

CEMENT.

PORTLAND CEMENT.

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PRODUCTION.

The production of Portland cement in the United States in 1898 was 3,692,284 barrels, an increase of 1,014,509 barrels, or 37.9 per cent over the product of 1897. Since 1896 the annual increase of production has been more than 1,000,000 barrels, and there is good reason to believe that this rate of increase will be greatly exceeded in the near future. The growth of the industry continues to be most marked in the neighborhood of Lehigh County, Pennsylvania.

The following table shows the product of Portland cement in the United States in 1897 and 1898, by States:

Product of Portland cement in the United States in 1897 and 1898.

State.	1897.			1898.		
	Num- ber of works.	Product.	Value, not in- cluding pack- ages.	Num- ber of works.	Product.	Value, not in- cluding pack- ages.
		<i>Barrels.</i>			<i>Barrels.</i>	
Arkansas.....	1	15,000	\$26,250			
California.....	1	15,000	30,000	1	50,000	\$100,000
South Dakota ..	1	39,890	79,780	1	31,000	62,000
Illinois.....	1	15,000	26,250			
Indiana.....	1	2,823	2,117	1	2,500	4,375
Maryland.....				1	10,000	17,500
Michigan.....	2	15,000	26,250	2	77,000	134,750
New York.....	7	394,398	690,197	7	554,358	970,126
New Jersey.....	2	430,335	753,086	2	587,163	1,027,535
Ohio.....	4	146,452	256,291	6	265,872	465,276
Pennsylvania ..	7	1,579,724	2,369,586	8	2,095,141	3,142,711
Texas.....	1	7,778	23,334	1	8,000	24,000
Utah.....	1	16,375	32,750	1	11,250	22,500
Total	29	2,677,775	4,315,891	31	3,692,284	5,970,773

This table shows that two small factories, in Arkansas and Illinois, respectively, were not in operation in 1898, while the production of Portland cement was begun at one factory in Maryland. New York, New Jersey, Ohio, and Pennsylvania show striking increases, and a considerable gain is also to be noted in Michigan. In other sections the industry is still insignificant.

The relative extent of development of the Portland cement industry in the United States since 1890 is shown in the following table:

Table showing development of Portland cement industry in the United States since 1890.

Section.	1890.			1894.		
	Number of works.	Product.	Per cent.	Number of works.	Product.	Per cent.
New York	4	<i>Barrels.</i> 65,000	19.4	4	<i>Barrels.</i> 117,275	14.7
Lehigh County, Pa., and Phil- lipsburg, N. J. .	5	201,000	60.0	7	485,329	60.8
Ohio	2	22,000	6.5	4	80,653	10.1
All other sections.	5	47,500	14.1	9	115,500	14.4
Total	16	335,500	100.0	24	798,757	100.0

Section.	1897.			1898.		
	Number of works.	Product.	Per cent.	Number of works.	Product.	Per cent.
New York	7	<i>Barrels.</i> 394,398	14.7	7	<i>Barrels.</i> 554,358	15.0
Lehigh County, Pa., and Phil- lipsburg, N. J. .	8	2,002,059	74.8	9	2,674,304	72.4
Ohio	4	146,452	5.5	6	265,872	7.2
All other sections.	10	134,866	5.0	9	197,750	5.4
Total	29	2,677,775	100.0	31	3,692,284	100.0

It will be noted that the product of Lehigh County, Pennsylvania, and the neighboring region near Phillipsburg, New Jersey, has increased in eight years to more than ten times what it was in 1890. This section now produces nearly three-fourths of the total product of the country. New York and Ohio also show an increase nearly pro-

portional to that which has taken place in the country as a whole. In other sections the development of the industry has been slow, and the percentage of the total product has greatly declined.

IMPORTS.

The imports of Portland cement in 1898 were 2,013,818 barrels, a decrease of 77,106 barrels from the quantity imported in 1897. This decrease is largely due to the greatly increased demand for cement in Germany and England during the past year, and the consequent indifference of foreign manufacturers toward the American market. Germany has at present 70 Portland cement factories, the product of which in 1898 was over 18,000,000 barrels. The exports were about 3,000,000 barrels, leaving 15,000,000 barrels as the quantity consumed in Germany. The consumption of Portland cement per capita was therefore more than six times that in the United States. In view of the far greater magnitude of the building and engineering operations carried on in this country there is good reason to believe that the consumption of Portland cement in the United States will eventually exceed that in Germany.

