and cars, the manufacturers of heating apparatus have not attempted to compete with direct heat application in large volume for severe weather, but rather to meet the innumerable cases where a moderate degree of warmth is required not only in the spring and fall of the year, but in the winter months. This applies not merely to the heating of bedrooms, bathrooms, etc., but to incidental cooking. The gas and the oil stove have effected a revo-

lution in the methods of modern American households in preparing food for the table, but the peculiarity of electric heat is that, being without odor or dirt, it allows the apparatus to be employed as well in the boudoir as in the kitchen, and all that is needed to set it in operation is attachment to the nearest lamp socket. Moreover, to get an ordinary kitchen coal range or stove in operation for one slight meal or for a single hour is not economical.

The principle of apparatus developing heat electrically is simple, and depends upon the resistance offered by some form of metallic conductor to the flow of current through it. This conductor is usually surrounded by, or surrounds, a non-inflammable heat-conducting substance, and may be iron or German silver. In some of the latest and successful types, metallic paint is fired upon strips of mica, which are grouped together so as to constitute small or large sets, depending upon the use to which the apparatus is to be put. There is thus obtained a high resistance, with a maximum of radiating surface, and a large amount of current can be passed into apparatus, ranging from a kitchen stove to a car heater, or from a foot warmer to a set of curling irons.

Electric car heaters are ordinarily manufactured in sets of 4 or 6, and are placed vertically under the seats, with a grating in front to permit the heat to permeate the car, and to protect the passengers, the current being derived from the circuits which furnish current also to the propelling motors and the car lamps. Such heaters are usually built up of small helical conductors wound around porcelain tubes, or of wire encircling a narrow, flat, grid frame. These heaters have a fixed position in a car, and can be used in any combination of numbers by means of a switch; but heaters are also made in portable forms, so that they can be used temporarily in any room or position. The great bulk of the electric heating done in America to-day is performed by apparatus of this class, and is to be found in thousands of street and elevated cars in all parts of the country. It is stated that the average cost of heating a standard trolley car in the winter by electricity is about 2.25 cents per hour, or 40.5 cents per day of eighteen hours, as a maximum. Actual measurements in Boston, in severe winter weather, are reported to have shown that street cars with 2 doors, 12 windows, and 850 cubic feet of space could be heated 25° F. above the external air with an ordinary set of electric car heaters. It must be borne in mind, moreover, that such heaters are under the seats, do not occupy space (as do coal stoves) that is needed for passengers, give out no odors or gases, are instantly ready for use, and can be closely regulated.

Variations and modifications of these heaters for house, office, and shipboard use have become numerous in the last few years, and are included in the returns in Table 24. But domestic electric heating is largely being used for cooking, and apparatus of wide range has been devised for this class of service. A great many electric ovens are in use, while coffee heaters, electric kettles, and chafing dishes are now made by the thousands, with the heating member generally inclosed in the base, although a common form is a detachable base to which any cooking utensil can be applied.

A large class of such heating apparatus is now employed in factory work, and is to be found in hat factories, laundries, etc., and in many places where a nice degree of heat, which can be closely regulated, is desirable. Appliances of this kind are blocking machines, glue pots, sealing-wax heaters, bread ovens, cracker-baking machines, etc.

An interesting illustration of electrical heating for cooking purposes is to be found in one of the factories at Niagara Falls, N. Y., which is devoted to the preparation of a special form of biscuit or cracker. In this instance, pans full of crackers are kept revolving in large electric ovens. The filled pans are placed on shelves of what is essentially a diminutive Ferris wheel, each containing 12 paddles or shelves holding 8 pans of biscuits each. When the crackers have reached the right degree of cooking and the proper external appearance, the pans are taken out of the oven. The kitchen for the operatives contains a full electric cooking equipment, and in the dining room are tables fitted with improved electric cooking utensils, coffee and tea urns, chafing dishes, etc., while on one side of the room stands a row of covered compartments, heated by resistance coils placed within lengths of pipe, over which food may be kept hot.

One of the most striking illustrations of the application of electric heat to industrial purposes, is that afforded by a hat factory at Orange Valley, N. J., where no less than 250 horsepower of electrical energy is used for heating purposes. In a hat factory two kinds of heat, broadly speaking, are usually required, that of low degree, for sizing and coloring vats, etc., and that of high degree, for the hat-finishing tools. In the factory referred to, the latter form of heat is all supplied by electricity, while the exhaust steam from the electrical generating plant is utilized for all the various other purposes not requiring a higher temperature than can thus be obtained. With regard to felt hats, it may be noted that the shaping process consists in placing the very rough shape on one or more blocks, and then bringing it to the desired finishing shape by means of heat applied by irons. The different parts of the hat are not of equal thickness, the brim being the heavier and the crown the lighter portion, so that different degrees of heat are required when finishing different portions of the hat. Electric irons lend themselves with peculiar adaptability to such work, as different degrees of heat can be supplied at will, and any temperature can be definitely maintained at the proper point. Formerly the heat for machine irons was sup-

plied by gas jets, and constant attention was necessary to insure that the temperature did not become too high for too low.

Under the old method, in each of the several hand-finishing rooms, where about 125 men were employed, and hot slugs were used, it was necessary to replace at and short intervals those slugs that had become cooled with others taken red-hot direct from the furnace. To heat these slugs there were 3 furnaces on a floor, consuming 3 tons of coal per day, and in summer time causing an unbearable heat. Moreover, the frequent journeys of the men from their tables to the slug furnaces reduced their productive capacity, while the stream of men going to and fro congested the passages and disturbed the others at work. At the present time, it is not necessary for any man to move from his particular part of the bench, and all he has to do to keep his electric slugs at the right temperature is to throw in and out a little switch placed on the wall within easy reach. These same advantages appear in connection with the electric curling machines and the flanging pads employed to define and finish the brims. As to the economy of electric heat in this particular application, it is stated that where formerly 8 tons of coal were used per day, now with one-third greater capacity only 10 tons have been used; moreover, the gas bill was formerly $200 per month, while fuel and attendance for the slug furnaces amounted to $10 per day. This, moreover, does not entirely represent the economy derived from the use of electrical apparatus, as the percentage of hats injured in the process of finishing is less, on account of the use of electric heat. The workmen, moreover, enjoy greater comfort and better health.

Characteristic of the variety of work to which electric heat can be put, is the use of branding irons to imprint on cork the names of firms. In this case, the sealing of the bottle or package and the branding of the cork are accomplished by one and the same operation, lessening the amount of labor and minimizing the risk of deterioration from imperfect sealing. The same process of electric heating has also been applied to the branding of bread, hams, etc., and in a variety of other industries.

Elsewhere in this report reference has been made to the use of electricity in electro-metallurgy and electro-chemistry. Both of these depend in no small measure upon electric heat, but as no commercial apparatus can be mentioned as built for that class of work, further note is here unnecessary. A few portable electric furnaces are made, but they are unimportant in the returns of Table 24. Next to electric heating and cooking apparatus come electric resistances and rheostats, which are essentially of the same nature and class, their object being, however, not to utilize electric current in the form of heat, but to dissipate it before it can reach, in dangerous quantities, apparatus designed for other functions connected with light and power service. One of the commonest features of electrical work is to "cut in" or "cut out" a resistance, and this resistance is usually a separate, simple piece of apparatus, a few coils of resistance wire in a metal case, with a switch, or embedded in enamel, fire clay, asbestos, etc., that enables more or less of the wire to be interposed. Yet another class of apparatus employing electric heat consists in that employed for welding metals. This welding, the original processes of which were devised by Prof. Elihu Thomson, is done either by bringing the two pieces of metal to a welding temperature by passing a definite current through them when pressed together, or by using on them the high-temperature electric arc. Thomson welding apparatus has enjoyed a sphere of usefulness in welding street car rails, wire cables, electrical wire, wheel tires, tubing, etc.

ANNUNCIATORS.

Table 25 shows the number of annunciators, by states, 1900.

TABLE 25.—ANNUNCIATORS, ETC.: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Total value.	ESTABLISHMENTS REPORTING QUANTITIES AND VALUES.		Establishments reporting values only.
		Number.	Value.	
United States	$224,885	57,022	$199,565	$25,320
California	5,000	500	5,000	.....
Illinois	30,233	750	4,913	25,320
Massachusetts	20,856	22,748	20,856	.....
Michigan	2,426	4,044	2,426	.....
New Jersey	20,000	10,000	20,000	.....
New York	125,760	14,461	125,760	.....
Pennsylvania	20,610	4,519	20,610	.....

It appears from Table 25 that during the census year 1900 the output of annunciators was 57,022, valued at $224,885. Such annunciators are not strictly telegraphic, but belong in that class, as they convey their intimation so that it may be received by eye or ear. Practically all of the annunciators included in this report are of the visual character, as those which have a bell of the vibrating kind when used other than singly have numbered drops to indicate which bell has been rung. These annunciators are a familiar device in the house for summoning the servant, and in hotels the drops will run up to several hundred, corresponding with the number of the rooms. Variations upon hotel annunciators have been devised based upon the principle of placing in the room of each guest apparatus usually in the form of a dial upon which are printed the names of all articles likely to be needed. Upon placing the indicative finger at the article needed, where named on the dial, and sending in the signal to the office, the guest can secure what he wants without a preliminary visit from the hall boy. The introduction of this apparatus, however, has been somewhat interfered with by the use

of the telephone, as it is becoming the practice to place telephones in the guest chambers of hotels connected with the central switchboard at the office.

With regard to the beginnings of electric bells and annunciators, Mr. T. D. Lockwood, a well-known authority on electrical matters, says that we may assume that the electric annunciator and electric bell business both grew out of the introduction of the telegraph; the bell especially being first employed as a call for the telegraph communications; and the annunciator more especially being a direct successor of such telegraphs as that of Cooke and Wheatstone, which gave transient signals addressed to the eye; this again going back to the galvanoscope, which followed hard upon the heels of Oersted's discovery of electro-magnetism. The historian would be quite justified in considering Schweigger's invention of his galvano-magnetic indicator, made by giving an insulated wire a number of turns around an elongated frame inclosing a compass needle, as really being the first annunciator. This was done in 1819, was reported in a paper read at Halle, September 16 and November 4, 1820, and a full description appeared in the Journal Fur Chemie und Physik, 1821, Vol. XXXI, pages 1–117. It is also reported in English in Taylor's "Historical Sketch of Henry's Contribution to the Electro-Magnetic Telegraph" in the Smithsonian report for 1878.

The two distinct lines of visible annunciators and call bells came together first, according to Mr. Lockwood, in the Cooke and Wheatstone telegraph system, put into operation in 1837, and described in the three British patents No. 7390 of 1837, No. 7719 of 1838, and No. 8345 of 1840. This system and its apparatus is also described in the Telegraph Manual, of Shaffner, N. Y., 1859, pages 181–232; also in Manual of Electricity, Noad, London, 1859, pages 757–769; and The Electric Telegraph, Highton, London, 1852, pages 70–82. The annunciator feature of this was of course the needle telegraph itself, which is still largely used in England both commercially and on railroads, and which does give visible signs of various character by changes in the direction and number of deflections. The bell-alarm part of the system in all of this work as long as it was used was not, however, the call bell, either single stroke or vibratory, as we know it now, but was more like the American fire-alarm bell striker on a small scale; that is, the bell hammer was worked by a tripping clockwork, and the clockwork was controlled electro-magnetically. This was in the first Cooke and Wheatstone patent, and was, among other plans, worked by a kind of relay wherein a forked lever extending at a right angle from one of the magnetic needles was arranged to tip on the deflection of the needle into two mercury cups, and thus complete a local circuit to work the bell.

It is rather odd to notice the tenacity with which this electro-mechanical style of bell held its place, since no record is known prior to the British patent of Barlow & Foster, No. 12136, of April 27, 1848, of the bell hammer being attached directly to the magnet armature to make a single-stroke bell. That is to say, this is the first clear record of the kind; but it must not be forgotten that Prof. Joseph Henry, at Albany, N. Y., 1830–1832, employed a bell struck by an armature of a magnet to convey signals over a wire of considerable length. Prior to the Barlow & Foster idea was a suggestion of a polarized bell directly in the line thus indicated by Henry, in the English Brett patent, No. 12054, of February 8, 1848 (this being the English representative of one of the Royal E. House American printing telegraphs), which provides that a permanent bar magnet may be poised from the pole of another permanent magnet, or between the poles of two permanent magnets, so as to point north and south; in this case it is provided that a bell may be placed in relation to this poised magnet so that it may sound when a current of electricity is projected toward either of the poles.

Next comes the manufacture of the vibratory or trembling bell. This traces its ancestry first to the vibratory circuit breaker for induction coils, as might be expected, since the induction coil line of investigation was thoroughly prosecuted long before the advent of the telegraph. The first electro-magnetic device of this kind wherein a magnet which might be the core of the coil was caused to attract an armature or iron hammer, the same when attracted being enabled to break its own circuit, is that of McGauley, exhibited by him in September, 1837, at the meeting of the British Association at Liverpool. This was reinvented by the American, Page, before he had seen any description of McGauley's invention.[1]

The automatic electro-magnetic vibratory circuit-breaking device, it is believed, was first associated with a dial telegraph and an alarm for it by Werner Siemens, who is therefore to be credited with having made the first vibratory electric bell. Both the telegraph and the bell are described in the Siemens British patent No. 13062, April 23, 1850, and are alluded to by Werner Siemens himself in his "Personal Recollections," published, as translated, by Appleton in New York, 1893, pages 49–50. Siemens, there speaking of the manufacture of his dial telegraph and of the experiment made therein by a mechanician, says that "this made it apparent to me that the problem was most completely to be solved by converting the indicating telegraph into self-acting machines, each of which would automatically make and break the circuit. If two or more of such electrical machines were connected to a single electric circuit a fresh impulse could only be given when all the inserted apparatus had again completed their stroke and this had again closed the circuit. This proved in the

[1] See History of Induction, Page; Washington, 1867, pages 57–58. Also The Alternate Current Transformer, Fleming; New York and London, 1892, Vol. II, pages 26–31.

sequel a very fruitful principle for innumerable electro-technical applications. All the self-acting alarms or bells employed at the present time are based upon the automatic interruption after the completed stroke first introduced as above stated."

Siemens was in error about his "two or more," since when a plurality of vibratory instruments are on a line together they do not vibrate in unison. However, Siemens' broad statements are confirmed by Robert Sabine in his large book on the "Electric Telegraph," published in London, 1867, where the Siemens telegraph is described and illustrated, the pictures showing the vibratory circuit breaker on pages 51–53. The first instance of the said vibratory circuit breaker illustrated in an American book is that in Shaffner's Manual, page 351, in connection with a description of French telegraphs.

One more phase of the subject may be referred to, viz: that of such multiple annunciators as are used to signal from a plurality of rooms or outlying points to a central point and to the association of a common bell with all of the drops. On October 2, 1852, English patent No. 162 was granted to John I. Fuchs for a burglar alarm, wherein a vibratory electro-magnetic bell was brought into a circuit closed by springs arranged to work when a door or window was opened. The first record of a compound annunciator and common bell is that of United States patent to Charles S. Bulkley, No. 7739, October 29, 1850. This Bulkley was the man, who, sixteen years afterwards, had charge of the telegraph line survey and part construction planned to be extended from a connection with the Western Union through British Columbia and Siberia to the European telegraph system, and who had for his assistant the well-known electrician and inventor, Franklin L. Pope. The first record in England of any such thing appears to be found in British patent to John Mirand, No. 750, of November 15, 1852. In this patent is described a compound annunciator having a number of different electro-magnetic drops to be worked by closing different loops of the circuit at different points by keys or buttons, all of the loops returning to the battery by way of the common bell.

ELECTRIC CLOCKS.

Table 26 shows the number and value of electric clocks, by states, 1900.

TABLE 26.—ELECTRIC CLOCKS: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Total value.	ESTABLISHMENTS REPORTING QUANTITIES AND VALUES.		Establishments reporting values only.
		Number.	Value.	
United States	$132,149	9,180	$132,039	$110
Illinois	10,000	4,200	10,000	.....
Maine	800	75	800	.....
Massachusetts	39,453	313	39,343	110
Michigan	2,750	1,000	2,750	.....
Minnesota	600	50	600	.....
New York	78,546	3,542	78,546	.....

Among the subsidiary uses of telegraphy should be enumerated the distribution of time. This service is of two kinds. One consists in the distribution of time from Government observatories, in connection with the telegraph system of the country, at noon each day, and the other consists in the installation of electric clocks in factories or other establishments in connection with a master clock, so that the clocks are all regulated by the master clock at specific intervals of time. Some of these clocks are wound in the ordinary manner, but are corrected once an hour; others are in constant electro-magnetic relation with the master clock and are kept in synchronism by a current sent over the line once per second. Electric clocks have also been introduced independent of master clocks and operated by electro-magnetic mechanism in place of the ordinary winding devices, on the supposition that they would thus run for months without any attendance.

In the class of apparatus of this character might also be included devices for conveying signals between the power plant and the manager's office, between the engine room of a steamer and the captain's bridge, between water reservoirs and the gate keeper's office, as well as for conveying intelligence of an increase or diminution in heat, pressure, etc., at distant points. It appears from the returns with regard to electrical clocks that during the census year 9,180 were manufactured, of a total value of $132,149.

LIGHTNING ARRESTERS, FUSES, ETC.

Table 27 shows the number and value of lightning arresters, fuses, etc., by states, 1900.

TABLE 27.—LIGHTNING ARRESTERS, FUSES, ETC.: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Total value.	ESTABLISHMENTS REPORTING QUANTITIES AND VALUES.		Establishments reporting values only.
		Number.	Value.	
United States	$595,497	11,264,570	$516,636	$79,861
Illinois	88,400	4,053,150	88,400	.....
Indiana	60,157	.....	.....	60,157
Iowa	30,700	8,325	30,700	.....
Massachusetts	19,704	.....	.....	19,704
New Hampshire	4,110	1,500	4,110	.....
New York	314,768	6,015,945	314,768	.....
Ohio	51,823	1,085,550	51,823	.....
Pennsylvania	840	100	840	.....
Rhode Island	25,000	100,000	25,000	.....

Table 27 shows that in the census year 1900 lightning arresters, fuses, etc., were manufactured to the value of $595,497. This covers the amount of such apparatus reported separately, although there is reason for believing that under the head of telephonic supplies and miscellany comes a further amount, as every modern telephone exchange, as well as every telegraph office, has every one of its circuits thus protected before the wires reach the switchboard, a number of excellent protectors being built for this specific purpose. Such an arrester will consist, for example, of two small blocks of carbon separated a small distance by a thin sheet or film of

insulating mica, perforated with one or two holes, so that an undue charge or current coming in over the line jumps through the hole in the mica from the carbon block on the line side to the other lower carbon, which is connected with the ground, and by this diversion the instruments on each circuit are shielded from damage.

There are other and more important lightning arresters which protect large circuits and heavy electrical machinery, such as dynamos and motors, and which may consist of numerous disks arranged to break up the discharge on receiving it, or of electro-magnetic coils whose object is to "choke" the discharge and direct it into the arrester. One of the best-known lightning arresters for use on high-voltage alternating-current circuits is that devised by Mr. A. J. Wurts. It consists of, say, seven cylinders of a special non-arcing alloy with a crinkled surface, these being arranged about one thirty-second of an inch apart on a covered porcelain block. This gives six spark gaps in series in each unit. The lightning can jump or pass these gaps easily, but the arc which follows is dissipated by the non-conducting oxide thrown off by the lightning in its discharge, and the arrangement is very satisfactory in protecting the apparatus, especially when employed in connection with a flat spiral choke coil, which impedes the lightning and interferes to a minimum extent with the working current. In another form of lightning arrester developed by the General Electric Company, resistance is largely used in series with the spark gap of each arrester unit. It consists of three or more brass cylinders connected in series, with current-resistance rods varying, according to the work for which it is to be used, from several hundred ohms to less than one hundred. These are installed with the choking coils between them and the machines to be protected, and one such arrester unit is usually employed for each 2,000 volts of potential. Another form of lightning arrester for continuous-current circuits is that known as the Thomson magnetic blow-out, which consists of a pair of curved metallic horns situated between the poles of a compact electro-magnet energized by the main circuit. The line is connected with one horn and the ground wire with the other. The lightning discharge leaps the gap, and the arc that follows is at once repelled to the tips of the horns and there blown out.

The art of making "fuses," in the electrical sense of the word, has long been practiced in connection with the protection of interior light and power circuits, in which, for many years past, short pieces of fuse wire or metal strip have been inserted at predetermined points. Ordinarily the fuse wire and the copper wire circuit which it guards will carry the normal amount of current or "load" for which that circuit was calculated, but if undue current comes on the circuit the fuse wire, as it has a much lower melting point than the copper, gets hot much sooner and "lets go," or melts, before the copper can become dangerously heated. The flow of current in the circuit is thus automatically stopped and can not be resumed until another fuse has been inserted. Hence the name "safety fuse." These devices, made usually of an alloy of tin and lead, are of a certain fixed diameter and carrying capacity, and there are elaborate insurance rules as to the use of such wire, or strips, or links. It has been the practice to mount these on slabs of porcelain, slate, etc., and to inclose them so that the melted metal can not be flung around. Usually a porcelain cover is provided to fuse boxes or blocks, and sometimes mica, so that they can be readily inspected. There are many special forms and arrangements, such as those for ceiling fixtures, transformer cases, etc.

As early as 1880 a patent issued to Mr. Edison marked the direction of the latest improvements in fuses, viz, the introduction of the "inclosed type," whose use is rapidly becoming universal. The word "inclosed" might indeed be applied to any fuse wire or strip that is covered up or incased, but it is restricted now more particularly to those of the "cartridge" type, of which there are two general classes. In both of these types the inclosing tube incases entirely the fuse and the filling material. In one form, the material intended to stifle the fire or arc caused by "blowing" the fuse fills the case thoroughly. In the other form, the filling material is so arranged or employed as to leave part of the fuse uncovered, thus affording an air chamber or vent, so that the rush of air assists in extinguishing the arc. The filling or packing may consist of such a material as chalk, for example, or asbestos, while borax powders have been employed to help prevent the wire from remaining in a hot, molten condition. These inclosed fuses are usually made up in a stout paper jacket with metal ends, and have been manufactured in sizes up to 5,000 and 10,000 volts and 30 amperes, or 500 volts with 600 amperes, so that they are to be found on some of the circuits carrying the heaviest volume, assisting or even replacing electro-magnetic arresters and circuit breakers of the types noted above; whereas the open fuse wires were limited in their applicability to smaller and branch circuits carrying lighter currents. In fact, it might be said that the only limit to fuses as compared with circuit breakers is the necessity of immediately reclosing main circuits after an overload, short circuit, or lightning discharge, and therefore of using an electro-mechanical appliance which can be immediately reset by hand or automatically. The inclosed fuse is, however, of enormous value and is rapidly increasing in use in various improved forms, one of which has a small target or disk on the exterior of its paper shell which by discoloration indicates that it has done its duty and needs renewal.

It deserves noting in this section that no inclusion whatever is made of lightning rods in this report, although these are certainly the oldest form of lightning arresters, with a manufacturing history of more than a hundred years behind them, in association with

Franklin and other great electrical pioneers. Lightning rods are, however, bare metal conductors, and this alone would explain their exclusion from these statistics, in which no metals, as such, are embraced. It is also a fact that no electrical manufacturers report lightning rods among their products, and, so far as can be ascertained by the writer, only one American electrical engineering firm or contractor makes a business of setting them up or of designing equipments. Lightning rods, even in recent years, have been the subject of elaborate scientific report, but it may be questioned whether, relatively to the amount of new building, their use is not diminishing, not alone in cities, but in the rural districts, where the "lightning-rod man" once reaped his richest harvests. So far as cities are concerned, the rarity of disastrous lightning stroke is noteworthy, and it has been urged that the network around them of modern electrical circuits constitutes in itself a "cage" of the most scientific protective nature for warding off, by its unseen absorption at innumerable points, the dangerous discharges between sky and earth. It is true, however, that a common device on some long-distance lines to protect them against lightning, is a barbed fence wire carried on the pole top and frequently grounded. On the Niagara-Buffalo power line such a circuit is used, grounded at every fifth pole, and supported on the guard irons at each end of the upper cross-arms.

ELECTRICAL MEASURING INSTRUMENTS.

Table 28 shows the number and value of electrical measuring instruments, by states, 1900.

TABLE 28.—ELECTRICAL MEASURING INSTRUMENTS: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Total value.	ESTABLISHMENTS REPORTING QUANTITIES AND VALUES.		Establishments reporting values only.
		Number.	Value.	
United States	$1,842,135	112,843	$1,565,903	$276,232
Connecticut	43,200	600	6,000	37,200
Illinois	94,538	8,104	78,538	16,000
Massachusetts	1,071,230	88,132	988,730	82,500
New Hampshire	57,000	.....	.....	57,000
New Jersey	482,635	15,607	482,635	.....
New York	25,356	400	10,000	15,356
Pennsylvania	68,176	.....	.....	68,176

The output of electrical measuring instruments is shown by Table 28 to have been $1,842,135 during the census year 1900, of which amount $1,565,903 was reported by concerns which returned the number of apparatus they had manufactured as 112,843. This would show an average value of about $14, an indication which merits, however, little weight, as the range is very wide, extending from minute galvanometers carried in the pocket, for testing batteries, up to complicated instruments placed on switchboards and used for noting the total current output of a central station power house. Development in this field of work is almost wholly confined to the last two decades, as prior to the introduction of the electric light the demand was very limited and was restricted to telegraph and submarine cable work, for which the instruments were generally imported from England, Germany, and France. At the present time the United States is not only self-supplied in regard to almost all classes of instruments, but has created a large export trade in them, while some of the leading American types are also made abroad.

Electric measuring instruments and meters may be regarded from various standpoints, and constitute several distinct groups. The more delicate and sensitive forms are found usually in scientific and commercial laboratories and employed to make refined tests as to magnetism, electricity, etc., the insulation resistance of wires and cables, etc. These are required to give the highest degree of precision, and are quite costly. There are also instruments for commercial purposes of all kinds which are required merely to indicate, while others record in some continuous or permanent form, the amount and pressure of current flowing in any circuit. Some instruments are made in large quantities for use by consumers of electric light and power and are analogous to gas meters. Others again are intended to be carried from point to point to take readings. A fourth class comprises those which are located in lighting and power plants to assist the attendants in properly regulating the apparatus and in determining the output, etc. Some instruments are intended for direct-current work, others for alternating, and others for both types of current.

A broad view would divide instruments and meters in common use for the indication and registration of current and voltage, into such groups as the following: 1, the electro-magnetic; 2, the electro-static; 3, the electro-chemical; 4, the electro-thermic or hot wire; 5, the tangent galvanometer; 6, the dynamometric; 7, the d'Arsonval or Weston. Some of them simply indicate; others, in association with clockwork escapement, record results, subject sometimes to a certain "constant" for exact correction. Some, as in the electro-chemical or voltameter group, depend upon the amount of metal, say silver, deposited by the action of the current in a cell through which a definite portion is to flow, the plates being periodically weighed. The electro-thermic or hot-wire instruments operate by means of the expansion of a fine wire or strip of conducting material, whose indications are proportionate to the square of the current passing. One singular variation arranges the conductor as a coil underneath a small windmill, which is rotated by the warm air put in circulation on account of the heating of the conductor, so that the speed of the little windmill registers the amount of current. The heating principle is also ingeniously availed of in

meters for consumers where it is desired to grade the charge according to the largest use of current. In this form there is a glass tube with two bulbs, around one of which the conductor is wrapped. The passage of current heating the air in one bulb forces some of the liquid out of it into the other and into a graduated overflow tube, where it remains until the meter is read and tipped over for another turn of duty. Obviously, while a larger current will force more liquid into the overflow-indicating tube, a smaller current will have a lesser effect, or none at all; and the consumer benefits by a rate of discount for current based on his largest use thus shown. Instruments of this kind and of others aiming to encourage increased use of current by consumers have been largely manufactured of late years. The voltametric or electro-chemical meters at one time in widespread use have been replaced by them or by mechanisms of the Thomson recording wattmeter class, which are essentially small motors, whose revolving part actuates the registration escapement. In Europe the electro-chemical type has again come forward.

Central station voltmeters and ammeters have of late come to be frequently of the d'Arsonval or Weston type, in which, broadly stated, a coil suspended in a strong field between the poles of a magnet can rotate through a small angle when the current passes, and in these instruments, if measuring large current, shunts are employed, so that only part of the current goes through the coil. The swing of the coil carries a needle attached to it over the graduated face of a dial on which are the figures to be watched or noted.

Electro-static instruments are in use to some extent for high tension measurements, ground detectors, etc., and depend for their action upon the mutual attraction of two plates connected with opposite sides of the line or circuit when any difference of potential exists between them. If one of these plates or conductors be free to move, it will approach the other, and thus an indication is obtained. Some beautiful apparatus of this nature is due to Lord Kelvin and is also manufactured by a few of the larger American concerns, especially for circuits carrying currents of 10,000 volts and upward.

Each new electrical development necessitates, as a rule, some new device for measurement of the current employed, and hence the growth of automobilism has caused the manufacture of a large number of combined or duplex ammeters and voltmeters, so that the one instrument placed on the dashboard before the chauffeur enables him to note at any moment by a single glance the amount of current he is taking from his storage batteries in volts and amperes.

ALL OTHER PRODUCTS.

Table 29 shows the value of all other products, by states, 1900.

TABLE 29.—ALL OTHER PRODUCTS: VALUE, BY STATES, 1900.

STATES.	Value.	STATES.	Value.
United States	$13,653,114	Massachusetts	$2,222,073
		Michigan	14,150
California	69,349	Minnesota	102,000
Colorado	5,000	Missouri	48,117
Connecticut	445,449	Nebraska	18,350
Delaware	5,202	New Jersey	1,159,979
Georgia	3,500	New York	1,915,108
Illinois	3,218,171	Ohio	1,285,431
Indiana	308,532	Pennsylvania	2,225,336
Iowa	39,882	Rhode Island	294,893
Kentucky	5,085	Tennessee	36,157
Louisiana	21,200	Texas	53,115
Maine	9,471	Wisconsin	146,064
Maryland	1,500		

It will be noted that in spite of the careful and somewhat minute division of the production of electrical apparatus into at least a score of different branches, there remains under the heading of "all other products," shown in Table 29, the large amount of $13,653,114. It is possible that some of this amount might have been separated and put under one of the categories dealt with above, but in each case reasons have been considered which were deemed sufficient for non-inclusion. The public has probably very little idea of the vast range of the industry and its application, although in these modern times few efforts are spared to make it believe that electricity is a panacea for whatever ill or deficiency has not yet been cured or rectified in the advance of civilization.

An idea of the miscellaneous character of the innumerable articles of an electrical nature now manufactured may be formed from the fact that a catalogue of a well-known supply house now lying before the writer includes in its index over 2,000 separate articles, none of which belong in the category of large apparatus and all of which are embraced under the general head of "supplies." It is true that a great many of these articles would be included in the classes which have been discussed in this report, but there is a large residue, forming an extremely heterogeneous collection, best grouped as "all other products."

It may suffice to mention that this section includes, for example, a large variety of electro-medical, electro-surgical, and electro-therapeutic apparatus in general, the tendency to variation in style and nature of appliance being ceaselessly exercised in this field of application, particularly in America, which now exports such goods to all parts of the world.

Under the same general head of "all other products" are included a large variety of miscellaneous appliances for electric railway work, as well as for electric lighting—special electrical shades, bulbs, and globes; electrical dental specialties; electrical house goods; scientific apparatus for schools and colleges; special forms of insulating materials and compounds; a large variety of electric insulators in lava, porcelain, slate, mica,

asbestos, vulcanized fiber, hard rubber, wood, etc.; a large class of electric ignition apparatus for hydrocarbon automobiles and for gas and oil engines; electric cigar lighters, portable gas lighters and gas-igniting appliances in general; a very extensive and varied class of electrical toys; a number of forms of metal appliances used as fixtures, switch boxes, cases, holders, etc.; a great many special tools for doing specific work electrically, such as grinding, burning patterns on wood, cutting cloth, trimming the pile on plush or the long hair on furs; special forms of magnet coils, commutator bars, segments, etc.; dynamo and motor brushes other than those of carbon and chiefly of copper strips or netting; brush holders; electric shocking machines for amusement purposes; appliances for electro-plating; clips and connectors for cables and wires; ceiling blocks, rosettes, brackets, etc. In fact pages could be filled with the enumeration of electrical supplies of these and other kinds, but a few are here mentioned in order to account for what may seem to be the rather large amount included under the head of "all other products."

Table 30 shows the amount received for custom work and repairing, by states, 1900.

TABLE 30.—AMOUNT RECEIVED FOR CUSTOM WORK AND REPAIRING: BY STATES, 1900.

STATES.	Value.	STATES.	Value.
United States	$2,063,736	Massachusetts	$108,936
		Michigan	83,210
California	97,633	Minnesota	29,050
Colorado	2,500	Missouri	15,365
Connecticut	4,075	Nebraska	7,000
Georgia	23,000	New Hampshire	8,663
Illinois	206,360	New Jersey	129,081
Indiana	86,504	New York	863,128
Iowa	7,490	Ohio	63,866
Kentucky	11,330	Pennsylvania	211,330
Louisiana	9,474	Rhode Island	20,340
Maine	12,269	Wisconsin	61,141
Maryland	1,475		

Table 31 shows the detailed statistics of electrical apparatus and supplies, by states, for 1900.

TABLE 31.—ELECTRICAL APPARATUS

		United States.	California.	Colorado.	Connecticut.	Illinois.	Indiana.	Kentucky.
1	Number of establishments	580	11	4	17	82	24	4
	Character of organization:							
2	Individual	167	5	1	5	16	3	1
3	Firm and limited partnership	102	.....	1	2	18	5	1
4	Incorporated company	311	6	2	10	48	16	2
	Capital:							
5	Total	$83,130,943	$181,474	$77,000	$2,513,812	$11,641,177	$1,453,356	$76,077
6	Land	$3,480,520	$6,000	.....	$69,400	$935,189	$84,600	.....
7	Buildings	$9,732,537	$12,196	.....	$174,949	$1,270,721	$140,908	.....
8	Machinery, tools, and implements	$14,293,747	$80,101	$50,000	$422,696	$1,338,780	$392,382	$34,811
9	Cash and sundries	$55,624,139	$83,177	$27,000	$1,846,767	$8,096,487	$835,516	$41,266
10	Proprietors and firm members	384	5	3	8	61	13	3
	Salaried officials, clerks, etc.:							
11	Total number	4,987	29	6	142	1,142	134	7
12	Salaries	$4,563,112	$28,638	$6,000	$170,490	$637,933	$133,693	$6,379
	Officers of corporations—							
13	Number	516	4	.....	21	83	26	2
14	Salaries	$1,201,223	$6,900	.....	$55,541	$167,979	$33,605	$3,800
	General superintendents, managers, clerks, etc.—							
15	Total number	4,471	25	6	121	1,059	108	5
16	Salaries	$3,361,889	$21,738	$6,000	$114,949	$469,954	$100,088	$2,579
	Men—							
17	Number	3,784	25	5	100	929	87	3
18	Salaries	$3,058,206	$21,738	$5,400	$103,074	$415,178	$91,926	$2,220
	Women—							
19	Number	687	.....	1	21	130	21	2
20	Salaries	$303,683	.....	$600	$11,875	$54,776	$8,162	$359
	Wage-earners, including pieceworkers, and total wages:							
21	Greatest number employed at any one time during the year	50,389	307	102	1,178	8,065	1,129	73
22	Least number employed at any one time during the year	32,582	220	69	804	3,943	827	53
23	Average number	40,890	238	84	961	6,048	881	56
24	Wages	$20,190,344	$129,906	$41,720	$405,604	$2,818,274	$340,355	$24,396
	Men, 16 years and over—							
25	Average number	34,150	228	56	690	4,699	715	37
26	Wages	$18,369,228	$127,826	$30,120	$336,112	$2,440,344	$304,922	$21,801
	Women, 16 years and over—							
27	Average number	6,158	.....	27	270	1,246	166	18
28	Wages	$1,701,110	.....	$11,200	$69,307	$356,927	$35,433	$2,461
	Children, under 16 years—							
29	Average number	582	10	1	1	103	.....	1
30	Wages	$120,006	$2,089	$400	$185	$21,003	.....	$134
	Average number of wage-earners employed during each month:							
	Men, 16 years and over—							
31	January	34,061	255	67	639	4,177	771	36
32	February	32,052	241	67	641	4,232	776	35
33	March	32,774	233	49	638	4,244	775	38
34	April	32,166	215	49	633	4,207	766	35
35	May	32,931	214	49	647	4,197	811	33
36	June	32,790	201	47	686	4,100	614	35
37	July	33,109	186	46	718	4,337	615	31
38	August	34,260	208	45	705	4,742	637	34
39	September	35,382	215	45	716	5,204	677	38
40	October	36,413	234	69	734	5,559	691	43
41	November	37,298	269	69	766	5,718	722	44
42	December	36,564	265	69	757	5,672	729	47
	Women, 16 years and over—							
43	January	6,236	.....	23	237	918	161	24
44	February	5,984	.....	23	244	952	172	24
45	March	6,038	.....	23	247	1,028	178	23
46	April	6,753	.....	25	257	1,094	182	20
47	May	5,858	.....	30	257	1,205	183	19
48	June	5,678	.....	30	252	1,117	159	.....
49	July	5,761	.....	32	257	1,187	156	.....
50	August	5,939	.....	32	256	1,304	160	18
51	September	6,252	.....	32	314	1,407	160	20
52	October	6,611	.....	26	314	1,524	159	22
53	November	6,811	.....	28	287	1,602	159	24
54	December	6,975	.....	26	314	1,604	158	17
	Children, under 16 years—							
55	January	565	10	1	1	92	.....	.....
56	February	504	10	1	1	88	.....	.....
57	March	524	10	1	.....	95	.....	.....
58	April	545	10	1	.....	100	.....	1
59	May	537	10	1	.....	94	.....	1
60	June	537	10	1	.....	96	.....	1
61	July	558	10	1	.....	99	.....	.....
62	August	608	10	1	.....	105	.....	.....
63	September	620	10	1	2	110	.....	.....
64	October	664	10	1	2	113	.....	1
65	November	679	10	1	2	123	.....	1
66	December	643	10	1	2	120	.....	1
	Miscellaneous expenses:							
67	Total	$6,788,314	$11,771	$8,027	$222,400	$1,565,404	$89,172	$11,526
68	Rent of works	$549,641	$8,152	$3,510	$7,240	$74,764	$3,670	$2,325
69	Taxes, not including internal revenue	$237,043	$690	$470	$4,797	$54,970	$2,672	$142
70	Rent of offices, insurance, interest, and all sundry expenses not hitherto included.	$5,625,486	$2,929	$4,047	$210,063	$1,385,489	$70,930	$8,020
71	Contract work	$376,145	.....	.....	$300	$50,181	$11,900	$1,030
	Materials used:							
72	Aggregate cost	$48,916,440	$359,135	$51,608	$1,973,715	$4,675,961	$784,393	$66,285
	Principal materials—							
73	Total cost	$47,049,479	$350,152	$45,300	$1,917,112	$4,402,787	$789,986	$63,511
74	Purchased in raw state	$776,946	.....	.....	.....	.....	$85,110	.....
75	Purchased in partially manufactured form	$46,272,533	$350,152	$45,300	$1,917,112	$4,402,787	$704,876	$63,511
76	Fuel	$738,642	$2,100	$1,400	$12,112	$94,340	$21,389	$040
77	Rent of power and heat	$237,593	$3,388	$426	$7,288	$33,947	$2,100	$459
78	Mill supplies	$492,526	$335	$662	$17,033	$99,640	$13,894	$663
79	Freight	$398,200	$2,710	$3,820	$20,170	$45,247	$7,024	$1,012
80	Value of products, including custom work and repairing	$91,348,889	$555,735	$121,000	$3,167,842	$12,169,425	$1,586,229	$117,680
	Comparison of products:							
81	Number of establishments reporting for both years	417	8	3	14	50	13	2
82	Value for census year	$83,360,937	$176,821	$101,000	$3,100,242	$10,727,767	$364,978	$90,060
83	Value for preceding business year	$57,845,428	$145,421	$58,000	$2,321,091	$6,337,371	$289,858	$75,613

AND SUPPLIES: BY STATES, 1900.

Maryland.	Massachusetts.	Michigan.	Minnesota.	Missouri.	Nebraska.	New Hampshire.	New Jersey.	New York.	Ohio.	Pennsylvania.	Rhode Island.	Wisconsin.	All other states.[1]	
6	54	12	12	17	3	5	35	134	64	63	13	7	13	1
1	9	4	4	7	1	.....	8	59	15	17	3	1	7	2
.....	12	2	4	2	1	1	4	24	7	15	2	.....	1	3
5	33	6	4	8	1	4	23	51	42	31	8	6	5	4
$236,710	$8,259,612	$547,319	$79,935	$981,975	$19,265	$183,233	$7,380,139	$17,697,352	$7,036,103	$20,967,587	$2,652,135	$981,553	$165,129	5
$8,000	$112,300	$12,800	.....	$35,000	.....	$400	$182,693	$1,301,218	$239,787	$362,348	$125,150	$5,600	$35	6
$51,125	$716,298	$43,472	.....	$65,000	.....	$3,800	$765,707	$2,442,795	$1,338,168	$2,406,873	$288,600	$10,000	$1,925	7
$54,717	$1,280,069	$104,907	$29,360	$170,973	$8,400	$98,870	$1,530,224	$3,092,606	$2,081,368	$2,924,209	$414,400	$142,272	$42,652	8
$122,868	$6,150,945	$386,140	$50,575	$711,002	$10,865	$80,163	$4,901,515	$10,860,783	$3,376,780	$15,274,157	$1,823,985	$823,681	$120,517	9
1	34	9	11	11	2	3	15	111	29	48	8	1	8	10
26	565	29	13	59	2	11	543	1,113	394	646	50	56	20	11
$26,925	$556,703	$28,962	$7,976	$68,650	$1,872	$7,056	$598,011	$904,201	$399,202	$836,960	$64,524	$63,744	$15,193	12
7	46	5	3	17	2	4	48	72	78	62	15	14	7	13
$16,328	$127,988	$11,400	$2,000	$39,700	$1,872	$2,575	$155,849	$164,786	$158,240	$192,314	$28,276	$26,520	$5,550	14
19	519	24	10	42	.....	7	495	1,041	316	584	35	42	13	15
$10,597	$428,715	$17,502	$5,976	$28,950	.....	$4,481	$442,162	$739,415	$240,962	$644,646	$36,248	$37,224	$9,643	16
19	426	19	7	35	.....	5	433	902	206	517	26	33	7	17
$10,597	$387,119	$15,542	$5,040	$25,250	.....	$3,845	$410,708	$683,772	$199,529	$605,856	$31,616	$32,404	$7,392	18
.....	93	5	3	7	.....	2	62	139	110	67	9	9	6	19
.....	$41,596	$2,020	$936	$3,700	.....	$636	$31,454	$55,643	$41,433	$38,790	$4,632	$4,820	$2,251	20
225	6,512	287	131	615	16	110	3,350	12,434	4,732	9,268	1,007	595	253	21
156	4,261	113	61	441	10	76	2,196	8,540	3,104	6,325	769	447	167	22
155	5,202	184	86	533	12	94	2,793	10,370	3,773	7,817	864	527	212	23
$54,303	$2,714,449	$86,188	$45,340	$186,216	$8,707	$82,956	$1,514,333	$5,666,702	$1,502,270	$4,002,737	$328,691	$221,501	$65,696	24
137	4,256	170	86	405	12	53	2,505	9,266	2,956	6,600	586	489	204	25
$50,967	$2,445,100	$81,269	$45,340	$156,646	$8,707	$22,331	$1,430,591	$5,341,834	$1,315,376	$3,677,780	$254,318	$213,701	$64,143	26
13	843	11	.....	111	.....	41	218	1,023	794	1,054	278	38	7	27
$2,736	$244,221	$4,513	.....	$26,245	.....	$10,625	$69,044	$309,044	$181,569	$294,236	$74,378	$7,800	$1,376	28
5	103	3	.....	17	.....	.....	70	81	23	163	.....	.....	1	29
$600	$25,128	$406	.....	$3,325	.....	.....	$14,698	$15,824	$5,325	$30,721	.....	.....	$177	30
126	4,632	200	79	348	12	54	2,373	9,376	2,907	6,705	629	484	191	31
149	3,617	160	77	350	12	54	2,400	8,158	2,933	6,862	616	484	188	32
154	3,694	124	77	368	12	57	2,468	8,494	2,948	7,115	613	485	188	33
171	3,827	101	81	459	12	56	2,558	9,136	2,992	5,622	552	499	195	34
199	3,935	113	82	454	14	53	2,593	9,406	3,045	5,898	537	451	200	35
116	4,053	187	72	428	11	53	2,684	9,270	3,096	5,930	553	454	200	36
120	4,189	181	70	423	13	50	2,546	9,188	2,800	6,363	552	466	220	37
121	4,403	177	71	434	13	50	2,559	9,203	2,847	6,768	547	478	218	38
121	4,484	181	103	366	13	54	2,508	9,612	2,922	6,831	581	495	216	39
121	4,575	203	108	366	12	52	2,439	9,922	2,994	6,981	595	504	211	40
119	4,764	207	111	433	13	52	2,411	10,146	2,990	7,095	630	529	215	41
124	4,893	209	101	435	13	53	2,518	9,281	2,997	7,030	631	536	204	42
14	1,002	15	.....	120	.....	51	200	1,092	842	1,180	310	40	7	43
14	816	10	.....	122	.....	47	208	985	858	1,149	303	40	7	44
14	808	7	.....	118	.....	46	210	981	861	1,146	299	41	8	45
17	759	5	.....	108	.....	47	226	986	810	905	259	45	8	46
15	780	5	.....	98	.....	48	225	979	805	918	252	31	8	47
11	735	10	.....	105	.....	27	219	995	734	984	261	32	7	48
11	756	10	.....	85	.....	31	231	1,013	670	1,013	268	34	7	49
11	802	8	.....	99	.....	31	212	999	668	1,026	271	35	7	50
11	865	11	.....	113	.....	35	199	968	775	1,025	273	37	7	51
11	898	13	.....	117	.....	39	229	1,065	828	1,051	270	38	7	52
11	927	16	.....	122	.....	45	224	1,085	840	1,115	278	41	7	53
12	974	18	.....	121	.....	39	239	1,132	841	1,136	294	43	7	54
6	125	2	.....	17	.....	.....	72	100	19	119	.....	.....	1	55
7	88	2	.....	17	.....	.....	71	79	20	119	.....	.....	1	56
7	92	3	.....	17	.....	.....	68	81	22	127	.....	.....	1	57
7	95	3	.....	17	.....	.....	70	80	21	139	.....	.....	1	58
7	96	4	.....	17	.....	.....	69	70	24	143	.....	.....	1	59
4	93	4	.....	17	.....	.....	63	66	29	152	.....	.....	1	60
4	98	3	.....	17	.....	.....	61	83	32	149	.....	.....	1	61
4	101	3	.....	17	.....	.....	65	78	33	190	.....	.....	1	62
4	106	3	.....	17	.....	.....	65	79	21	201	.....	.....	1	63
4	108	3	.....	17	.....	.....	78	87	21	218	.....	.....	1	64
4	118	2	.....	14	.....	.....	80	87	19	217	.....	.....	1	65
4	120	2	.....	17	.....	.....	81	87	18	179	.....	.....	1	66
$28,166	$454,008	$38,314	$9,585	$144,966	$1,632	$3,704	$769,135	$893,038	$568,201	$1,647,426	$257,774	$48,245	$15,880	67
$1,510	$62,103	$3,024	$3,365	$11,408	$530	$1,850	$34,687	$110,367	$148,956	$50,943	$7,509	$8,734	$4,994	68
$583	$37,276	$1,451	$565	$3,147	$72	$354	$16,056	$51,717	$24,880	$30,674	$3,535	$1,943	$1,049	69
$22,563	$345,802	$30,239	$5,655	$124,276	$1,030	$1,500	$718,892	$690,170	$891,900	$1,318,786	$246,330	$37,568	$9,787	70
$3,500	$8,827	$3,600	.....	$6,135	.....	.....	.....	$40,784	$2,465	$247,023	$400	.....	.....	71
$112,464	$5,250,293	$182,452	$121,782	$355,475	$24,395	$81,614	$2,996,908	$12,538,790	$3,338,978	$11,372,789	$4,134,980	$358,976	$135,497	72
$109,158	$5,101,799	$173,889	$112,105	$326,188	$23,333	$77,855	$2,854,246	$12,128,293	$3,027,284	$11,021,909	$4,104,156	$341,234	$129,187	73
.....	$146,282	$2,000	.....	.....	.....	.....	.....	$408,149	.....	$92,655	.....	.....	$2,750	74
$109,153	$4,955,517	$171,889	$112,105	$326,188	$23,333	$77,855	$2,854,246	$11,630,144	$3,027,284	$10,929,254	$4,104,156	$341,234	$126,437	75
$1,960	$31,164	$2,781	$1,345	$10,144	$405	$160	$46,499	$169,887	$191,252	$124,508	$20,899	$3,580	$2,127	76
$118	$41,038	$840	$2,514	$989	$520	$340	$20,459	$68,959	$18,064	$28,111	$3,344	$7,600	$1,639	77
$448	$26,434	$1,787	$1,368	$1,062	$62	$1,822	$33,182	$58,710	$74,603	$152,564	$5,955	$1,588	$764	78
$785	$49,858	$3,255	$4,450	$17,092	$75	$1,437	$42,522	$117,941	$27,775	$45,647	$626	$4,974	$1,780	79
$266,811	$10,490,361	$438,144	$228,076	$910,602	$44,950	$181,793	$6,447,154	$22,695,024	$6,504,847	$19,112,665	$5,113,292	$923,587	$273,672	80
5	39	11	11	9	3	4	25	104	47	44	11	4	10	81
$228,324	$9,956,288	$422,182	$211,576	$772,520	$44,950	$85,000	$6,142,627	$21,982,890	$4,972,829	$18,364,132	$5,088,900	$771,346	$250,505	82
$215,365	$6,994,217	$262,224	$132,400	$625,285	$32,600	$66,500	$4,502,438	$15,780,704	$4,087,489	$11,633,083	$3,601,284	$520,684	$163,851	83

[1] Includes establishments distributed as follows: Delaware, 1; Georgia, 1; Iowa, 2; Louisiana, 2; Maine, 2; North Carolina, 2; South Carolina, 1; Tennessee, 1; Texas, 1.

TABLE 31.—ELECTRICAL APPARATUS

		United States.	California.	Colorado.	Connecticut.	Illinois.	Indiana.	Kentucky.
	Power:							
84	Number of establishments reporting	490	8	4	15	69	20	3
85	Total horsepower	63,856	406	120	1,248	9,817	1,636	82
	Owned—							
	Engines—							
86	Steam, number	263	6	2	9	32	16	1
87	Horsepower	34,018	337	105	665	5,328	1,324	60
88	Gas or gasoline, number	52	.....	.....	.....	7	5	.....
89	Horsepower	1,695	.....	.....	.....	55	38	.....
90	Water wheels, number	17	.....	.....	2	.....	.....	.....
91	Horsepower	835	.....	.....	15	.....	.....	.....
92	Electric motors, number	1,643	.....	.....	24	298	28	.....
93	Horsepower	20,182	.....	.....	261	3,543	157	.....
94	Other power, number	5	.....	.....	1	.....	.....	.....
95	Horsepower	60	.....	.....	1	.....	.....	.....
	Rented—							
96	Electric, horsepower	4,074	69	15	34	498	87	22
97	Other kind, horsepower	2,992	.....	.....	272	393	30	.....
98	Furnished to other establishments, horsepower	1,489	8	.....	.....	160	4	.....
	Establishments classified by number of persons employed, not including proprietors and firm members:							
99	Total number of establishments	580	11	4	17	82	24	4
100	No employees	17	.....	.....	1	3	1	1
101	Under 5	99	3	.....	2	16	4	.....
102	5 to 20	194	3	3	3	29	10	.....
103	21 to 50	128	4	.....	3	21	3	3
104	51 to 100	60	.....	1	3	6	1	.....
105	101 to 250	49	1	.....	4	3	4	.....
106	251 to 500	21	.....	.....	1	2	1	.....
107	501 to 1,000	6	.....	.....	.....	.....	.....	.....
108	Over 1,000	6	.....	.....	.....	2	.....	.....

AND SUPPLIES: BY STATES, 1900—Continued.

Maryland.	Massachusetts.	Michigan.	Minnesota.	Missouri.	Nebraska.	New Hampshire.	New Jersey.	New York.	Ohio.	Pennsylvania.	Rhode Island.	Wisconsin.	All other states.[1]	
6	53	8	9	12	3	4	31	107	57	53	13	6	9	84
298	6,173	317	39	633	45	303	4,939	18,755	5,816	11,174	1,398	445	212	85
1	24	5	.....	4	1	.....	26	40	45	40	4	4	3	86
12	2,942	280	.....	377	20	.....	2,423	8,355	4,428	5,747	1,320	200	95	87
3	6	1	.....	1	1	.....	3	8	6	10	.....	.....	1	88
75	107	4	.....	6	5	.....	32	54	137	1,172	.....	.....	10	89
4	1	.....	.....	.....	.....	2	1	2	5	.....	.....	.....	.....	90
200	25	.....	.....	.....	.....	250	200	48	97	.....	.....	.....	.....	91
1	244	3	.....	24	.....	1	128	549	210	128	1	4	.....	92
7	2,505	8	.....	212	.....	10	2,018	7,706	693	3,037	10	15	.....	93
.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	94
.....	55	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....	.....	95
4	261	25	35	18	20	35	82	2,297	230	96	19	160	67	96
.....	278	.....	4	20	.....	8	184	295	231	1,122	45	70	40	97
.....	205	.....	.....	.....	.....	40	.....	1,009	45	3	.....	.....	15	98
6	54	12	12	17	3	5	35	134	64	63	13	7	13	99
.....	3	2	1	.....	.....	.....	1	1	.....	2	.....	.....	1	100
1	6	2	3	8	2	.....	2	28	6	11	.....	1	4	101
2	11	5	5	5	1	3	8	53	16	26	7	.....	4	102
1	16	1	3	1	.....	1	7	26	20	11	3	2	2	103
2	11	.....	.....	.....	.....	1	5	12	10	5	2	.....	1	104
.....	2	2	.....	2	.....	.....	7	10	5	4	.....	4	1	105
.....	4	.....	.....	1	.....	.....	3	2	5	2	.....	.....	.....	106
.....	.....	.....	.....	.....	.....	.....	2	.....	2	1	1	.....	.....	107
.....	1	.....	.....	.....	.....	.....	.....	2	.....	1	.....	.....	.....	108

[1] Includes establishments distributed as follows: Delaware, 1; Georgia, 1; Iowa, 2; Louisiana, 2; Maine, 2; North Carolina, 2; South Carolina, 1; Tennessee, 1; Texas, 1.

SHIPBUILDING.

SHIPBUILDING.

By ALEXANDER R. SMITH, *Expert Special Agent.*

The growth of the shipbuilding industry in the United States during the past ten years, as shown by the census reports, exceeds that of any preceding decade, and the tonnage constructed during the census year ending May 31, 1900, was greater than during any preceding year in the history of the United States, with the possible exceptions of 1854 and 1855. Although in other countries iron and steel long ago largely superseded wood as the chief material used in the construction of ships, the census statistics show that it was not until the last decade that metal shipbuilding attained proportions greater than wooden in the private shipyards of the United States.

This substitution of iron and steel for wood has wrought a revolution in the shipbuilding industry in the United States. The zenith of American shipbuilding, judged by the tonnage annually added to the merchant marine, was reached during the decade between 1850 and 1860. At that time the superiority of ships built in the United States for endurance, speed, and safety was conceded. It was the era of the American clipper. This class of wooden sailing ships commanded higher freight rates, even in Liverpool and London, than British ships, and insurance rates on American vessels and their cargoes were lower than on foreign ships. These advantages placed the United States in the very front rank in international trade-carrying competition. This prestige had been increasing ever since the successes achieved by the United States in the carrying trade during the Napoleonic wars. The easy convertibility of the wooden vessels of that time into ships of war gave a distinct naval strength and solidity to the nation. The passing of wooden shipbuilding, therefore, as the dominant branch of the shipbuilding industry in the United States, has an historical significance.

One remarkable feature of the growth of the industry during the past decade is the fact that the product of merchant vessels has been so largely absorbed and employed in the domestic commerce of the country. Up to the time of the Civil War the tonnage of vessels constructed in American shipyards for the foreign trade compared favorably with that for the domestic trade; and, indeed, the progress and prosperity of the industry rested largely upon the demands for vessels for foreign commerce. This is no longer true. Comparatively few vessels for foreign trade are now built in American shipyards. But in the meantime the enormous growth of internal commerce, together with the opportunities afforded by the extensive coast line of the United States, the Great Lakes, and the navigable rivers, which in many cases have been so deepened, at an expense reaching into hundreds of millions of dollars, as to accommodate the passage of the largest vessels, has greatly developed the demand for vessels in the domestic trade. This has not only kept alive our shipbuilding industry, but constitutes also, in large part, the foundation upon which it has expanded. Another important element in the growth of the industry has been the demand of the Government for a new Navy constructed in home shipyards.

During the last four decades, therefore, the stability of the industry in the United States has rested almost wholly upon the domestic or coastwise trade, the vessels constructed for foreign trade representing but a small proportion of the entire output of the shipyards. Whether or not this is due to the fact that the domestic water-borne trade of the United States has by law been restricted to vessels built in the United States, need not here be discussed. These restrictions have existed since the foundation of the Government, at first by statutory discriminations in favor of home vessels that practically excluded foreign tonnage, and, ever since the early part of the Nineteenth century, by statutory prohibition. Under such restrictions shipbuilding for the internal commerce of the United States has grown and prospered. On the other hand, in the foreign trade, to which foreign vessels for many years have been admitted upon terms of perfect equality with those of the United States, the foreign tonnage has maintained an almost constant increase, while the domestic tonnage has steadily diminished.

The completeness of the decline of American shipping in the foreign trade may be briefly illustrated by quotations from the statistical history of the growth of the foreign commerce of the United States, showing the share in its carriage taken by American ships in the earlier years compared with the present time. In 1826 American vessels carried 92.5 per cent of the foreign

commerce of the United States, the value of which was $150,331,636, while in 1900 they carried 9.3 per cent, the value of which was $195,083,155, an increase in value of only 29.8 per cent in seventy-four years. In 1826 foreign vessels carried 7.5 per cent of our foreign commerce, valued at $12,238,163, while in 1900 they carried 90.7 per cent, valued at $1,894,445,461, an increase of 15,379.8 per cent in seventy-four years.[1]

While the census returns do not indicate the particular trade in which the vessels built are to engage, other official records are at hand which in part supply the information. For instance, no vessel is permitted to engage in foreign trade unless provided with a register, a document issued by the Government through its custom houses. Hence the American shipping under register accurately shows the total tonnage of the United States engaged in the foreign trade. The returns for the Twelfth Census show that the vessels of all kinds—sail and steam, steel and wood, including barges and canal boats—constructed in the shipyards of the United States in 1900 numbered 2,087, with a gross tonnage of 687,681 tons. The report of the Commissioner of Navigation for 1900[2] shows that 88 American-built vessels, with a total of 29,069 gross tons, were registered for the foreign trade. This tonnage constitutes only 4.2 per cent of the total product turned out by American shipyards in 1900, hardly equivalent to half a month's construction. Reports of the Commissioner of Navigation show further that during the ten years ending with 1900, 206,771 tons of vessels built in the United States were registered for the foreign trade, a total that is equal to only 30.1 per cent of the tonnage constructed in shipyards of the United States for all purposes in the year 1900; that is to say, in less than four months of 1900 as much tonnage was built in American shipyards for all trades as was built in those shipyards for foreign trade during the entire ten years ending with 1900.

Although the actual tonnage of different vessels, foreign and domestic, engaged in the foreign trade of the United States is not precisely known, estimates have been made by different commissioners of navigation which may serve as a basis for comparison. In the report of the Commissioner of Navigation for 1900 the tonnage necessary for the foreign carrying trade in 1899 is estimated at 3,571,284 gross tons of steam and 1,000,000 tons of sail, a total of 4,571,284 tons.[3] This is the lowest official estimate that has been made. The Commissioner of Navigation stated in 1890 that 6,500,000 tons would be required to carry 83 per cent of the foreign commerce of the United States at that time.[4] That would make the tonnage required for carrying the entire foreign commerce of the United States 7,831,325 tons. Since that time the value of our foreign commerce has increased 36 per cent. In view of these expert official estimates, it would be conservative to state that fully 5,000,000 tons of shipping are now required for the carriage of the entire foreign commerce. Toward supplying that need home shipyards, as we have seen, contributed only 29,069 tons during the census year of 1900, and only 206,771 tons during the entire ten years ending with 1900. At the rate of construction in 1900 one hundred and seventy-two years would elapse before enough tonnage would be built for the present needs of our foreign trade. The average life of a ship is commonly computed at ten years, taking into account losses, accidents, and deterioration. But allowing twenty years as the average life of a modern steel steamship, at the present rate of construction for foreign trade over eight years would elapse before enough ships would be constructed to provide for the average losses of one year. In Great Britain, in 1899, steel steamships to the number of 567 were constructed, the tonnage of which aggregated 1,341,425, while in the United States 123 steel steam vessels, aggregating 237,379 gross tons, were constructed for all kinds of trade, inland, coastwise, and foreign. As a matter of fact only one steel steam vessel, of 1,771 tons, was built in the United States during 1900 for the foreign trade.[5] On the Great Lakes alone vessels aggregating 111,241 gross tons were built in 1900, or 16.2 per cent of the total tonnage built during that year in the United States, while the tonnage built under register, as previously stated, constituted but 4.2 per cent of the total tonnage, or 26.1 per cent of that constructed for the traffic of the Great Lakes. In number of tons, the merchandise moved annually upon the Great Lakes approximates very closely to the merchandise annually imported into and exported from the United States, but the distance it is carried is very much less. For this reason the commerce of the Great Lakes can be carried by use of a tonnage approximately one-third as large as is necessary for the carriage of our foreign commerce. And yet, notwithstanding the smaller requirements of the traffic on the Great Lakes, the tonnage built for that traffic in 1900 was nearly four times that built for foreign trade.

While in general our laws deny American registry to foreign-built vessels, there are exceptions provided by which such vessels may be registered if owned by citizens of the United States. For instance, a foreign-built vessel wrecked in American waters and purchased and repaired by a citizen of the United States may be registered "if it shall be proved to the satisfaction of the Commissioner [of Navigation] that the repairs put upon such vessel are equal to three-fourths of the cost of the vessel when so repaired."[6] Congress also, by special enactment, admits foreign vessels to American registry from time to time, under exceptional circumstances. During the past ten years vessels of foreign

[1] Report Commissioner of Navigation, 1901, pages 492–493.
[2] Ibid., 1900, page 382.
[3] Ibid., page 24.
[4] Ibid., 1890, page 132.
[5] Report Commissioner of Navigation, 1900, pages 25–27.
[6] Navigation Laws of the United States, 1899, page 16.

construction, including Hawaiian tonnage and vessels captured from Spain, aggregating 134,859 tons, were admitted to American registry, a total equal to 65.2 per cent of the tonnage constructed in domestic shipyards for the foreign trade during the same period.[1]

In 1890 the American tonnage under register, in our foreign trade, amounted to 946,695 tons, since which time 206,771 tons have been built in the United States and documented under register, and 134,859 tons of foreign-built vessels have been granted American registry. This would have made a total of 1,288,325 tons in 1900, had none gone out of existence. But in 1900 the tonnage under American registry was only 826,694, showing a loss of 461,631 tons during the ten years. This shrinkage is more than twice as much as the total new registered tonnage built in the United States during the decade. This indicates how hopeless, under present conditions, are the prospects of the shipyards of the United States maintaining even the present tonnage in the foreign carrying trade, to say nothing of providing the additional tonnage made necessary by the growth in volume of foreign commerce. An idea of the extent of this growth may be obtained from a study of the statistics of tonnage of foreign commerce entering at and clearing from the seaports of the United States in 1890 and 1900. In 1890 the tonnage of American and foreign vessels entering the seaports of the United States from foreign ports was 15,365,604 tons; in 1900 it was 23,533,597 tons, an increase of 8,167,993 tons, or 53.2 per cent, in ten years. The tonnage of clearances in foreign trade is approximately that of entries, and consequently shows about the same percentage of increase.[2]

The domestic water-borne traffic of the United States is confined to vessels constructed and owned in the United States, and the growth of shipping in the domestic trade seems to be all that can be desired. The improvement of rivers and harbors has, during the last decade especially, proceeded upon an enormous scale, with promise of continuance. These improvements make possible the use of craft of constantly increasing size; and freight rates being gradually decreased, the effect is inevitably stimulating upon the growth of domestic water-borne commerce. This growth assures to shipbuilders of the United States a steady demand for vessels adapted to the needs of domestic traffic.

The recent territorial acquisitions of the United States, extending to the West Indies and the islands of the Pacific, our trade with which must be confined to vessels built in the United States, holds promise to shipbuilders of a demand for ocean-going vessels adapted to the trade requirements and harbor facilities of the ports of these possessions. Moreover, it is likely that the future growth of the Navy will afford employment for many shipyards. Its growth during the past twenty years accounts, in very large degree, for the establishment of new and entirely up-to-date plants and the reequipment of old plants with the modern facilities required for the construction of high-class naval vessels. These establishments are also prepared to enter upon the construction of vessels of any size or type for any trade; and the grade of work and fineness of finish demanded by the specifications for our war ships, and insured by the thorough inspection under which they are built, are likewise evinced in the improvements shown in the constructions for our merchant service. The demand for yachts, steam and sail, of the finest and largest type, the finish and elegance of which are so notable, gives employment to men of the greatest efficiency in a number of our shipyards in different parts of the country.

These are the varied demands upon our shipbuilders that form the broad underlying foundation of their present prosperous condition. But the constructions for the foreign trade of the United States, which afford, in other countries, investment for a capital probably twice as large as is at present invested in the United States, furnishing employment to thousands of skilled workmen and providing an enormous market for materials, assume very small proportions in the shipyards of our own country. The demand for vessels in the foreign trade is so great that if it were supplied by American shipyards the average annual construction of these yards would be increased fully one-third in tonnage and probably doubled in value. The types of vessels engaged in the foreign trade are much more costly than those employed in domestic trade. Summing up the present situation, the paradox exists of a substantial number of establishments, equipped with every essential for the construction of ocean-going ships of every type, being limited to the construction of war ships and of vessels for our domestic trade, except for the infrequent and spasmodic requirements of a few courageous shipowners who persist in operating American-built ships in foreign trade. The very infrequency and uncertainty of this demand largely account for the fact that the cost of construction per ton is higher in the United States than in other countries, notably Great Britain, which probably builds four-fifths of the world's ocean-going tonnage, although less than three-fifths of it is under the flag of that nation. This anomalous condition of American shipyards, in respect of equipment for and output of ocean-going shipping, has attracted widespread attention and provoked world-wide comment. Precisely what should be done to increase United States shipping in foreign trade is the much discussed and still unsolved American maritime problem.

As previously stated, 206,771 tons of ships for foreign trade were built in the United States during the past decade. During the same period 12,077,359 tons of steel steamships were built in the world's shipyards,

[1] Reports of the Commissioner of Navigation, 1891 to 1900, inclusive; table giving "Balance sheets of tonnage accounts."
[2] Statistical Abstract of the United States, 1900, pages 441–442.

of which Great Britain built 9,793,426 tons, or 81.1 per cent. In the United States only 742,830 tons of steel vessels were built during the past ten years, 450,089 tons of which were constructed upon the Great Lakes. The remainder, 292,741 tons, or 39.4 per cent of the total, represents the constructions of the Atlantic and Pacific shipyards for the coastwise and ocean traffic.[1] It should be stated in this connection that during the last three years of the decade 80,687 tons of American vessels were sold to the Government, as compared with a total of 4,254 tons sold during the intervening years succeeding the Civil War. This, naturally, created an abnormal demand for new tonnage, which is shown by the fact that of the 275,550 tons of steel vessels built on the Atlantic coast of the United States during the past decade, 138,888 tons, or more than one-half, were constructed in the last three years of that period, and 70,548, or more than one-fourth, in the year 1900. Since, however, 8,258 tons were bought back, the net purchases amounted to 72,429 tons.[2] It is very easy to see, in the light of these large purchases, comprising in most cases vessels of the largest and most serviceable type for the needs of the Government, what an abnormal demand for construction has arisen, leading to an unparalleled degree of activity in our shipyards. The acquirement of Porto Rico and Hawaii, and the restriction of that trade to American-built vessels, has also added to the demand for large vessels, in the construction of which a few of our shipyards are now engaged. The total documented tonnage annually lost, abandoned, sold, and exempted is quite large, the amount in the year 1900 being 156,862 tons. During the last decade 1,897,488 tons have been so withdrawn, an annual average of 189,748 tons. The documented tonnage of the United States in 1900 constituted only 57.3 per cent of the tonnage constructed in the shipyards of the United States during that year, as disclosed by the census returns. The undocumented tonnage consists of a class of shipping which is much lighter, more frail, and more short-lived, so that it is reasonable to believe that the annual loss in this tonnage fully equals that in the documented. Therefore, there is an annual demand, merely to make good average losses, for new tonnage aggregating between 300,000 and 350,000 tons, so that losses alone in our national shipping create a steady demand for what may be regarded as a substantial annual total of new tonnage—more than one-half, probably, of the tonnage constructed during the year 1900.

Although iron ships were constructed in American shipyards previous to the inauguration of the new Navy, which were almost wholly employed in domestic trade, modern steel shipbuilding is contemporaneous with the growth of the new Navy, the first vessels for which were launched about sixteen years ago. These initial constructions led to the equipment of a few of the shipbuilding establishments in operation at that time with plants adequate for the production of modern ships of war, and these plants, with others that have been established since, are equally capable of producing steel merchant vessels of the highest type, a limited number of which, in every way a credit to the skill of the shipbuilders, have been turned out during the last decade.

Table 1 shows the statistics for the entire industry, exclusive of establishments owned by the Government, as returned at the censuses of 1850 to 1900, inclusive, with the percentage of increase for each decade.

[1] Report Commissioner of Navigation, 1900, page 24.
[2] Ibid., page 439.

TABLE 1.—COMPARATIVE SUMMARY, 1850 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

	DATE OF CENSUS.						PER CENT OF INCREASE.				
	1900	1890	1880	1870	1860	1850	1890 to 1900	1880 to 1890	1870 to 1880	1860 to 1870	1850 to 1860
Number of establishments	1,116	1,006	2,188	964	675	958	10.9	[1]54.0	127.0	42.8	[1]29.2
Capital	$77,362,701	$27,262,892	$20,979,874	$11,463,076	$5,952,665	$5,373,139	183.8	29.9	83.0	92.6	10.8
Salaried officials, clerks, etc., number	1,407	[2]1,123	[3]	[3]	[3]	[3]	25.3	.....	.....	.....	.....
Salaries	$2,008,537	[2]$1,194,870	[3]	[3]	[3]	[3]	68.1	.....	.....	.....	.....
Wage-earners, average number	46,781	22,143	21,345	13,915	10,071	12,976	111.3	3.7	53.4	38.2	[1]22.4
Total wages	$24,899,163	$13,083,949	$12,713,813	$7,073,400	$4,539,313	$6,055,884	89.3	2.9	79.7	55.8	[1]25.0
Men, 16 years and over	45,744	21,960	21,338	13,814	10,070	12,962	108.3	2.9	54.5	37.2	[1]22.3
Wages	$24,636,612	$13,055,088	[3]	[3]	[3]	[3]	88.7	.....	.....	.....	.....
Women, 16 years and over	34	9	.....	6	1	14	277.8	.....	[1]100.0	500.0	[1]92.9
Wages	$11,424	$2,522	.....	[3]	[3]	[3]	353.0	.....	.....	.....	.....
Children, under 16 years	1,003	174	7	95	[3]	[3]	476.4	2,385.7	[1]92.6	.....	.....
Wages	$191,127	$26,344	[3]	[3]	[3]	[3]	625.5	.....	.....	.....	.....
Miscellaneous expenses	$3,685,661	$1,392,551	[4]	[4]	[4]	[4]	164.7	.....	.....	.....	.....
Cost of materials used	$33,486,772	$16,521,246	$19,736,358	$9,379,980	$5,788,676	$7,420,496	102.7	[1]16.3	110.4	62.0	[1]22.0
Value of products, including repairing	$74,578,158	$38,065,410	$36,800,327	$21,483,967	$13,424,037	$16,937,525	95.9	3.4	71.3	60.0	[1]20.7

[1] Decrease.
[2] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. (See Tables 21 and 22.)
[3] Not reported separately.
[4] Not reported.

Table 1 includes returns from a large number of small establishments engaged in the building or repairing of canal boats, ships' boats, fishing boats, pleasure boats, and other small craft, as well as in the construction of masts and spars. It is possible that the canvass for the collection of returns for these small establishments has been more thorough at some censuses than at others.

In some of the great shipbuilding establishments the manufactures of a character different from shipbuilding are too important to be included as by-products of that industry. In such cases the method was adopted of

treating each of the establishments as two separate plants, including in the tables presented in this report the operations in shipbuilding, with value of products and cost of labor and materials, and assigning to this branch of the work a certain proportion of the officers, clerks, etc., employed in the establishment. All other products of the establishments, with the materials, wages, and salaries chargeable thereto, were included under their proper classified industries. There are 3 such establishments in Delaware, 1 in Maryland, and 1 in Washington.

On the other hand a certain amount of vessel construction and repair work is carried on in the United States by establishments which, so far as their main business is concerned, are not shipbuilding plants. The construction of stationary engines, machinery, and steel work of a general character so largely predominates in their output that it is not practicable to include them in the shipbuilding tables. Of the more important establishments of this class, one is located in Pennsylvania, classified under "foundries and machine shops," whose total product in marine construction during 1900 was $54,990. This value included a wooden steam vessel of 200 gross tons, valued at $25,675. An establishment in Michigan, similarly classified, built 4 wooden steam vessels aggregating 202 gross tons measurement and $23,100 in value. An establishment in Maryland did general marine repair work valued at $15,000.

The report on shipbuilding at the census of 1890 contained the following statement: "Returns too imperfect for tabulation were received from a few shipbuilders. It is believed that the omission of reports from the delinquent establishments has but slight effect on the totals for the United States. The principal omissions occur in the state of Pennsylvania." In the light of the information at that time in the possession of those tabulating the returns for shipbuilding for the Eleventh Census, the statement seemed to adequately qualify the statistical results. Certain not wholly explainable omissions of considerable magnitude, however, indicate that the deficiencies may have been more serious than was supposed, and that caution must be exercised in making comparisons between the census returns of 1890 and those of 1900. Taking the governmental establishments as an illustration, 9 were reported in 1900, while but 4 were reported in 1890, and yet the fact is that 7 of the establishments reported in 1900 were in existence in 1890. It is possible that the omission of 3 of these establishments from the 1890 report was due to the small amount of repairing on ships, which led to their inclusion in the foundry and machine shop classification. Moreover, but 18 private iron and steel shipbuilding establishments were reported at the census of 1890, although the schedules for 1900 show that of the 44 iron and steel shipbuilding establishments then reporting, all but 6, according to the statements of the officers or proprietors, had been established before 1890. These seeming omissions may, in part, be explained upon the theory that establishments engaged in building wooden vessels at the census of 1890 have since entered upon the construction of iron and steel vessels, as the schedules show only the date that the establishments commenced operations, no information in regard to the change in the character of its products being required.

Table 1 shows that the number of establishments engaged in the building and repairing of vessels, boats, masts, and spars increased from 953 in 1850 to 1,116 in 1900, or 17.1 per cent, while the capital invested increased from $5,373,139 to $77,362,701, or 1,339.8 per cent. This is an increase in the average capital per establishment invested in the industry, from $5,638 in 1850 to $69,321 in 1900, or 1,129.5 per cent. During the same period the average number of wage-earners increased from 12,976 to 46,781, or 260.5 per cent. The total value of constructions and repairs increased from $16,937,525 to $74,578,158, or 340.3 per cent. Of the latter sum a large part represents work done for the Navy and War Departments. It was found impracticable to secure any statement from these departments covering the census year ending May 31; but it appears that during the year ending June 30, 1900, the sum of $8,554,862 was disbursed in the Navy Department to private shipbuilding establishments for construction and repairs, and the sum of $5,493,556 in the War Department, the total being $14,048,438, or 18.8 per cent of the total value of products reported by private shipyards for the census year. Of the amount disbursed in the War Department, $1,291,581 was for "fitting up chartered transports," the remainder being expended "for refitting and repairs of vessels owned by the War Department."

Table 1 shows that the capital invested in shipbuilding in 1850 and 1860 was less than $6,000,000, a sum insufficient to replace any one of several existing iron and steel establishments. The value of the products in 1850 was more than three times greater than the capital invested, and in 1860 was more than twice as great. In 1900, for the first time in the census history of the industry, the value of products was less than the capital invested. The ratio of capital to product has steadily increased from 1850 to the present time. In 1850 the wages paid to labor exceeded the capital, but in 1900 was less than one-third the amount invested.

Table 2 presents the statistics for the industry by establishments manufacturing a product exceeding $500 in value, separated into those of iron and steel shipbuilding and wooden shipbuilding, by governmental establishments, and by establishments with a product of less than $500. These two latter classes of establishments are omitted from all the other tables, except Tables 3 and 22, which present comparative and detailed statistics, respectively, for governmental establishments. In addition to the 1,229 active establishments in the industry during the census year, with a capital of $131,736,843, shown in Table 2, there were 3 idle iron and steel shipbuilding establishments, with a total capital of $2,688,940.

TABLE 2.—SUMMARY FOR ALL ESTABLISHMENTS.

CLASSES.	Number of establishments.	Capital.	Proprietors and firm members.	WAGE-EARNERS.		Miscellaneous expenses.	COST OF MATERIALS USED.			Value of products, including repairing.
				Average number.	Total wages.		Total.	Principal materials.	Fuel, freight, etc.	
Total	1,229	$131,736,843	1,366	54,477	$31,063,176	$3,718,836	$37,303,618	$35,743,967	$1,559,651	$85,642,540
Iron and steel shipbuilding	44	59,839,555	16	30,906	16,231,311	2,642,690	23,585,549	22,447,481	1,138,068	50,367,739
Wooden ship and boat building	1,072	17,523,146	1,239	15,875	8,607,852	1,042,971	9,901,223	9,638,159	263,064	24,210,419
Governmental establishments	9	54,291,011	.....	7,690	6,222,263	29,064	3,805,326	3,647,155	158,171	11,034,312
Establishments with a product of less than $500	104	83,131	111	6	1,750	4,111	11,520	11,172	348	30,070

Table 3 presents a comparative summary of the statistics reported by governmental establishments at the censuses of 1890 and 1900, with the percentages of increase for the decade.

