THREE DECADES OF DELAWARE'S MANUFACTURES

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Industrial activity has been carried on in Delaware from its earliest history. For instance, the shipbuilding industry became well established in Wilmington at quite an early date, first in the building of sailing vessels, and later in the construction of iron and steel steamships. In fact, it was in Wilmington that the first iron sailing vessel ever built in the United States was constructed and launched in 1854.† The manufacture of gunpowder in Delaware dates from the establishment of the first powder mills in America by E. I. du Pont de Nemours in 1802. This industry has continued under the auspices of the same family ever since, and today turns out the largest product of any establishment of its kind in the country. Similarly, the tanning, currying, and finishing of leather has had a vigorous growth. By the beginning of the century it had already become a large and flourishing industry. In 1900 Wilmington claimed the distinction of having one of the largest morocco plants in the world.

In a number of instances Delaware manufacturers made definitely valuable contributions to the development of their respective industries as a whole by the introduction of new and better methods and processes of production. For example, as early as 1817 Thomas Gilpin invented and put into operation the first paper-making machine built in the United States. In the paper mill which he and Joshua Gilpin established in 1787, they put into operation the first endless sheet machine used in America in the manufacture of paper.‡ This invention cheapened the cost, increased the production, and entirely revolutionized the paper-making business.

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† "Industrial Wilmington," 1898, Compiled by George A. Wolf, and issued by authority of Board of Trade, p. 54.

‡ Montgomery's "Reminiscences of Wilmington," 1851, pp. 33-35.

Geographically the location of Delaware is very well suited to the advantageous development of manufactures. Both the Delaware River and Delaware Bay are navigable for large vessels, while good harbors exist at Wilmington, New Castle, and Lewes. The Delaware and Chesapeake canal provides additional trans-state transportation facilities. The extensive coal fields of Pennsylvania, Virginia, and West Virginia are within relatively easy access, and materials can be put down at Wilmington as readily and about as cheaply as at Philadelphia.

In his message to the State legislature in 1857, Governor Causey urged the adoption of measures which would aid the industrial growth of Delaware. He could see no reason why Delaware should not become a manufacturing state. Again in 1859 he addressed the legislature as follows: ". . . . . there is no good reason why our own people should not, under a wise system of State and National legislation, become a manufacturing and commercial, as well as an agricultural community. Our flour-mills and powder-works on the Brandywine have obtained a just celebrity throughout the civilized world; and blessed as we are with a genial and healthful climate, an abundance of wood, and water-power easily available in every section of the State, with a proper spirit of enterprise and sufficient capital rightly fostered and directed, the loom, the anvil and the engine, might become emblems of our industry as befitting as the plow, the sickle and wheaten sheaf. The superior ship-timber of our forests, our noble bay and river, with their fine harbors also earnestly invite us to participate with our sister States in the profits of a prosperous and extended commerce."* It is interesting to note what has taken place since then. According to the reports of the Bureau of Census, there has been a steady growth in the industrial development of Delaware during the half century preceding 1900. This can be seen partially through a comparison of the figures in the increase of the average number of wage earners employed as compared with the

* Delaware Legislature, Senate Journal, January, 1859.

increase in population. Although the population grew from 91,532 in 1850 to 184,735 in 1900, the average number of wage earners employed increased from 3,888 to 22,203, comprising in 1900, 12 per cent of the total population, compared with 4.2 per cent in 1850.

However, it is the purpose of this study to measure the growth of manufactures in Delaware since the turn of the century. The statistical material upon which this study is based was taken from the reports of the Bureau of Census.

In estimating the growth of physical production it was of course necessary at the very start to eliminate from consideration all value series, since they reflect the combined movement of prices and quantities. The Bureau of Census reports on numerous aspects of manufacturing, of which the most important are value of products, cost of materials, wages, value added by manufacture, primary horsepower installed, and average number of wage earners employed. Some are definitely value series while others are physical. The latter two are the only purely physical series available for all industries.