The following table shows the imports, by countries, in 1896, 1897, and 1898.

Imports of cement into the United States in 1896, 1897, and 1898, by countries.

[Barrels.]

Country.	1896.	1897.	1898.
United Kingdom	742, 169	344, 336	241, 198
Belgium	742, 237	529, 986	651, 204
France.....	26, 714	19, 319	17, 294
Germany	1, 366, 909	1, 109, 280	1, 032, 429
Other Europe	99, 184	46, 916	51, 582
British North America.....	11, 334	4, 907	4, 635
Other countries	1, 050	36, 480	15, 476
Total	2, 989, 597	2, 090, 924	2, 013, 818

This table shows that the chief decline in imports since 1896 has been in those from Great Britain. This is due to the growing preference for German cements over the English, and also to the increased demand for cement in Great Britain and the consequent falling off in exports from that country. Trade reports show that the demand for cement in all European countries was most active during the past year and that prices advanced in a marked degree.

The total exports from the chief producing countries in 1898 were as follows:

	Barrels.
United Kingdom.....	1,958,550
Germany.....	3,096,234
Belgium.....	2,495,370

RELATION OF DOMESTIC PRODUCTION TO IMPORTATION.

The total consumption of Portland cement in the United States in 1898 exceeded that in 1897 by nearly 1,000,000 barrels. During the latter part of the year a veritable cement famine prevailed, and many important engineering works were delayed or suspended for lack of cement. In consequence, the actual amount consumed was considerably less than that required by the country. The same condition appears to have existed throughout the world, and is due to the multitude of new applications which Portland cement is constantly finding and its rapidly increasing use in place of stone in constructions of all kinds. It is difficult to set a limit to the possible further growth of the demand for Portland cement, and it is not improbable that the next few years may see the industry, both here and abroad, reach a magnitude at present undreamed of.

Owing to the great increase in domestic production and the slightly decreased imports the proportion of domestic to imported cement consumed has advanced materially, as the following table shows:

Comparison of the domestic production of Portland cement with the imports.

[Barrels.]

	1891.	1896.	1897.	1898.
Production in the United States	454,813	1,543,023	2,677,775	3,692,284
Imports.....	2,988,313	2,989,597	2,090,924	2,013,818
Total	3,443,126	4,532,620	4,768,699	5,706,102
Exports		85,486	53,466	36,732
Total consumption	3,443,126	4,447,134	4,715,233	5,669,370
Percentage of total consumption produced in the United States.	13.2	34.7	56.8	65.1

It will be noted that nearly two-thirds of the Portland cement consumed in this country in 1898 was of domestic manufacture.

The remarkable growth of the production and consumption of

Portland cement in the United States in the last nine years appears strikingly in the following diagram:

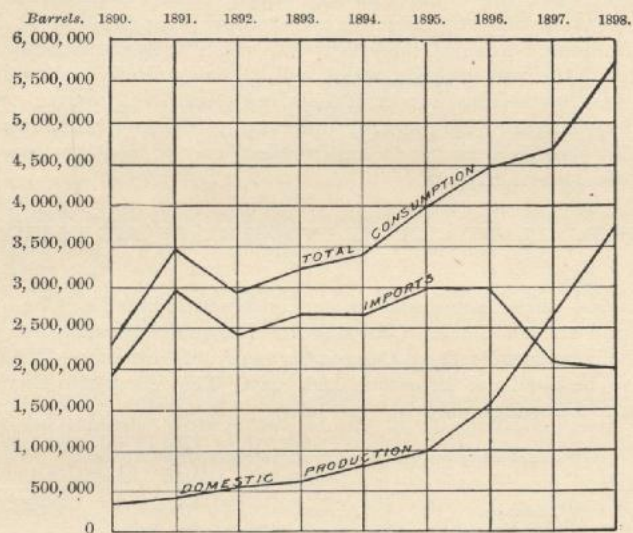


FIG. 2.—Graphic representation of the production, importation, and total consumption of Portland cement from 1890 to 1898.

This table shows that the consumption of Portland cement has more than doubled since 1890, while the domestic production has increased more than tenfold. As the imports in 1898 were almost exactly the same as in 1890, the table allows no conclusion to be drawn as to the probable time that must elapse before the whole demand is supplied by domestic factories. When it is considered that the period from 1893 to the middle of 1897 was one of great industrial depression in the United States, the fact that the increase in demand for Portland cement has equaled the great increase in domestic production is highly significant and points to the continuance of favorable conditions for the industry for some time to come.