TABLE 3.—COMPARATIVE SUMMARY, GOVERNMENTAL ESTABLISHMENTS, 1890 AND 1900, WITH PER CENT OF INCREASE.

	1900	1890	Per cent of increase.
Number of establishments	9	4	125.0
Capital	$54,291,011	$26,130,182	107.8
Salaried officials, clerks, etc., number	540	.....	.....
Salaries	$466,497	.....	.....
Wage-earners, average number	7,690	2,668	188.2
Total wages	$6,222,263	$1,750,028	255.6
Men, 16 years and over	7,664	[1]	.....
Wages	$6,202,882	[1]	.....
Women, 16 years and over	25	[1]	.....
Wages	$19,281	[1]	.....
Children, under 16 years	1	[1]	.....
Wages	$100	[1]	.....
Miscellaneous expenses	$29,064	.....	.....
Cost of materials used	$3,805,326	$403,863	842.2
Value of products, including repairing	$11,034,312	$2,276,705	384.7
Vessels:			
Number	.....	18	.....
Tonnage	.....	24,956	.....
Value	.....	$1,705,857	.....
Boats:			
Number	[2] 679	50	1,258.0
Value	[2] $115,322	$50,000	130.6
Masts and spars:			
Value	[1]	$20,000	.....
Repairs:			
Value	$6,470,238	$500,848	1,191.9

[1] Not reported separately. [2] Includes 2 barges, valued at $1,200.

Table 3 shows a large increase in the statistics of governmental establishments engaged in shipbuilding and repairs. In this connection, the fact that several establishments which are included for 1900 were probably entered under some other classification in 1890 should be taken into account. As previously stated, 7 of the yards reported as governmental shipyards were in existence and engaged in similar work in 1890, although 4 only appear in the report for that year. The establishments whose reports compose Table 3 are the governmental navy-yards located at Kittery, Me., Boston (Charlestown), Mass., Brooklyn, N. Y., Philadelphia (League Island), Pa., Norfolk, Va., Port Royal, S. C., Vallejo (Mare Island), Cal., and Bremerton (Puget Sound), Wash., and an establishment under the supervision of the state of Illinois, engaged in the repair of canal boats, locks, gates, etc., at Lockport, Ill. Table 3 includes the reports of all United States navy-yards, except that at Washington, D. C., at which yard a very large proportion of the work done was the manufacture of ordnance, and the report was classified accordingly, and the naval station at Pensacola, Fla., where a small amount of repair work was done, a return of which was not received.

The work performed at several of the navy-yards consisted of the repair of naval vessels and the manufacture of ships' boats, small boats, barges, etc.; the building and repair of machinery, and the ordnance and other equipment of the vessels. It was impossible to make separate reports of each class of work. The figures presented in Table 3 include, therefore, statistics that do not pertain strictly to shipbuilding or repairing. The table shows that in 1890 there were constructed 13 vessels, valued at $1,705,857, with a total tonnage of 24,956. The reports show no work of this character in 1900. There were 50 boats made in 1890, valued at $50,000, as compared with 679 in 1900, valued at $115,322. The figures for 1900 include 2 barges, valued at $1,200, made at the Port Royal, S. C., yard, the only new constructional work reported, with the exception of boat building. The figures for 1900 show that almost the entire work consisted of repairing, equipment, etc. In 1890, 74.9 per cent of the value of the work was new construction, while in 1900, of the $11,034,312 reported as the value of the products, $10,918,990, or 99.0 per cent, was the value of repair work and equipment. In 1890 the tonnage of new vessels built in Government yards was 24,956, valued at $1,705,857, an average of $68 per ton, which precludes the possibility of such tonnage being warships. The value of the product as reported by governmental establishments for 1899 was $8,061,093, which was an increase of 254.1 per cent over 1890. The increase indicated by the figures for 1900 over 1899 was 36.9 per cent.

The large capital invested in governmental shipbuilding establishments indicates the costliness of such modern equipment, and explains, in a measure, the enormous investment necessary in private yards to enable them to successfully engage in the construction of modern ships of war. The average capital invested in the 8 navy-yards is $6,785,064. This exceeds the total capital invested in shipbuilding in the United States in 1850 by $1,411,925.

Table 4 presents the comparative statistics for iron and steel shipbuilding for 1890 and 1900.

TABLE 4.—COMPARATIVE SUMMARY, IRON AND STEEL SHIPBUILDING, 1890 AND 1900, WITH PER CENT OF INCREASE.

	1900	1890	Per cent of increase.
Number of establishments	44	18	144.4
Capital	$59,839,555	$10,712,023	458.6
Salaried officials, clerks, etc., number	857	[1] 138	521.0
Salaries	$1,411,868	[1] $291,105	385.0
Wage-earners, average number	30,906	8,165	278.5
Total wages	$16,231,311	$4,883,665	232.4
Men, 16 years and over	29,940	[2]	.....
Wages	$16,045,494	[2]	.....
Women, 16 years and over	17	[2]	.....
Wages	$4,908	[2]	.....
Children, under 16 years	949	[2]	.....
Wages	$180,909	[2]	.....
Miscellaneous expenses	$2,642,690	$546,135	383.9
Cost of materials used	$23,585,549	$6,256,905	277.0
Value of products, including repairing	$50,367,739	$13,012,266	287.1
Vessels:			
Number	134	88	52.3
Tonnage—			
Gross	262,516	[3] 123,973	111.8
Net	186,509	.....	.....
Value	$25,454,943	$11,550,846	120.4

[1] Includes proprietors and firm members, with their salaries; number only reported in 1900 but not included in this table. (See Table 21.)
[2] Not reported separately.
[3] Kind of tonnage not specified in 1890.

Table 4 discloses a remarkable growth in the number of establishments, capital invested, wage-earners employed, wages paid, cost of materials, and value of products. The statistics indicate not only that this branch of the industry increased largely in all the essential items of information, but that the individual establishments have enlarged their productive capacity by investments in improved machinery equipment, and by extensions of their plants. The capital per establishment in 1890 averaged $595,112, and in 1900, $1,359,990, an increase of 128.5 per cent. The average number of wage-earners to each establishment in 1890 was 454; in 1900 it was 702, an increase of 54.6 per cent. The average value of product per establishment in 1890 was $722,904; in 1900 it was $1,144,721, an increase in value per establishment of 58.4 per cent. The value of the new iron and steel vessels constructed in 1890 was 88.8 per cent of the total value of the products; in 1900 only 50.5 per cent of the product was represented in new construction. The increase in the value of the products in this branch of the industry in 1900 over 1890 was 287.1 per cent, yet the number of vessels constructed increased only from 88 to 134, or 52.3 per cent. The value of the new construction was 120.4 per cent greater in 1900 than in 1890.

The new tonnage constructed in the iron and steel branch of the industry in 1890 was 123,973, but whether gross or net is unknown. In view of this uncertainty, but little value can be attached to any comparative deductions as to the value of iron and steel vessels per ton in 1900 as compared with 1890. Assuming that the tonnage statistics for the census of 1890 were for gross measurement, the value per ton was $93.17, while it is shown that the value in 1900 was $96.97 per gross ton of the iron and steel vessels constructed. In view of the great reduction in the cost of iron and steel during the past ten years, it is not reasonable to suppose that there has been an actual increase in the cost per ton of vessels constructed from these materials; on the contrary, there has been a substantial decline. It is believed that in some cases gross and in others net tonnage was reported in 1890, without any distinction.

The increase in capital invested in the iron and steel branch of the industry, for the decade ending with 1900, was $49,127,532, or 458.6 per cent. The capital in the whole industry increased only $50,099,809, or 183.8 per cent, which indicates what an insignificant increase was made in this respect in the wooden-shipbuilding branch. The increase in the value of shipbuilding products in both branches of the industry from 1890 to 1900 was $36,512,748, or 95.9 per cent. The increase in the value of iron and steel shipbuilding products alone was $37,355,473. Wooden shipbuilding, therefore, suffered an actual decrease.

Table 5 presents the comparative statistics for wooden shipbuilding for 1890 and 1900.

TABLE 5.—COMPARATIVE SUMMARY, WOODEN SHIP AND BOAT BUILDING, 1890 AND 1900, WITH PER CENT OF INCREASE.

	1900	1890	Per cent of increase.
Number of establishments	1,072	988	8.5
Capital	$17,523,146	$16,550,869	5.9
Salaried officials, clerks, etc., number	550	[1] 985	[2] 44.2
Salaries	$596,674	[1] $903,765	[2] 34.0
Wage-earners, average number	15,875	14,116	12.5
Total wages	$8,607,852	$8,491,389	1.4
Men, 16 years and over	15,804	[3]	.....
Wages	$8,591,118	[3]	.....
Women, 16 years and over	17	[3]	.....
Wages	$6,516	[3]	.....
Children, under 16 years	54	[3]	.....
Wages	$10,218	[3]	.....
Miscellaneous expenses	$1,042,971	$846,416	23.2
Cost of materials used	$9,901,223	$10,264,341	[2] 3.5
Value of products, including repairing	$24,210,419	$25,053,144	[2] 3.4
Vessels:			
Number	1,953	1,265	54.4
Tonnage—			
Gross	425,165	[4] 360,667	17.9
Net	356,380	.....	.....
Value	$10,300,971	$12,933,149	[2] 20.4
Small boats:			
Number	15,448	18,689	[2] 17.3
Value	$1,972,825	$1,392,084	41.7

[1] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. (See Table 22.)
[2] Decrease.
[3] Not reported separately.
[4] Kind of tonnage not specified in 1890.

The statistics presented in Table 5 include not only wooden shipbuilding and repairing, but also the manufacture of boats, oars, masts, and spars. Subsidiary tables, presented elsewhere in this report, will show what part these minor or auxiliary industries form of the whole.

Several items in the foregoing table show a decrease. While there has been an increase during the decade of 8.5 per cent in the number of establishments and 5.9 per cent in the capital, there has been a decrease of 435, or 44.2 per cent, in the number of salaried officials, clerks, etc., and of $307,091, or 34 per cent, in the salaries paid, with comparatively slight increases in the number

of wage-earners and in wages paid. The decrease in cost of materials was $363,118, or 3.5 per cent, and in value of products it was $842,725, or 3.4 per cent. While the number of vessels built increased 688, or 54.4 per cent, their value decreased $2,632,178, or 20.4 per cent, showing that the use of wood in shipbuilding is being restricted to smaller vessels than formerly. It is impracticable, however, to make reliable comparisons between the tonnage of wooden vessels built in 1900 and in 1890, for the same reason as in the iron and steel branch of the industry, that the tonnage at the former census was reported in one item, no distinction being made between gross and net. Assuming, however, that gross tonnage was reported, the average tonnage per vessel was 285 in 1890, compared with 218 in 1900. In the latter year the value of wooden construction was $24.23 per gross ton or $28.91 per net ton.

Table 6 is a comparative summary by states of the totals for the shipbuilding industry in the census years 1890 and 1900.

TABLE 6.—COMPARATIVE SUMMARY, BY STATES: 1890 AND 1900.

STATES.	Year.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS.		Miscellaneous expenses.	Cost of materials used.	Value of products, including repairing.
				Number.	Salaries.	Average number.	Total wages.			
United States	1900	1,116	$77,362,701	1,407	$2,008,537	46,781	$24,839,163	$3,685,661	$33,486,772	$74,578,158
	1890	1,006	27,262,892	[1]1,123	[1]1,194,870	22,143	13,083,949	1,392,551	16,521,246	38,065,410
Alabama	1900	6	146,946	3	4,300	293	101,526	6,022	76,767	240,242
	1890	5	37,750	3	750	82	24,324	1,085	9,493	38,701
California	1900	41	5,776,518	97	147,948	3,549	2,239,694	518,200	3,234,804	6,736,636
	1890	32	1,958,198	15	60,146	1,467	1,158,843	378,104	1,212,671	3,148,683
Connecticut	1900	35	601,871	12	14,012	915	451,086	13,529	680,213	1,227,120
	1890	29	564,941	28	27,904	624	348,218	20,463	535,093	1,058,301
Delaware	1900	11	2,226,811	97	124,010	2,031	992,449	122,267	1,594,918	3,004,366
	1890	11	1,745,213	43	98,174	1,759	800,977	69,819	836,979	2,044,313
District of Columbia	1900	3	14,465	.....	.....	17	11,480	154	6,989	24,280
	1890	4	15,575	.....	.....	14	8,410	654	9,940	28,755
Florida	1900	16	284,159	14	15,250	327	125,509	16,385	167,461	409,991
	1890	16	93,156	7	3,740	69	29,881	2,083	21,702	68,020
Georgia	1900	4	15,170	2	1,400	19	5,156	680	12,650	23,500
	1890	4	156,100	6	6,080	112	55,054	9,384	45,716	126,300
Illinois	1900	18	1,972,220	33	83,559	1,359	670,658	58,751	952,960	2,331,659
	1890	10	638,489	10	15,155	315	171,866	11,723	148,127	421,815
Indiana	1900	15	430,907	18	58,620	403	189,179	42,461	296,143	675,207
	1890	11	371,860	8	6,794	543	246,939	7,722	204,229	551,640
Iowa	1900	11	69,996	12	11,900	214	79,460	55,417	60,578	291,025
	1890	5	38,850	3	1,825	45	25,101	3,997	22,820	73,144
Kentucky	1900	10	60,377	6	3,785	104	48,090	7,804	20,775	97,492
	1890	29	53,511	26	15,612	62	25,965	3,157	31,675	95,545
Louisiana	1900	15	212,643	23	15,232	247	105,196	9,732	71,621	250,307
	1890	13	368,218	17	15,104	175	104,451	13,227	71,259	229,645
Maine	1900	117	2,819,053	54	57,938	2,216	1,219,657	109,572	2,022,557	3,777,059
	1890	85	1,027,756	89	65,721	1,450	777,994	109,082	1,423,175	2,818,565
Maryland	1900	47	4,446,023	95	105,442	2,615	1,517,705	141,565	1,798,564	4,161,525
	1890	34	1,315,262	32	28,359	1,043	620,483	92,677	737,457	1,737,674
Massachusetts	1900	125	2,149,291	80	79,046	1,606	1,035,993	231,769	1,357,405	3,057,454
	1890	147	1,239,998	112	96,961	1,076	768,967	71,604	890,405	2,248,647
Michigan	1900	54	3,893,019	73	76,388	2,916	1,343,887	209,555	2,197,883	4,432,101
	1890	62	3,266,472	93	81,901	2,191	1,185,201	97,736	2,300,299	4,710,108
Minnesota	1900	25	161,967	7	7,580	137	74,317	11,401	84,962	223,971
	1890	20	521,373	11	9,924	308	168,684	2,570	322,412	542,440
Mississippi	1900	13	54,885	5	4,500	73	46,452	1,829	46,376	115,744
	1890	9	8,554	2	764	45	14,978	157	7,495	26,425
Missouri	1900	10	25,930	3	3,070	66	45,909	6,342	31,914	93,367
	1890	5	125,625	11	11,381	346	147,843	18,067	145,707	417,236
New Hampshire	1900	6	10,585	.....	.....	5	3,600	368	2,625	9,793
	1890	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Jersey	1900	68	3,686,382	123	158,027	2,874	1,792,209	368,027	1,949,519	4,810,470
	1890	62	2,165,104	70	78,499	1,116	817,290	89,200	1,140,452	2,592,420
New York	1900	227	9,675,080	197	265,349	5,572	3,181,959	309,415	3,115,907	8,647,371
	1890	216	4,281,884	235	278,245	3,303	2,337,511	166,442	2,267,391	6,154,488
North Carolina	1900	14	73,760	2	1,200	73	34,782	2,504	21,253	77,528
	1890	16	76,978	12	8,496	126	41,988	3,423	30,396	101,615
Ohio	1900	53	5,155,440	68	125,545	3,117	1,650,775	218,305	1,236,450	3,614,714
	1890	44	2,950,811	143	128 967	2,679	1,392,245	86,986	1,750,989	3,804,838
Oregon	1900	17	592,564	28	39,590	687	361,357	46,641	623,189	1,287,385
	1890	14	305,220	9	7,597	199	127,625	9,508	119,086	320,715

[1] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. (See Tables 21 and 22.)

TABLE 6.—COMPARATIVE SUMMARY, BY STATES: 1890 AND 1900—Continued.

STATES.	Year.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS.		Miscellaneous expenses.	Cost of materials used.	Value of products, including repairing.
				Number.	Salaries.	Average number.	Total wages.			
Pennsylvania	1900	38	$14,141,482	161	$253,901	7,077	$3,544,945	$630,163	$7,173,201	$14,493,158
	1890	32	2,443,063	47	76,096	1,975	1,139,780	82,941	1,759,582	3,239,770
Rhode Island	1900	21	700,847	28	45,534	762	441,358	189,217	470,163	1,234,333
	1890	15	316,665	16	15,980	184	117,473	5,271	68,900	239,626
South Carolina	[1]1900									
	1890	8	128,020	7	6,360	76	40,926	11,554	46,752	186,130
Tennessee	1900	3	1,020			11	2,560	39	3,710	8,097
	[1]1890									
Texas	1900	7	10,930			33	19,315	1,150	90,845	126,446
	1890	9	9,619	2	918	29	10,870	425	12,808	29,777
Vermont	[1]1900									
	1890	3	8,950	2	312	12	4,260	153	2,859	8,289
Virginia	1900	29	14,824,884	93	228,261	5,569	2,525,121	224,144	2,943,317	6,162,962
	1890	17	310,726	15	9,988	194	89,706	4,436	83,694	297,000
Washington	1900	37	766,909	33	38,014	842	568,985	51,763	802,529	1,723,476
	1890	17	155,620	15	12,711	171	84,505	5,037	68,885	188,085
West Virginia	1900	4	46,455	4	1,575	53	20,204	1,780	19,354	51,170
	1890	4	21,303	2	700	55	16,850	2,307	8,252	38,980
Wisconsin	1900	30	2,273,952	36	37,561	935	360,380	83,012	307,689	1,091,372
	1890	16	544,828	26	28,206	285	176,799	11,157	178,351	463,120
All other states	[2]1900	6	40,210			64	27,710	698	11,441	66,137
	[3]1890	2	2,250			13	6,942	450	6,295	19,000

[1] Included in "all other states."
[2] Includes states having less than 3 establishments, distributed as follows: Arkansas, 1; Idaho, 1; South Carolina, 2; Vermont, 2.
[3] Includes states having less than 3 establishments, distributed as follows: Arkansas, 1; Tennessee, 1.

Table 6 shows the totals for the industry for 1900 in 33 states, of which the following 17 reported either a capital or products of more than $1,000,000 each: California, Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Virginia, Washington, and Wisconsin. Of these states, 3 are located on the Pacific coast, 4 on the Great Lakes, and 10 on the Atlantic, although both New York and Pennsylvania have ports on the Great Lakes. All of the above states show gratifying increases, with the exception of Michigan and Ohio, which show decreases in cost of materials and value of products. The percentages of increase or decrease during the decade for the foregoing states, in capital, wages paid, cost of materials used, and value of products, are shown in the following statement:

STATES.	PERCENTAGE OF INCREASE.			
	Capital.	Wages.	Cost of materials used.	Value of products.
California	195.7	94.1	166.8	114.0
Connecticut	6.5	29.5	27.1	16.5
Delaware	27.6	23.9	90.6	47.0
Illinois	208.9	290.2	543.3	452.8
Maine	174.3	56.8	42.1	34.0
Maryland	288.0	144.6	143.9	139.5
Massachusetts	73.3	34.7	52.4	36.0
Michigan	19.2	13.4	[1]4.5	[1]5.9
New Jersey	70.3	119.3	70.9	85.6
New York	126.0	36.1	37.4	40.5
Ohio	74.7	18.6	[1]29.4	[1]5.0
Oregon	94.1	183.1	423.5	301.4
Pennsylvania	478.8	211.0	307.7	347.4
Rhode Island	121.3	275.7	582.4	415.1
Virginia	4,671.0	2,714.9	3,416.8	1,975.1
Washington	392.8	573.3	1,065.1	813.4
Wisconsin	317.4	103.3	72.5	135.7

[1] Decrease.

Of the states included in the above statement, notable advances have been made in Virginia, Pennsylvania, Illinois, Maryland, California, Washington, Oregon, and New Jersey.

During the last decade Virginia has advanced from a position of comparatively small importance to a place among the leading shipbuilding states. In 1900 this state was first in the amount of capital invested, third in the number of wage-earners and in wages paid, and fourth in the value of products. Its capital invested in shipbuilding has increased from less than a third of a million in 1890 to nearly fifteen millions in 1900, and is two and one-third times as great as the entire capital invested in the industry in New England, more than double the entire capital so invested on the Pacific coast, and almost equal to the entire amount of capital invested in shipbuilding on the Great Lakes. When the prolific development in the shipbuilding industry upon the Great Lakes—a development that has challenged the attention of the entire shipbuilding world for more than a decade—is taken into consideration, this comparison seems to indicate the future development and importance of Virginia as a great shipbuilding center.

The amount of capital invested in shipbuilding in Illinois was 208.9 per cent greater in 1900 than in 1890, the number of wage-earners increased 331.4 per cent, and the wages 290.2 per cent; the increase in the cost of materials used was 543.3 per cent and in the value of products 452.8 per cent.

In California the capital increased 195.7 per cent in 1900 over 1890, the number of wage-earners 141.9 per cent, the total amount of wages paid 94.1 per cent, the

cost of materials used 166.8 per cent, and the value of products 114 per cent.

In Delaware the capital showed an increase for 1900 over 1890 of 27.6 per cent, number of wage-earners 15.5 per cent, wages paid 23.9 per cent, cost of materials used 90.6 per cent, and value of products 47 per cent.

In Maine the capital increased during the decade 174.3 per cent, the number of wage-earners 52.8 per cent, wages paid 56.8 per cent, cost of materials used 42.1 per cent, and value of products 34 per cent.

In Maryland the capital increased 238 per cent, the number of wage-earners 150.7 per cent, wages paid 144.6 per cent, cost of materials used 143.9 per cent, and value of products 139.5 per cent.

In Massachusetts the capital increased 73.3 per cent, the number of wage-earners 49.3 per cent, wages paid 34.7 per cent, cost of materials used 52.4 per cent, and value of products 36 per cent.

In Michigan the capital increased 19.2 per cent, the number of wage-earners 33.1 per cent, and wages paid 13.4 per cent; the cost of materials used and value of products decreased 4.5 per cent and 5.9 per cent, respectively.

In New Jersey the capital invested increased 70.3 per cent, the number of wage-earners 157.5 per cent, wages paid 119.3 per cent, cost of materials used 70.9 per cent, and value of products 85.6 per cent.

In New York there was an increase of 126 per cent in capital invested, 68.7 per cent in the number of wage-earners, 36.1 per cent in wages paid, 37.4 per cent in cost of materials, and 40.5 per cent in value of products. New York ranks third in the amount of capital invested in shipbuilding, second in the number of wage-earners and amount of wages paid, third in the cost of materials used, and second in the value of products. There were employed in this state only three more wage-earners than, during the same year, in Virginia. The amount of wages paid, however, in the former state exceeded that in the latter by $656,838.

In Ohio the capital increased 74.7 per cent, number of wage-earners 16.3 per cent, and wages paid 18.6 per cent; the cost of materials used and value of products decreased 29.4 per cent and 5 per cent, respectively. It is a singular fact that there should be so large an increase in the amount of capital invested in shipbuilding in this state coincident with a decrease in the value of the products between 1890 and 1900.

In Pennsylvania there was an increase of 478.8 per cent in capital invested, 258.3 per cent in the number of wage-earners, 211 per cent in wages, 307.7 per cent in the cost of materials used, and 347.4 per cent in the value of products.

In Virginia there was an increase of 4,671 per cent in the capital invested in 1900 over 1890, 2,770.6 per cent in the number of wage-earners, 2,714.9 per cent in wages paid, 3,416.8 per cent in the cost of materials used, and 1,975.1 per cent in the value of products.

For the reason previously pointed out, that an omission of considerable importance occurred in the statistics for Pennsylvania at the census of 1890, any comparison between the figures for the two censuses will be of little value. According to the figures for 1900, Pennsylvania is second in the amount of capital invested in shipbuilding, and first in the number of wage-earners and wages paid and in the value of products. Notwithstanding the omissions from the figures for 1890 it can be stated with certainty that the growth of the industry in this state has been considerable. Table 6 shows also that California, Washington, Oregon, Illinois, Maryland, New Jersey, and Wisconsin have made considerable increases. On the Pacific coast Washington and Oregon have shared with California the expansion in the shipbuilding industry, their percentages of increase being as follows: Washington, capital invested, 392.8; wages paid, 573.3; cost of materials, 1,065.1; value of products, 813.4; Oregon, capital invested, 94.1; wages paid, 183.1; cost of materials, 423.5; value of products, 301.4. The remarkable growth of the industry in the Pacific states is due in part to their large forests of the finest shipbuilding timber. Decreases, both in capital invested and in value of products, are shown in the District of Columbia, Georgia, Minnesota, Missouri, North Carolina, South Carolina, and Vermont. In Michigan the capital increased 19.2 per cent, while the value of products decreased 5.9 per cent, and in Ohio the capital increased 74.7 per cent, while the value of products decreased 5 per cent.

The rank, with respect to the principal items of information at the censuses of 1890 and 1900, of states reporting either capital or products in shipbuilding to the value of more than $1,000,000 in 1900, is given in the following statement, the number indicating the rank:

STATES.	Capital.		WAGE-EARNERS.				Cost of materials used.		Value of products.	
			Average number.		Total wages.					
	1900	1890	1900	1890	1900	1890	1900	1890	1900	1890
California	4	6	4	6	4	4	2	6	3	5
Connecticut	16	12	14	11	14	11	14	11	16	11
Delaware	11	7	10	5	11	7	9	9	11	9
Illinois	13	11	12	14	12	14	12	15	12	15
Maine	9	10	9	7	9	8	6	5	8	6
Maryland	6	8	8	10	7	10	8	10	7	10
Massachusetts	12	9	11	9	10	9	10	8	10	8
Michigan	7	2	6	3	8	3	5	1	6	2
New Jersey	8	5	7	8	5	6	7	7	5	7
New York	3	1	2	1	2	1	3	2	2	1
Ohio	5	3	5	2	6	2	11	4	9	3
Oregon	17	19	17	17	16	17	15	17	14	17
Pennsylvania	2	4	1	4	1	5	1	3	1	4
Rhode Island	15	17	16	19	15	18	16	20	15	19
Virginia	1	18	3	18	3	20	4	18	4	18
Washington	14	21	15	21	13	21	13	21	13	21
Wisconsin	10	13	13	16	17	13	17	14	17	14

It is probable that the contest for primacy in shipbuilding during the next decade will be between the Delaware River and the Chesapeake Bay districts. The capital invested in shipbuilding on the Delaware River in 1900 was $16,756,690, and the value of the prod-

ucts $18,013,279. On Chesapeake Bay the capital was $19,262,193, and the value of the products $10,263,345. The figures for the Delaware River district do not include a new shipbuilding plant of large proportions, the capital invested in which runs into the millions, but which was not in operation during the census year. The value of the shipbuilding products of the Great Lakes was almost double that of Virginia, and considerably larger than that of the Chesapeake Bay district as a whole. It was, however, less than two-thirds of that of the Delaware River district. The capital invested in shipbuilding on the shores of the Delaware River and of Chesapeake Bay is nearly one-half of the capital invested in the industry in the United States, and the value of the products of these districts is more than three-eighths that of the whole country. There can be no doubt, in view of the above facts, that these two sections possess attractions and advantages which may in time materially help in advancing the United States to a leading position among shipbuilding nations.

Table 7 presents for the United States the quantity and cost of the principal materials used, the cost of all other materials, and the number and value of steam and sailing vessels and barges built, the value of all other products, and the amount received for repair work; also the number of establishments reporting for 1899 and 1900, with the value of products for both years, for iron and steel shipbuilding.

TABLE 7.—MATERIALS AND PRODUCTS, IRON AND STEEL SHIPBUILDING: 1900.

MATERIALS USED.		PRODUCTS.	
Total cost	$23,585,549	Total value	$50,367,739
Lumber, all kinds, including logs, timber, and knees, thousand feet B.M	267,953	Vessels:	
Cost	$1,341,113	Steam, number	123
Pig and scrap iron, tons	22,639	Gross tonnage	237,379
Cost	$395,091	Net tonnage	164,313
Iron and steel plates, beams, angles, forgings, bolts, spikes, rivets, girders, castings, etc., pounds	375,383,913	Value	$24,311,343
Cost	$11,878,297	Sailing, number	6
Anchors and chains purchased	$168,726	Gross tonnage	21,085
Cordage:		Net tonnage	18,348
Wire, feet	633,175	Value	$962,600
Cost	$72,791	Barges, number	5
Manila and hemp, pounds	973,283	Gross tonnage	4,052
Cost	$142,138	Net tonnage	3,848
All other materials	$9,587,393	Value	$181,000
		All other products	$12,609,836
		Amount received for repair work	$12,302,960
		Comparison of products:	
		Number of establishments reporting for both years	41
		Value for census year	$46,262,760
		Value for preceding business year	$25,222,512

Table 7 shows that the value of the products of iron and steel shipbuilding establishments was $50,367,739, of which $24,311,343 represents the value of steam vessels, $962,600 that of sailing vessels, and $181,000 that of barges. The production of sailing vessels is almost equally divided between two states, one on the Great Lakes and the other on the Atlantic coast. The steam vessels, including steam launches, numbered 123, aggregating 237,379 gross and 164,313 net tons. The sailing vessels numbered 6, having a total of 21,085 gross and 18,348 net tons, and the barges 5, with a total of 4,052 gross and 3,848 net tons. More than one-half of the value of products was the value of new construction; about one-fourth, or $12,302,960, the value of repairs; and the remainder, $12,609,836, the value of unfinished construction and repairs.

Reference to Table 21 shows that of the 6 states separately reported, Michigan shows the minimum value per gross ton of construction, the average per gross ton being $61.34, and the maximum average of size, 4,291 tons for the 8 iron and steel vessels built. In Massachusetts and New Jersey, where the maximum value per gross ton is shown, the average tonnage per vessel was smallest. In Massachusetts the value averaged $255 per gross ton, the 3 vessels averaging 533 gross tons. In New Jersey the average value per gross ton was $242.27, the 10 vessels averaging 343 gross tons. In these 2 states the construction of river steamboats, yachts, and Government torpedo boats may account for the higher average value per gross ton. In New York, where the size of the vessels built closely approximates to that of those built in Massachusetts, the value per gross ton was not one-half that in the latter state. In Pennsylvania, where several large warships were built, the value per gross ton averaged only $104.48, and the size 3,850 gross tons, for the 22 vessels built.

In New Jersey and New York steel barges were built—1 in the former and 3 in the latter. That in New Jersey, of 500 gross tons, shows a value of $80 per gross ton, while those in New York, averaging 1,167 gross tons, were valued at $38.55 per gross ton.

In view of these wide variations in the value of vessels similar in size or type, deductions as to average value per gross ton for the United States possess no significance.

The following is a statement of the number and value of iron and steel vessels built in each state:

STATE.	Number.	Value.	STATE.	Number.	Value.
United States	134	$25,454,943	Massachusetts	3	$408,000
			Michigan	8	2,105,500
			New Jersey	11	870,000
California	4	1,450,000	New York	17	995,650
Delaware	13	1,908,399	Ohio	8	1,649,000
Florida	1	88,000	Oregon	2	379,000
Illinois	5	918,478	Pennsylvania	22	8,849,029
Indiana	4	135,000	Washington	2	93,000
Iowa	5	228,360	Wisconsin	1	268,500
Maine	4	724,600	Virginia	10	2,644,885
Maryland	14	1,789,542			

The above statement presents, by states, items of chief importance not in all cases disclosed in Table 21, which shows the detailed statistics for the industry. Inasmuch as the construction of iron and steel vessels has, during the census year, for the first time exceeded in value that of wooden vessels, the data shown in the statement will afford opportunities for comparisons in future censuses of the growth, by states, in this, the more important branch of the industry.

For 41 of the 44 establishments the value of products was reported for both 1899 and 1900. For the latter year this was $46,262,750, or 91.8 per cent of the total value of products of all the 44 establishments. In the preceding year the value of products of these 41 establishments was $25,222,512. In every state except Wisconsin there was an increase in the value of products in 1900 over 1899, the aggregate increase for these 41 establishments being 83.4 per cent. Upon this basis the value of products in 1899 increased 111.2 per cent over 1890, while the value of the products in 1900 increased 287.1 per cent over 1890. It can be stated, therefore, that while the value of the products of the iron and steel branch of the industry little more than doubled in the nine years preceding the census year, it nearly doubled again in 1900, although there seems to have been but 1 iron and steel shipbuilding plant established in the latter year. This seems to indicate that the establishments were only operated at about one-half their capacity in 1899 and that the great expansion in iron and steel shipbuilding has but just commenced.

Of the $23,585,549 expended for materials in iron and steel shipbuilding, $11,878,297 was for 375,383,913 pounds of iron and steel plates, beams, angles, forgings, bolts, spikes, rivets, girders, castings, etc.; $1,341,113 for lumber of all kinds, including logs, timbers, and knees, the lumber measuring 267,953,000 feet, board measure; and $395,091 for 22,639 tons of pig and scrap iron.

Table 21 comprehends the entire iron and steel shipbuilding industry, as conducted in private establishments. The number of such establishments was 44, of which 26 were located in six states—Maryland, Massachusetts, Michigan, New Jersey, New York, and Pennsylvania—the remaining 18 being located in California, Delaware, Florida, Illinois, Indiana, Iowa, Maine, Ohio, Oregon, Rhode Island, Virginia, Washington, and Wisconsin. The statistics for this latter group of states are not separately reported, for the reason that there are less than three establishments in each state.

Of the total number of establishments, 4 are owned by individuals, 5 by firms and limited partnerships, and 35 by incorporated companies.

Of the capital, amounting to $59,839,555, invested in the iron and steel shipbuilding industry, $32,624,784 represents the value of the plants, consisting of land, $9,614,552; buildings, $10,925,216; machinery, tools, and implements, $12,085,016; and cash on hand, bills receivable, unsettled ledger accounts, raw materials, stock in process of manufacture, finished products on hand, and other sundries, $27,214,771.

Table 21 also shows the number of proprietors and firm members, and officers of corporations, and general superintendents, managers, clerks, and salesmen with their salaries, and wage-earners by sex, with the amounts paid in wages.

The average number of wage-earners employed during each month is stated, there being comparatively small variations in the several months, although in a few cases, in certain states, the variations are greater than in others, the changes being apparently due rather to the demands of the industry than to climatic or other unusual causes.

It is also shown that in this branch of the industry no materials are purchased in the raw state. Separate items are given showing the amounts paid for fuel, rent of power and heat, mill supplies, all other materials, and freight. Other miscellaneous expenses, such as rent of works, taxes not including internal revenue, rent of offices, insurance, interest, internal-revenue tax and stamps, ordinary repairs of buildings and machinery, advertising, and other sundries are not reported under the head of materials; in addition the different kinds of materials used are separately stated with the quantities, when possible, and cost.

Table 8 presents for the United States the quantity and cost of the principal materials used, the cost of all other materials, and the number and value of steam and sailing vessels, barges, canal boats, and small boats, the value of all other products, and the amount received for repair work; also the number of establishments reporting for 1899 and 1900, with the value of products for both years, for wooden shipbuilding.

TABLE 8.—MATERIALS AND PRODUCTS, WOODEN SHIP AND BOAT BUILDING: 1900.

MATERIALS USED.		PRODUCTS.	
Total cost	$9,901,223	Total value	$24,210,419
Lumber, all kinds, including logs, timber, and knees, thousand feet B. M	257,338	Wooden vessels: Steam, number	396
Cost	$4,890,728	Gross tonnage	48,932
Iron and steel plates, beams, angles, forgings, bolts, spikes, rivets, girders, castings, etc., pounds	36,277,031	Net tonnage	32,845
Cost	$1,519,460	Value	$2,994,358
Anchors and chains purchased	$152,830	Sailing, number	646
Cordage: Wire, feet	914,656	Gross tonnage	59,291
Cost	$93,301	Net tonnage	51,847
Manila and hemp, pounds	1,436,929	Value	$3,251,069
Cost	$223,686	Barges, number	839
All other materials	$3,021,228	Gross tonnage	295,608
		Net tonnage	251,689
		Value	$3,828,170
		Canal boats, number	72
		Gross tonnage	21,434
		Net tonnage	19,949
		Value	$227,374
		Small boats, launches and ships', fishing, pleasure, life, and row boats, etc., number	15,448
		Value	$1,972,825
		All other products	$1,070,297
		Amount received for repair work	$10,866,326
		Comparison of products: Number of establishments reporting for both years	393
		Value for census year	$21,648,485
		Value for preceding business year	$17,886,228

Of the materials used in wooden shipbuilding, Table 8 shows that $4,890,728 was expended for lumber of all kinds, including logs, timber, and knees, measuring 257,338,000 feet, board measure; and $1,519,450

for iron and steel materials, weighing 36,277,031 pounds.

Of the value of products, amounting to $24,210,419, the sum of $2,994,358 represented the value of 396 steam vessels of 48,932 gross and 32,845 net tons; $3,251,069, that of 646 sailing vessels of 59,291 gross and 51,847 net tons; $3,828,170, that of 839 barges of 295,508 gross and 251,689 net tons; $227,374, that of 72 canal boats of 21,434 gross and 19,949 net tons; $1,972,825, that of 15,448 small boats; $1,070,297, that of all other products, consisting of unfinished new vessels and small boats, and unfinished repairs; and $10,866,326, that of repair work.

The average value per gross ton of wooden steam vessels is $61.19, of sailing vessels $54.83, of barges $12.95, and of canal boats $10.61. There is a wide variation in different parts of the country in the average value per gross ton of steam vessels.

Reference to Table 22 shows that in Indiana 20 vessels of a total of 10,159 gross tons averaged $27.28 per gross ton; in Connecticut 25 vessels of a total of 1,102 gross tons averaged $37.59; in Wisconsin 12 vessels of a total of 382 gross tons averaged $134.58; in New York 87 vessels of 4,817 gross tons averaged $111.12; in Michigan 17 vessels of a total of 4,710 gross tons averaged $63.99; in Ohio 15 vessels of a total of 1,262 gross tons averaged $60.36; in California 28 vessels of a total of 3,922 gross tons averaged $71.52; in Washington 21 vessels of a total of 6,298 gross tons averaged $57.67; and in Oregon 16 vessels of a total of 4,899 gross tons averaged $54.36.

In wooden sailing vessels the variations are nearly as wide. In Massachusetts 128 vessels of a total of 3,889 gross tons averaged $98.74; in New York 85 vessels of a total of 1,400 gross tons averaged $99.78; in California 22 vessels of a total of 8,256 gross tons averaged $67.93; in Washington 30 vessels of a total of 8,963 gross tons averaged $55.27; in Maine 73 vessels of a total of 26,683 gross tons averaged $40.76; and in Delaware 3 vessels of a total of 1,600 gross tons averaged $29.38.

The variation is greatest in the values per ton of barges. In Pennsylvania, 174 barges, averaging 378.6 gross tons, had a value of only $1.90 per gross ton. In this state, large numbers of roughly built barges are constructed near Pittsburg for carrying coal down the Ohio and Mississippi rivers to New Orleans. In Minnesota 5 barges of a total of 664 gross tons averaged $48.84; and in Michigan 2 barges of a total of 1,225 gross tons averaged $49.43. In the two states last named, the vessels were built to withstand the storms of the Great Lakes. In Maine 34 barges of a total of 25,286 gross tons averaged $30.25; in New York 172 barges of a total of 62,100 gross tons averaged $14.07; in New Jersey 40 barges of a total of 42,487 gross tons averaged $8.16; in Connecticut 31 barges of a total of 18,746 gross tons averaged $28.52; and in Delaware 22 barges of a total of 10,125 gross tons averaged $18.81. In New Jersey and New York the barges were largely of the type used in conveying coal around the harbor of New York and in inland waters; in Maine, Connecticut, and Delaware they were of a heavier type, in some cases adapted to coast navigation. In California 35 barges of a total of 6,726 gross tons had an average value of $21.07; and in Washington 116 barges of a total of 2,478 gross tons had an average value of $30.63.

Reference to Table 22 shows that in 1900 there were 1,072 private establishments engaged in wooden shipbuilding, and in the construction of boats, masts, and spars, and in the repairing of wooden vessels. As compared with the statistics for wooden shipbuilding for 1890 there is an increase of 84 establishments. From 1890 to 1900 there was a gain in Alabama of 1 establishment, in California of 8, in Connecticut of 6, in Idaho of 1, in Illinois of 7, in Indiana of 3, in Iowa of 5, in Louisiana of 2, in Maine of 30, in Maryland of 10, in Minnesota of 6, in Mississippi of 4, in Missouri of 5, in New Hampshire of 6, in New Jersey of 3, in New York of 5, in Oregon of 2, in Pennsylvania of 5, in Rhode Island of 6, in Tennessee of 2, in Virginia of 10, in Washington of 20, and in Wisconsin of 13. There was a loss in the District of Columbia of 1, in Florida of 1, in Kentucky of 19, in Massachusetts of 25, in Michigan of 10, in North Carolina of 2, in Ohio of 9, in South Carolina of 6, in Texas of 2, and in Vermont of 1.

Not in all cases, however, has a decrease in number of establishments been accompanied with a loss of capital or of value of products, and not in every case of increase in number of establishments has there been a corresponding increase in capital invested and in value of products. In California, while there was an increase of 8 establishments, there was a decrease of $67,791, or 18.5 per cent, in capital, but an increase of $682,001, or 70.2 per cent, in the value of products. In Connecticut there was an increase of 6 in number of establishments, of $36,930, or 6.5 per cent, in capital invested, and $173,819, or 16.5 per cent, in the value of products. In Florida there was a loss of 1 establishment, but an increase of $56,003, or 60.1 per cent, in the capital, and of $186,971, or 274.9 per cent, in the value of products. In Maine there was an increase of 30 establishments and of $288,064, or 28 per cent, in capital, but a decrease of $326,800, or 11.6 per cent, in value of products. In Massachusetts there was a decrease of 25 establishments, of $101,168, or 8.2 per cent, in capital, and of $488,073, or 21.7 per cent, in value of products. In no other state was the decrease so great as in Michigan, the decrease being 10 in number of establishments, $2,140,617, or 72.7 per cent, in capital, and $2,117,210, or 60.1 per cent, in value of products. In New Jersey there was an increase of 3 in number of establishments,

$290,865, or 21.1 per cent, in capital, but a decrease of $254,379, or 11.5 per cent, in value of products. In New York there was an increase of 5 in number of establishments, with an increase of $2,597,496, or 73.3 per cent, in capital, a larger gain in capital than is shown for any other state in wooden shipbuilding, but there was a decrease of $25,841 in the value of products. In Ohio there was a decrease of 9 in number of establishments, of $559,471, or 66.3 per cent, in capital, and of $617,857, or 56 per cent, in value of products. In Oregon, with an increase of 2 in number of establishments, there was a decrease of $178,375, or 58.4 per cent, in capital, and an increase of $333,670, or 104 per cent, in value of products. In Washington there was an increase of 20 in number of establishments, of $494,164, or 916.5 per cent, in capital, and of $1,378,164, or 1,081 per cent, in value of products. The percentage of increase in Washington in wooden shipbuilding is remarkable, being next to that of Virginia in steel shipbuilding. As in Virginia, so it is in Washington. The proximity of the coast to the almost inexhaustible supply of shipbuilding materials is an explanation of the great growth recorded. In Wisconsin there was an increase of 13 in number of establishments, of $287,397, or 52.8 per cent, in capital, and of $244,835, or 52.9 per cent, in value of products. In Virginia there was an increase of 10 in number of establishments and of $10,256, or 3.3 per cent, in capital, with a decrease of $33,198, or 11.2 per cent, in value of products.

From such conditions as have been shown but very little intelligible deduction is possible. On the Great Lakes, with the exception of Wisconsin, the wooden shipbuilding industry is evidently declining. On the Atlantic it holds its own, while on the Pacific coast it has advanced, owing to large forests of the finest shipbuilding timber.

The amount of capital invested in wooden shipbuilding was $17,523,146, of which $9,944,225 was invested in plant, divided into $3,868,999 for land, $2,182,156 for buildings, and $3,893,070 for machinery, tools, and implements, leaving the sum of $7,578,921 in cash on hand, bills receivable, unsettled ledger accounts, raw materials, stock in process of manufacture, finished products on hand, and other sundries.

Establishments reporting in 1900 products valued at $21,643,485, or 89.4 per cent of the total of $24,210,419, reported also the value of their products for 1899—$17,386,228. In every state reported separately in Table 22, except Indiana, Minnesota, and Tennessee, there was an increase in the value of the products in 1900 over 1899, the aggregate increase being 24.5 per cent. For certain states the increases from 1899 to 1900 in the value of the products of establishments reporting for both years were as follows: California, 18.3 per cent; Connecticut, 39.1 per cent; Maine, 46.6 per cent; Massachusetts, 33.2 per cent; New Jersey, 24.5 per cent; New York, 18.5 per cent; and Washington, 45.3 per cent. At the close of the census year nearly all the large shipyards in both branches of the industry were engaged in the construction of vessels which could not be reported as finished. Careful estimates of the approximate value of such uncompleted work, based on the labor and materials employed, were made by the builders. The valuations thus reached are included in Tables 7, 8, 21, and 22, under "all other products." Thus a large proportion of the total under that heading represents the value of important steel shipbuilding operations, while nearly all of the products so classified are for maritime use and are properly included in the shipbuilding of the country. The total value of the unfinished vessels in the large shipyards of the country at the close of the census year was closely estimated by the builders, and the aggregate value was $9,336,897. Reports of this character were received from 14 establishments, located in the following states: Connecticut, 1; Delaware, 1; Illinois, 1; Maine, 2; Maryland, 1; Michigan, 2; New Jersey, 1; New York, 2; Ohio, 1; Pennsylvania, 1; Virginia, 1.

Summarizing the new construction of vessels of all kinds—steam, sailing, barges, and canal boats, both iron and steel and wooden—there were constructed in American shipyards during the year ending May 31, 1900, 2,087 vessels of a total of 687,681 gross tons. Of these, 519, of a total of 286,311 gross tons, were steam; 652, of a total of 80,376 gross tons, were sailing vessels; 844, of a total of 299,560 gross tons, were barges; and 72, of a total of 21,434 gross tons, were canal boats. Of the 2,087 vessels built, 134, of a total of 262,516 gross tons, were of iron and steel, divided as follows: 123 steam vessels of a total of 237,379 gross tons, 6 sailing vessels of a total of 21,085 gross tons, and 5 canal boats of a total of 4,052 gross tons. The wooden vessels numbered 1,953, of a total of 425,165 gross tons, divided as follows: 396 steam vessels of a total of 48,932 gross tons, 646 sailing vessels of a total of 59,291 gross tons, 839 barges of a total of 295,508 gross tons, and 72 canal boats of a total of 21,434 gross tons.

Tables 9, 10, 11, and 12 present statistics of shipbuilding on the Great Lakes, as follows: Table 9, a summary of all shipbuilding for 1900; Tables 10 and 11, summaries of iron and steel shipbuilding and wooden shipbuilding, respectively, for 1900; Table 12, a comparative summary of iron and steel shipbuilding for 1890 and 1900, with the percentages of increase.

TABLE 9.—SUMMARY OF SHIPBUILDING ON THE GREAT LAKES, WOODEN AND IRON AND STEEL: 1900.

Number of establishments	122
Capital	$15,185,173
Salaried officials, clerks, etc., number	217
Salaries	$306,987
Wage-earners, average number	8,517
Total wages	$4,331,065
Miscellaneous expenses	$556,466
Cost of materials used	$4,966,250
Value of products, including repairing	$11,958,854

TABLE 10.—IRON AND STEEL SHIPBUILDING ON THE GREAT LAKES: 1900.

Number of establishments	[1] 8
Capital	$12,509,788
Salaried officials, clerks, etc., number	140
Salaries	$230,330
Wage-earners, average number	6,388
Total wages	$3,130,005
Miscellaneous expenses	$405,446
Cost of materials used	$4,003,854
Value of products:	
Total	$9,247,305
Steam vessels:	
Number	21
Gross tonnage	81,211
Net tonnage	60,228
Value	$4,633,628
Sailing vessels:	
Number	3
Gross tonnage	15,117
Net tonnage	14,001
Value	$550,000
All other products	$2,035,038
Repair work	$2,028,639

TABLE 11.—WOODEN SHIPBUILDING ON THE GREAT LAKES: 1900.

Number of establishments	[2] 114
Capital	$2,675,385
Salaried officials, clerks, etc., number	77
Salaries	$76,657
Wage-earners, average number	2,129
Total wages	$1,201,060
Miscellaneous expenses	$151,020
Cost of materials used	$962,396
Value of products:	
Total	$2,706,549
Steam vessels:	
Number	57
Gross tonnage	5,872
Net tonnage	4,808
Value	$380,450
Sailing vessels:	
Number	27
Gross tonnage	3,044
Net tonnage	2,928
Value	$184,000
Barges:	
Number	8
Gross tonnage	3,083
Net tonnage	2,813
Value	$131,754
Canal boats:	
Number	12
Gross tonnage	2,914
Net tonnage	2,164
Value	$33,600
Small boats:	
Number	2,096
Value	$333,034
All other products	$76,404
Repair work	$1,617,307

[1] Distributed as follows: On Lake Superior—Wisconsin, 1; on Lake Michigan—Illinois, 1; on Lake Huron—Michigan, 1; on Lake Erie—Ohio, 2, and New York, 1; on St. Clair River—Michigan, 1; on Detroit River—Michigan, 1.

[2] Distributed as follows: On Lake Superior—Minnesota, 5; Wisconsin, 3; Michigan, 2; on Lake Michigan—Michigan, 10; Wisconsin, 9; Illinois, 8; on Lake Huron—Michigan, 9; on Lake Erie—Ohio, 11; Pennsylvania, 1; New York, 8; on Lake Ontario—New York, 20; on St. Marys River—Michigan, 1; on St. Clair River—Michigan, 8, on Lake St. Clair—Michigan, 3; on Detroit River—Michigan, 12; on Niagara River—New York, 4.

TABLE 12.—COMPARATIVE SUMMARY, IRON AND STEEL SHIPBUILDING ON THE GREAT LAKES: 1890 AND 1900.

	1900	1890	Per cent of increase.
Number of establishments	8	8	.....
Capital	$12,509,788	$3,034,580	312.2
Salaried officials, clerks, etc., number	140	[1] 46	204.3
Salaries	$230,330	[1] $90,160	155.6
Wage-earners, average number	6,388	2,544	151.1
Total wages	$3,130,005	$1,298,789	141.0
Miscellaneous expenses	$405,446	$69,826	480.7
Cost of materials used	$4,003,854	$1,767,922	126.5
Value of products	$9,247,305	$4,321,400	114.0
Iron and steel vessels:			
Number	24	33	[2] 27.3
Gross tonnage	96,328	[3] 36,728	162.3
Value	$5,183,628	$4,128,000	25.6
All other products, including amount received for repair work	$4,063,677	$193,400	2,001.2

[1] Includes proprietors and firm members, with their salaries; number only reported in 1900.

[2] Decrease.

[3] Kind of tonnage not reported in 1890.

Comparison of Table 9 with the totals for the industry in the United States shows that while only 10.9 per cent of the total number of shipbuilding establishments were located on the Great Lakes, the capital invested there was 19.6 per cent of the total capital, the number of wage-earners employed, 18.2 per cent of the total number; the wages paid, 17.4 per cent of the total wages; and the value of products, consisting of iron and steel and wooden vessels, boats, masts, spars, and oars, and repairing, constituted 16 per cent of the total value of products.

Table 10 shows that only 8 establishments on the Great Lakes constructed iron and steel vessels during the census year, but their capital, averaging $1,563,723 per establishment, and the value of their products constituted 82.4 and 77.3 per cent, respectively, of the corresponding totals for all shipbuilding establishments on the Great Lakes. There were 114 establishments engaged in the construction of wooden vessels, small boats, masts, and spars, and repairing, but their capital investment amounted to only $2,675,385, an average of $23,468. Of the total gross tonnage of wooden vessels constructed in the United States in 1900, Table 11 shows that only 3.5 per cent, with a value constituting 6.6 per cent of the total, was turned out by the Great Lakes shipyards. Of the total gross tonnage of iron and steel vessels, 36.7 per cent was built there, with a value constituting 20.4 per cent of the total value.

As shown by Table 12, the number of iron and steel shipbuilding establishments on the Great Lakes was the same at the censuses of 1890 and 1900. Very large increases are shown, however, in the items of capital, wage-earners, wages, cost of materials used, and value of products. The number of vessels constructed decreased from 33 to 24, but they were of considerably

larger tonnage. Assuming that the tonnage reported in 1890 was gross, the average gross tonnage of vessels was 4,014 in 1900, compared with 1,113 in 1890.

In the Southern states, during the last decade, the growth in shipbuilding was probably greater than in any other geographical division of the United States. This was due in a large measure to the remarkable increase made in Virginia. The capital invested increased from $4,467,860 in 1890 to $22,476,618 in 1900, or 403.1 per cent. In 1890 it constituted 16.4 per cent of shipbuilding capital in the United States, and in 1900, 29.1 per cent. The increase in the capital invested in shipbuilding in the United States during the past decade amounted to $50,099,809, of which $18,008,758, or 35.9 per cent, was placed in Southern shipbuilding establishments.

In 1890 the value of the products of shipbuilding in the South was $5,485,116, or 14.4 per cent of the total for the United States; in 1900 it was $14,905,422, or 20 per cent of the total, showing an increase of 171.7 per cent.

Table 13 presents statistics for wooden ship and boat building and repairing in cities of 20,000 population and over for 1900.

TABLE 13.—SHIP AND BOAT BUILDING, WOODEN, BY CITIES: 1900.

CITIES.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS.		Miscellaneous expenses.	Cost of materials used.	Value of products, including repairing.
			Number.	Salaries.	Average number.	Total wages.			
Total	422	$10,317,854	337	$370,024	8,333	$4,722,895	$680,935	$4,276,135	$12,449,833
Baltimore, Md	14	469,015	17	16,716	413	233,532	25,445	164,437	555,852
Bangor, Me	4	7,900	.....	.....	14	8,683	652	4,837	20,638
Bay City, Mich	4	9,125	1	1,500	63	36,600	611	21,290	132,909
Bayonne, N. J	3	77,400	8	4,183	23	8,292	1,167	17,275	42,000
Boston, Mass	30	643,760	26	20,510	653	415,417	102,144	451,779	1,120,763
Bridgeport, Conn	3	10,601	.....	.....	24	17,685	2,020	6,434	32,871
Buffalo, N. Y	8	574,826	9	10,091	162	86,547	22,867	65,922	216,486
Camden, N. J	9	219,712	12	8,594	266	177,218	21,452	142,778	409,500
Chester, Pa	3	13,550	.....	.....	10	6,450	617	6,175	17,775
Chicago, Ill	7	284,072	9	13,010	160	86,469	8,396	55,114	187,083
Cincinnati, Ohio	4	59,800	4	3,760	103	32,899	15,047	24,254	93,114
Cleveland, Ohio	3	9,025	.....	.....	42	21,400	1,603	13,200	43,950
Detroit, Mich	10	75,021	8	5,556	91	47,836	9,426	35,983	123,635
Duluth, Minn	5	80,482	7	7,580	71	41,760	8,055	30,990	102,316
Gloucester, Mass	24	145,172	6	5,860	102	62,800	12,160	74,531	201,448
Jacksonville, Fla	3	4,625	.....	.....	12	3,864	712	2,582	11,154
Jersey City, N. J	5	151,400	7	12,200	212	116,693	19,324	70,204	259,000
Kingston, N. Y	4	90,000	1	1,500	146	93,476	4,004	88,560	207,201
Minneapolis, Minn	3	1,365	.....	.....	1	420	99	743	2,395
Mobile, Ala	4	146,026	3	4,300	291	100,816	6,013	75,218	236,142
New Bedford, Mass	11	13,650	.....	.....	22	12,760	1,699	6,073	27,925
New Haven, Conn	5	17,400	.....	.....	11	7,190	808	6,925	19,635
New Orleans, La	6	171,847	19	11,082	137	57,402	8,953	25,773	132,771
New York, N. Y	83	3,974,116	77	117,576	[1]2,484	1,493,448	144,872	1,267,853	3,919,804
Norfolk, Va	6	184,550	8	7,900	104	50,926	4,071	32,164	129,148
Oshkosh, Wis	4	39,641	1	468	33	15,342	1,134	17,913	56,310
Philadelphia, Pa	10	51,955	.....	.....	69	38,184	4,143	21,342	91,957
Portland, Me	6	5,275	.....	.....	14	10,016	643	1,750	22,350
Portland, Oreg	9	97,620	6	8,060	261	120,044	6,187	186,890	399,717
Providence, R. I	3	81,701	2	2,500	51	37,240	2,867	20,650	80,904
Quincy, Mass	3	38,805	2	2,500	18	10,360	806	10,925	16,150
Rochester, N. Y	7	30,552	.....	.....	6	3,010	1,181	8,507	20,109
St. Louis, Mo	4	23,592	3	3,070	58	41,696	6,000	23,187	77,326
St. Paul, Minn	3	13,125	.....	.....	5	2,428	190	6,492	10,275
Salem, Mass	3	5,460	.....	.....	8	6,250	398	3,215	13,200
San Francisco, Cal	21	112,290	11	10,000	334	201,706	69,296	287,047	646,084
Seattle, Wash	12	237,925	9	6,842	184	130,081	18,170	159,081	429,641
Tacoma, Wash	3	117,584	7	11,280	169	95,602	8,856	115,965	209,750
Toledo, Ohio	4	64,505	.....	.....	53	25,694	494	24,742	65,950
Waltham, Mass	3	21,655	1	260	9	5,500	2,494	4,003	13,920
Washington, D. C	3	14,465	.....	.....	17	11,480	154	6,989	24,980
Wilmington, Del	4	182,226	7	8,936	176	94,114	6,212	123,282	301,018
All other cities[1]	59	1,745,038	66	64,240	1,251	653,565	134,194	563,061	1,714,697

[1] Includes establishments distributed as follows: Akron, Ohio, 2; Albany, N. Y., 2; Allegheny, Pa., 2; Burlington, Iowa, 2; Cambridge, Mass., 2; Charleston, S. C., 1; Chattanooga, Tenn., 1; Chelsea, Mass., 2; Clinton, Iowa, 1; Covington, Ky., 1; Dubuque, Iowa, 2; Elizabeth, N. J., 1; Elmira, N. Y., 1; Erie, Pa., 1; Fall River, Mass., 1; Galveston, Tex., 1; Grand Rapids, Mich., 2; Hartford, Conn., 1; Hoboken, N. J., 2; Indianapolis, Ind., 1; Jamestown, N. Y., 2; Kalamazoo, Mich., 1; Knoxville, Tenn., 1; La Crosse, Wis., 1; Lawrence, Mass., 1; McKeesport, Pa., 1; Milwaukee, Wis., 1; Memphis, Tenn., 1; New Brunswick, N. J., 1; Newton, Mass., 1; Oakland, Cal., 2; Oswego, N. Y., 1; Paterson, N. J., 1; Pittsburg, Pa., 2; Poughkeepsie, N. Y., 1; Quincy, Ill., 1; Racine, Wis., 1; Sacramento, Cal., 1; Saginaw, Mich., 1, San Jose, Cal., 1; Superior, Wis., 1; Taunton, Mass., 1; Trenton, N. J., 1; Troy, N. Y., 1; Wilkesbarre, Pa., 1; Wilmington, N. C., 1; Yonkers, N. Y., 1.

Table 13 shows that of the 1,072 wooden ship and boat building establishments in the United States, 422, or 39.4 per cent, are located in cities with a population of 20,000 and over. The value of the products of these establishments was $12,449,833, which was 51.4 per cent of the total for the United States. The statistics shown do not represent the entire shipbuilding operations of the several cities included in the above table. It was impossible to present the combined statistics for iron and steel and wooden shipbuilding in this manner without danger of disclosing individual operations in the industry. There were one or more iron and steel

shipbuilding establishments located in each of the following cities: Baltimore, Md., 3; Boston, Mass., 2; Buffalo, N. Y., 1; Camden, N. J., 1; Chester, Pa., 1; Chicago, Ill., 1; Cleveland, Ohio, 1; Detroit, Mich., 1; Dubuque, Iowa, 1; Elizabeth, N. J., 1; Hoboken, N. J., 2; Jacksonville, Fla., 1; Newburg, N. Y., 1; New York, N. Y., 7; Philadelphia, Pa., 2; Portland, Oreg., 1; Richmond, Va., 1; San Francisco, Cal., 2; Seattle, Wash., 1; Superior, Wis., 1; Toledo, Ohio, 1; Wilmington, Del., 2. The statistics of iron and steel shipbuilding in several of the foregoing cities greatly exceed those of wooden shipbuilding. This is notably the case in Philadelphia, Pa., San Francisco, Cal., Cleveland, Ohio, Wilmington, Del., Chicago, Ill., Detroit, Mich., Chester, Pa., Elizabeth, N. J., Baltimore, Md., and Hoboken, N. J., which are the ten leading cities in the value of products, ranked in the order in which they are given.

Table 14 presents the detailed items of capital invested in the shipbuilding industry in the United States, with the percentage that each forms of the total.

TABLE 14.—ITEMS OF CAPITAL INVESTED IN SHIPBUILDING AND PERCENTAGE THAT EACH FORMS OF THE TOTAL: 1900.

	Capital.	Per cent of total.
Total capital	$77,862,701	100.0
Total value of plant	42,569,009	55.0
Land	13,483,551	17.4
Buildings	13,107,372	17.0
Machinery, tools, and implements	15,978,086	20.6
Cash and sundries	34,793,692	45.0

Table 15 shows the percentages that the items reported for each branch of the industry, iron and steel shipbuilding and wooden shipbuilding, under the general heads of this inquiry, form of the corresponding totals for the entire industry.

TABLE 15.—PERCENTAGES THAT THE SEVERAL ITEMS FOR EACH BRANCH OF SHIPBUILDING FORM OF THE TOTAL FOR THAT ITEM FOR THE ENTIRE INDUSTRY: 1900.

	Iron and steel.	Wooden.[1]
Capital	77.3	22.7
Salaried officials, clerks, etc., number	60.9	39.1
Salaries	70.3	29.7
Wage-earners, average number	66.1	33.9
Total wages	65.3	34.7
Miscellaneous expenses	71.7	28.3
Cost of materials used	70.4	29.6
Value of products, including repairing	67.5	32.5

[1] Including small boats, spar making, rigging, and repairing.

Table 16 shows the sums expended for the different materials used in shipbuilding and the percentage that each is of the total cost of materials.

TABLE 16.—COST OF DIFFERENT MATERIALS USED IN SHIPBUILDING AND THE PERCENTAGE THAT EACH FORMS OF THE TOTAL: 1900.

	Cost.	Per cent of total.
Total cost of materials	$33,486,772	100.0
Lumber, all kinds, including logs, timber, and knees	6,231,841	18.6
Iron and steel plates, beams, angles, forgings, bolts, spikes, rivets, girders, castings, pig and scrap iron, etc.	13,792,838	41.2
Anchors and chains purchased	321,556	1.0
Cordage:		
Wire	166,092	0.5
Manila and hemp	365,824	1.1
Duck	177,866	0.5
Paints, oils, etc	721,865	2.2
Oakum and pitch	275,652	0.8
Masts and spars purchased	223,601	0.7
Blocks purchased	85,262	0.2
Machinery and boilers purchased	3,082,977	9.2
Fittings and furniture purchased	808,516	2.4
All other materials, including fuel, rent of power and heat, mill supplies, freight, etc	7,232,882	21.6

Table 16, compared with a similar table appearing in the report on shipbuilding at the Eleventh Census, shows that the cost of lumber used has increased but slightly. In 1890 it was $5,995,894 and in 1900 it was $6,231,841, an increase of $235,947, or only 3.9 per cent. The cost of metal used increased from $4,872,074 in 1890 to $13,792,838 in 1900, an increase of $8,920,764, or 183.1 per cent. The cost of machinery and boilers purchased in 1890 was $2,913,856 and in 1900, $3,082,977, an increase of $169,121, or 5.8 per cent. In view of the large increase in the number and tonnage of steam vessels, the small increase in the amount expended by shipbuilders, for boilers and machinery purchased, indicates that the equipment of their plants had been sufficiently increased to enable a large proportion of them to manufacture the machinery and boiler equipment of the vessels built, without recourse to specialists in these lines of manufacturing industry. It should be stated at this point that the tables presenting the cost of materials in detail in 1890 included governmental establishments, and it has been found impossible to separate the detailed items reported by such establishments; to some extent, therefore, the value of the statistics is impaired for comparative purposes, as such data are not included in Table 16. The total cost of materials reported by governmental establishments in 1890 was $403,863.

So large a number of the establishments reporting were exclusively engaged in the building of small boats, in repair work, or in other distinct branches of the industry, that tables are here presented giving separately the number of such establishments by states, with their capital and value of products, in order that by deduction from the general tables the totals for shipbuilding proper may be ascertained, and computations based thereon rendered more accurate and valuable. The most numerous among such establishments are those devoted exclusively to the construction of small boats, as shown in Table 17.

Table 17 shows, by states, the number of establish-

ments, capital invested, and value of products of establishments engaged exclusively in the manufacture and repair of small boats, including power launches, ships' boats, lifeboats and life rafts, rowboats, and sailboats under 5 tons measurement.

TABLE 17.—ESTABLISHMENTS ENGAGED IN THE CONSTRUCTION AND REPAIR OF SMALL BOATS, WITH CAPITAL AND VALUE OF PRODUCTS, BY STATES: 1900.

STATES.	Number of establishments.	Capital.	Value of products, including repairing.
United States	363	$2,596,887	$2,330,229
California	10	23,700	71,475
Connecticut	17	47,491	110,565
Delaware	4	27,254	28,818
Florida	7	6,107	13,626
Illinois	4	2,272	15,158
Indiana	9	37,565	53,560
Iowa	5	3,975	6,054
Maine	46	78,652	95,711
Maryland	10	30,755	45,919
Massachusetts	45	208,559	271,114
Michigan	27	85,727	158,069
Minnesota	12	17,710	26,630
Missouri	3	11,215	12,210
New Jersey	21	89,490	59,799
New York	71	1,707,010	1,046,698
North Carolina	4	7,435	6,593
Ohio	9	24,765	52,665
Pennsylvania	7	33,430	42,926
Rhode Island	10	26,245	26,405
Virginia	6	7,225	11,854
Washington	9	9,250	16,317
Wisconsin	16	91,895	133,625
All other States[1]	11	19,160	24,488

[1] Includes establishments distributed as follows: District of Columbia, 1; Idaho, 1; Kentucky, 2; Louisiana, 2; Tennessee, 1; Texas, 2, Vermont, 2.

Table 17 includes a certain number of establishments that were engaged solely in the construction and repair of small boats during the census year, although equipped for the building of larger vessels and occasionally so occupied. No establishments were included, however, whose reports showed repair work on small boats alone and no new construction. In this connection it should be stated that the statistics presented in Table 17 differ from those applying to small boats shown in Tables 20 and 22, in that the latter show the total construction of such vessels in the United States, many being the output of establishments engaged principally in the more important branches of the industry.

It is important to state that, in order to carry out the general plan of showing separately the statistics for iron and steel and for wooden shipbuilding in the United States, it was necessary, in the case of 2 establishments largely engaged in each class of construction, to consider each establishment as 2 separate plants, and to treat them as such in the tabulations, including under iron and steel shipbuilding the output in that class and the materials used in it, with an equitable proportion of the investment values, wages, etc. The same course was followed under wooden construction. In the case of one of these establishments the output under wooden shipbuilding, so segregated, was small-boat construction. As its inclusion in Table 17 adds more to the total than any other plant, it is proper to state that steel-shipbuilding operations of an important character were carried on by this firm during the census year. Its inclusion, however, is justified, not only by the large output, but by the fact that to all intents and purposes of the present census the establishment is considered as 2 separate and distinct plants.

Table 18 shows, by states, the number of establishments, capital invested, and value of products of establishments engaged exclusively in repairing. Plants maintained by transportation companies for the repair of their own vessels are not included.

TABLE 18.—ESTABLISHMENTS ENGAGED DURING THE CENSUS YEAR IN REPAIR WORK EXCLUSIVELY, WITH CAPITAL AND VALUE OF WORK DONE, BY STATES: 1900.

STATES.	Number of establishments.	Capital.	Value of work done.
United States	215	$7,154,552	$7,418,489
Alabama	3	49,800	131,116
Connecticut	7	82,650	151,227
Florida	3	13,894	11,194
Illinois	9	345,830	253,208
Louisiana	5	149,100	80,791
Maine	15	127,318	166,262
Maryland	12	116,971	141,939
Massachusetts	16	920,707	1,042,699
Michigan	15	278,525	325,800
New Jersey	16	627,313	628,660
New York	48	2,960,711	2,557,262
North Carolina	5	48,560	50,015
Ohio	9	61,490	117,764
Pennsylvania	9	142,833	103,939
Rhode Island	4	242,676	749,810
Virginia	15	218,942	194,618
Washington	3	113,484	183,000
West Virginia	3	34,455	26,495
All other states[1]	18	619,293	502,669

[1] Includes establishments distributed as follows: California, 2; Delaware, 1; District of Columbia, 1; Iowa, 2; Kentucky, 2; Minnesota, 2; Mississippi, 1; New Hampshire, 2; Oregon, 1; South Carolina, 1; Texas, 1; Wisconsin, 2.

In point of capital invested and value of products, Table 18 shows, in comparison with the statistics presented in Table 17, that the establishments engaged exclusively in repairing formed the most important group of the subsidiary branches of the shipbuilding industry. A large part of the repair work throughout the country is carried on by plants also engaged in construction work, and is, therefore, shown in Tables 21 and 22; but the establishments included in Table 18 did no other work than repairing during the census year, although many are equipped for building new vessels and are at times so employed.

In addition to the branches of the industry covered by Tables 17 and 18, there are also included in the general tables a number of contributory industries carried on as separate trades, such as rigging, spar making, and calking. Almost all of the work reported by such establishments was a part of the construction of new vessels during the census year, and has, accordingly, been included with shipbuilding proper; a large proportion of the work was done by contract, in the shipyard, and would otherwise have been done by the builders themselves. It is important that this should be taken into consideration in basing computations on the general totals, and the total investment and the

value of the work done by such establishments are given here in order that they may be deducted from shipbuilding proper.

Reports were received from 32 establishments in the United States engaged in spar making, calking, and ship fitting, showing an aggregate capital of $208,633, and products valued at $405,323. They were located as follows: California, 2; Connecticut, 2; Maine, 5; Massachusetts, 12; New Jersey, 2; New York, 6; Oregon, 2; Pennsylvania, 1. Reports were received from 30 ships' riggers, showing an aggregate capital of $94,575, and products valued at $253,015. They were located as follows: California, 1; Maine, 5; Massachusetts, 13; New York, 5; Ohio, 1; Pennsylvania, 5. Reports were received from 7 establishments engaged exclusively on ship-joiner work, their capital aggregating $108,158, and the value of their products $209,310. They were located as follows: Maryland, 2; Massachusetts, 3; New York, 2. Other minor contributory industries are included in the general report for manufactures of the Twelfth Census, sailmaking being classified under "awnings, tents, and sails."

Table 19 shows the number of establishments, capital, and value of work done at plants maintained by transportation companies for the construction and repair of their own vessels exclusively, no work being performed on contract. The table also includes plants operated by railroad companies for the exclusive repair of their floating equipment.

TABLE 19.—TRANSPORTATION COMPANIES ENGAGED IN THE CONSTRUCTION AND REPAIR OF VESSELS, WITH CAPITAL AND VALUE OF PRODUCTS, BY STATES: 1900.

STATES.	Number of establishments.	Capital.	Value of products, including repairing.
United States	20	$1,112,068	$2,428,385
California	4	75,300	779,264
Connecticut	3	73,000	167,279
Massachusetts	2	80,500	120,200
New Jersey	3	542,250	876,127
New York	3	81,000	131,854
Ohio	1	5,000	20,000
Pennsylvania	2	14,000	68,105
Rhode Island	1	160,000	678,506
Wisconsin	1	81,018	87,000

Table 20 shows the total small-boat construction of the United States, by states, giving the number and value of each class, and supplements by its greater detail the data relating to small-boat construction presented in other tables.

TABLE 20.—SMALL BOATS, BY STATES: 1900.

STATES.	SMALL BOATS.									
	Steam launches.[1]				Power launches other than steam—electric, gasoline, naphtha, alcohol, vapor, etc.		Sailboats under 5 tons—pleasure and fishing.		Rowboats—pleasure, fishing, life, racing, ships', hunting, and canvas canoes.	
	Number.	Gross tonnage.	Net tonnage.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
United States	96	848	453	$143,660	1,689	$1,060,365	4,317	$473,307	9,442	$439,153
California	11	50	23	9,600	14	9,800	263	58,810	320	31,405
Connecticut	22	189	104	13,050	159	56,855	77	12,202	82	3,050
Delaware					3	1,450	7	1,500	285	26,192
District of Columbia							7	500		
Florida	2	18	9	900	1	1,000	37	18,030	59	1,641
Illinois	9	48	28	8,800	5	5,950	80	4,848	276	10,100
Indiana	2	51	29	1,550	81	40,400	8	840	435	5,900
Iowa					2	1,404	8	880	30	1,965
Kentucky									45	800
Louisiana							5	875	33	1,060
Maine	3	8	3	335	8	5,895	353	35,388	1,539	52,288
Maryland					17	12,500	97	10,780	160	12,074
Massachusetts	7	61	35	28,850	41	49,383	2,099	98,242	1,661	61,339
Michigan	12	79	44	16,400	327	171,405	215	51,393	454	18,212
Minnesota					37	17,485	17	3,740	471	12,750
Mississippi							4	517		
Missouri					5	6,500	12	2,180	123	3,385
New Hampshire	1	10	5	900			18	1,610	50	1,333
New Jersey	6	34	21	6,000	82	48,857	115	18,140	104	2,780
New York	15	248	121	56,975	552	454,643	337	74,189	1,756	125,870
North Carolina					1	318	6	680	2	30
Ohio					78	34,400	24	4,450	268	8,355
Oregon	2	15	9	1,400	4	6,040	12	985	26	2,000
Pennsylvania					15	11,000	91	18,176	289	22,860
Rhode Island	2	22	12	2,200	2	3,000	58	15,435	73	3,469
Tennessee									52	820
Texas	2	15	10	1,700			18	1,086		
Virginia					1	4,000	44	3,887	32	2,550
Washington					10	26,900	185	21,184	199	13,205
Wisconsin					241	89,780	108	17,160	531	10,861
All other states[2]					3	1,400	22	650	87	2,859

[1] Included under "steam vessels" in Tables 8 and 22.

[2] Includes Arkansas, Idaho, and Vermont.

Table 20 presents the number, gross and net tonnage, and value of steam launches, and the number and value of other power launches, small sailboats under 5 tons, and rowboats of all types. Gasoline engines were employed as a motive power in all but a small proportion of the launches using power other than steam. Both these and the steam launches varied widely in value. The average value of steam launches is shown to be considerably higher than the actual value of the greater proportion of those constructed. The same is true of boats propelled by oars, the average value being raised by the inclusion in this class of racing shells valued as high as $2,000, of metal lifeboats averaging $200 in value, and of a large number of hunting boats of expensive construction.

The detailed statistics for the industry as reported are shown in Tables 21, 22, and 23: Table 21 presenting statistics of iron and steel shipbuilding; Table 22, of wooden ship and boat building; and Table 23, of governmental establishments. These tables present separate totals for each state in which there were 3 or more establishments, and group the statistics for other states so as not to disclose the operations of individual establishments, except in Table 23, which shows separately the data reported by each establishment. The establishments are classified according to the character of the ownership, which shows that in iron and steel shipbuilding 4 were owned by individuals, 5 by partnerships, and 35 by corporations; and in wooden shipbuilding 744 were owned by individuals, 212 by partnerships, and 116 by corporations. The employees are classified so as to show for salaried officials, clerks, etc., and for wage-earners separately the number and salaries or wages of men, women, and children, respectively, and also the average number of wage-earners employed during each month of the year. Separate totals are shown for the different materials, presenting quantities when possible; and the kind, number, and value of the several types of vessels constructed, the amount received for repairing, and the value of all other products, are given. The number of engines, water wheels, electric motors, and other forms of power in use, with their horsepower, are shown. The establishments are grouped in the tables according to the number of employees in each.

TABLE 21.—SHIPBUILDING, IRON AND STEEL, BY STATES: 1900.