Both "primary horsepower installed" and "average number of wage earners employed" are obviously only indirect indexes of production. Also, either one if taken by itself as an indicator of growth or production would be valueless, especially when applied to a short period of time. One of the reasons for this is that the Bureau of Census reports primary horsepower, regardless of whether or not it is then being employed. It may very well happen that production might actually be curtailed with the same primary horsepower operating at a decided decrease in per cent capacity, or there may be an installation of power which is not necessarily accompanied by an increase in output. Similarly, dangers are encountered in the use of average number of wage earners as an indicator of production over a short period of time, for this series represents not the number of man-hours employed, but rather the number of wage earners on the payroll. This being the case, it is quite possible for

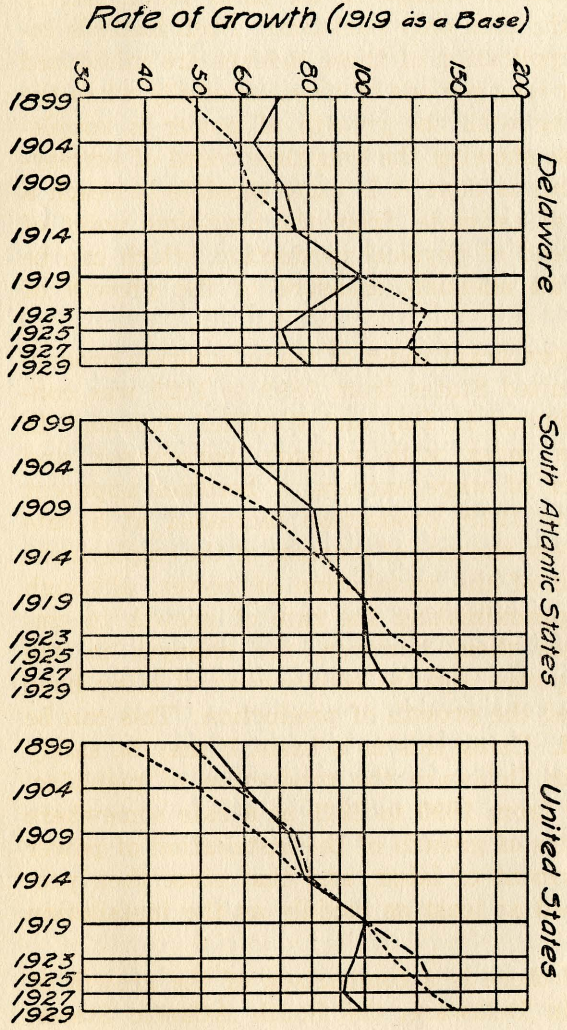
production to increase temporarily with no change in the employment of labor through resorting to overtime. It would be equally possible for production to decrease temporarily, with no change in the labor force, merely by employing the men only part-time. Such hazards involved in the application of these indexes are minimized when used over long periods of time, especially when the statistics dealing with the growth of power is supplemented by those showing the long-time trend of employment. When this is done it is quite possible to reach a fairly significant estimate, from the long-time point of view, of the trend of physical production, which can be considered as an adequate measure of the growth of manufactures.

The most significant index of manufacturing production for the United States from 1899 to 1925 was constructed by Edmund E. Day and Woodlief Thomas.* In comparing this index with primary horsepower and average number of wage earners, it becomes apparent that previous to 1919, production increased at a rate somewhat between the rate of increase of the employment of workers and of the installation of power, although more closely approximating the rate of growth in employment. Since then, however, the changes in the installation of power and the employment of labor have both understated the growth of production. This can be seen in Chart I. Using this as a basis, it may be safely assumed that in Delaware the production of manufactures increased from 1899 to 1919 at a rate somewhere between the rates of growth of the installation of power and the employment of labor, and that since then production increased at least as rapidly as the installation of power.

In Chart I there is a comparison of the growth of manufactures in Delaware, the South Atlantic States, within which Delaware is grouped by the Bureau of Census, and the United States. With the exception of

* Day and Thomas, The Growth of Manufactures, 1899-1925, Census Monographs VII.