	United States.	Maryland.	Massachusetts.	Michigan.	New Jersey.	New York.	Pennsylvania.	All other states.[1]
Number of establishments	44	4	3	3	4	9	3	18
Character of organization:								
Individual	4	.....	.....	.....	2	2	.....	.....
Firm and limited partnership	5	1	1	.....	.....	2	.....	1
Incorporated company	35	3	2	3	2	5	3	17
Capital:								
Total	$59,839,555	$3,822,588	$1,010,461	$3,087,164	$2,015,863	$3,536,165	$13,858,081	$32,509,733
Land	$9,614,552	$103,000	$122,500	$703,115	$557,000	$1,273,066	$2,505,514	$4,350,357
Buildings	$10,925,216	$250,000	$167,388	$729,017	$189,500	$401,862	$4,551,982	$4,635,467
Machinery, tools, and implements	$12,085,016	$945,000	$445,898	$803,403	$414,436	$642,370	$2,042,882	$5,791,027
Cash and sundries	$27,214,771	$2,524,588	$274,675	$851,629	$854,427	$1,218,867	$4,757,703	$16,732,882
Proprietors and firm members	16	3	2	.....	1	7	.....	3
Salaried officials, clerks, etc.:								
Total number	857	70	29	41	54	74	148	441
Total salaries	$1,411,863	$85,122	$40,944	$50,020	$82,168	$110,673	$245,221	$797,715
Officers of corporations—								
Number	78	8	4	7	2	5	10	42
Salaries	$380,328	$27,400	$12,700	$19,000	$8,000	$22,020	$63,186	$228,017
General superintendents, managers, clerks, etc.—								
Total number	779	62	25	34	52	69	138	399
Total salaries	$1,031,540	$57,722	$28,244	$31,020	$74,168	$88,653	$182,035	$569,698
Men—								
Number	758	62	21	34	51	68	138	384
Salaries	$1,020,794	$57,722	$26,594	$31,020	$73,768	$88,133	$182,035	$561,522
Women—								
Number	21	.....	4	.....	1	1	.....	15
Salaries	$10,746	.....	$1,650	.....	$400	$520	.....	$8,176
Wage-earners, including pieceworkers, and total wages:								
Greatest number employed at any one time during the year	41,228	2,795	888	2,934	1,877	3,261	8,836	20,637
Least number employed at any one time during the year	23,059	1,351	361	938	1,134	1,389	5,477	12,409
Average number	30,906	1,939	563	1,796	1,458	2,108	6,820	16,222
Wages	$16,231,311	$1,185,832	$399,307	$869,366	$1,014,106	$1,167,171	$3,425,226	$8,170,303
Men, 16 years and over—								
Average number	29,940	1,904	563	1,796	1,429	2,100	6,347	15,801
Wages	$16,045,494	$1,178,297	$399,307	$869,366	$1,005,106	$1,164,415	$3,423,216	$8,105,787
Women, 16 years and over—								
Average number	17	1	.....	.....	.....	2	.....	14
Wages	$4,908	$482	.....	.....	.....	$936	.....	$3,490
Children, under 16 years—								
Average number	949	34	.....	.....	29	6	473	407
Wages	$180,909	$7,053	.....	.....	$9,000	$1,820	$102,010	$61,026
Average number of wage-earners, including pieceworkers, employed during each month:[2]								
Men, 16 years and over—								
January	29,842	1,795	409	1,677	1,469	2,080	6,293	16,119
February	30,163	1,869	443	1,834	1,546	2,041	6,664	15,766
March	31,470	2,402	570	2,108	1,505	1,953	7,089	15,893
April	33,209	2,441	608	2,396	1,519	2,693	7,631	16,921

[1] Includes establishments distributed as follows: California, 2; Delaware, 2; Florida, 1; Illinois, 1; Indiana, 1; Iowa, 1; Maine, 2; Ohio, 2; Oregon, 1; Rhode Island, 1; Virginia, 2; Washington, 1; Wisconsin, 1.

[2] The average number of women, 16 years and over, and children, under 16 years, employed during each month are not included in the table, because of the small number reported.

TABLE 21.—SHIPBUILDING, IRON AND STEEL, BY STATES: 1900—Continued.

	United States.	Maryland.	Massachusetts.	Michigan.	New Jersey.	New York.	Pennsylvania.	All other states.[1]
Average number of wage-earners, including piece-workers, employed during each month—Cont'd:[2]								
Men, 16 years and over—Continued—								
May	30,345	2,049	495	2,309	1,574	2,270	5,833	15,815
June	30,592	2,130	522	2,015	1,632	2,298	5,943	16,052
July	28,739	1,884	559	1,357	1,551	2,119	6,323	14,946
August	28,884	1,891	583	1,391	1,291	2,280	6,513	14,935
September	28,877	1,852	582	1,531	1,037	1,998	6,192	15,685
October	28,646	1,725	589	1,483	1,348	1,885	5,715	15,951
November	28,802	1,529	662	1,677	1,320	1,754	5,887	15,973
December	29,711	1,276	735	1,768	1,360	1,882	6,133	16,557
Miscellaneous expenses:								
Total	$2,642,690	$110,916	$97,982	$109,687	$251,092	$98,970	$591,535	$1,382,508
Rent of works	$93,990	$27,875	.....	$1,275	$29,520	$15,400	$2,500	$17,420
Taxes, not including internal revenue	$145,284	$12,716	$7,904	$15,699	$9,151	$23,934	$23,925	$51,955
Rent of offices, insurance, interest, and all sundry expenses not hitherto included	$1,287,554	$67,325	$82,328	$92,713	$87,421	$34,636	$286,774	$636,357
Contract work	$1,115,862	$3,000	$7,750	.....	$125,000	$25,000	$278,336	$676,776
Materials used:								
Total cost	$23,585,549	$1,497,554	$652,966	$1,654,348	$1,232,927	$1,233,338	$6,996,703	$10,317,718
Lumber, all kinds, including logs, timber, and knees, thousand feet, B. M	267,953	3,526	554	220,286	2,544	2,934	15,843	22,266
Cost	$1,341,113	$95,616	$14,884	$46,853	$78,781	$89,412	$390,042	$625,525
Pig and scrap iron, tons	22,639	405	.....	1,035	300	312	6,115	14,472
Cost	$395,091	$6,500	.....	$20,692	$5,400	$5,000	$100,742	$256,757
Iron and steel plates, beams, angles, forgings, bolts, spikes, rivets, girders, castings, etc., pounds	375,383,913	30,480,153	13,800,900	42,042,000	9,520,119	24,818,241	66,106,421	188,616,079
Cost	$11,878,297	$874,803	$482,866	$1,100,462	$511,122	$728,085	$3,442,416	$4,738,543
Anchors and chains purchased	$168,726	$25,465	.....	$21,326	$3,247	$11,751	$30,511	$76,426
Cordage—								
Wire, feet	633,175	39,406	2,700	32,365	115,231	19,148	75,962	348,363
Cost	$72,791	$5,294	$400	$4,968	$10,899	$1,488	$11,314	$38,428
Manila and hemp, pounds	973,283	24,804	1,800	54,775	109,864	51,883	94,169	635,988
Cost	$142,138	$3,382	$300	$6,977	$12,743	$6,074	$15,129	$97,533
Duck	$41,363	$2,271	$215	$740	$1,939	$3,350	$3,537	$29,311
Paints, oils, etc	$331,423	$19,404	$1,565	$7,035	$34,551	$23,864	$105,040	$189,964
Oakum and pitch	$33,697	$1,277	$160	$2,027	$1,709	$6,475	$1,866	$20,183
Masts and spars purchased	$40,018	$1,768	$60	.....	$5,333	$16,370	$5,809	$10,678
Blocks purchased	$32,527	$3,549	$30	.....	$2,605	$1,224	$10,768	$14,351
Machinery and boilers purchased	$2,315,161	$94,528	$93,566	$146,843	$207,520	$98,249	$590,139	$1,084,316
Fittings and furniture purchased	$694,024	$31,182	$7,569	$26,346	$170,463	$13,348	$15,106	$430,010
Fuel	$568,320	$38,161	$11,700	$25,701	$24,525	$16,965	$93,262	$358,006
Rent of power and heat	$16,156	.....	.....	.....	.....	$4,820	.....	$11,336
Mill supplies	$198,266	$8,205	$3,365	$5,480	$4,643	$2,248	$120,065	$54,260
All other materials	$4,712,846	$286,049	$33,751	$233,276	$136,871	$204,615	$2,031,045	$1,787,239
Freight	$553,592	$100	$2,535	$5,622	$20,576	.....	$29,912	$494,847
Products:								
Total value	$50,367,739	$3,299,491	$1,296,880	$3,029,203	$2,857,429	$3,223,654	$14,085,395	$22,575,687
Steel and iron vessels—								
Steam, number	123	14	3	8	10	14	22	52
Gross tonnage	237,379	15,173	1,600	34,327	3,426	7,582	84,698	90,573
Net tonnage	164,313	10,789	950	25,551	2,358	5,527	56,447	62,691
Value	$24,311,843	$1,789,542	$408,000	$2,105,500	$830,000	$860,650	$8,849,029	$9,468,622
Sailing, number	6	.....	.....	.....	.....	.....	.....	6
Gross tonnage	21,085	.....	.....	.....	.....	.....	.....	21,085
Net tonnage	18,348	.....	.....	.....	.....	.....	.....	18,348
Value	$962,600	.....	.....	.....	.....	.....	.....	$962,600
Barges, number	5	.....	.....	.....	1	3	.....	1
Gross tonnage	4,052	.....	.....	.....	500	3,502	.....	50
Net tonnage	3,848	.....	.....	.....	450	3,348	.....	50
Value	$181,000	.....	.....	.....	$40,000	$135,000	.....	$6,000
All other products	$12,609,836	$875,293	$95,000	$479,203	$1,139,112	$352,335	$2,690,782	$6,988,111
Amount received for repair work	$12,302,960	$634,656	$793,880	$444,500	$848,317	$1,875,669	$2,555,584	$5,150,354
Comparison of products:								
Number of establishments reporting for both years	41	4	3	2	4	9	3	16
Value for census year	$46,262,750	$3,299,491	$1,296,880	$2,429,203	$2,857,429	$3,223,654	$14,085,395	$19,070,698
Value for preceding business year	$25,222,512	$1,256,091	$761,555	$577,000	$1,575,437	$2,249,402	$8,905,753	$9,897,274
Power:								
Number of establishments reporting	43	4	3	3	4	8	3	18
Total horsepower	44,096	1,933	505	1,697	769	3,130	20,187	15,875
Owned—								
Engines—								
Steam, number	308	20	8	32	15	18	53	162
Horsepower	35,902	1,075	375	1,500	637	2,500	18,178	11,637
Gas or gasoline, number	3	.....	.....	1	.....	.....	.....	2
Horsepower	28	.....	.....	12	.....	.....	.....	16
Electric motors, number	395	37	10	3	31	4	78	237
Horsepower	5,234	363	130	80	82	200	1,039	3,340
Other power, horsepower	2,220	495	.....	105	50	.....	970	600
Rented—								
Electric, horsepower	692	.....	.....	.....	.....	410	.....	282
Other kind, horsepower	20	.....	.....	.....	.....	20	.....	.....
Establishments classified by number of persons employed, not including proprietors and firm members:								
Total number of establishments	44	4	3	3	4	9	3	18
51 to 100	2	.....	.....	.....	.....	1	.....	1
101 to 250	5	1	1	.....	.....	2	.....	1
251 to 500	15	1	1	.....	2	4	.....	7
501 to 1,000	13	1	1	2	2	2	1	4
Over 1,000	9	1	.....	1	.....	.....	2	5

[1] Includes establishments distributed as follows: California, 2; Delaware, 2; Florida, 1; Illinois, 1; Indiana, 1; Iowa, 1; Maine, 2; Ohio, 2; Oregon, 1; Rhode Island, 1; Virginia, 2, Washington, 1; Wisconsin, 1.

[2] The average number of women, 16 years and over, and children, under 16 years, employed during each month, are not included in the table, because of the small number reported.

TABLE 22.—SHIP AND BOAT BUILDING,

		United States.	Alabama.	California.	Connecticut.	Delaware.	District of Columbia.
1	Number of establishments	1,072	6	39	35	9	3
	Character of organization:						
2	Individual	744	2	28	24	6	1
3	Firm and limited partnership	212	1	10	6	1	2
4	Incorporated company	116	3	6	5	2	.....
	Capital:						
5	Total	$17,523,146	$146,946	$298,990	$601,871	$224,726	$14,465
6	Land	$3,868,999	$24,750	$30,950	$121,900	$40,900	$11,500
7	Buildings	$2,182,156	$2,600	$38,170	$118,730	$14,350	$1,400
8	Machinery, tools, and implements	$3,893,070	$31,820	$92,360	$80,939	$36,850	$515
9	Cash and sundries	$7,578,921	$87,776	$137,510	$280,302	$132,626	$1,050
10	Proprietors and firm members	1,239	4	51	37	9	5
	Salaried officials, clerks, etc.:						
11	Total number	550	3	21	12	7	.....
12	Total salaries	$596,074	$4,300	$23,348	$14,012	$8,936	.....
	Officers of corporations—						
13	Number	104	1	5	3	4	.....
14	Salaries	$183,707	$2,000	$7,200	$2,212	$5,500	.....
	General superintendents, managers, clerks, etc.—						
15	Total number	446	2	16	9	3	.....
16	Total salaries	$412,967	$2,300	$16,148	$11,800	$3,436	.....
	Men—						
17	Number	413	2	16	9	3	.....
18	Salaries	$397,656	$2,300	$16,148	$11,800	$3,436	.....
	Women—						
19	Number	33	.....	.....	.....	.....	.....
20	Salaries	$15,311	.....	.....	.....	.....	.....
	Wage-earners, including pieceworkers, and total wages:						
21	Greatest number employed at any one time during the year	28,591	642	1,666	1,187	321	27
22	Least number employed at any one time during the year	9,668	52	448	697	144	10
23	Average number	15,875	293	885	915	207	17
24	Wages	$8,607,852	$101,526	$538,694	$451,086	$110,504	$11,480
	Men, 16 years and over—						
25	Average number	15,804	293	880	915	201	17
26	Wages	$8,591,118	$101,526	$537,060	$451,086	$109,464	$11,480
	Women, 16 years and over—						
27	Average number	17	.....	.....	.....	.....	.....
28	Wages	$6,516	.....	.....	.....	.....	.....
	Children, under 16 years—						
29	Average number	54	.....	5	.....	6	.....
30	Wages	$10,218	.....	$1,634	.....	$1,040	.....
	Average number of wage-earners, including pieceworkers, employed during each month:[1]						
	Men, 16 years and over—						
31	January	13,233	132	832	841	179	12
32	February	13,808	118	915	881	224	12
33	March	15,967	139	812	1,017	227	15
34	April	17,459	307	853	929	148	19
35	May	18,579	428	869	1,003	186	20
36	June	17,560	409	921	1,016	214	21
37	July	16,807	313	919	932	219	18
38	August	16,632	445	963	924	220	20
39	September	16,329	539	1,002	922	197	20
40	October	15,103	377	765	804	201	18
41	November	14,122	129	759	821	200	16
42	December	14,049	177	948	888	201	11
	Miscellaneous expenses:						
43	Total	$1,042,971	$6,022	$89,025	$13,529	$7,791	$154
44	Rent of works	$199,483	$2,350	$9,751	$3,227	$869	.....
45	Taxes, not including internal revenue	$92,184	$1,538	$1,548	$1,885	$557	$29
46	Rent of offices, insurance, interest, and all sundry expenses not hitherto included.	$508,944	$2,134	$67,226	$7,547	$6,007	$125
47	Contract work	$242,360	.....	$10,500	$870	$358	.....
	Materials used:						
48	Total cost	$9,901,223	$76,767	$702,319	$680,213	$153,361	$6,989
49	Lumber, all kinds, including logs, timber, and knees, thousand feet, B. M.	257,338	1,745	14,328	14,628	3,222	164
50	Cost	$4,890,728	$33,579	$352,559	$354,073	$98,065	$5,335
51	Iron and steel plates, beams, angles, forgings, bolts, spikes, rivets, girders, castings, etc., pounds.	36,277,031	285,973	1,468,486	3,062,140	912,130	20,200
52	Cost	$1,519,450	$8,837	$94,266	$78,351	$23,641	$1,308
53	Anchors and chains purchased	$152,830	$317	$17,625	$11,302	$1,985	$40
	Cordage—						
54	Wire, feet	914,656	340	46,489	17,695	9,250	.....
55	Cost	$93,301	$38	$4,534	$2,910	$860	.....
56	Manila and hemp, pounds	1,436,929	16,480	115,996	167,128	12,770	200
57	Cost	$223,680	$2,380	$18,076	$27,910	$1,598	$24
58	Duck	$136,503	$88	$19,030	$1,360	$1,931	.....
59	Paints, oils, etc	$340,442	$4,282	$13,946	$23,099	$3,810	.....
60	Oakum and pitch	$241,955	$2,602	$12,274	$8,891	$2,860	$148
61	Masts and spars purchased	$183,583	$842	$9,144	$14,964	$5,145	.....
62	Blocks purchased	$52,795	$32	$2,784	$3,416	$975	.....
63	Machinery and boilers purchased	$767,816	$18,091	$69,580	$70,629	$20	.....
64	Fittings and furniture purchased	$114,492	$375	$6,614	$6,671	$260	.....
65	Fuel	$121,171	$185	$4,692	$5,783	$2,499	.....
66	Rent of power and heat	$16,011	$100	$450	$522	$75	.....
67	Mill supplies	$27,562	$75	$1,384	$1,549	$392	.....
68	All other materials	$893,076	$4,365	$69,438	$62,745	$8,055	$134
69	Freight	$125,882	$579	$5,923	$6,038	$1,190	.....

[1] The average number of women, 16 years and over, and children, under 16 years, employed during each month, are not included in the table, because of the small number reported.

WOODEN, BY STATES: 1900.

Florida.	Georgia.	Illinois.	Indiana.	Iowa.	Kentucky.	Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	
15	4	17	14	10	10	15	115	43	122	51	1
11	2	11	10	7	5	6	90	27	85	39	2
2	.....	3	3	1	3	3	20	13	28	6	3
2	2	3	1	2	2	6	5	3	9	6	4
$149,159	$15,170	$363,006	$350,907	$28,996	$30,377	$212,643	$1,315,820	$623,435	$1,138,830	$805,855	5
$8,550	.....	$149,817	$27,501	$8,400	$12,100	$125,850	$106,500	$197,750	$221,539	$149,955	6
$9,600	.....	$74,975	$19,855	$5,625	$8,300	$19,100	$91,975	$54,525	$129,878	$252,956	7
$45,992	$770	$22,745	$25,351	$6,200	$12,075	$35,814	$125,520	$150,994	$201,104	$118,545	8
$85,017	$14,400	$115,469	$278,200	$8,771	$27,902	$31,879	$991,825	$220,166	$586,309	$284,389	9
15	2	19	16	9	14	10	150	58	141	53	10
3	2	13	9	7	6	23	28	25	51	32	11
$3,150	$1,400	$46,550	$8,020	$4,700	$3,785	$15,232	$23,326	$20,320	$38,102	$26,308	12
.....	.....	4	2	1	2	2	4	4	12	7	13
.....	.....	$22,500	$2,380	$1,200	$500	$1,900	$6,900	$3,880	$11,562	$5,500	14
3	2	9	7	6	4	21	24	21	39	25	15
$3,150	$1,400	$24,050	$5,640	$3,500	$3,285	$13,332	$16,426	$16,440	$26,540	$20,868	16
3	2	9	5	6	2	21	23	21	32	22	17
$3,150	$1,400	$24,050	$4,200	$3,500	$900	$13,332	$16,166	$16,440	$23,750	$19,840	18
.....	.....	.....	2	.....	2	.....	1	.....	7	3	19
.....	.....	.....	$1,440	.....	$2,385	.....	$260	.....	$2,790	$1,028	20
197	62	658	546	125	195	398	2,401	1,039	1,821	1,981	21
79	13	101	82	23	45	109	861	360	637	975	22
141	19	311	343	38	104	247	1,369	676	1,043	1,120	23
$73,509	$5,156	$159,158	$160,379	$13,430	$48,090	$105,196	$749,567	$331,873	$636,686	$474,521	24
141	19	311	343	38	104	247	1,369	675	1,043	1,116	25
$73,509	$5,156	$159,158	$160,379	$13,430	$48,090	$105,196	$749,567	$331,707	$636,686	$473,291	26
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	27
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$1,230	28
.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	29
.....	.....	.....	.....	.....	.....	.....	.....	$166	.....	.....	30
139	10	406	193	31	76	181	952	430	963	1,114	31
137	19	408	187	40	63	194	970	482	870	1,195	32
143	9	340	254	53	59	251	1,143	562	1,078	1,206	33
146	9	323	271	98	100	212	1,417	766	1,218	1,294	34
147	39	303	343	68	105	237	1,558	804	1,387	1,271	35
147	30	292	413	26	82	268	1,513	833	1,299	1,138	36
157	30	316	476	23	120	293	1,522	801	1,040	1,123	37
145	30	295	447	25	140	299	1,543	774	908	1,081	38
128	22	262	434	19	160	270	1,542	804	963	1,120	39
129	10	245	413	26	146	271	1,541	715	961	970	40
139	10	168	365	27	114	277	1,452	642	941	952	41
139	10	376	317	20	82	215	1,277	492	882	928	42
$7,135	$680	$11,526	$41,261	$1,180	$7,804	$9,732	$65,463	$30,649	$133,787	$99,868	43
$1,195	$10	$3,622	$85	$315	$245	$2,127	$6,936	$5,225	$21,453	$6,463	44
$439	$25	$3,067	$1,132	$228	$564	$2,372	$4,705	$7,651	$6,772	$11,058	45
$5,551	$300	$4,785	$40,044	$637	$6,199	$5,233	$18,051	$16,793	$40,861	$45,434	46
.....	$345	$52	.....	.....	$796	.....	$35,771	$980	$64,701	$30,913	47
$111,111	$12,650	$83,246	$195,243	$13,207	$20,775	$71,621	$1,377,769	$301,010	$704,439	$543,535	48
1,950	158	1,345	36,164	135	347	2,281	30,682	6,370	11,834	7,209	49
$41,862	$2,985	$38,243	$83,847	$4,986	$8,662	$41,780	$742,280	$176,052	$384,314	$227,642	50
528,206	91,800	195,822	177,180	18,670	32,650	158,000	4,691,615	652,939	3,811,803	966,975	51
$48,285	$974	$7,746	$28,712	$1,640	$2,893	$12,274	$150,169	$41,253	$122,710	$67,320	52
$589	$222	$100	$5	$10	$80	$841	$57,840	$3,415	$7,289	$11,190	53
8,800	325	3,600	.....	100	.....	.....	269,010	12,940	81,150	47,255	54
$1,250	$35	$230	.....	$9	.....	.....	$28,111	$2,158	$7,226	$5,159	55
5,788	2,190	16,606	3,028	600	2,590	2,566	373,158	23,230	153,376	101,770	56
$960	$354	$1,205	$336	$83	$430	$327	$54,422	$4,243	$24,131	$16,663	57
$372	$431	$4,576	$1,617	$30	$65	$63	$34,962	$2,166	$9,247	$4,215	58
$4,635	$363	$3,118	$22,437	$276	$520	$1,790	$21,567	$15,410	$28,231	$11,682	59
$1,490	$197	$4,280	$4,937	$293	$3,068	$2,802	$24,324	$9,341	$12,022	$11,750	60
$695	$18	$6,802	$49	.....	$45	$800	$44,882	$15,035	$11,468	$2,659	61
$212	$183	$250	$24	.....	$10	$200	$16,120	$1,182	$5,709	$1,351	62
.....	$4,500	$4,800	$35,460	$3,750	$2,000	$400	$102,364	$1,500	$41,327	$109,729	63
$95	$1,450	$1,700	$345	$110	.....	$69	$13,909	$490	$16,338	$11,778	64
$415	.....	$1,981	$1,271	$604	$699	$2,670	$4,295	$4,066	$10,252	$4,559	65
.....	.....	$261	.....	.....	.....	.....	$2,723	.....	$3,252	$200	66
$277	$248	$179	$423	$231	$141	$582	$1,923	$1,679	$2,635	$1,682	67
$9,557	$440	$6,392	$11,652	$425	$1,837	$6,377	$51,067	$15,016	$65,407	$40,170	68
$417	$250	$1,433	$4,128	$760	$825	$646	$26,811	$8,004	$7,881	$9,786	69

TABLE 22.—SHIP AND BOAT BUILDING,

		Minnesota.	Mississippi.	Missouri.	New Hampshire.	New Jersey.	New York.	North Carolina.
1	Number of establishments	25	13	10	6	64	218	14
	Character of organization:							
2	Individual	19	11	6	6	42	160	12
3	Firm and limited partnership	4	1	2	.....	8	44	2
4	Incorporated company	2	1	2	.....	14	14	.....
	Capital:							
5	Total	$161,967	$54,885	$25,930	$10,585	$1,670,969	$6,138,915	$73,760
6	Land	$24,050	$4,850	$1,901	$1,500	$178,054	$1,674,472	$21,600
7	Buildings	$29,975	$11,850	$2,625	$2,000	$210,227	$646,203	$2,700
8	Machinery, tools, and implements	$44,732	$16,705	$7,627	$1,725	$616,894	$1,373,036	$22,185
9	Cash and sundries	$63,210	$21,480	$13,777	$5,360	$665,794	$2,444,604	$27,275
10	Proprietors and firm members	28	13	12	6	60	268	17
	Salaried officials, clerks, etc.:							
11	Total number	7	5	3	.....	69	123	2
12	Total salaries	$7,580	$4,500	$3,070	.....	$75,859	$154,676	$1,200
	Officers of corporations—							
13	Number	.....	3	.....	.....	16	12	.....
14	Salaries	.....	$2,000	.....	.....	$30,350	$37,508	.....
	General superintendents, managers, clerks, etc.—							
15	Total number	7	2	3	.....	53	111	2
16	Total salaries	$7,580	$2,500	$3,070	.....	$45,509	$117,168	$1,200
	Men—							
17	Number	7	2	2	.....	49	104	2
18	Salaries	$7,580	$2,500	$2,680	.....	$44,095	$113,109	$1,200
	Women—							
19	Number	.....	.....	1	.....	4	7	.....
20	Salaries	.....	.....	$390	.....	$1,414	$4,059	.....
	Wage-earners, including pieceworkers, and total wages:							
21	Greatest number employed at any one time during the year	358	162	129	9	2,043	6,539	178
22	Least number employed at any one time during the year	87	40	43	5	887	2,242	44
23	Average number	137	73	66	5	1,416	3,464	73
24	Wages	$74,317	$46,452	$45,909	$3,600	$778,103	$2,014,788	$34,782
	Men, 16 years and over—							
25	Average number	137	73	66	5	1,416	3,426	73
26	Wages	$74,317	$46,452	$45,909	$3,600	$778,103	$2,006,374	$34,782
	Women, 16 years and over—							
27	Average number	.....	.....	.....	.....	.....	9	.....
28	Wages	.....	.....	.....	.....	.....	$4,136	.....
	Children, under 16 years—							
29	Average number	.....	.....	.....	.....	.....	29	.....
30	Wages	.....	.....	.....	.....	.....	$4,278	.....
	Average number of wage-earners, including pieceworkers, employed during each month:[1]							
	Men, 16 years and over—							
31	January	102	56	52	4	1,130	3,114	65
32	February	107	50	41	5	1,137	3,298	74
33	March	188	65	91	6	1,316	3,727	87
34	April	268	82	82	7	1,401	4,250	89
35	May	200	84	77	8	1,575	4,274	81
36	June	163	75	61	6	1,474	3,948	79
37	July	125	65	92	5	1,503	3,520	85
38	August	102	79	79	5	1,482	3,264	82
39	September	92	68	63	5	1,518	3,113	82
40	October	106	91	71	4	1,594	2,983	66
41	November	96	88	49	4	1,548	2,776	53
42	December	93	74	32	4	1,314	2,842	48
	Miscellaneous expenses:							
43	Total	$11,401	$1,829	$6,342	$368	$116,935	$210,445	$2,504
44	Rent of works	$2,485	$319	$2,880	$110	$39,040	$70,095	$1,520
45	Taxes, not including internal revenue	$1,529	$260	$82	$41	$6,144	$23,043	$454
46	Rent of offices, insurance, interest, and all sundry expenses not hitherto included.	$2,572	$840	$3,230	$217	$60,564	$101,752	$530
47	Contract work	$4,815	$410	$150	.....	$11,187	$15,555	.....
	Materials used:							
48	Total cost	$84,962	$46,376	$31,914	$2,625	$716,592	$1,882,659	$21,253
49	Lumber, all kinds, including logs, timber, and knees, thousand feet, B. M.	1,195	950	441	44	12,238	78,356	399
50	Cost	$31,006	$25,252	$16,576	$1,420	$352,717	$976,362	$12,737
51	Iron and steel plates, beams, angles, forgings, bolts, spikes, rivets, girders, castings, etc., pounds.	219,847	118,950	106,350	3,650	3,504,712	7,621,589	59,495
52	Cost	$13,996	$4,988	$4,293	$300	$107,286	$331,441	$3,927
53	Anchors and chains purchased	$430	$464	$26	$15	$4,319	$5,106	$328
	Cordage—							
54	Wire, feet	7,075	2,475	280	.....	20,115	191,985	420
55	Cost	$1,046	$185	$26	.....	$1,823	$14,111	$26
56	Manila and hemp, pounds	6,106	4,080	950	540	32,006	140,496	1,375
57	Cost	$1,006	$718	$180	$90	$4,747	$21,591	$224
58	Duck	$526	$1,138	$118	.....	$3,342	$13,378	$253
59	Paints, oils, etc	$2,688	$1,111	$656	$250	$49,954	$80,147	$1,397
60	Oakum and pitch	$1,794	$1,688	$1,237	$18	$25,574	$54,244	$1,000
61	Masts and spars purchased	$153	$944	$12	$40	$7,386	$40,155	$515
62	Blocks purchased	$203	$168	.....	$20	$2,657	$5,577	$124
63	Machinery and boilers purchased	$16,990	$1,400	$3,375	.....	$30,160	$66,634	.....
64	Fittings and furniture purchased	$2,453	$90	$195	$20	$6,590	$17,473	.....
65	Fuel	$2,076	$1,294	$830	$150	$10,641	$28,514	$350
66	Rent of power and heat	$590	.....	.....	.....	$1,023	$6,299	.....
67	Mill supplies	$332	$264	$65	$10	$2,286	$6,288	$35
68	All other materials	$7,498	$5,839	$4,205	$237	$96,795	$194,952	$295
69	Freight	$2,175	$833	$120	$55	$9,292	$20,387	$42

[1] The average number of women, 16 years and over, and children, under 16 years, employed during each month, are not included in the table, because of the small number reported.

WOODEN, BY STATES: 1900—Continued.

Ohio.	Oregon.	Pennsylvania.	Rhode Island.	Tennessee.	Texas.	Virginia.	Washington.	West Virginia.	Wisconsin.	All other states.[2]	
31	16	35	20	3	7	27	36	4	29	6	1
18	10	23	15	3	4	18	23	1	20	4	2
9	3	8	2	.....	3	8	7	1	6	2	3
4	3	4	3	.....	.....	1	6	2	3	.....	4
$283,940	$126,845	$283,401	$540,847	$1,020	$10,930	$320,982	$548,084	$46,455	$832,225	$40,210	5
$90,050	$23,750	$58,550	$50,850	.....	$270	$131,270	$106,660	$2,000	$263,700	$7,500	6
$35,880	$6,200	$59,450	$98,917	.....	$2,850	$27,240	$80,200	$4,000	$111,000	$8,800	7
$52,785	$39,770	$44,790	$164,567	$320	$2,335	$121,150	$110,375	$19,200	$250,670	$16,010	8
$105,225	$57,125	$120,611	$226,513	$700	$5,475	$41,322	$250,849	$21,255	$216,855	$7,900	9
37	15	41	19	3	10	35	39	4	31	8	10
14	8	13	8	.....	.....	10	22	4	20	.....	11
$9,445	$10,460	$8,680	$20,440	.....	.....	$10,100	$27,572	$1,575	$19,968	.....	12
2	3	.....	6	.....	.....	.....	3	4	4	.....	13
$1,800	$3,600	.....	$18,840	.....	.....	.....	$6,000	$1,575	$8,800	.....	14
12	5	13	2	.....	.....	10	19	.....	16	.....	15
$7,645	$6,860	$8,680	$1,600	.....	.....	$10,100	$21,572	.....	$11,168	.....	16
11	5	12	2	.....	.....	10	19	.....	12	.....	17
$7,420	$6,860	$8,560	$1,600	.....	.....	$10,100	$21,572	.....	$9,968	.....	18
1	.....	1	.....	.....	.....	.....	.....	.....	4	.....	19
$225	.....	$120	.....	.....	.....	.....	.....	.....	$1,200	.....	20
743	662	527	430	65	68	362	1,926	102	927	95	21
148	212	231	204	65	16	88	336	27	351	11	22
368	338	257	299	11	33	187	741	53	562	64	23
$161,123	$187,357	$119,719	$210,009	$2,560	$19,815	$97,681	$510,301	$20,204	$282,567	$27,710	24
368	338	252	299	11	33	187	732	53	559	64	25
$161,123	$187,357	$118,619	$210,009	$2,560	$19,815	$97,681	$508,051	$20,204	$281,667	$27,710	26
.....	.....	1	.....	.....	.....	.....	.....	.....	3	.....	27
.....	.....	$250	.....	.....	.....	.....	.....	.....	$900	.....	28
.....	.....	.....	.....	.....	.....	.....	9	.....	.....	.....	29
.....	.....	4	.....	.....	.....	.....	$2,250	.....	.....	.....	30
.....	.....	$850	.....	.....	.....	.....	.....	.....	.....	.....	
211	306	186	209	65	61	124	399	32	584	42	31
251	310	166	235	65	42	125	519	25	601	42	32
360	356	224	299	.....	43	158	1,014	28	642	60	33
396	279	240	368	.....	44	179	900	40	655	69	34
388	346	255	358	.....	47	232	1,011	49	750	76	35
342	330	347	350	.....	25	266	743	62	591	76	36
425	326	332	334	.....	24	224	780	70	519	76	37
458	355	332	327	.....	17	230	902	86	486	87	38
455	423	340	293	.....	11	241	643	89	414	75	39
415	316	219	265	.....	22	166	592	81	464	66	40
366	318	191	273	.....	20	165	627	46	449	46	41
352	394	186	278	.....	40	148	651	33	557	50	42
$23,908	$8,351	$38,628	$7,821	$39	$1,150	$10,582	$32,415	$1,780	$42,119	$698	43
$3,360	$1,865	$3,223	$2,226	$14	$841	$942	$4,379	$593	$1,653	$65	44
$1,704	$1,652	$2,251	$1,421	.....	$9	$1,219	$2,317	$288	$5,787	$413	45
$6,994	$3,503	$3,537	$3,874	$25	.....	$8,421	$20,265	$399	$24,674	$120	46
$11,850	$1,331	$29,617	$300	.....	$300	.....	$5,454	.....	$10,005	$100	47
$202,516	$306,579	$176,498	$229,496	$3,710	$90,845	$72,418	$735,050	$19,354	$212,680	$11,441	48
3,994	6,142	4,608	3,066	83	345	912	12,636	539	3,529	299	49
$147,879	$127,113	$116,188	$90,085	$1,270	$42,959	$21,758	$266,285	$13,423	$94,024	$7,460	50
629,367	882,462	802,525	464,700	2,700	63,150	750,385	2,591,075	39,500	1,381,915	10,070	51
$21,376	$43,868	$27,265	$40,554	$150	$1,473	$20,546	$158,153	$2,722	$46,108	$625	52
$179	$5,872	$197	$2,468	$300	$55	$2,800	$17,448	.....	$328	$150	53
4,850	18,892	15,050	68,600	110	.....	1,570	85,455	575	800	.....	54
$599	$2,666	$1,565	$8,359	$13	.....	$175	$10,027	$60	$100	.....	55
13,850	42,216	53,670	23,825	400	7,200	4,560	100,319	300	7,560	.....	56
$2,303	$7,021	$8,965	$3,584	$45	$1,240	$733	$16,787	$50	$1,260	.....	57
$1,874	$3,824	$400	$16,598	$67	$35	$450	$9,532	$5	$4,810	.....	58
$3,980	$11,151	$3,297	$9,725	$250	$703	$5,999	$11,517	$109	$6,609	$733	59
$6,471	$8,516	$6,808	$451	$80	$565	$3,649	$16,121	$2,025	$9,855	$650	60
$30	$2,810	$220	$7,079	.....	$70	$3,245	$7,622	.....	$764	.....	61
$63	$1,606	$179	$4,231	.....	$165	$213	$4,677	.....	$374	$30	62
$3,694	$51,400	$300	$1,000	$1,400	$40,000	$2,500	$71,728	.....	$12,785	$350	63
$1,656	$11,318	$1,300	$645	$25	$1,000	$775	$7,878	.....	$2,720	$150	64
$2,834	$1,430	$2,204	$4,760	.....	$50	$4,702	$6,286	$170	$10,799	$110	65
$203	$35	$168	.....	.....	.....	.....	$90	.....	$20	.....	66
$718	$382	$431	$750	.....	.....	$543	$656	$78	$1,291	$33	67
$5,056	$26,447	$5,786	$37,609	$100	$2,530	$3,620	$126,016	$531	$15,403	$1,050	68
$3,571	$1,120	$1,275	$1,598	$30	.....	$1,210	$4,227	$181	$5,495	$100	69

[2] Includes establishments distributed as follows: Arkansas, 1; Idaho, 1; South Carolina, 2; Vermont, 2.

TABLE 22.—SHIP AND BOAT BUILDING,

		United States.	Alabama.	California.	Connecticut.	Delaware.	District of Columbia.
	Products:						
70	Total value	$24,210,419	$240,242	$1,654,108	$1,227,120	$860,117	$24,980
	Wooden vessels—						
71	Steam, number	396	3	28	25	8	.....
72	Gross tonnage	48,932	326	3,922	1,102	443	.....
73	Net tonnage	32,845	220	2,632	980	283	.....
74	Value	$2,994,358	$28,600	$280,486	$41,425	$23,008	.....
75	Sailing, number	646	1	22	14	3	.....
76	Gross tonnage	59,291	6	8,256	188	1,600	.....
77	Net tonnage	51,847	6	7,530	180	1,143	.....
78	Value	$3,251,069	$700	$560,860	$18,500	$47,000	.....
79	Barges, number	839	4	35	31	22	3
80	Gross tonnage	295,508	3,669	6,726	18,746	10,125	360
81	Net tonnage	251,689	1,859	5,890	17,089	9,457	300
82	Value	$3,828,170	$66,250	$141,750	$534,000	$190,456	$7,980
83	Canal boats, number	72	.....	.....	4	.....	.....
84	Gross tonnage	21,434	.....	.....	3,240	.....	.....
85	Net tonnage	19,949	.....	.....	3,240	.....	.....
86	Value	$227,374	.....	.....	$64,000	.....	.....
87	Small boats, launches and ships'; fishing, pleasure, life, and row boats, etc., number.	15,448	.....	597	318	295	7
88	Value	$1,972,825	.....	$100,015	$72,107	$29,142	$500
89	All other products	$1,070,297	.....	$87,980	$185,872	$4,961	.....
90	Amount received for repair work	$10,866,326	$144,692	$483,017	$310,616	$65,550	$16,500
	Comparison of products:						
91	Number of establishments reporting for both years	898	4	35	32	8	2
92	Value for census year	$21,643,485	$161,066	$1,627,728	$1,196,070	$358,467	$26,980
93	Value for preceding business year	$17,386,228	$129,275	$1,375,347	$859,997	$235,922	$23,000
	Power:						
94	Number of establishments reporting	382	3	16	15	6	.....
95	Total horsepower	23,903	156	918	814	176	.....
	Owned—						
	Engines—						
96	Steam, number	496	3	11	25	8	.....
97	Horsepower	19,997	146	458	720	170	.....
98	Gas or gasoline, number	45	.....	9	3	.....	.....
99	Horsepower	617	.....	312	12	.....	.....
100	Water wheels, number	10	.....	.....	2	.....	.....
101	Horsepower	1,700	.....	.....	16	.....	.....
102	Electric motors, number	33	.....	.....	2	.....	.....
103	Horsepower	968	.....	.....	26	.....	.....
104	Other power, horsepower	55	.....	3	.....	.....	.....
	Rented—						
105	Electric, horsepower	283	.....	20	40	.....	.....
106	Other kind, horsepower	283	10	125	.....	6	.....
107	Furnished to other establishments, horsepower	127	.....	10	.....	.....	.....
	Establishments classified by number of persons employed, not including proprietors and firm members:						
108	Total number of establishments	1,072	6	39	35	9	3
109	No employees	198	.....	4	4	.....	.....
110	Under 5	211	1	6	11	3	1
111	5 to 20	361	1	15	10	2	2
112	21 to 50	152	1	6	7	2	.....
113	51 to 100	81	2	3	1	1	.....
114	101 to 250	51	.....	4	1	1	.....
115	251 to 500	14	1	1	.....	.....	.....
116	501 to 1,000	4	.....	.....	1	.....	.....

WOODEN, BY STATES: 1900—Continued.

Florida.	Georgia.	Illinois.	Indiana.	Iowa.	Kentucky.	Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	
$254,991	$23,500	$322,446	$465,207	$42,665	$97,492	$250,307	$2,491,765	$862,034	$1,760,574	$1,402,898	70
3	3	11	20	6	4	7	14	9	16	17	71
68	525	198	10,159	454	242	1,040	1,212	1,701	1,474	4,710	72
39	405	124	5,723	277	242	747	946	582	864	4,039	73
$10,900	$22,300	$12,800	$277,123	$16,650	$10,223	$17,582	$85,340	$69,775	$158,275	$301,400	74
6	1	8	.....	.....	5	1	73	24	128	13	75
522	15	40	.....	.....	220	15	26,683	456	3,889	2,884	76
394	12	36	.....	.....	194	10	23,753	295	2,910	2,793	77
$42,685	$600	$8,600	.....	.....	$3,450	$275	$1,087,701	$23,891	$384,000	$117,250	78
26	1	2	41	3	2	20	34	29	9	2	79
1,888	100	60	21,500	193	560	3,210	25,286	12,027	2,030	1,225	80
1,708	100	52	10,388	171	500	2,686	22,751	10,911	798	1,015	81
$41,751	$600	$250	$97,056	$900	$2,800	$56,425	$764,875	$169,820	$36,800	$60,550	82
.....	.....	1	.....	.....	.....	.....	.....	6	.....	.....	83
.....	.....	100	.....	.....	.....	.....	.....	920	.....	.....	84
.....	.....	75	.....	.....	.....	.....	.....	920	.....	.....	85
.....	.....	$1,600	.....	.....	.....	.....	.....	$6,800	.....	.....	86
97	.....	361	524	40	45	38	1,900	274	3,801	996	87
$20,671	.....	$20,898	$47,140	$4,249	$800	$1,935	$93,571	$35,354	$208,964	$241,010	88
$5,000	.....	$6,700	.....	.....	$987	$10,921	$37,974	$17,780	$162,699	$99,265	89
$133,984	.....	$271,598	$43,888	$20,866	$79,232	$163,169	$422,804	$538,614	$809,886	$583,423	90
14	1	15	6	9	5	13	102	35	116	40	91
$253,815	$600	$305,996	$415,707	$41,740	$69,727	$225,557	$2,311,313	$784,493	$1,657,349	$1,180,455	92
$138,205	$500	$285,488	$528,762	$37,874	$42,310	$186,863	$1,576,250	$635,520	$1,244,606	$949,683	93
2	.....	5	5	6	2	7	22	17	40	21	94
845	.....	221	338	116	206	427	612	600	736	1,855	95
12	.....	6	11	4	2	13	19	24	34	25	96
845	.....	215	242	96	200	427	466	562	619	1,741	97
.....	.....	1	1	2	1	.....	1	3	2	3	98
.....	.....	6	6	20	6	.....	16	38	36	34	99
.....	.....	.....	1	.....	.....	.....	.....	.....	.....	1	100
.....	.....	.....	80	.....	.....	.....	.....	.....	.....	65	101
.....	.....	.....	1	.....	.....	.....	1	.....	2	2	102
.....	.....	.....	10	.....	.....	.....	8	.....	6	15	103
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	104
.....	.....	.....	.....	.....	.....	.....	100	.....	74	.....	105
.....	.....	.....	.....	.....	.....	.....	22	.....	1	.....	106
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35	107
15	4	17	14	10	10	15	115	43	122	51	108
4	1	3	3	1	1	.....	43	3	28	10	109
5	.....	4	5	5	3	1	17	5	20	13	110
4	2	3	2	2	4	7	30	22	54	10	111
1	1	4	2	1	1	4	11	6	11	8	112
.....	.....	.....	.....	1	.....	2	7	5	7	6	113
1	.....	3	1	.....	1	.....	5	2	1	2	114
.....	.....	.....	1	.....	.....	1	1	.....	1	1	115
.....	.....	.....	.....	.....	.....	.....	1	.....	.....	1	116

TABLE 22.—SHIP AND BOAT BUILDING,

		Minnesota.	Mississippi.	Missouri.	New Hampshire.	New Jersey.	New York.	North Carolina.
	Products:							
70	Total value	$223,971	$115,744	$93,367	$9,793	$1,953,041	$5,423,717	$77,528
	Wooden vessels—							
71	Steam, number	11	25	2	1	10	87	2
72	Gross tonnage	627	534	84	10	581	4,817	214
73	Net tonnage	448	306	53	5	405	2,874	183
74	Value	$41,750	$31,700	$6,210	$900	$55,605	$535,252	$4,200
75	Sailing, number	15	14	2	.....	80	85	9
76	Gross tonnage	176	193	48	.....	357	1,400	142
77	Net tonnage	158	140	48	.....	240	1,150	109
78	Value	$11,085	$12,800	$500	.....	$25,695	$139,697	$6,225
79	Barges, number	5	8	8	.....	40	172	.....
80	Gross tonnage	664	1,150	956	.....	42,487	62,100	.....
81	Net tonnage	659	946	852	.....	37,328	47,848	.....
82	Value	$32,429	$22,310	$9,632	.....	$346,606	$873,664	.....
83	Canal boats, number	.....	.....	.....	.....	24	32	.....
84	Gross tonnage	.....	.....	.....	.....	9,815	6,909	.....
85	Net tonnage	.....	.....	.....	.....	9,805	5,499	.....
86	Value	.....	.....	.....	.....	$67,674	$82,850	.....
87	Small boats, launches and ships'; fishing, pleasure, life, and row boats, etc., number.	525	4	140	63	801	2,645	9
88	Value	$33,975	$517	$12,065	$2,943	$69,777	$654,702	$1,028
89	All other products	$26,135	$6,000	$503	$150	$6,520	$155,305	$140
90	Amount received for repair work	$78,597	$42,417	$64,457	$5,800	$1,381,164	$2,982,247	$85,935
	Comparison of products:							
91	Number of establishments reporting for both years	21	11	6	5	53	190	11
92	Value for census year	$214,186	$83,944	$74,752	$8,750	$1,834,081	$4,821,975	$75,703
93	Value for preceding business year	$268,235	$49,875	$73,817	$8,175	$1,473,395	$4,068,740	$55,336
	Power:							
94	Number of establishments reporting	11	6	2	1	28	82	4
95	Total horsepower	180	197	142	15	2,152	7,444	156
	Owned—							
	Engines—							
96	Steam, number	10	6	3	1	63	98	5
97	Horsepower	138	182	142	15	2,094	5,714	156
98	Gas or gasoline, number	2	1	.....	.....	3	8	.....
99	Horsepower	18	15	.....	.....	24	45	.....
100	Water wheels, number	.....	.....	.....	.....	.....	6	.....
101	Horsepower	.....	.....	.....	.....	.....	1,539	.....
102	Electric motors, number	2	.....	.....	.....	.....	.....	.....
103	Horsepower	4	.....	.....	.....	.....	.....	.....
104	Other power, horsepower	.....	.....	.....	.....	.....	52	.....
	Rented—							
105	Electric, horsepower	.....	.....	.....	.....	20	24	.....
106	Other kind, horsepower	20	.....	.....	.....	14	70	.....
107	Furnished to other establishments, horsepower	2	.....	.....	.....	20	60	.....
	Establishments classified by number of persons employed, not including proprietors and firm members:							
108	Total number of establishments	25	13	10	6	64	218	14
109	No employees	5	.....	2	2	11	45	.....
110	Under 5	7	2	2	4	14	36	4
111	5 to 20	8	9	4	.....	20	71	8
112	21 to 50	3	2	1	.....	3	33	2
113	51 to 100	1	.....	1	.....	10	18	.....
114	101 to 250	1	.....	.....	.....	5	12	.....
115	251 to 500	.....	.....	.....	.....	1	2	.....
116	501 to 1,000	.....	.....	.....	.....	.....	1	.....

WOODEN, BY STATES: 1900—Continued.

Ohio.	Oregon.	Pennsylvania.	Rhode Island.	Tennessee.	Texas.	Virginia.	Washington.	West Virginia.	Wisconsin.	All other states.[1]	
$485,581	$654,385	$407,763	$555,827	$8,097	$126,446	$263,802	$1,505,649	$51,170	$707,955	$66,137	70
15	16	5	10	2	4	2	21	1	12	1	71
1,262	4,899	875	93	114	325	104	6,298	78	382	59	72
893	3,293	522	56	76	268	63	4,953	58	298	38	73
$76,177	$266,328	$41,950	$40,700	$7,052	$105,200	$4,400	$363,187	$4,200	$51,410	$2,250	74
2	1	9	35	.....	2	61	30	.....	.....	2	75
50	1,443	76	414	.....	17	1,220	8,963	.....	.....	18	76
34	1,353	58	374	.....	16	920	7,975	.....	.....	16	77
$1,750	$50,000	$15,850	$191,650	.....	$1,100	$3,200	$495,425	.....	.....	$580	78
36	5	174	.....	.....	2	4	116	1	2	2	79
9,640	517	65,880	.....	.....	450	400	2,478	600	419	62	80
8,610	486	65,328	.....	.....	400	360	2,183	535	417	62	81
$120,000	$5,290	$125,000	.....	.....	$12,000	$4,000	$75,916	$1,800	$26,300	$800	82
2	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	83
150	.....	300	.....	.....	.....	.....	.....	.....	.....	.....	84
150	.....	260	.....	.....	.....	.....	.....	.....	.....	.....	85
$2,200	.....	$2,250	.....	.....	.....	.....	.....	.....	.....	.....	86
370	42	895	133	52	13	77	394	.....	880	112	87
$47,205	$9,025	$47,036	$21,904	$820	$1,086	$10,387	$61,289	.....	$117,801	$4,909	88
$11,200	$15,080	$14,992	$106,014	.....	$1,400	$15,000	$79,900	.....	$11,819	.....	89
$227,049	$303,602	$160,625	$195,559	$225	$6,660	$226,815	$429,932	$45,670	$500,625	$57,598	90
25	11	30	19	1	5	23	17	4	23	6	91
$417,631	$478,928	$367,349	$555,193	$1,000	$125,250	$255,502	$908,677	$51,170	$685,794	$66,537	92
$891,284	$864,623	$304,857	$435,077	$1,000	$76,950	$242,635	$625,227	$45,518	$594,182	$57,700	93
15	2	10	9	.....	.....	14	14	2	13	2	94
553	90	218	437	.....	.....	1,579	1,408	72	1,170	70	95
19	1	11	15	.....	.....	19	18	3	25	2	96
543	75	209	437	.....	.....	734	1,371	72	1,138	70	97
1	.....	2	.....	.....	.....	.....	1	.....	1	.....	98
10	.....	9	.....	.....	.....	.....	2	.....	8	.....	99
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	101
.....	.....	.....	.....	.....	.....	21	1	.....	1	.....	102
.....	.....	.....	.....	.....	.....	845	30	.....	24	.....	103
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	104
.....	.....	.....	.....	.....	.....	.....	5	.....	.....	.....	105
.....	15	.....	.....	.....	.....	.....	.....	.....	.....	.....	106
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	107
31	16	35	20	3	7	27	36	4	29	6	108
5	.....	5	2	2	1	.....	7	.....	4	2	109
5	1	5	5	.....	3	8	4	.....	10	1	110
10	5	15	9	.....	2	14	6	1	7	2	111
6	5	8	2	.....	1	4	9	5	4	.....	112
4	3	2	1	1	.....	1	3	.....	.....	1	113
1	1	.....	1	.....	.....	.....	5	.....	3	.....	114
.....	1	.....	.....	.....	.....	.....	2	.....	1	.....	115
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	116

[1] Includes establishments distributed as follows: Arkansas, 1; Idaho, 1; South Carolina, 2; Vermont, 2.

TABLE 23.—SHIPBUILDING, GOVERNMENTAL ESTABLISHMENTS, BY STATES: 1900.

	United States.	California.	Illinois.[1]	Maine.	Massachusetts.	New York.	Pennsylvania.	South Carolina.	Virginia.	Washington.
Number of establishments	9	1	1	1	1	1	1	1	1	1
Capital:										
Total	$54,291,011	$5,347,090	$10,500	$6,082,965	$13,273,708	$18,299,276	$3,198,451	$899,603	$6,380,867	$798,551
Land	$30,412,074	$1,156,387	$2,500	$1,583,200	$8,143,882	$14,345,875	$1,760,440	$118,792	$2,900,998	$400,000
Buildings	$11,515,795	$1,804,213	$5,000	$1,016,135	$3,120,390	$3,089,489	$883,645	$138,505	$1,291,444	$166,974
Machinery, tools, and implements	$8,543,293	$2,216,535	$3,000	$483,630	$1,636,519	$746,062	$479,019	$639,301	$2,188,425	$150,802
Cash and sundries	$3,819,849	$169,955	.....	$3,000,000	$372,917	$117,850	$75,347	$3,005	.....	$80,775
Salaried officials, clerks, etc.:										
Total number	540	112	1	130	82	135	32	8	40	.....
Total salaries	$466,497	$92,857	$1,500	$31,320	$84,720	$138,489	$27,478	$9,977	$80,156	.....
Men—										
Number	537	112	1	130	82	132	32	8	40	.....
Salaries	$463,738	$92,857	$1,500	$31,320	$84,720	$135,730	$27,478	$9,977	$80,156	.....
Women—										
Number	3	.....	.....	.....	.....	3	.....	.....	.....	.....
Salaries	$2,759	.....	.....	.....	.....	$2,759	.....	.....	.....	.....
Wage-earners, including pieceworkers, and total wages:										
Greatest number employed at any one time during the year	9,520	1,441	6	694	1,634	2,450	590	149	2,358	198
Least number employed at any one time during the year	6,261	1,000	6	439	1,068	1,545	302	73	1,787	41
Average number	7,690	1,176	6	559	1,298	1,973	397	104	2,094	83
Wages	$6,222,263	$1,111,486	$4,308	$470,248	$902,579	$1,654,727	$307,913	$47,667	$1,659,214	$64,121
Men, 16 years and over—										
Average number	7,664	1,162	6	559	1,298	1,962	397	104	2,094	82
Wages	$6,202,882	$1,103,986	$4,308	$470,248	$902,579	$1,642,946	$307,913	$47,667	$1,659,214	$64,021
Women, 16 years and over—						11	.....	.....	.....	.....
Average number	25	14	.....	.....	.....	$11,781	.....	.....	.....	.....
Wages	$19,281	$7,500	.....	.....	.....					
Children, under 16 years—										1
Average number	1	.....	.....	.....	.....	.....	.....	.....	.....	$100
Wages	$100	.....	.....	.....	.....	.....	.....	.....	.....	
Average number of wage-earners, including pieceworkers, employed during each month:[2]										
Men, 16 years and over—										
January	7,437	1,019	6	493	1,128	1,978	362	105	2,302	44
February	7,530	1,001	6	450	1,123	2,064	410	73	2,358	45
March	7,827	1,025	6	444	1,371	2,086	402	117	2,309	67
April	7,779	1,143	6	478	1,450	2,000	401	98	2,115	88
May	8,185	1,161	6	512	1,536	2,212	389	75	2,098	106
June	8,090	1,245	6	560	1,508	2,109	414	73	2,044	131
July	7,458	1,408	6	627	1,205	1,734	338	136	1,813	101
August	7,369	1,164	6	628	1,293	1,968	348	120	1,787	65
September	7,941	1,277	6	661	1,253	2,053	455	143	2,051	42
October	8,289	1,247	6	688	1,346	2,071	439	118	2,331	45
November	7,154	1,153	6	610	1,272	1,701	453	106	1,811	42
December	6,909	1,097	6	555	1,097	1,570	353	80	2,111	40
Miscellaneous expenses:										
Total	$29,064	.....	.....	.....	.....	$9,564	$14,875	.....	$4,625	.....
Rent of offices, insurance, and all sundry expenses	$19,500	.....	.....	.....	.....	.....	$14,875	.....	$4,625	.....
Contract work	$9,564	.....	.....	.....	.....	$9,564	.....	.....	.....	.....
Materials used:										
Total cost	$3,805,326	$536,886	$2,981	$205,012	$843,795	$1,115,650	$243,518	$24,567	$764,558	$69,359
Lumber, all kinds, including logs, timber, and knees, thousand feet, B. M	12,478	1,740	45	792	1,590	3,344	483	188	3,996	900
Cost	$320,049	$43,556	$1,125	$19,875	$39,759	$83,614	$19,957	$4,700	$99,963	$7,950
Pig and scrap iron, tons	1,435	20	.....	196	342	52	175	26	624	.....
Cost	$20,636	$250	.....	$3,147	$5,489	$600	$788	$362	$10,000	.....
Iron and steel plates, beams, angles, forgings, bolts, spikes, rivets, girders, castings, etc., pounds	7,294,846	1,200,000	12,000	200,000	2,000,000	2,100,000	367,346	65,500	1,100,000	250,000
Cost	$477,209	$70,321	$360	$16,180	$152,679	$132,384	$7,328	$4,133	$73,824	$20,000
Anchors and chains purchased	$9,964	$326	$200	.....	.....	$161	$8,082	.....	$1,195	.....
Cordage—										
Wire, feet	147,787	11,500	.....	15,000	11,000	6,000	10,500	243	88,544	5,000
Cost	$18,212	$1,568	.....	$2,347	$1,288	$574	$855	$12	$11,068	$500
Manila and hemp, pounds	592,383	89,045	1,800	23,796	45,850	100,000	18,100	1,392	302,400	10,000
Cost	$88,611	$11,208	$180	$3,966	$7,557	$11,490	$2,578	$232	$50,400	$1,000
Duck	$52,242	$10,082	$24	$2,024	$5,932	$28,879	$5,246	$105	.....	.....
Paints, oils, etc	$177,575	$24,478	$152	$6,668	$27,756	$63,436	$8,112	$1,973	$40,000	$5,000
Oakum and pitch	$45,316	$2,175	$72	$751	$6,237	$560	$151	$248	$33,122	$2,000
Masts and spars purchased	$2,145	$1,875	.....	.....	.....	$14	$606	.....	$150	.....
Blocks purchased	$28,085	$930	.....	$283	$1,058	$11,498	$781	$122	$13,413	.....
Machinery and boilers purchased	$913,387	$109,083	.....	$27,357	$166,408	$274,703	$65,285	$6,040	$248,011	$16,000
Fittings and furniture purchased	$52,103	$3,642	.....	$7,391	$3,926	$12,358	$169	$1,146	$18,476	$5,000
Fuel	$158,103	$40,306	$600	$10,558	$31,007	$34,198	$8,805	$3,069	$27,060	$2,500
Mill supplies	$88,465	$320	$200	$1,756	$9,572	$8,296	$893	$717	$66,211	$600
All other materials	$1,353,156	$217,316	.....	$102,209	$385,127	$452,890	$113,882	$1,708	$71,665	$8,359
Freight	$68	.....	$68	.....	.....	.....	.....	.....	.....	.....
Products:										
Total value	$11,034,312	$1,741,229	$12,000	$764,022	$1,361,816	$3,895,689	$546,312	$82,211	$2,498,553	$132,480
Barges, number	2	.....	.....	.....	.....	.....	.....	2	.....	.....
Gross tonnage	180	.....	.....	.....	.....	.....	.....	180	.....	.....
Net tonnage	120	.....	.....	.....	.....	.....	.....	120	.....	.....
Value	$1,200	.....	.....	.....	.....	.....	.....	$1,200	.....	.....
Small boats, launches and ships', life and row boats, etc.—										
Number	677	.....	.....	632	.....	.....	12	3	30	.....
Value	$114,122	.....	.....	$63,272	.....	.....	$12,350	$2,000	$36,500	.....
All other products	$4,448,752	$852,222	.....	$367,825	$655,752	$1,709,864	$248,482	$23,227	$591,380	.....
Repair work	$6,470,238	$889,007	$12,000	$332,925	$706,064	$2,185,825	$285,480	$55,784	$1,870,673	$132,480

[1] State institution.

[2] The average number of women, 16 years and over, and children, under 16 years, employed during each month, are not included in the table, because of the small number reported.

TABLE 23.—SHIPBUILDING, GOVERNMENTAL ESTABLISHMENTS, BY STATES: 1900—Continued.

	United States.	California.	Illinois.[1]	Maine.	Massachusetts.	New York.	Pennsylvania.	South Carolina.	Virginia.	Washington.
Comparison of products:										
Number of establishments reporting for both years	8	1	1	1	1	1	1	1	1	.....
Value for census year	$10,901,832	$1,741,229	$12,000	$764,022	$1,361,816	$3,895,689	$546,312	$82,211	$2,498,553	.....
Value for preceding business year	$8,061,093	$575,727	$12,000	$373,620	$678,443	$4,286,935	$97,578	$12,817	$2,023,973	.....
Power:										
Number of establishments reporting	9	1	1	1	1	1	1	1	1	1
Total horsepower	10,998	1,954	25	980	2,467	2,754	685	833	950	350
Owned—										
Engines—										
Steam, number	95	13	1	16	21	19	9	6	7	3
Horsepower	7,465	1,555	25	780	1,582	1,200	540	833	600	350
Gas or gasoline, number	1	.....	.....	.....	.....	1	.....	.....	.....	.....
Horsepower	10	.....	.....	.....	.....	10	.....	.....	.....	.....
Electric motors, number	197	45	.....	11	15	122	4	.....	.....	.....
Horsepower	2,733	399	.....	200	445	1,544	145	.....	.....	.....
Other power, horsepower	790	.....	.....	.....	440	.....	.....	.....	350	.....
Establishments classified by number of persons employed, not including proprietors and firm members:										
Total number of establishments	9	1	1	1	1	1	1	1	1	1
5 to 20	1	.....	1	.....	.....	.....	.....	.....	.....	.....
51 to 100	1	.....	.....	.....	.....	.....	.....	.....	.....	1
101 to 250	1	.....	.....	.....	.....	.....	.....	1	.....	.....
501 to 1,000	2	.....	.....	1	.....	.....	1	.....	.....	.....
Over 1,000	4	1	.....	.....	1	1	.....	.....	1	.....

[1] State institution.

LOCOMOTIVES.

LOCOMOTIVES.

By Edward H. Sanborn, *Expert Special Agent.*

This report, while it deals chiefly with locomotives, is intended to embrace all classes of self-propelled and self-contained engines, including, in addition to railroad locomotives, traction engines, motor vehicles, and steam road rollers.

Table 1 gives the number and value in 1900 of locomotives and other self-propelled engines manufactured by the 200 establishments embraced by this report.

Table 1.—NUMBER AND VALUE OF LOCOMOTIVES AND OTHER SELF-PROPELLED ENGINES: 1900.

	Number.	Value.
Total	13,500	$42,027,806
Locomotives:		
Steam	2,831	29,988,588
Compressed air	55	115,802
Electric	155	288,071
Gas	5	5,000
Traction engines	6,132	6,385,026
Motor vehicles	4,192	4,899,448
Steam road rollers	130	345,881

It is impracticable to present statistics of capital, wage-earners, wages, or materials in this group of industries, for the reason that at most of the establishments in which these engines were constructed many other products also were manufactured, the aggregate value being, in some cases, many times greater than the value of the engines. Nothing but an arbitrary separation of the statistics named could have been made, and figures thus obtained would be of little value. It is true that the building of railway locomotives is for the most part a separate and distinct industry, except when conducted in railroad repair shops, in which a comparatively small number of engines were built in 1900—the larger part of the products being cars and repair work. But traction engines were built, in 1900, largely in works at which farm and other machinery also was manufactured to an equal or greater extent; a large proportion of the motor vehicles were constructed in factories producing bicycles and other articles, while road rollers represented only a small part of the output of the establishments in which they were built.

While the value of the engines enumerated in Table 1 was $42,027,806, the value of the other products manufactured in the same establishments, including the amounts received for custom work and repairing, was $51,763,415. It will be seen, therefore, that the statistics of capital, labor, and materials for this group of industries bear no direct relation to the products separated from the totals, for the purposes of this report.

Inasmuch as this grouping of products appears at the census of 1900 for the first time, it is impossible to make comparisons with 1890, except with regard to certain statistics relating to locomotives for railroad use.

LOCOMOTIVES.

In presenting these statistics it is necessary to distinguish between locomotive works devoted exclusively, or for the most part, to the building of locomotives, and the repair and construction shops of railroads at which the building of a few locomotives forms but a minor feature in connection with other work.

Table 2 is a comparative summary of the principal statistics for locomotive works, 1890 and 1900.

Table 2.—LOCOMOTIVE WORKS: COMPARATIVE SUMMARY, 1890 AND 1900, WITH INCREASE AND PER CENT OF INCREASE.

	1900	1890	Increase.	
			Number.	Per cent.
Number of establishments	28	19	9	47.4
Capital	$40,813,793	$24,516,574	$16,297,219	66.5
Salaried officials, clerks, etc., number	786	[1] 317	419	132.2
Salaries	$902,196	[1] $381,654	$520,542	136.4
Wage-earners, average number	19,039	15,678	3,361	21.4
Total wages	$10,899,614	$8,697,488	$2,202,126	25.3
Men, 16 years and over	18,824	15,651	3,173	20.3
Wages	$10,854,628	$8,692,378	$2,162,250	24.9
Women, 16 years and over	1	.....	.....	.....
Wages	$288	.....	.....	.....
Children, under 16 years	214	27	187	692.6
Wages	$44,698	$5,110	$39,588	774.7
Miscellaneous expenses	$1,369,341	$991,380	$377,961	38.1
Cost of materials used	$20,174,395	$13,338,742	$6,835,653	51.2
Value of products	$35,209,048	$24,922,756	$10,286,292	41.3
Locomotives:				
Number	2,774	2,409	365	15.2
Value	$27,121,063	$19,752,465	$7,368,598	37.3
Other products, value	$8,087,985	$5,170,291	$2,917,694	56.4

[1] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary. (See Table 3.)

During the census year 1900 there were 28 establishments the sole or chief product of which was locomotives. At these works 2,774 locomotives of all classes were built, with an aggregate value of $27,121,063, compared with 2,409 locomotives, valued at $19,752,465, built in 19 establishments in 1890. In addition, 272 locomotives, valued at $3,276,393, were constructed at 26 railroad shops, making a total of 3,046 locomotives, valued at $30,397,456, built in 54 establishments during the census year 1900. The figures for 1890 do not include locomotives built in railroad shops.

It will be seen that there was a considerable increase in the value of locomotives during the ten years. The 2,409 locomotives built in 1890 had an average value of $8,199, while the 2,774 built at locomotive works in 1900 averaged $9,777 in value, an increase of $1,578, or 19.2 per cent. This increase is due in part to changes in size and construction. The increase in number of locomotives built in 1900, compared with 1890, appears to have been due to the foreign demand, the number exported in 1900 being 525, compared with 161 in 1890, an increase of 364. The absolute increase between the two census years, as shown in Table 2, was 365.

Table 3 is a summary for locomotive works, by states, 1900.

TABLE 3.—LOCOMOTIVE WORKS: SUMMARY BY STATES, 1900.

	United States.	Illinois.	New York.	Ohio.	Pennsylvania.	All other states.[1]
Number of establishments	28	4	4	3	8	9
Capital:						
Total	$40,813,793	$385,000	$6,851,675	$1,051,742	$20,134,539	$12,390,837
Land	$4,471,617	$75,000	$224,356	$61,500	$3,035,261	$1,075,500
Buildings	$6,693,715	$55,000	$1,028,681	$133,340	$3,272,784	$2,153,910
Machinery, tools, and implements	$11,511,185	$81,000	$1,570,168	$133,204	$4,175,674	$5,501,139
Cash and sundries	$18,137,276	$174,000	$4,028,470	$823,698	$9,650,820	$3,660,288
Proprietors and firm members	15	2	1		8	4
Salaried officials, clerks, etc., number	736	25	107	58	396	150
Salaries	$902,196	$12,207	$147,719	$71,310	$454,118	$216,842
Wage-earners, average number	19,039	86	4,394	794	9,374	4,391
Total wages	$10,899,614	$53,543	$2,660,001	$412,980	$5,508,381	$2,264,709
Men, 16 years and over	18,824	86	4,370	794	9,274	4,300
Wages	$10,854,628	$53,543	$2,655,418	$412,980	$5,487,178	$2,245,509
Women, 16 years and over	1		1			
Wages	$288		$288			
Children, under 16 years	214		23		100	91
Wages	$44,698		$4,295		$21,203	$19,200
Miscellaneous expenses:						
Total	$1,369,341	$6,675	$332,440	$74,263	$658,416	$297,547
Rent of works	$2,920	$1,100	$300	$200	$240	$1,080
Taxes, not including internal revenue	$128,763	$950	$17,412	$6,809	$58,350	$45,242
Rent of offices, interest, insurance, etc.	$1,222,124	$4,625	$313,128	$67,254	$585,892	$251,225
Contract work	$15,534		$1,600		$13,934	
Materials used:						
Total cost	$20,174,395	$134,612	$5,690,066	$812,812	$9,600,875	$3,936,030
Principal materials, including mill supplies and freight	$19,608,678	$131,892	$5,551,912	$801,543	$9,321,878	$3,801,453
Fuel, including rent of power and heat	$565,717	$2,720	$138,154	$11,269	$278,997	$134,577
Value of products, including custom work and repairing	$35,209,048	$225,300	$9,492,891	$1,528,514	$16,964,525	$6,997,818

[1] Includes establishments distributed as follows: Alabama, 1; Maryland, 1; New Hampshire, 1; New Jersey, 2; North Carolina, 1; Rhode Island, 1; Virginia, 2.

This table shows that Pennsylvania led in the manufacture, in 1900, with 48.2 per cent of the total value of products. In 1890 the state also led in value of products, with 44.6 per cent of the total. New York was second, with 27 per cent. New Jersey was third, but as there were only 2 establishments in the state its totals can not be separately shown.

Table 4 shows, by states, the number of locomotives of each kind built in all establishments, including railroad repair shops, 1900.

TABLE 4.—NUMBER AND VALUE OF LOCOMOTIVES BUILT IN LOCOMOTIVE WORKS AND RAILROAD REPAIR SHOPS, BY STATES: 1900.

	AGGREGATE.		STEAM.						COMPRESSED AIR.		ELECTRIC.		GAS.	
			Total.		Simple.		Compound.							
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
United States	3,046	$30,397,456	2,831	$29,988,583	2,502	$26,000,538	329	$3,988,045	55	$115,802	155	$288,071	5	$5,000
Illinois	80	488,101	67	420,601	67	420,601					8	12,500	5	5,000
Michigan	16	107,011	16	107,011	16	107,011								
New York	743	8,578,399	718	8,540,899	670	7,933,757	48	607,142	25	37,500				
Ohio	113	263,474	33	113,474	33	113,474					80	150,000		
Pennsylvania	1,562	15,736,320	1,465	15,532,447	1,219	12,504,981	246	3,027,466	30	78,302	67	125,571		
Virginia	121	1,165,920	121	1,165,920	93	896,400	28	269,520						
All other states[1]	411	4,108,231	411	4,108,231	404	4,024,314	7	83,917						

[1] Includes Alabama, 26; Arkansas, 3; Connecticut, 6; Indiana, 1; Iowa, 8; Kansas, 12; Maryland, 2; Missouri, 2; New Hampshire, 33; New Jersey, 263; North Carolina, 3; Rhode Island, 29; Texas, 9; Vermont, 1; Wisconsin, 13.

Included among the locomotives reported in 1900 are 5 mine locomotives driven by gas, valued at $5,000; 17 miniature locomotives, valued at $16,600; and 63 locomotives driven by gears instead of by direct rod and crank connection, valued at $247,813.

As a result of conditions which have necessitated the practical reconstruction of the railroad transportation systems of the United States—a work still in progress and likely to continue for many years—the period between 1890 and 1900 was probably the era of most notable development in locomotive construction.

In transportation, as in every other branch of industry, the tendency has been toward larger operations, necessitating the use of more powerful appliances of every description. The problem has been, as in manufacturing, to produce the greatest possible result with the smallest expenditure of manual labor. This is shown in the continuous increase in the size and capacity of freight cars, requiring more powerful locomotives.

In 1890 a freight car with a carrying capacity of 60,000 pounds was deemed adequate for all ordinary

requirements, but in ten years the limit has been increased to 100,000 pounds, while cars of even greater capacity have been constructed. This increase has been made possible through the substitution of steel for wood in the construction of freight cars. The application of the air brake to freight cars has permitted freight trains to travel with safety at higher rates of speed than were practicable a few years ago. To meet the use of heavier rolling stock, especially locomotives, and the increasing speed of trains, it has become necessary in recent years for the railroads to undertake extensive reconstruction, involving the laying of heavier rails and of a firmer and better ballasted roadbed, the strengthening of steel bridges or their replacement by masonry structures, and the elimination of curves and grades approved or deemed unavoidable by earlier engineers. Concurrent with the increase in the carrying capacity of freight cars, there has been a reduction in the length of cars used for the transportation of coal and of iron ore. This shortening of the wheel base has resulted in a concentration of the weight in a manner not taken into consideration when most of the railroads now in operation were planned and constructed.

All the changes mentioned, together with the demand for higher rates of speed in the passenger service, have given great stimulus to the development of a locomotive having greater tractive power and capable of running at higher rates of speed than those manufactured in 1890. The most important features of this develop ment may be summarized as follows: A marked increase in size and weight, with increased tractive power and speed; the use of larger boilers, with thicker shells; larger fire-boxes and increased grate area, made necessary by the demand for higher steam pressure and greater steam-generating capacity; economy in the use of steam, by compounding; and the substitution of steel castings for wrought-iron or iron castings for several important parts.

It is difficult to measure, in exact terms, the increase in weight of locomotives since 1890. Some figures taken from the records of a single locomotive establishment may be accepted, however, as fairly representative. In 1890 the average weight of the locomotives built in this plant was 92,000 pounds for the engine alone, exclusive of the tender. In 1900 the average weight for the same establishment, and on the same basis, was 129,000 pounds, an increase of 37,000 pounds, or 40.2 per cent; the average weight of the complete locomotive, including tender, at this same works, was 158,534 pounds, or 79.3 short tons. Many locomotives exceeding 100 tons in weight have been constructed during the past ten years. The largest engine thus far built weighed about 133 tons, or nearly 190 tons with tender, and it is not safe to say that even this limit will not be exceeded.

The continually increasing demands put upon boilers by the requirements of heavier traffic and higher rates of speed have brought about a continuous increase in the pressure per square inch at which steam is used in locomotives. In 1870 about 130 pounds was a fair average; in 1890 the average was about 160 pounds; within the past ten years this has been increased more than 25 per cent, and steam is now used frequently at a pressure of 225 pounds.

To meet the increased pressure it has become necessary to use heavier steel plates in the construction of boilers. In 1890 it was customary to use plates about one-half or nine-sixteenths of an inch in thickness for boiler shells, but now it is quite common to use plates up to seven-eighths of an inch thick; at the same time there has been a marked increase in both the length and the diameter of boilers.

With the increasing diameter and higher steam pressure, the enlargement of the fire-box and the increase of the grate surface became necessary, in order to meet the larger steam requirements. For many years the space between the locomotive frames afforded ample room for as large a fire-box as was needed. Figure 1 shows a typical boiler with a narrow fire-box.

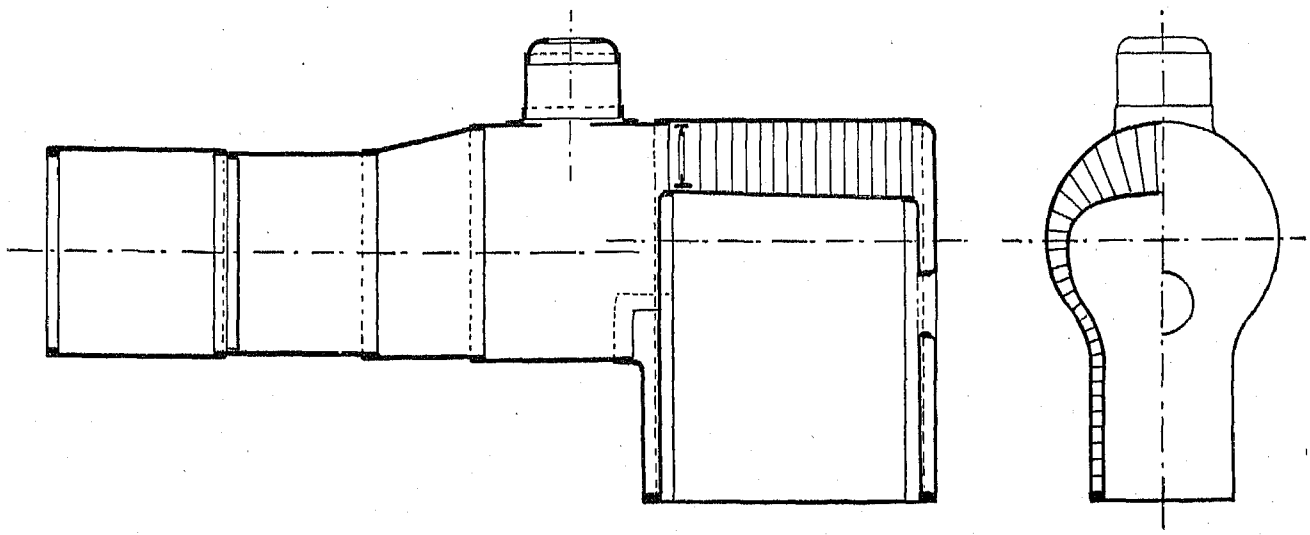


FIG. 1.—Type of locomotive boiler with fire-box between the frame.

When the space between the frames became too contracted, the fire-box was gradually extended until it occupied all the space between the tires of the driving wheels. When the possibilities of increasing the grate surface by widening the fire-box within the limits fixed by the driving wheels, and also by increasing its length, had been exhausted, the necessity for further enlargement led to a radical departure in construction, resulting in the evolution of a new and distinct type of locomotive, in which the driving wheels were moved forward and placed under the barrel or cylindrical portion of the boiler, the fire-box being supported by a single pair of wheels of smaller diameter placed underneath so as to permit an increase of its width. This type of engine, which has been variously designated by different builders, is one of the notable developments in locomotive construction in recent years, particularly in engines intended for passenger service and designed for high rates of speed.

Figure 2 shows a typical broad-fire-box boiler of recent design.