CHART I



Comparison of Growth of Manufactures in Delaware, the South Atlantic States, and the United States, 1899-1929

1919 = 100

As Reflected by: {Wage Earners Employed ——— / Installed Horsepower (Primary) - - - - - / Day-Thomas Index of Production (U.S.) —·—·—

the period from 1899 to 1904, Delaware has experienced a rate of growth similar to that of the rest of the country, and until 1919 somewhat paralleled that of the South Atlantic States.

It is interesting to note the extent to which mechanization has taken place in Delaware as well as the rest of the country. The growth of industries has been accompanied by increased dependence upon mechanical power rather than human labor. The spread between installation of power and the employment of wage earners is clearly noticeable. Since 1919 most industries of Delaware have increased the installation of primary horsepower at a more rapid rate than they have increased employment, and in some cases they have continued the installation of primary horsepower while curtailing employment. The latter movement is most typical, the exception being the pulp goods industry from 1923 to 1927. This general trend has resulted in a decline of factory employment to a point where we employed in 1920 only about the same number of workers as we did thirty years ago, although production has increased, as it has under similar conditions in the country as a whole.

It is not within the scope of this paper to discuss the question of the compensations for the decline which has occurred in Delaware's manufacturing employment. Undoubtedly a considerable proportion of the labor thus released has found employment in other fields of activity, such as merchandising, transportation, construction, and service industries. Some, no doubt, may have migrated back to farms not far from their former place of employment.

In order to see how the several manufacturing groups of Delaware shared in the industrial growth of the state, only those industries were considered for which comparable figures were available. The Bureau of Census has made it a policy not to publish statistics for industries which cannot be shown separately without the possibility of disclosing the operations of individual plants. In the case of Delaware there are several industries of consider-

able importance for which statistics are not published by the Bureau. In certain instances they are more important than some of the industries for which comparable data is available. The following industries are some which could not be dealt with separately: belting and hose, rubber, dyeing and finishing textiles, machine tools, paints, plumber's supplies, steel, steam fittings and steam and hot water apparatus, sulphuric, nitric, and mixed acids, and tobacco and snuff.

It can be seen from Chart II that the growth of the various industries has not been equal by any means. Some have experienced rather rapid expansion, as for example the pulp goods industry, which is a comparatively new comer to Delaware; others more moderately, like the