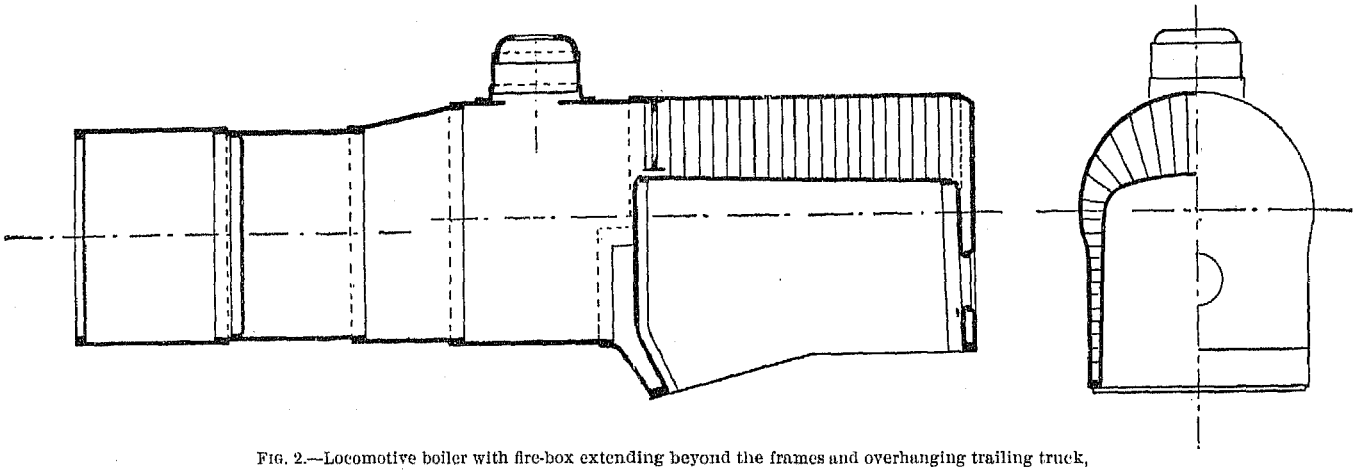


FIG. 2.—Locomotive boiler with fire-box extending beyond the frames and overhanging trailing truck.

The diameter of the barrel of the boiler has been so greatly increased that the gain in width of the fire-box is not fully apparent in the drawing. The latest type of wide fire-box resembles, in some respects, the well-known Wootten pattern, which has been used extensively in locomotive construction for more than a quarter of a century. The Wootten fire-box was designed to burn small sizes and low grades of anthracite coal, which require a very large grate surface and a thin fire. This requirement was met by raising the fire-box to the top of the driving wheels and extending it beyond them on each side. While a very large grate surface was thus obtained, the height of the fire-box was reduced, and the best results were obtainable only with the small sizes of anthracite coal for which this form of boiler was originally designed. The modified type of Wootten boiler now in common use is shown in figure 3.

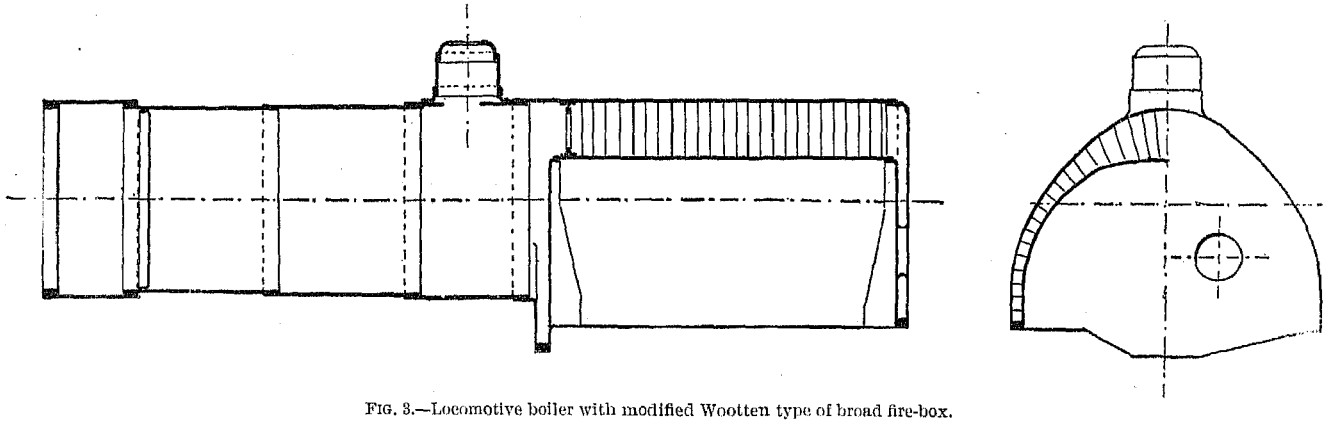


FIG. 3.—Locomotive boiler with modified Wootten type of broad fire-box.

The latest type of wide fire-box, however, is a radical departure from the Wootten boiler, in that it is placed wholly behind the driving wheels, and, as it overhangs a pair of low trailing wheels instead of drivers, there is no sacrifice of height. While resembling the Wootten type in width, it is radically different in its height or depth and its relation to the driving wheels. Each of these types of fire-box was designed to meet certain distinct conditions, which appear to have been fulfilled by a well-defined step of progress in locomotive construction.

Another radical change in boiler construction is the

recent introduction of the cylindrical, corrugated fire-box, shown in figure 4, which has heretofore been used mainly in marine boilers. For this type of fire-box, which has not yet come into extended use, there are claimed certain marked advantages in simplicity of construction, great structural strength, and economy in fuel. The most apparent advantages are the preservation of the cylindrical form of the boiler throughout, the elimination of all flat surfaces, and the entire avoidance of the stay bolts, which are a source of much trouble and expense in the ordinary form of locomotive boiler. It is claimed also that this type of fire-box can be removed from the boiler with comparative ease, and that the cost of maintenance and repairs is less than for the ordinary form.

A comparison of the grate areas obtainable in the different types of fire-box shows the following results: Restricting the fire-box to the width between the frames and to a maximum length of about 10 feet, a grate area of approximately 27 square feet is obtained. Extending the width to the limits of the space between the driving wheels and using the same maximum length gives a possible grate area of about 35 square feet. In the Wootten type, with a possible width of 8 feet and a length of 10 feet, 80 square feet of grate surface can be had. The later type of broad fire-box offers the same possibilities, but a length of 8 feet and a breadth of 66 inches, giving an area of 44 square feet, probably represent the most advantageous dimensions. The grate surface of a cylindrical fire-box is usually from 30 to 35 square feet, but may be more, according to the diameter of the boiler.

Probably the most important improvement during the past ten years in locomotive construction has been the introduction of the compounding principle in the use of steam. The principle is not new, even in this industry, as patents for compound locomotives were issued in the United States as early as 1846, and an engine of this class was built in 1867 at the Shepard Iron Works, Buffalo, N. Y. Compound locomotives did not come

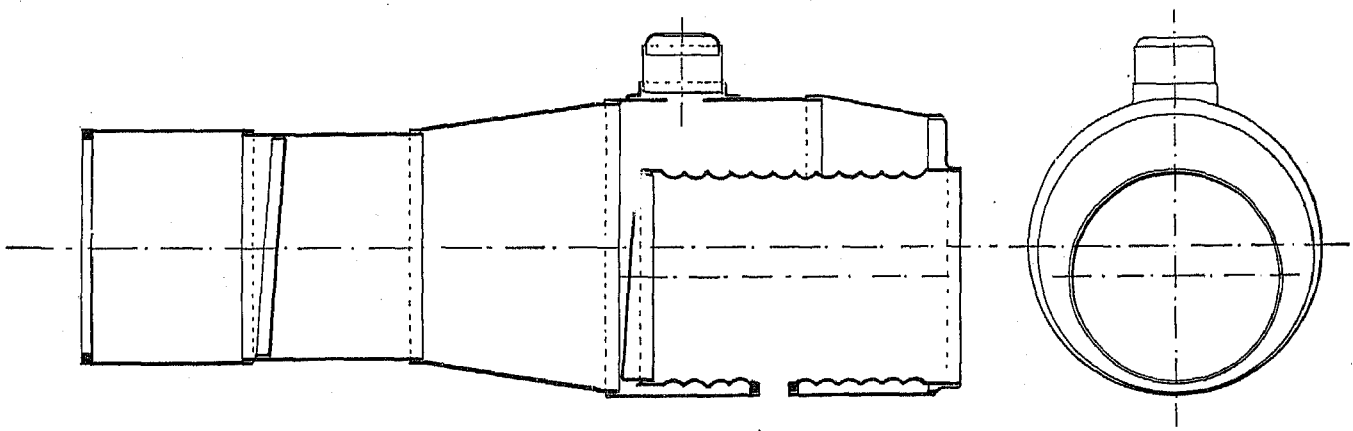


FIG. 4.—Locomotive boiler with cylindrical corrugated fire-box.

into any general use in the United States, however, until within the last decade, although many engines embodying this principle were built in England and continental Europe a few years earlier.

The advantages of compounding, so well demonstrated in stationary engines, have attained general recognition by railroads and by the builders of locomotives, and a large proportion of the engines built each year are constructed upon this principle. During the census year 1900, 329 out of a total of 2,831 steam locomotives were built with compound cylinders.

In the compound locomotive the cylinders are of unequal diameter, so proportioned that steam at a high pressure in the smaller cylinder exerts upon the piston approximately the same force that is exerted by steam at a lower pressure in the larger cylinder. Steam is admitted first into the smaller cylinder, where it expends a portion of its initial energy and then passes into the larger cylinder, where it performs an equal amount of work by exerting a diminished pressure upon a larger surface. This is the principle of compounding, the relative sizes and positions of the cylinders being varied according to the conditions to be met by the engine or the ideas of the designer and builder, or of the purchaser. While in marine and stationary engines the compound principle has been carried with success and economy to three and four stages of expansion in the use of steam, it has not been found practicable to go beyond two stages in compound locomotives.

The principal types of compound locomotives developed to a point of practical utility, and now in use, may be classified as follows:

1. The cross-compound locomotive, which has one high-pressure and one low-pressure cylinder, located on opposite sides of the engine.

2. The four-cylinder compound locomotive, with one high-pressure and one low-pressure cylinder on either side of the engine, the high-pressure cylinders being located either above or below the low-pressure cylinders, as conditions may require.

3. The four-cylinder balanced compound locomotive, differing from the preceding type in that the high-

pressure and low-pressure cylinders on either side of the engine are located side by side instead of one above the other, their axes being parallel and in the same horizontal plane.

4. The four-cylinder tandem compound locomotive, which has a high-pressure and a low-pressure cylinder on each side of the engine, the two cylinders having the same axis and both pistons being attached to the same rod.

The different kinds of compound locomotives are described in the following pages, the usual arrangement of cylinders in a single-expansion locomotive being given, for purposes of comparison, in figure 5.

The simplest form of compound locomotive, and that

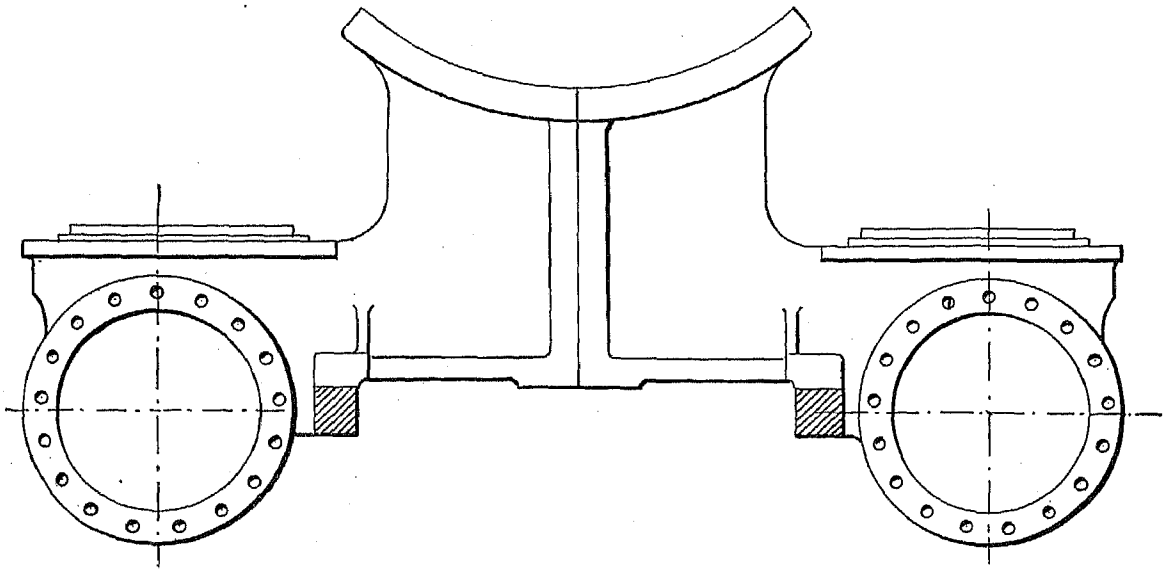


FIG. 5.—Common arrangement of cylinders in a single-expansion locomotive.

which approaches most nearly to one of the common types of stationary engine, is the two-cylinder cross-compound, shown in Figure 6. This type of locomotive, in which is shown one of the earliest English methods of compounding, has found considerable favor in the United States. Among the advantages claimed are simplicity of construction and adaptability to varying requirements of service. In its present form this engine may be used as either compound or simple. In starting, in switching, or in any service requiring limited movements, direct steam can be admitted into both cylinders, a reducing valve being used to lessen the pressure at which steam is admitted into the low-pressure cylinder, until the work of that cylinder is equal-

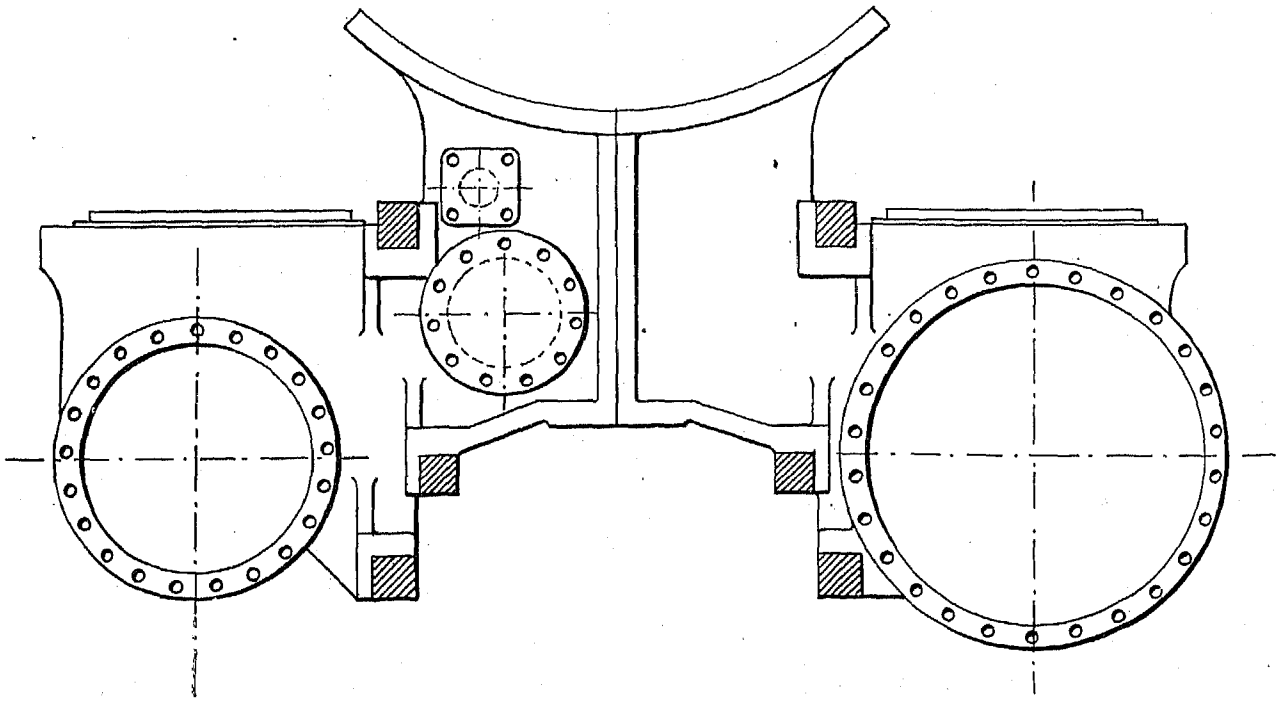


FIG. 6.—Arrangement of cylinders in a two-cylinder cross-compound locomotive.

ized with the high-pressure cylinder. It is claimed that there are many conditions of service which make this adaptability a decided advantage. The chief objection raised against this type of compound locomotive is the difficulty of bringing the low-pressure cylinder within the limits fixed for the width of the engine. Continuous increase in the size of locomotives calls for cylinders of larger diameter, and a single low-pressure cylinder of large diameter on one side of the engine threatens to exceed the limits of available space. For many purposes, however, this type of compound locomotive is credited with decided advantages, and many of them are in use.

Of the several types of four-cylinder compounds, that in which the cylinders are placed with their axes parallel and in the same vertical plane has met with the greatest favor and the most general use. The location of the high-pressure cylinder above or below the low-pressure cylinder is not governed by any fixed rule, but is determined by several conditions. Figure 7

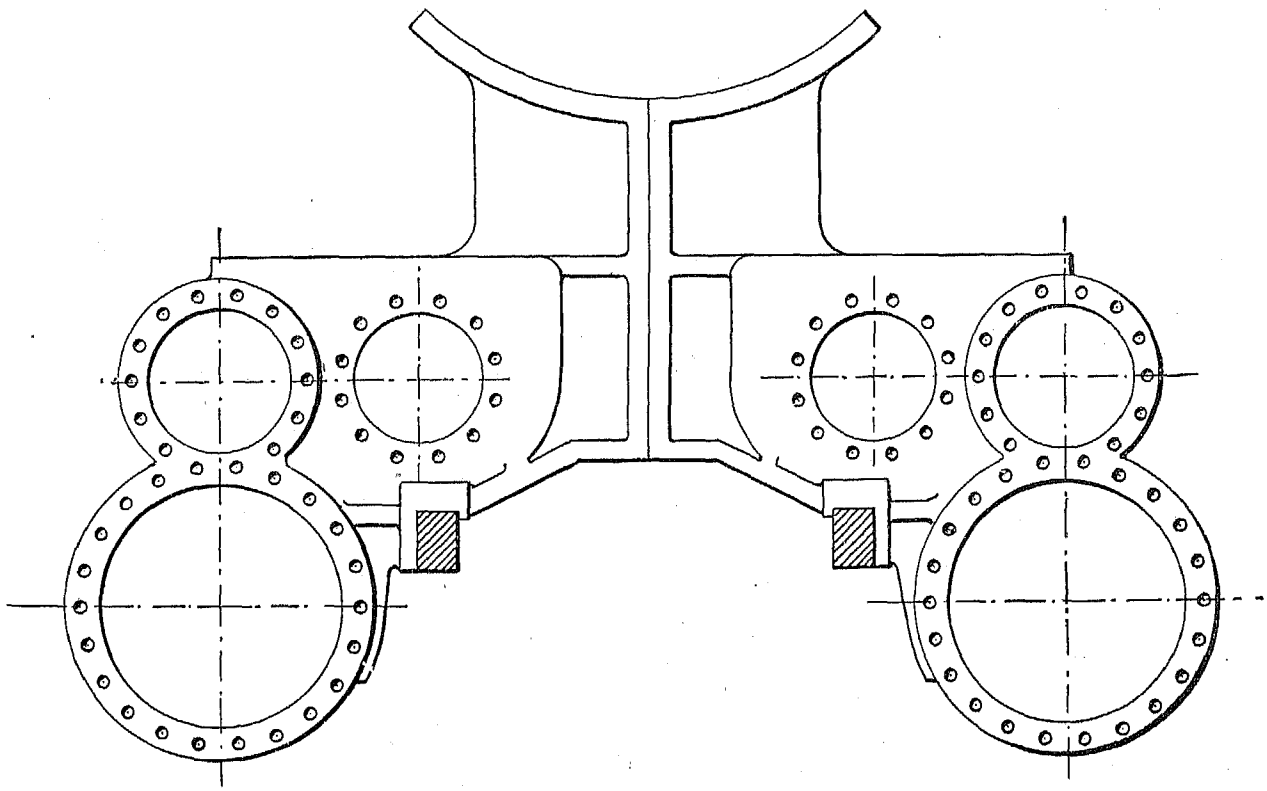


FIG. 7.—A common arrangement of cylinders in a four-cylinder compound locomotive.

shows this type with the high-pressure cylinder placed above. If the low-pressure cylinder is not so large in diameter as to cause danger of interference with track fixtures, station platforms, or any other obstructions that may be encountered, it is usually placed below the high-pressure cylinder. The shape of the side frames of the engine, also, has more or less to do with determining the relative positions of the two cylinders. In the type under consideration, the two parallel piston rods of each pair of high-pressure and low-pressure cylinders are attached to a single heavy crosshead, connected with the driving wheels in the manner usual in simple engines. This form of compound locomotive has found favor because of the simplicity of its construction, its well-balanced operation, and the economy which its use has demonstrated.

A more recent modification of the four-cylinder compound is that in which the high-pressure and low-pressure cylinders in each pair are placed side by side instead of one above the other, as shown in Figure 8. This type, which has not yet come into general use, involves some ideas in construction radically different from those embodied in any other form of compound locomotives. The low-pressure cylinders lie outside the frame of the locomotive on either side, while the high-pressure cylinders are inside the frame. Instead of attaching both piston rods of each pair of cylinders to the same crosshead, as in the type of four-cylinder compound just described, the outside rod of each pair is connected with crank pins on the driving wheels, and the piston rods of the inside cylinders are connected with cranks upon the axle of the forward driving wheels. The axle cranks and the crank pins on the wheels are set at different angles, thereby effecting a very even distribution of power in its application to the driving wheels.

The most important advantage claimed for this form of construction is that an almost perfect balance is

secured for the engine by the use of four cranks instead of two, as in other types of engines. It is claimed that such an engine will permit a maximum load on the driving wheels without injury to the track, as there is no unbalanced rotating weight in the wheels tending either to lift them or to exert an additional pressure upon the rails. While this type of locomotive is of too recent design to have fully demonstrated its advantages, it is believed, nevertheless, that it will show a decided step in advance.

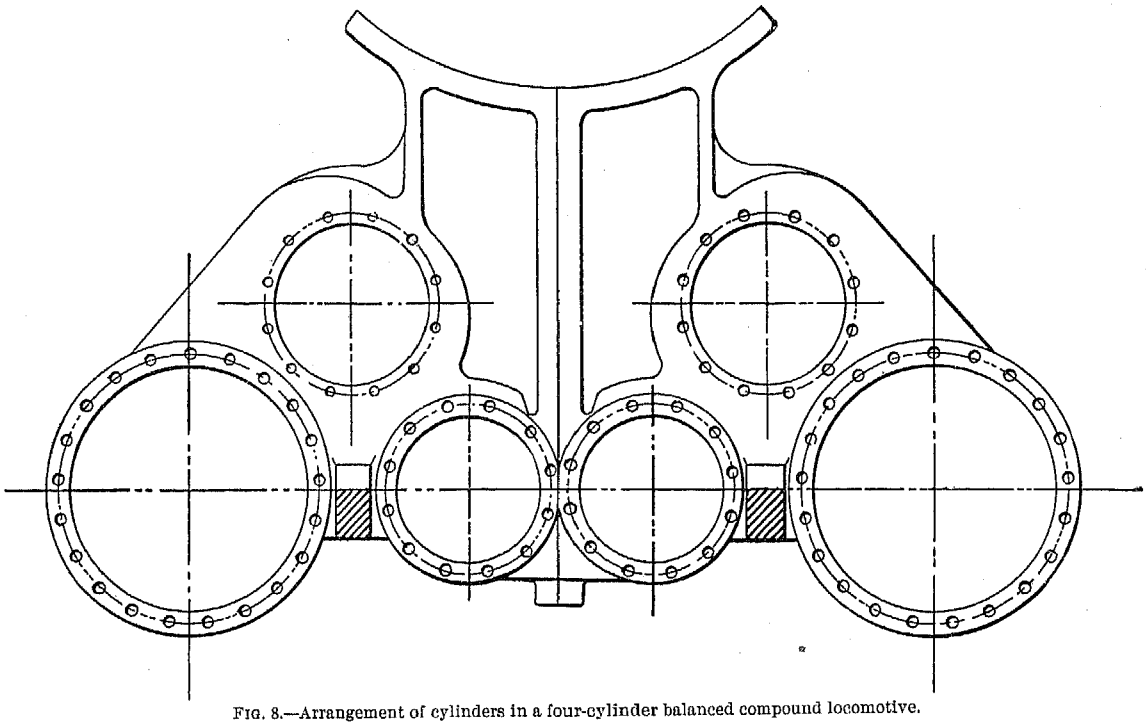


FIG. 8.—Arrangement of cylinders in a four-cylinder balanced compound locomotive.

The tandem arrangement of the high-pressure and low-pressure cylinders, as shown in Figure 9, was designed to obviate the disadvantages of using cylinders in parallel. The increased size of locomotives and the larger diameters of their cylinders threaten to overreach the limits of the space allotted. The tandem arrangement is claimed to be particularly advantageous, because it will permit the use of larger low-pressure cylinders than could be used in any other form of compound locomotive. The use of a single piston rod, attached to a single crosshead, for each pair of cylinders, simplifies the construction and reduces the weight of those moving parts. This type of engine has been designed specially for heavy freight service, and with a view to producing a locomotive of maximum power and efficiency.

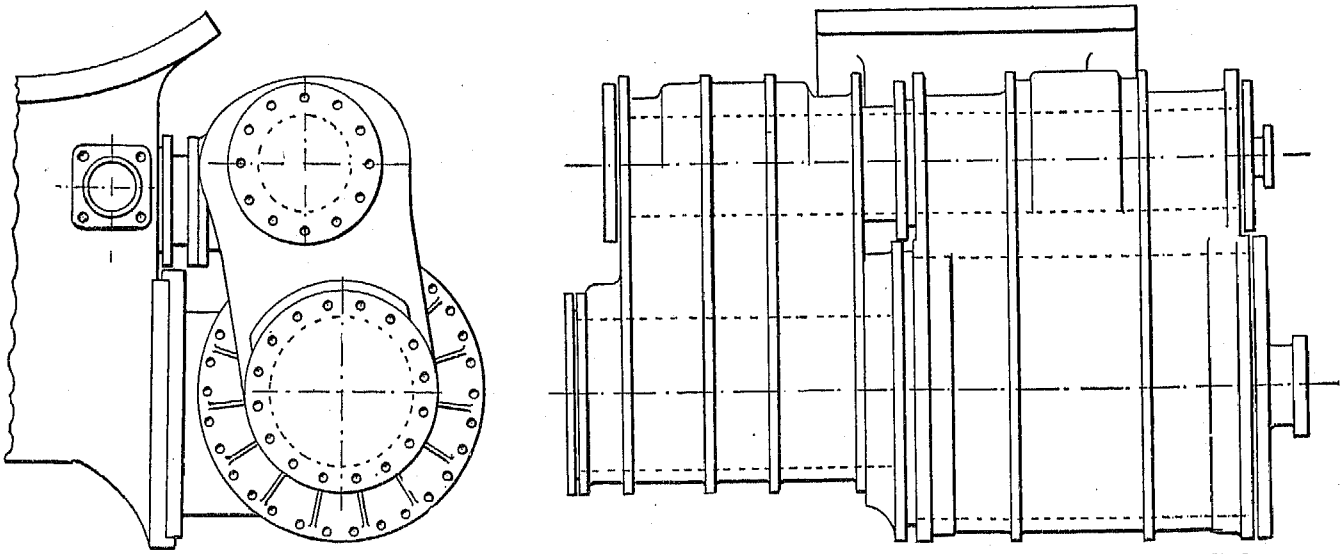


FIG. 9.—Arrangement of cylinders in a four-cylinder tandem compound locomotive, showing cross-section and side elevation of one pair of cylinders.

The causes which have led to the introduction of the compound principle in locomotives, and the funda-

mental principles underlying this double use of steam, are concisely stated in a pamphlet recently issued by one of the leading locomotive works.

In stationary engine practice the chief measure of the boiler efficiency is the economical consumption of steam. In most stationary engines the boilers are fired independently, and the draft is formed from causes entirely separate and beyond the control of the escape of steam from the cylinders. Hence any economy shown by the boilers must of necessity be separate and distinct from that which may be effected by the engine itself. In a locomotive, however, the amount of work depends entirely upon the weight on the driving wheels, the cylinder dimensions being proportioned to this weight, and, whether the locomotive is compound or single expansion, no larger boiler can be provided, after allowing for the wheels, frames, and other mechanism, than the total limit of weight permits. The heating surface and grate areas in both compound and single-expansion locomotives of the same class are practically the same, and the evaporative efficiency of both locomotives is chiefly determined by the action of the exhaust, which must be of sufficient intensity in both cases to generate the amount of steam necessary for utilizing to the best advantage the weight on the driving wheels. This is a feature that does not appear in any stationary engine, so that the compound locomotive can not be judged by stationary standards, and the only true comparison to be made is between locomotives of similar construction and weight, equipped in one case with compound and in the other with single-expansion cylinders.

No locomotive, compound or single-expansion, can haul more than its adhesion will allow. The weight on driving wheels is the limiting factor in the problem which confronts the locomotive engineer. Power can of course be increased by building a larger engine and augmenting this weight, but in the present construction of tracks and bridges the limit of driving-wheel load has almost been reached. Hence in modern locomotive practice the goal before the designer and engineer is to obtain maximum efficiency for the minimum weight admissible.

It is not claimed for compound locomotives that a heavier train can be hauled at a given speed than with a single-expansion locomotive of similar weight and class; but the compound will, at very slow speed, on heavy grades, keep a train moving where a single-expansion locomotive will slip and stall. This is due to the pressure on the crank pins of the compound being more uniform throughout the stroke than is the case with the single-expansion locomotive, and also to the fact that, when needed, live steam can be admitted to the low-pressure cylinders.

The principal object in compounding locomotives is to effect fuel economy, and this economy is obtained—

1. By the consumption of a smaller quantity of steam in the cylinders than is necessary for a single-expansion locomotive doing the same work.

2. The amount of water evaporated in doing the same work being less in the compound, a slower rate of combustion combined with a mild exhaust produces a higher efficiency from the coal burned.

One of the obvious advantages of the compound system is that, owing to the better utilization of the steam, less demand is made upon the boiler, which enables sufficient steam pressure to be maintained with the mild exhaust, due to the low tension of the steam when exhausted from the cylinders. This milder exhaust does not tear the fire, nor carry unconsumed fuel through the flues into the smoke box and thence out of the smokestack, but is sufficient to maintain the necessary rate of combustion in the fire box with a decreased velocity of the products of combustion through the flues.

The heating surfaces of a boiler absorb heat units from the fire and deliver them to the water at a certain rate. If the rate at which the products of combustion are carried away exceeds the capacity of the heating surfaces to absorb and deliver the heat to the water in the boiler, there is a continual waste that can be overcome only by reducing the velocity of the products of combustion passing through the tubes. This is effected by the compound principle. It gives, therefore, not only the economy due to a smaller consumption of water for the same work, but the additional economy due to slower combustion. It is obvious that these two sources of economy are interdependent.

The improved action of the boiler can be obtained only by the use of the compound principle, while at the same time the use of the compound principle enables the locomotive to develop its full efficiency under conditions which in a single-expansion locomotive would require a boiler of capacity so large as to be out of the question under the circumstances usually governing locomotive construction. It is therefore evident that where both locomotives are exact duplicates in all their parts, excepting the cylinders, the improved action of the boiler is due entirely to the compound principle, and the percentage of economy should be based upon the total saving in fuel consumption, and not upon the water consumption, as in stationary practice.

The comparative economy of single-expansion and compound locomotives is a much-debated question. Many tests have been made of the various types of compound engines in comparison with single-expansion engines of similar dimensions, and the results have shown a very wide range. Some tests have shown for the compound locomotive a saving of more than 40 per cent in fuel, while under other conditions the economy of the compound engine has seemed to be very slight. The saving of fuel alone is not an entirely adequate gauge of the economy of compound locomotives; due allowance must be made, in any comparison of the operations of the two classes of engines, for the fact, generally conceded, that the cost of maintenance and repairs is greater for a compound engine than for a simple locomotive. Repeated and long-extended tests have demonstrated beyond question the fact that the compound use of steam in a locomotive will effect, under average conditions, a saving of from 10 to 25 per cent, while in some cases, undoubtedly, a much larger economy can be shown.

Among minor improvements in locomotive construction during the past ten years may be noted the larger use of steel castings in place of cast or wrought iron. The first use of steel castings for any important part of a locomotive was for driving-wheel centers, formerly made of cast iron with rolled steel tires. Steel castings have now been substituted very largely for the cast-iron centers, with considerable advantage in strength. Until within recent years, locomotive frames have always been forged from iron or steel. The building up of a locomotive frame under a hammer is always a complicated piece of work, and the use of cast-steel frames has greatly simplified the construction of this part of the locomotive. Experience has demonstrated that steel castings can be depended upon with perfect safety both for driving-wheel centers and for frames, and the use of this material marks an important innovation.

The introduction of the compound principle has

necessitated a radical change in valve construction, and in locomotives with cylinders arranged in parallel pairs a cylindrical piston valve has been substituted for the flat slide valve used on simple locomotives. The piston valve has proved to be the most feasible form for certain types of compound locomotives, but, although used to some extent, has not yet established unquestioned superiority over the flat slide valve in simple engines.

The electric headlight is one of the minor accessories which have been developed in recent years. It consists of an arc light placed in the usual position upon the boiler front, and supplied with current from a small, direct-connected dynamo and engine, usually mounted upon the boiler just behind the stack. These headlights furnish light of intense brilliancy, illuminating the track for a long distance in advance of the locomotive, and their use has been quite general in recent years upon many railroads, particularly in the West.

Recent developments in the oil supply of the country have stimulated the use of liquid fuel upon locomotives, particularly in the far West and Southwest, and many locomotives have been equipped with burners for the use of crude petroleum. These locomotives required no modification in their construction except some slight alteration in the arrangement of the brickwork in the fire-box and the introduction of the burners; the latter are very simple in both principle and construction, throwing into the fire-box a spray of steam and vaporized oil, which burns with great freedom and generates an intense and steady heat.

The firing of the huge boilers now in use on the largest locomotives is one of the problems which will have to be met in the near future, as the ability of the fireman has about reached its limit. Any further increase in the size of boilers will make it necessary either to add another man on the engine or to substitute the use of a mechanical stoker for hand labor. A mechanical stoker has been tried experimentally, and apparently with satisfactory results, but its use has not been sufficiently extended to warrant positive conclusions as to its utility.

The conditions encountered in railroad traffic in the United States have been quite different, in some respects, from those existing in England and on the Continent, requiring engines of greater flexibility than those generally used abroad.

Therefore, almost from the very beginning American locomotives have been radically different in their general construction from those used in Europe. It is a marked tribute to the excellence of the American locomotives, however, that in recent years they have been purchased in large numbers for railroads in England, France, and Russia, where they have been put into service in competition with types of locomotives to which those countries have adhered persistently for many years. The growth of the export trade in American locomotives during the past ten years is noteworthy. In the fiscal year 1890, which almost coincides with the census year, there were exported from the United States 161 locomotives, valued at $1,280,606; while during the fiscal year 1900 there were exported 525, valued at $5,592,403.

Table 5 shows the number and value of locomotives exported from the United States during each fiscal year from 1890 to 1900, inclusive, as taken from the reports on Commerce and Navigation, United States Treasury Department.

TABLE 5.—EXPORTS OF LOCOMOTIVES: 1890 TO 1900.

FISCAL YEARS.	Number.	Value.
1890	161	$1,280,606
1891	275	2,424,363
1892	197	1,717,715
1893	195	1,794,709
1894	142	1,028,336
1895	252	2,379,519
1896	261	2,512,270
1897	338	3,225,831
1898	468	3,883,719
1899	517	4,728,748
1900	525	5,592,403

American locomotives have found their way into all parts of the world, having proved their superiority over every type of foreign locomotive with which they have been brought in competition. The large export trade is due to several causes. While the efficiency and the excellence of material and workmanship of the American locomotive are important considerations in many cases, questions of price and speedy delivery have been the determining factor. Building, in large numbers, locomotives with perfect interchangeability of parts, and employing labor-saving machinery of the highest efficiency, American manufacturers have been able to construct engines at lower cost and in less time than any other builders in the world; and the placing of many large foreign orders in the United States has been due to these facts alone.

American locomotives owe much of their excellence and cheapness to the efficient machines, tools, and processes used in their manufacture. The boiler is built in two sections, entirely by power riveting, practically the only rivets set by hand being those in the single ring where the halves are united. Traveling cranes handle the sheets during the process of construction, and also the completed boiler, so that the use of mere human muscle is practically eliminated. Multiple-spindle drilling machines not only bore many holes simultaneously, but can also drill each hole through four or five sheets at the same operation if desired, thus securing absolute uniformity in duplicate parts, and at the same time effecting great economy in time and labor. Flanging of such parts as dome rings, furnace-door flanges, tube sheets, etc., is done in one heat, at a single operation, by powerful hydraulic flanging presses.

The boring and facing of cylinders are done by the same machine. In the case of a four-cylinder compound a pair of high-pressure and low-pressure cylinders, with their steam chest, which form one casting, are all bored at one operation, and the same machine then faces the ends of the casting. The saving in time and labor and the accuracy thus insured warrant the construction of expensive machinery especially for this work.

Instead of finishing correcting and coupling rods singly, several are clamped together and planed or milled simultaneously, with an expenditure of practically the same time and labor that would be required to finish one. Similarly, and with even more marked economy, four or six frames are planed and slotted as one piece. This same principle of multiple work is applied in the manufacture of many of the minor parts of the locomotive, as well as in making fittings which are required in larger number.

The light steel plates of which the tender tanks are formed are rapidly and accurately punched for riveting by machines which automatically space and punch the holes and trim the edge of the plate at the same operation.

The assembling of the finished parts and the erection of the complete locomotive are characterized by the same time and labor-saving methods that are applied in the making of the component parts of the engine. Practically everything is finished and fitted, and some of the parts are even painted, before being transferred to the erecting floor, so that putting the parts together is a rapid operation. The greatest saving of both time and labor in the erecting shop is made by the use of overhead traveling cranes powerful enough to pick up the completed engine, making it possible to lift the boiler for the purpose of placing the wheels in position after the frames and cylinders have been attached, or to move the engine during erection as much and as frequently as may be desired.

To each portion of the work of erecting the engine is allotted a separate gang of men, each having in a large establishment only one operation to perform. For example, one crew does nothing but set guides, another sets up the frames, still another attaches the cab fittings, and so on. This subdivision and specialization of the work greatly expedites the whole operation, reducing the time necessary for erecting a completed engine to a minimum that is surprising to those not familiar with the methods employed.

The time required for the construction of a completed locomotive from the raw material varies greatly, according to the requirements of the purchaser and the conditions governing the supply of materials. While ordinarily it takes several weeks, or even two or three months, to build a locomotive, some remarkable achievements in quick work have been made by American builders, either to meet emergencies or to establish records. Eight days is probably the shortest time in which an engine has been built, starting with the raw material and constructing all the parts; but an engine has been assembled and erected ready to run in twenty-four hours.

Locomotives driven by compressed air in place of steam have been in use for many decades, and have found increasing favor in recent years. They are confined chiefly to coal mines, where contracted space and inability to dispose of smoke and gas from steam locomotives have made compressed air particularly useful. They have also proved satisfactory in manufacturing plants where conditions do not permit the use of steam and where an electric current is not available or desirable. There has been no tendency to substitute air for steam in regular railroad service. The conditions under which compressed-air locomotives are used make it necessary that they be of small dimensions, and this, together with the fact that they are not in demand for the heavy service of ordinary outdoor railroad work, has narrowed their field.

During the census year 55 compressed-air locomotives, with an aggregate value of $115,802, were built by 4 establishments located in New York and Pennsylvania. The successful application of the principle of compounding in steam locomotives has led to the use of the same idea in locomotives driven by compressed air, and substantial advantage over the single-expansion engines is claimed. For the most part, however, the compressed-air locomotives have been of the single-expansion type. For the operation of these locomotives, air is stored in tanks, which take the place of boilers, at a pressure of from 600 to 800 pounds per square inch. In the single-expansion engine the air is used at a pressure of about 100 pounds, while in the compound locomotive the pressure ranges as high as 800 pounds to the square inch.

The number of electric locomotives built during the census year was 155, and their aggregate value, $288,071. Nearly all of these engines were built for use in mines, a field in which they have proved their utility and have met with much favor. A few electric locomotives of large capacity have been built for special service upon standard-gauge railroads, but for the most part this service has consisted of local switching and service in the yards of large manufacturing establishments. Thus far the substitution of electric locomotives for steam-propelled engines on long runs has not been undertaken.

The distinction between an electric locomotive and a railway motor car is somewhat vague and indefinite, as a motor car often performs practically all the service required of an electric locomotive, not only propelling itself, but hauling other cars. The motor car has come into universal use for street, suburban, and interurban railways. Its work very closely approaches that of an independent electric locomotive. This report deals, however, only with detachable locomotives, not equipped to carry passengers or freight.

A large proportion of the electric locomotives are constructed in shops which do not manufacture electrical equipment, but purchase the motors and their attachments. On this account their construction is not a distinct industry, not really belonging either to the locomotive-building or to the electrical-equipment industry. While most electric locomotives are built for operation by current transmitted from central power plants, a few have been equipped with storage batteries, being used chiefly for light work in manufacturing establishments.

TRACTION ENGINES.

The manufacture of traction engines is carried on chiefly in connection with the construction of agricultural machinery, especially thrashing machinery, with which they are most largely used.

Table 6 shows the number and value of traction engines made in the United States during the census year 1900.

TABLE 6.—TRACTION ENGINES: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Number of establishments.	TRACTION ENGINES.	
		Number.	Value.
United States	31	6,132	$6,385,026
Indiana	6	977	914,178
Michigan	3	1,310	1,769,720
Minnesota	3	388	408,640
New York	3	418	439,256
Ohio	7	1,378	1,310,403
Pennsylvania	3	322	300,748
All other states[1]	6	1,339	1,242,086

[1] Includes establishments distributed as follows: California, 2; Illinois, 2; and Wisconsin, 2.

During 1900, 31 establishments reported the manufacture of 6,132 traction engines, valued at $6,385,026. Michigan reported the largest value of such products, 3 establishments in that state having constructed 1,310 engines, aggregating $1,769,720 in value.

Portable farm engines, mounted on wheels and drawn from place to place by horses, have given way very largely, in recent years, to traction, or self-propelling engines, which have been greatly improved. Not only do they furnish their own motive power, but they also have capacity for drawing a tender and water cart, as well as a thrashing machine, and thus do not need horses either on the road or in the field. So rapid has been the substitution of the traction engine for the old type of portable engine that, according to the estimate of one large manufacturer of this class of machinery, probably 90 per cent of all the engines used on farms to-day are of the self-propelling variety.

The work demanded of farm engines is exacting. They must travel over rough country roads, which constantly subject them to severe strains and shocks; must raise steam with any fuel available; and when used to drive machinery must transmit power without any careful setting up. It is therefore necessary to dispense with delicate adjustments. Few classes of machinery require such elastic construction. Their chief use is for hauling the thrashing machine from place to place and furnishing power for its operation in the field. Their thrashing capacity ranges from 60 to 400 bushels of wheat per hour—much depending, however, upon the size and capacity of the thrashing machine. On the Pacific coast, where the traction engine has reached its highest efficiency in farm work, as many as 15 or 20 plows have been drawn by a single engine, tearing up a strip of soil from 20 to 30 feet wide, and sometimes, under favorable circumstances, covering 50 acres per day. Harrowing and seeding are done similarly, and with even more striking speed.

Traction engines are much used in driving portable sawmills, in operating cotton gins, in grading and ditching roads, and in an infinite variety of other work for which a readily portable power is required. While the use of the traction engine is most extensive in farm work, its adaptation to road service in the transportation of heavy loads is so marked that this service promises, with the further development of the engine itself and the improvement of country roads, to increase largely.

The traction engine came into extended use in England before its utility was generally recognized in the United States, but since its introduction into this country it has been materially improved and rendered applicable to a much wider range of work. Its construction has been much improved, its size and power greatly augmented, and its economy of fuel and water notably increased. During the past ten years, in particular, this development has been marked. Formerly a 15-horsepower engine was considered large, but now 25 horsepower is a common size, and engines up to 35 horsepower are being built. About 6 horsepower is the minimum. Some of the 35-horsepower engines weigh about 12 tons, and have rear driving wheels 78 inches in diameter, with tires from 24 to 32 inches in width.

As illustrating the capacity and economy of some of the larger sizes of traction engines used in farm work, the following particulars of one type of engine constructed by one of the largest builders may be of interest. This is a simple engine with a cylinder 11 by 11 inches, carrying 140 pounds of steam, and making 250 revolutions per minute. Although rated at 25 horsepower, this engine will develop nearly 100 brake horsepower. This size of engine is used largely for plowing, for which service the rear wheels are fitted with tires 36 inches wide, while the tires of the front wheels are 18 inches wide. Such an engine easily handles 10 plows 16 inches wide, plowing furrows 6 inches deep at the rate of 2½ miles per hour. Under average conditions of soil this work is done on a fuel consumption of about 1,400 pounds of coal in ten hours. For the same work about 25 horses would be required.

Traction engines formerly were built with only a single cylinder, but in recent years many have been

constructed with two cylinders, the chief advantage being a better balance and therefore a steadier motion. The avoidance of dead centers, and the ability to start slowly and run at any desired speed, are further advantages of no small importance.

Compounding is another new feature introduced during the past five years. The tandem arrangement of cylinders is used almost exclusively. The economy of the compound traction engine is the subject of differences of opinion among makers and users, but some claim for this type a degree of economy comparable to that generally ascribed to the stationary engine of similar principle; its popularity is evidenced by the fact that one large manufacturer built and sold over 2,000 compound engines from 1895 to 1900.

Traction engine boilers are of various types and suited to various kinds of fuel. In the eastern and southern sections of the United States coal is used almost exclusively; in the northern states wood is commonly used; while in the West straw is a common fuel. Petroleum burners have been introduced recently, and the use of crude oil promises to work a great change in the fuel question in some parts of the country. As a rule, fewer tubes are used than is customary in the construction of stationary boilers, and some makers claim advantage for large flues and few tubes, especially when straw is used for fuel. Return-flue boilers also are used to a considerable extent. As in stationary engine practice, there has been a continuous increase in steam pressures, and 150 to 160 pounds represents about the present average.

Power is usually transmitted from the engine shaft to the driving wheels by gears, spur gears being the most common, although in some types of engines bevel gears and a connecting shaft are used. A recent innovation is the use of sprocket chains in place of gears, and great success is claimed for this method of transmission. The elasticity so essential in a machine used for such rough service is accomplished by the use of cushioned gears and spring connections for the driven gear upon the driving wheels. Connection between the engine and the driving gears is effected by means of a friction clutch, of which there are many kinds.

The link motion is used largely in the valve gear, as the ability to reverse readily is an essential qualification. Another form of reversing gear much used has a single eccentric, the strap of which has an extended arm pivoted in a wooden block placed in a guide, the angle of which can be varied so as either to reverse the engine or simply to change the travel of the valve.

Internal-combustion engines, using gasoline, have been adapted for traction purposes in recent years, but thus far they have been used chiefly in small sizes, and have not as yet demonstrated their superiority over steam where greater power is required.

MOTOR VEHICLES.

The term motor vehicles, as used in this report, is intended to embrace all classes of self-propelled carriages, wagons, or trucks used for the conveyance of passengers or for the transportation of merchandise. Of such vehicles, variously designated as automobiles, motor carriages, or autotrucks, 4,192 were constructed in the United States during the census year, and their aggregate value, as reported by the manufacturers, was $4,899,443. These vehicles were constructed in 109 establishments.

As but few of these establishments were devoted exclusively to this work, and as in many cases their operations covered only a portion of the census year or were not continuous during that period, it is impracticable to give any statistics relating to the industry beyond the quantity and value of the product. The industry was too indefinite during the census year, and too essentially in its early stages of development, to give any value to statistics of capital invested, materials, labor, and wages.

In many establishments the building of motor vehicles was largely experimental and merely incidental to much larger operations of different character. To a considerable extent also the manufacture of automobiles consisted chiefly of assembling parts purchased from different makers, a feature of the industry that is assuming greater prominence as the various parts become perfected and their manufacture specialized. In the short time that has elapsed since the first commercial production of automobiles, numerous makes of engines, boilers, underframes, and all accessory parts have been put upon the market. Carriage bodies for automobiles are largely furnished by vehicle manufacturers. With this rapid specialization there are comparatively few establishments in which all the parts of a complete motor vehicle are manufactured.

The large number of motor vehicles made during the census year was the output of factories devoted either chiefly or wholly to this product. Bicycle factories figure largely in the industry, and a considerable number of automobiles were constructed by carriage builders. A great many small machine shops each built from one to half a dozen motor vehicles, mostly, however, in an experimental way.

The 4,192 motor vehicles constructed during the census year were divided as follows: Steam carriages, 1,681, valued at $1,147,927; electric vehicles, 1,575, valued at $2,873,464; automobiles using hydrocarbon motors, 936, valued at $878,052.

Table 7 shows the number and value of each type of motor vehicle manufactured in various states and in the entire country during the census year 1900.

TABLE 7.—MOTOR VEHICLES: NUMBER AND VALUE, BY STATES, 1900.

STATES.	Number of establishments.	TOTAL.		STEAM.		ELECTRIC.		HYDROCARBON.	
		Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
United States	109	4,192	$4,899,443	1,681	$1,147,927	1,575	$2,873,464	936	$878,052
California	4	6	9,350					6	9,350
Connecticut	4	911	1,899,592	84	59,250	730	1,679,397	97	160,945
Illinois	6	671	758,777	16	13,600	604	699,177	51	46,000
Indiana	4	55	61,915			22	24,415	33	37,500
Maine	3	13	13,100	1	600			12	12,500
Maryland	3	25	55,500	6	7,500	11	42,000	8	6,000
Massachusetts	17	1,198	789,892	1,106	724,750	4	7,500	88	57,642
Missouri	3	28	29,600			1	2,200	27	27,400
New Jersey	8	248	452,655	34	26,755	129	299,050	85	126,850
New York	21	624	471,547	376	266,822	21	23,025	227	181,700
Ohio	8	188	240,600			42	79,200	146	161,400
Pennsylvania	13	74	73,450	39	34,650	9	15,000	26	23,800
Wisconsin	6	124	30,900	15	11,250			109	19,650
All other states	9	27	12,565	4	2,750	2	2,500	21	7,315

Although spasmodic efforts were made during a period of nearly seventy-five years to produce a practical self-propelled vehicle for road use, it is only within the past ten years that a successful motor carriage has been evolved, and it is even more recently that the construction of such vehicles has become an established industry. But little attention was given to the problems involved in automobile construction in the United States until the possibilities of the motor car had been demonstrated by the building of several successful types in France; but the awakening of interest in self-propelled vehicles in this country has been followed by the same progress that has characterized the development of many other American industries. The improvement of the storage battery for a time centered attention upon the possibilities of electricity as a motive power for automobiles, but the efforts of the many inventors who attacked the problem called into use all available forms of power, and there has been notable progress along several distinct lines. Few industries involving such a degree of mechanical skill and ingenuity and presenting so many new problems for solution have developed so rapidly, both in ideas and in commercial results. Notwithstanding the large number of motor vehicles constructed during the census year, the industry was still in the experimental stage, and its development promises to be as remarkable as the expansion of the bicycle industry.

Motor vehicles are of three distinct types or classes:

1. Steam carriages.
2. Hydrocarbon automobiles.
3. Electric vehicles.

Each of these types is a strong claimant for public favor, and each has evolved rapidly from the experimental stage to a practical vehicle, capable of continuous operation on ordinary roads. As each of these classes of motor carriages has its points of merit and its ardent advocates, it is not within the province of this report to pass judgment upon any of them or to determine which is rightly entitled to claim superiority. A brief description of the essential features of the several types, and some account of the mechanical progress which their development has stimulated, will suffice as an outline of the early stage in what promises to become a great industry.

The earliest attempts to construct motor vehicles were based upon the use of steam as the motive power, and in the evolution of this type of carriage to its present form, both boiler and engine have been reduced to a compact form and light weight which are a triumph of mechanical skill and ingenuity. Automobile boilers are of many forms, embodying the principles of several types of stationary steam generators. Vertical fire-tube boilers are chiefly used, and several forms of water-tube boilers, in the designing of which a large amount of ingenuity appears to have been expended, are also in use In the construction of fire-tube boilers both steel and copper are used, not only for shells but also for tubes.

In several of the popular makes of fire-tube automobile boilers the lengths range from 13 to 18 inches and the diameters run from 14 to 16 inches. As a fair specimen of these boilers, one that is used very largely has a copper shell 14 inches high and 14 inches in diameter, and about 300 half-inch copper tubes. Such a boiler as this has a heating surface of about 42 square feet, and under proper conditions will develop between 3 and 4 horsepower. The shell of this boiler is a section of seamless drawn-copper tube, with ends flanged outwardly and riveted to the flue plates. The copper tubes also are cold drawn and seamless, and sixty-five one-thousandths or about one-sixteenth of an inch in thickness.

Another boiler of similar size and style is made of five thirty-second inch fire-box steel, with a heavily riveted double-strap butt joint. Still another has for a shell a piece of seamless drawn-steel tubing. In some boilers the flue plates are flanged outward and riveted inside the shell; in others flat flue plates are riveted on the outflanged ends of the shells, and then again both of these forms of construction are used in the same boiler. Still another method of construction is the use of a seamless pressed-steel shell and head all in one piece, the other end being flanged and riveted inside the shell. This gives only one riveted joint in the

whole boiler. A characteristic feature of a type of fire-tube automobile boiler that is much used is the false top which is placed above the water level to form a dry steam chamber.

The working steam pressure of these classes of fire-tube boilers ordinarily ranges from 150 to 180 pounds to the square inch, while for some of them the makers claim safety at five or six times the working pressure.

Of water-tube boilers the types are numerous, embracing straight, horizontal tubes connecting two narrow, upright heads, pipe coils in great variety, vertical, spirally curved or inclined tubes, suspended U tubes, and many other modifications or combinations of these forms of construction.

The chief advantages claimed for water-tube boilers for motor vehicles are: compactness and light weight, rapid generation of steam, ability to use higher pressure, and greater safety due to absence of pressure upon any large surfaces. The respective merits of fire-tube and water-tube boilers for automobile use, however, are subject to the same differences of opinion that manifest themselves among the friends of similar types of stationary boilers.

Liquid fuel is used in nearly all steam-motor vehicles. Gasoline is most commonly used in preference to kerosene, because of the greater ease with which it is vaporized, and the more complete combustion which takes place. Kerosene requires larger and more complicated burners, which are more difficult to regulate than those used for gasoline.

The principles involved in the use of gasoline are: The storage, in a tank under air pressure, of a supply sufficient to feed the oil to the burner as desired; a heated vaporizing tube, coil, or cell in which the liquid is turned into vapor; and a burner by which the vaporized gasoline mixed with air is consumed and the flame applied to a large area of the heating surface of the steam generator. The vaporization of the fuel is effected by the heat of the flame itself when once ignited, but when the burner is started cold, an auxiliary vaporizer is required for the initial ignition of the fuel, and for this purpose a variety of devices are used. Sometimes a U-shaped tube is used for this purpose, being heated by a torch or any convenient fire and then temporarily inserted in the burner, its hot surface giving sufficient temporary gasification of the fuel to permit its ignition, and thereby starting the regular vaporizer. A drip cup, in which a small quantity of gasoline is ignited, is also used to heat the vaporizing tubes in starting the fire, and several other devices of greater or less convenience are used for the same purpose.

The common type of gasoline burner is a hollow circular plate with numerous tube-lined perforations. Around or between these tubes are small holes opening into the hollow interior of the plate. The mixture of air and vaporized gasoline enters the hollow plate and is ignited as it escapes through the small perforations. The further supply of air necessary for perfect combustion comes through the tubes which pass through the plate, and mingles with the burning gasoline at the point of ignition. By this type of burner an intense heat is created over a large surface, and steam can be generated quickly and continuously.

Of steam engines for automobile propulsion there is a great range in style and size. There are, however, three principal types or classes which include most of the engines that have demonstrated their practical utility. These may be designated as single and double acting, and compound.

The most popular type is the double-acting engine with 2 cylinders, a machine that has been brought to a high state of efficiency and reduced to very compact form. These engines operate vertically and are placed close to the boiler, to the shell of which they are sometimes attached. A double steam chest is usually placed between the 2 cylinders. The driving sprocket is in the middle of the shaft, the eccentrics on either side, and the cranks at the ends. Nearly all engines of this type have the link motion, and D slide valves are most commonly used, although some engines have piston valves. The boiler feed pump is usually connected with one of the crossheads. In one make of steam carriage of this class the engine has cylinders $2\frac{1}{2}$ inches in diameter, with a stroke of 4 inches, and with a speed of 300 to 400 revolutions 4 to 5 horsepower is developed. Another engine has cylinders of 3 inches diameter and 4 inches stroke; another has cylinders $2\frac{1}{8}$ by 3 inches, and is rated at 4 horsepower; still another has cylinders $2\frac{1}{2}$ by $3\frac{1}{2}$ inches, and yields about $4\frac{1}{2}$ horsepower.

Some of the makers inclose the engines in tight metal casings to protect the working parts from dust and dirt.

The single-acting steam engine, which has come into use for motor vehicles, has two or more cylinders, in which impulse is given in only one direction, one end of each cylinder being open. In some respects this type resembles the gasoline engine, chiefly in its piston, which is of the trunk type—a hollow cylinder open at one end. A well-known French engine of this kind is built with from 2 to 6 cylinders with cam-operated poppet valves.

A more advanced development of this type is found in an American engine with 4 single-acting cylinders, the steam inlet and exhaust being controlled by a single rotary cylindrical valve. The piston rods of these 4 cylinders connect in pairs with 2 crank shafts, both of which are geared to the main driving shaft of the vehicle.

The chief advantage of the single-acting type of steam engine is simplicity of construction, the absence of stuffing boxes and crossheads, and the simple form of valve, which reduces the working and wearing parts to a minimum. As steam is used only on one-half

of the stroke—or, more properly, on the alternate strokes—a four-cylinder engine of the single-acting type is ordinarily rated at about the same power as a two-cylinder double-acting engine of similar dimensions.

Compound steam engines have been successfully adapted to automobile propulsion, the two-cylinder cross compound being the type used for this purpose. These are constructed in a variety of styles, the vertical type being most used, although horizontal engines are introduced on some classes of heavy motor vehicles.

Apart from the more economical use of steam which a compound engine permits, the reserve power of these engines constitutes one of their chief advantages in automobile work. When there is necessity for a sudden increase of power beyond the normal output of the compound engine, direct steam can be admitted into both high and low pressure cylinders, and the engine then becomes a two-cylinder single-expansion engine. This use of an intercepting valve which will admit direct steam into the low-pressure cylinder is a common feature of compound automobile engines, and one which has contributed largely to their success.

The hydrocarbon motor, or gasoline engine, has proved to be one of the most popular and efficient powers for driving automobiles, and the rapid evolution of this machine is one of the interesting phases of the development of the motor vehicle.

Simplicity in construction, higher efficiency obtainable by the direct application of the energy contained in the fuel, and the use of more powerful motors than other forms permit under given conditions are some of the advantages claimed for internal-combustion engines for automobile use. In their earlier forms hydrocarbon motors were open to many objections, but most of these have been removed in the rapid progress that has been made within a period of two or three years. The weight and dimensions of the engines have been materially reduced, and the excessive vibration of the earlier single-cylinder motors has disappeared in the multi-cylinder machines, with more perfectly balanced moving parts. The increasing use of this class of engines, particularly where high power and speed are required, attests the popularity of this form of motor.

Gasoline is the fuel used almost exclusively in the United States for internal-combustion automobile engines, although several motors using kerosene have been produced, with claims for all the points of advantage ascribed to gasoline engines.

There is a wide range in the size and construction of gasoline engines, from the single-cylinder motor of simplest form to the three or four cylinder type of complicated construction, and from the small cycle motor to powerful racing engines of 40 horsepower and upward. In no feature of the motor vehicle industry is there such a diversity of types as in hydrocarbon motors. Within the limits of such a report as this it is possible only to mention briefly a few of the characteristic features of this system of propulsion.

The essential features of the internal-combustion automobile engine are the carburetter, which vaporizes the gasoline, mixes it in suitable proportions with air, and feeds the explosive mixture to the cylinder; the cylinder itself, in which the energy of the explosion is transformed into motive power; and the ignition device, by which the charge of mixed gasoline vapor and air is fired.

The carburetters, or vaporizers, are of several types, employing in each case different principles. The early carburetter of Daimler, to whom the automobile industry is chiefly indebted for the use of liquid fuel in gas engines, was a simple device in which air was drawn through a small vessel of gasoline, thus taking up sufficient vapor to form an effective explosive mixture. The carburetters now mostly used, however, accomplish the vaporization of the gasoline by means of a needle valve through which a fine spray of the liquid is drawn by the inrushing air following the suction stroke of the piston in the cylinder of the engine. The supply of gasoline through this needle valve is regulated by a float attached to the valve spindle and controlled by various forms of springs and weighted levers.

Various devices have been designed as substitutes for the complicated float-feed carburetters, among them being simple mixing valves, in which the suction of the air drawn into the engine cylinder raises a spring-balanced mushroom valve and admits a spray of gasoline, which is carried by the air into the cylinder. Another type of carburetter of simple form filters the air supply through successive disks of wire gauze upon which gasoline is allowed to drip. The tendency appears to be toward the simplification of the carburetter and the substitution of devices of less delicate mechanism but equal efficiency of operation.

Gas engines used on motor vehicles are chiefly of the 4-cycle type, in which 4 strokes, or 2 complete revolutions, are necessary for the 4 successive acts which constitute a complete operation. The first stroke draws into the cylinder a supply of gas, the second stroke compresses this gas, on the third stroke the charge explodes and gives impulse to the piston, and the fourth stroke expels the products of combustion from the cylinder. Several 2-cycle engines are made which perform all of these acts in the 2 strokes or 1 revolution, but thus far these engines have not reached the point of efficiency demonstrated for the 4-cycle type. The disadvantage of receiving impulse during only one stroke in four in the 4-cycle engine has been overcome by providing 2, 3, or even 4 cylinders, so that more frequent impulse and more regular and uniform operation are assured.

Among the typical arrangements of cylinders and driving mechanism may be mentioned the following:

A single-cylinder horizontal engine, transmitting its power direct to the driven axle by a chain and sprocket.

A horizontal double opposed-cylinder engine, i. e., two cylinders placed on opposite sides of the crank shaft.

A vertical engine of 2 or more cylinders with a crank shaft at right angles to the driven axle, and transmitting power either by bevel gears direct to the axle or by bevel gears and chain and sprocket.

A vertical engine of 2 or more cylinders with crank shaft parallel to the driven axle, and driving by a chain and sprocket.

While these constitute the chief types of automobile gasoline engines, there are numerous modifications and variations of the arrangements indicated.

The ignition device by which the fuel charge is exploded in the cylinder is of several distinct types, which may be grouped under the two general classes of hot tubes and electric sparkers. The hot tube consists of a tube of metal and porcelain, one end opening direct into the cylinder, and heated by an external gas flame. The gas admitted into the cylinder enters this incandescent tube, is ignited, and explodes the entire charge in the cylinder.

The electric spark, however, is by far the most common means of ignition, and current for this purpose is furnished either by a primary battery or by a small dynamo or magneto-generator driven by the motor engine of the vehicle.

There are numerous other details of hydrocarbon motor vehicles that are of interest and importance, and in the development of which rapid progress has been made since the manufacture of automobiles was undertaken on a commercial scale in the United States; among which might be mentioned the various devices for reversing the power and changing speed, the different methods of cooling cylinders by air and by water-jackets, exhaust mufflers, etc., but their consideration is not called for in a report which is intended to deal with only the outlines of the industry.

The possibilities of the electrical propulsion of motor vehicles have received a very large share of the attention which has been centered on the various problems of the automobile, and some of the earliest successful American motor carriages were driven by electricity. Safety, freedom from noise and odor, ease of control, great flexibility of the power, and simplicity of the mechanical features of the electric automobile are recognized advantages over other methods of propulsion; but the limited range of travel, due to dependence upon charging stations, has tended to restrict the use of electric vehicles to strictly local service. Where only short runs are to be made and high speed is not a consideration, or where the service is intermittent, electricity has proved to be an ideal power for automobiles, but their limitations have practically excluded this class of vehicles from the touring field, where the use of the automobile is becoming more and more popular.

The storage battery, which is the sole dependence of the electric vehicle, has been much improved since its first application to this work, and recent developments point to even more marked advancement in the direction of lessened weight and cost, greater capacity within the limits of the vehicle, and decreased cost of operation, all of which promise a wider field and larger use for this power. If the increasing use of electric vehicles shall lead to the multiplication of charging stations, the limits of their usefulness will be still further extended.

STEAM ROAD ROLLERS.

The steam road roller, which is really a modified form of traction engine, has come into extended use in the United States as a result of the improvements in roadmaking. Road rollers were imported from England about twenty-five years ago, but are now manufactured in this country in sufficient quantities to meet all demands. During the census year 130 steam road rollers, valued at $345,881, were manufactured by 8 establishments, located in New Jersey, New York, Ohio, and Pennsylvania.

While the original type of English road roller, with its two large wheels at the rear and a single small wheel in front, has been retained and greatly improved by American manufacturers, a new type has been evolved to meet the lighter requirements of street paving. In this type of machine the rolling surface consists of a single large, hollow drum. The frame of the machine is carried upon the projecting axles of this drum, and the weight of the engine and boiler is divided between this large drum and a smaller one, which is pivoted for steering purposes. These rollers are made in a wide range of sizes and weights, and the work for which they are generally used is quite distinct from that of the larger and more massive rollers used chiefly for heavy highway work.

CARS, STEAM RAILROAD.

CARS, STEAM RAILROAD.

By GEORGE A. HUTCHINS.

HISTORICAL AND DESCRIPTIVE.

A report of the manufacture of cars and general shop construction and repairs by steam railroad companies, and of steam railroad cars, not including those made by railroad companies, should be prefaced by a brief account of the marvelous growth of that industry, effected by invention, experience, and changed requirements. The development and importance of railroads in the United States have been commensurate with the economic growth and political power of the nation.

The railroad is an important factor in human progress, and has promoted the unification of the nation, by bringing men more closely together, and by furnishing the means of satisfying their wants with the varied treasures and products of the earth. Indeed, this vast network of railways has become the arterial system of national life, carrying to and fro the commerce of the nation and making the world one vast market. Every sphere of the social, industrial, and political world reflects the marvelous achievements of this agent of transportation.

The American railroad car is the outcome of a remarkable yet gradual development. Invention has followed invention, discovery has succeeded discovery, until, from the old-fashioned stage-coach placed on an unstable frame, with four flanged wheels, and heated with a warming pan, has been developed the luxury of the private car of to-day.

The railway was the invention of England, at that time leader of the world in the knowledge of the useful arts. There the power of steam was first utilized and first applied to locomotion. The use of cars for transportation can be traced as far back as the year 1734, when Ralph Allen constructed a stone car which was clearly the forerunner of the freight car of to-day. The first passenger car was constructed in 1814. It consisted simply of the body of a stage-coach mounted on a wooden frame with flanged wheels. It was natural that the stage-coach should be selected as a model, for in it the conveniences of travel had been most highly developed, and it was also a matter of economy, for the stage owners became railroad promoters and transformed their displaced vehicles into railway coaches.[1]

[1] One Hundred Years of American Commerce, Vol. I, page 113.

In 1825 the Stockton and Darlington Railway of England was opened, and trains of coal cars with one passenger coach were run regularly. The coach was well patronized for a time, but when the novelty wore off the faster stage-coaches carried the passengers.

The railway system which had its origin in England was quickly adopted in the United States. In 1827 a crude railway was constructed between Quincy and Boston for the purpose of transporting granite for Bunker Hill monument. The Delaware and Hudson Canal Company, in 1829, opened a road from Honesdale, to Carbondale, Pa., a distance of 16 miles, over which the first locomotive was run in this country. About the same time the South Carolina Railroad was begun. The first division of the Baltimore and Ohio road was opened in 1830. It was at first operated by horsepower, but steam locomotion was substituted in 1832. As early as 1840 a well defined system of railroads had been established in New England, and prior to 1845 the Pennsylvania and Reading was in operation, running to the coal fields of Pennsylvania. By means of these and subsequently constructed lines, the Atlantic states were put in close communication with the vast mineral supplies upon which is based the industrial and commercial development of the country.

In America the changes in car construction have been marked. The first important modifications were made necessary by the speed developed in the locomotive. With increased speed, the light, cast-iron wheels first demanded attention. The shape of the tread and flange was developed by Knight. Edgar and Winans developed the "chilled" features, and Davis altered the disposition of the metal and introduced into the cast-iron wheel a wrought-iron ring, thus perfecting the chill and strengthening the wheel. The light, unsteady cars easily adapted themselves to the unevenness of the road, but the new conditions of speed demanded a stronger rail, a more stable car frame, a flexible truck, and improvement in brakes. Indeed, the development of the locomotive has necessitated a scientific development of the entire railway system.

Adaptation to circumstances has changed the rail from the rude wooden stringer with a piece of strap iron spiked along the top, to the present refined section of

steel, whose every dimension, angle, and curve are exactly suited to the tremendous strain it has to bear.

In 1833, Ross Winans, of Baltimore, built three long cars, each capable of seating 60 passengers. With these originated the American passenger car of the present day, and to Winans is due the adoption of cars with longer and more stable frames, having bogie or swiveling four-wheeled trucks at each end. These cars were a marked improvement upon the old coach, yet they have been aptly called "combinations of inconveniences." Until late in the fifties the springs were made of india rubber. These were unsatisfactory because of their tendency to harden with age, and gradually they were replaced by steel springs. The cars had no raised roof. The windows were glazed in solid without any sash, because of the fear that accidents would surely follow should they be opened. The methods of ventilation supplied an abundance of dust and cinders. The lighting was poor. The heat was supplied by cast-iron stoves which broiled those who sat near them, while they failed to warm those who did not.

The proper ventilation of cars is a problem that has not yet been satisfactorily solved. The successful system must at all times supply a sufficient quantity of air, without creating a draft, lowering the temperature, or admitting dust, cinders, smoke, or gases. Probably the best system provides for the admission of air from the exterior of the car to steam pipes where it may be heated before it reaches the interior.

The demand for adequate lighting has resulted in the adoption of a number of different systems. Electric lights are clean, cool, safe, and very desirable, but in their present stage of development they are too expensive for general use. The Pintsch system of lighting, which uses a high quality of oil gas, furnishes a desirable light and one which works well practically. It is safe, clean, of nominal cost, and in case of collisions or derailment does not furnish fuel to the flames.

Many of the dangers of the old platform, buffer, and coupler were eliminated by the patents of Colonel Miller, in 1867, but it was not until after the dining car was introduced that the importance of a safe, covered passageway came to be fully recognized. This need was met by Mr. Pullman in his "vestibuled train," which not only provides for the convenience and safety of the passengers while going from one car to another, but at the same time furnishes a buffer extending from platform to roof, thus producing one of the best anti-telescoping features and greatly lessening the danger to human life in case of collision. The brake, with its wonderful development from the old hand brake to the air brake patented by Westinghouse; and the modern coupler, which is the result of countless experiments and over 6,500 patented inventions, have eliminated many of the dangers of the old methods and devices. Each year shows a marked improvement in features contributing to the comfort and safety of the passenger, and in providing cheap, speedy, regular, and adequate transportation in cars especially adapted to the needs of the public.

In the construction of freight cars, the change has been equally marked. Many devices for the protection of life and property have been readily adopted. There is a general tendency toward specialization. No longer are grain, beef, fruits, and oil shipped in the same kind of cars. The transportation of various kinds of products has called into being cars peculiarly adapted to each class of freight, so that scores of different kinds of cars are now constructed to meet the demands of shippers. Perishable articles are now conveyed in cars which insure their preservation.

The tendency of the changes in the modern freight car is toward increased weight, strength, size, and convenience. In developing these qualities steel has been used in some cases to replace wood, and, in other cases, steel plates have been used to strengthen wooden construction. Ten years ago the steel car industry was in its infancy, but its growth during the decade has been phenomenal. At present the Pressed Steel Car Company, of Pittsburg, Pa., using in the manufacture of its product over 1,600 tons of steel a day, is the largest single consumer of steel in the world. The changes have resulted in an increased carrying capacity of the cars, a decrease in the relative dead weight moved, and a better paying load. Marked advances in the average capacity per car have been made in the last few years. The normal capacity in the sixties was about 15,000 pounds. The capacity increased to 28,000 in 1873; to 40,000 in 1875; to 60,000 in 1885; to 70,000 in 1895; while at the present time cars with a capacity of 80,000 to 100,000 pounds are in every-day use.

The economy of heavy loading has been indisputably proved. According to figures of the Industrial Commission, the average train load for the United States, as a whole, increased from about 175 tons of paying freight in 1890 to 243.5 tons in 1899.

The movement toward combination began among the railroads earlier than in industrial lines, and made possible "through trains" by which goods could be shipped long distances rapidly and at low rates.

The changes that have taken place in business methods have been largely due to improved methods of transportation. The traffic of railroads has become the greatest single business ever carried on in the annals of the world, all other business contributing to swell its volume. It has become one of the greatest factors in changing the conditions of supply and demand and revolutionizing the habits and aspirations of mankind.

The service of railroads in the United States may perhaps be best shown by the statement that during 1900 the passenger mileage amounted to upward of 1,600,000,000 miles, a journey of 211 miles per capita for the population of the country. The ton mileage of freight amounted to 141,599,000,000 tons; that is, the

freight service of the country was equivalent to the carriage of this amount of freight 1 mile.[1]

The census year was characterized by extraordinary activity in construction. Table 15 shows that in the car department 144,505 cars were constructed for steam railways, and 8,376,769 cars were repaired. In the motive department of the railroad repair shops 272 locomotives were built, and 1,375,265 were repaired. The number of repairs shown for cars and locomotives may include several repairs on the same car or locomotive. It must not be inferred that the number of single cars and locomotives reach so large a total. The total value of all new equipment manufactured and work necessary to keep the vast amount of rolling stock in repair during the year was $308,748,457.

A study of economic history and industrial progress leads to the conclusion that in no other country has the development of the car industry been more rapid than in the United States. Transportation of persons and property with ease, speed, and safety has ever been the aim of railroad promoters and the demand of the American people, and as a result, the railway system of the United States to-day is the most progressive and among the most perfect in the world.

The statistics presented in the following tables embrace the operations of establishments engaged in the construction of "cars, steam railroad, not including operations of railroad companies," and "cars and general shop construction and repairs by steam railroad companies," during the census year. In these tables the figures showing the manufacture of street cars, whether horse, cable, or electric, appear only where they were constructed as a by-product in large plants engaged in the manufacture of steam railway cars. In the motive power and machinery department, the report of the number of locomotives built and repaired does not include the operations of the regular locomotive works in the country, but only those constructed and repaired by the railroad companies in their repair shops. The report of the bridge and building department includes the shop work only.

In reporting the operations of steam railroad companies, where cars were constructed and repaired for the use of the corporation operating the plant, the value of products equals the cost of labor, materials, and miscellaneous expenses incident to the manufacture of same. It was deemed inexpedient to estimate the market value of the cars constructed for, and repair work done on cars owned by the railroad companies operating their own plants; therefore an increase over cost is shown only on cars constructed for other railroad companies or contract work done for other establishments. Table 1 presents a combined summary for the industries—cars, steam railroad, not including operations of railroad companies, and cars and general shop construction and repairs by steam railroad companies.

[1] Report of Industrial Commission, Vol. XIX, page 262 f.

TABLE 1.—CARS, STEAM RAILROAD: COMBINED SUMMARY FOR THE UNITED STATES, 1900.

	Total.	Cars, steam railroad, not including operations of railroad companies.	Cars and general shop construction and repairs by steam railroad companies.
Number of establishments	1,361	65	1,296
Capital:			
Total	$207,904,125	$88,323,852	$119,580,273
Land	$21,283,501	$4,306,808	$16,976,693
Buildings	$45,860,155	$9,229,810	$36,630,345
Machinery, tools, and implements	$37,987,255	$9,538,673	$28,448,582
Cash and sundries	$102,773,214	$65,248,561	$37,524,653
Salaried officials, clerks, etc., number	8,462	1,366	7,096
Salaries	$7,748,379	$1,538,132	$6,210,247
Wage-earners, average number	207,105	33,453	173,652
Total wages	$113,049,623	$16,987,294	$96,062,329
Miscellaneous expenses	$9,131,216	$2,837,229	$6,293,987
Cost of materials used	$171,281,760	$61,742,747	$109,539,013
Value of products[1]	$308,748,457	$90,510,180	$218,238,277

[1] Including custom work and repairing by steam railroad companies.

The combined summary in Table 1 shows that in the census year there were 1,361 establishments, with a capital of $207,904,125, employing 215,567 wage-earners and salaried officials, with wages and salaries aggregating $120,798,002. The materials used cost $171,281,760 and the value of products aggregated $308,748,457.

Of the 1,361 establishments in the combined industry, 1,296, or 95.2 per cent, were operated by railroad companies. These establishments reported a capital invested of $119,580,273, or 57.5 per cent of the capital of the combined industry. Of 8,462 salaried officials, 7,096, or 83.9 per cent, were employed in shops operated by railroad companies, and received $6,210,247, or 80.1 per cent of the total salaries paid in this industry.

The total number of wage-earners, 207,105, received $113,049,623. There were 173,652 wage-earners employed in railroad repair shops, who received $96,062,329; that is, 83.8 per cent of the total number of wage-earners engaged in this industry were employed by establishments operated by railroad companies, and received 85 per cent of the total wages.

Of the total cost of materials, $109,539,013, or 64 per cent, was reported for establishments operated by railroad companies, and of the $308,748,457 reported for the total value of the product, $218,238,277, or 70.7 per cent, was reported for railroad repair shops.

Steam railroad companies engaged in the construction and repair of cars in 1900, had an average capital of $92,191, with 139 salaried officials and wage-earners, and salaries and wages aggregating $78,914. The cost of materials for each plant averaged $84,521, and the average product was $168,394.

The average capital per establishment in plants not operated by steam railroad companies, in 1900, was $1,358,828. The number of wage-earners and salaried officials per establishment was 536, with wages and salaries aggregating $285,007. The cost of materials per establishment was $949,888, and the value of products was $1,392,464.