CHART II

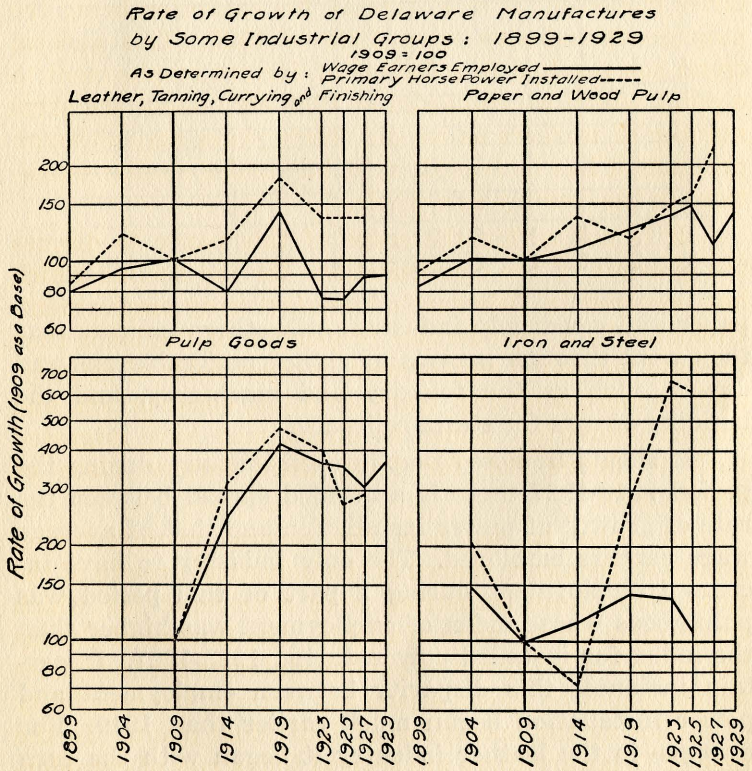
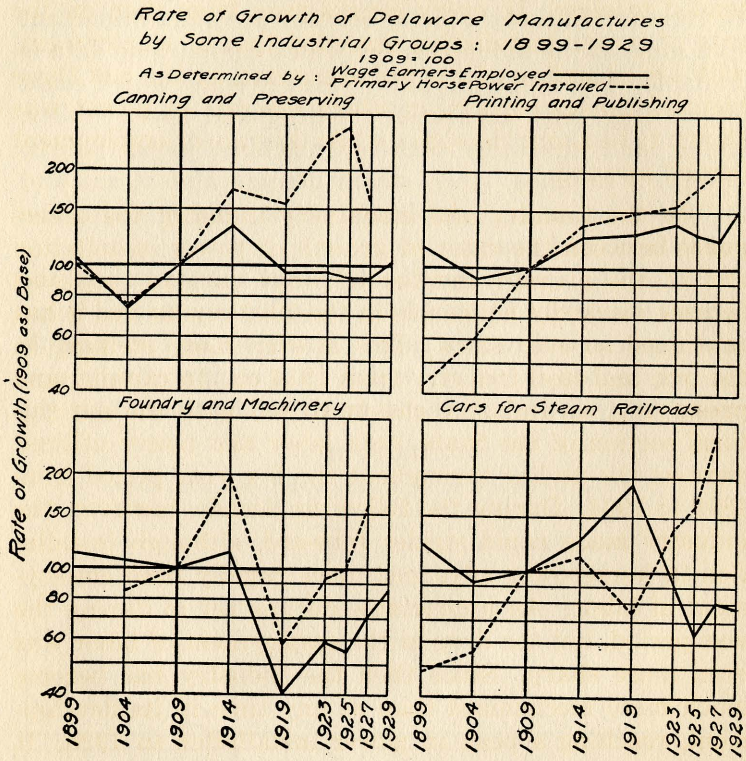


CHART II (Continued)



paper and wood pulp industry; still others indicate that they went through periods of rather noticeable ups and downs, such as the foundry and machinery, and the building of cars for steam railroads.

It should be noted that in each industry during the period 1919-1927 there is a decided spread between the rate of growth of power installation and that of average wage earners employed. The only industry to have increased employment during a part of this period was pulp goods whose index of employment was higher than the index for installed power during 1923-1927. In certain instances this disparity between employment and power installation began much earlier than 1919. For example in the leather industry it began with the turn

of the century. However, from 1904 to 1909 this gap tended to close. In every census year from then on the rate of power installation exceeded that of employment, with the exception of the period covered by the last three biennial census reports, in which the rate of power was shown to be about the same, while the rate of employment tended upward.

In the foundry and machinery industry the divergence between the rates of growth of power installation and of the average number of wage earners employed became markedly noticeable in the 1909 census and it has continued so ever since. This is even more striking in the iron and steel industry from 1914 on. In canning and preserving, an industry closely linked with the agricultural section of the State, both labor and power utilized were on the decline throughout the five year period from 1899 to 1904. During the following decade, however, the industry made rapid strides forward, although installation in horsepower advanced more rapidly than employment of labor. An appreciable decline set in during the war period, but the drop in the employment of labor was even more sharp. Since then the industry has become much more mechanized than at any time in its development, reaching a peak in power installation in 1925. It has with more recent years suffered a decline in the rate of power growth and slightly increased its employment of labor.

The growth in employment of wage earners in the paper and wood pulp industry was mild but steady from 1899 to 1925. Similar to other groups, its rate of installation of primary horse power increased also, and with two exceptions, at a more rapid rate than employment. From 1925 to 1927 it made an even sharper upward movement in its rate of growth of power, and at the same time suffered an equally sharp decline in the number of men employed. During two years, 1927 to 1929, more labor was employed. However, the figures for power are not available for comparison. The printing

and publishing establishments evidently relied upon man power quite considerably in earlier days. Nevertheless, this industry too accepted the advantages of mechanization. From the very beginning of the century the rate of growth of power installation has been considerable, especially so since 1923.

The only instance in which there was a decided increase in the employment of labor accompanied by a similar decline in power installed occurred in the years from 1914 to 1919 in the establishments building cars for steam railroads. Aside from that period the spread between employment and power is marked, especially since the close of the war.

According to the figures for Delaware manufactures recently released by the Bureau of Census there had been an increase of 9.7 per cent in the average number of wage earners employed in 1929 as compared with 1927, while during the same period there had been a gain of 10.5 per cent in the amount of primary horsepower installed. At the same time the value added by manufacture increased 14.7 per cent.

It may, therefore, be generalized that since 1919 there has been an unusually rapid growth in the mechanization of manufacturing in the United States as a whole, and that this is reflected in the growth of manufactures in Delaware, and in her leading industries.

In determining the relative importance of the various types of manufactures within the State a great number of possible criteria might be used. For example, they could be ranked in accordance with their consumption of power, utilization of materials, number of wage earners employed, value of the product, or value added by manufacture. There is no doubt that each test will assume greater or lesser significance with the varying purposes of different investigators. It would seem, however, that if we could ascertain the specific contribution made by an industry to the total net product, we would have a measure which would more closely approach a significant social evaluation of an industry's importance. Unfor-

tunately the figures necessary for the computation of such a test are not available.

We could perhaps use value of product as a guide to the relative importance of industrial groups within the State. It has frequently been employed so. However, such a test is beset with errors due chiefly to duplications. It is well known that the value of products as reported by manufacturing establishments to the Bureau of Census duplicates to a large extent the value of the products of the industries producing raw materials—the agricultural, mining, and fishery industries. This, also, is by no means the only duplication involved in the census statistics of value of products. There is even greater duplication within the manufacturing industries themselves, due to the fact that the products of one establishment very often become the materials for others. Some excellent examples of this are furnished by the Census Bureau itself, in its general explanations of the census of manufactures. For instance, "in the slaughtering and meat-packing industry certain packing establishments purchase fresh meat from slaughtering houses for use as their material." Thus the total value of products reported by an industry would include the factory value of all finished goods plus the value of products which passed through further manufacturing processes in other establishments. An example of duplication on a much broader scale is furnished by the following: "Copper ingots made in the copper smelting and refining industry are sold to copper-rolling mills, which roll them into rods. The rods are sold to copper-wire mills, which draw them into wire. Wire made by these mills is sold to establishments in the 'Electrical machinery, apparatus, and supplies' industry, which use it in the manufacturing of ignition apparatus for internal-combustion engines. These establishments sell the ignition apparatus to manufacturers of automobile engines. The engines in turn are sold to automobile manufacturers, who install them in complete automobiles. The value of the automobiles, as reported by the automobile manufacturers, includes, of course, the value of the engines;

similarly, the value of the engines includes the value of the ignition apparatus; and so on. Thus in the aggregate of the values of products reported by the copper smelters and refiners, the rod mills, the wire mills, the manufacturers of ignition apparatus, the engine manufacturers, and the automobile manufacturers, the value of the copper ingots is included six times, of the rods five times, of the wire four times, of the ignition apparatus three times, and of the engines twice; and corresponding duplication occurs in the aggregate cost of materials."*

Manufacturing is primarily a transformation of materials. Therefore, the economic importance of the process of manufacture should not be judged by the quantity or value of the products leaving the factories, but rather by the addition to the utility or money value of the materials. The value created by the manufacturing processes is in most cases substantially the difference between the combined cost of the materials, supplies, containers for products, fuel, and power, and the value of the products. In comparing the relative ranking of manufacturing industries this relation of the value of finished goods to the cost of materials is highly significant. The products of one industry may be valued at the same amount as that of another, but the one may have added several times as much value to the materials as the other, and may therefore have been of correspondingly greater economic importance. For this reason, "the value added by manufacture" has been used in determining the relative importance of the leading industries of Delaware. Furthermore, the statistics of value added by manufacture are particularly valuable because they are almost entirely free from the duplication that appears in the value of products.