The amount of capital per wage-earner, as deduced from the report of railroad repair shops, was $689, and

in car construction the reports show $2,640 capital per wage-earner. This difference is due mainly to the fact that car-construction plants not operated in connection with railroad companies usually have more cash on hand, bills receivable, unsettled ledger accounts, stock in process of manufacture, and finished products on hand than does the plant whose product is immediately converted to its own use. The cost of materials and the value of the product per wage-earner for railroad repair shops were $631 and $1,257, respectively, while plants not operated by railroad companies reported $1,846 for the cost of materials used, and $2,706 for value of product per wage-earner.

Table 2 presents a comparative summary of the combined industries, as reported at the several censuses from 1850 to 1900, inclusive, with the per cent of increase for each decade.

Since the beginning of the second quarter of the last century, the manufacture and repair of cars for steam railways has developed until it produces an annual prod-

TABLE 2.—CARS, STEAM RAILROAD: COMPARATIVE SUMMARY, 1850 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

	DATE OF CENSUS.						PER CENT OF INCREASE.			
	1900	1890	1880[4]	1870	1860	1850	1890 to 1900	1870 to 1890	1860 to 1870	1850 to 1860
Number of establishments	1,361	787	.....	170	62	41	72.9	362.9	174.2	51.2
Capital	$207,904,125	$119,833,687	.....	$16,632,792	$2,953,717	$896,015	73.5	620.5	463.1	229.7
Salaried officials, clerks, etc., number	8,462	[3]2,661	.....	[1]	[1]	[1]	218.0	.....	.....	.....
Salaries	$7,748,379	[3]$2,343,944	.....	[1]	[1]	[1]	230.6	.....	.....	.....
Wage-earners, average number	207,105	137,986	.....	15,931	3,179	1,554	50.1	766.1	401.1	104.6
Total wages	$113,049,623	$76,290,262	.....	$9,659,992	$1,237,452	$664,708	48.2	689.8	680.6	86.2
Men, 16 years and over	206,345	137,352	.....	15,690	3,172	1,554	50.2	775.4	394.6	104.1
Wages	$112,842,153	$76,127,521	.....	[1]	[1]	$664,708	48.2	.....	.....	.....
Women, 16 years and over	471	382	.....	20	7	.....	23.3	1,810.0	185.7	.....
Wages	$138,878	$114,939	.....	[1]	[1]	.....	20.8	.....	.....	.....
Children, under 16 years	289	252	.....	221	.....	.....	14.7	14.0	.....	.....
Wages	$68,592	$47,802	.....	[1]	.....	.....	43.5	.....	.....	.....
Miscellaneous expenses	$9,131,216	$1,725,113	.....	[2]	[2]	[2]	429.3	.....	.....	.....
Cost of materials used	$171,281,760	$111,236,012	.....	$18,117,707	$1,841,344	$1,393,676	54.0	514.0	883.9	32.1
Value of products[5]	$308,748,457	$199,545,435	.....	$31,070,734	$4,302,613	$2,493,558	54.7	542.2	622.1	72.5

[1] Not reported separately.
[2] Not reported.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table.
[4] No comparison can be made for 1880.
[5] Including custom work and repairing by steam railroad companies.

uct to the value of over $300,000,000. No comparison can be made with 1880, as the operations of establishments by railroad companies were not reported at that census. The fact that the classification has been slightly changed must also be taken into consideration in comparing the reports of 1890 and 1900 with the reports of previous censuses. The summary for 1870 includes the construction and repair of street railway cars. The Eleventh and Twelfth censuses include the construction of street railway cars only when they are manufactured as a by-product in large steam railway car construction plants. There were separate classifications for the construction and repair of street railway cars in 1890 and 1900. The first census at which the statistics of the manufacture and repair of cars were returned with sufficient accuracy and detail to justify a comparison, was that of 1850. In that year 41 establishments were reported, and in 1860 the number was increased to 62, an increase of 21 establishments, or 51.2 per cent. The capital increased $2,057,702, or 229.7 per cent, and during the decade the value of the product increased $1,809,055, or 72.5 per cent. From 1860 to 1870 there was an increase of 109 establishments, or 174.2 per cent, while the capital increased $13,669,075, and the value of the product increased $26,768,121. From 1870 to 1890 the number of establishments increased 617; the capital, $103,200,895; the cost of materials increased $93,118,305; and the value of the product advanced $168,474,701.

During the last decade the car industry has shown another marked advance. In 1890 there were 787 establishments, with a capital of $119,833,687, and an aggregate product of $199,545,435; in 1900 there were 1,361 establishments, with a capital of $207,904,125, and an aggregate value of product of $308,748,457; an increase of 574, or 72.9 per cent, in the number of establishments, $88,070,438 in capital, and $109,203,022, or 54.7 per cent, in value of product. The total number of wage-earners has increased from 1,554, with wages aggregating $664,708, in 1850, to 207,105, with wages aggregating $113,049,623, in 1900. Of the total number of employees in this industry in 1900, 206,345, or 99.6 per cent, were men over 16 years of age. Thus Table 2 shows the remarkable growth of this industry during the past half century. The striking increase in the number of establishments, from 41 in 1850 to 1,361 in 1900, an increase of 1,320, has not kept pace with the increase in capital, wage-earners, wages, materials, and product during the same period.

The following are the averages per establishment for 1850 and 1900, respectively: Capital, $21,855 and $152,758; wage-earners, 38 and 152; wages, $16,212 and $83,064; cost of materials, $33,992 and $125,850; and product, $60,818 and $226,854.

CARS, STEAM RAILROAD, NOT INCLUDING THE OPERATIONS OF RAILROAD COMPANIES.

Table 3 presents a comparative summary, 1880 to 1900, with percentages of increase.

TABLE 3.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES: COMPARATIVE SUMMARY, 1880 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

	DATE OF CENSUS.			PER CENT OF INCREASE.	
	1900	1890	1880	1890 to 1900	1880 to 1890
Number of establishments	65	71	130	[1]8.5	[1]45.4
Capital	$88,323,852	$43,641,210	$9,272,680	102.4	370.6
Salaried officials, clerks, etc., number	1,366	[2]708	([3])	92.9	.....
Salaries	$1,598,132	[2]$759,702	([3])	102.5	.....
Wage-earners, average number	33,453	31,354	14,232	6.7	120.3
Total wages	$16,987,294	$16,076,829	$5,507,753	5.7	191.9
Men, 16 years and over	33,136	30,904	13,885	7.2	122.6
Wages	$16,902,543	$15,966,188	([3])	5.9	.....
Women, 16 years and over	107	254	13	[1]57.9	1,853.8
Wages	$32,452	$75,691	([3])	[1]57.1	.....
Children, under 16 years	210	196	334	7.1	[1]41.3
Wages	$52,299	$34,950	([3])	49.6	.....
Miscellaneous expenses	$2,337,229	$1,725,113	([3])	64.5	.....
Cost of materials used	$61,742,747	$44,674,486	$19,780,271	38.2	125.9
Value of products	$90,510,180	$70,083,737	$27,997,591	29.1	150.3

[1] Decrease.
[2] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. (See Table 9.)
[3] Not reported separately.

One of the most notable features in the above table is the decrease in the number of establishments, caused by the combination or consolidation of a number of plants under a single corporate management. While the number of establishments had decreased 50 per cent from 1880 to 1900, the capital increased more than eightfold, or $79,051,172, and the value of the product increased $62,512,589, or 223.3 per cent, during the same period. In 1880 there were 130 establishments, and in 1890 the number had been reduced to 71; a decrease of 59 establishments, or 45.4 per cent, during the decade. From 1890 to 1900 there was a decrease of 6 establishments, or 8.5 per cent. The capital increased from $9,272,680 in 1880 to $43,641,210 in 1890, and in 1900 the aggregate capital was $88,323,852, an increase of $44,682,642, or 102.4 per cent, over 1890. The amount paid to wage-earners showed an increase of $10,569,076, or 191.9 per cent, from 1880 to 1890, and a further increase of 5.7 per cent during the last decade, while the number of wage-earners increased 120.3 per cent from 1880 to 1890 and 6.7 per cent during the succeeding decade.

In comparing the increase in the cost of materials used and the value of the product, we find that from 1880 to 1890 the cost of materials increased $24,894,215, or 125.9 per cent, and the value of the product increased $42,086,146, or 150.3 per cent. In 1890 the cost of materials was $44,674,486, and in 1900 it was $61,742,747, an increase of $17,068,261, or 38.2 per cent. The value of the product increased from $70,083,737 to $90,510,180, or 29.1 per cent. From 1880 to 1890 the number of women employed increased from 13 to 254, but the next decade showed a decrease from 254 to 107, or 57.9 per cent. The number of children employed decreased 41.3 per cent from 1880 to 1890. During the last decade the number of children employed increased from 196 in 1890 to 210 in 1900, or 7.1 per cent, and the wages increased from $34,950 in 1890 to $52,299 in 1900, or 49.6 per cent. The increase in the average wages paid to children is probably due to the fact that more complex machinery is being used, and also to laws enacted by various states, defining and limiting the ages and number of hours per day which a minor shall work in mines or in manufacturing and mechanical industries. The capital, materials, and value of product have increased faster than has the number of wage-earners, showing that with increased equipment of plant an operative can use more material and manufacture a larger product than in 1880 or 1890.

While the number of establishments has decreased from 130 to 65 from 1880 to 1900, the average capital per establishment has increased from $71,328 to $1,358,828. The average cost of materials was $152,156 per establishment in 1880, and $949,888 in 1900, and the value of the product increased from $215,366 per establishment in 1880 to $1,392,464 in 1900. The amount of capital per wage-earner was $652 in 1880; $1,392 in 1890; and $2,640 in 1900. The cost of materials per wage-earner was $1,390 in 1880; $1,425 in 1890; and $1,846 in 1900. The value of the product manufactured by each wage-earner was $1,967 in 1880; $2,235 in 1890; and $2,706 in 1900.

Table 4 presents a comparative summary of the capital for 1890 and 1900 with the per cent that each item is of the total, and the per cent of increase during the decade.

TABLE 4.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES: COMPARATIVE SUMMARY OF CAPITAL, 1890 AND 1900.

	1900		1890		Per cent of increase.
	Amount.	Per cent of total.	Amount.	Per cent of total.	
Total	$88,323,852	100.0	$43,641,210	100.0	102.4
Land	4,306,808	4.9	3,811,086	8.7	13.0
Buildings	9,229,810	10.4	7,878,189	18.1	17.2
Machinery, tools, and implements	9,538,673	10.8	7,626,804	17.5	25.1
Cash and sundries	65,248,561	73.9	24,325,131	55.7	168.6

The total capital for 1900 was $88,323,852, while in 1890 it was $43,641,210; an increase of $44,682,642, or 102.4 per cent, during the decade. In 1890 the value of land was $3,811,086, which was 8.7 per cent of the total capital, and in 1900 the value was $4,306,808, or 4.9 pe

cent of the total; an increase of $495,722, or 13 per cent. The value of buildings increased from $7,878,189 in 1890 to $9,229,810 in 1900, an advance of 17.2 per cent. An increase of 25.1 per cent, or $1,911,869, in the value of machinery, tools, and implements makes that item now exceed the value of buildings, and more than double the total value of land. The most marked increase is found in the item of capital, which includes cash on hand, bills receivable, unsettled ledger accounts, raw materials, stock in process of manufacture, finished products on hand, and other sundries. In 1890 the value of this item was $24,325,131, or 55.7 per cent of the total. The item increased $40,923,430, or 168.2 per cent, during the decade, and in 1900 formed 73.9 per cent of the total capital. It can readily be seen that the constant demand for new varieties of cars, and the tendency to use steel in place of wood requires new and more expensive equipment, as well as a greater amount invested in materials in process of manufacture, and an increased value of finished products on hand.

Table 5 presents the cost of all materials used.

TABLE 5.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES: COST OF MATERIALS USED, 1900.

MATERIALS USED.	Amount.	Per cent of total.
Total	$61,742,747	100.0
Principal materials[1]	59,773,393	96.8
Fuel	1,021,046	1.7
Rent of power and heat	313	(2)
Freight	947,995	1.5

[1] Includes mill supplies, and all other materials, which are shown separately in Table 9

[2] Less than one-tenth of 1 per cent.

The cost of partially manufactured materials, or those which have passed through one or more stages of production, such as lumber, iron, steel, etc., constituted the principal item, aggregating more than nine-tenths the total cost. The amount paid for rent of power and heat was very small, showing that practically all of the power used in car construction was owned by the company operating the plant. The cost of fuel was $1,021,046, or 1.7 per cent, and the amount of freight paid was $947,995 or 1.5 per cent of the total cost. During the decade the cost of materials increased $17,068,261, or 38.2 per cent.

The miscellaneous expenses, comprising rent of works, taxes, contract work, rent of offices, interest, insurance, ordinary repairs to buildings and machinery, and expenses incurred in the manufacture of the product, other than those reported for wages and materials, aggregated $2,837,229. (See Table 9.) The amount paid for ordinary repairs of buildings and machinery, and for insurance, interest, advertising, etc., is the principal item of the miscellaneous expenses, aggregating $2,240,558, or 79 per cent of the total. Of the remaining items, contract work forms 14.3 per cent of the total expenses; taxes, 5.6 per cent; and rent of works only 1.1 per cent. No comparison of the separate items of miscellaneous expenses can be made with previous censuses, as in 1890 reports were made of total expenses only, and no figures were presented previous to the Tenth Census.

In 1890 there were in the United States 71 establishments engaged in car construction other than those operated by steam railroad companies, and during the decade 17 new establishments were constructed, but in 1900 only 65 establishments were in operation. This condition clearly illustrates the industrial changes which are constantly taking place in the commercial world. It does not necessarily indicate that 23 establishments formerly engaged in car construction have gone out of business and their plants are idle. In many cases the larger manufacturers have purchased the plants of their smaller competitors, and now use them for the manufacture of supplies for the central plants. Thus the product has been changed, and they can no longer be classified as establishments engaged in car construction and repairs. In some instances an establishment which was classified under "foundry and machine shop products" in 1890 had so changed its product that "car construction" predominated in 1900. This may account for the fact that, in some states, there was an increased number of establishments engaged in this industry, without a corresponding increase in the number of plants constructed during the decade.

In considering the location of the various plants it is interesting to note that a large part of the manufacturing was done near the various supply centers as well as in places convenient to commercial centers. In 1890 Pennsylvania was the leading state, with 15 establishments; in 1900 the number was reduced to 11. In Illinois the number of establishments has increased from 9 to 17, with a corresponding increase in production, and both in the number of plants engaged in the industry, and in the value of the product, this state has now taken first place. The North Central and the North Atlantic states, on account of their close proximity to coal fields, lumber districts, and the great commercial centers, have special advantages in the manufacture of cars, and in them are found the greatest number of well-equipped plants, and the greatest activity in the construction of new plants during the decade.

From the accompanying tables it will be seen that a large percentage of the establishments engaged in the manufacture of steam railroad cars, exclusive of those made by railroad companies, were located within a comparatively small area. The cities of Chicago, Joliet, Madison, Mt. Vernon, Litchfield, and East St. Louis, in Illinois, and St. Louis and St. Charles, in Missouri, reported a product of $32,568,374, or 36 per cent of the total product for the United States. Michigan City, Terre Haute, Indianapolis, and Jeffersonville, in Indiana, reported a product of $9,006,577, or 10

per cent of the total. Establishments in Allegheny, Pittsburg, McKees Rocks, Berwick, and Milton, in Pennsylvania, showed a product of $17,724,290, or 19.6 per cent of the total. The cities of Rochester, Buffalo, and Depew, in New York, showed a product of $5,228,351, or 5.8 per cent of the total. Detroit, Mich., Dayton, Ohio, and Wilmington, Del., reported a product of $16,707,419, or 18.5 per cent of the total.

The larger plants are, for the most part, located in the suburb of some large city, near the coal and iron districts, and in places where supplies of lumber are easily obtained. These conditions give the plant so located the advantage of being close to the great commercial centers and in a position to obtain skilled labor on short notice. The value of products, for the cities enumerated above, aggregated $81,235,012 or 89.8 per cent of the total for this branch of industry.

Table 6 presents a comparative summary of the number of establishments, capital, salaried officials and salaries, wage-earners and wages, miscellaneous expenses, cost of materials, and products, for states having 3 establishments and over, in 1890 and 1900.

TABLE 6.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES: COMPARATIVE SUMMARY, BY STATES, 1890 AND 1900.

STATES.	Year.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS.		Miscellaneous expenses.	Cost of materials used.	Value of products.
				Number.	Salaries.	Average number.	Total wages.			
United States	1900	65	$88,323,852	1,366	$1,588,132	33,453	$16,987,294	$2,837,229	$61,742,747	$90,510,180
	1890	71	43,641,210	708	759,702	28,292	11,571,617	1,725,113	44,674,486	70,083,737
Delaware	1900	3	2,429,007	73	83,528	2,032	1,041,088	121,819	1,876,435	3,274,922
	1890	3	2,839,733	46	66,459	2,001	1,039,739	87,677	1,528,528	3,291,293
Illinois	1900	17	18,782,466	279	330,409	9,314	5,360,756	483,271	17,075,461	24,845,606
	1890	9	10,070,784	176	128,712	4,583	2,708,989	217,384	10,093,125	17,117,223
Indiana	1900	4	6,062,000	96	111,858	3,337	1,550,764	224,009	6,287,256	9,006,577
	1890	4	5,199,706	34	50,880	2,050	1,319,741	150,782	4,924,342	7,073,329
Michigan	1900	4	6,693,209	107	145,795	3,187	1,409,580	227,774	7,272,761	9,920,780
	1890	5	3,769,483	85	115,868	3,406	1,376,037	245,560	8,007,974	11,078,281
Missouri	1900	4	4,530,982	117	125,561	2,772	1,373,353	198,160	5,101,335	7,722,768
	1890	5	1,442,927	50	52,247	1,354	869,104	75,773	2,655,320	3,974,173
New York	1900	4	4,299,251	92	75,920	2,091	1,038,948	81,996	3,744,911	5,228,351
	1890	5	1,885,321	53	63,342	1,792	978,102	92,779	2,382,777	3,166,771
Ohio	1900	5	2,581,894	61	75,616	1,805	862,011	45,450	2,791,908	3,942,372
	1890	5	2,843,166	21	38,890	1,326	594,505	92,007	2,817,578	4,784,135
Pennsylvania	1900	11	33,828,723	414	426,399	5,840	3,111,556	1,265,456	12,188,811	19,260,910
	1890	15	7,060,466	128	141,866	3,524	1,397,176	465,900	6,496,258	10,080,722
All other states	[1]1900	18	9,166,320	127	163,046	3,075	1,239,238	189,294	5,403,869	7,307,894
	[2]1890	20	8,579,624	115	101,438	2,656	1,228,224	297,251	5,768,584	9,517,810

[1] Includes establishments distributed as follows: Alabama, 2; Georgia, 2; Kentucky, 1; Maryland, 1; Massachusetts, 2; New Hampshire, 1; New Jersey, 2; Tennessee, 1; West Virginia, 1.
[2] Includes establishments distributed as follows: Alabama, 3; California, 1; Florida, 1; Kansas, 2; Kentucky, 2; Massachusetts, 3; Minnesota, 2; New Hampshire, 1; North Carolina, 1; Tennessee, 2; Virginia, 1; West Virginia, 1.

The states which show a decrease in both capital and product are Delaware and Ohio. The state of Michigan, while showing an increase in capital, reported a decrease in value of product of $1,157,501, or 10.4 per cent. In Illinois the capital increased from $10,070,784 in 1890 to $18,732,466 in 1900, or 86 per cent. The value of the product in 1890 was $17,117,223, and in 1900 an increase of $7,728,383, or 45.1 per cent, was shown. Indiana reported an increase of $862,294, or 16.6 per cent, in capital, and the product increased $1,933,248, or 27.3 per cent, during the decade. Missouri in 1890 reported a capital of $1,442,927; in 1900 the capital was $4,530,982, an increase of $3,088,055, or 214 per cent. The product increased from $3,974,173 in 1890 to $7,722,768 in 1900, or 94.3 per cent. The capital in New York increased 134.3 per cent, and the value of the product showed an increase of $2,061,580, or 65.1 per cent. Pennsylvania showed an increase of 379.1 per cent in capital, and an increase of $9,180,188, or 91.1 per cent, in the value of the product. The marked increase in capital in Pennsylvania was caused by the construction of new plants for the manufacture of pressed steel cars. The value of the products shown for the establishments which had been in operation only a few months during the census year was only a small fraction of their annual capacity, and therefore the value of plant and cost of equipment, together with the other items of capital, makes it appear that the increase in capital was disproportionate to that of products.

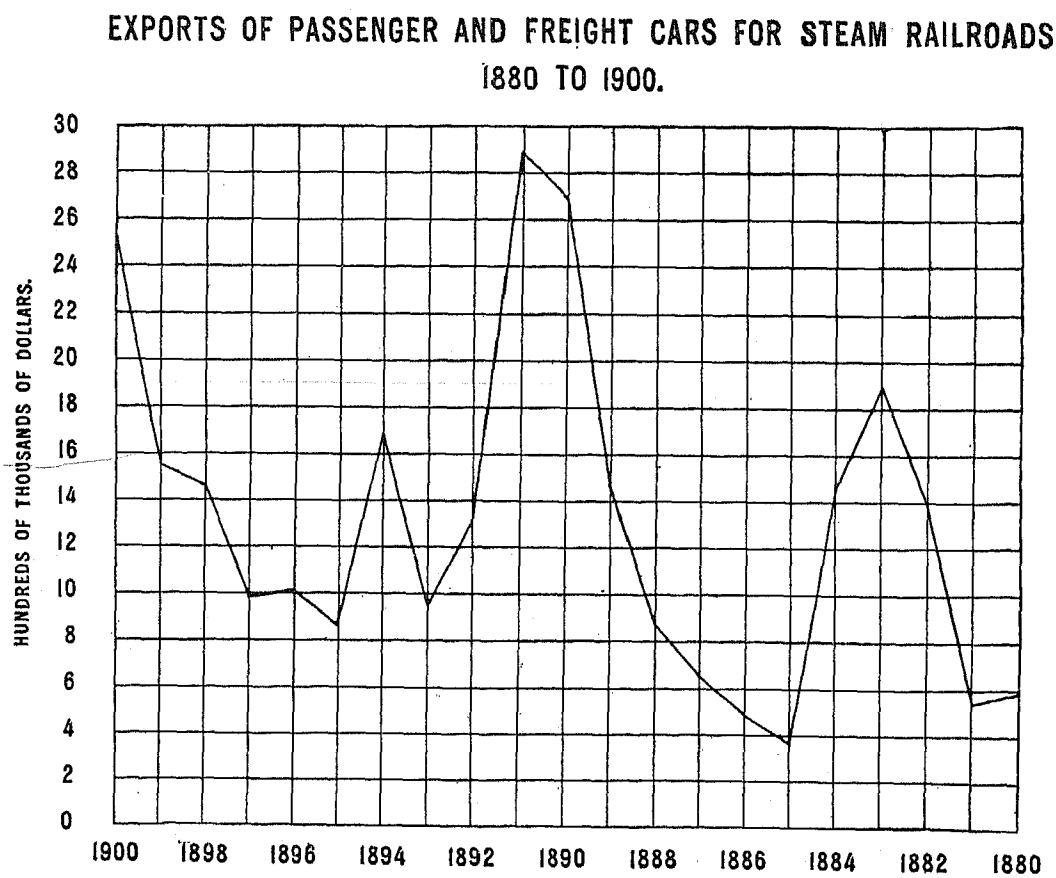
Alabama and Massachusetts each had 3 establishments in 1890, but in 1900 only 2 establishments were reported, operating independent of railroad repair shops, and no comparison can be made for the two censuses for these states.

Table 7 presents the operations of establishments engaged in car construction, exclusive of plants operated by railroad companies, in four geographic divisions.

TABLE 7.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES: COMPARATIVE SUMMARY, BY GEOGRAPHIC DIVISIONS, 1900.

	Number of establishments.	CAPITAL					SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS, INCLUDING PIECE-WORKERS, AND TOTAL WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products (including custom work and repairing).
		Total.	Land.	Buildings.	Machinery, tools, and implements.	Cash and sundries.	Total number.	Total salaries.	Average number.	Total wages.			
United States....	65	$88,323,852	$4,306,808	$9,229,810	$9,538,673	$65,248,561	1,366	$1,538,132	33,453	$16,987,294	$2,837,229	$61,742,747	$90,510,180
New England states..	3	787,490	42,868	128,747	107,038	508,837	11	17,113	374	174,160	19,305	578,340	825,012
Middle states.....	21	45,191,780	1,680,033	3,067,463	2,751,533	37,692,751	606	629,197	10,719	5,433,698	1,500,241	19,666,277	30,121,982
Southern states.....	7	3,744,031	420,000	878,498	900,598	1,544,935	89	102,583	1,945	822,972	139,019	2,968,909	4,125,083
Central states.....	34	38,600,551	2,163,907	5,155,102	5,779,504	25,502,038	660	789,239	20,415	10,556,464	1,178,664	38,528,721	55,438,103

In the United States there were 65 establishments, with the value of products aggregating $90,510,180. The New England states, with 3 establishments, or 4.6 per cent of the total, manufactured a product of $825,012, or 0.9 per cent of the total value. In the Middle states there were 21 establishments, with an aggregate product of $30,121,982, or 33.3 per cent of the total. The Southern states, with 10.8 per cent of the total number of establishments engaged in this industry, manufactured a product of $4,125,083, or 4.6 per cent of the total. The Central states reported 34 establishments, with a product of $55,438,103, or 61.2 per cent of the total. In the New England division each establishment reported an average of 4 salaried officials, with an average salary of $1,556. The Middle states reported 29 salaried officials per establishment, with an average salary of $1,038. The salaries of 660 officials in the Central states averaged $1,196, and in the Southern states the average establishment had 13 officials, with an average salary of $1,153.



The constantly increasing traffic in this country rapidly absorbs the product of the car shops, but there is also a foreign demand of considerable magnitude for American-built cars. This demand changes with the varying industrial conditions and commercial activity of the countries importing these products, as well as with the economic conditions existing in this country.

The above graphic chart shows the value of cars, passenger and freight, for steam railroads, exported, 1880 to 1900.

In 1890 and 1891 the value of exported cars exceeded the value in 1900. During the business depression which followed there was a marked decrease in the number of cars constructed, both for foreign and domestic use. The construction of freight cars was the first to be affected. The number of passenger cars constructed in this country did not decrease materially until after the Columbian Exposition in 1893. The foreign demand and the exposition were potent factors in keeping many of the shops running during 1893. A year or two later the demand for freight cars began to increase, and since 1897 the demand for both passenger and freight cars for foreign and domestic use has shown a constant growth. The exports for 1900, aggregating $2,558,323, exceeded the average yearly exports from 1880 to 1890 by $1,581,872; those from 1890 to 1900 by $756,484; and the average for twenty years by $1,169,178.

Table 8 presents the statistics of exports of cars and parts of cars, passenger and freight, for steam railways, 1880, 1890, and 1900.

TABLE 8.—CARS, PASSENGER AND FREIGHT, AND PARTS OF: EXPORTS, 1880, 1890, AND 1900, BY COUNTRIES.[1]

COUNTRIES TO WHICH EXPORTED.	1900	1890	1880
	For steam railroads.	For steam railroads.	For steam railroads.
Total	$2,558,323	$2,689,698	$583,723
ASIA.			
Chinese Empire	16,838	.....	.....
East Indies—British	2,947	.....	.....
Japan	12,589	.....	48,562
Russia—Asiatic	898	.....	.....
Turkey in Asia	220	.....	.....
OCEANIA.			
British Australasia	50,754	9,000	10,204
Hawaii	15,100	5,000	.....
AFRICA.			
British Africa	4,744	.....	18,100
Turkey in Africa—Egypt	401,151	.....	.....
EUROPE.			
Belgium	30,713	.....	.....
Denmark	125	.....	.....
France	280,939	33,000	.....
Germany	62,319	.....	26,800
Gibraltar	.....	.....	500
Italy	52,507	.....	.....
Netherlands	1,925	.....	.....
Portugal	1,583	16,792	1,565
Russia—Baltic and White Seas	1,300	.....	.....
Spain	.....	43,920	.....
Sweden and Norway	3,788	.....	.....
Switzerland	4,848	.....	.....
United Kingdom	124,585	190,773	61,467

COUNTRIES TO WHICH EXPORTED	1900	1890	1880
	For steam railroads.	For steam railroads.	For steam railroads.
NORTH AMERICA.			
Dominion of Canada:			
Nova Scotia, New Brunswick, etc.	$15,464	.....	.....
Quebec, Ontario, Manitoba, etc.	349,078	$49,900	$2,100
British Columbia	12,070	.....	4,716
Newfoundland and Labrador	232	.....	.....
Central American states	16,495	33,865	23,613
Costa Rica	6,149	.....	.....
Guatemala	1,271	3,500	.....
Honduras	2,664	.....	.....
Nicaragua	4,704	26,365	.....
Salvador	1,707	4,000	.....
Mexico	714,329	492,326	28,743
West Indies:			
British	253	1,747	7,400
Cuba	79,723	163,455	39,450
Porto Rico	8,763	.....	1,863
Santo Domingo	12,862	1,710	.....
SOUTH AMERICA.			
Argentina	105,147	1,063,319	21,162
Brazil	133,378	347,222	276,683
Chile	8,007	169,879	.....
Colombia	13,107	9,300	4,800
Ecuador	1,990	.....	.....
Guiana—British	12,500	700	4,485
Peru	2,692	2,800	1,510
Uruguay	2,150	47,500	.....
Venezuela	210	7,490	.....

[1] Annual Reports United States Treasury Department on Commerce and Navigation of the United States, 1880, 1890, and 1900.

The exports to South American countries decreased from $1,648,210 in 1890 to $279,181 in 1900. This was probably due to the fact that there was less activity in railway construction than at the beginning of the decade; also to the fact that the railways which were in process of construction in 1890 were in a position to supply their own equipment. The exports to North American countries during the decade increased $466,266; to Europe, $280,147; and to Oceania, $51,854. No cars or parts of cars were exported to Asia or Africa in 1890, but in 1900 these exports to Asia were valued at $33,492, and those to Africa at $405,895.

Table 9 presents in detail, for 1900, the statistics relating to the manufacture of cars, steam railroad, not including operations of railroad companies, by states and territories.

TABLE 9.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES: BY STATES, 1900.

	United States.	Delaware.	Illinois.	Indiana.	Michigan.	Missouri.	New York.	Ohio.	Pennsylvania.	All other states.[1]
Number of establishments	65	3	17	4	4	4	4	5	11	13
Character of organization:										
Individual	1	.....	.....	.....	.....	.....	.....	.....	.....	1
Firm and limited partnership	3	.....	.....	.....	.....	.....	.....	.....	3	.....
Incorporated company	60	3	17	4	4	4	3	5	8	12
Miscellaneous	1	.....	.....	.....	.....	.....	1	.....	.....	.....
Capital:										
Total	$88,323,852	$2,429,007	$18,732,466	$6,062,000	$6,693,209	$4,530,982	$4,299,251	$2,581,894	$33,828,723	$9,166,320
Land	$4,306,808	$239,828	$795,701	$190,000	$736,000	$393,229	$420,305	$48,977	$944,900	$537,868
Buildings	$9,229,810	$364,493	$2,563,234	$765,000	$824,875	$755,476	$816,129	$246,517	$1,780,000	$1,114,086
Machinery, tools, and implements	$9,538,673	$348,170	$3,475,151	$675,000	$780,330	$711,140	$881,616	$137,883	$1,424,595	$1,104,788
Cash and sundries	$65,248,561	$1,476,516	$11,898,380	$4,432,000	$4,352,004	$2,671,137	$2,181,201	$2,148,517	$29,679,228	$6,409,578
Proprietors and firm members	7	.....	.....	.....	.....	.....	.....	.....	6	1
Salaried officials, clerks, etc.:										
Total number	1,366	73	279	96	107	117	92	61	414	127
Total salaries	$1,538,132	$83,528	$330,409	$111,858	$145,795	$125,561	$75,920	$75,616	$426,399	$163,046
Officers of corporations—										
Number	112	7	25	6	6	2	2	10	35	19
Salaries	$535,161	$27,750	$94,409	$30,495	$33,340	$25,000	$10,883	$36,320	$219,214	$57,750
General superintendents, managers, clerks, etc.—										
Number	1,254	66	254	90	101	115	90	51	379	108
Salaries	$1,002,971	$55,778	$236,000	$81,363	$112,455	$100,561	$65,037	$39,296	$207,185	$105,296
Men—										
Number	1,200	64	244	85	99	101	87	50	368	102
Salaries	$974,179	$54,528	$230,333	$78,363	$110,955	$92,691	$63,777	$38,876	$203,658	$100,998
Women—										
Number	54	2	10	5	2	14	3	1	11	6
Salaries	$28,792	$1,250	$5,667	$3,000	$1,500	$7,870	$1,260	$420	$3,527	$4,298
Wage-earners, including pieceworkers, and total wages:										
Greatest number employed at any one time during the year	44,447	2,494	10,677	3,866	3,972	3,288	3,380	2,181	10,636	3,953
Least number employed at any one time during the year	27,192	1,555	8,874	2,780	2,282	2,134	1,092	1,584	4,810	2,131
Average number	33,453	2,032	9,314	3,337	3,187	2,772	2,091	1,805	5,840	3,075
Wages	$16,987,294	$1,041,088	$5,360,756	$1,550,764	$1,409,580	$1,373,353	$1,038,948	$862,011	$3,111,556	$1,239,238
Men, 16 years and over—										
Average number	33,136	1,978	9,171	3,337	3,187	2,766	2,072	1,800	5,753	3,072
Wages	$16,902,543	$1,028,731	$5,325,964	$1,550,764	$1,409,580	$1,371,198	$1,033,313	$860,799	$3,083,636	$1,238,558
Women, 16 years and over—										
Average number	107	29	50	.....	.....	6	17	5	.....	.....
Wages	$32,452	$8,925	$15,041	.....	.....	$2,155	$5,119	$1,212	.....	.....
Children, under 16 years—										
Average number	210	25	93	.....	.....	.....	2	.....	87	3
Wages	$52,299	$3,432	$19,751	.....	.....	.....	$516	.....	$27,920	$680
Average number of wage-earners, including pieceworkers, employed during each month:										
Men, 16 years and over—										
January	34,113	2,226	9,394	3,362	2,775	3,055	2,641	1,967	5,440	3,253
February	33,553	2,288	9,339	3,450	2,573	3,209	2,512	2,022	4,767	3,393
March	35,796	2,289	9,691	3,433	4,155	2,853	2,877	2,090	5,205	3,203
April	33,851	2,033	9,607	3,368	3,122	2,808	2,866	1,754	5,164	3,129
May	34,647	2,098	9,408	3,394	3,658	2,705	2,852	1,740	5,446	3,346
June	34,517	1,873	9,350	3,413	3,904	2,760	2,767	1,737	5,580	3,193
July	32,659	1,874	9,330	3,535	3,789	2,314	1,716	1,678	5,437	2,986
August	30,632	1,656	8,512	3,378	3,363	2,269	1,462	1,666	5,517	2,814
September	29,913	1,629	8,689	3,083	2,532	2,690	1,473	1,680	5,349	2,788
October	30,877	1,751	8,878	3,103	2,365	2,929	1,344	1,698	5,883	2,926
November	32,496	1,900	8,774	3,204	2,582	2,806	1,260	1,743	7,356	2,871
December	34,578	2,124	9,082	3,324	3,424	2,800	1,093	1,830	7,939	2,962
Women, 16 years and over—										
January	147	36	58	.....	.....	8	39	6	.....	.....
February	137	29	58	.....	.....	8	37	5	.....	.....
March	143	29	65	.....	.....	7	37	5	.....	.....
April	136	31	58	.....	.....	7	36	4	.....	.....
May	127	29	59	.....	.....	7	27	5	.....	.....
June	123	30	53	.....	.....	7	25	8	.....	.....
July	79	30	43	.....	.....	3	.....	3	.....	.....
August	75	23	45	.....	.....	3	.....	4	.....	.....
September	68	23	36	.....	.....	5	.....	4	.....	.....
October	79	29	39	.....	.....	7	.....	4	.....	.....
November	77	28	38	.....	.....	7	.....	4	.....	.....
December	93	31	47	.....	.....	9	.....	6	.....	.....
Children, under 16 years—										
January	194	27	93	.....	.....	.....	5	.....	65	4
February	189	33	95	.....	.....	.....	4	.....	55	2
March	198	31	86	.....	.....	.....	4	.....	74	3
April	202	30	85	.....	.....	.....	5	.....	80	2
May	179	28	77	.....	.....	.....	5	.....	65	4
June	199	23	90	.....	.....	.....	4	.....	80	2
July	209	21	108	.....	.....	.....	.....	.....	78	2
August	215	24	109	.....	.....	.....	.....	.....	80	2
September	201	23	95	.....	.....	.....	.....	.....	80	3
October	223	22	91	.....	.....	.....	.....	.....	105	5
November	253	18	92	.....	.....	.....	.....	.....	140	3
December	258	21	95	.....	.....	.....	.....	.....	140	2
Miscellaneous expenses:										
Total	$2,837,229	$121,819	$483,271	$224,009	$227,774	$198,160	$81,996	$45,450	$1,265,456	$189,294
Rent of works	$31,597	.....	$4,021	.....	.....	$3,263	.....	$2,170	$20,804	$1,339
Taxes, not including internal revenue	$169,440	$7,100	$38,899	$12,978	$34,023	$7,463	$8,446	$13,876	$20,806	$15,849
Rent of offices, insurance, interest, etc.	$2,240,558	$114,719	$436,717	$211,031	$191,751	$187,434	$73,550	$29,404	$823,846	$172,106
Contract work	$405,634	.....	$3,634	.....	$2,000	.....	.....	.....	$400,000	.....
Materials used:										
Aggregate cost	$61,742,747	$1,876,435	$17,075,461	$6,287,256	$7,272,761	$5,101,335	$3,744,911	$2,791,908	$12,188,811	$5,403,869
Total	$52,637,603	$1,744,990	$14,050,032	$5,581,378	$6,370,394	$4,558,343	$3,056,390	$2,449,025	$10,175,148	$4,651,903
Purchased in raw state	$45,730	.....	$8,704	$3,468	$11,684	$8,801	$8,910	.....	$8,975	$188
Purchased in partially manufactured form	$52,591,873	$1,744,990	$14,041,328	$5,577,910	$6,358,710	$4,549,542	$3,052,480	$2,449,025	$10,166,173	$4,651,715
Fuel	$1,021,046	$22,339	$303,164	$102,094	$94,390	$101,527	$64,629	$36,489	$195,927	$100,487
Rent of power and heat	$313	.....	$313	.....	.....	.....	.....	.....	.....	.....
Mill supplies	$214,689	$15,819	$91,712	$9,686	$8,418	$8,263	$9,193	$5,847	$22,350	$43,406
All other materials	$6,921,151	$81,617	$2,542,123	$121,390	$795,629	$483,202	$614,699	$9,905	$1,791,675	$530,911
Freight	$947,995	$11,670	$88,117	$472,758	$3,935	.....	.....	$290,642	$3,711	$77,162

[1] Includes establishments distributed as follows: Alabama, 2; Georgia, 2; Kentucky, 1; Maryland, 1; Massachusetts, 2; New Hampshire, 1; New Jersey, 2; Tennessee, 1; West Virginia, 1.

TABLE 9.—CARS, STEAM RAILROAD, NOT INCLUDING OPERATIONS OF RAILROAD COMPANIES: BY STATES, 1900—Continued.

	United States.	Delaware.	Illinois.	Indiana.	Michigan.	Missouri.	New York.	Ohio.	Pennsylvania.	All other states.[1]
Products:										
Aggregate value	$90,510,180	$3,274,922	$24,845,606	$9,006,577	$9,920,780	$7,722,768	$5,228,351	$3,942,372	$19,260,910	$7,307,894
Total number of cars constructed	118,504	738	30,842	15,234	22,000	9,903	4,425	4,944	20,682	9,736
Total value	$70,620,166	$1,953,151	$19,616,128	$8,521,954	$9,281,671	$6,317,744	$3,052,189	$3,710,477	$12,718,711	$5,448,141
Passenger cars—										
Total number	979	233	349	64	.....	113	16	198	.....	6
Total value	$7,368,299	$1,363,500	$3,624,251	$328,538	.....	$546,106	$266,696	$1,219,428	.....	$19,780
Baggage and express, number	72	16	6	13	.....	10	.....	24	.....	3
Value	$238,554	$66,692	$18,373	$38,522	.....	$17,760	.....	$91,207	.....	$6,000
Chair and coach, number	181	6	10	19	.....	78	.....	66	.....	2
Value	$957,526	$54,000	$78,680	$82,872	.....	$396,374	.....	$335,320	.....	$10,280
Dining and buffet, number	37	.....	9	6	.....	3	.....	19	.....	.....
Value	$404,503	.....	$103,166	$66,715	.....	$28,720	.....	$205,902	.....	.....
Mail, number	42	.....	10	10	.....	14	.....	8	.....	.....
Value	$197,465	.....	$50,933	$44,109	.....	$66,748	.....	$35,675	.....	.....
Parlor, number	37	.....	6	.....	.....	5	.....	26	.....	.....
Value	$272,403	.....	$45,665	.....	.....	$26,377	.....	$200,361	.....	.....
Passenger, number	331	192	86	11	.....	3	.....	39	.....	.....
Value	$1,975,469	$1,190,224	$524,187	$59,629	.....	$10,127	.....	$191,302	.....	.....
Private, number	11	.....	7	1	.....	.....	.....	3	.....	.....
Value	$154,709	.....	$107,136	$11,211	.....	.....	.....	$36,362	.....	.....
Sleeping, number	194	4	158	2	.....	.....	16	13	.....	1
Value	$2,767,061	$22,002	$2,339,474	$12,090	.....	.....	$266,696	$123,299	.....	$3,500
Other varieties, number	74	15	57	2	.....	.....	.....	.....	.....	.....
Value	$400,609	$30,582	$356,637	$13,390	.....	.....	.....	.....	.....	.....
Freight cars—										
Total number	116,590	42	30,314	15,170	22,000	9,790	4,409	4,660	20,682	9,523
Total value	$62,161,013	$22,235	$15,856,625	$8,193,416	$9,281,671	$5,771,638	$2,785,493	$2,324,700	$12,718,711	$5,206,524
Box, number	47,838	32	17,262	9,716	6,630	7,111	1,347	1,784	297	3,659
Value	$26,562,893	$16,532	$9,118,277	$5,341,287	$3,679,362	$4,183,860	$740,414	$955,762	$228,361	$2,299,038
Coal and coke, number	28,857	.....	1,674	2,721	7,289	1,116	1,384	1,770	10,486	2,417
Value	$18,414,718	.....	$892,400	$1,449,891	$4,223,713	$615,205	$822,847	$865,335	$8,213,729	$1,331,598
Flat, number	4,525	2	1,339	575	260	399	.....	534	172	1,244
Value	$1,923,525	$960	$497,843	$249,304	$112,132	$214,094	.....	$226,756	$92,698	$529,788
Fruit, number	1,620	.....	1,182	.....	.....	.....	.....	.....	1	437
Value	$665,354	.....	$591,705	.....	.....	.....	.....	.....	$675	$72,974
Furniture, number	1,717	.....	700	554	210	228	25	.....	.....	.....
Value	$1,148,265	.....	$506,265	$332,013	$135,020	$160,160	$14,807	.....	.....	.....
Gondolas, number	11,821	.....	2,230	10	1,200	10	1,250	555	5,531	1,035
Value	$6,873,145	.....	$926,640	$6,984	$588,700	$5,850	$803,152	$258,055	$3,683,359	$600,405
Refrigerator, number	2,354	.....	1,693	.....	300	169	103	12	.....	77
Value	$1,956,097	.....	$1,224,583	.....	$307,300	$278,272	$93,378	$13,992	.....	$38,577
Stock, number	2,760	8	1,713	525	.....	11	.....	.....	6	497
Value	$1,426,800	$4,748	$889,314	$229,162	.....	$5,665	.....	.....	$4,387	$293,529
Caboose, number	193	.....	23	60	2	51	.....	5	39	13
Value	$184,865	.....	$19,814	$56,940	$1,500	$62,464	.....	$4,800	$31,700	$7,647
Other varieties, number	14,905	.....	2,498	1,009	6,109	695	800	.....	4,150	144
Value	$3,005,351	.....	$1,189,784	$527,835	$233,944	$246,068	$310,900	.....	$463,802	$33,018
Street cars—										
Total number	935	463	179	.....	.....	.....	.....	86	.....	207
Total value	$1,090,854	$567,416	$135,252	.....	.....	.....	.....	$166,349	.....	$221,837
Electric, number	902	455	154	.....	.....	.....	.....	86	.....	207
Value	$1,062,172	$559,966	$114,020	.....	.....	.....	.....	$166,349	.....	$221,837
Open, number	371	156	76	.....	.....	.....	.....	9	.....	130
Value	$300,709	$129,679	$42,477	.....	.....	.....	.....	$12,660	.....	$115,893
Closed, number	487	283	77	.....	.....	.....	.....	51	.....	76
Value	$693,143	$400,687	$70,793	.....	.....	.....	.....	$116,494	.....	$105,169
Combination, number	44	16	1	.....	.....	.....	.....	26	.....	1
Value	$68,320	$29,600	$750	.....	.....	.....	.....	$37,195	.....	$775
Cable, closed, number	25	.....	25	.....	.....	.....	.....	.....	.....	.....
Value	$21,232	.....	$21,232	.....	.....	.....	.....	.....	.....	.....
Horse, number	8	8	.....	.....	.....	.....	.....	.....	.....	.....
Value	$7,450	$7,450	.....	.....	.....	.....	.....	.....	.....	.....
All other products	$19,890,014	$1,321,771	$5,229,478	$484,623	$639,109	$1,405,024	$2,176,162	$231,895	$6,542,190	$1,859,753
Comparison of products:										
Number of establishments reporting for both years	54	3	16	4	4	4	3	2	7	11
Value for census year	$82,879,333	$3,274,922	$24,805,707	$9,006,577	$9,920,780	$7,722,768	$4,204,081	$3,472,478	$18,756,290	$6,715,735
Value for preceding business year	$59,418,873	$1,812,928	$19,406,789	$7,220,572	$7,752,887	$5,929,329	$3,624,994	$2,553,254	$5,898,126	$5,219,994
Power:										
Number of establishments reporting	60	3	15	4	3	4	4	4	10	13
Total horsepower	34,687	1,623	11,161	3,748	2,760	2,439	3,110	2,005	4,426	3,415
Owned—										
Engines—										
Steam, number	242	13	65	30	11	17	17	12	41	36
Horsepower	32,293	1,623	9,917	3,740	2,360	2,439	2,995	1,640	4,386	3,193
Gas or gasoline, number	3	.....	1	.....	.....	.....	.....	1	1	.....
Horsepower	85	.....	20	.....	.....	.....	.....	25	40	.....
Waterwheels, number	9	.....	.....	.....	6	.....	.....	.....	.....	4
Horsepower	392	.....	.....	.....	295	.....	.....	.....	.....	97
Electric motors, number	62	.....	31	3	2	.....	2	19	.....	5
Horsepower	1,292	.....	664	8	105	.....	50	340	.....	125
Other kind, number	6	.....	3	.....	.....	.....	3	.....	.....	.....
Horsepower	565	.....	500	.....	.....	.....	65	.....	.....	.....
Rented—										
Horsepower	5	.....	.....	.....	.....	.....	.....	.....	.....	5
Furnished to other establishments—Horsepower	60	.....	60	.....	.....	.....	.....	.....	.....	.....
Establishments classified by number of persons employed, not including proprietors and firm members:										
Total number of establishments	65	3	17	4	4	4	4	5	11	13
Under 5	1	.....	.....	.....	.....	.....	.....	1	.....	.....
21 to 50	10	.....	3	.....	1	.....	.....	2	1	3
51 to 100	8	.....	3	.....	1	.....	.....	.....	2	2
101 to 250	13	.....	5	.....	.....	1	1	1	2	3
251 to 500	8	.....	2	1	1	1	.....	.....	1	2
501 to 1,000	9	2	1	1	.....	.....	1	.....	2	2
Over 1,000	16	1	3	2	1	2	2	1	3	1

[1] Includes establishments distributed as follows: Alabama, 2; Georgia, 2; Kentucky, 1; Maryland, 1; Massachusetts, 2; New Hampshire, 1; New Jersey, 2; Tennessee, 1; West Virginia, 1.

CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD COMPANIES.

Table 10 presents the statistics for general shop construction and repairs by steam railroad companies as returned at the censuses of 1890 and 1900, with the percentages of increase during the decade.

TABLE 10.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD COMPANIES: COMPARATIVE SUMMARY, 1890 TO 1900, WITH PER CENT OF INCREASE.

	DATE OF CENSUS.		PER CENT OF INCREASE.
	1900	1890	1890 to 1900
Number of establishments	1,296	716	81.0
Capital	$119,580,273	$76,192,477	56.9
Salaried officials, clerks, etc., number	7,096	1,953	263.3
Salaries	$6,210,247	$1,584,242	292.0
Wage-earners, average number	173,652	106,632	62.9
Total wages	$96,062,329	$60,213,433	59.5
Men, 16 years and over	173,209	106,448	62.7
Wages	$95,939,610	$60,161,333	59.5
Women, 16 years and over	364	128	184.4
Wages	$106,426	$39,248	171.2
Children, under 16 years	79	56	41.1
Wages	$16,293	$12,852	26.8
Miscellaneous expenses	$6,293,987	[1]	
Cost of materials used	$109,539,013	$66,561,526	64.6
Value of products, including custom work and repairing	$218,238,277	$129,461,698	68.6

[1] Not reported.

The census of 1890 was the first at which the statistics of the manufacture of cars by steam railroad companies were reported separate from the statistics of the operations of plants, engaged in car construction, not conducted by railroad companies. During the decade the number of establishments has increased from 716 to 1,296, an increase of 480, or 81 per cent, while the capital has increased $43,387,796, or 56.9 per cent. The cost of materials used increased from $66,561,526 in 1890, to $109,539,013 in 1900, or 64.6 per cent; and the value of the product, including custom work and repairing, was $129,461,698 in 1890, and $218,238,277 in 1900, an increase of $88,776,579, or 68.6 per cent.

The most striking increase was shown in the number of salaried officials, clerks, etc., and their salaries. In 1890 the number of salaried officials was 1,953, and in 1900 there were 7,096 officials, an increase of 5,143, or 263.3 per cent. During the same period the salaries increased $4,626,005, or 292 per cent. This increase is all the more striking, when it is remembered that the number for 1900 does not include the firm members and officials not drawing a salary. The total number of wage-earners increased 62.9 per cent, while the wages increased from $60,213,433 in 1890 to $96,062,329 in 1900, or 59.5 per cent.

Improved facilities for transportation by steam railways have resulted in constantly lessening the competition of canal and river transportation, and now they have ceased to be effective for high-grade freight transportation. The extraordinary increase in traffic requires new equipment at the rate of about 500 cars and 10 locomotives per day. The repair work both on locomotives and cars has constantly increased. During the census year the 1,296 establishments operated by railroad companies reported a capital of $119,580,273, and a product aggregating $218,238,277, and employed 180,748 wage-earners and officials. In this branch of the industry the product of the several establishments was manufactured or repaired for their own use. In the motive power and machinery department the total value of product was $94,447,260, or 43.3 per cent of the aggregate. The product in the car department was valued at $118,376,552, or 54.2 per cent, and the value of the shop work in the bridge and building department was $5,414,465, or 2.5 per cent of the aggregate product.

Table 11 presents a comparative summary of the capital for 1890 and 1900, with the percentage of each item to the total and the per cent of increase during the decade.

TABLE 11.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD COMPANIES: COMPARATIVE SUMMARY OF CAPITAL, 1890 AND 1900.

	1900		1890		Per cent of increase.
	Amount.	Per cent of total.	Amount.	Per cent of total.	
Total	$119,580,273	100.0	$76,192,477	100.0	56.9
Land	16,976,693	14.2	10,860,668	14.3	56.3
Buildings	36,630,345	30.6	25,399,382	33.3	44.2
Machinery, tools, and implements	28,448,582	23.8	18,473,121	24.2	54.0
Cash and sundries	37,524,653	31.4	21,459,306	28.2	74.9

In 1890 the total capital was $76,192,477, and in 1900 it was $119,580,273, an increase of $43,387,796, or 56.9 per cent. The value of land, buildings, machinery, tools, and implements, cash on hand, etc., relative to the total, has not changed materially during the decade. Of the total capital in 1890 the value of land composed 14.3 per cent; buildings, 33.3 per cent; and machinery, tools, etc., 24.2 per cent. In 1900 the value of land was 14.2 per cent; buildings, 30.6 per cent; and machinery, tools, etc., 23.8 per cent of the total capital. The largest per cent of increase was in the item including stock in process of manufacture, unfinished products on hand, etc., the aggregate value of which was $21,459,306, or 28.2 per cent of the total in 1890, and in 1900 the value was $37,524,653, or 31.4 per cent of the total, an increase of $16,065,347, or 74.9 per cent. During the decade the amount of capital invested in land increased 56.3 per cent; buildings, 44.2 per cent; and machinery, tools, and implements, 54 per cent.

Table 12 presents the cost of materials used, with per cent which each item forms of the total cost.

TABLE 12.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD COMPANIES: COST OF MATERIALS USED, 1900.

MATERIALS USED.	Amount.	Per cent of total.
Total	$109,539,013	100.0
Principal materials[1]	106,554,718	97.3
Fuel	2,443,987	2.2
Rent of power and heat	27,565	(2)
Freight	512,743	0.5

[1] Includes mill supplies and all other materials, which are shown separately in Table 16.
[2] Less than one-tenth of 1 per cent.

The partially manufactured materials, such as lumber, iron, and steel, etc., constitute the principal item, aggregating 97.3 per cent of the total. The cost of fuel was $2,443,987. The amount paid for rent of power and heat was $27,565, or less than one-tenth of 1 per cent of the total cost of materials, showing that nearly all of the power used was owned by the company operating the plant. The expenses, other than those for wages and materials, incurred in the manufacture of the product are reported in detail under miscellaneous expenses in Table 16. Of the total expense, $3,094,941, or 49.2 per cent, was paid for contract work.

The second item in importance, aggregating $2,329,924, was paid for rent of offices, interest, insurance, ordinary repairs of buildings and machinery, advertising, etc. Of the remaining items, rent of works formed only 0.7 per cent, while the amount paid for taxes constituted 13.1 per cent of the miscellaneous expenses, showing that a large percentage of the plants were owned by the corporations operating them.

Table 13 presents a comparative summary between 1890 and 1900, by states and territories.

TABLE 13.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD COMPANIES: COMPARATIVE SUMMARY, BY STATES AND TERRITORIES, 1890 AND 1900.

STATES AND TERRITORIES.	Year.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS.		Miscellaneous expenses.	Cost of materials used.	Value of products, including custom work and repairing.
				Number.	Salaries.	Average number.	Total wages.			
United States	1900	1,296	$119,580,273	7,096	$6,210,247	173,652	$96,062,329	$6,203,987	$109,539,013	$218,238,277
	1890	716	76,192,477	1,953	1,584,242	106,632	60,218,433	(1)	66,561,526	129,461,698
Maine	1900	19	921,905	37	31,332	571	300,755	35,435	487,604	857,136
	1890	10	150,672	5	4,500	239	135,275	.....	82,536	224,113
New Hampshire	1900	9	850,873	30	24,201	966	516,990	36,763	523,347	1,101,301
	1890	4	205,465	2	2,120	141	86,804	.....	30,612	119,555
Vermont	1900	7	711,261	32	23,744	779	446,017	4,614	350,401	824,776
	1890	8	534,729	.....	.....	290	157,573	.....	153,976	311,549
Massachusetts	1900	16	3,056,043	111	103,962	3,031	1,822,959	32,544	1,752,564	3,712,029
	1890	14	1,988,676	25	18,711	2,264	1,279,517	.....	1,390,705	2,712,763
Rhode Island[2]	1900	3	120,900	17	14,490	215	133,300	1,770	48,596	203,326
Connecticut	1900	9	1,639,134	100	78,392	1,557	943,503	41,879	1,366,281	2,430,056
	1890	8	690,265	9	5,920	682	418,317	.....	274,237	698,474
New York	1900	82	11,244,747	443	344,596	13,062	6,762,504	203,221	8,879,813	16,194,850
	1890	46	4,213,639	91	75,535	8,585	4,420,441	.....	4,527,381	9,046,025
New Jersey	1900	18	2,819,759	179	137,191	4,594	2,399,675	195,707	2,301,699	5,034,267
	1890	18	2,766,957	99	63,775	5,134	2,813,713	800	3,172,891	6,051,179
Pennsylvania	1900	144	19,182,001	1,065	810,857	28,554	15,825,640	3,280,079	23,147,574	43,065,171
	1890	61	17,475,056	346	230,894	22,649	12,301,884	82,909	15,822,037	28,769,728
Delaware	1900	5	751,213	17	20,824	880	529,025	2,315	460,519	1,012,688
	1890	3	767,875	29	19,178	821	489,690	.....	748,556	1,280,485
Maryland	1900	19	2,877,954	134	100,843	3,620	1,849,737	55,163	2,567,486	4,573,229
	1890	10	2,904,677	36	52,806	2,978	1,437,658	.....	3,588,572	5,079,035
District of Columbia[3]	1890	3	44,700	37	33,810	253	126,360	1,878	140,582	370,154
West Virginia	1900	23	1,040,311	90	67,646	2,605	1,256,640	32,355	1,586,916	2,943,557
	1890	7	533,305	14	9,217	1,022	433,335	.....	467,841	910,393
Virginia	1900	28	1,733,389	283	248,425	4,922	2,452,195	45,406	3,531,283	6,277,279
	1890	8	583,022	22	13,730	1,643	833,254	.....	658,011	1,504,995
North Carolina	1900	12	539,513	47	38,463	1,141	550,504	29,259	893,150	1,511,376
	1890	9	210,458	8	6,640	434	186,262	.....	200,335	393,576
South Carolina	1900	6	354,842	27	21,379	776	363,041	12,555	294,334	691,361
	1890	5	420,859	7	5,500	828	394,411	.....	287,862	688,191
Georgia	1900	32	1,408,592	97	98,003	3,175	1,602,208	89,380	1,272,692	3,062,288
	1890	11	460,512	23	19,140	966	522,657	.....	349,844	892,610
Florida	1900	13	414,390	33	26,663	958	486,488	19,224	579,870	1,112,245
	1890	10	168,960	7	7,160	280	144,997	1,800	201,514	354,048

[1] Not reported.
[2] Not reported separately in 1890.
[3] Includes establishments distributed as follows: Alaska, 1; District of Columbia, 2.

TABLE 13.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD COMPANIES: COMPARATIVE SUMMARY, BY STATES AND TERRITORIES, 1890 AND 1900—Continued.

STATES AND TERRITORIES.	Year.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS.		Miscellaneous expenses.	Cost of materials used.	Value of products, including custom work and repairing.
				Average number.	Salaries.	Average number.	Total wages.			
Kentucky	1900	25	$1,761,958	96	$82,689	3,572	$1,841,778	$55,984	$2,267,578	$4,248,029
	1890	9	305,229	11	10,240	623	353,200	.....	225,485	588,925
Tennessee	1900	16	1,319,628	65	58,606	2,817	1,459,319	66,765	1,528,363	3,113,053
	1890	10	1,198,940	15	16,672	1,772	995,287	.....	593,819	1,605,778
Alabama	1900	19	2,019,434	118	112,795	4,080	1,941,081	86,045	2,032,166	4,172,192
	1890	12	909,911	4	2,820	1,373	761,134	.....	784,304	1,581,207
Mississippi	1900	9	741,753	45	40,754	1,534	807,899	18,336	464,034	1,331,401
	1890	5	612,744	18	19,580	1,076	677,093	.....	632,876	1,329,549
Arkansas	1900	21	720,907	103	97,935	1,927	1,203,761	27,124	765,003	2,095,447
	1890	8	355,747	22	20,028	847	563,187	.....	715,340	1,299,558
Louisiana	1900	19	782,588	43	46,344	1,378	800,398	19,699	562,658	1,429,099
	1890	6	156,136	10	7,235	61	43,421	101	61,592	112,847
Indian Territory[1]	1900	3	8,080	3	2,820	64	35,504	87	18,224	56,635
Oklahoma[1]	1900	3	9,350	3	2,405	22	13,333	117	6,736	22,591
Texas	1900	56	3,730,792	263	292,398	6,633	4,004,769	138,888	3,878,536	8,314,691
	1890	31	1,140,049	58	61,775	2,354	1,574,786	.....	1,223,674	2,860,235
Ohio	1900	91	5,701,129	576	456,971	11,534	6,087,052	391,581	5,963,808	12,975,182
	1890	64	3,907,278	150	107,675	7,397	3,968,797	.....	3,930,052	8,096,905
Michigan	1900	42	2,527,256	182	147,119	3,938	2,026,000	39,642	2,120,166	4,332,927
	1890	17	1,226,103	32	33,340	2,098	1,119,487	.....	1,492,487	2,645,314
Indiana	1900	54	4,730,231	348	290,197	8,081	4,325,101	171,355	5,454,676	10,242,422
	1890	48	3,929,805	116	93,963	6,613	3,274,288	.....	3,904,281	7,289,382
Illinois	1900	98	11,726,424	618	568,702	13,803	7,422,527	267,497	8,286,776	16,580,424
	1890	70	7,791,234	264	198,680	10,277	5,855,481	5,629	5,909,493	12,208,617
Wisconsin	1900	46	4,206,285	272	245,163	4,502	2,398,144	138,270	3,525,144	6,306,823
	1890	22	1,681,255	50	44,778	2,148	1,217,632	.....	898,678	2,221,152
Minnesota	1900	39	4,933,805	264	243,448	4,700	2,599,387	95,561	3,380,441	6,319,876
	1890	18	2,926,860	66	56,706	1,951	1,219,325	.....	1,305,136	2,628,174
Iowa	1900	58	3,277,617	278	249,948	5,497	2,948,947	124,453	2,896,269	6,221,378
	1890	41	2,404,648	81	65,312	3,812	2,121,824	300	2,244,274	4,473,089
Missouri	1900	43	3,645,260	242	219,292	5,581	3,182,753	102,500	3,019,574	6,524,121
	1890	27	1,394,974	77	67,945	2,859	1,737,771	1,637	2,082,326	3,890,542
Montana	1900	7	524,725	49	50,382	621	397,552	5,138	301,338	754,410
	1890	4	317,765	12	10,354	301	226,013	.....	193,201	429,568
Idaho[1]	1900	4	177,912	12	13,326	399	293,396	2,743	214,166	523,631
Wyoming[1]	1900	7	591,725	28	29,374	853	623,046	37,194	480,199	1,169,813
North Dakota[1]	1900	3	171,043	7	6,725	126	67,922	1,400	64,847	140,894
South Dakota[1]	1900	7	68,079	9	8,354	117	79,661	3,049	86,567	177,631
Nebraska	1900	23	3,635,267	114	100,401	2,458	1,421,284	92,946	1,009,830	2,624,461
	1890	9	1,245,519	28	20,877	2,041	1,146,206	.....	900,825	2,067,908
Nevada	1900	6	404,577	8	9,800	214	168,102	7,446	110,637	295,985
	1890	6	428,999	6	8,460	209	194,643	.....	231,893	435,084
Utah[1]	1900	10	496,149	46	49,389	908	636,076	16,219	604,907	1,306,591
Colorado	1900	29	1,681,860	137	148,040	2,687	1,676,500	88,863	1,278,299	3,141,602
	1890	10	1,551,311	26	47,700	1,366	1,023,809	.....	894,090	1,965,696
Kansas	1900	37	2,931,699	175	167,786	5,592	3,476,400	101,457	3,071,173	6,816,816
	1890	26	1,683,210	60	46,949	2,819	1,722,326	.....	1,874,646	3,644,038
Arizona	1900	7	430,119	14	21,300	576	437,288	16,454	412,490	887,482
	1890	3	72,724	2	1,414	140	112,990	.....	74,985	189,390
New Mexico	1900	7	386,721	19	18,784	1,061	585,401	1,913	463,182	1,069,280
	1890	5	137,389	4	2,525	254	174,038	.....	177,503	354,066
Washington	1900	16	944,800	55	51,353	956	653,205	14,264	760,858	1,479,080
	1890	4	272,195	9	7,440	342	278,628	.....	175,492	461,561
Oregon	1900	14	725,935	29	31,678	751	496,159	15,688	483,644	1,026,169
	1890	5	2,815,997	28	26,700	1,101	907,739	.....	781,217	1,760,924
California	1900	29	4,429,951	119	141,798	4,920	3,507,028	76,590	3,825,340	7,553,620
	1890	10	3,139,514	29	23,840	2,858	2,151,594	.....	2,777,806	4,923,071
All other states	[2]1900	3	470,387	14	13,160	394	205,475	1,100	157,255	376,990
	[3]1890	11	487,054	15	12,598	731	610,586	.....	379,064	1,002,248

[1] Not reported separately in 1890.
[2] Includes establishments distributed as follows: Alaska, 1; District of Columbia, 2.
[3] Includes establishments distributed as follows: Indian Territory, 2; North Dakota, 2; Rhode Island, 2; South Dakota, 2; Utah, 2; Wyoming, 1.

In 1890 there were in the United States 716 railroad repair shops, and during the decade the number increased 580, or 81 per cent. The New England states reported 63 establishments in 1900, an increase of 17, or 43.2 per cent, since 1890. The Middle states increased 129, or 91.5 per cent; the Southern, 152, or 114.3 per cent; the Central, 164, or 53.4 per cent; the Western, 77, or 110 per cent, while the Pacific states increased 40, or 200.0 per cent. The largest actual increase during the decade has been in the Central and Southern states, which have also shown the greatest activity in the establishment of new plants during the census year.

The only decreases in number of plants were found in Vermont and the District of Columbia. The other states and territories except New Jersey and Nevada show an increase. The largest percentages of increase were in the Western and Pacific states.

In 1890 the 3 states having the greatest number of plants were Illinois with 70, Ohio with 64, and Pennsylvania with 61. In 1900 Pennsylvania led with 144 establishments, Illinois was second with 98, and Ohio third, reporting 91 plants in operation.

Of the 51 states and territories included in the comparative table, 6 have shown a decrease in the value of the product. The value of the products in New Jersey decreased $1,016,912; in Delaware, $267,802; in Maryland, $505,806; in Nevada, $139,099; and in Oregon, $724,757. The decrease in the product in the District of Columbia can not be shown, on account of disclosing the operations of individual establishments.

There has been a remarkable increase in value of products—$88,776,579, or 68.6 per cent, during the decade. Pennsylvania led with an increase of $14,295,443, New York was second with an increase of $7,148,825, and Texas third with a product of $8,314,691, an advance $5,454,456 over 1890. The states which show an increase of from three to five millions in the manufactured product are Virginia, Kentucky, Ohio, Illinois, Minnesota, Wisconsin, and Kansas; while those which show an increase of from one to three millions are Connecticut, West Virginia, North Carolina, Georgia, Tennessee, Alabama, Louisiana, Michigan, Indiana, Iowa, Missouri, Colorado, Washington, and California.

Table 14 presents the statistics by geographic divisions for the manufacture and repair of steam railroad cars, by establishments operated by steam railroad companies.

TABLE 14.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM RAILROAD COMPANIES: COMPARATIVE SUMMARY, BY GEOGRAPHIC DIVISIONS, 1900.

	Number of establishments.	CAPITAL.				SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS, INCLUDING PIECE-WORKERS, AND TOTAL WAGES.		Miscellaneous expenses.	Cost of materials used.	Value of products (including custom work and repairing).
		Total.	Land.	Buildings.	Machinery, tools, and implements.	Cash and sundries.	Total number.	Total salaries.	Average number.	Total wages.			
United States	1,296	$119,580,273	$16,976,693	$36,630,345	$28,448,582	$37,524,653	7,096	$6,210,247	173,652	$96,062,329	$6,293,987	$109,539,013	$218,238,277
New England states..	63	7,300,116	1,582,658	2,207,912	1,518,379	1,991,167	327	276,121	7,119	4,163,524	153,005	4,528,793	9,128,624
Middle states	270	37,238,830	4,486,574	11,553,117	8,900,838	12,298,301	1,850	1,425,471	51,047	27,516,297	3,737,385	37,447,686	70,132,571
Southern states	285	16,585,527	1,633,172	4,450,487	4,673,024	5,828,844	1,316	1,237,325	35,554	18,818,868	641,174	19,681,543	40,381,239
Central states	471	40,748,007	5,670,261	13,526,620	8,465,795	13,085,331	2,780	2,420,840	57,636	30,989,911	1,330,859	34,646,854	69,503,153
Western states	147	11,499,876	2,965,043	3,114,372	3,062,243	2,358,218	618	623,661	15,612	9,862,578	324,822	8,097,635	18,908,596
Pacific states[1]	60	6,207,917	638,985	1,777,837	1,828,303	1,962,792	205	226,829	6,684	4,711,151	106,742	5,136,502	10,184,094

[1] Includes Alaska.

The Middle states led in the manufacture of products in this branch of the industry, with 20.8 per cent of the total number of establishments, 31.1 per cent of the capital invested, and with products valued at $70,132,571, or 32.1 per cent of the total value. The Central states, with 36.3 per cent of the establishments and 34.1 per cent of the capital invested in the industry, manufactured a product valued at $69,503,153, or 31.8 per cent of the total. The Southern states manufactured 18.5 per cent; the Western, 8.7 per cent; the Pacific states, including Alaska, 4.7 per cent; and the New England states, 4.2 per cent of the total product.

The establishments of New England had an average capital of $115,875; those of the Middle states, $137,922; of the Southern states, $58,195; of the Central states, $86,514; of the Western states, $78,230; and of the Pacific states, $103,465. The average value of products for the various geographic divisions were as follows: New England, $144,899; Middle states, $259,750; Southern, $141,689; Central, $147,565; Western, $128,630; and Pacific states, $169,735.

The average wages in New England were 5.8 per cent above the average for the United States; in the Middle states, 2.5 per cent below the average; in the Southern states, 4.3 per cent below; in the Central states, 2.7 per cent below; in the Western states, 14.3 per cent above; and in the Pacific division the average wages were $705, or 27.5 per cent above the average wages for the industry.

Table 15 presents the statistics of the products for the combined industries, cars and general shop construction and repairs by railroad companies, and cars, steam railroad, not including the operations of railroad companies.

TABLE 15.—CARS, STEAM RAILROAD: COMBINED SUMMARY OF PRODUCTS, BY STATES AND TERRITORIES, 1900.

STATES AND TERRITORIES.	Aggregate value.	MOTIVE POWER AND MACHINERY.					Work for other corporations.	All other products.
		Total value.	Locomotives.					
			Built.		Repaired.			
			Number.	Value.	Number.	Value.	Value.	Value.
United States	$308,748,457	$94,447,260	272	$3,276,393	1,375,265	$57,383,143	$3,338,589	$30,449,135
Alabama	4,921,987	1,544,805	.....	.....	1,414	986,867	31,055	526,883
Arizona	887,482	542,525	.....	.....	1,608	439,413	9,643	93,469
Arkansas	2,095,447	873,835	3	23,169	25,197	666,911	46,928	136,827
California	7,553,626	1,783,739	.....	.....	2,977	1,630,941	20,167	132,631
Colorado	3,141,602	1,648,308	.....	.....	19,142	1,309,052	198,618	140,638
Connecticut	2,430,056	1,198,797	6	53,728	350	511,352	.....	633,717
Delaware	4,287,605	490,921	.....	.....	1,368	249,941	12,357	228,623
Florida	1,112,245	575,228	.....	.....	1,060	465,954	816	108,458
Georgia	3,407,047	1,126,034	.....	.....	2,926	892,086	26,411	207,537
Idaho	523,631	294,333	.....	.....	1,329	223,694	5,433	65,266
Illinois	41,426,030	7,402,600	27	338,826	162,810	4,497,144	391,048	2,175,582
Indiana	19,248,999	4,363,977	1	5,709	102,604	2,983,445	143,509	1,231,314
Indian Territory	56,635	31,701	.....	.....	6,867	30,055	.....	1,646
Iowa	6,221,378	2,898,775	8	59,149	62,664	2,251,443	60,406	527,777
Kansas	6,816,816	2,519,320	12	140,800	78,597	1,801,317	36,003	539,200
Kentucky	4,418,889	1,753,703	.....	.....	5,699	1,099,216	28,209	626,278
Louisiana	1,429,099	959,941	.....	.....	1,435	329,551	21,101	609,289
Maine	857,136	344,536	.....	.....	5,400	216,874	2,955	124,707
Maryland	6,087,752	2,695,668	.....	.....	5,588	1,236,343	61,155	1,398,170
Massachusetts	3,820,819	1,709,229	.....	.....	902	1,196,487	430	512,312
Michigan	14,253,707	1,506,894	16	107,011	3,239	1,137,222	20,783	241,878
Minnesota	6,319,876	3,256,252	.....	.....	29,071	1,826,432	469,236	960,584
Mississippi	1,331,401	481,510	.....	.....	1,818	337,734	22,881	120,895
Missouri	14,246,889	2,482,874	2	13,545	61,233	1,559,718	229,877	679,734
Montana	754,410	524,006	.....	.....	3,541	327,637	1,869	194,500
Nebraska	2,624,461	1,476,402	.....	.....	54,281	1,208,860	47,931	219,611
Nevada	295,985	111,856	.....	.....	132	90,834	12,587	8,435
New Hampshire	1,817,523	576,751	.....	.....	812	449,949	323	126,479
New Jersey	5,877,543	2,551,960	.....	.....	8,064	1,181,002	29,432	1,341,526
New Mexico	1,069,280	631,029	.....	.....	16,598	591,129	25,400	14,500
New York	21,423,201	6,864,940	2	25,114	131,290	4,218,942	324,190	2,296,694
North Carolina	1,511,376	494,501	.....	.....	15,044	430,099	2,128	62,334
North Dakota	140,894	102,101	.....	.....	194	34,941	.....	67,160
Ohio	16,917,554	4,726,651	.....	.....	160,306	3,175,272	52,023	1,499,356
Oklahoma	22,591	9,400	.....	.....	1,572	9,400	.....	.....
Oregon	1,026,169	275,894	.....	.....	252	233,750	10,375	31,769
Pennsylvania	62,326,081	20,409,988	166	2,303,712	223,987	8,878,878	521,698	8,705,700
Rhode Island	203,326	87,529	.....	.....	98	73,555	.....	13,974
South Carolina	691,361	355,726	.....	.....	1,076	288,665	4,839	62,222
South Dakota	177,631	91,917	.....	.....	5,740	66,015	867	25,035
Tennessee	3,605,563	1,333,763	.....	.....	2,673	888,751	48,770	396,242
Texas	8,314,691	4,046,335	9	59,842	7,965	2,239,853	270,132	1,476,508
Utah	1,306,591	703,752	.....	.....	1,996	504,169	2,748	196,835
Vermont	824,776	343,864	1	4,718	1,358	208,441	15,632	115,073
Virginia	6,277,279	1,666,179	6	61,455	75,826	1,396,735	1,901	206,088
Washington	1,479,680	742,945	.....	.....	3,274	339,445	74,919	328,581
West Virginia	5,310,711	910,903	.....	.....	49,169	633,861	16,747	260,295
Wisconsin	6,306,823	1,942,515	13	77,615	12,251	1,125,855	30,876	708,169
Wyoming	1,169,813	831,217	.....	.....	11,470	831,180	37	.....
Other territories [1]	376,990	149,571	.....	.....	998	76,733	4,144	68,694

[1] Includes establishments distributed as follows: Alaska, 1; District of Columbia, 2.

TABLE 15.—CARS, STEAM RAILROAD: COMBINED SUMMARY OF PRODUCTS, BY STATES AND TERRITORIES, 1900—Continued.