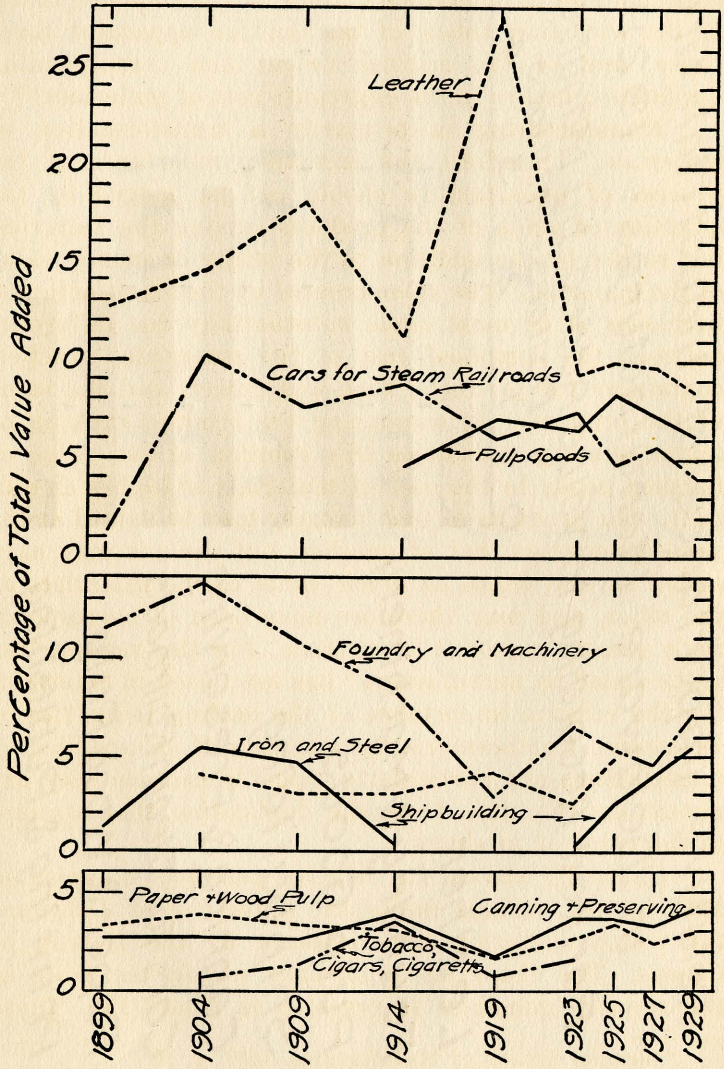
Chart III shows the relative positions occupied in 1929 by the various important industries of Delaware for which statistics were released by the Bureau of Census. The changing importance within the State of the several industries is revealed in Chart IV. Those

* Biennial Census of Manufactures, 1927, p. 10.

CHART III

Changes in the Relative Importance of Industrial Groups in Delaware During the Period 1899-1929

As Reflected by Changes in Per Centage of Value Added by Manufacture for Each Group to Total Value Added by all Delaware Manufactures.