STATES AND TERRITORIES.	CAR DEPARTMENT.									BRIDGE AND BUILDING DEPARTMENT (SHOP WORK ONLY).			
	Total value.	Cars built.				Cars repaired.		Work for other corporations.	All other products.	Total value.	Repairs and renewals.	Work for other corporations.	All other products.
		Passenger.		Freight.		Passenger and freight.							
		Number.	Value.	Number.	Value.	Number.	Value.	Value.	Value.		Value.	Value.	Value.
United States	$208,886,732	1,371	$8,810,032	143,134	$77,240,632	8,376,769	$74,665,500	$7,084,857	$41,085,711	$5,414,465	$3,937,170	$241,626	$1,235,669
Alabama	3,316,991	.....	.....	2,177	1,352,082	121,317	1,515,731	152,416	296,762	60,191	48,227	.....	11,964
Arizona	276,025	.....	.....	.....	.....	9,029	251,586	16,310	8,735	68,332	67,305	.....	1,027
Arkansas	878,798	5	20,272	51	16,723	120,368	657,521	120,139	64,143	342,814	71,685	14,838	256,291
California	5,745,358	4	11,777	667	329,577	58,973	1,576,111	334,609	3,493,284	24,529	13,015	7,868	3,646
Colorado	1,305,898	7	26,583	221	91,801	186,675	959,311	112,503	115,700	187,396	96,238	.....	91,158
Connecticut	1,180,996	7	18,343	16	8,976	12,354	757,687	15,216	380,774	50,263	29,230	.....	21,033
Delaware	3,790,846	233	1,363,500	42	22,235	8,449	312,530	34,210	2,058,371	5,838	5,838	.....	.....
Florida	524,304	.....	.....	65	35,254	39,437	461,255	1,778	26,022	12,713	8,286	700	3,727
Georgia	2,112,365	.....	.....	1,062	439,621	58,420	1,223,447	119,853	329,444	168,648	102,217	1,200	65,231
Idaho	222,887	.....	.....	.....	.....	28,561	192,026	10,967	19,894	6,411	4,529	1,030	852
Illinois	33,617,555	381	3,722,715	32,889	17,234,323	741,728	5,641,067	460,931	6,558,519	405,875	369,133	5,072	31,670
Indiana	14,696,545	69	350,234	17,111	9,185,928	256,131	3,584,005	493,631	1,082,747	188,477	156,665	1,856	29,956
Indian Territory	24,934	.....	.....	.....	.....	9,632	24,934	.....	.....	.....	.....	.....	.....
Iowa	2,960,771	.....	.....	38	26,964	228,415	2,570,313	170,172	193,322	361,832	305,955	1,043	54,834
Kansas	3,955,303	6	21,300	662	353,037	220,673	3,170,853	196,257	213,856	342,193	122,155	10,728	209,310
Kentucky	2,600,076	1	3,079	555	328,786	147,916	1,384,470	138,997	744,744	65,110	52,553	.....	12,557
Louisiana	446,507	.....	.....	25	11,726	48,443	368,974	19,012	46,795	22,651	20,359	.....	2,292
Maine	494,151	7	17,241	.....	.....	20,236	434,363	21,802	20,745	18,449	13,941	273	4,235
Maryland	3,316,164	1	2,265	3,010	1,538,913	38,272	1,221,773	53,526	499,687	75,920	70,341	.....	5,579
Massachusetts	2,107,170	20	35,451	330	165,582	72,206	1,342,309	190,228	373,609	4,420	4,420	.....	.....
Michigan	12,473,201	3	10,055	22,460	9,496,779	72,782	1,855,941	86,269	1,024,157	273,612	247,373	.....	26,239
Minnesota	3,009,788	1	13,904	117	56,433	152,941	2,157,271	273,063	509,117	53,836	51,445	.....	2,391
Mississippi	828,839	.....	.....	76	41,189	71,356	530,114	33,712	223,824	21,052	21,052	.....	.....
Missouri	11,466,623	117	557,001	9,862	5,803,760	262,960	2,595,377	693,548	1,816,987	297,392	82,660	159,536	55,196
Montana	228,796	.....	.....	.....	.....	36,850	228,271	.....	525	1,608	1,608	.....	.....
Nebraska	1,074,737	.....	.....	.....	.....	44,901	631,541	377,663	65,533	73,322	73,322	.....	.....
Nevada	176,748	.....	.....	12	6,157	18,142	51,169	6,954	112,468	7,381	6,866	.....	515
New Hampshire	1,207,132	10	36,114	627	334,500	20,579	219,801	54,603	562,114	33,640	25,846	.....	7,794
New Jersey	3,199,291	16	111,304	1	435	217,801	1,888,186	107,609	1,091,757	126,292	125,563	125	604
New Mexico	426,913	.....	.....	.....	.....	38,429	339,686	70,052	17,225	11,338	5,284	4,478	1,576
New York	14,205,007	89	451,887	5,195	3,114,212	1,792,341	6,819,591	737,088	3,582,229	353,254	310,265	.....	42,989
North Carolina	993,194	3	15,538	649	276,476	27,015	633,263	26,483	41,434	23,621	12,292	.....	11,329
North Dakota	38,793	.....	.....	.....	.....	4,430	36,833	.....	1,960	.....	.....	.....	.....
Ohio	11,974,609	207	1,266,346	5,994	2,750,343	722,929	5,819,411	391,321	1,747,185	216,294	208,038	.....	8,256
Oklahoma	10,191	.....	.....	.....	.....	2,387	9,740	.....	451	3,000	3,000	.....	.....
Oregon	721,047	.....	.....	.....	.....	55,716	460,654	11,158	249,235	29,228	22,629	.....	6,599
Pennsylvania	41,382,083	158	643,113	29,002	18,524,347	1,466,305	12,876,887	611,351	8,726,385	534,010	394,779	5,947	133,284
Rhode Island	112,890	.....	.....	.....	.....	5,275	91,343	3,717	17,830	2,907	2,557	.....	350
South Carolina	333,781	.....	.....	.....	.....	16,470	260,787	2,595	70,399	1,854	1,613	.....	241
South Dakota	50,878	.....	.....	.....	.....	4,413	42,048	5,730	2,600	35,336	34,993	.....	343
Tennessee	2,187,009	.....	.....	919	513,600	143,876	1,077,097	116,798	479,514	84,791	41,776	.....	43,015
Texas	4,159,970	11	55,564	425	191,945	207,906	3,033,077	344,021	535,363	108,386	78,776	23,495	11,115
Utah	598,563	.....	.....	14	15,187	33,876	320,568	45,649	217,159	4,276	4,076	.....	200
Vermont	487,468	.....	.....	54	27,473	17,179	181,151	100,077	128,767	43,444	21,600	.....	21,844
Virginia	4,469,806	1	3,800	1,468	988,971	154,625	1,860,432	89,128	1,532,475	141,294	126,409	50	14,835
Washington	705,243	.....	.....	216	108,308	58,695	415,609	51,141	130,185	31,492	20,105	2,700	8,687
West Virginia	4,202,884	1	2,878	3,650	2,003,177	163,161	1,085,840	124,244	987,245	196,924	195,020	.....	1,904
Wisconsin	4,072,534	18	50,268	3,371	1,792,612	117,161	1,540,355	50,052	639,247	291,774	260,669	104	31,001
Wyoming	337,551	.....	.....	.....	.....	15,881	333,149	4,402	.....	1,045	462	583	.....
Other territories[1]	227,419	.....	.....	101	58,200	3,152	120,098	3,874	45,247	.....	.....	.....	.....

[1] Includes establishments distributed as follows: Alaska, 1; District of Columbia, 2.

The above table divides the product into 3 departments—the motive power and machinery, the car department, and the bridge and building department. The construction of new locomotives is almost entirely done by establishments engaged exclusively in that work, but a few were built in the car construction plants. In the motive power and machinery department, Pennsylvania led, both in the number of locomotives constructed and the value of the repair work. In the car department, the value of the street cars which were constructed as a by-product was included under "all other products." Of the 1,371 passenger cars constructed for steam railroads, 381 were manufactured in Illinois, 233 in Delaware, 207 in Ohio, 153 in Pennsylvania, and 117 in Missouri; that is, about four-fifths of the passenger cars were constructed in these 5 states. Illinois, Pennsylvania, Michigan, Indiana, and Missouri manufactured 111,324 freight cars, or 77.8 per cent of the total product of the United States.

The value of the products in the bridge and building department, including shop work only, was $5,414,465. The product in the motive and power department aggregated $94,447,260, and in the car department $208,886,732. The average value of locomotives constructed was $12,046. The value of 143,134 freight cars was $77,240,632, or an average of $540.

The 10 states leading in the construction and repair of steam railway cars were: Pennsylvania, with a product of $62,326,081; Illinois, with $41,426,030; New York, with $21,423,201; Indiana, $19,248,999; Ohio, $16,917,554; Michigan, $14,253,707; Missouri, $14,246,889; Texas, $8,314,691; California, $7,553,626; and Kansas, $6,816,816. The aggregate value of the products for these states was $212,527,594, or 68.8 per cent of the total value for the United States. The products for the first five states aggregated $161,341,865, or 52.3 per cent of the total value.

Table 16 presents in detail the statistics relating to cars and general shop construction and repairs by steam railroad companies, by states and territories, in 1900.

TABLE 16.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS

		United States.	Alabama.	Arizona.	Arkansas.	California.	Colorado.	Connecticut.	Delaware.	Florida.	Georgia.
1	Number of establishments	1,296	19	7	21	29	29	9	5	13	32
	Character of organization:										
2	Incorporated company	1,296	19	7	21	29	29	9	5	13	32
	Capital:										
3	Total	$119,580,273	$2,019,434	$430,119	$720,907	$4,429,951	$1,681,860	$1,639,184	$751,213	$414,390	$1,408,592
4	Land	$16,976,693	$169,200	$54,300	$50,950	$300,165	$277,550	$389,500	$256,825	$35,880	$190,110
5	Buildings	$36,630,345	$559,810	$141,289	$114,780	$1,242,009	$576,572	$246,950	$238,025	$79,025	$412,414
6	Machinery, tools, and implements	$28,448,582	$660,570	$130,532	$209,697	$1,409,802	$481,007	$425,412	$97,391	$127,099	$408,005
7	Cash and sundries	$37,524,653	$629,854	$103,998	$345,480	$1,477,975	$346,731	$577,272	$158,972	$172,386	$398,063
	Salaried officials, clerks, etc.:										
8	Total number	7,096	118	14	103	119	137	100	17	33	97
9	Total salaries	$6,210,247	$112,795	$21,300	$97,935	$141,798	$148,040	$78,392	$20,824	$26,663	$98,003
	General superintendents, managers, clerks, etc.—										
10	Total number	7,096	118	14	103	119	137	100	17	33	97
11	Total salaries	$6,210,247	$112,795	$21,300	$97,935	$141,798	$148,040	$78,392	$20,824	$26,663	$98,003
	Men—										
12	Number	6,954	115	14	103	117	137	99	17	33	96
13	Salaries	$6,149,463	$111,290	$21,300	$97,935	$140,718	$148,040	$78,221	$20,824	$26,663	$97,763
	Women—										
14	Number	142	3	.....	.....	2	.....	1	.....	.....	1
15	Salaries	$60,784	$1,505	.....	.....	$1,080	.....	$171	.....	.....	$240
	Wage-earners, including pieceworkers, and total wages:										
16	Greatest number employed at any one time during the year	191,387	4,388	703	2,155	5,371	3,206	1,662	918	1,111	3,435
17	Least number employed at any one time during the year	156,865	3,645	478	1,716	4,519	2,184	1,448	846	855	2,941
18	Average number	173,652	4,030	576	1,927	4,920	2,687	1,557	880	958	3,175
19	Wages	$96,062,329	$1,941,031	$437,238	$1,203,761	$3,507,028	$1,676,500	$943,503	$529,025	$486,488	$1,602,208
	Men, 16 years and over—										
20	Average number	173,209	4,019	576	1,927	4,908	2,687	1,551	878	955	3,169
21	Wages	$95,939,610	$1,939,170	$437,238	$1,203,761	$3,502,570	$1,676,500	$941,296	$528,376	$485,708	$1,601,128
	Women, 16 years and over—										
22	Average number	364	11	.....	.....	7	.....	6	2	3	6
23	Wages	$106,426	$1,861	.....	.....	$2,578	.....	$2,207	$649	$720	$1,080
	Children, under 16 years—										
24	Average number	79	.....	.....	.....	5	.....	.....	.....	.....	.....
25	Wages	$16,293	.....	.....	.....	$1,880	.....	.....	.....	.....	.....
	Average number of wage-earners, including pieceworkers, employed during each month:										
	Men, 16 years and over—										
26	January	171,763	4,065	653	2,041	4,861	2,680	1,490	862	980	3,218
27	February	172,487	4,131	617	2,040	4,871	2,540	1,511	872	991	3,205
28	March	174,961	4,177	589	2,028	4,723	2,616	1,518	862	976	3,228
29	April	175,886	4,179	590	2,014	4,689	2,652	1,557	885	995	3,235
30	May	175,917	4,199	593	1,966	4,760	2,707	1,559	893	1,052	3,252
31	June	170,060	3,805	506	1,792	4,775	2,450	1,572	877	1,076	3,151
32	July	166,774	3,745	528	1,748	4,863	2,342	1,561	874	848	3,081
33	August	169,680	3,916	545	1,799	4,981	2,550	1,560	876	861	3,075
34	September	171,610	4,020	533	1,857	4,978	2,725	1,543	872	883	3,090
35	October	174,884	4,051	561	1,930	5,060	2,944	1,588	888	916	3,110
36	November	176,568	3,966	577	1,949	5,147	2,948	1,578	882	938	3,220
37	December	177,918	3,970	619	1,956	5,185	3,085	1,574	898	940	3,166
	Women, 16 years and over—										
38	January	364	10	.....	.....	8	.....	6	2	3	6
39	February	364	10	.....	.....	8	.....	6	2	3	6
40	March	363	10	.....	.....	8	.....	6	2	3	6
41	April	364	10	.....	.....	8	.....	6	2	3	6
42	May	375	12	.....	.....	8	.....	6	2	3	6
43	June	367	11	.....	.....	6	.....	7	2	3	6
44	July	362	12	.....	.....	6	.....	6	2	3	6
45	August	362	11	.....	.....	6	.....	6	2	3	6
46	September	355	11	.....	.....	7	.....	6	2	3	6
47	October	357	11	.....	.....	7	.....	6	2	3	6
48	November	361	11	.....	.....	8	.....	6	2	3	6
49	December	374	11	.....	.....	7	.....	6	2	3	6
	Children, under 16 years—										
50	January	73	.....	.....	.....	6	.....	.....	.....	.....	.....
51	February	73	.....	.....	.....	6	.....	.....	.....	.....	.....
52	March	78	.....	.....	.....	6	.....	.....	.....	.....	.....
53	April	79	.....	.....	.....	6	.....	.....	.....	.....	.....
54	May	81	.....	.....	.....	7	.....	.....	.....	.....	.....
55	June	78	.....	.....	.....	5	.....	.....	.....	.....	.....
56	July	80	.....	.....	.....	4	.....	.....	.....	.....	.....
57	August	81	.....	.....	.....	4	.....	.....	.....	.....	.....
58	September	81	.....	.....	.....	4	.....	.....	.....	.....	.....
59	October	80	.....	.....	.....	4	.....	.....	.....	.....	.....
60	November	85	.....	.....	.....	4	.....	.....	.....	.....	.....
61	December	79	.....	.....	.....	5	.....	.....	.....	.....	.....
	Miscellaneous expenses:										
62	Total	$6,293,987	$86,045	$16,454	$27,124	$76,590	$38,863	$41,879	$2,315	$19,224	$89,380
63	Rent of works	$41,134	.....	.....	.....	.....	$21,075	.....	.....	.....	$1,800
64	Taxes, not including internal revenue	$827,988	$12,276	$5,039	$5,504	$53,658	$13,772	.....	$1,692	$10,985	$16,472
65	Rent of offices, etc	$2,329,924	$73,769	$11,415	$21,620	$22,932	$3,468	$41,879	$623	$3,146	$69,934
66	Contract work	$3,094,941	.....	.....	.....	.....	$548	.....	.....	$5,093	$1,174
	Material used:										
67	Total cost	$109,539,013	$2,032,166	$412,490	$765,003	$3,825,340	$1,278,299	$1,366,281	$460,519	$579,870	$1,272,692
68	Purchased in partially manufactured form	$84,290,687	$1,647,522	$339,419	$614,040	$2,516,424	$933,489	$988,571	$122,174	$354,218	$894,144
69	Fuel	$2,443,987	$35,428	$13,033	$20,479	$196,357	$35,890	$13,870	$13,086	$8,294	$15,159
70	Rent of power and heat	$27,565	.....	.....	.....	$17,538	.....	$300	.....	.....	.....
71	Mill supplies	$1,155,435	$35,525	$6,022	$20,502	$15,174	$18,137	$12,959	$1,283	$5,707	$15,586
72	All other materials	$21,108,596	$260,027	$48,654	$109,982	$899,668	$290,783	$350,581	$323,976	$209,384	$347,803
73	Freight	$512,743	$53,664	$5,362	.....	$180,179	.....	.....	.....	$2,207	.....

BY STEAM RAILROAD COMPANIES, BY STATES AND TERRITORIES: 1900.

Idaho.	Illinois.	Indiana.	Indian Territory.	Iowa.	Kansas.	Kentucky.	Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.	Mississippi.	Missouri.	
4	98	54	3	58	37	25	19	19	19	16	42	39	9	43	1
4	98	54	3	58	37	25	19	19	19	16	42	39	9	43	2
$177,912	$11,726,424	$4,730,231	$8,080	$3,277,617	$2,931,699	$1,761,958	$782,588	$921,905	$2,877,954	$3,056,043	$2,527,256	$4,933,805	$741,753	$3,645,260	3
$28,000	$2,106,841	$514,788	$750	$282,825	$358,213	$252,430	$72,750	$72,900	$298,490	$885,850	$348,620	$453,700	$52,692	$764,835	4
$67,991	$3,617,599	$1,071,232	$4,180	$1,365,929	$853,770	$484,950	$201,539	$376,850	$1,547,939	$1,061,500	$877,176	$2,117,592	$230,775	$882,094	5
$66,912	$2,214,121	$944,880	$1,550	$816,126	$861,867	$442,561	$260,864	$217,081	$550,609	$343,925	$676,944	$1,117,309	$251,529	$701,632	6
$15,009	$3,787,863	$1,599,331	$1,600	$862,737	$857,849	$582,017	$247,435	$255,074	$480,916	$764,768	$624,516	$1,245,204	$206,757	$1,296,699	7
12	618	348	3	278	175	96	43	37	134	111	182	264	45	242	8
$13,326	$568,702	$290,197	$2,820	$249,948	$167,786	$82,689	$46,344	$31,332	$100,843	$103,962	$147,119	$243,448	$40,754	$219,292	9
12	618	348	3	278	175	96	43	37	134	111	182	264	45	242	10
$13,326	$568,702	$290,197	$2,820	$249,948	$167,786	$82,689	$46,344	$31,332	$100,843	$103,962	$147,119	$243,448	$40,754	$219,292	11
12	598	337	3	275	171	94	43	36	134	109	181	260	43	234	12
$13,326	$560,017	$285,479	$2,820	$248,708	$165,295	$82,343	$46,344	$30,840	$100,843	$102,870	$146,819	$241,198	$39,794	$216,222	13
.....	20	11	.....	3	4	2	.....	1	.....	2	1	4	2	8	14
.....	$8,685	$4,718	.....	$1,240	$2,491	$346	.....	$492	.....	$1,092	$300	$2,250	$960	$3,070	15
445	15,122	8,945	73	5,983	6,001	3,802	1,556	618	3,866	3,220	4,439	5,183	1,736	6,020	16
376	12,728	7,240	59	5,015	5,101	3,356	1,193	509	3,293	2,496	3,432	4,306	1,345	5,172	17
399	13,803	8,081	64	5,497	5,592	3,572	1,378	571	3,620	3,031	3,938	4,700	1,534	5,581	18
$293,896	$7,422,527	$4,325,101	$35,504	$2,948,947	$3,476,400	$1,841,778	$800,398	$300,755	$1,849,737	$1,822,959	$2,026,000	$2,599,387	$807,899	$3,182,753	19
399	13,766	8,076	64	5,488	5,590	3,564	1,377	571	3,616	3,028	3,931	4,696	1,534	5,572	20
$293,896	$7,409,512	$4,323,459	$35,504	$2,946,013	$3,476,251	$1,838,893	$800,299	$300,755	$1,848,957	$1,821,912	$2,024,700	$2,598,359	$807,899	$3,180,795	21
.....	34	5	.....	4	.....	8	.....	.....	4	3	4	1	.....	6	22
.....	$12,293	$1,642	.....	$1,284	.....	$2,885	.....	.....	$780	$1,047	$1,240	$312	.....	$1,569	23
.....	3	.....	.....	5	2	.....	1	.....	.....	.....	.....	3	.....	3	24
.....	$722	.....	.....	$1,650	$149	.....	$99	.....	.....	.....	.....	$716	.....	$389	25
384	13,641	7,943	68	5,333	5,668	3,562	1,407	578	3,619	3,066	3,702	4,657	1,485	5,593	26
378	13,840	8,094	62	5,291	5,654	3,575	1,335	583	3,668	3,040	3,741	4,729	1,448	5,439	27
386	14,095	8,110	67	5,418	5,701	3,566	1,422	587	3,733	3,050	3,838	4,765	1,619	5,519	28
395	14,148	8,179	72	5,501	5,697	3,518	1,407	589	3,743	3,065	3,921	4,863	1,642	5,528	29
386	13,810	7,901	68	5,524	5,602	3,543	1,443	582	3,699	3,095	4,015	4,890	1,691	5,492	30
391	13,407	7,770	62	5,420	5,350	3,529	1,295	580	3,704	3,058	3,908	4,628	1,629	5,402	31
385	13,312	7,692	64	5,443	5,398	3,512	1,349	525	3,413	2,952	3,895	4,565	1,502	5,414	32
389	13,515	8,022	63	5,572	5,442	3,617	1,389	541	3,443	2,936	3,905	4,607	1,580	5,543	33
395	13,707	8,117	61	5,552	5,412	3,635	1,299	541	3,538	2,908	4,016	4,537	1,632	5,560	34
422	13,916	8,319	62	5,648	5,689	3,532	1,332	561	3,545	3,005	4,064	4,681	1,578	5,708	35
443	13,928	8,419	62	5,582	5,708	3,574	1,426	585	3,628	3,064	4,110	4,704	1,408	5,815	36
430	13,868	8,351	62	5,574	5,756	3,607	1,472	601	3,659	3,096	4,094	4,720	1,445	5,825	37
.....	36	5	.....	4	.....	8	.....	.....	4	4	4	1	.....	6	38
.....	35	5	.....	4	.....	8	.....	.....	4	4	4	1	.....	6	39
.....	33	4	.....	4	.....	8	.....	.....	4	4	4	1	.....	6	40
.....	36	5	.....	4	.....	8	.....	.....	4	4	4	1	.....	6	41
.....	36	5	.....	4	.....	8	.....	.....	4	3	4	1	.....	6	42
.....	36	5	.....	4	.....	8	.....	.....	4	3	4	1	.....	6	43
.....	36	5	.....	4	.....	8	.....	.....	4	3	4	1	.....	6	44
.....	36	5	.....	4	.....	8	.....	.....	4	3	4	1	.....	6	45
.....	35	5	.....	4	.....	8	.....	.....	4	3	4	1	.....	6	46
.....	35	5	.....	4	.....	8	.....	.....	4	3	4	1	.....	6	47
.....	31	5	.....	4	.....	8	.....	.....	4	3	3	1	.....	6	48
.....	31	5	.....	4	.....	8	.....	.....	4	3	3	1	.....	12	49
.....	30	5	.....	4	.....	8	.....	.....	.....	.....	.....	.....	.....	.....	
.....	3	.....	.....	5	2	.....	1	.....	.....	.....	.....	3	.....	6	50
.....	3	.....	.....	4	2	.....	1	.....	.....	.....	.....	3	.....	3	51
.....	3	.....	.....	4	2	.....	1	.....	.....	.....	.....	3	.....	3	52
.....	3	.....	.....	4	2	.....	1	.....	.....	.....	.....	3	.....	2	53
.....	3	.....	.....	5	2	.....	.....	.....	.....	.....	.....	3	.....	1	54
.....	3	.....	.....	5	2	.....	.....	.....	.....	.....	.....	3	.....	3	55
.....	3	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	3	.....	3	56
.....	4	.....	.....	5	2	.....	.....	.....	.....	.....	.....	3	.....	2	57
.....	4	.....	.....	5	2	.....	1	.....	.....	.....	.....	3	.....	3	58
.....	4	.....	.....	5	2	.....	1	.....	.....	.....	.....	3	.....	2	59
.....	3	.....	.....	5	2	.....	1	.....	.....	.....	.....	3	.....	4	60
.....	3	.....	.....	10	2	.....	.....	.....	.....	.....	.....	3	.....	4	61
.....	3	.....	.....	4	2	.....	1	.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$95,561	$18,336	$102,500	62
.....	.....	.....	.....	.....	.....	.....	$19,699	$35,485	$55,163	$32,544	$39,642	.....	.....	$10	63
$2,743	$267,497	$171,355	$87	$124,453	$101,457	$55,984	$1,348	.....	.....	$2,500	$300	.....	.....	$48,637	64
.....	$8,601	.....	.....	.....	.....	$35	.....	.....	.....	$50	$1,827	$15,031	$15,441	$53,853	65
$2,723	$84,826	$33,490	$26	$36,894	$37,799	$16,135	$1,082	$6,715	$8,252	$29,994	$33,572	$80,530	$2,895	.....	66
$20	$172,683	$131,072	$61	$87,559	$63,658	$39,814	$8,269	$28,720	$46,911	.....	$3,943	.....	.....	.....	
.....	$1,387	$6,798	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
$214,166	$8,286,776	$5,454,676	$18,224	$2,896,269	$3,071,173	$2,267,578	$562,658	$487,604	$2,567,486	$1,752,564	$2,120,166	$3,380,441	$464,034	$3,019,574	67
$174,649	$6,712,080	$4,253,201	$18,509	$2,097,882	$2,424,789	$1,857,790	$484,497	$361,303	$2,172,354	$1,432,336	$1,649,454	$2,175,062	$362,468	$2,227,563	68
$3,216	$203,403	$97,996	$150	$101,214	$77,365	$49,122	$13,870	$10,846	$28,469	$45,446	$73,121	$119,239	$16,472	$85,702	69
.....	.....	.....	.....	.....	.....	$400	.....	.....	.....	.....	$200	$1,800	$100	$2,641	70
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$15,284	$48,325	$6,402	$30,003	71
$815	$113,024	$53,431	$140	$33,173	$23,733	$15,037	$6,826	$2,266	$12,824	$11,426	$386,896	$1,038,015	$78,592	$663,640	72
$35,299	$1,250,503	$1,004,396	$4,425	$630,437	$489,576	$324,168	$57,465	$112,427	$352,670	$263,356	$14,211	.....	.....	$1,025	73
$187	$7,766	$45,652	.....	$33,583	$55,710	$21,061	.....	$762	$1,669	.....	.....	.....	.....	.....	

TABLE 16.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM

		United States.	Alabama.	Arizona.	Arkansas.	California.	Colorado.	Connecticut.	Delaware.	Florida.	Georgia.
	Products:										
74	Aggregate value	$218,238,277	$4,172,192	$887,482	$2,095,447	$7,553,626	$3,141,602	$2,430,056	$1,012,683	$1,112,245	$3,062,283
	Motive power and machinery—										
75	Total value	$94,437,260	$1,544,805	$542,525	$873,835	$1,783,739	$1,648,308	$1,198,797	$490,921	$575,228	$1,126,034
76	Locomotives built, number	272	.....	.....	3	.....	.....	6	.....	.....	.....
77	Value	$3,276,393	.....	.....	$23,169	.....	.....	$53,728	.....	.....	.....
78	Locomotives repaired, number	1,375,265	1,414	1,608	25,197	2,977	19,142	350	1,868	1,060	2,926
79	Value	$57,383,143	$986,867	$439,413	$666,911	$1,630,941	$1,309,052	$511,352	$249,941	$465,954	$892,086
80	Work for other corporations, value	$3,338,589	$31,055	$9,643	$46,928	$20,167	$198,618	.....	$12,357	$816	$26,411
81	Other products, value	$30,449,135	$526,883	$93,469	$136,827	$132,631	$140,638	$633,717	$228,623	$108,458	$207,537
	Car department—										
82	Total value	$118,376,552	$2,567,196	$276,625	$878,798	$5,745,358	$1,305,898	$1,180,996	$515,924	$524,304	$1,767,601
83	Passenger cars built, number	390	.....	.....	5	4	7	7	.....	.....	.....
84	Value	$1,441,733	.....	.....	$20,272	$11,777	$26,583	$18,343	.....	.....	.....
85	Freight cars built, number	26,543	1,206	.....	51	667	221	16	.....	65	364
86	Value	$15,079,619	$681,413	.....	$16,723	$329,577	$91,801	$8,976	.....	$35,254	$170,964
87	Cars repaired, number	8,376,769	121,317	9,029	120,368	58,973	186,675	12,354	8,449	39,437	58,420
88	Value	$74,665,500	$1,515,731	$251,580	$657,521	$1,576,111	$959,311	$757,087	$312,530	$461,255	$1,223,447
89	Work for other corporations, value	$7,084,857	$152,416	$16,310	$120,139	$334,609	$112,503	$15,216	$34,210	$1,773	$119,853
90	Other products, value	$20,104,843	$217,636	$8,735	$64,143	$3,493,284	$115,700	$380,774	$169,184	$26,022	$258,337
	Bridge and building department—										
91	Total value	$5,414,465	$60,191	$68,332	$342,814	$24,529	$187,396	$50,263	$5,838	$12,713	$168,648
92	Repairs and renewals, value	$3,937,170	$48,227	$67,805	$71,685	$13,015	$96,238	$29,230	$5,838	$8,286	$102,217
93	Work for other corporations, value	$241,626	.....	.....	$14,838	$7,868	.....	.....	.....	$700	$1,200
94	Other products, value	$1,235,669	$11,964	$1,027	$256,291	$3,646	$91,158	$21,033	.....	$3,727	$65,231
	Comparison of products:										
95	Number of establishments reporting for both years	1,234	16	5	18	29	26	9	5	10	29
96	Value for census year	$215,921,429	$4,067,895	$767,484	$2,088,362	$7,553,626	$2,979,022	$2,430,056	$1,012,683	$1,029,915	$2,950,266
97	Value for preceding business year	$179,268,482	$3,192,798	$707,645	$1,848,661	$6,611,783	$2,865,540	$2,294,962	$928,390	$866,999	$2,632,716
	Power:										
98	Number of establishments reporting	932	16	6	12	19	17	8	2	9	22
99	Total horsepower	99,430	1,588	230	920	3,182	1,153	613	339	433	1,357
	Owned—										
	Engines—										
100	Steam, number	1,556	28	6	14	36	21	12	11	12	25
101	Horsepower	90,342	1,588	140	720	2,150	1,147	498	339	433	1,237
102	Gas or gasoline, number	30	.....	.....	.....	1	.....	.....	.....	.....	.....
103	Horsepower	703	.....	.....	.....	12	.....	.....	.....	.....	.....
104	Water wheels, number	7	.....	.....	.....	2	1	.....	.....	.....	.....
105	Horsepower	56	.....	.....	.....	16	5	.....	.....	.....	.....
106	Electric motors, number	241	.....	1	.....	1	1	.....	.....	.....	2
107	Horsepower	4,343	.....	15	.....	20	1	.....	.....	.....	120
108	Other kind, number	32	.....	1	1	2	.....	.....	.....	.....	.....
109	Horsepower	2,096	.....	75	200	125	.....	.....	.....	.....	.....
	Rented—										
110	Supplied to other establishments, horsepower	381	.....	.....	.....	.....	.....	75	.....	.....	.....
111	From other establishments, horsepower	1,890	.....	.....	.....	859	.....	115	.....	.....	.....
	Establishments classified by number of employees:										
112	Total number	1,296	19	7	21	29	29	9	5	18	32
113	Under 5	132	1	.....	8	3	2	1	.....	3	7
114	5 to 20	325	4	2	6	9	6	1	2	3	9
115	21 to 50	228	2	1	2	3	9	.....	1	2	2
116	51 to 100	172	2	2	1	6	4	2	1	.....	4
117	101 to 250	201	3	1	.....	2	2	3	.....	4	5
118	251 to 500	154	5	1	3	4	4	1	.....	1	4
119	501 to 1,000	61	1	.....	1	1	2	1	1	.....	1
120	Over 1,000	23	1	.....	.....	1	.....	.....	.....	.....	.....

RAILROAD COMPANIES, BY STATES AND TERRITORIES: 1900—Continued.

Idaho.	Illinois.	Indiana.	Indian Territory.	Iowa.	Kansas.	Kentucky.	Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.	Mississippi.	Missouri.	
$523,631	$16,580,424	$10,242,422	$56,635	$6,221,378	$6,816,816	$4,248,029	$1,429,099	$857,136	$4,573,229	$3,712,029	$4,332,927	$6,319,876	$1,331,401	$6,524,121	74
$294,333	$7,402,600	$4,363,977	$31,701	$2,898,775	$2,519,320	$1,753,703	$959,941	$344,536	$2,695,668	$1,709,229	$1,506,894	$3,256,252	$481,510	$2,482,874	75
.....	27	1	.....	8	12	.....	.....	.....	.....	.....	16	.....	.....	2	76
.....	$338,826	$5,709	.....	$59,149	$142,800	.....	.....	.....	.....	.....	$107,011	.....	.....	$13,545	77
1,329	162,810	102,604	6,867	62,664	78,597	5,699	1,435	5,400	5,588	902	3,239	29,071	1,818	61,233	78
$223,694	$4,497,144	$2,983,445	$30,055	$2,251,443	$1,801,317	$1,099,216	$329,551	$216,874	$1,236,343	$1,196,487	$1,137,222	$1,826,432	$337,734	$1,559,718	79
$5,433	$391,048	$148,509	.....	$60,406	$36,003	$28,209	$21,101	$2,955	$61,155	$430	$20,783	$469,236	$22,881	$229,877	80
$65,206	$2,175,582	$1,231,314	$1,646	$527,777	$539,200	$626,278	$609,289	$124,707	$1,398,170	$512,312	$241,878	$960,584	$120,895	$679,734	81
$222,887	$8,771,949	$5,689,968	$24,934	$2,960,771	$3,955,303	$2,429,216	$446,507	$494,151	$1,801,641	$1,998,380	$2,552,421	$3,009,788	$828,839	$3,743,855	82
.....	32	5	.....	.....	6	1	.....	7	1	20	3	1	.....	2	83
.....	$98,464	$21,696	.....	.....	$21,300	$3,079	.....	$17,241	$2,265	$35,451	$10,055	$13,904	.....	$10,895	84
.....	2,570	1,941	.....	38	662	555	25	.....	54	230	460	117	84	72	85
.....	$1,877,698	$992,512	.....	$26,964	$353,037	$328,786	$11,726	.....	$24,390	$96,150	$215,108	$56,433	$41,139	$32,122	86
28,561	741,728	256,131	9,632	228,415	220,673	147,916	48,443	20,236	38,272	72,206	72,782	152,941	71,356	262,960	87
$192,026	$5,641,067	$3,584,005	$24,934	$2,570,313	$3,170,853	$1,884,470	$368,974	$434,363	$1,221,773	$1,342,309	$1,855,941	$2,157,271	$530,114	$2,595,377	88
$10,967	$460,931	$493,631	.....	$170,172	$196,257	$138,997	$19,012	$21,802	$53,526	$190,228	$86,269	$273,063	$33,712	$693,548	89
$19,894	$1,193,789	$598,124	.....	$193,322	$213,856	$573,884	$46,795	$20,745	$499,687	$334,242	$385,048	$509,117	$223,824	$411,913	90
$6,411	$405,875	$188,477	.....	$361,832	$342,193	$65,110	$22,651	$18,449	$75,920	$4,420	$273,612	$53,336	$21,052	$297,392	91
$4,529	$369,133	$156,665	.....	$305,955	$122,155	$52,553	$20,359	$13,941	$70,341	$4,420	$247,373	$51,445	$21,052	$82,660	92
$1,030	$5,072	$1,856	.....	$1,043	$10,728	.....	.....	$273	.....	.....	.....	.....	.....	$159,586	93
$852	$31,670	$29,956	.....	$54,834	$209,310	$12,557	$2,292	$4,235	$5,579	.....	$26,239	$2,391	.....	$55,196	94
4	94	51	3	57	37	25	18	19	18	16	36	39	9	43	95
$523,631	$16,328,465	$10,280,721	$56,635	$5,766,008	$6,816,816	$4,248,029	$1,424,239	$857,136	$4,557,988	$3,712,029	$4,249,136	$6,319,876	$1,331,401	$6,524,121	96
$470,847	$14,148,410	$8,777,904	$51,388	$5,217,045	$6,272,264	$3,173,418	$1,282,317	$802,641	$3,869,289	$3,087,849	$3,435,214	$5,294,207	$1,201,549	$5,586,348	97
2	68	34	.....	34	22	19	10	13	13	13	33	30	7	30	98
167	8,038	5,975	.....	4,192	2,840	2,063	632	437	3,603	1,583	3,551	3,981	1,040	2,893	99
4	121	71	.....	54	33	31	15	10	33	14	55	51	10	39	100
167	6,864	5,503	.....	3,662	2,100	2,013	632	341	3,486	1,577	3,305	3,560	680	2,710	101
.....	.....	1	.....	2	.....	.....	.....	1	.....	.....	1	5	.....	.....	102
.....	.....	13	.....	18	.....	.....	.....	4	.....	.....	22	62	.....	.....	103
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	104
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	105
.....	.....	.....	.....	.....	.....	.....	.....	1	6	.....	.....	9	.....	5	106
.....	38	16	.....	27	.....	.....	.....	10	167	.....	.....	185	.....	48	107
.....	1,059	459	.....	512	.....	.....	.....	2	.....	.....	3	3	.....	.....	108
.....	5	.....	.....	.....	5	1	.....	12	.....	.....	204	150	.....	.....	109
.....	115	.....	.....	.....	740	25	.....	70	.....	6	.....	5	.....	.....	110
.....	75	.....	.....	.....	.....	.....	.....	70	.....	6	20	24	360	135	111
4	98	54	3	58	37	25	19	19	19	16	42	39	9	43	112
1	7	9	.....	9	2	3	2	2	.....	1	3	4	1	4	113
1	25	16	2	15	8	5	6	7	7	2	14	8	2	10	114
1	22	5	.....	11	8	6	7	5	1	.....	8	14	1	10	115
.....	18	5	1	7	5	4	2	4	4	2	6	.....	1	4	116
.....	14	6	.....	7	6	2	1	1	4	6	4	2	1	8	117
1	11	6	.....	7	7	4	.....	.....	1	5	6	8	2	4	118
.....	3	6	.....	2	.....	.....	1	.....	1	.....	1	3	1	3	119
.....	3	1	.....	.....	1	1	.....	.....	1	.....	.....	.....	.....	.....	120

TABLE 16.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM

		Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	North Dakota.	Ohio.	Oklahoma.
1	Number of establishments	7	23	6	9	18	7	82	12	3	91	3
	Character of organization:											
2	Incorporated company	7	23	6	9	18	7	82	12	3	91	3
	Capital:											
3	Total	$524,725	$3,635,267	$404,577	$850,873	$2,819,759	$386,721	$11,244,747	$539,513	$171,043	$5,701,129	$9,350
4	Land	$37,500	$1,947,600	$53,700	$130,808	$404,314	$5,000	$1,200,582	$36,540	$20,180	$659,277	$1,900
5	Buildings	$163,135	$704,550	$104,200	$207,412	$1,218,005	$113,151	$2,679,844	$165,435	$87,214	$1,651,260	$3,400
6	Machinery, tools, and implements	$141,513	$593,118	$83,303	$265,003	$560,030	$227,092	$2,790,025	$166,365	$43,750	$1,304,205	$1,800
7	Cash and sundries	$182,577	$389,999	$163,374	$247,650	$637,410	$41,478	$4,574,296	$171,173	$19,899	$2,086,387	$2,050
	Salaried officials, clerks, etc.:											
8	Total number	49	114	8	30	179	19	443	47	7	576	3
9	Total salaries	$50,382	$100,401	$9,800	$24,201	$137,191	$18,784	$344,596	$38,463	$6,725	$456,971	$2,405
	General superintendents, managers, clerks, etc.—											
10	Total number	49	114	8	30	179	19	443	47	7	576	3
11	Total salaries	$50,382	$100,401	$9,800	$24,201	$137,191	$18,784	$344,596	$38,463	$6,725	$456,971	$2,405
	Men—											
12	Number	48	114	8	30	172	19	433	47	7	561	3
13	Salaries	$49,642	$100,401	$9,800	$24,201	$134,437	$18,784	$341,102	$38,463	$6,725	$451,398	$2,405
	Women—											
14	Number	1	.....	.....	.....	7	.....	10	.....	.....	15	.....
15	Salaries	$740	.....	.....	.....	$2,754	.....	$3,494	.....	.....	$5,573	.....
	Wage-earners, including pieceworkers, and total wages:											
16	Greatest number employed at any one time during the year.	700	2,585	277	1,044	5,083	1,215	14,574	1,241	148	12,839	25
17	Least number employed at any one time during the year.	533	2,265	184	925	4,207	912	11,561	1,028	92	10,085	19
18	Average number	621	2,458	214	966	4,594	1,061	13,062	1,141	126	11,534	22
19	Wages	$397,552	$1,421,284	$168,102	$516,990	$2,399,675	$585,401	$6,762,504	$550,504	$67,922	$6,087,052	$13,333
	Men, 16 years and over—											
20	Average number	621	2,458	214	966	4,587	1,061	13,013	1,139	126	11,520	22
21	Wages	$397,552	$1,421,284	$168,102	$516,990	$2,397,518	$585,401	$6,747,126	$550,128	$67,922	$6,082,128	$13,333
	Women, 16 years and over—											
22	Average number	.....	.....	.....	.....	7	.....	49	2	.....	14	.....
23	Wages	.....	.....	.....	.....	$2,157	.....	$15,378	$376	.....	$4,924	.....
	Children, under 16 years—											
24	Average number	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Wages	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Average number of wage-earners, including pieceworkers, employed during each month:											
	Men, 16 years and over—											
26	January	638	2,525	186	937	4,565	1,156	12,954	1,139	129	11,423	21
27	February	621	2,483	188	941	4,639	1,108	13,071	1,169	119	11,432	19
28	March	656	2,526	193	946	4,692	1,007	13,305	1,208	124	11,643	18
29	April	626	2,477	266	970	4,761	1,037	13,488	1,197	120	11,732	20
30	May	657	2,505	212	968	4,715	1,050	13,630	1,224	109	11,767	23
31	June	658	2,517	208	946	4,565	946	13,079	1,097	110	11,326	21
32	July	576	2,324	209	939	4,440	1,011	12,322	1,139	99	10,930	19
33	August	614	2,348	204	949	4,485	1,043	12,460	1,106	133	10,987	22
34	September	613	2,388	227	953	4,455	1,047	12,473	1,108	146	11,338	23
35	October	615	2,418	227	985	4,479	1,081	12,824	1,096	139	11,688	25
36	November	565	2,472	230	1,034	4,574	1,116	13,178	1,095	147	11,956	24
37	December	608	2,515	218	1,023	4,680	1,124	13,376	1,094	136	12,015	28
	Women, 16 years and over—											
38	January	.....	.....	.....	.....	7	.....	47	2	.....	15	.....
39	February	.....	.....	.....	.....	7	.....	47	2	.....	15	.....
40	March	.....	.....	.....	.....	7	.....	47	2	.....	15	.....
41	April	.....	.....	.....	.....	7	.....	47	2	.....	13	.....
42	May	.....	.....	.....	.....	7	.....	57	2	.....	13	.....
43	June	.....	.....	.....	.....	7	.....	56	2	.....	12	.....
44	July	.....	.....	.....	.....	6	.....	47	2	.....	13	.....
45	August	.....	.....	.....	.....	6	.....	48	2	.....	14	.....
46	September	.....	.....	.....	.....	6	.....	47	2	.....	14	.....
47	October	.....	.....	.....	.....	6	.....	46	2	.....	14	.....
48	November	.....	.....	.....	.....	10	.....	47	2	.....	13	.....
49	December	.....	.....	.....	.....	8	.....	49	2	.....	13	.....
	Children, under 16 years—											
50	January	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
51	February	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
52	March	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
53	April	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
54	May	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
55	June	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
56	July	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
57	August	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
58	September	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
59	October	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
60	November	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
61	December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Miscellaneous expenses:											
62	Total	$5,138	$92,946	$7,446	$36,763	$195,707	$1,913	$203,221	$29,259	$1,400	$391,581	$117
63	Rent of works	.....	.....	.....	.....	.....	.....	$3,400	.....	.....	$1,350	.....
64	Taxes not including internal revenue.	$4,728	$24,824	$2,531	$5,013	$17,078	$436	$63,721	$4,831	$1,400	$58,321	$117
65	Rent of offices, etc.	$410	$68,122	$4,915	$31,750	$76,411	$1,477	$136,100	$23,861	.....	$327,558	.....
66	Contract work	.....	.....	.....	.....	$102,218	.....	.....	$567	.....	$4,352	.....
	Materials used:											
67	Total cost	$301,338	$1,009,830	$110,637	$523,347	$2,301,699	$463,182	$8,879,813	$893,150	$64,847	$5,963,808	$6,736
68	Purchased in partially manufactured form.	$185,328	$746,227	$65,789	$322,192	$1,815,797	$324,462	$6,648,296	$739,081	$39,093	$4,884,232	$4,266
69	Fuel	$19,209	$46,634	$9,284	$14,780	$51,243	$18,153	$158,519	$12,300	$6,195	$111,639	$286
70	Rent of power and heat	.....	.....	.....	.....	.....	.....	.....	.....	.....	$120	.....
71	Mill supplies	$6,108	$31,801	$1,294	$2,064	$8,012	$21,525	$147,840	$4,807	$975	$52,824	$302
72	All other materials	$90,693	$180,964	$30,316	$184,311	$426,647	$99,042	$1,925,158	$137,462	$18,584	$1,388,967	$1,882
73	Freight	.....	$4,204	$3,954	.....	.....	.....	.....	.....	.....	$26,026	.....

RAILROAD COMPANIES, BY STATES AND TERRITORIES: 1900—Continued.

Oregon.	Pennsylvania.	Rhode Island.	South Carolina.	South Dakota.	Tennessee.	Texas.	Utah.	Vermont	Virginia	Washington.	West Virginia.	Wisconsin.	Wyoming.	All other states.[1]	
14	144	3	6	7	16	56	10	7	28	16	23	46	7	3	1
14	144	3	6	7	16	56	10	7	28	16	23	46	7	3	2
$725,935	$19,182,001	$120,900	$354,842	$68,079	$1,319,628	$3,730,792	$496,149	$711,261	$1,733,389	$944,800	$1,040,311	$4,206,285	$591,725	$470,387	3
$141,000	$2,128,663	$11,500	$24,050	$6,040	$102,517	$437,873	$141,200	$92,100	$101,572	$194,820	$43,958	$589,375	$35,760	$200,700	4
$202,433	$5,766,904	$41,000	$86,833	$34,600	$147,145	$897,579	$115,450	$274,200	$482,886	$313,270	$279,536	$1,343,738	$152,450	$122,525	5
$161,219	$4,858,929	$50,500	$78,903	$6,941	$287,159	$1,104,483	$147,412	$216,458	$421,488	$243,176	$250,951	$690,578	$278,796	$57,960	6
$221,283	$6,427,505	$17,900	$165,056	$20,498	$422,807	$1,290,857	$92,087	$128,503	$727,443	$193,534	$465,866	$1,582,594	$124,719	$89,202	7
29	1,065	17	27	9	65	263	46	32	283	55	90	272	28	14	8
$31,678	$810,857	$14,490	$21,379	$8,354	$58,606	$292,398	$49,389	$23,744	$248,425	$51,353	$67,646	$245,163	$29,374	$13,160	9
29	1,065	17	27	9	65	263	46	32	283	55	90	272	28	14	10
$31,678	$810,857	$14,490	$21,379	$8,354	$58,606	$292,398	$49,389	$23,744	$248,425	$51,353	$67,646	$245,163	$29,374	$13,160	11
29	1,042	17	26	9	62	259	46	25	280	54	90	270	28	14	12
$31,678	$800,687	$14,490	$20,959	$8,354	$56,896	$289,758	$49,389	$21,978	$247,093	$50,948	$67,646	$244,023	$29,374	$13,160	13
.....	23	.....	1	.....	3	4	.....	7	3	1	.....	2	.....	.....	14
.....	$10,170	.....	$420	.....	$1,710	$2,640	.....	$1,766	$1,332	$405	.....	$1,140	.....	.....	15
855	31,289	218	889	150	3,070	7,336	1,034	883	5,262	1,153	2,908	5,141	1,049	461	16
705	26,392	206	680	102	2,503	5,879	746	713	4,569	820	2,367	4,027	731	361	17
751	28,554	215	776	117	2,817	6,633	908	779	4,922	956	2,605	4,502	853	394	18
$495,159	$15,825,640	$133,300	$363,041	$79,661	$1,459,319	$4,004,709	$636,076	$446,017	$2,452,195	$653,205	$1,256,640	$2,398,144	$623,046	$205,475	19
751	28,372	215	774	117	2,810	6,633	907	779	4,897	955	2,604	4,499	851	373	20
$495,159	$15,779,638	$133,300	$362,681	$79,661	$1,457,718	$4,004,709	$635,776	$446,017	$2,447,732	$652,780	$1,256,280	$2,396,997	$622,446	$198,601	21
.....	144	.....	2	.....	7	.....	1	.....	8	1	1	3	.....	21	22
.....	$38,974	.....	$360	.....	$1,601	.....	$300	.....	$1,403	$425	$360	$1,147	.....	$6,874	23
.....	38	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	24
.....	$7,028	.....	.....	.....	.....	.....	.....	.....	$3,060	.....	.....	.....	$600	.....	25
788	27,636	206	790	113	2,933	6,439	895	742	5,040	965	2,579	4,247	814	356	26
770	28,134	212	807	114	2,911	6,353	906	731	5,003	979	2,672	4,260	810	379	27
763	28,462	211	854	121	2,975	6,479	933	760	5,078	1,025	2,708	4,416	856	419	28
772	28,525	218	856	118	2,934	6,459	958	780	5,044	1,050	2,701	4,554	812	397	29
778	28,540	218	853	112	2,885	6,430	936	859	5,127	1,056	2,734	4,611	795	401	30
713	28,177	217	691	111	2,579	6,407	969	834	4,780	907	2,454	4,496	743	366	31
723	27,617	215	731	103	2,598	6,620	832	799	4,661	884	2,443	4,417	758	349	32
738	27,907	216	751	119	2,658	6,888	830	798	4,748	893	2,500	4,520	844	342	33
737	28,378	217	728	111	2,769	6,805	852	786	4,791	887	2,591	4,523	869	358	34
760	28,801	217	741	120	2,775	6,949	921	770	4,798	918	2,598	4,707	947	376	35
736	28,872	216	740	139	2,841	6,944	897	772	4,796	942	2,605	4,695	955	366	36
739	29,430	217	740	119	2,861	6,870	961	766	4,902	954	2,661	4,643	1,014	371	37
.....	142	.....	2	.....	8	.....	1	.....	8	1	1	3	.....	21	38
.....	143	.....	2	.....	8	.....	1	.....	8	1	1	3	.....	21	39
.....	144	.....	2	.....	8	.....	1	.....	8	1	1	3	.....	21	40
.....	144	.....	2	.....	7	.....	1	.....	8	1	1	3	.....	21	41
.....	144	.....	2	.....	7	.....	1	.....	8	1	1	3	.....	21	42
.....	143	.....	.....	.....	7	.....	1	.....	7	1	1	3	.....	21	43
.....	145	.....	2	.....	7	.....	1	.....	7	1	1	3	.....	21	44
.....	145	.....	2	.....	7	.....	1	.....	7	1	1	3	.....	21	45
.....	140	.....	2	.....	7	.....	1	.....	7	1	1	3	.....	19	46
.....	144	.....	2	.....	7	.....	1	.....	9	1	1	3	.....	20	47
.....	144	.....	2	.....	7	.....	1	.....	9	1	1	3	.....	20	48
.....	149	.....	2	.....	7	.....	1	.....	8	1	1	7	.....	21	49
.....	28	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	50
.....	32	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	51
.....	37	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	52
.....	38	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	53
.....	41	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	54
.....	40	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	55
.....	40	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	56
.....	41	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	57
.....	40	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	58
.....	41	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	59
.....	40	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	60
.....	38	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	2	.....	61
$15,688	$3,280,079	$1,770	$12,555	$3,049	$66,765	$138,838	$16,219	$4,614	$45,406	$14,264	$32,355	$138,270	$37,194	$1,100	62
.....	$225	.....	.....	.....	.....	.....	.....	.....	$200	$230	$60	.....	.....	.....	63
$9,807	$61,366	$1,770	$4,508	$1,270	$12,478	$45,194	$10,815	$2,092	$12,279	$11,614	$11,831	$15,988	$6,250	$900	64
$6,381	$265,622	.....	$8,047	$1,779	$54,287	$77,644	$5,404	$2,522	$32,927	$2,420	$20,464	$122,282	$30,944	$200	65
.....	$2,952,866	.....	.....	.....	.....	$16,000	.....	.....	.....	.....	.....	.....	.....	.....	66
$483,644	$23,147,574	$48,596	$294,334	$86,567	$1,528,363	$3,878,586	$604,907	$350,401	$3,531,283	$760,858	$1,586,916	$3,525,144	$480,199	$157,255	67
$341,625	$18,813,128	$38,100	$197,669	$60,028	$1,034,198	$3,116,632	$445,609	$294,478	$2,480,483	$571,888	$1,366,609	$2,981,275	$369,771	$116,537	68
$19,629	$855,541	$2,575	$8,235	$2,029	$21,458	$87,472	$16,087	$11,052	$57,287	$22,086	$19,616	$69,274	$18,499	$7,678	69
$200	$1,544	.....	.....	.....	.....	$504	.....	$500	.....	$1,718	.....	.....	.....	.....	70
$3,677	$145,101	$584	$1,520	$4,782	$25,395	$63,569	$8,131	$6,605	$55,330	$7,037	$16,007	$23,511	$3,667	$1,303	71
$110,224	$3,829,654	$7,331	$86,910	$19,728	$434,723	$607,940	$135,080	$37,501	$938,139	$158,065	$184,524	$421,999	$88,262	$31,787	72
$8,289	$2,606	.....	.....	.....	$12,589	$2,419	.....	$265	$44	$64	$160	$29,085	.....	.....	73

[1] Includes establishments distributed as follows: Alaska, 1; District of Columbia, 2.

TABLE 16.—CARS AND GENERAL SHOP CONSTRUCTION AND REPAIRS BY STEAM

		Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	North Dakota.	Ohio.	Oklahoma.
	Products:											
74	Aggregate value	$754,410	$2,624,461	$295,985	$1,101,301	$5,034,267	$1,069,280	$16,194,850	$1,511,376	$140,894	$12,975,182	$22,591
	Motive power and machinery—											
75	Total value	$524,006	$1,476,402	$111,856	$576,751	$2,551,960	$631,029	$6,864,940	$494,561	$102,101	$4,726,651	$9,400
76	Locomotives built, number	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....
77	Value	.....	.....	.....	.....	.....	.....	$25,114	.....	.....	.....	.....
78	Locomotives repaired, number.	3,541	54,281	132	812	8,064	16,598	131,290	15,044	194	160,306	1,672
79	Value	$327,637	$1,208,860	$90,834	$449,949	$1,181,002	$591,129	$4,218,942	$430,099	$34,941	$3,175,272	$9,400
80	Work for other corporations, value.	$1,869	$47,931	$12,587	$323	$29,432	$25,400	$324,190	$2,128	.....	$52,023	.....
81	Other products, value	$194,500	$219,611	$8,435	$126,479	$1,341,526	$14,500	$2,296,694	$62,334	$67,160	$1,499,356	.....
	Car department—											
82	Total value	$228,796	$1,074,737	$176,748	$490,910	$2,356,015	$426,913	$8,976,656	$993,194	$38,793	$8,032,237	$10,101
83	Passenger cars built, number.	.....	.....	.....	8	12	.....	73	3	.....	9	.....
84	Value	.....	.....	.....	$25,834	$101,804	.....	$185,191	$15,538	.....	$46,918	.....
85	Freight cars built, number	.....	.....	12	129	1	.....	786	649	.....	1,304	.....
86	Value	.....	.....	$6,157	$63,382	$435	.....	$328,719	$276,476	.....	$425,643	.....
87	Cars repaired, number	36,850	44,901	18,142	20,579	217,801	38,429	1,792,841	27,015	4,430	722,929	2,387
88	Value	$228,271	$631,541	$51,169	$219,801	$1,888,186	$339,636	$6,319,591	$633,263	$36,833	$5,819,411	$9,740
89	Work for other corporations, value.	.....	$377,063	$6,954	$54,603	$107,609	$70,052	$737,088	$26,483	.....	$391,324	.....
90	Other products, value	$525	$65,533	$112,468	$127,290	$257,981	$17,225	$1,406,067	$41,434	$1,960	$1,348,941	$451
	Bridge and building department—											
91	Total value	$1,608	$73,322	$7,381	$33,640	$126,292	$11,338	$353,254	$23,621	.....	$216,294	$3,000
92	Repairs and renewals, value	$1,608	$73,322	$6,866	$25,846	$125,563	$5,284	$310,265	$12,292	.....	$208,038	$3,000
93	Work for other corporations, value.	.....	.....	.....	.....	$125	$4,478	.....	.....	.....	.....	.....
94	Other products, value	.....	.....	$515	$7,794	$604	$1,576	$42,989	$11,329	.....	$8,256	.....
	Comparison of products:											
95	Number of establishments reporting for both years.	7	23	6	9	17	5	82	6	3	87	2
96	Value for census year	$754,410	$2,624,461	$295,985	$1,101,301	$5,027,001	$1,020,770	$16,194,850	$1,310,339	$140,894	$12,913,772	$21,372
97	Value for preceding business year	$688,042	$2,348,276	$237,654	$1,073,301	$4,588,762	$1,012,471	$13,664,930	$1,069,326	$126,752	$11,188,852	$10,101
	Power—											
98	Number of establishments reporting	7	14	5	6	16	6	66	10	2	72	.....
99	Total horsepower	396	2,037	175	854	2,084	760	6,741	762	223	6,797	.....
	Owned—											
	Engines—											
100	Steam, number	9	30	5	8	37	8	95	11	3	107	.....
101	Horsepower	396	1,987	170	684	1,597	610	6,556	757	181	6,762	.....
102	Gas or gasoline, number	.....	.....	.....	.....	8	.....	2	.....	1	.....	.....
103	Horsepower	.....	.....	.....	.....	391	.....	35	.....	16	.....	.....
104	Water wheels, number	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....
105	Horsepower	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	.....
106	Electric motors, number	.....	.....	.....	10	4	.....	28	.....	3	2	.....
107	Horsepower	.....	.....	.....	95	16	.....	148	.....	26	30	.....
108	Other kind, number	.....	1	.....	1	1	1	1	.....	.....	.....	.....
109	Horsepower	.....	50	.....	75	80	150	2	.....	.....	.....	.....
	Rented—											
110	Supplied to other establishments, horsepower.	.....	.....	.....	.....	.....	.....	.....	.....	.....	150	.....
111	From other establishments, horsepower.	.....	.....	.....	.....	.....	.....	.....	5	.....	5	.....
	Establishments classified by number of employees:											
112	Total number	7	23	6	9	18	7	82	12	3	91	3
113	Under 5	.....	4	1	2	1	.....	.....	4	1	2	1
114	5 to 20	.....	7	3	3	1	1	19	1	.....	20	2
115	21 to 50	2	2	1	1	.....	.....	17	1	.....	20	.....
116	51 to 100	2	3	.....	1	6	2	11	2	2	13	.....
117	101 to 250	3	4	1	1	4	2	15	2	.....	20	.....
118	251 to 500	.....	2	.....	1	2	1	14	2	.....	12	.....
119	501 to 1,000	.....	.....	.....	.....	2	1	3	.....	.....	3	.....
120	Over 1,000	.....	1	.....	.....	2	.....	3	.....	.....	1	.....

RAILROAD COMPANIES, BY STATES AND TERRITORIES: 1900—Continued.

Oregon.	Pennsylvania.	Rhode Island.	South Carolina.	South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	All other states.[1]	
$1,026,169	$43,065,171	$203,326	$691,361	$177,631	$3,113,053	$8,314,691	$1,306,591	$824,776	$6,277,279	$1,479,680	$2,943,557	$6,306,823	$1,169,813	$376,990	74
$275,894	$20,409,988	$87,529	$555,726	$91,917	$1,333,763	$4,046,335	$703,752	$343,864	$1,666,179	$742,945	$910,903	$1,942,515	$831,217	$149,571	75
.....	166	.....	.....	.....	.....	9	.....	1	6	.....	.....	13	.....	.....	76
.....	$2,303,712	.....	.....	.....	.....	$59,842	.....	$4,718	$61,455	.....	.....	$77,615	.....	.....	77
252	223,987	98	1,076	5,740	2,673	7,965	1,996	1,358	75,826	3,274	49,169	12,251	11,470	998	78
$233,750	$8,878,878	$73,555	$288,665	$66,015	$888,751	$2,239,853	$504,169	$208,441	$1,396,785	$339,445	$633,861	$1,125,855	$831,180	$76,733	79
$10,375	$521,698	.....	$4,839	$867	$48,770	$270,132	$2,748	$15,632	$1,901	$74,919	$16,747	$30,876	$37	$4,144	80
$31,769	$8,705,700	$13,974	$62,222	$25,035	$396,242	$1,476,508	$196,835	$115,073	$206,088	$328,581	$260,295	$708,169	.....	$68,694	81
$721,047	$22,121,173	$112,890	$333,781	$50,378	$1,694,499	$4,159,970	$598,563	$437,468	$4,469,806	$705,243	$1,835,730	$4,072,534	$337,551	$227,419	82
.....	153	.....	.....	.....	.....	11	.....	.....	1	.....	1	18	.....	.....	83
.....	$643,113	.....	.....	.....	.....	$55,564	.....	.....	$3,800	.....	$2,378	$50,268	.....	.....	84
.....	8,420	.....	.....	.....	107	412	14	54	1,407	216	162	3,371	.....	101	85
.....	$5,805,636	.....	.....	.....	$53,525	$191,945	$15,187	$27,473	$983,971	$108,308	$51,127	$1,792,612	.....	$58,200	86
55,716	1,466,305	5,275	16,470	4,413	143,876	207,906	33,876	17,179	154,625	58,695	163,161	117,161	15,881	3,152	87
$460,654	$12,876,887	$91,343	$260,787	$42,048	$1,077,097	$3,033,077	$320,568	$181,151	$1,860,432	$415,609	$1,085,840	$1,540,355	$333,149	$120,098	88
$11,158	$611,351	$3,717	$2,595	$5,730	$116,798	$344,021	$45,649	$100,077	$89,128	$51,141	$124,244	$50,052	$4,402	$3,874	89
$249,235	$2,184,186	$17,830	$70,399	$2,600	$447,079	$535,363	$217,159	$128,767	$1,532,475	$130,185	$572,141	$639,247	.....	$45,247	90
$29,228	$534,010	$2,907	$1,854	$35,336	$84,791	$108,386	$4,276	$43,444	$141,294	$31,492	$196,924	$291,774	$1,045	.....	91
$22,629	$394,779	$2,557	$1,613	$34,993	$41,776	$73,776	$4,076	$21,600	$126,409	$20,105	$195,020	$260,669	$462	.....	92
.....	$5,947	.....	.....	.....	.....	$23,496	.....	.....	$50	$2,700	.....	$104	$583	.....	93
$6,599	$133,284	$350	$241	$343	$43,015	$11,115	$200	$21,844	$14,835	$8,687	$1,904	$31,001	.....	.....	94
14	138	2	4	7	16	55	9	7	28	16	20	45	7	3	95
$1,026,169	$42,657,092	$198,156	$579,636	$177,631	$3,113,053	$8,304,204	$1,305,471	$824,776	$6,277,279	$1,479,680	$2,906,626	$6,294,223	$1,169,813	$376,990	96
$894,206	$31,426,681	$178,938	$407,914	$147,308	$2,719,703	$6,512,638	$1,179,629	$757,615	$4,712,581	$1,080,998	$2,376,866	$5,679,497	$807,469	$257,788	97
10	111	2	6	3	10	43	5	7	24	9	17	32	7	3	98
721	13,335	120	413	70	1,341	3,189	375	404	1,433	1,187	834	3,071	1,121	177	99
12	260	3	8	3	16	74	9	8	50	13	22	41	13	5	100
701	12,191	120	413	70	1,341	3,133	293	280	1,433	937	834	2,941	1,001	152	101
.....	5	.....	.....	.....	.....	.....	2	1	.....	.....	.....	.....	.....	.....	102
.....	104	.....	.....	.....	.....	.....	22	4	.....	.....	.....	.....	.....	.....	103
.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	104
.....	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	.....	.....	105
.....	51	.....	.....	.....	.....	3	2	.....	.....	6	.....	14	8	3	106
.....	949	.....	.....	.....	.....	31	60	.....	.....	170	.....	117	80	25	107
.....	1	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	1	1	.....	108
.....	30	.....	.....	.....	.....	.....	.....	20	.....	.....	.....	3	40	.....	109
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	110
20	41	.....	.....	.....	.....	25	.....	100	.....	80	.....	.....	.....	.....	111
14	144	3	6	7	16	56	10	7	28	16	23	46	7	3	112
1	14	.....	.....	2	1	3	2	1	2	3	3	11	.....	.....	113
5	36	1	1	4	2	16	2	3	5	7	4	11	1	.....	114
6	28	1	1	.....	3	10	1	.....	5	.....	4	7	1	1	115
.....	15	.....	.....	1	2	10	2	.....	6	3	3	7	.....	1	116
.....	28	1	3	.....	3	6	2	2	4	1	7	6	4	.....	117
2	9	.....	1	.....	3	8	1	1	2	2	1	3	1	1	118
.....	14	.....	.....	.....	2	3	.....	.....	3	.....	1	.....	.....	.....	119
.....	5	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	1	.....	.....	120

[1] Includes establishments distributed as follows: Alaska, 1; District of Columbia, 2.

CARRIAGES AND WAGONS.

CARRIAGES AND WAGONS.

By JAMES K. DAWES.

At the census of 1900 the classification of "carriages and wagons" included all varieties of carriages and wagons (except children's carriages), drays and carts, sleighs and sleds (except children's sleds), and automobiles and other horseless conveyances, except bicycles and tricycles and steam railway and street cars.

Table 1 is a comparative summary of the statistics for this industry as returned at the censuses of 1880 to 1900, inclusive, with the percentages of increase for each decade.

TABLE 1.—COMPARATIVE SUMMARY, 1880 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

	DATE OF CENSUS.			PER CENT OF INCREASE.	
	1900	1890	1880	1890 to 1900.	1880 to 1890.
Number of establishments	7,632	4,572	3,841	66.9	19.0
Capital	$118,187,838	$93,455,257	$37,973,493	26.5	146.1
Salaried officials, clerks, etc., number	4,302	[1] 6,069	([2])	[3] 29.1	.....
Salaries	$4,073,932	[1] $5,715,426	([2])	[3] 28.7	.....
Wage-earners, average number	62,540	56,525	45,394	10.6	24.5
Total wages	$29,814,911	$28,972,401	$18,988,615	2.9	52.6
Men, 16 years and over	61,281	55,403	43,630	10.6	27.0
Wages	$29,492,195	$28,702,169	([2])	2.8	.....
Women, 16 years and over	846	615	273	37.6	125.3
Wages	$249,976	$180,195	([2])	38.7	.....
Children, under 16 years	413	507	1,491	[3] 18.5	[3] 66.0
Wages	$72,740	$90,037	([2])	[3] 19.2	.....
Miscellaneous expenses	$6,261,469	$5,495,271	([4])	13.9	.....
Cost of materials used	$56,676,073	$46,022,769	$30,597,086	23.1	50.4
Value of products, including custom work and repairing	$121,537,276	$102,080,341	$64,951,617	18.4	58.1

[1] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. (See Table 8.)
[2] Not reported separately.
[3] Decrease.
[4] Not reported.

The manufacture of carriages and wagons has been carried on in the United States since the organization of the Republic, and prior to that, in the colonies, practically since the establishment of permanent settlements therein.

Prior to the census of 1850 the unsatisfactory methods of taking the returns for the manufacturing and mechanical industries of the country render the published statistics of little, if any, practical value. At the censuses from 1850 to 1870, inclusive, the classification of the industry was so diverse as to the inclusion of wheelwrights, cars, etc., that the statistics as returned are of little value for comparative purposes. Table 1, therefore, presents the figures for the last three decades only.

The statistics for the census of 1810 were published officially in 1813 by Tench Coxe, of Philadelphia, in "Tables of the Several Branches of American Manufactures at the Census of 1810." At that census there were 16 states, 6 territories, and 4 districts, a total of 26, of which 9 reported the industry as being conducted within their borders. The reports showed simply the value of the manufactured product, without giving, except in a few cases, the number either of establishments or of vehicles constructed. The aggregate value for the whole country was $1,421,573. The censuses of 1810 and 1900, therefore, represent the condition and growth of the industry during the nineteenth century. The figures indicate that the value of the fin-

ished product in the manufacture of carriages and wagons has grown from $1,421,573 in 1810 to $121,537,276 in 1900.

At the census of 1850 the classification was "coaches and carriages," and 1,822 establishments were reported. Wagon builders were classified as "wheelwrights," and 4,226 establishments, including repairing as well as manufacturing plants, were reported. The totals of the two classifications were: Number of establishments, 6,048; capital, $8,119,918; number of hands employed, 25,589; wages, $7,426,448; materials, $5,842,240; and products, $17,901,081. At the census of 1860 the classifications were "carriages, wagons, and carts," and "cars, omnibuses, and repairing." The number of establishments of each of the divisions was: Carriages, 3,917; wagons and carts, 3,305; and cars, omnibuses, and repairing, 62; total, 7,284. There was no classification of "wheelwrights," all these, wagon builders and repairers, being included presumably under "wagons and carts." The totals for the three classes were: Number of establishments, 7,284; capital, $21,677,222; number of hands employed, 40,281; wages, $14,655,268; materials, $13,739,626; and products, $39,855,455.

At the census of 1870 the classifications were "carriages and wagons" and "wheelwrighting," for the manufacturing and the repairing business, respectively, this latter classification appearing then for the first time in census reports. The returns for "carriages and wagons" were: Number of establishments, 11,847; capital, $36,563,095; number of hands employed, 54,928; wages, $21,272,730; materials, $22,787,341; and products, $65,362,837. Under the classification "wheelwrighting" the returns were: Number of establishments, 3,613; capital, $2,839,316; number of hands, 6,989; wages, $1,353,474; materials, $1,907,418; and products, $5,846,943.

At the census of 1880 the classifications were again "carriages and wagons" and "wheelwrighting," 3,841 establishments being reported under the first and 10,701 under the second, a total of 14,542. The returns for the first classification will be found in Table 1. For "wheelwrighting" they were: Number of establishments, 10,701; capital, $10,641,080; number of hands, 16,108; wages, $5,074,799; cost of materials used, $6,703,677; and value of products, $18,892,858. This separation of establishments engaged in the manufacture of factory product from those engaged chiefly in custom and repair work has been substantially continued at the two subsequent censuses. At the census of 1890 the classification was "carriages and wagons, including custom work and repairing." The classifications "blacksmithing" and "wheelwrighting" in former censuses were combined in "blacksmithing and wheelwrighting," and this combination was continued at the census of 1900. The industry was further segregated by the introduction of a table showing "carriages and wagons, factory product." "Carriages and wagons, factory product," shown in the Report on Manufacturing Industries for the Eleventh Census, Part I, page 674, included only those carriage and wagon factories that made 5 vehicles or more for the trade; that of "carriages and wagons, including custom work and repairing," comprised custom and repair shops making 5 vehicles or more, but in the report for the Eleventh Census this classification also includes that part of the industry shown as factory product. All establishments engaged in any branch of the industry making less than 5 vehicles were reported under "blacksmithing and wheelwrighting." The schedules of inquiry for this industry did not plainly distinguish between the "factory" and the "custom work and repairing" classes, and the segregation was made at the Census Office from the best information obtainable from the returns as made and from other available sources. In the comparative tables, 1880 and 1890, published at the census of 1890, the two classes were united under the title "carriages and wagons, including custom work and repairing." The totals for the combined classes in 1890 were: Number of establishments, 8,614; capital, $104,210,602; average number of wage-earners, 64,259; wages, $32,665,301; miscellaneous expenses, $6,022,972; cost of materials used, $49,889,173; and value of products, $114,551,907. The separation of the two classes is believed to have been substantially correct, and for comparative purposes the statistics for "carriages and wagons, factory product," are used in Table 1. Although under this head there was included at the census of 1890 only 53.1 per cent, or a little over one-half, of the total number of establishments, yet these represented 89.7 per cent of the capital employed, 88 per cent of the wage-earners, 88.7 per cent of the wages paid, 92.2 per cent of the cost of materials used, and 89.6 per cent of the value of products, the remaining 10.4 per cent of this latter item being very largely composed of amounts received for repairing.

At the census of 1900 the classification was "carriages and wagons," and included the class of establishments which in 1890 were shown as "carriages and and wagons, factory product," "carriages and wagons, custom work and repairing" being classified under "blacksmithing and wheelwrighting." The information obtained from the schedules in 1900 made possible a closer segregation than in 1890, and a considerable number of establishments were classified as "carriages and wagons" which in 1890 would have been excluded from the "factory product" division, but this change was not sufficient to impair the comparable value of the statistics.

The statistics of the census of 1880, gathered for seven months of 1879 and for only five months of 1880,

show the effects of the general depression of business following the panic of 1873. The country did not recover from this panic until 1880, but at the census of 1890 the industries of the country generally, including "carriages and wagons," were enjoying a period of almost unparalleled prosperity. The decade from 1890 to 1900 was one of vicissitudes for the industry, which during the first half of this period was brought almost to a standstill by the effect of the bicycle boom, to which was added the general industrial depression existing for several years about the middle of the decade, and it was not until near the close of the decade that the industry began to show signs of recovery from the two great crises through which it had passed. These causes explain the smaller percentages of increase, except in number of establishments, during the decade from 1890 to 1900 than from 1880 to 1890. The statistics for 1900, however, give assurance of prosperity, capital having increased $24,732,581, or 26.5 per cent, since 1890, and value of products $18,856,935, or 18.4 per cent.

Table 1 shows that from 1880 to 1900 the number of establishments increased 3,791, or 98.7 per cent; capital, $80,214,345, or 211.2 per cent; average number of wage-earners, 17,146, or 37.8 per cent; wages, $10,826,296, or 57 per cent; cost of materials used, $26,078,987, or 85.2 per cent; and value of products, $56,585,659, or 87.1 per cent.

The apparently abnormal increase in capital from 1880 to 1890, viz: $55,481,764, or 146.1 per cent, is largely due to the difference in the items composing the return for capital at these two censuses. At the census of 1880 live capital, that is, cash on hand, bills receivable, unsettled ledger accounts, raw materials, stock in process of manufacture, finished products on hand, and other sundries, was not returned, the first definite attempt made to secure this return being at the census of 1890. At that time this item amounted to $59,740,487, or 63.9 per cent of a total capital of $93,455,257. By comparing the total of the remaining items, $33,714,770 (these items being land, buildings, and machinery, tools, and implements), with the capital reported for 1880, $37,973,493, a decrease of $4,258,723, or 12.1 per cent, is shown. This deduction is of doubtful value, as at the census of 1880 many manufacturers undoubtedly included cash and bills receivable as capital, and possibly other of the items returned in 1890 as live assets. The explanation, however, will serve to remove any false conclusions relative to the exceedingly great per cent of increase of capital for the decade.

Table 2 presents the number of establishments, by states and territories, for the last three decades, and the increase.

TABLE 2.—NUMBER OF ESTABLISHMENTS, 1880 TO 1900, WITH INCREASE FOR EACH DECADE, BY STATES AND TERRITORIES.

STATES AND TERRITORIES.	NUMBER OF ESTABLISHMENTS.			INCREASE.		
	1900	1890	1880	1890 to 1900.	1880 to 1890.	1880 to 1900.
United States	7,632	4,572	3,841	3,060	731	3,791
Alabama	49	29	22	20	7	27
Arizona	5	.....	.....	5	.....	5
Arkansas	40	23	14	17	9	26
California	228	103	87	125	16	141
Colorado	48	16	10	32	6	38
Connecticut	117	72	124	45	[1]52	[1]7
Delaware	36	22	15	14	7	21
District of Columbia	21	12	25	9	[1]13	[1]4
Florida	47	14	2	33	12	45
Georgia	132	58	59	74	[1]1	73
Idaho	.....	.....	1	.....	[1]1	[1]1
Illinois	407	259	215	148	44	192
Indiana	275	211	195	64	16	80
Indian Territory	9	.....	.....	9	.....	9
Iowa	211	132	208	79	[1]76	3
Kansas	73	48	23	25	25	50
Kentucky	151	94	95	57	[1]1	56
Louisiana	49	33	12	16	21	37
Maine	165	103	46	62	57	119
Maryland	178	95	81	83	14	97
Massachusetts	388	211	215	177	[1]4	173
Michigan	299	238	208	61	30	91
Minnesota	194	107	51	87	56	143
Mississippi	30	19	20	11	[1]1	10
Missouri	377	231	119	146	112	258
Montana	9	4	2	5	2	7
Nebraska	45	18	5	27	13	40
Nevada	3	.....	1	3	[1]1	2
New Hampshire	73	55	30	18	25	43
New Jersey	288	173	129	115	44	159
New Mexico	8	.....	1	8	[1]1	7
New York	893	692	667	201	25	226
North Carolina	160	67	47	93	20	113
North Dakota	13	.....	([2])	13	.....	13
Ohio	543	419	325	124	94	218
Oklahoma	8	.....	.....	8	.....	8
Oregon	27	12	9	15	3	18
Pennsylvania	872	571	391	301	180	481
Rhode Island	69	39	51	30	[1]12	18
South Carolina	59	28	10	31	18	49
South Dakota	15	5	([2])	10	5	15
Tennessee	99	37	51	62	[1]14	48
Texas	78	31	34	47	[1]3	44
Utah	5	.....	5	5	[1]5	.....
Vermont	86	37	21	49	16	65
Virginia	199	59	43	140	16	156
Washington	28	11	3	17	8	25
West Virginia	80	25	8	55	17	72
Wisconsin	436	158	156	278	2	280
Wyoming	7	1	1	6	.....	6
Dakota	.....	.....	[2]4	.....	[1]4	[1]4

[1] Decrease.
[2] Dakota in 1880 included the present states of North and South Dakota.

From Table 2 it appears that from 1880 to 1900 the number of establishments increased 3,791, of which increase 731 was between 1880 and 1890, and 3,060 between 1890 and 1900. The Central states showed an increase from 1880 to 1900 of 1,265, or 85.6 per cent, and of 33.4 per cent of the total increase for the United States. For the decade from 1890 to 1900 these

states showed an increase of 987 establishments, or 56.2 per cent of the totals for that group, and of 32.3 per cent of the total increase for the United States. These states showed increases as follows: Illinois, from 215 in 1880 to 407 in 1900, an increase of 192, or 89.3 per cent, and from 259 in 1890 to 407 in 1900, an increase of 148, or 57.1 per cent; Indiana, from 195 in 1880 to 275 in 1900, an increase of 80, or 41 per cent, and from 211 in 1890 to 275 in 1900, an increase of 64, or 30.3 per cent; Iowa, from 208 in 1880 to 211 in 1900, an increase of 3, or 1.4 per cent; Michigan, from 208 in 1880 to 299 in 1900, an increase of 91, or 43.8 per cent, and from 238 in 1890 to 299 in 1900, an increase of 61, or 25.6 per cent; Minnesota, from 51 in 1880 to 194 in 1900, an increase of 143, or 280.4 per cent, and from 107 in 1890 to 194 in 1900, an increase of 87, or 81.3 per cent; Missouri, from 119 in 1880 to 377 in 1900, an increase of 258, or 216.8 per cent, and from 231 in 1890 to 377 in 1900, an increase of 146, or 63.2 per cent; Ohio, from 325 in 1880 to 543 in 1900, an increase of 218, or 67.1 per cent, and from 419 in 1890 to 543 in 1900, an increase of 124, or 29.6 per cent; and Wisconsin, from 156 in 1880 to 436 in 1900, an increase of 280, or 179.5 per cent, and from 158 in 1890 to 436 in 1900, an increase of 278, or 175.9 per cent.