Relative Importance of Industrial Groups in Delaware Manufactures: 1929

Ranked According to Value Added by Manufactures

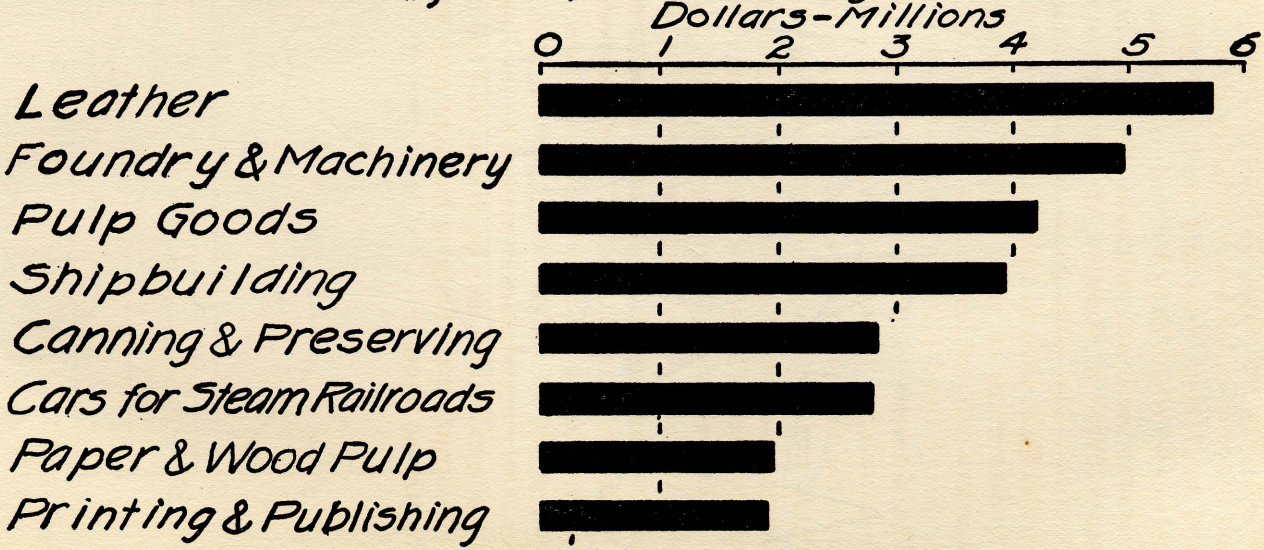


CHART IV

which have increased in relative importance since 1923 are in the so-called heavy industry class, such as foundry and machinery, iron and steel, and shipbuilding. The industries which have declined in importance are leather, and cars for steam railroads. However, although leather has suffered a recession, it has not lost its first rank position. The pulp goods industry, which made such strides from 1914 to 1925, has somewhat declined so that its percentage of value added by manufacture in 1929 was two per cent less than in 1925. It was able, however, to secure third place in rank with other manufactures. The industries which have experienced little change in their relative importance during the period 1923-1929 are: canning and preserving, and paper and wood pulp. There were no comparable statistics available to extend the graph beyond 1923 for tobacco, cigars, and cigarettes, and beyond 1925 for the iron and steel industry.

In conclusion it might be said that Governor Causey's hope that some day "the loom, the anvil and engine, might become emblems of our industry as befitting as the plow, the sickle and wheaten sheaf" has to a good measure been realized during the past three score years. Every indication points to Delaware's industrial growth, and from the available statistics furnished by the Bureau of Census the generalization may be drawn that the rate of growth of Delaware manufactures has kept pace with that of the country at large.

TABLE I

Average Number of Wage Earners Employed in Manufactures of United States, South Atlantic States, Delaware, and Wilmington, for Census Years: 1899-1929 (In thousands)

Region	1899	1904	1909	1914	1919	1923	1925	1927	1929
United States	4,713	5,468	6,615	7,036	9,096	8,777	8,382	8,350	8,808*
South Atlantic States	459	523	663	685	817	832	839	879	907
Delaware	21	18	21	22	29	23	21	21	23
Wilmington	15	14	15	15	21	15	14	14	15

Primary Horsepower Installed in the United States, South Atlantic States, and Delaware, for Census Years: 1899-1929 (In thousands)

Region	1899	1904	1909	1914	1919	1923	1925	1927	1929
United States	10,410	14,642	18,675	22,437	29,324	33,092	35,767	38,826	42,799
South Atlantic States	1,055	1,293	1,832	2,275	2,791	3,144	3,517	3,805	4,396
Delaware	40	49	53	64	85	112	107	103	114

* Preliminary figures subject to revision.