The trend of the industry is toward the Central states, where land is cheaper, where suitable lumber is abundant and prices are therefore favorable, and where also the developed railroad systems afford abundant means of transportation. The same rapid development of the industry is seen in certain of the Southern states, such as North Carolina, Tennessee, and Virginia, where lumber is cheap and where manufactures are fast gaining industrial predominance. The increase in Massachusetts, New Jersey, New York, and Pennsylvania is due partly to the growing use of the automobile, to the diminishing use of the bicycle, and materially to the more perfect segregation of the "factory product" and that formerly classed as "custom work and repairing."

Table 3 is a comparative summary of capital, by its several divisions, as returned at the censuses of 1890 and 1900, with the per cent of increase for the decade, and also the per cent each item is of the total.

TABLE 3.—COMPARATIVE SUMMARY: CAPITAL, 1890 AND 1900, WITH PER CENT OF INCREASE AND PER CENT OF TOTAL.

	1900		1890		Per cent of increase.
	Amount.	Per cent of total.	Amount.	Per cent of total.	
Total	$118,187,838	100.0	$93,455,257	100.0	26.5
Land	13,700,705	11.6	11,469,152	12.3	19.5
Buildings	19,878,684	16.8	14,841,811	15.9	33.9
Machinery, tools, and implements	11,028,188	9.3	7,403,807	7.9	49.0
Cash and sundries	73,580,261	62.3	59,740,487	63.9	23.2

It appears from Table 3 that during the last decade capital increased $24,732,581, or 26.5 per cent; land, $2,231,553, or 19.5 per cent; buildings, $5,036,873, or 33.9 per cent; machinery, tools, and implements, $3,624,381, or 49 per cent; and cash and sundries, $13,839,774, or 23.2 per cent. In 1890 land formed 12.3 per cent of the total capital, and in 1900, 11.6 per cent, a slight decrease of 0.7 in the per cent that this item was of the total capital; buildings in 1890, 15.9 per cent, and in 1900, 16.8 per cent, an increase of 0.9 in the per cent that this item was of the total; machinery, tools, and implements in 1890, 7.9 per cent, and in 1900, 9.3 per cent, an increase of 1.4 in the per cent that this item was of the total; and cash and sundries in 1890, 63.9 per cent, and in 1900, 62.3 per cent, a decrease of 1.6 in the per cent that this item was of the total. The increase during the decade of 33.9 per cent in value of buildings, and of 49 per cent in machinery, tools, and implements, emphasizes the great advance of the industry in the introduction of improved machinery, and in part the increased size and more permanent construction of the buildings necessary for its installation.

In addition to the 7,632 active establishments reported for 1900, there were 13 idle establishments, with a capital of $109,161. There were also 33 establishments, each with a product of less than $500, having altogether a capital of $15,159, and 1 penal establishment, with a capital of $30,600, making the total capital invested in the industry $118,342,758.

Table 4 is a comparative summary, by states and territories, of the statistics for the industry at the censuses of 1890 and 1900.

TABLE 4.—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES: 1890 AND 1900.

STATES AND TERRITORIES.	Year.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS.		Miscellaneous expenses.	Cost of materials used.	Value of products, including custom work and repairing.
				Number.	Salaries.	Average number.	Total wages.			
United States	1900	7,632	$118,187,838	4,302	$4,073,932	62,540	$29,814,911	$6,261,469	$56,676,073	$121,537,276
	1890	4,572	93,455,257	6,069	5,715,426	56,525	28,972,401	5,495,271	46,022,769	102,680,341
Alabama	1900	49	386,064	24	15,985	408	128,647	40,928	230,397	556,327
	1890	29	364,995	31	25,617	332	149,490	16,997	273,303	530,004
Arizona	1900	5	50,450	4	1,180	25	17,396	1,507	16,398	53,010
	[1]1890									
Arkansas	1900	40	176,820	5	2,300	150	54,718	8,121	103,666	223,790
	1890	23	134,365	21	16,798	127	65,193	5,791	53,944	164,144
California	1900	228	1,474,424	34	37,975	1,004	532,203	99,663	715,207	1,874,467
	1890	103	1,286,389	119	124,821	688	481,739	93,748	467,246	1,362,032
Colorado	1900	48	319,121	11	10,960	191	132,625	19,917	148,606	419,304
	1890	16	607,570	39	60,680	281	225,925	23,483	287,906	723,374
Connecticut	1900	117	5,010,816	137	158,381	2,192	1,298,096	161,571	1,532,351	4,205,723
	1890	72	2,563,662	129	133,300	1,457	1,012,202	125,648	1,149,387	2,808,742
Delaware	1900	36	423,689	11	9,506	224	104,307	18,239	113,496	310,865
	1890	22	582,350	25	22,441	377	201,191	32,926	306,723	653,691
District of Columbia	1900	21	141,306	2	1,212	154	71,382	8,502	57,023	191,545
	1890	12	287,600	14	14,070	187	99,172	6,697	118,269	282,626
Florida	1900	47	142,522	3	2,100	143	59,384	7,737	97,683	216,277
	1890	14	90,525	17	12,835	52	28,489	1,724	46,664	108,485
Georgia	1900	132	847,426	39	31,024	880	261,856	45,092	545,587	1,350,644
	1890	58	741,160	66	62,207	701	270,229	53,180	511,856	1,062,928
Illinois	1900	407	9,539,235	340	346,428	4,355	2,210,722	532,635	4,360,269	9,210,379
	1890	259	8,153,778	379	374,379	4,305	2,354,591	511,585	3,397,273	8,047,148
Indiana	1900	275	17,718,489	599	583,962	6,490	2,756,780	674,971	6,986,043	12,742,243
	1890	211	10,077,806	362	284,788	4,147	1,772,358	508,517	3,532,057	7,781,975
Indian Territory	1900	9	11,190			8	3,684	659	5,799	20,837
	[1]1890									
Iowa	1900	211	4,087,400	140	112,704	1,692	713,901	243,791	1,863,988	3,931,067
	1890	132	2,372,742	184	139,913	1,382	679,189	124,874	1,322,863	2,802,230
Kansas	1900	73	271,122	21	12,880	239	102,276	20,418	150,693	377,134
	1890	48	975,735	55	54,084	288	152,781	66,721	210,791	546,349
Kentucky	1900	151	3,084,793	122	116,935	1,677	625,304	144,774	1,500,815	2,866,699
	1890	94	1,803,035	140	124,607	1,101	514,561	82,797	823,257	1,839,030
Louisiana	1900	49	264,647	13	8,359	291	120,906	12,915	132,072	369,431
	1890	33	203,440	40	34,351	206	96,244	12,055	103,714	298,472
Maine	1900	165	602,773	16	10,100	339	173,634	25,269	274,772	719,859
	1890	103	419,168	95	57,377	352	168,751	23,561	186,465	518,925
Maryland	1900	178	835,342	27	20,356	822	339,949	44,896	377,296	1,086,478
	1890	95	665,591	87	66,569	669	296,569	32,739	322,105	899,854
Massachusetts	1900	388	5,594,939	141	115,685	3,164	1,709,164	346,351	2,585,363	6,118,121
	1890	211	4,619,067	321	322,560	3,463	2,081,019	306,819	2,781,647	6,407,837
Michigan	1900	299	7,935,269	401	352,498	4,890	2,028,530	495,520	6,616,081	11,205,602
	1890	238	5,453,720	357	292,601	2,932	1,347,650	307,447	3,226,063	6,281,104
Minnesota	1900	194	1,860,594	50	49,724	1,066	461,295	104,319	877,885	1,959,974
	1890	107	1,799,470	148	134,988	817	449,410	100,049	579,431	1,520,512
Mississippi	1900	30	96,525	4	3,500	113	43,452	3,443	46,425	134,334
	1890	19	131,050	17	11,822	120	51,704	5,159	59,560	143,705
Missouri	1900	377	4,019,087	190	210,805	2,583	1,310,560	251,744	2,733,960	5,583,364
	1890	231	3,564,709	325	311,474	2,684	1,344,366	205,707	2,256,332	4,691,684
Montana	1900	9	71,169	7	5,880	34	34,718	6,204	35,598	111,780
	[2]1890									
Nebraska	1900	45	151,919	9	7,618	135	72,143	14,386	82,755	248,182
	1890	18	311,273	19	20,790	188	112,523	8,595	168,836	366,519
Nevada	1900	3	4,850			2	1,500	160	2,980	8,675
	[1]1890									
New Hampshire	1900	73	1,102,675	26	22,583	507	264,919	40,864	278,691	754,426
	1890	55	888,266	50	44,374	461	251,830	35,519	333,649	808,817
New Jersey	1900	288	3,457,827	110	122,768	1,909	1,077,745	186,025	1,333,685	3,626,442
	1890	173	2,202,290	173	164,565	1,477	850,466	101,555	991,708	2,583,524
New Mexico	1900	8	24,275			17	8,760	2,006	9,101	28,600
	[1]1890									
New York	1900	893	14,141,207	486	520,231	6,981	3,399,899	873,942	5,174,662	13,068,385
	1890	692	14,124,310	963	1,030,951	9,000	4,941,937	903,896	6,371,872	15,567,776
North Carolina	1900	160	866,933	29	19,257	802	236,855	30,099	522,017	1,059,237
	1890	67	430,557	50	29,078	408	133,967	86,570	219,468	500,176
North Dakota	1900	13	41,110			23	11,761	1,746	17,830	42,609
	[1]1890									

[1] No establishments reported.

[2] Included in "all other states."

TABLE 4.—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES: 1890 AND 1900—Continued.

STATES AND TERRITORIES.	Year.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS.		Miscellaneous expenses.	Cost of materials used.	Value of products, including custom work and repairing.
				Number.	Salaries.	Average number.	Total wages.			
Ohio	1900	543	$12,158,302	687	$576,062	7,274	$3,369,550	$813,400	$8,262,052	$15,919,173
	1890	419	13,333,262	793	804,634	8,993	4,304,763	1,030,760	9,187,975	18,063,776
Oklahoma	1900	8	30,400			32	10,892	995	14,681	44,800
	[1]1890									
Oregon	1900	27	79,621	2	200	62	38,886	5,864	49,603	128,425
	1890	12	163,152	16	16,743	79	62,078	12,325	52,086	185,990
Pennsylvania	1900	872	8,643,315	247	206,649	5,166	2,497,452	393,101	3,215,741	8,342,662
	1890	571	6,355,173	539	413,915	4,476	2,192,530	268,682	2,578,588	6,698,522
Rhode Island	1900	69	446,116	15	11,597	353	205,706	31,146	215,313	631,711
	1890	30	370,141	35	28,552	241	140,128	16,164	147,168	393,394
South Carolina	1900	59	317,550	15	12,780	356	95,950	15,995	211,039	428,082
	1890	28	199,655	18	15,936	194	65,397	10,616	77,951	202,661
South Dakota	1900	15	76,780	2	2,000	40	21,456	3,292	31,462	86,495
	1890	5	36,910	4	3,820	17	9,825	2,032	17,643	39,250
Tennessee	1900	99	774,749	43	44,462	621	258,734	42,906	519,544	1,127,898
	1890	37	496,981	58	47,192	423	212,886	24,691	341,380	765,855
Texas	1900	78	416,977	9	7,480	310	168,415	22,039	197,030	555,574
	1890	31	222,134	20	18,472	182	108,535	12,557	120,540	308,971
Utah	1900	5	36,674	8	1,250	38	17,213	2,331	26,317	63,978
	[1]1890									
Vermont	1900	86	357,035	3	1,275	196	95,516	14,585	110,709	321,315
	1890	37	306,039	30	23,659	157	83,301	9,466	110,067	279,397
Virginia	1900	199	1,162,900	33	30,805	818	330,961	54,655	622,782	1,473,176
	1890	59	590,903	61	44,346	470	198,613	31,488	343,464	773,212
Washington	1900	28	101,260	8	8,800	134	90,061	9,724	112,039	289,068
	1890	11	111,000	8	9,524	90	73,258	7,956	64,076	200,138
West Virginia	1900	80	345,700	7	6,576	260	114,095	11,604	182,719	427,288
	1890	25	228,050	27	18,827	143	67,132	7,814	91,328	213,469
Wisconsin	1900	436	8,461,561	221	249,800	3,402	1,620,693	370,099	3,346,621	6,956,341
	1890	158	6,195,279	228	242,442	2,840	1,301,656	326,448	2,777,034	5,207,298
Wyoming	1900	7	22,890	1	1,800	18	10,260	1,366	29,227	65,485
	[2]									
All other states	1900									
	[3]1890	5	41,955	6	5,324	18	18,800	4,913	11,080	46,750

[1] No establishments reported. [2] Included in "all other states." [3] Includes establishments distributed as follows: Montana, 4; Wyoming, 1.

Table 4 shows that the industry at the census of 1900 was carried on in 49 states and territories, each of which, excepting Nevada (with 3), had more than 3 establishments, Alaska and Idaho being the only ones in which the manufacture of carriages and wagons was not carried on. At the census of 1890 the industry existed in only 42 states and territories, all except Wyoming having more than 3 establishments, there being no establishments in Alaska, Arizona, Idaho, Indian Territory, Nevada, New Mexico, North Dakota, Oklahoma, and Utah. Wyoming, with only 1 establishment in 1890, had increased to 7 in 1900.

Table 4 shows that at the census of 1900, in number of establishments New York ranked first, with 893 establishments; Pennsylvania second, with 872; and Ohio third, with 543. The number in certain other states, ranking in the order named, was: Wisconsin, 436; Illinois, 407; Massachusetts, 388; Missouri, 377; Michigan, 299; New Jersey, 288; Indiana, 275; and California, 228.

In respect to capital, at the census of 1890, New York ranked first, with a capital of $14,124,310; Ohio second, with $13,333,262; and Indiana third, with $10,077,806. Several states following Indiana ranked as follows: Illinois fourth, with $8,153,778; Pennsylvania fifth, with $6,355,173; Wisconsin sixth, with $6,195,279; and Michigan seventh, with $5,453,720. At the census of 1900 Indiana had risen from third to first place, with a capital of $17,718,489, an increase of $7,640,683, or 75.8 per cent; New York went from first to second place, with $14,141,207, an increase of only $16,897, or one-tenth of 1 per cent; Ohio from second to third place, with $12,158,302, a decrease of $1,174,960, or 8.8 per cent. The other four states named above retained their relative places in rank, with capital, increase, and per cent of increase respectively as follows: Illinois, $9,539,235, an increase of $1,385,457, or 17 per cent; Pennsylvania, $8,643,315, an increase of $2,288,142, or 36 per cent; Wisconsin, $8,461,561, an increase of $2,266,282, or 36.6 per cent; and Michigan, $7,935,269, an increase of $2,481,549, or 45.5 per cent. In 1890, 15 states reported a capital in excess of $1,000,000 each; in 1900 the number had increased to 17.

Table 4 also shows that at the census of 1900 Ohio ranked first as to number of wage-earners, with 7,274, and, in amount of wages paid, second, with $3,369,550;

New York second in number of wage-earners, with 6,981, and first in wages, with $3,899,899; and Indiana third, both as to number of wage-earners and wages, with number 6,490, and wages $2,756,780; followed by Pennsylvania, fourth in both, with 5,166 in number, and $2,497,452 in wages; Michigan fifth in number, with 4,890, and sixth in wages, with $2,028,530; Illinois sixth in number, with 4,355, and fifth in wages, with $2,210,722; Wisconsin seventh in number, with 3,402, and eighth in wages, with $1,620,693; Massachusetts eighth in number, with 3,164, and seventh in wages, with $1,709,164; and Missouri ninth, both as to number and wages, with 2,583 and $1,310,560, respectively. These 9 ranking states as to number of wage-earners and wages paid, show a total of 44,305 wage-earners, or 70.8 per cent of the total for the industry, and in wages, $21,403,350, or 71.8 per cent of the total. Of these 9 states the 6 Central states show a total number of wage-earners of 28,994, or 46.4 per cent of the total for the industry; and of wages, $13,296,835, or 44.6 per cent of the same total.

With respect to wage-earners and their wages, at the census of 1890, New York ranked first in number of wage-earners, having 9,000; Ohio second, having 8,993; and Pennsylvania third, with 4,476; followed by Illinois, with 4,305; Indiana, 4,147; Massachusetts, 3,463; Michigan, 2,932; and Wisconsin, 2,840. At the census of 1900, Ohio had risen from second to first place in rank, with 7,274 wage-earners, a decrease of 1,719, or 19.1 per cent; New York passed from first to second place, with 6,981, a decrease of 2,019, or 22.4 per cent; Indiana rose from fifth to third place, with 6,490, an increase of 2,343, or 56.5 per cent; Pennsylvania from third to fourth place, with 5,166, an increase of 690, or 15.4 per cent; Michigan from seventh to fifth place, with 4,890, an increase of 1,958, or 66.8 per cent; Illinois from fourth to sixth place, with 4,355, an increase of 50, or 1.2 per cent; Wisconsin passed from eighth to seventh place, with 3,402, an increase of 562, or 19.8 per cent; and Massachusetts from sixth to eighth place, with 3,164, a decrease of 299, or 8.6 per cent.

With respect to the amount of wages, at the census of 1890, New York ranked first, with $4,941,937; Ohio second, with $4,304,763; and Illinois third, with $2,354,591; followed by Pennsylvania, with $2,192,530; Massachusetts, with $2,081,019; Indiana, with $1,772,358; Michigan, with $1,347,650; Missouri, with $1,344,366; and Wisconsin, with $1,301,656. At the census of 1900, New York continued to hold first place, with $3,899,899, though with a decrease of $1,042,038, or 21.1 per cent; Ohio remained second, with $3,369,550, a decrease of $935,213, or 21.7 per cent; and Indiana took third place instead of sixth, with $2,756,780, an increase of $984,422, or 55.5 per cent; Pennsylvania retained fourth place, with $2,497,452, an increase of $304,922, or 13.9 per cent; Illinois passed from third to fifth place, with $2,210,722, a decrease of $143,869, or 6.1 per cent; Michigan rose from seventh to sixth place, with $2,028,530, an increase of $680,880, or 50.5 per cent; Massachusetts passed from fifth to seventh place, with $1,709,164, a decrease of $371,855, or 82.1 per cent; Wisconsin from ninth to eighth place, with $1,620,693, an increase of $319,037, or 17.9 per cent; and Missouri from eighth to ninth place, with $1,310,560, a decrease of $33,806, or 2.5 per cent.

With respect to the value of products, at the census of 1890, Ohio ranked first, with $18,063,776; New York second, with $15,567,776; and Illinois third, with $8,047,148; followed by Indiana, with $7,781,975; Pennsylvania, with $6,698,522; Massachusetts, with $6,407,837; Michigan, with $6,281,104; and Wisconsin, with $5,207,298. At the census of 1900 Ohio and New York continued to hold first and second rank, respectively, Ohio with $15,919,173, a decrease of $2,144,603, or 11.9 per cent; and New York with $13,068,385, a decrease of $2,499,391, or 16.1 per cent. Indiana rose from fourth to third place, with $12,742,243, an increase of $4,960,268, or 63.7 per cent; Michigan advanced from seventh to fourth place, with $11,205,602, an increase of $4,924,498, or 78.4 per cent; Illinois passed from third to fifth place, with $9,210,379, with an increase, however, of $1,163,231, or 14.5 per cent; Pennsylvania from fifth to sixth place, with $8,342,662, though with an increase of $1,644,140, or 24.5 per cent; Wisconsin from eighth to seventh place, with $6,956,341, an increase of $1,749,043, or 33.6 per cent; and Massachusetts from sixth to eighth place, with $6,118,121, a decrease of $289,716, or 4.5 per cent.

Table 5 shows the cost, and for some items also the quantity, of the different materials used in the industry at the censuses of 1890 and 1900, and the percentages of increase for the decade.

TABLE 5.—QUANTITY AND COST OF MATERIALS USED, 1890 AND 1900, WITH PER CENT OF INCREASE.

	1900	1890	Per cent of increase.
Total cost	$56,676,078	$46,022,769	23.1
Lumber, cost	$8,940,823	$6,825,155	41.4
Iron and steel, cost	$11,892,442	$7,674,596	55.0
Carriage hardware, lamps and mountings, cost	$3,542,629	$3,922,428	[1] 9.7
Paints, oil, turpentine, and varnish, cost	$4,048,383	$3,759,254	7.7
Enamel, rubber, and other carriage cloth, cost	$3,165,987	$3,189,811	[1] 0.7
Leather, cost	$3,538,719	$2,886,757	22.6
Carriage bodies purchased:			
Number	443,017	318,580	39.1
Cost	$1,740,360	$2,490,979	[1] 30.1
Wagon bodies purchased:			
Number	26,029	90,036	[1] 71.1
Cost	$344,437	$774,988	[1] 55.6
Wheels purchased:			
Number	3,670,780	2,746,498	33.7
Cost	$5,412,212	$5,790,391	[1] 6.5
Axles and springs purchased, cost	$4,504,828	$5,253,690	[1] 14.3
Fuel	$1,024,255	$805,176	27.2
Rent of power and heat	$96,871	$35,997	169.1
All other materials, including mill supplies and freight	$8,424,127	$3,118,547	170.6

[1] Decrease.

Comparison between the two censuses with reference to the cost of materials is exceedingly difficult,

because of the varied methods of manufacturers in making their returns, some including rims, spokes, etc., in "lumber," and some including them in "all other materials." The decrease in wagon bodies purchased, taken in connection with an increase in the number of wagons manufactured, would appreciably affect the amount expended for lumber and for iron and steel. The difference in the price of the several items in 1890 and 1900 is also an important factor.

The increase in the number of carriage bodies purchased, 39.1 per cent, and the reduction in their cost, 30.1 per cent, is undoubtedly due to the increased use of the latest improved machinery, and the location of new factories at points nearer the source of the supply of the kind of lumber used in this industry. In the item "all other materials," for 1900, there is included $2,257,224 for rubber tires, a new and largely increasing item of the materials used in the industry.

Table 6 shows the kind, quantity, and value of products for the industry at the censuses of 1890 and 1900, and the percentage of increase for the decade.

TABLE 6.—KIND, QUANTITY, AND VALUE OF PRODUCTS, 1890 AND 1900, WITH PER CENT OF INCREASE.

	1900	1890	Per cent of increase.
Total value	$121,587,276	$102,680,341	18.4
Family and pleasure carriages:			
Number	907,482	841,305	7.9
Value	$51,504,176	$52,480,671	[1]1.9
Public conveyances:			
Number	2,316	3,200	[1]27.6
Value	$1,147,630	$1,302,666	[1]11.9
Business, farm, Government, municipal, etc., wagons:			
Number	575,351	433,010	32.9
Value	$31,480,157	$26,787,039	17.5
Sleighs and sleds:			
Number	118,222	87,161	35.6
Value	$2,324,600	$1,938,821	19.9
All other products, value	$35,080,713	$20,171,144	73.9
Carriage bodies, number[2]	13,020	35,662	[1]63.5
Wagon bodies, number[2]	9,475	13,102	[1]27.7
Wheels, number[2]	149,723	107,216	39.6

[1] Decrease. [2] Value included in "all other products."

At the census of 1890, the division of the several kinds of vehicles was based, as to some classes, on the value, and, as to others, on whether hung on perch carriage part or not, and whether on springs or not, and on the character of the spring. The schedules called for return, in some instances, both of the number of vehicles and their value; and in others of the number only. The varying prices of the finished vehicle at each decade render a classification based on values of but little statistical value. At the census of 1900, a classification was adopted which was based on the character of the vehicle and on its proposed use. This classification was as follows: (1) Family and pleasure carriages; (2) public conveyances; (3) business, Government, municipal, etc., and farm wagons and carts; (4) automobiles and other horseless conveyances, not including bicycles and tricycles, which were classified separately from carriages and wagons; and (5) sleighs and sleds. These classes were subdivided, and the various kinds of vehicles manufactured were each assigned to its appropriate subdivision. The schedules called for returns by "classes" of the number of vehicles manufactured and the value or price at the factory, and of the number, but not the value, of each particular kind.

So far as it was possible to arrange it, Table 6 makes a comparison between the statistics of the products of the industry in 1890 and 1900. The total value of the products showed an increase of $18,856,935, or 18.4 per cent, notwithstanding the decreased prices prevailing in 1900, caused by lessened cost of production and active competition.

Under the head of public conveyances, Table 6 shows that for 1900 there was a decrease, in number, of 884 vehicles, or 27.6 per cent, and in value of $155,036, or 11.9 per cent. At the census of 1890, hearses were included in "public conveyances," and in 1900 in "business wagons." In 1900, 797 hearses were reported, and if this number were added to "public conveyances" the total would be 3,113, and the decrease would be reduced from 884 to 87, or only 2.7 per cent instead of 27.6. A similar reduction from 575,351 business and other wagons in the same classification would leave the increase 141,544, and reduce the per cent of increase in business wagons from 32.9 to 32.7. Under the head of "all other products" are included parts of vehicles, repairing, etc., of which only the value is given, except that the number of carriage bodies, wagon bodies, and wheels is given, where these quantities were returned at both censuses. Not all the parts that were manufactured are included under "all other products," but only the excess over those parts used in the construction of vehicles by the establishments reporting them. The number of carriage bodies purchased increased 124,437, or 39.1 per cent, while the number manufactured in excess of use was reduced 22,642, or 63.5 per cent; the number of wagon bodies purchased decreased 64,007, or 71.1 per cent, and the number manufactured in excess of use was reduced 3,627, or 27.7 per cent; and the number of wheels purchased increased 924,282, or 33.7 per cent, and the number manufactured in excess of use 42,507, or 39.6 per cent.

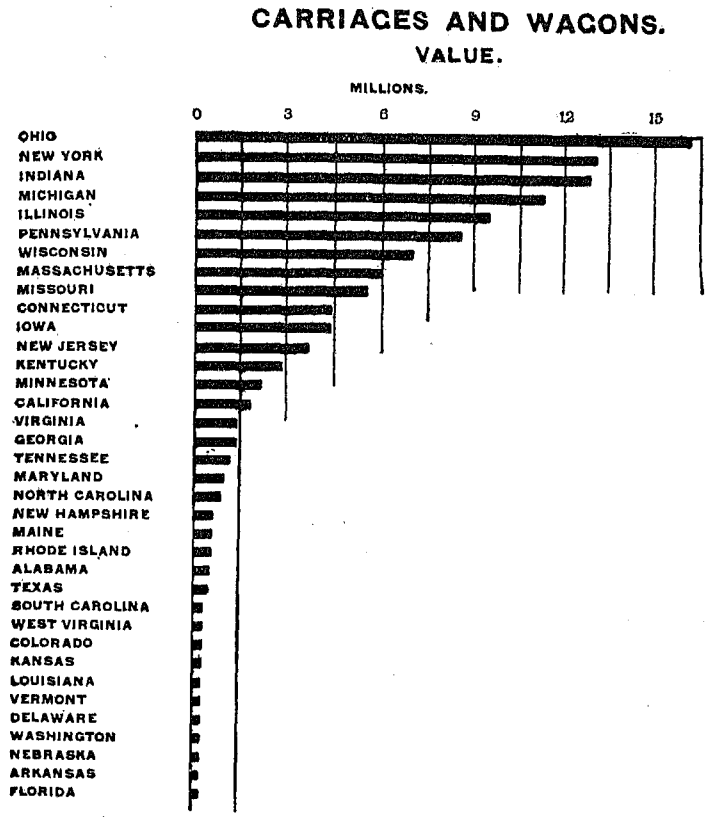
Automobiles formed a new item of product for 1900, there being manufactured 3,901, with a value of $4,680,276. In Table 6 this value is included in "all other products," as there was, in 1890, no similar item with which to compare it. There were also manufactured 56 automobiles, valued at $60,788, in bicycle and tricycle factories.

As reported at the census of 1900, the total number of vehicles manufactured in carriage and wagon factories was 1,607,272, with a value of $91,136,839; to this must be added 23,914 wagons, carts, trucks, etc., reported by manufacturers of agricultural implements, and 56 automobiles, with a value of $60,788, manufactured in

bicycle and tricycle and other factories, making a total manufacture of 1,631,242 vehicles, with a value of $91,197,627. This does not include the number and value of many wagons, carts, sleds, and some carriages manufactured in blacksmithing, wheelwrighting, and other establishments, the statistics for which are not available.

Of the total for "all other products," $5,208,380 represents the value of carriage parts manufactured in excess of the quantity used in the vehicles manufactured, and $25,192,057 the amount received for repair work, which forms a very important and lucrative item in the industry. Much of the necessary repairing, especially to heavy wagons, is done at establishments classified as blacksmithing and wheelwrighting, but nearly all of the carriage and wagon factories maintain a repair department, largely for vehicles of their own manufacture.

The following chart shows, at a glance, for the industry, the relative rank in value of products at the census of 1900, of all states in which the value exceeded $200,000:



The products of 13 states and territories in the order named were valued at less than $200,000: District of Columbia, $191,545; Mississippi, $134,334; Oregon, $128,425; Montana, $111,780; South Dakota, $86,495; Wyoming, $65,485; Utah, $63,978; Arizona, $53,010; Oklahoma, $44,800; North Dakota, $42,609; New Mexico, $28,600; Indian Territory, $20,837; and Nevada, $8,675.

Table 7 presents a comparison as to capital, number of wage-earners, amount of wages, and value of products, for 1890 and 1900. This table also compares the industry in the different geographic divisions of states, giving the percentages for each state and geographic division of the total for the United States.

TABLE 7.—COMPARATIVE SUMMARY: CAPITAL, WAGE-EARNERS AND WAGES, AND VALUE OF PRODUCTS, WITH PERCENTAGES, BY STATES AND TERRITORIES ARRANGED GEOGRAPHICALLY, 1890 AND 1900.

STATES.	CAPITAL.				WAGE-EARNERS.								VALUE OF PRODUCTS, INCLUDING CUSTOM WORK AND REPAIRING.			
	Amount.		Per cent of total.		Average number.				Total wages.				Value.		Per cent of total.	
					Number.		Per cent of total.		Amount.		Per cent of total.					
	1900	1890	1900	1890	1900	1890	1900	1890	1900	1890	1900	1890	1900	1890	1900	1890
United States..	$118,187,888	$93,455,257	100.0	100.0	62,540	56,525	100.0	100.0	$29,814,911	$28,972,401	100.0	100.0	$121,537,276	$102,680,341	100.0	100.0
New England states.....	13,114,354	9,166,343	11.1	9.8	6,751	6,131	10.8	10.9	3,747,035	3,737,234	12.6	12.9	12,751,155	11,217,112	10.5	10.9
Maine.....	602,773	419,168	0.5	0.5	339	352	0.5	0.6	173,634	168,751	0.6	0.6	719,859	518,925	0.6	0.5
New Hampshire.	1,102,675	888,266	0.9	1.0	507	461	0.8	0.8	264,919	251,830	0.9	0.8	754,426	808,817	0.6	0.8
Vermont.....	357,035	306,039	0.3	0.3	196	157	0.3	0.3	95,516	83,304	0.3	0.3	321,315	279,397	0.3	0.3
Massachusetts...	5,594,939	4,619,067	4.7	4.9	3,164	3,463	5.1	6.1	1,709,164	2,081,019	5.7	7.2	6,118,121	6,407,837	5.0	6.2
Rhode Island ...	446,116	370,141	0.4	0.4	353	241	0.6	0.5	205,706	140,128	0.7	0.5	631,711	393,394	0.5	0.4
Connecticut.....	5,010,816	2,563,662	4.3	2.7	2,192	1,457	3.5	2.6	1,298,096	1,012,202	4.4	3.5	4,205,723	2,808,742	3.5	2.7
Middle states.....	27,642,686	24,217,314	23.4	25.9	15,256	16,186	24.4	28.6	7,990,784	8,581,865	26.8	29.6	26,626,372	26,685,993	21.9	26.0
New York.....	14,141,207	14,124,310	12.0	15.1	6,981	9,000	11.2	15.9	3,899,899	4,941,937	13.1	17.1	13,068,385	15,567,776	10.7	15.2
New Jersey.....	3,457,827	2,202,290	2.9	2.4	1,909	1,477	3.0	2.6	1,077,745	850,466	3.6	2.9	3,626,442	2,583,524	3.0	2.5
Pennsylvania ...	8,643,315	6,355,173	7.3	6.8	5,166	4,476	8.3	7.9	2,497,452	2,192,530	8.4	7.6	8,342,662	6,698,522	6.9	6.5
Delaware.....	423,689	582,350	0.4	0.6	224	377	0.4	0.7	104,307	201,191	0.4	0.7	310,865	653,691	0.2	0.6
Maryland.....	635,342	665,591	0.7	0.7	822	669	1.3	1.2	389,949	296,569	1.1	1.0	1,086,478	899,854	0.9	0.9
Dist. Columbia ..	141,306	287,600	0.1	0.3	154	187	0.2	0.3	71,382	99,172	0.2	0.3	191,545	282,626	0.2	0.3
Southern states....	8,925,196	5,636,850	7.5	6.1	6,819	4,459	10.9	7.9	2,513,853	1,962,440	8.4	6.8	10,854,394	6,911,107	8.9	6.7
West Virginia...	345,700	228,050	0.3	0.3	260	143	0.4	0.3	114,095	67,132	0.4	0.2	427,288	213,469	0.3	0.2
Virginia.....	1,162,900	590,903	1.0	0.6	818	470	1.3	0.8	330,961	198,613	1.1	0.7	1,473,176	773,212	1.2	0.8
North Carolina..	866,933	430,557	0.7	0.5	802	408	1.3	0.7	236,855	133,967	0.8	0.5	1,059,237	500,176	0.9	0.5
South Carolina..	317,550	199,655	0.3	0.2	356	194	0.6	0.3	95,950	65,397	0.3	0.2	428,082	202,661	0.3	0.2
Georgia.....	847,426	741,160	0.7	0.8	830	701	1.3	1.2	261,856	270,229	0.9	0.9	1,350,644	1,062,923	1.1	1.0
Florida.....	142,522	90,525	0.1	0.1	143	52	0.2	0.1	59,384	28,489	0.2	0.1	216,277	108,485	0.2	0.1
Kentucky.....	3,084,793	1,803,035	2.6	1.9	1,677	1,101	2.7	2.0	625,304	514,561	2.1	1.8	2,866,699	1,839,030	2.4	1.8
Tennessee.....	774,749	496,981	0.7	0.5	621	423	1.0	0.8	258,784	212,886	0.9	0.8	1,127,898	765,855	0.9	0.7
Alabama.....	386,064	364,995	0.3	0.4	408	332	0.7	0.6	128,647	149,490	0.4	0.5	556,327	530,004	0.5	0.5
Mississippi	96,525	131,050	0.1	0.2	113	120	0.2	0.2	43,452	51,704	0.1	0.1	134,334	143,705	0.1	0.1
Arkansas.....	176,820	134,365	0.1	0.2	150	127	0.2	0.2	54,718	65,193	0.2	0.2	223,790	164,144	0.2	0.2
Louisiana.....	264,647	203,440	0.2	0.2	291	206	0.5	0.4	120,906	96,244	0.4	0.3	369,431	298,472	0.3	0.3
Indian Territory	11,190	.....	(1)	.....	8	.....	(1)	.....	3,684	.....	(1)	.....	20,837	.....	(1)	.....
Oklahoma.....	30,400	.....	(1)	.....	32	.....	(1)	.....	10,892	.....	(1)	.....	44,800	.....	(1)	.....
Texas	416,977	222,134	0.4	0.2	310	182	0.5	0.3	168,415	108,535	0.6	0.4	555,574	308,971	0.5	0.3
Central states	65,779,937	50,950,766	55.7	54.5	31,752	28,100	50.8	49.7	14,472,031	13,553,983	48.5	46.8	67,508,143	54,395,727	55.6	53.0
Ohio.....	12,158,302	13,333,262	10.3	14.3	7,274	8,993	11.6	15.9	3,369,550	4,304,763	11.3	14.9	15,919,173	18,068,776	13.1	17.6
Michigan.....	7,935,269	5,453,720	6.7	5.8	4,890	2,932	7.8	5.2	2,028,530	1,347,650	6.8	4.7	11,205,602	6,281,104	9.2	6.1
Indiana.....	17,718,489	10,077,806	15.0	10.8	6,490	4,147	10.4	7.3	2,756,780	1,772,358	9.2	6.1	12,742,243	7,781,975	10.5	7.6
Illinois	9,589,285	8,153,778	8.1	8.7	4,355	4,305	7.0	7.6	2,210,722	2,354,591	7.4	8.1	9,210,379	8,047,148	7.6	7.8
Wisconsin.....	8,461,561	6,195,279	7.2	6.6	3,402	2,840	5.5	5.0	1,620,693	1,301,656	5.4	4.5	6,956,341	5,207,298	5.7	5.1
Minnesota.....	1,860,594	1,799,470	1.6	1.9	1,066	817	1.7	1.5	461,295	449,410	1.6	1.6	1,959,974	1,520,512	1.6	1.5
Iowa	4,087,400	2,372,742	3.4	2.6	1,692	1,382	2.7	2.4	713,901	679,189	2.4	2.3	3,931,067	2,802,230	3.3	2.7
Missouri.....	4,019,087	3,564,709	3.4	3.8	2,583	2,684	4.1	4.8	1,310,560	1,344,366	4.4	4.6	5,583,364	4,691,684	4.6	4.6
Western states.....	1,070,360	1,973,443	0.9	2.1	762	792	1.2	1.4	430,108	519,804	1.5	1.8	1,505,252	1,722,242	1.2	1.7
Montana.....	71,169	(2)	0.1	.....	34	.....	0.1	.....	34,718	.....	0.1	.....	111,780	.....	0.1	.....
Wyoming	22,890	(2)	(1)	.....	18	.....	(1)	.....	10,260	.....	(1)	.....	65,485	.....	0.1	.....
North Dakota ...	41,110	.....	(1)	.....	23	.....	(1)	.....	11,761	.....	(1)	.....	42,609	.....	(1)	.....
South Dakota ...	76,780	36,910	0.1	(1)	40	17	0.1	(1)	21,456	9,825	0.1	(1)	86,495	39,250	0.1	(1)
Nebraska.....	151,919	311,273	0.1	0.3	135	188	0.2	0.4	72,143	112,523	0.2	0.4	248,182	366,519	0.2	0.4
Nevada	4,850	.....	(1)	.....	2	.....	(1)	.....	1,500	.....	(1)	.....	8,675	.....	(1)	.....
Utah	36,674	.....	(1)	.....	38	.....	0.1	.....	17,218	.....	0.1	.....	63,978	.....	0.1	.....
Colorado	319,121	607,570	0.3	0.7	191	281	0.3	0.5	132,625	225,925	0.5	0.8	419,304	723,374	0.3	0.7
Kansas	271.122	975,735	0.2	1.0	239	288	0.4	0.5	102,276	152,731	0.4	0.5	377,134	546,349	0.3	0.5
Arizona	50,450	.....	0.1	.....	25	.....	(1)	.....	17,396	.....	0.1	.....	53,010	.....	(1)	.....
New Mexico.....	24,275	.....	(1)	.....	17	.....	(1)	.....	8,760	.....	(1)	.....	28,600	.....	(1)	.....
All other Western states[3].....	.....	41,955	.....	0.1	.....	18	.....	(1)	.....	18,800	.....	0.1	.....	46,750	.....	0.1
Pacific states	1,655,305	1,510,541	1.4	1.6	1,200	857	1.9	1.5	661,150	617,075	2.2	2.1	2,291,960	1,748,160	1.9	1.7
Washington.....	101,260	111,000	0.1	0.1	134	90	0.2	0.2	90,061	78,258	0.3	0.2	289,068	200,188	0.2	0.2
Oregon	79,621	163,152	0.1	0.2	62	79	0.1	0.1	38,886	62,078	0.1	0.2	128,425	185,990	0.1	0.2
California.....	1,474,424	1,236,389	1.2	1.3	1,004	688	1.6	1.2	532,203	481,739	1.8	1.7	1,874,467	1,362,082	1.6	1.3

[1] Less than one-tenth of 1 per cent.
[2] Included in "all other Western states."
[3] Includes in 1890 establishments distributed as follows: Montana, 4; Wyoming, 1.

Table 7 shows that the capital in the United States increased from $93,455,257 in 1890 to $118,187,838 in 1900, a gain of $24,732,581, or 26.5 per cent. At the census of 1890 the Central states ranked first as to capital, with $50,950,766, or 54.5 per cent of the total for the United States; retaining the same rank in 1900 with a capital of $65,779,937, or 55.7 per cent of the total, an increase of $14,829,171, or 1.2 per cent. In 1890 and in 1900 the Middle states ranked second, reporting a capital of $24,217,314, or 25.9 per cent of the total, and of $27,642,686, or 23.4 per cent of the total, for the censuses of 1890 and 1900, respectively. This showed a loss in per cent of total capital during the decade of 2.5 per cent, though there was an increase in amount of $3,425,372. In 1890 the New England states ranked third, with $9,166,343, or 9.8 per cent of the total, and in 1900 retained this rank with $13,114,354, or 11.1 per cent of the total, an increase of 1.3 per cent, and an increase in amount of $3,948,011.

In 1890 the Southern states ranked fourth, with $5,636,850, or 6.1 per cent of the total, and in 1900 retained their rank with $8,925,196, or 7.5 per cent of the total, a gain of $3,288,346, or 1.4 per cent. In 1890 the Western states ranked fifth, with $1,973,443, or 2.1 per cent of the total, but in 1900 went to sixth place, with $1,070,360, or nine-tenths of 1 per cent, a decrease of $903,083, or 1.2 per cent. In 1890 the Pacific states ranked sixth, with $1,510,541, or 1.6 per cent of the total, and in 1900 advanced to fifth place with $1,655,305, or 1.4 per cent of the total, a decrease of two-tenths of 1 per cent, but an increase in amount of $144,764.

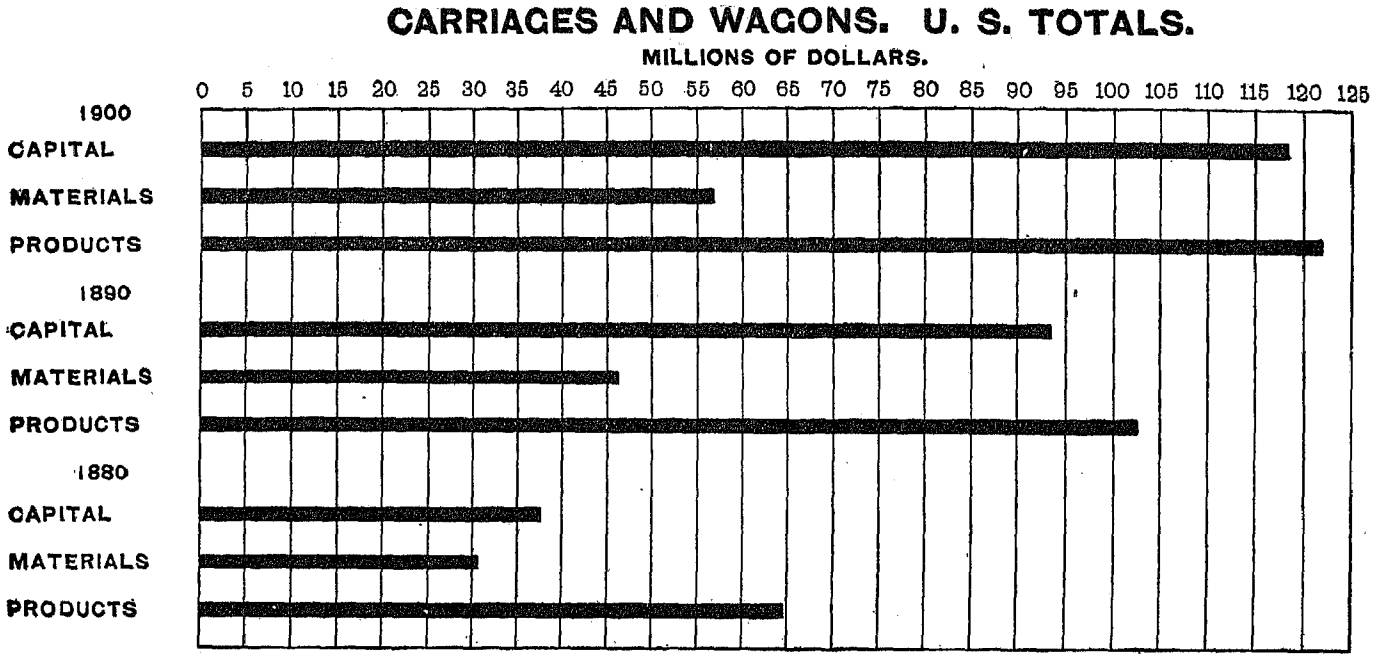
With respect to the average number of wage-earners employed and the total amount of wages paid, the divisions occupied in 1890 and 1900 nearly the same relative positions as in the case of capital invested. The rank was as follows: Central states first, with 49.7 and 50.8 per cent, respectively, of the totals as to number of wage-earners, an increase of 3,652, or nine-tenths of 1 per cent, and as to amount of wages 46.8 and 48.5 per cent of the total, an increase of $908,048, or 1.7 per cent; the Middle states second, with 28.6 and 24.4 per cent, respectively, of the total as to number, a decrease of 930, or 4.2 per cent, and as to amount of wages of 29.6 and 26.8 per cent, respectively, of the total, a decrease of $591,131, or 2.8 per cent; the New England states third, with 10.9 and 10.8 per cent, respectively, of the total as to number, though with an increase in number of 620, and as to amount of wages 12.9 and 12.6 per cent of the total, respectively, a decrease of three-tenths of 1 per cent, though with an increase in amount of $9,801; the Southern states fourth, with 7.9 and 10.9 per cent of the total as to number, an increase of 2,360, or 1 per cent, and as to amount 6.8 and 8.5 per cent of the total, respectively, an increase of $551,413, or 1.7 per cent; the Pacific states fifth, with 1.5 and 1.9 per cent, respectively, of the total as to number, an increase of 343, or four-tenths of 1 per cent, and as to amount 2.1 and 2.2 per cent, respectively, of the total, a gain of $44,075, or one-tenth of 1 per cent; and the Western states sixth with 1.4 and 1.2 per cent, respectively, of the total as to number, a decrease of 30, or two-tenths of 1 per cent, and as to amount of 1.8 and 1.4 per cent, respectively, of the total, a decrease of $89,696, or four-tenths of 1 per cent.

With respect to value of product, the relative rank for 1890 and 1900 was practically the same as in the matter of capital invested, the Central states ranking first, with 53 and 55.6 per cent, respectively, of the total, an increase of $13,112,416, or 2.6 per cent; the Middle states second, with 26 and 21.9 per cent, respectively, of the total, a decrease of $59,621, or 4.1 per cent; the New England states third, with 10.9 and 10.5 per cent, respectively, of the total, an increase of $1,534,043, or a decrease of four-tenths of 1 per cent; the Southern states fourth, with 6.7 and 8.9 per cent, respectively, of the total, an increase of $3,943,287, or 2.2 per cent; the Pacific states fifth, with 1.7 and 1.9 per cent, respectively, of the total, an increase of $1,543,800, or two-tenths of 1 per cent; and the Western states sixth, with 1.7 and 1.2 per cent, respectively, of the total, a decrease of $216,990, or five-tenths of 1 per cent.

The great decrease in the Western states occurred in 3 states, Colorado, Kansas, and Nebraska. In 1890 the capital in these 3 states was $1,894,578, and in 1900, $742,162, a decrease of $1,152,416, or 60.8 per cent; the value of products in 1890 was $1,636,242, and in 1900, $1,044,620, a decrease of $591,622, or 36.2 per cent.

The increase in value of products in the United States, from $102,680,341 in 1890 to $121,537,276 in 1900, was $18,856,935, or 18.4 per cent. This increase by geographic divisions was, in the Central states, from $54,395,727 to $67,508,143, being $13,112,416, or 24.1 per cent; in the Southern states, from $6,911,107 to $10,854,394, being $3,943,287, or 57.1 per cent; in the New England states, from $11,217,112 to $12,751,155, being $1,534,043, or 13.7 per cent; and in the Pacific states, from $1,748,160 to $2,291,960, being $543,800, or 31.1 per cent. These increases were reduced by decrease in the Western states from $1,722,242 to $1,505,252, being $216,990, or 12.6 per cent; and in the Middle states, from $26,685,993 to $26,626,372, being $59,621, or two-tenths of 1 per cent.

The following graphic chart shows for the industry the comparative growth of capital, cost of materials, and value of products, from 1880 to 1900, the unit of growth being $1,000,000:



The following statements, compiled from the United States Treasury reports, show the value of carriages and parts imported for consumption from 1884 to 1900, inclusive. Prior to 1884 the classification of these imports included cars, etc., and is therefore of no comparative value so far as this industry is concerned.

IMPORTS FOR CONSUMPTION, 1884 TO 1900.[1]

YEAR.	Value.	YEAR.	Value.	YEAR.	Value.
1900	$29,662	1894	$149,102	1888	$181,277
1899	19,863	1893	529,986	1887	242,999
1898	7,551	1892	670,574	1886	256,367
1897	13,128	1891	501,670	1885	243,259
1896	16,913	1890	452,884	1884	193,890
1895	82,307	1889	258,249		

[1] Annual Reports on Commerce and Navigation: United States Treasury Department.

In 1884 the importation of carriages and parts thereof amounted to $193,890. Except in 1888 this amount increased until 1892, when the imports reached $670,574; from this year imports decreased until 1898, when they were $7,551, increasing in 1899 to $19,863 and in 1900 to $29,662. The increase in the last two years of the decade was undoubtedly due to the importation of automobiles.

The Treasury reports furnish no distinctive statistics of the exportation of carriages and parts thereof prior to 1898, in which year the exports were valued at $1,685,838. In 1899 they were valued at $2,047,788, and in 1900 at $2,809,784. The increase in the three years was $1,123,946, or 66.7 per cent. In 1898 the exports exceeded the imports by $1,678,287; in 1899, by $2,027,925; and in 1900, by $2,780,122. This increasing volume of excess of exports over imports is a very encouraging feature of the growth and prosperity of the industry.

The detailed statistics for the industry as reported at the census of 1900 are shown in Table 8 of this report. This table presents totals for each of the 49 states and territories in which the industry was carried on, Alaska and Idaho being the only ones having no establishments. The establishments are classified according to the character of the ownership, which shows that out of the total of 7,632 establishments there were owned by individuals, 5,361; by partnerships, 1,829; by incorporated companies, 442. The capital is shown by separate divisions, and the employees are segregated so as to show the number and total salaries for salaried officers and for wage-earners, separately, the number and salaries of men, women, and children, respectively, and also the average number of wage-earners employed during each month of the year. Miscellaneous expenses, the cost of materials used, and the value of the products are shown in detail by items, and the number of engines, water wheels, electric motors, and other power in use, with

their horsepower, and the 7,632 establishments are grouped according to the number of employees in each.

The following tabular statement shows the number of vehicles manufactured, both by general and sub-classes, as returned in Table 8:

CLASS.	Number.
Total	1,607,272
Family and pleasure carriages:	
Total	907,482
Two-wheeled—	
Total	29,302
Carts and cars—	
Total	24,994
Carts	20,402
Dogcarts	1,804
Hackney carts	299
Pony carts	1,536
Tandems	72
Cars	881
Gigs—	
Total	455
Gigs	116
Physicians' gigs	339
Sulkies and skeleton carts—	
Total	3,853
Sulkies	1,492
Skeleton carts	2,361
Four-wheeled, for 1 or 2 persons—	
Total	730,270
Buggies	513,565
Phaetons	25,207
Driving wagons	29,945
Pony and park wagons—	
Total	3,868
Pony wagons	1,396
Park wagons	2,472
Road wagons	116,682
Runabouts	22,747
Spiders, stanhopes, and traps—	
Total	8,807
Spiders	606
Stanhopes	6,735
Traps	1,466
Buckboards	9,449
Four-wheeled, for 3 or more persons—	
Total	147,910
Road wagons	30,444
Surreys and phaetons—	
Total	91,408
Surreys	87,162
Phaetons	4,232
Victorias, cabriolets, and vis-a-vis—	
Total	2,645
Victorias	257
Cabriolets	2,335
Vis-a-vis	53
Broughams, landaus, etc.—	
Total	4,507
Broughams	846
Coupes	177
Landaus	318
Rockaways	3,166
Traps, spiders, brakes, and tallyhos—	
Total	5,695
Traps	3,971
Spiders	304
Brakes	349
Tallyhos	1,071
Coaches	588
Park wagons	6,001
Mountain wagons	4,084
Buckboards	2,538
Public conveyances:	
Total	2,316
Hacks, omnibuses, cabs, etc.—	
Total	1,567
Hacks	1,012
Omnibuses	346
Herdics	3
Cabs	39
Stages	167
Hotel coaches and opera buses—	
Total	412
Hotel coaches	245
Opera buses	167
Hansoms	337
Business wagons:	
Total	128,726
Express and baggage-transfer wagons—	
Total	19,912
Express wagons, light	8,291
Express wagons, heavy	3,802
Baggage-transfer wagons, light	5,841
Baggage-transfer wagons, heavy	1,918
Business wagons—Continued.	
Delivery wagons for light packages—	
Total	64,950
Delivery wagons for light packages, 2-wheeled	963
Delivery wagons for light packages, 4-wheeled, light	52,720
Delivery wagons for light packages, 4-wheeled, heavy	11,267
Furniture vans and wagons, and caravans:	
Total	1,725
Furniture vans	300
Furniture wagons	937
Caravans, light	241
Caravans, heavy	247
Drays and trucks:	
Total	7,417
Drays, 2-wheeled	407
Drays, 4-wheeled	1,676
Trucks, light	3,060
Trucks, heavy	2,274
Dump dirt wagons and carts:	
Total	4,898
Dump dirt carts, 2-wheeled	2,973
Dump dirt wagons, 4-wheeled	1,925
Coal wagons and carts:	
Total	3,155
Coal carts, 2-wheeled	917
Coal wagons, 4-wheeled	2,238
Ice wagons	1,144
Log and ore wagons:	
Total	4,282
Log wagons	4,208
Ore wagons	74
Hearses	797
Trade wagons:	
Total	11,788
Laundry wagons, 2-wheeled	54
Laundry wagons, 4-wheeled	2,047
Milk wagons	6,749
Painters' and builders' wagons	568
Peddlers' wagons, 1-horse	817
Peddlers' wagons, 2-horse	309
Pie and bakery wagons	1,244
Street sweepers, sprinklers, etc.:	
Total	491
Street sweepers	8
Street sprinklers, 2-wheeled	24
Street sprinklers, 4-wheeled	207
Garbage carts, 2-wheeled	51
Garbage wagons, 4-wheeled	114
Street cleaners' wagons, 1-horse	64
Street cleaners' wagons, 2-horse	23
Handcarts, etc.:	
Total	8,167
Handcarts	8,153
Foundry-yard and lawn sprinklers, 2-wheeled, hand	14
Government, municipal, etc., wagons:	
Total	1,108
Ambulances	324
Police and fire patrol wagons, etc.—	
Total	294
Fire-patrol wagons	31
Hose wagons	213
Police-patrol wagons	45
Prison vans	5
Mail and mail carriers' wagons and carts—	
Total	490
Mail and mail carriers' wagons and carts, 2-wheeled	113
Mail and mail carriers' wagons and carts, 4-wheeled	377
Automobiles and other horseless wagons:	
Total	3,901
Passenger and pleasure	3,472
Delivery and transfer	429
Farm wagons and carts:	
Total	445,517
Light wagons and carts—	
Total	119,428
Light wagons and carts, 2-wheeled	3,427
Light wagons, 4-wheeled	116,001
Heavy and dump wagons, and trucks—	
Total	326,089
Heavy wagons	299,323
Dump wagons and carts	14,340
Trucks	12,426
Sleighs:	
Total	118,222
One-seated, and speeding or racing—	
Total	66,398
One-seated	65,769
Speeding or racing	629
Two-seated	10,482
Sleds, including "bobs"	41,342

While the classes into which the several kinds of conveyances were divided at the censuses of 1890 and 1900 varied materially, and differed in the basis on which the division was made, still a general grouping of the styles and character of the conveyances can be arranged so as to enable comparisons between the products of the industry to be safely made. At the census of 1890 there were reported as manufactured 1,369,254 conveyances, and in 1900, 1,607,272, an increase of 238,018, or 17.4 per cent. In the following comparison the basis is the groupings or divisions in 1900 (see Table 8) as compared with similar ones in 1890:[1] Family and

[1] Eleventh Census, Part I, Manufactures, pages 682 to 685.

pleasure carriages in 1890 numbered 841,305; in 1900, 907,482; increase, 66,177. Comparable items in this group: Buggies and phaetons to carry 2 people in 1890 numbered 359,497; in 1900, 538,772; increase, 179,275. Landaus, broughams, etc., in 1890, 3,232; in 1900, 4,507; increase, 1,275. Victorias, cabriolets, etc., in 1890, 2,723; in 1900, 2,645; decrease, 78. Coaches, in 1890, 1,004; in 1900, 588; decrease, 416. Road wagons, phaetons, etc., in 1890, 105,003; in 1900, 124,390; increase, 19,387. Traps, brakes, mountain wagons, etc., in 1890, 8,439; in 1900, 15,780; increase, 7,341. Public conveyances in 1890 numbered 3,200; in 1900, including hearses, 3,113; decrease, 87. Business wagons, delivery wagons, light trade wagons, etc., in 1890, 98,841; in 1900, 95,735; decrease, 3,106. Transfer and other heavy wagons, in 1890, 26,987; in 1900, 43,149; increase, 16,162. Dirt and dump carts, in 1890, 8,331; in 1900, 19,238; increase, 10,907. The number of farm wagons reported in 1890 was 298,851; in 1900, 415,324; increase, 116,473. Sleighs, in 1890, 87,161; in 1900, 118,222; increase, 31,061.

In considering the increase in the industry the fact must be borne in mind that in its earlier stages almost the entire work of manufacturing was done at the establishment, only certain lines of hardware being purchased. Gradually certain parts were manufactured in establishments making a specialty of certain of the component parts of the vehicle, such as rims, spokes, hubs, etc., and, later on, wheels and carriage and wagon bodies. Finally almost all parts were manufactured in establishments making a specialty of one or more of the parts, and many of the smaller manufactories purchase most of the parts, generally in the white, and from these produce the manufactured article. In fact, there are very few, if any, manufacturers who produce all the parts, but purchase more or less of the same in fully or partly manufactured form. The census classification for these establishments is "carriage and wagon materials," and they form, in point of fact, a part of the general carriage and wagon industry. The census of 1880 was the first at which the classification of carriage and wagon materials appeared, and the statistics for that and succeeding censuses show to what extent the industry had grown at that time, and its continued expansion. The general statistics for the industry at the censuses of 1880, 1890, and 1900 afford valuable information as to this collateral branch of the carriage and wagon industry, and are here given as follows: Number of establishments, 1880, 412; 1890, 539; 1900, 588. Capital, 1880, $7,034,718; 1890, $13,028,161; 1900, $19,085,775. Number of wage-earners, 1880, 7,502; 1890, 9,996; 1900, 15,387. Wages paid, 1880, $2,733,004; 1890, $4,366,233; 1900, $5,987,267. Miscellaneous expenses, 1880, not returned; 1890, $821,743; 1900, $1,202,666. Cost of materials used, 1880, $4,781,095; 1890, $7,387,904; 1900, $13,048,608. Value of products, 1880, $10,114,352; 1890, $16,262,293; 1900, $25,027,173. It will thus be seen that capital has increased since 1880, $12,051,057, or 171.3 per cent; and the value of products, $14,912,821, or 147.4 per cent.

A combination of the statistics for carriages and wagons for 1900, as exhibited in Table 1, and the figures above given for carriage and wagon materials, is herewith presented:

	Total for both industries.	Carriages and wagons.	Carriage and wagon materials.
Number of establishments	8,220	7,632	588
Capital	$137,273,613	$118,187,838	$19,085,775
Average number of wage-earners	77,927	62,540	15,387
Total wages	$35,802,178	$29,814,911	$5,987,267
Miscellaneous expenses	$7,464,135	$6,261,469	$1,202,666
Cost of materials used	$69,724,681	$56,676,073	$13,048,608
Value of products	$146,564,449	$121,537,276	$25,027,173

The capital invested ($137,273,613) and the value of products ($146,564,449) show the magnitude of the industry, and considered with the tables in the earlier part of this report indicate its prosperous condition.

In this connection it will not be amiss to call attention to the natural effect produced on the industry by the remarkable and rapidly increasing extension of the electric traction systems during the last few years. These systems connect the thickly populated cities with the surrounding towns and villages, and afford not only the residents thereof, but also the rural communities through which they pass, rapid and convenient methods of communication. Thus at a minimum expense rural and suburban communities are brought into close touch with the city markets, and in consequence the use of carriages and light wagons has been largely reduced. The introduction into such general and increasing use of the rubber tire for light vehicles has had the effect of prolonging the stability and life of both wheels and wagons, and of largely reducing the cost of repairs.

TABLE 8.—CARRIAGES AND WAGONS:

		United States.	Alabama.	Arizona.	Arkansas.	California.	Colorado.	Connecticut.	Delaware.	District of Columbia.	Florida.
1	Number of establishments	7,632	49	5	40	228	48	117	36	21	47
	Character of organization:										
2	Individual	5,361	33	3	26	172	30	80	26	16	39
3	Firm and limited partnership	1,829	13	.....	13	50	12	27	8	5	8
4	Incorporated company	442	3	2	1	6	6	10	2	.....	.....
	Capital:										
5	Total	$118,187,838	$386,064	$50,450	$176,820	$1,474,424	$319,121	$5,010,816	$423,689	$141,306	$142,522
6	Land	$13,700,705	$15,540	$12,000	$17,827	$327,321	$62,550	$357,694	$66,920	$49,800	$24,075
7	Buildings	$19,878,684	$39,670	$11,400	$29,957	$230,630	$62,600	$755,588	$71,150	$48,800	$29,040
8	Machinery, tools, and implements	$11,028,188	$32,297	$5,350	$35,518	$228,725	$37,890	$601,652	$31,135	$11,625	$22,545
9	Cash and sundries	$73,580,261	$298,557	$21,700	$93,518	$687,748	$156,081	$3,295,882	$254,484	$31,081	$66,862
10	Proprietors and firm members	9,357	58	3	58	274	53	137	40	27	57
	Salaried officials, clerks, etc.:										
11	Total number	4,302	24	4	5	34	11	137	11	2	3
12	Total salaries	$4,073,932	$15,985	$1,180	$2,300	$37,975	$10,960	$158,381	$9,506	$1,212	$2,100
	Officers of corporations—										
13	Number	736	3	.....	.....	7	9	14	3	.....	.....
14	Salaries	$1,218,266	$4,900	.....	.....	$13,500	$9,460	$37,635	$4,900	.....	.....
	General superintendents, managers, clerks, etc.—										
15	Total number	3,566	21	4	5	27	2	123	8	2	3
16	Total salaries	$2,855,666	$11,085	$1,180	$2,300	$24,475	$1,500	$120,746	$4,606	$1,212	$2,100
	Men—										
17	Number	2,988	20	4	5	24	1	101	6	2	3
18	Salaries	$2,615,284	$10,605	$1,180	$2,300	$23,033	$780	$115,052	$4,150	$1,212	$2,100
	Women—										
19	Number	578	1	.....	.....	3	1	22	2	.....	.....
20	Salaries	$240,382	$480	.....	.....	$1,442	$720	$5,694	$456	.....	.....
	Wage-earners, including pieceworkers, and total wages:										
21	Greatest number employed at any one time during the year.	79,947	496	27	184	1,294	272	3,124	294	190	163
22	Least number employed at any one time during the year.	49,631	321	22	118	810	160	1,559	181	138	129
23	Average number	62,540	408	25	150	1,004	191	2,192	224	154	143
24	Wages	$29,814,911	$128,647	$17,396	$54,718	$532,203	$132,625	$1,298,096	$104,307	$71,382	$59,384
	Men, 16 years and over—										
25	Average number	61,281	394	24	150	978	187	2,184	219	153	141
26	Wages	$29,492,195	$126,609	$17,336	$54,718	$527,447	$131,685	$1,294,443	$103,339	$71,128	$58,874
	Women, 16 years and over—										
27	Average number	846	.....	.....	.....	.....	1	7	3	.....	1
28	Wages	$249,976	.....	.....	.....	.....	$240	$3,445	$748	.....	$364
	Children, under 16 years—										
29	Average number	413	14	1	.....	26	3	1	2	1	1
30	Wages	$72,740	$2,038	$60	.....	$4,756	$700	$208	$220	$254	$146
	Average number of wage-earners, including pieceworkers, employed during each month:										
	Men, 16 years and over—										
31	January	57,281	354	23	139	848	156	2,272	193	131	145
32	February	60,433	364	23	135	867	174	2,431	193	141	145
33	March	64,632	380	23	135	933	194	2,684	232	149	144
34	April	68,511	383	24	149	1,041	215	2,879	256	182	139
35	May	69,915	390	24	154	1,118	204	2,998	259	183	139
36	June	66,807	410	25	150	1,116	199	1,705	229	165	134
37	July	61,760	395	25	151	1,067	201	1,768	228	151	134
38	August	59,438	398	24	162	1,053	190	1,842	222	151	132
39	September	58,303	440	26	168	1,019	193	1,832	213	151	138
40	October	56,424	418	25	158	950	181	1,870	216	150	149
41	November	55,728	411	24	153	880	172	1,929	193	140	147
42	December	56,140	383	24	141	845	165	1,996	191	146	145
	Women, 16 years and over—										
43	January	843	.....	.....	.....	.....	1	6	3	.....	1
44	February	908	.....	.....	.....	.....	1	8	3	.....	1
45	March	983	.....	.....	.....	.....	1	9	3	.....	1
46	April	1,006	.....	.....	.....	.....	1	11	3	.....	1
47	May	1,021	.....	.....	.....	.....	1	11	3	.....	1
48	June	969	.....	.....	.....	.....	1	5	3	.....	1
49	July	865	.....	.....	.....	.....	1	5	3	.....	1
50	August	783	.....	.....	.....	.....	1	5	3	.....	1
51	September	732	.....	.....	.....	.....	1	5	3	.....	1
52	October	670	.....	.....	.....	.....	1	5	3	.....	1
53	November	659	.....	.....	.....	.....	1	5	3	.....	1
54	December	712	.....	.....	.....	.....	1	6	1	.....	1
	Children, under 16 years—										
55	January	379	13	1	.....	23	3	1	1	1	1
56	February	385	14	1	.....	23	3	1	1	1	1
57	March	417	14	1	.....	27	3	1	2	1	2
58	April	435	12	1	.....	26	3	1	2	1	2
59	May	458	14	1	.....	28	3	1	3	1	2
60	June	455	18	1	.....	28	3	1	2	1	1
61	July	446	16	.....	.....	28	3	1	2	1	1
62	August	431	17	.....	.....	28	3	1	2	1	1
63	September	401	18	.....	.....	27	3	1	2	1	1
64	October	390	14	.....	.....	27	3	1	1	1	1
65	November	381	14	.....	.....	25	3	1	2	1	1
66	December	378	9	.....	.....	22	3	1	2	1	1
	Miscellaneous expenses:										
67	Total	$6,261,469	$40,928	$1,507	$8,121	$99,663	$19,917	$161,571	$18,239	$8,502	$7,737
68	Rent of works	$1,192,415	$6,500	.....	$1,904	$45,670	$8,599	$22,728	$6,090	$5,255	$4,415
69	Taxes, not including internal revenue	$609,410	$2,876	$773	$1,334	$10,598	$3,408	$18,889	$2,247	$553	$1,035
70	Rent of offices, insurance, interest, and all sundry expenses not hitherto included.	$4,234,434	$31,177	$734	$4,611	$33,985	$6,960	$117,547	$9,902	$2,159	$2,287
71	Contract work	$224,210	$375	.....	$272	$9,410	$950	$2,407	.....	$535	.....

BY STATES AND TERRITORIES, 1900.

Georgia.	Illinois.	Indiana.	Indian Territory.	Iowa.	Kansas.	Kentucky.	Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.	Mississippi.	Missouri.	
132	407	275	9	211	73	151	49	165	178	388	299	194	30	377	1
90	266	159	7	141	56	97	36	141	139	276	205	128	26	260	2
34	106	80	2	55	16	47	12	23	35	91	56	58	3	87	3
8	35	36	.....	15	1	7	1	1	4	21	38	8	1	30	4
$847,426	$9,539,235	$17,718,489	$11,190	$4,087,400	$271,122	$3,084,793	$264,647	$602,778	$835,342	$5,594,939	$7,935,269	$1,860,594	$96,525	$4,019,087	5
$84,698	$1,213,404	$2,163,709	$900	$338,147	$29,785	$271,364	$54,220	$57,420	$97,399	$542,596	$640,144	$216,095	$12,900	$461,954	6
$121,334	$1,409,256	$3,326,474	$2,225	$451,661	$55,510	$463,311	$45,530	$118,350	$173,255	$753,697	$944,508	$321,456	$20,020	$558,643	7
$107,339	$794,025	$967,807	$1,975	$504,239	$44,125	$227,393	$41,486	$71,528	$97,466	$614,059	$509,651	$215,456	$17,810	$314,923	8
$584,055	$6,122,550	$11,260,499	$6,090	$2,793,353	$141,702	$2,122,725	$123,411	$355,475	$467,222	$3,684,587	$5,840,966	$1,107,587	$45,795	$2,683,567	9
166	498	329	18	270	91	196	60	189	223	482	326	258	34	462	10
39	340	599	.....	140	21	122	13	16	27	141	401	50	4	190	11
$31,024	$346,428	$583,962	.....	$112,704	$12,880	$116,935	$8,359	$10,100	$20,356	$115,685	$352,498	$49,724	$3,500	$210,305	12
6	55	89	.....	28	3	12	5	.....	5	17	62	19	2	65	13
$7,900	$100,781	$185,397	.....	$37,986	$3,600	$30,782	$4,275	.....	$5,420	$25,400	$103,320	$20,185	$2,000	$97,521	14
33	285	510	.....	112	18	110	8	16	22	124	339	31	2	125	15
$28,124	$245,647	$898,565	.....	$74,768	$9,280	$86,153	$4,084	$10,100	$14,936	$90,285	$249,178	$29,539	$1,500	$112,784	16
31	242	410	.....	88	14	97	8	14	20	95	257	25	2	101	17
$21,954	$225,494	$349,109	.....	$64,693	$7,380	$79,639	$4,084	$9,850	$14,550	$79,629	$217,487	$27,404	$1,500	$102,491	18
2	43	100	.....	24	4	13	.....	2	2	29	82	6	.....	24	19
$1,170	$20,153	$49,456	.....	$10,075	$1,900	$6,514	.....	$250	$386	$10,656	$31,691	$2,135	.....	$10,293	20
1,010	5,608	7,906	14	2,081	299	1,996	351	510	989	3,998	6,476	1,309	141	3,323	21
700	3,086	5,276	7	1,241	206	1,448	242	303	723	2,649	3,535	865	94	2,055	22
830	4,355	6,490	8	1,692	289	1,677	291	339	822	3,164	4,890	1,066	113	2,583	23
$261,856	$2,210,722	$2,756,780	$8,684	$713,901	$102,276	$625,304	$120,906	$173,634	$339,949	$1,709,164	$2,028,530	$461,295	$43,452	$1,310,560	24
822	4,270	6,284	8	1,655	283	1,628	285	337	805	3,148	4,755	1,052	113	2,520	25
$261,056	$2,181,092	$2,702,795	$8,684	$704,689	$100,930	$615,812	$119,835	$173,084	$337,765	$1,704,006	$1,986,932	$456,247	$43,452	$1,292,522	26
.....	54	198	.....	32	1	14	.....	1	.....	16	130	8	.....	42	27
.....	$22,475	$52,811	.....	$7,452	$300	$3,405	.....	$350	.....	$5,158	$40,703	$3,000	.....	$13,966	28
8	31	8	.....	5	5	35	6	1	17	.....	5	6	.....	21	29
$800	$7,155	$1,174	.....	$1,760	$1,046	$6,087	$1,071	$200	$2,184	.....	$895	$2,048	.....	$4,072	30
794	4,027	6,150	9	1,450	195	1,497	287	301	714	2,949	4,643	988	102	2,224	31
819	4,272	6,371	9	1,670	207	1,544	275	325	726	3,028	5,134	1,025	102	2,368	32
858	4,570	6,711	9	1,735	228	1,633	288	369	792	3,274	5,368	1,086	118	2,703	33
850	4,856	6,978	9	1,628	237	1,679	289	396	865	3,535	5,589	1,110	111	2,745	34
804	4,826	7,100	10	1,667	255	1,730	282	417	904	3,685	5,522	1,130	119	2,829	35
811	4,629	6,640	8	1,737	261	1,702	278	393	912	3,567	5,138	1,105	115	2,839	36
784	4,205	6,133	9	1,732	255	1,721	269	327	875	3,144	4,537	1,045	110	2,702	37
803	4,266	5,981	8	1,766	252	1,673	271	301	840	2,878	4,064	1,033	124	2,641	38
844	4,077	5,963	10	1,782	253	1,669	305	288	819	2,953	4,015	1,034	116	2,567	39
863	3,684	5,748	6	1,661	243	1,598	310	308	767	2,939	4,146	1,020	116	2,367	40
831	3,871	5,584	6	1,570	212	1,557	289	318	723	2,933	4,403	1,019	114	2,169	41
808	3,960	6,054	4	1,509	198	1,536	281	295	717	2,893	4,503	1,032	108	2,087	42
.....	49	216	.....	25	1	15	.....	1	.....	17	135	10	.....	36	43
.....	56	220	.....	29	1	17	.....	1	.....	17	148	10	.....	41	44
.....	61	232	.....	33	1	17	.....	1	.....	17	160	10	.....	46	45
.....	67	233	.....	34	1	17	.....	1	.....	14	158	10	.....	48	46
.....	69	237	.....	37	1	17	.....	1	.....	19	157	10	.....	52	47
.....	73	216	.....	39	1	11	.....	1	.....	16	142	9	.....	51	48
.....	60	191	.....	43	1	15	.....	1	.....	14	127	6	.....	41	49
.....	50	176	.....	40	1	14	.....	1	.....	12	105	5	.....	47	50
.....	47	172	.....	35	1	12	.....	.....	.....	14	102	5	.....	42	51
.....	84	151	.....	30	1	7	.....	.....	.....	16	102	6	.....	37	52
.....	37	159	.....	21	1	9	.....	1	.....	17	103	5	.....	31	53
.....	41	178	.....	19	1	11	.....	1	.....	17	118	7	.....	33	54
7	82	6	.....	7	3	36	5	1	17	.....	4	3	.....	19	55
7	31	6	.....	3	4	36	6	1	17	.....	4	3	.....	19	56
8	30	6	.....	4	5	36	6	1	17	.....	4	4	.....	20	57
8	32	7	.....	3	9	35	5	1	17	.....	4	4	.....	24	58
8	28	10	.....	8	9	36	5	1	18	.....	5	5	.....	25	59
7	35	10	.....	9	7	36	5	1	18	.....	6	9	.....	25	60
8	33	9	.....	8	7	36	6	2	18	.....	8	8	.....	23	61
8	32	6	.....	7	5	34	7	2	18	.....	8	8	.....	22	62
8	28	7	.....	4	5	34	8	2	17	.....	7	8	.....	20	63
7	32	6	.....	4	5	34	7	2	17	.....	4	8	.....	19	64
7	28	7	.....	4	3	31	6	2	16	.....	5	9	.....	19	65
7	29	10	.....	2	2	35	5	2	16	.....	6	9	.....	18	66
$45,092	$532,635	$674,971	$659	$243,794	$20,418	$144,774	$12,915	$25,269	$44,896	$346,351	$495,520	$104,319	$3,443	$251,744	67
$10,420	$122,125	$37,332	$340	$19,378	$6,361	$13,195	$6,841	$6,072	$24,296	$117,419	$24,902	$17,649	$945	$92,603	68
$8,389	$51,288	$67,244	$49	$24,471	$2,388	$12,454	$1,752	$4,318	$5,627	$35,900	$37,714	$10,936	$1,033	$18,074	69
$26,168	$352,625	$567,025	$270	$198,475	$9,512	$118,625	$4,047	$11,896	$13,301	$172,300	$386,694	$73,379	$1,130	$128,880	70
$120	$6,602	$8,370	.....	$1,470	$2,157	$500	$275	$2,983	$1,672	$20,782	$46,210	$2,355	$335	$12,187	71

TABLE 8.—CARRIAGES AND WAGONS:

		United States.	Alabama.	Arizona.	Arkansas.	California.	Colorado.	Connecticut.	Delaware.	District of Columbia.	Florida.
	Materials used:										
72	Total cost	$56,676,073	$230,397	$16,398	$103,666	$715,207	$148,606	$1,532,351	$113,496	$57,023	$97,683
73	Lumber, feet	257,031,542	673,800	88,000	646,000	2,203,640	645,700	1,771,883	408,744	153,500	454,000
74	Cost	$8,940,823	$36,617	$4,550	$17,280	$119,702	$27,912	$89,153	$12,697	$7,240	$13,949
75	Iron and steel, pounds	353,534,958	2,935,900	147,000	979,730	6,539,201	1,356,375	5,963,435	690,468	606,500	632,200
76	Cost	$11,892,442	$101,230	$5,320	$32,810	$240,205	$48,882	$193,371	$19,889	$17,783	$36,124
77	Carriage hardware, lamps, and mountings	$3,542,629	$6,913	$150	$6,250	$24,595	$6,620	$99,879	$12,886	$1,603	$1,259
78	Paints, oil, turpentine, and varnish	$4,048,383	$22,696	$950	$8,704	$50,778	$12,268	$93,581	$9,660	$8,726	$7,717
79	Enamel, rubber, and other carriage cloth	$3,165,987	$4,421	$525	$1,125	$23,562	$3,910	$104,381	$7,720	$3,395	$2,346
80	Leather	$3,538,719	$3,281	$125	$1,975	$22,731	$2,446	$86,483	$10,343	$1,500	$1,338
81	Rubber tires	$2,257,224	$4,615	.....	$4,560	$37,637	$7,405	$153,572	$2,004	$935	$714
82	Carriage bodies, purchased, number	443,017	53	5	41	87	55	473	104	2	78
83	Cost	$1,740,360	$959	$50	$589	$1,420	$707	$16,032	$1,136	$21	$724
84	Wagon bodies, purchased, number	26,029	16	7	600	58	.....	1,006	8	1	6
85	Cost	$344,437	$168	$70	$6,000	$1,413	.....	$182,627	$250	$18	$24
86	Tops, purchased, number	39,730	84	9	62	283	35	298	7	31	162
87	Cost	$280,223	$806	$120	$522	$3,479	$377	$5,135	$70	$404	$1,722
88	Wheels, purchased, number	3,670,780	11,618	64	1,928	9,180	3,132	18,923	5,886	1,031	7,108
89	Cost	$5,412,212	$26,361	$225	$4,823	$30,006	$11,225	$60,861	$11,845	$4,476	$11,933
90	Axles and springs, purchased	$4,504,828	$6,566	$400	$6,046	$37,198	$6,264	$86,166	$10,175	$2,653	$6,146
91	Fuel	$1,024,255	$4,151	$1,450	$3,373	$32,626	$5,148	$50,498	$2,004	$1,317	$2,527
92	Rent of power and heat	$96,871	$60	$120	$100	$4,210	$20	$891	$612	.....	$4
93	Mill supplies	$216,647	$259	.....	$453	$3,708	$225	$11,240	$284	$110	$187
94	All other materials	$4,479,883	$9,713	$758	$5,916	$59,592	$9,603	$276,069	$9,192	$6,168	$3,800
95	Freight	$1,190,150	$1,581	$1,585	$3,140	$22,345	$5,594	$24,417	$2,749	$674	$4,169
	Products:										
96	Total value	$121,537,276	$556,327	$53,010	$223,790	$1,874,467	$419,304	$4,205,728	$310,865	$191,545	$216,277
97	Family and pleasure carriages, number	907,482	941	22	839	2,477	169	2,946	1,210	24	404
98	Value	$51,504,176	$50,538	$3,100	$57,978	$290,208	$23,690	$1,014,179	$141,996	$3,715	$21,669
99	Public conveyances, number	2,816	5	.....	.....	61	.....	170	3	.....	42
100	Value	$1,147,630	$1,140	.....	.....	$21,046	.....	$115,450	$450	.....	$9,116
101	Business, farm, Government, municipal, etc., wagons, number.	575,351	9,546	47	1,251	2,396	1,013	1,427	1,302	222	1,703
102	Value	$31,480,157	$368,935	$6,575	$77,085	$321,284	$108,550	$142,974	$78,641	$38,910	$76,293
103	Automobiles and other horseless conveyances, number.	3,901	.....	.....	.....	8	.....	896	1	.....	.....
104	Value	$4,080,276	.....	.....	.....	$6,665	.....	$1,892,092	$1,500	.....	.....
105	Sleighs and sleds, number	118,222	.....	.....	.....	21	22	267	3	.....	.....
106	Value	$2,324,600	.....	.....	.....	$501	$1,618	$12,016	$85	.....	.....
107	All other products	$5,208,380	$11,438	.....	$15,387	$142,012	$27,345	$421,499	$6,300	$1,545	$16,464
108	Amount received for repair work	$25,192,057	$124,276	$43,335	$73,340	$1,092,801	$258,101	$607,513	$81,893	$147,375	$92,786
	Kinds and quantities of products:										
	Family and pleasure carriages—										
109	Aggregate	907,482	941	22	839	2,477	169	2,946	1,210	24	404
	Two-wheeled—										
110	Total	29,302	17	1	18	720	3	129	15	.....	31
111	Carts and cars	24,994	13	1	16	706	1	123	11	.....	28
112	Gigs	455	1	.....	2	2	.....	6	4	.....	3
113	Sulkies and skeleton carts	3,853	3	.....	.....	12	2	.....	.....	.....	.....
	Four-wheeled, for 1 or 2 persons—										
114	Total	730,270	747	19	109	1,370	150	1,335	877	14	336
115	Buggies	513,565	612	13	50	711	103	301	641	14	145
116	Phaetons	25,207	30	.....	5	26	1	148	56	.....	12
117	Driving wagons	29,945	10	.....	4	214	9	94	1	.....	12
118	Pony and park wagons	3,868	3	.....	.....	47	.....	31	17	.....	8
119	Road wagons	116,682	80	3	45	289	26	169	83	.....	89
120	Runabouts	22,747	2	.....	.....	18	6	472	69	.....	.....
121	Spiders, stanhopes, and traps	8,807	.....	.....	2	7	2	105	10	.....	.....
122	Buckboards	9,449	10	3	3	58	3	15	.....	.....	70
	Four-wheeled, for 3 or more persons—										
123	Total	147,910	177	2	712	387	16	1,482	318	10	37
124	Road wagons	30,444	114	.....	702	128	5	120	7	.....	16
125	Surreys and phaetons	91,408	60	.....	4	96	.....	247	108	7	9
126	Victorias, cabriolets, and vis-a-vis.	2,646	.....	.....	.....	2	.....	241	.....	.....	.....
127	Broughams, landaus, etc	4,507	1	.....	1	24	.....	416	158	.....	.....
128	Traps, spiders, brakes, and tallyhos.	5,695	1	.....	1	26	1	242	12	3	.....
129	Coaches	588	1	.....	.....	24	.....	65	2	.....	.....
130	Park wagons	6,001	.....	.....	.....	.....	5	35	29	.....	.....
131	Mountain wagons	4,084	.....	2	4	56	2	15	2	.....	.....
132	Buckboards	2,538	.....	.....	.....	31	3	101	.....	.....	12
	Public conveyances—										
133	Total	2,816	5	.....	.....	61	.....	170	3	.....	42
134	Hacks, omnibuses, cabs, etc	1,567	5	.....	.....	30	.....	22	2	.....	27
135	Hotel coaches and opera buses	412	.....	.....	.....	31	.....	41	1	.....	15
136	Hansoms	337	.....	.....	.....	.....	.....	107	.....	.....	.....
	Business wagons—										
137	Total	128,726	868	47	481	1,924	557	1,219	1,115	204	501
138	Express and baggage-transfer wagons	19,912	74	12	32	471	179	267	247	32	44
139	Delivery wagons for light packages	64,950	246	35	137	786	298	490	801	144	153
140	Furniture vans and wagons, and caravans.	1,725	27	.....	8	25	11	10	2	5	17
141	Drays and trucks	7,417	100	.....	11	106	4	60	.....	.....	78
142	Dump dirt wagons and carts	4,898	52	.....	26	94	4	158	.....	1	62
143	Coal wagons and carts	3,155	22	.....	6	54	8	48	2	7	24
144	Ice wagons	1,144	58	.....	6	13	5	22	2	.....	16
145	Log and ore wagons	4,282	217	.....	214	8	13	17	.....	.....	31
146	Hearses	797	2	.....	1	1	.....	.....	.....	.....	.....
147	Trade wagons	11,788	54	.....	39	211	35	134	61	15	65
148	Street sweepers and sprinklers, and garbage wagons and carts.	491	.....	.....	.....	31	.....	6	.....	.....	.....
149	Handcarts, etc	8,167	16	.....	1	124	.....	7	.....	.....	11
	Government, municipal, etc., wagons—										
150	Total	1,108	1	.....	.....	46	.....	1	.....	18	2
151	Ambulances	324	.....	.....	.....	7	.....	1	.....	18	.....
152	Police and fire patrol, and hose wagons and prison vans.	294	1	.....	.....	8	.....	.....	.....	.....	.....
153	Mail and mail carriers' wagons and carts.	490	.....	.....	.....	31	.....	.....	.....	.....	2
	Automobiles and other horseless conveyances—										
154	Total	3,901	.....	.....	.....	8	.....	896	1	.....	.....
155	Passenger and pleasure	3,472	.....	.....	.....	7	.....	700	1	.....	.....
156	Delivery and transfer	429	.....	.....	.....	1	.....	196	.....	.....	.....