TABLE II

Average Number of Wage Earners Employed in Delaware Manufactures by Selected Industrial Groups for Census Years: 1899-1929

Industrial Group	Average Number of Wage Earners									Relative to 1909								
	1899	1904	1909	1914	1919	1923	1925	1927	1929	1899	1904	1909	1914	1919	1923	1925	1927	1929
Leather	2,457	2,836	3,045	2,382	4,251	2,261	2,251	2,651	2,686	81	93	100	78	140	74	74	87	88
Foundry and Machinery	2,471	2,328	2,210	2,522	878	1,306	1,212	1,562	1,864	112	105	100	114	40	59	55	71	84
Paper and Wood Pulp	451	547	546	591	683	751	815	602	768	83	100	100	108	125	138	149	110	141
Pulp Goods	*	*	359	892	1,485	1,319	1,287	1,108	1,306	*	*	100	248	414	367	359	309	364
Printing and Publishing	334	267	288	360	370	399	371	352	435	116	93	100	125	129	139	129	122	151
Canning and Preserving	1,437	999	1,369	1,831	1,310	1,299	1,261	1,255	1,414	105	73	100	134	96	95	92	92	103
Cars for Steam Railroads	2,032	1,559	1,679	2,110	3,223	1,526	1,062	1,336	1,294	121	93	100	126	192	91	63	80	77
Tobacco, Cigars, and Cigarettes	*	113	245	525	303	509	*	591	*	*	46	100	214	124	208	*	241	*
Shipbuilding	207	1,122	1,239	*	*	*	692	*	103	17	91	100	*	*	*	56	*	9
Iron and Steel	*	1,055	710	818	1,009	975	772	*	*	*	149	100	115	142	137	109	*	*

* Adequate information not available.

TABLE II—Continued
Primary Horsepower Installed in Delaware Manufactures by Selected Industrial Groups for Census Years: 1899-1927

Industrial Group	Installed Primary Horsepower								Relative to 1909							
	1899	1904	1909	1914	1919	1923	1925	1927	1899	1904	1909	1914	1919	1923	1925	1927
Leather	3,640	5,377	4,417	5,163	7,977	5,933	5,940	5,932	82	122	100	117	181	134	135	134
Foundry and Machinery	*	3,635	4,270	8,527	2,477	4,002	4,292	7,241	*	85	100	200	58	94	101	170
Paper and Wood Pulp	4,010	5,115	4,318	5,954	5,120	6,494	7,106	9,963	93	119	100	138	119	150	165	231
Pulp Goods	*	*	1,087	3,402	5,154	4,380	2,933	3,145	*	*	100	313	474	403	270	289
Printing and Publishing	130	184	305	420	457	482	556	616	43	60	100	138	150	158	182	202
Canning and Preserving	1,736	1,275	1,725	3,003	2,723	4,269	4,749	2,846	101	74	100	174	158	250	275	165
Cars for Steam Railroads	1,623	1,887	3,388	3,833	2,515	4,741	5,530	9,255	48	56	100	113	74	140	163	273
Iron and Steel	*	10,310	4,912	3,545	13,442	32,961	30,487	*	*	210	100	72	274	671	621	*

* Adequate information not available.

TABLE III

Relative Importance of Industrial Groups in Delaware Manufactures: 1899-1929

(Ranked according to value added by manufacture)

Industry	1899	1904	1909	1914	1919	1923	1925	1927	1929
Leather	1	1	1	2	1	1	1	1	1
Foundry and Machinery	2	2	2	4	4	4	3	4	2
Paper and Wood Pulp	3	6	6	8	6	7	6	7	7
Pulp Goods	*	*	*	5	2	3	2	2	3
Printing and Publishing	5	8	8	9	7	8	7	6	8
Canning and Preserving	4	7	7	6	5	6	5	5	5
Cars for Steam Railroads	6	3	3	3	3	2	4	3	6
Tobacco, Cigars, and Cigarettes	*	9	9	7	9	9	*	8	*
Shipbuilding	7	4	4	*	*	*	8	*	4
Iron and Steel	*	5	5	1	8	5	*	*	*

TABLE IV

Value Added by Manufactures in the United States, South Atlantic States, and Delaware for Census Years: 1899-1929

(In Millions of Dollars)

Region	1899	1904	1909	1914	1919	1923	1925	1927	1929
United States	4,831	6,294	8,529	9,856	24,803	25,846	26,771	27,585	31,844
South Atlantic States	371	425	591	680	1,859	1,800	1,983	2,144	*
Delaware	19	16	22	24	79	58	55	60	70

* Adequate information not available.