BY STATES AND TERRITORIES, 1900—Continued.

Georgia.	Illinois.	Indiana.	Indian Territory.	Iowa.	Kansas.	Kentucky.	Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.	Mississippi.	Missouri.	
$545,587	$4,360,269	$6,986,043	$5,799	$1,863,988	$150,693	$1,500,815	$132,072	$274,772	$377,296	$2,585,363	$6,616,081	$877,885	$46,425	$2,733,960	72
3,207,106	26,646,006	37,783,835	35,500	9,379,894	685,450	14,539,600	620,000	1,500,000	1,209,400	3,434,900	29,689,646	6,715,900	1,319,800	10,280,032	73
$63,884	$940,667	$1,361,450	$1,248	$419,583	$24,296	$508,476	$21,540	$39,248	$45,940	$228,794	$772,159	$251,664	$11,516	$322,658	74
4,219,866	26,296,426	32,958,051	47,600	24,634,446	1,227,260	18,559,435	914,200	2,171,526	3,047,590	13,817,268	33,998,969	8,079,633	546,500	13,985,662	75
$132,542	$1,003,849	$1,396,812	$2,064	$649,415	$41,886	$497,239	$36,846	$72,664	$101,906	$447,756	$1,048,718	$305,907	$20,007	$422,747	76
$31,465	$249,886	$470,555	$100	$148,593	$5,844	$39,500	$5,798	$16,132	$16,748	$235,723	$385,222	$21,508	$790	$191,963	77
$48,801	$287,960	$419,090	$388	$124,202	$13,696	$128,353	$10,493	$20,125	$33,249	$204,414	$520,932	$63,624	$3,463	$160,615	78
$15,848	$195,796	$423,035	$64	$75,751	$8,910	$30,664	$7,176	$17,331	$17,982	$166,631	$436,249	$13,118	$763	$147,212	79
$32,689	$230,075	$392,737	$47	$84,930	$6,106	$56,737	$5,276	$17,103	$15,881	$149,104	$436,879	$19,214	$484	$280,903	80
$9,346	$164,808	$226,517	.....	$20,649	$4,478	$20,747	$4,635	$13,076	$11,490	$227,003	$72,281	$11,851	.....	$111,926	81
316	11,826	43,388	.....	9,900	250	3,625	5	424	1,247	3,476	155,922	385	12	42,202	82
$1,646	$58,005	$164,007	.....	$37,991	$1,970	$18,799	$100	$4,100	$14,786	$124,169	$478,241	$2,321	$89	$125,189	83
69	326	948	.....	762	24	69	31	24	171	445	11,840	434	21	839	84
$355	$4,186	$4,920	.....	$4,995	$280	$1,266	$245	$210	$3,192	$7,337	$41,920	$2,702	$210	$7,114	85
291	1,850	1,330	24	807	203	265	40	122	361	900	2,180	290	82	18,695	86
$1,590	$14,690	$5,447	$242	$7,277	$1,948	$2,777	$361	$1,136	$3,392	$12,987	$13,770	$2,572	$579	$96,802	87
37,009	157,885	582,280	240	56,806	5,018	39,354	3,254	14,574	13,825	57,634	774,968	21,143	507	219,311	88
$90,922	$273,181	$623,250	$600	$82,403	$13,994	$60,898	$13,117	$33,066	$44,000	$248,482	$954,563	$43,921	$1,190	$280,148	89
$47,606	$286,483	$650,815	$100	$67,335	$7,856	$48,900	$12,209	$14,008	$31,896	$147,842	$739,359	$30,511	$1,278	$239,318	90
$10,855	$65,819	$103,532	$217	$35,191	$5,304	$16,793	$4,845	$7,075	$8,275	$46,721	$84,799	$23,130	$1,936	$45,835	91
$1,025	$18,659	$310	$75	$2,413	$214	$454	$1,113	$1,542	$423	$16,461	$3,202	$3,869	.....	$5,042	92
$2,197	$18,700	$27,014	$30	$6,613	$1,190	$3,314	$600	$615	$786	$5,580	$17,243	$3,891	$215	$6,865	93
$42,845	$442,631	$678,582	$394	$54,842	$7,301	$44,028	$6,183	$10,400	$23,362	$296,912	$491,882	$31,567	$3,006	$243,339	94
$11,971	$104,874	$137,970	$235	$41,805	$5,420	$16,870	$1,535	$6,941	$4,038	$19,447	$118,712	$46,515	$899	$46,289	95
$1,350,644	$9,210,379	$12,742,243	$20,887	$3,931,067	$377,134	$2,866,699	$369,431	$719,859	$1,086,473	$6,118,121	$11,205,602	$1,959,974	$134,334	$5,583,364	96
7,622	51,030	141,755	59	20,848	1,447	11,806	303	2,313	3,329	11,913	193,331	6,370	235	52,841	97
$527,400	$3,104,892	$6,961,607	$4,195	$1,436,811	$97,181	$655,249	$29,365	$269,399	$279,731	$1,890,547	$7,430,449	$350,140	$10,195	$2,799,318	98
29	40	64	.....	80	29	25	2	3	11	310	.....	12	3	88	99
$7,575	$30,640	$13,605	.....	$28,800	$4,595	$2,295	$800	$1,350	$3,120	$210,700	.....	$3,322	$400	$24,550	100
11,560	56,545	94,417	23	31,868	1,270	39,375	1,429	1,190	1,403	4,044	50,014	16,959	910	24,721	101
$478,012	$3,154,975	$4,371,618	$1,880	$1,660,217	$80,520	$1,662,557	$123,976	$88,195	$199,848	$637,051	$2,055,940	$328,071	$46,585	$1,402,015	102
.....	671	33	.....	.....	.....	1	1	12	25	1,173	.....	.....	.....	28	103
.....	$758,777	$37,500	.....	.....	.....	$500	$1,000	$12,500	$55,500	$779,650	.....	.....	.....	$29,600	104
.....	1,889	3,834	.....	4,189	24	87	40	2,321	81	882	51,255	7,624	.....	170	105
.....	$21,515	$52,554	.....	$71,593	$352	$1,188	$400	$94,094	$1,415	$80,741	$349,955	$139,637	.....	$3,204	106
$44,428	$585,058	$630,313	$2,510	$264,769	$26,248	$144,126	$23,125	$31,795	$20,775	$354,073	$295,157	$169,981	$19,074	$166,982	107
$298,229	$1,554,522	$675,046	$12,252	$468,877	$168,238	$400,784	$190,765	$222,526	$526,084	$2,165,359	$574,101	$468,823	$58,080	$1,157,695	108
7,622	51,030	141,755	59	20,848	1,447	11,806	303	2,313	3,329	11,913	193,331	6,370	235	52,841	109
93	3,208	4,220	1	159	85	336	71	28	368	478	7,999	880	29	39	110
93	3,044	4,215	1	154	70	232	55	3	345	464	6,967	792	29	27	111
.....	.....	5	.....	.....	.....	.....	10	.....	9	13	.....	75	.....	7	112
.....	164	.....	.....	5	15	104	6	25	14	1	1,032	13	.....	5	113
7,216	38,788	111,419	57	17,944	976	9,858	191	1,772	2,391	7,017	150,300	4,585	199	49,260	114
6,552	28,308	77,925	27	14,554	547	6,844	137	628	1,553	2,463	95,819	2,318	64	43,449	115
100	1,833	6,042	.....	195	79	552	20	81	99	292	1,319	62	.....	1,296	116
33	1,434	3,555	7	161	52	299	12	391	79	394	8,281	319	4	639	117
25	122	767	1	22	6	16	1	4	22	418	256	29	.....	442	118
468	6,120	21,139	22	2,946	191	1,976	17	474	354	1,090	39,737	1,724	129	1,901	119
13	340	1,049	.....	36	69	4	.....	8	187	967	3,522	54	.....	842	120
19	393	769	.....	28	19	27	3	76	48	1,350	677	37	.....	630	121
6	238	173	.....	2	13	140	1	110	49	43	689	42	2	61	122
313	9,034	26,116	1	2,745	386	1,612	41	513	570	4,418	35,032	905	7	3,542	123
121	1,903	2,491	.....	485	69	8	8	251	146	932	10,565	630	5	119	124
143	6,570	22,667	1	2,155	97	1,488	9	61	266	1,030	20,728	71	2	2,586	125
2	39	252	.....	24	.....	7	8	19	14	492	64	2	.....	46	126
.....	169	21	.....	13	.....	44	8	24	40	750	38	.....	.....	51	127
8	68	487	.....	25	4	27	7	2	22	390	521	5	.....	63	128
.....	7	15	.....	2	4	.....	.....	.....	1	54	41	.....	.....	12	129
5	214	223	.....	37	1	30	.....	73	19	455	1,800	2	.....	343	130
22	49	8	.....	2	203	.....	1	.....	34	287	410	141	.....	320	131
12	15	2	.....	2	8	8	.....	83	28	28	865	54	.....	2	132
29	40	64	.....	80	29	25	2	3	11	310	.....	12	3	68	133
29	3	52	.....	50	24	25	2	.....	8	77	.....	12	3	77	134
.....	37	12	.....	30	5	.....	.....	3	3	67	.....	.....	.....	11	135
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	166	.....	.....	.....	.....	136
1,532	4,754	20,521	11	1,100	837	1,553	1,064	761	1,124	3,616	8,820	2,476	233	3,442	137
72	1,165	1,205	.....	108	174	134	152	229	293	1,017	502	372	6	340	138
457	1,694	16,273	10	741	436	562	396	376	431	1,047	6,711	888	31	1,518	139
33	67	21	.....	8	21	1	9	5	18	222	42	24	2	42	140
240	675	757	1	118	7	47	110	46	99	56	322	679	22	426	141
137	82	1,000	.....	2	22	17	104	37	60	367	67	152	13	50	142
40	35	113	.....	15	64	204	31	14	85	142	61	76	16	180	143
4	34	69	.....	15	16	7	41	11	10	75	10	18	2	76	144
418	43	303	.....	12	12	534	168	4	15	10	295	37	127	335	145
22	238	9	.....	2	.....	.....	.....	.....	.....	21	.....	.....	.....	24	146
87	643	344	.....	67	81	39	53	37	105	619	744	172	14	406	147
8	17	121	.....	8	.....	2	.....	.....	8	34	28	21	.....	13	148
14	66	306	.....	4	4	6	.....	2	.....	6	43	37	.....	32	149
4	188	260	1	8	46	9	.....	3	5	37	21	18	.....	80	150
.....	104	21	.....	.....	1	.....	.....	1	2	7	.....	3	.....	10	151
4	32	2	.....	6	.....	2	.....	1	2	24	11	15	.....	24	152
.....	52	237	1	2	45	7	.....	1	1	6	10	.....	.....	46	153
.....	671	33	.....	.....	.....	1	1	12	25	1,178	.....	.....	.....	28	154
.....	614	33	.....	.....	.....	1	1	12	12	1,155	.....	.....	.....	25	155
.....	57	.....	.....	.....	.....	.....	.....	.....	13	18	.....	.....	.....	3	156

TABLE 8.—CARRIAGES AND WAGONS:

		United States.	Alabama.	Arizona.	Arkansas.	California.	Colorado.	Connecticut.	Delaware.	District of Columbia.	Florida.
	Kinds and quantities of products—Continued.										
	Farm wagons and carts—										
157	Total	445,517	8,677	.....	770	426	456	207	187	.....	1,200
158	Light wagons and carts	119,428	192	.....	184	58	39	106	80	.....	1,062
159	Heavy and dump wagons and trucks	326,089	8,485	.....	586	368	417	101	107	.....	138
	Sleighs and sleds—										
160	Total	118,222	.....	.....	.....	21	22	267	3	.....	.....
161	One-seated, and speeding or racing	66,398	.....	.....	.....	7	20	99	3	.....	.....
162	Two-seated	10,482	.....	.....	.....	.....	2	69	.....	.....	.....
163	Sleds, horse, including "bobs"	41,342	.....	.....	.....	14	.....	99	.....	.....	.....
	Parts manufactured, not included in above—										
164	Carriage bodies, number	13,020	219	.....	29	150	1	1,260	12	.....	33
165	Wagon bodies, number	9,475	324	.....	51	520	34	265	3	9	360
166	Tops, number	14,339	122	.....	82	226	6	175	21	12	100
167	Wheels, number	149,723	415	.....	377	1,266	15	12,237	.....	2	285
	Miscellaneous—										
168	Parts manufactured, number	2,009	.....	.....	.....	.....	.....	.....	.....	.....	50
	Comparison of products:										
169	Number of establishments reporting for both years.	5,859	30	5	29	181	40	100	28	20	37
170	Value for census year	$101,995,079	$451,935	$53,010	$183,066	$1,587,988	$336,837	$2,144,876	$240,886	$186,570	$179,813
171	Value for preceding business year	$88,871,748	$389,661	$42,114	$140,731	$1,363,158	$288,695	$1,786,220	$217,121	$159,145	$143,894
	Power:										
172	Number of establishments reporting	1,802	8	2	7	52	7	48	7	1	4
173	Total horsepower	54,309	263	17	160	526	113	1,795	103	25	87
	Owned—										
	Engines—										
174	Steam, number	1,226	6	1	8	23	2	36	2	1	4
175	Horsepower	41,487	210	12	150	144	80	1,313	45	25	70
176	Gas or gasoline, number	351	.....	.....	.....	23	7	8	2	.....	3
177	Horsepower	3,325	.....	.....	.....	168	33	74	17	.....	17
178	Water wheels, number	130	2	.....	.....	4	.....	6	.....	.....	.....
179	Horsepower	3,189	46	.....	.....	23	.....	153	.....	.....	.....
180	Electric motors, number	146	.....	.....	.....	2	.....	7	.....	.....	.....
181	Horsepower	2,554	.....	.....	.....	12	.....	212	.....	.....	.....
182	Other power, number	10	.....	.....	.....	.....	.....	.....	.....	.....	.....
183	Horsepower	898	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Rented—										
184	Electric, horsepower	2,588	7	5	.....	179	.....	.....	41	.....	.....
185	Other kind, horsepower	768	.....	.....	10	.....	.....	43	.....	.....	.....
186	Furnished to other establishments, horsepower.	545	.....	.....	.....	.....	.....	30	20	.....	.....
	Establishments classified by number of persons employed, not including proprietors and firm members:										
187	Total number of establishments	7,632	49	5	40	228	48	117	36	21	47
188	No employees	1,129	5	.....	6	27	3	3	2	.....	10
189	Under 5	3,481	23	2	21	122	18	42	20	4	26
190	5 to 20	2,426	19	3	12	73	26	55	9	16	11
191	21 to 50	370	1	.....	1	4	1	9	4	1	.....
192	51 to 100	142	.....	.....	.....	2	.....	3	1	.....	.....
193	101 to 250	99	1	.....	.....	.....	.....	3	.....	.....	.....
194	251 to 500	27	.....	.....	.....	.....	.....	1	.....	.....	.....
195	501 to 1,000	5	.....	.....	.....	.....	.....	.....	.....	.....	.....
196	Over 1,000	3	.....	.....	.....	.....	.....	1	.....	.....	.....

		Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	North Dakota.	Ohio.
1	Number of establishments	9	45	3	73	288	8	893	160	13	543
	Character of organization:										
2	Individual	2	31	1	55	233	6	652	112	10	307
3	Firm and limited partnership	4	11	2	15	45	2	194	43	3	181
4	Incorporated company	3	3	.....	3	10	.....	47	5	.....	55
	Capital:										
5	Total	$71,169	$151,919	$4,850	$1,102,675	$3,457,827	$24,275	$14,141,207	$866,933	$41,110	$12,158,302
6	Land	$8,200	$18,490	$1,000	$164,390	$511,404	$4,650	$1,793,076	$72,294	$4,575	$1,199,593
7	Buildings	$14,109	$22,923	$1,550	$202,460	$734,235	$9,550	$2,530,117	$147,472	$6,250	$1,980,861
8	Machinery, tools, and implements	$12,543	$34,071	$1,800	$115,845	$507,794	$3,625	$1,524,527	$101,884	$8,850	$818,455
9	Cash and sundries	$36,317	$76,435	$500	$619,980	$1,704,394	$6,450	$8,293,487	$545,283	$21,435	$8,159,393
10	Proprietors and firm members	11	59	5	82	327	10	1,066	205	17	717
	Salaried officials, clerks, etc.:										
11	Total number	7	9	.....	26	110	.....	486	29	.....	687
12	Total salaries	$5,880	$7,618	.....	$22,588	$122,768	.....	$520,231	$19,257	.....	$576,062
	Officers of corporations—										
13	Number	6	2	.....	4	24	.....	72	8	.....	92
14	Salaries	$4,680	$1,248	.....	$7,100	$48,283	.....	$128,061	$8,100	.....	$134,895
	General superintendents, managers, clerks, etc.—										
15	Total number	1	7	.....	22	86	.....	414	21	.....	595
16	Total salaries	$1,200	$6,370	.....	$15,483	$74,485	.....	$392,170	$11,157	.....	$441,167
	Men—										
17	Number	1	5	.....	20	77	.....	373	21	.....	485
18	Salaries	$1,200	$5,300	.....	$14,683	$70,976	.....	$375,593	$11,157	.....	$401,549
	Women—										
19	Number	.....	2	.....	2	9	.....	41	.....	.....	110
20	Salaries	.....	$1,070	.....	$800	$3,509	.....	$16,577	.....	.....	$39,618
	Wage-earners, including pieceworkers, and total wages:										
21	Greatest number employed at any one time during the year.	49	182	2	606	2,495	20	8,868	1,000	33	9,724
22	Least number employed at any one time during the year.	28	109	2	444	1,640	15	5,551	767	20	5,040
23	Average number	34	135	2	507	1,909	17	6,981	802	23	7,274
24	Wages	$34,718	$72,143	$1,500	$264,919	$1,077,745	$8,760	$3,899,899	$236,855	$11,761	$3,369,550
	Men, 16 years and over—										
25	Average number	34	134	2	505	1,900	17	6,908	781	23	7,051
26	Wages	$34,718	$72,013	$1,500	$264,099	$1,076,042	$8,760	$3,879,282	$234,173	$11,761	$3,310,330

BY STATES AND TERRITORIES, 1900—Continued.

Georgia.	Illinois.	Indiana.	Indian Territory.	Iowa.	Kansas.	Kentucky.	Louisiana.	Maine.	Maryland.	Massachusetts.	Michigan.	Minnesota.	Mississippi.	Missouri.	
10,024	51,603	73,636	11	30,760	387	37,813	365	426	274	391	41,173	14,465	677	21,199	157
5,686	14,388	6,781	3	402	198	30,532	276	125	217	92	9,347	612	644	3,076	158
4,438	37,215	67,855	8	30,358	189	7,281	89	301	57	299	31,826	13,853	33	18,123	159
.....	1,889	3,834	.....	4,189	24	87	40	2,321	81	882	51,255	7,624	.....	170	160
.....	55	3,332	.....	97	9	14	40	1,172	63	254	40,857	1,135	.....	64	161
.....	17	110	.....	43	4	1	.....	351	12	168	3,059	271	.....	43	162
.....	1,817	392	.....	4,049	11	72	.....	798	6	460	7,339	6,218	.....	63	163
6	122	2,017	7	132	218	161	2	13	99	154	4,236	1,070	40	272	164
150	397	131	3	278	626	640	15	36	101	122	148	879	20	679	165
83	748	516	4	135	1,556	316	.....	24	590	51	3,406	1,529	12	134	166
266	361	36,446	.....	540	816	4,488	27	2,540	695	1,247	1,211	2,008	244	642	167
.....	.....	400	.....	.....	19	100	.....	.....	.....	.....	.....	.....	.....	.....	168
95	323	229	3	173	61	116	40	115	151	330	249	39	24	293	169
$1,099,548	$6,966,678	$11,250,281	$9,390	$3,037,182	$339,564	$2,602,453	$342,121	$540,340	$951,681	$5,148,288	$10,634,297	$1,688,144	$106,340	$4,679,668	170
$922,522	$6,187,132	$9,678,890	$15,045	$2,514,385	$293,490	$2,215,458	$329,699	$470,512	$817,684	$4,452,785	$8,924,537	$1,483,443	$91,680	$4,350,452	171
21	106	75	.....	75	13	22	12	22	17	96	88	76	6	73	172
564	4,205	6,143	.....	2,064	107	1,391	149	347	209	1,703	4,465	1,584	211	1,608	173
16	62	70	.....	51	7	20	6	15	11	38	76	48	7	57	174
469	3,284	4,923	.....	1,399	67	1,242	104	193	157	871	3,911	1,235	211	1,332	175
1	23	21	.....	22	6	5	3	3	4	5	18	25	.....	5	176
15	244	287	.....	141	40	42	19	17	80	23	326	199	.....	59	177
3	4	3	.....	.....	.....	.....	.....	7	.....	5	3	2	.....	.....	178
38	166	275	.....	.....	.....	.....	.....	102	.....	113	65	40	.....	.....	179
.....	3	31	.....	6	.....	3	.....	.....	.....	8	4	5	.....	3	180
.....	50	618	.....	56	.....	70	.....	.....	.....	67	55	35	.....	18	181
.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	182
.....	.....	.....	.....	300	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	183
36	391	15	.....	168	.....	37	26	22	.....	416	108	75	.....	199	184
6	70	25	.....	.....	.....	.....	.....	13	22	213	.....	.....	.....	.....	185
.....	.....	.....	.....	.....	6	.....	.....	10	.....	13	15	49	.....	80	186
132	407	275	9	211	73	151	49	165	178	388	299	194	30	377	187
15	65	32	2	44	9	18	5	43	17	47	61	30	3	60	188
55	189	102	7	96	38	68	20	89	89	124	123	102	18	179	189
54	108	90	.....	53	25	55	17	30	67	162	66	50	8	106	190
4	22	24	.....	7	.....	4	7	3	4	47	11	6	1	17	191
3	10	11	.....	7	1	2	.....	.....	1	7	18	5	.....	8	192
1	7	12	.....	3	.....	3	.....	.....	.....	1	15	1	.....	6	193
.....	6	2	.....	1	.....	.....	.....	.....	.....	.....	5	.....	.....	1	194
.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	195
.....	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	196

Oklahoma.	Oregon.	Pennsylvania.	Rhode Island.	South Carolina.	South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	
8	27	872	69	59	15	99	78	5	86	199	28	80	436	7	1
5	18	647	57	53	10	57	57	3	69	142	14	60	304	4	2
3	9	195	10	4	4	33	19	.....	16	51	11	18	113	2	3
.....	.....	80	2	2	1	9	2	2	1	6	3	2	19	1	4
$30,400	$79,621	$8,643,315	$446,116	$317,550	$76,780	$774,749	$416,977	$36,674	$357,035	$1,162,900	$101,260	$345,700	$8,461,561	$22,890	5
$4,850	$6,500	$1,397,475	$80,525	$72,597	$8,700	$99,048	$76,078	$2,500	$41,000	$100,251	$3,600	$44,135	$863,272	$4,040	6
$4,500	$12,675	$2,025,796	$91,200	$52,316	$22,450	$132,948	$101,818	$12,300	$105,550	$235,567	$19,525	$64,025	$1,301,072	$3,350	7
$8,600	$20,750	$919,800	$63,371	$30,572	$15,655	$110,928	$62,585	$3,650	$55,010	$129,021	$16,687	$51,002	$871,994	$3,150	8
$12,450	$39,696	$4,300,244	$211,020	$162,065	$29,975	$431,825	$176,496	$18,224	$155,475	$698,061	$61,448	$186,538	$5,425,223	$12,350	9
11	36	1,064	77	61	18	126	99	5	105	257	37	102	547	9	10
.....	2	247	15	15	2	43	9	8	3	33	8	7	221	1	11
.....	$200	$206,649	$11,597	$12,780	$2,000	$44,462	$7,480	$1,250	$1,275	$30,805	$8,800	$6,576	$249,800	$1,800	12
.....	.....	38	2	3	2	20	.....	.....	1	4	7	4	43	.....	13
.....	.....	$57,285	$8,200	$4,100	$2,000	$28,252	.....	.....	$600	$5,100	$8,200	$5,400	$76,850	.....	14
.....	2	209	13	12	.....	23	9	8	2	29	1	3	178	1	15
.....	$200	$149,364	$8,397	$8,680	.....	$16,210	$7,480	$1,250	$675	$25,705	$600	$1,176	$172,950	$1,800	16
.....	2	192	12	10	.....	18	9	8	2	29	1	1	151	1	17
.....	$200	$144,399	$8,085	$8,080	.....	$14,120	$7,480	$1,250	$675	$25,705	$600	$420	$156,336	$1,800	18
.....	.....	17	1	2	.....	5	.....	.....	.....	.....	.....	2	27	.....	19
.....	.....	$4,965	$312	$600	.....	$2,090	.....	.....	.....	.....	.....	$756	$16,614	.....	20
42	88	6,694	461	430	49	776	362	52	269	1,068	172	355	4,075	20	21
24	53	4,472	287	304	31	497	277	26	162	784	115	211	2,889	15	22
32	62	5,166	353	356	40	621	310	38	196	818	134	260	3,402	18	23
$10,892	$38,886	$2,497,452	$205,706	$95,950	$21,456	$258,734	$168,415	$17,213	$95,516	$330,961	$90,061	$114,095	$1,620,693	$10,260	24
31	62	5,082	353	331	40	616	309	36	196	800	132	258	3,317	18	25
$10,786	$38,886	$2,481,857	$205,706	$91,650	$21,456	$257,629	$168,315	$16,980	$95,516	$328,331	$89,153	$113,645	$1,599,917	$10,260	26

TABLE 8.—CARRIAGES AND WAGONS:

		Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	North Dakota.	Ohio.
	Wage-earners, including pieceworkers, and total wages—Continued.										
	Wages—Continued.										
	Women, 16 years and over—										
27	Average number	.....	.....	.....	2	2	.....	58	1	.....	199
28	Wages	.....	.....	.....	$820	$602	.....	$16,938	$165	.....	$55,621
	Children, under 16 years—										
29	Average number	.....	1	.....	.....	7	.....	15	20	.....	24
30	Wages	.....	$130	.....	.....	$1,101	.....	$3,679	$2,517	.....	$3,599
	Average number of wage-earners, including pieceworkers, employed during each month:										
	Men, 16 years and over—										
31	January	30	117	2	487	1,709	19	6,324	778	15	6,377
32	February	30	121	2	492	1,889	19	6,587	780	15	7,057
33	March	29	146	2	503	1,996	19	7,088	797	20	7,649
34	April	37	158	2	551	2,151	19	7,779	807	26	8,462
35	May	40	156	2	566	2,215	20	7,879	809	29	8,814
36	June	38	144	2	560	2,260	20	7,902	784	29	8,423
37	July	41	145	2	514	1,867	15	6,987	744	28	7,464
38	August	41	142	2	493	1,816	15	6,646	747	27	6,846
39	September	34	129	2	456	1,787	15	6,348	771	27	6,490
40	October	28	117	2	460	1,752	15	6,433	787	25	5,781
41	November	29	114	2	481	1,699	15	6,413	790	23	5,519
42	December	34	116	2	491	1,656	15	6,511	776	16	5,726
	Women, 16 years and over—										
43	January	.....	.....	.....	2	2	.....	57	1	.....	185
44	February	.....	.....	.....	2	2	.....	62	1	.....	207
45	March	.....	.....	.....	2	2	.....	70	1	.....	222
46	April	.....	.....	.....	2	2	.....	72	1	.....	242
47	May	.....	.....	.....	2	2	.....	65	1	.....	252
48	June	.....	.....	.....	2	2	.....	73	1	.....	242
49	July	.....	.....	.....	2	2	.....	63	1	.....	215
50	August	.....	.....	.....	2	2	.....	56	1	.....	188
51	September	.....	.....	.....	2	2	.....	41	1	.....	178
52	October	.....	.....	.....	2	2	.....	41	1	.....	164
53	November	.....	.....	.....	2	2	.....	44	1	.....	146
54	December	.....	.....	.....	2	2	.....	56	1	.....	153
	Children, under 16 years—										
55	January	.....	1	.....	.....	7	.....	11	20	.....	15
56	February	.....	1	.....	.....	7	.....	12	19	.....	21
57	March	.....	1	.....	.....	7	.....	17	21	.....	25
58	April	.....	1	.....	.....	7	.....	20	21	.....	31
59	May	.....	1	.....	.....	7	.....	19	21	.....	33
60	June	.....	1	.....	.....	7	.....	15	20	.....	31
61	July	.....	1	.....	.....	7	.....	16	19	.....	26
62	August	.....	1	.....	.....	7	.....	14	20	.....	26
63	September	.....	1	.....	.....	7	.....	15	21	.....	19
64	October	.....	1	.....	.....	7	.....	14	21	.....	19
65	November	.....	1	.....	.....	7	.....	14	20	.....	19
66	December	.....	1	.....	.....	7	.....	14	20	.....	19
	Miscellaneous expenses:										
67	Total	$6,204	$14,386	$160	$40,864	$186,025	$2,006	$873,942	$30,099	$1,746	$813,400
68	Rent of works	$2,980	$7,691	.....	$3,227	$37,900	$635	$244,236	$4,025	$552	$120,153
69	Taxes, not including internal revenue	$395	$1,230	$135	$5,778	$22,295	$521	$73,877	$5,570	$257	$73,176
70	Rent of offices, insurance, interest, and all sundry expenses not hitherto included.	$2,379	$4,165	$25	$30,939	$111,127	$850	$517,762	$20,002	$737	$610,761
71	Contract work	$500	$1,300	.....	$920	$14,703	.....	$38,067	$502	$200	$9,310
	Materials used:										
72	Total cost	$35,598	$82,755	$2,980	$278,691	$1,333,685	$9,101	$5,174,662	$522,017	$17,830	$8,262,052
73	Lumber, feet	51,000	294,100	8,000	649,600	3,586,800	41,000	16,743,058	5,378,066	91,000	21,226,086
74	Cost	$2,970	$13,120	$505	$22,042	$177,901	$2,400	$723,641	$92,024	$4,257	$767,461
75	Iron and steel, pounds	265,250	666,500	26,500	1,946,880	10,651,035	105,000	34,305,170	4,705,400	187,500	29,544,979
76	Cost	$10,120	$21,324	$910	$64,770	$360,088	$3,600	$1,133,889	$154,018	$6,615	$1,044,487
77	Carriage hardware, lamps, and mountings	$2,170	$2,085	$125	$25,442	$71,272	$40	$367,855	$25,813	$460	$543,742
78	Paints, oil, turpentine, and varnish	$3,475	$7,315	$315	$33,128	$99,793	$350	$391,896	$30,581	$998	$507,098
79	Enamel, rubber, and other carriage cloth	$1,115	$3,192	$75	$8,727	$66,729	$24	$336,649	$21,246	$216	$681,432
80	Leather	$920	$2,665	.....	$24,110	$70,434	$385	$263,285	$27,527	$95	$902,051
81	Rubber tires	$2,475	$10,546	.....	$12,379	$87,665	.....	$366,212	$3,263	$120	$408,985
82	Carriage bodies, purchased, number	3	330	8	807	4,132	.....	3,821	675	6	149,683
83	Cost	$120	$2,244	$100	$7,822	$18,903	.....	$31,600	$2,889	$30	$543,077
84	Wagon bodies, purchased, number	.....	1	.....	990	96	.....	822	542	6	4,166
85	Cost	.....	$10	.....	$8,094	$1,880	.....	$13,096	$2,653	$60	$31,330
86	Tops, purchased, number	28	243	11	97	421	.....	2,224	339	17	3,784
87	Cost	$500	$1,915	$170	$1,306	$5,020	.....	$23,694	$2,492	$227	$28,183
88	Wheels, purchased, number	968	2,716	96	13,822	53,895	8	231,559	31,481	94	856,539
89	Cost	$2,764	$6,438	$250	$25,733	$107,484	$25	$473,311	$60,212	$367	$1,077,258
90	Axles and springs, purchased	$2,976	$3,751	$150	$20,696	$78,292	.....	$445,099	$43,413	$282	$852,062
91	Fuel	$1,968	$3,261	$330	$7,934	$34,569	$660	$114,467	$12,408	$1,226	$84,742
92	Rent of power and heat	$250	$122	.....	$105	$2,921	.....	$8,566	$200	.....	$12,524
93	Mill supplies	$125	$188	.....	$1,540	$16,467	$52	$25,605	$1,765	$262	$19,991
94	All other materials	$2,400	$3,146	.....	$8,673	$110,842	$235	$360,005	$16,576	$1,332	$661,094
95	Freight	$1,250	$1,433	$50	$6,190	$24,425	$830	$95,792	$15,938	$1,283	$145,685
	Products:										
96	Total value	$111,780	$248,182	$8,675	$754,426	$3,626,442	$28,600	$13,068,385	$1,059,237	$42,609	$15,919,173
97	Family and pleasure carriages, number	11	493	38	2,251	6,987	66	58,282	9,458	61	218,878
98	Value	$1,105	$44,647	$3,400	$218,201	$810,932	$6,170	$4,953,224	$499,678	$3,945	$11,271,303
99	Public conveyances, number	1	3	.....	3	28	.....	744	26	.....	43
100	Value	$500	$1,150	.....	$600	$16,430	.....	$519,842	$4,615	.....	$16,465
101	Business, farm, Government, municipal, etc., wagons, number.	134	271	.....	2,474	7,691	103	23,145	12,326	33	44,586
102	Value	$20,683	$26,095	.....	$292,661	$815,498	$7,530	$2,228,083	$362,686	$2,220	$2,576,867
103	Automobiles and other horseless conveyances, number.	.....	1	.....	1	244	.....	582	.....	.....	134
104	Value	.....	$650	.....	$1,100	$445,455	.....	$425,947	.....	.....	$147,000
105	Sleighs and sleds, number	8	6	1	969	602	.....	14,740	13	75	8,575
106	Value	$195	$170	$75	$38,390	$11,156	.....	$422,550	$748	$1,668	$26,151
107	All other products	$15,152	$12,715	$200	$25,000	$84,317	$1,800	$423,509	$30,521	$3,511	$201,588
108	Amount received for repair work	$74,195	$162,755	$5,000	$178,474	$1,442,654	$13,100	$4,095,230	$160,989	$31,270	$1,679,799

BY STATES AND TERRITORIES, 1900—Continued.

Oklahoma.	Oregon.	Pennsylvania.	Rhode Island.	South Carolina.	South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	
.....	.....	17	.....	7	.....	1	.....	1	.....	2	.....	1	47	.....	27
.....	.....	$3,919	.....	$2,000	.....	$250	.....	$155	.....	$450	.....	$300	$14,339	.....	28
1	.....	67	.....	18	.....	4	1	1	.....	16	2	1	38	.....	29
$156	.....	$11,676	.....	$2,300	.....	$855	$100	$78	.....	$2,180	$908	$150	$6,437	.....	30
25	50	4,577	314	326	33	599	288	25	197	780	125	238	3,239	16	31
27	54	4,699	317	335	33	564	291	25	195	788	130	246	3,373	16	32
31	56	5,104	363	354	42	568	297	33	201	828	135	264	3,480	16	33
35	60	5,533	405	368	40	600	308	40	205	845	136	293	3,487	19	34
33	66	5,761	421	360	44	620	310	45	197	874	138	299	3,454	19	35
30	71	5,655	415	318	45	611	323	45	195	787	142	289	3,432	19	36
30	79	5,347	371	303	46	651	328	42	194	774	143	255	3,405	17	37
33	74	5,256	354	300	42	675	326	40	194	760	142	256	3,119	17	38
35	68	5,118	330	312	43	636	319	40	190	765	130	266	3,147	20	39
34	62	4,838	322	328	42	640	315	39	197	773	123	248	3,150	20	40
31	53	4,626	317	343	41	621	306	36	194	824	122	221	3,241	19	41
26	49	4,473	301	331	34	611	301	25	193	803	120	218	3,276	15	42
.....	.....	16	.....	8	.....	1	.....	1	.....	2	.....	1	51	.....	43
.....	.....	18	.....	8	.....	1	.....	1	.....	2	.....	1	50	.....	44
.....	.....	18	.....	8	.....	1	.....	1	.....	2	.....	1	63	.....	45
.....	.....	18	.....	8	.....	1	.....	1	.....	2	.....	1	57	.....	46
.....	.....	18	.....	8	.....	1	.....	1	.....	2	.....	1	52	.....	47
.....	.....	18	.....	7	.....	1	.....	1	.....	2	.....	1	50	.....	48
.....	.....	17	.....	7	.....	1	.....	1	.....	2	.....	1	44	.....	49
.....	.....	17	.....	7	.....	1	.....	1	.....	2	.....	1	44	.....	50
.....	.....	17	.....	7	.....	1	.....	1	.....	2	.....	1	39	.....	51
.....	.....	16	.....	7	.....	1	.....	1	.....	2	.....	1	38	.....	52
.....	.....	16	.....	7	.....	1	.....	1	.....	2	.....	1	42	.....	53
.....	.....	16	.....	8	.....	1	.....	1	.....	2	.....	1	39	.....	54
1	.....	62	.....	17	.....	4	1	.....	.....	15	2	1	38	.....	55
1	.....	63	.....	17	.....	4	1	.....	.....	16	2	1	38	.....	56
1	.....	69	.....	19	.....	4	1	1	.....	18	2	1	38	.....	57
1	.....	72	.....	19	.....	4	1	1	.....	19	2	1	38	.....	58
1	.....	79	.....	19	.....	4	1	1	.....	20	2	1	38	.....	59
1	.....	78	.....	16	.....	7	1	1	.....	13	2	1	38	.....	60
1	.....	81	.....	16	.....	5	1	1	.....	13	2	1	38	.....	61
1	.....	74	.....	17	.....	4	1	1	.....	14	2	1	38	.....	62
1	.....	59	.....	16	.....	2	1	1	.....	16	2	1	38	.....	63
1	.....	58	.....	18	.....	2	1	.....	.....	14	2	1	38	.....	64
1	.....	55	.....	18	.....	2	1	.....	.....	18	2	1	38	.....	65
1	.....	55	.....	18	.....	2	1	.....	.....	19	2	1	38	.....	66
$995	$5,864	$393,101	$31,146	$15,995	$8,292	$42,906	$22,039	$2,331	$14,535	$54,655	$9,724	$11,604	$370,099	$1,866	67
$160	$3,618	$87,260	$12,395	$2,118	$710	$13,566	$7,604	$1,050	$2,234	$14,433	$5,488	$4,824	$15,347	$270	68
$372	$464	$38,407	$1,936	$2,540	$817	$4,339	$4,021	$309	$2,902	$5,678	$816	$1,504	$38,320	$406	69
$483	$1,572	$240,027	$11,815	$11,328	$1,765	$28,669	$10,014	$972	$8,718	$33,224	$2,820	$5,276	$309,680	$690	70
$30	$210	$27,407	$5,000	$9	.....	$1,332	$400	.....	$681	$1,320	$650	.....	$6,752	.....	71
$14,681	$49,603	$8,215,741	$215,313	$211,039	$31,462	$519,544	$197,080	$26,317	$110,709	$622,782	$112,039	$182,719	$3,346,621	$29,227	72
44,500	86,000	11,036,368	665,000	1,096,900	130,672	3,933,000	720,000	117,000	1,034,333	3,792,500	368,200	1,390,800	30,213,773	186,500	73
$2,125	$9,945	$475,893	$26,169	$23,773	$5,951	$98,604	$31,003	$5,590	$17,580	$90,809	$20,100	$40,334	$933,158	$11,250	74
180,500	569,160	25,510,432	1,372,093	1,039,840	362,960	4,022,750	1,967,700	201,000	1,008,657	4,732,400	1,028,350	2,101,300	22,354,361	824,000	75
$4,825	$20,195	$709,218	$47,951	$32,982	$11,907	$132,310	$61,328	$7,250	$35,789	$144,704	$38,415	$61,480	$896,645	$11,700	76
$825	$575	$216,500	$14,815	$18,850	$906	$18,898	$6,777	$444	$3,555	$49,252	$4,865	$3,650	$185,751	.....	77
$1,360	$3,372	$289,834	$22,268	$14,640	$1,715	$38,965	$14,830	$2,360	$8,729	$47,736	$6,605	$15,762	$239,743	$1,485	78
$710	$2,525	$191,496	$11,703	$10,407	$1,255	$8,158	$6,038	$1,185	$3,227	$25,681	$3,800	$7,668	$113,965	$900	79
$590	$1,370	$107,283	$6,812	$21,650	$685	$9,312	$4,180	$545	$2,583	$44,040	$4,137	$4,370	$181,203	$100	80
$196	$600	$144,697	$13,733	$1,493	$168	$16,621	$16,597	$2,400	$1,463	$17,089	$794	$3,539	$35,990	.....	81
50	40	4,665	113	549	82	337	60	.....	157	2,258	3	244	1,168	.....	82
$500	$400	$36,517	$2,427	$2,091	$130	$2,725	$605	.....	$835	$9,637	$140	$2,096	$21,871	.....	83
100	.....	543	40	10	22	504	18	.....	4	203	.....	.....	197	.....	84
$300	.....	$8,669	$832	$35	$254	$4,265	$75	.....	$84	$1,100	.....	.....	$2,198	.....	85
6	15	1,761	87	94	67	124	398	.....	130	344	62	150	917	.....	86
$48	$155	$17,785	$1,167	$1,030	$725	$753	$2,517	.....	$1,109	$3,564	$662	$1,520	$9,476	.....	87
204	342	183,389	5,881	21,632	233	35,667	7,432	432	3,300	49,717	3,422	7,263	118,010	.....	88
$472	$1,200	$323,924	$21,614	$28,775	$556	$64,852	$15,301	$1,392	$10,460	$76,688	$9,408	$13,735	$164,503	.....	89
$454	$1,089	$345,587	$12,887	$26,284	$350	$29,429	$11,493	$1,911	$7,964	$50,344	$5,950	$8,119	$168,221	.....	90
$836	$3,415	$78,103	$7,639	$3,747	$2,824	$7,892	$8,253	$464	$5,412	$12,147	$3,676	$4,337	$59,844	$685	91
.....	$168	$3,157	$1,785	$45	$160	$1,206	$1,209	$265	$707	$531	$1,231	$275	$625	.....	92
$110	$389	$14,776	$1,132	$585	$240	$1,432	$372	$62	$1,308	$1,029	$545	$664	$12,664	$25	93
$405	$2,375	$175,330	$19,332	$15,011	$1,790	$82,428	$11,629	$924	$7,111	$32,144	$6,275	$8,919	$191,290	$2,532	94
$925	$1,830	$76,972	$3,052	$9,041	$1,846	$6,694	$4,823	$1,575	$2,793	$16,287	$5,436	$6,251	$129,474	$550	95
$44,800	$128,425	$8,342,662	$631,711	$428,082	$86,495	$1,127,898	$555,574	$63,978	$321,315	$1,473,176	$289,068	$427,288	$6,956,341	$65,485	96
84	169	41,608	339	5,037	92	1,854	788	59	524	13,087	397	1,387	36,359	29	97
$6,345	$18,984	$2,833,358	$51,385	$236,258	$8,555	$164,585	$59,390	$4,470	$43,009	$646,703	$27,785	$108,590	$2,024,402	$4,200	98
6	4	145	6	4	3	125	22	21	.....	39	3	12	101	.....	99
$1,000	$425	$29,295	$600	$500	$1,200	$17,730	$9,475	$2,250	.....	$11,100	$1,300	$2,300	$31,900	.....	100
29	154	27,443	1,031	1,826	130	11,842	1,096	254	1,266	10,043	451	3,785	70,464	139	101
$2,775	$15,580	$2,197,670	$109,140	$66,623	$16,130	$593,995	$94,540	$19,130	$77,432	$383,792	$61,800	$156,006	$3,321,564	$26,050	102
.....	.....	68	4	.....	.....	.....	.....	.....	.....	1	.....	.....	17	.....	103
.....	.....	$68,400	$775	.....	.....	.....	.....	.....	.....	$1,115	.....	.....	$14,550	.....	104
.....	4	5,563	147	.....	12	.....	.....	150	952	13	956	31	17,695	.....	105
$10	$90	$120,029	$7,410	.....	$170	.....	.....	$4,050	$22,723	$240	$6,060	$600	$331,252	.....	106
$15,660	$23,086	$230,720	$30,076	$23,649	$13,155	$102,344	$53,796	$4,850	$39,101	$55,480	$43,215	$16,005	$333,326	$5,200	107
$19,010	$70,260	$2,863,190	$432,325	$101,052	$47,285	$249,244	$338,373	$29,228	$139,050	$374,746	$148,908	$143,787	$899,347	$30,035	108

TABLE 8.—CARRIAGES AND WAGONS:

		Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	North Dakota.	Ohio.
	Kinds and quantities of products:										
	Family and pleasure carriages—										
109	Aggregate	11	493	38	2,251	6,987	66	58,282	9,458	61	213,878
	Two-wheeled—										
110	Total	6	5	6	1	1,595	.....	2,890	390	.....	3,502
111	Carts and cars	6	5	6	.....	1,220	.....	2,278	389	.....	1,826
112	Gigs	.....	.....	.....	.....	22	.....	211	1	.....	16
113	Sulkies and skeleton carts	.....	.....	.....	1	353	.....	401	.....	.....	1,660
	Four-wheeled, for 1 or 2 persons—										
114	Total	4	392	26	1,854	3,711	66	48,992	8,483	61	178,407
115	Buggies	4	318	11	674	1,695	24	20,876	7,753	32	143,485
116	Phaetons	.....	17	.....	55	109	.....	587	132	.....	10,191
117	Driving wagons	.....	2	6	592	155	10	2,029	11	17	6,751
118	Pony and park wagons	.....	.....	.....	1	32	.....	74	15	.....	1,307
119	Road wagons	.....	13	.....	351	200	24	16,912	523	10	9,526
120	Runabouts	.....	27	.....	51	1,268	.....	6,395	15	2	2,907
121	Spiders, stanhopes, and traps	.....	3	.....	108	148	.....	1,006	11	.....	2,385
122	Buckboards	.....	12	10	22	44	8	1,113	23	.....	1,855
	Four-wheeled, for 3 or more persons—										
123	Total	1	96	6	396	1,681	.....	6,400	585	.....	31,969
124	Road wagons	.....	26	1	61	214	.....	1,479	234	.....	3,170
125	Surreys and phaetons	.....	41	.....	207	787	.....	2,819	240	.....	22,905
126	Victorias, cabriolets, and vis-a-vis	.....	1	.....	.....	127	.....	452	57	.....	642
127	Broughams, landaus, etc	.....	1	.....	12	313	.....	418	7	.....	1,289
128	Traps, spiders, brakes, and tallyhos	.....	7	.....	5	142	.....	169	37	.....	2,580
129	Coaches	.....	.....	.....	.....	34	.....	60	.....	.....	80
130	Park wagons	.....	.....	.....	100	39	.....	389	.....	.....	565
131	Mountain wagons	1	20	5	9	8	.....	90	10	.....	220
132	Buckboards	.....	.....	.....	2	17	.....	524	.....	.....	518
	Public conveyances—										
133	Total	1	3	.....	3	28	.....	744	26	.....	43
134	Hacks, omnibuses, cabs, etc	1	3	.....	3	13	.....	611	26	.....	29
135	Hotel coaches and opera buses	.....	.....	.....	.....	9	.....	89	.....	.....	.....
136	Hansoms	.....	.....	.....	.....	6	.....	44	.....	.....	14
	Business wagons—										
137	Total	81	146	.....	2,200	6,858	85	11,979	764	14	15,188
138	Express and baggage-transfer wagons	10	33	.....	593	600	24	1,303	48	2	3,385
139	Delivery wagons for light packages	51	86	.....	1,045	2,815	53	4,458	87	10	9,054
140	Furniture vans and wagons, and caravans	.....	.....	.....	326	68	.....	126	9	.....	214
141	Drays and trucks	2	5	.....	39	505	2	965	121	.....	244
142	Dump dirt wagons and carts	.....	.....	.....	62	600	.....	541	196	.....	103
143	Coal wagons and carts	.....	2	.....	22	204	3	327	8	.....	147
144	Ice wagons	.....	.....	.....	36	64	.....	83	8	.....	96
145	Log and ore wagons	3	.....	.....	15	14	1	32	210	.....	92
146	Hearses	.....	.....	.....	.....	22	.....	203	.....	.....	202
147	Trade wagons	15	20	.....	44	613	2	1,282	20	2	1,593
148	Street sweepers and sprinklers, and garbage wagons and carts	.....	.....	.....	18	9	.....	23	1	.....	14
149	Handcarts, etc	.....	.....	.....	.....	1,344	.....	2,686	56	.....	44
	Government, municipal, etc., wagons—										
150	Total	3	.....	.....	19	17	.....	98	16	.....	76
151	Ambulances	1	.....	.....	.....	4	.....	34	.....	.....	35
152	Police and fire patrol, and hose wagons and prison vans	2	.....	.....	18	11	.....	48	1	.....	40
153	Mail and mail carriers' wagons and carts	.....	.....	.....	1	2	.....	16	15	.....	1
	Automobiles and other horseless conveyances—										
154	Total	.....	1	.....	1	244	.....	582	.....	.....	134
155	Passenger and pleasure	.....	1	.....	1	161	.....	551	.....	.....	121
156	Delivery and transfer	.....	.....	.....	.....	83	.....	31	.....	.....	13
	Farm wagons and carts—										
157	Total	50	125	.....	255	816	18	11,068	11,546	19	29,322
158	Light wagons and carts	.....	25	.....	40	281	3	2,012	9,622	10	5,405
159	Heavy and dump wagons and trucks	50	100	.....	215	535	15	9,056	1,924	9	23,917
	Sleighs and sleds—										
160	Total	8	6	1	969	602	.....	14,740	13	75	3,575
161	One-seated, and speeding or racing	7	5	1	487	295	.....	9,287	7	23	132
162	Two-seated	1	1	.....	138	270	.....	3,278	6	23	10
163	Sleds, horse, including "bobs"	.....	.....	.....	344	37	.....	2,175	.....	29	3,433
	Parts manufactured, not included in above—										
164	Carriage bodies, number	.....	3	.....	13	27	.....	1,355	256	11	177
165	Wagon bodies, number	7	44	.....	28	151	.....	613	481	11	245
166	Tops, number	3	12	.....	2	37	.....	462	373	.....	1,626
167	Wheels, number	194	12	.....	434	210	.....	1,479	1,577	16	72,704
	Miscellaneous—										
168	Parts manufactured, number	.....	.....	.....	57	.....	.....	983	400	.....	.....
	Comparison of products:										
169	Number of establishments reporting for both years	6	30	3	55	231	5	725	101	8	421
170	Value for census year	$70,220	$198,917	$8,675	$606,628	$3,058,560	$20,800	$11,398,113	$614,138	$26,754	$13,500,755
171	Value for preceding business year	$60,170	$168,569	$6,200	$531,414	$2,668,522	$17,900	$10,227,456	$480,331	$6,510	$11,984,813
	Power:										
172	Number of establishments reporting	1	14	1	28	68	.....	201	35	5	122
173	Total horsepower	6	81	6	666	1,295	.....	6,040	662	26	5,099
	Owned—										
	Engines—										
174	Steam, number	.....	1	1	18	35	.....	145	33	1	76
175	Horsepower	.....	10	6	327	895	.....	4,395	619	6	4,119
176	Gas or gasoline, number	1	12	.....	3	15	.....	31	2	4	29
177	Horsepower	6	66	.....	8	101	.....	283	13	20	392
178	Water wheels, number	.....	.....	.....	11	3	.....	31	3	.....	3
179	Horsepower	.....	.....	.....	213	36	.....	1,002	25	.....	80
180	Electric motors, number	.....	.....	.....	1	22	.....	1	.....	.....	19
181	Horsepower	.....	.....	.....	2	190	.....	5	.....	.....	217
182	Other power, number	.....	.....	.....	4	2	.....	1	.....	.....	.....
183	Horsepower	.....	.....	.....	74	8	.....	7	.....	.....	.....
	Rented—										
184	Electric, horsepower	.....	.....	.....	17	49	.....	201	5	.....	285
185	Other kind, horsepower	.....	5	.....	25	16	.....	147	.....	.....	6
186	Furnished to other establishments, horsepower	.....	.....	.....	30	2	.....	178	57	.....	.....

BY STATES AND TERRITORIES, 1900—Continued.

Oklahoma.	Oregon.	Pennsylvania.	Rhode Island.	South Carolina.	South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	
84	169	41,608	339	5,037	92	1,854	788	59	524	13,087	307	1,387	36,359	29	109
.....	9	970	1	48	.....	229	63	3	9	556	39	7	45	.....	110
.....	9	914	1	45	.....	221	45	3	7	547	39	7	36	.....	111
.....	.....	39	.....	1	.....	.....	18	.....	2	7	.....	.....	1	.....	112
.....	.....	17	.....	2	.....	8	.....	.....	.....	2	.....	.....	8	.....	113
37	112	36,359	325	4,989	80	1,261	464	26	506	11,952	198	1,048	23,968	19	114
35	65	21,750	75	4,296	55	831	290	12	347	10,506	65	468	16,111	9	115
.....	1	791	13	.....	3	139	9	.....	4	367	5	51	425	.....	116
.....	18	3,207	87	90	8	73	54	.....	31	49	63	124	565	.....	117
.....	.....	121	.....	.....	.....	11	7	.....	2	20	.....	3	38	.....	118
.....	24	3,155	61	577	14	142	47	13	56	660	27	100	5,175	.....	119
.....	.....	2,800	52	25	.....	1	18	.....	3	293	29	43	1,160	.....	120
2	.....	789	5	.....	.....	.....	6	.....	5	6	.....	16	115	.....	121
.....	4	3,746	32	1	.....	64	33	1	58	51	9	243	379	10	122
47	48	4,279	13	.....	12	364	261	30	9	[1]579	70	332	12,346	10	123
37	20	583	5	.....	11	136	202	.....	.....	61	35	206	5,138	.....	124
1	16	1,958	4	.....	1	157	16	.....	2	422	13	53	3,361	.....	125
.....	.....	64	.....	.....	.....	.....	.....	.....	.....	7	.....	.....	83	.....	126
.....	.....	634	4	.....	.....	5	20	.....	4	28	.....	1	13	.....	127
9	.....	388	.....	.....	.....	53	9	.....	.....	57	10	12	352	.....	128
.....	.....	186	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	129
.....	.....	342	.....	.....	.....	5	.....	.....	.....	2	.....	5	1,283	.....	130
.....	12	26	.....	.....	.....	.....	.....	5	.....	1	10	3	2,096	10	131
.....	.....	98	.....	.....	.....	8	14	25	3	1	2	52	20	.....	132
6	4	145	6	4	3	125	22	21	.....	39	3	12	101	.....	133
6	4	105	.....	4	3	125	19	21	.....	35	3	12	96	.....	134
.....	.....	40	6	.....	.....	.....	3	.....	.....	4	.....	.....	5	.....	135
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	136
29	129	16,296	928	157	96	2,127	703	54	240	1,559	411	406	9,516	.....	137
6	19	3,923	274	2	12	345	86	14	39	96	60	68	1,844	.....	138
7	55	5,769	395	57	63	867	321	31	90	619	255	195	3,906	.....	139
1	1	188	22	5	.....	21	11	.....	.....	13	14	9	77	.....	140
11	.....	492	14	5	21	151	60	2	10	142	19	19	624	.....	141
1	.....	352	79	3	.....	8	11	.....	50	212	1	8	164	.....	142
1	.....	572	78	.....	.....	60	16	.....	8	210	4	30	216	.....	143
1	1	146	7	6	.....	55	26	.....	2	16	.....	7	80	.....	144
.....	1	53	.....	68	.....	549	103	.....	11	165	.....	20	132	.....	145
.....	.....	30	5	.....	.....	1	.....	.....	1	.....	.....	2	16	.....	146
1	4	2,075	50	4	.....	58	64	7	20	50	40	40	1,759	.....	147
.....	.....	76	.....	.....	.....	6	1	.....	6	1	1	5	38	.....	148
1	48	2,620	4	7	.....	6	4	.....	3	35	17	3	660	.....	149
.....	.....	61	.....	.....	.....	4	4	.....	1	3	.....	3	55	.....	150
.....	.....	42	.....	.....	.....	1	.....	.....	.....	1	.....	3	28	.....	151
.....	.....	11	.....	.....	.....	1	4	.....	1	1	.....	.....	24	.....	152
.....	.....	8	.....	.....	.....	2	.....	.....	.....	1	.....	.....	3	.....	153
.....	.....	68	4	.....	.....	.....	.....	.....	.....	1	.....	.....	17	.....	154
.....	.....	67	1	.....	.....	.....	.....	.....	.....	1	.....	.....	17	.....	155
.....	.....	11	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	156
.....	25	11,086	103	1,669	34	9,711	389	200	1,025	8,481	40	3,876	60,893	139	157
.....	11	5,125	49	1,442	7	4,979	122	.....	198	7,147	9	2,985	6,956	.....	158
.....	14	5,961	54	227	27	4,732	267	200	827	1,334	81	391	53,937	139	159
1	4	5,563	147	.....	12	.....	.....	150	952	13	956	31	17,695	.....	160
.....	.....	4,089	16	.....	.....	.....	.....	.....	241	11	.....	20	4,576	.....	161
.....	.....	667	1	.....	2	.....	.....	.....	59	.....	.....	4	1,872	.....	162
1	4	827	130	.....	10	.....	.....	150	652	2	956	7	11,247	.....	163
2	.....	411	22	88	6	23	83	3	12	77	4	26	168	.....	164
3	.....	709	23	294	16	141	96	2	50	223	37	100	410	.....	165
77	.....	392	18	42	.....	159	76	130	6	79	36	110	851	.....	166
.....	16	2,000	217	689	16	569	548	.....	158	782	76	86	1,812	.....	167
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	168
4	22	690	65	43	10	75	56	5	65	129	26	55	313	5	169
$11,725	$102,510	$7,465,236	$564,587	$351,349	$67,340	$1,086,921	$467,285	$63,978	$247,744	$1,043,541	$266,418	$319,387	$5,644,592	$27,950	170
$10,100	$82,900	$6,549,688	$505,815	$268,807	$58,625	$864,361	$409,451	$53,826	$222,508	$877,738	$215,487	$290,755	$5,013,699	$22,650	171
1	5	192	23	13	5	19	14	2	44	35	8	14	113	1	172
8	34	4,210	340	192	41	810	129	13	708	737	40	370	4,955	2	173
1	3	138	8	11	1	18	9	.....	18	28	1	11	102	.....	174
8	16	3,870	127	161	5	768	115	.....	202	585	8	389	3,959	.....	175
.....	1	36	1	1	3	2	1	.....	2	1	.....	3	18	1	176
.....	4	435	8	6	28	5	3	.....	20	12	.....	23	139	2	177
.....	.....	9	4	1	.....	.....	.....	.....	21	3	.....	1	1	.....	178
.....	.....	155	75	10	.....	.....	.....	.....	439	115	.....	8	10	.....	179
.....	.....	5	.....	.....	.....	.....	.....	.....	1	.....	2	.....	23	.....	180
.....	.....	130	.....	.....	.....	.....	.....	.....	5	.....	5	.....	807	.....	181
.....	.....	1	.....	.....	.....	.....	.....	.....	.....	[1]1	.....	.....	.....	.....	182
.....	.....	8	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	183
.....	14	50	80	.....	8	37	11	13	12	24	27	.....	30	.....	184
.....	.....	62	50	15	.....	.....	.....	.....	30	.....	.....	.....	10	.....	185
.....	.....	44	1	.....	.....	4	.....	.....	6	.....	.....	.....	.....	.....	186

[1] Water motor.

TABLE 8.—CARRIAGES AND WAGONS:

		Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	North Dakota.	Ohio.
	Establishments classified by number of persons employed, not including proprietors and firm members:										
187	Total number of establishments	9	45	3	73	288	8	893	160	13	543
188	No employees	1	9	2	9	21	.....	122	27	2	65
189	Under 5	2	23	1	35	129	7	400	82	9	184
190	5 to 20	6	12	.....	26	117	1	298	43	2	202
191	21 to 50	.....	1	.....	1	16	.....	47	3	.....	45
192	51 to 100	.....	.....	.....	1	2	.....	12	5	.....	23
193	101 to 250	.....	.....	.....	1	2	.....	9	.....	.....	20
194	251 to 500	.....	.....	.....	.....	1	.....	4	.....	.....	2
195	501 to 1,000	.....	.....	.....	.....	.....	.....	1	.....	.....	2
196	Over 1,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

BY STATES AND TERRITORIES, 1900—Continued.

Oklahoma.	Oregon.	Pennsylvania.	Rhode Island.	South Carolina.	South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	
8	27	872	69	59	15	99	78	5	86	199	28	80	436	7	187
.....	2	120	8	3	4	24	14	.....	27	43	3	18	96	2	188
4	19	391	24	30	7	44	30	.....	39	103	13	42	233	3	189
4	6	304	31	21	4	21	32	5	20	45	10	17	82	2	190
.....	.....	36	6	4	.....	8	2	.....	.....	5	2	2	14	.....	191
.....	.....	14	.....	.....	.....	.....	.....	.....	.....	2	.....	1	3	.....	192
.....	.....	6	.....	1	.....	2	.....	.....	.....	1	.....	.....	4	.....	193
.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	.....	194
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	195
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	196

HISTORICAL AND DESCRIPTIVE.

In this country, for nearly the whole of the first two centuries after its discovery by Columbus, there were no coaches or carriages in use. There were very few in use in the succeeding century until after the Revolution, and most of these were imported from England. The travel was on horseback, and the only vehicles used were wagons, built by the wheelwright and blacksmith, and noticeable more for their strength than for the beauty of their construction. The old-time "Conestoga" wagon derived its name from the Conestoga, a stream in Lancaster county, Pa., and was famous in its day, prior to the building of railroads, as the means of conveyance between Philadelphia and the western parts of Pennsylvania. The Conestoga was a long wagon with very broad, heavy, iron-tired wheels, canvas-covered top, and with the front and back ends higher than the middle of the body. It was drawn by four or six yoke of oxen, and in later years by four or six horses. Similar wagons were afterwards used in the mountain districts of North Carolina, East Tennessee, and Georgia, and on the Western plains, where they received the name of "prairie schooners." For travel in the newly opened regions and over rough roads "Concord" wagons were much used, first in the Eastern states and later in the Pacific states.

The first line of mail stages between Boston and New York was established in 1784, prior to which time the mails were fortnightly carried on horseback. Stagecoaches did not come into general use until about 1817; the rack and boot were of American invention. In 1791 there were only 1,905 miles of mail roads in the United States; but during the first half of the next century the roads were greatly improved, and with them mail facilities and stagecoaches, which usually accommodated 9 passengers inside and 6, including the driver, outside. About the middle of the eighteenth century there were not more than four or five coaches in New York city, and in Philadelphia only 37 four-wheeled chaises, though single chaises were more numerous; in 1772 the number of four-wheeled carriages in Philadelphia had increased to 88, including 3 coaches and 2 landaus.

After the Continental Congress had organized the Government, "the importation of coaches, chairs, and carriages of all sorts from England was forbidden." In 1794 Congress, looking on carriages as articles of luxury, imposed a tax upon them. At that time there were in Philadelphia 33 coaches, 157 coachees, 35 chariots, 22 phaetons, 80 light wagons, and 520 chairs and sulkies.

Omnibuses were introduced into this country about 1830, on Broadway, New York city, and their number increased largely, but they were driven out by street cars.

A considerable number of so-called manufacturers of carriages and wagons are in reality merely assemblers, who slip on the wheels, attach the top to the carriage part, adjust and tighten the bolts and nuts, and touch over any part of the polished parts accidentally marred in transport from the several factories to the assembler's repository, or so-called factory.

Some idea of the number of the various changes and improvements in the industry may be gathered from the number of patents granted in connection therewith. The United States Patent Office has a separate division (No. 10, class 21) especially for carriages and wagons and parts thereof, and an examination of the records shows that from its establishment in 1836 to January 1, 1902, patents to the number of 26,307 have been granted for this class alone. A considerably larger number have been granted for some of the articles used in the manufacture.

In the census classification of carriages the line of demarcation was with reference to their proposed use, either as family or pleasure carriages, or as public conveyances, and as to the first, with reference to the number of wheels, whether 2 or 4, and the number of persons to be accommodated, whether from 1 to 2, or 3 and over. In considering in a descriptive way the various varieties of vehicles manufactured, another feature can very fitly be incorporated, viz, the way in which the occupants are seated with reference to each other and the moving direction of the vehicle. In the description of the several vehicles it will be understood that all the occupants face to the front unless otherwise specified.

Two-wheeled Conveyances require shafts which are more or less rigid, as the horse has to bear part of the load, whereas in four-wheeled vehicles the animals have simply to draw. Of all the two-wheelers in use in the English-speaking world, the gig is probably the oldest and most typical. It is a one-horse conveyance, the body of which usually rests on two or more semi-elliptical springs. It is intended to carry only 2 persons, and frequently has a hood or top, though not necessarily. Gigs intended for physicians usually have such an attachment. Its best known variety is the stanhope. The dogcart, for one horse or for tandem driving, accommodates 4 persons, back to back. The body rests on semi-elliptical springs, and is furnished with appliances for shifting the body, or the seat, so that the load may be balanced and the weight taken up as far as possible from the horse's back. This form of conveyance was originally intended for hunting purposes, and carried dogs, hence the name. The sulky is used in speeding trotting or pacing horses and is peculiar to the United States, the only country in which such horses are raised or used to any appreciable extent. It is of very compact and slight, though strong build, and seats 1 person. During the last decade the pneumatic tire, so much used in bicycles, was applied to the sulky, and the trotting record was at once lowered. The skeleton or road cart, which is constructed in a variety of forms, is a cheap modification of the sulky, with the addition of conveniences for carrying articles

of greater or less bulk. It is light in construction, hung low, and is extensively used in the agricultural regions of this country. The Irish jaunting car differs from most other two-wheeled vehicles in having very low wheels, over which the body is placed, the occupants sitting back to back and facing outward, thus traveling sideways. The hansom cab is a one-horse vehicle, and one of the most useful public conveyances, admirably adapted for use in the narrow, crowded streets of great cities. It was invented in 1835 by an Englishman, from whom it took its name, and it had its chief development in London. The body of the hansom (with paneled hood) hangs between the wheels, and the driver's seat is behind and above the body, from which position he is enabled more readily to control the horse. The whole is so balanced that little if any of the weight rests on the horse's back.

Four-wheeled Covered Carriages.—The coach is a family carriage with either full-paneled body or quarter panels, and is intended to carry four inside and two on the coachman's seat in front. The body is suspended on elliptical springs alone or in combination with curved C springs back and front. This latter method of suspension is called "double suspension." The coach is sometimes constructed with additional outside seats, and used with 4 horses as a road coach, and is then known as a "mail coach," "drag," or "tallyho." The landau is a carriage of the coach family, and takes its name from the town in Bavaria where it is supposed to have been first built. It differs from the coach only in having a falling top made either entirely of leather, when it is called a "leather-quarter" landau, or with glass quarters, when it is called a "glass front," a "4-glass quarter," or a "5-glass quarter," according to the number of the glasses. The brougham, named after the famous lord high chancellor of England for whom the first of this type of carriage is said to have been built, is a low-hung, close-paneled, straight glass-front carriage for two persons inside and a paneled seat for the coachman in front. Sometimes the body is extended to make room for two more persons inside, and it is then known as an "extension-front" brougham. The coupe, the French carriage of the brougham kind, is sometimes made with a curved glass front instead of straight, and the clarence has a curved glass front and inside seats for 2 or 4 persons. The rockaway is somewhat of the brougham style, with sides either curtained or paneled, the roof extending over the driver's seat, which is on the same level as the inside seats. It is made to carry 4 or 6 persons, and the body is hung on 2, 3, or 4 elliptical springs. It is a light carriage, and named after Rockaway Beach, a popular resort on Long Island, New York. This same vehicle is also called the "Germantown," after a suburb of Philadelphia, which was the favorite residence quarter of the fashionable and wealthy residents of the Quaker City. This style of carriage is also sometimes called a "carryall." The type has been greatly developed, and is now much used as a family carriage under the names of coupe, rockaway, and rockaway coach.

Four-wheeled Hooded Carriages.—The barouche is a coach type with the upper half of the body cut off, and is furnished with a leather hood or top over the back seat; if made with doors, it is called a vis-a-vis. The cabriolet, originally an Italian gig, is now a leather-hooded carriage for two persons, with no door, and with a driver's seat. The victoria, named after the late Queen of England, is in all respects similar to the cabriolet, except that instead of a paneled seat for the driver in front, the body is provided with iron loops which connect it with the front carriage. On these loops is constructed the driver's seat, an iron framework, and across them is stretched a wide leather dashboard. The mail phaeton is a heavy, square, box-body carriage, with hooded seat for two in front, and a seat for the grooms behind. A modified form of this phaeton is known as the demi-mail, or Stanhope phaeton. The spider phaeton, used for the same purposes as the mail phaeton, has the front seat supported on two iron loops which connect with the hind carriage and aid in supporting the groom's seat, which is either an iron frame or paneled.

Four-wheeled Open Carriages.—The brake is a heavy phaeton for gentlemen's driving, and seats from six to twelve persons, including grooms. It was originally used in England in breaking colts, hence the name. The buggy is peculiar to this country and Canada, and is a light vehicle with 1 seat, for one or two persons, drawn usually by 1 horse, and with or without a hood or top. If there is a top, it is a falling one. Formerly all buggies were hung high on elliptical springs, and if with a hood had a top-heavy appearance, but now they are generally hung low on side bars of wood attached at their ends to semi-elliptical springs. Though a peculiarly American carriage, the name "buggy" is of Anglo-Indian origin (from Hindi *bag*, pronounced *bug*, to move), and in India is used to designate "a kind of gig with a hood to screen the travelers from the rays of the sun." A variety of the buggy, called a buckboard, is one of the simplest kinds of carriages, only requiring for its construction the 4 wheels, the axles, a kingbolt, and a long, springy plank. This plank is rigidly attached to the hind axle and to a cross bar in front, to which the front axle is fastened by the kingbolt, and about which the front axle swings in turning the vehicle. At a proper distance between the front and the back a box is placed on the springy plank, and the seat for the occupants rests on the box. In the days of the early settlements of the country, when money was scarce and roads were bad, it met the demand in the sparsely settled, hilly regions of the New England and Middle states for a conveyance of simple and economic construction, homemade, so far as possible. The name came from the ability of the vehicle to

"buck" successfully against the rocks and inequalities occurring on the roads. In these later days it has also become a fashionable conveyance, with two or four seats, and of the very best construction and style of finish, and is much used at the summer resorts and in regions where the roads are good and the country is comparatively level. The surrey, of the buggy family, is a side-bar vehicle to accommodate 4 persons, and is made in a great variety of styles. The body is suspended in the same way as the modern buggy and is of three general patterns: one of longer gear to allow stepping in and out between the front and back wheels; another coupled somewhat shorter, in which entrance to the back seat is made by lifting half of the front seat; and a third, like the second, but with the additional convenience of dropping the back panel, and so shifting the back seat as to permit riding back to back, if desired.

The foregoing comprise the principal types of carriages in general use in this country; the others, of many names and some variations, are all, more or less, modifications of the types described.

It is not necessary to make special mention of the business and municipal wagons, their names suggesting their styles and uses, they being of everyday appearance on the streets of all cities, towns, and places of any business importance. Farm wagons and carts are familiar to all, and sleighs to such portions of the country as permit or demand their use.