In the report for 1897 it was foretold that the product in 1898 would reach 3,500,000 barrels, an increase of more than 1,000,000 barrels over 1897. The actual amount produced was, in fact, 3,692,284 barrels, slightly exceeding the above estimate. All indications point to a considerable further increase in the present year, and an enormous one in 1900. In the Lehigh Valley region four of the principal factories are undergoing enlargements which will add not less than 1,000 barrels per day to the product of each, and it is claimed that one factory, already the largest in the world, will soon reach a production of 10,000

barrels per day. A new producing region, that of La Salle, Illinois, has come into the field of Portland cement production, and three works are at present being erected at that point. Large factories are also under construction at Coldwater and Quincy, Michigan, and at Syracuse, Indiana. None of these new enterprises will greatly affect the product of the present year, which will probably reach 4,400,000 barrels. In 1900 the total output of Portland cement will probably reach 7,000,000 barrels. The steadily increasing demand will, however, probably provide a market for this amount, even without any considerable reduction of imports.

THE PORTLAND CEMENT INDUSTRY IN THE VARIOUS STATES.

Illinois.—Three factories are under construction near La Salle by the Chicago Portland Cement Company, the Marquette Cement Company, and the Hemmoor Portland Cement Company, of Germany. The materials to be used are limestone and clay. The Marquette Company gives the following analysis:

Analysis of ingredients of Portland cement from Illinois.

Limestone.	Per cent.	Clay.	Per cent.
Calcium carbonate	88.16	Silica	54.30
Magnesium carbonate	1.78	Alumina	19.33
Silica	8.20	Iron	5.57
Iron oxide	1.30	Lime	3.29
Alumina		Magnesia	2.57
		Sulphur	2.36

The limestone, as shown by this analysis, contains about one-half the silica and alumina required for a correct cement mixture. The clay evidently contains a good deal of iron sulphide, which may prove an obstacle to its successful use. The rotary-kiln process will be used at two of these factories and vertical continuous kilns at the third.

The Illinois Steel Company, of Chicago, one of the largest manufacturers of slag cement, has practically abandoned this industry, and now proposes to make a true Portland cement by grinding blast-furnace slag with the necessary proportion of limestone and burning the mixture in rotary kilns.

Indiana.—The factory of the Sandusky Portland Cement Company at Syracuse is in process of construction. Works are proposed at Bedford to utilize the oolitic limestone.

Kentucky.—Designs have been made for a factory at Litchfield. The materials to be used have the following composition.

Analysis of ingredients of Portland cement from Kentucky.

Limestone.	Per cent.	Clay.	Per cent.
Calcium carbonate	97.63	Silica	55.82
Magnesium carbonate	0.65	Iron oxide	6.19
Silica	0.49	Alumina	19.77
Alumina	Trace.	Lime.....	0.70
Iron oxide.....	0.22	Loss, alkalies, etc.....	19.52
Sulphuric acid	0.34		

Michigan.—The factory of the Peerless Portland Cement Company at Union City was destroyed by fire in October.

A factory is under construction by the Michigan Alkali Company at Wyandotte, at which Portland cement will be made from caustic soda waste (a very pure form of precipitated calcium carbonate) and clay.

MATERIALS.

Limestone continues to be the chief material for the manufacture of Portland cement. This is due to the immense development of the industry in the Lehigh Valley region, where unlimited quantities of a natural Portland cement rock occur. This material is similar to the argillaceous limestone deposits of Belgium, and contains a slight excess of clay over the amount required; a small proportion of pure limestone is therefore ground with the rock to produce a correct mixture. The grinding is not required to be very fine, since the coarse particles remaining in the raw material are of nearly correct composition. The case is very different, however, when pure limestone and clay are employed. In this case the stone must be ground to such a fineness as to leave practically no residue on a sieve of 180 meshes to the linear inch, or an inferior product will result. The cost of grinding large quantities of hard limestone to this degree of fineness is very great. Several attempts to make Portland cement in this country from pure limestone and clay have been made, but none have resulted satisfactorily in respect of cost of manufacture or quality of product.

The following table shows the comparative product from limestone and from marl in 1897 and 1898:

Comparative product of Portland cement from limestone and marl.

	1897.		1898.	
	Number.	Product.	Number.	Product.
		<i>Barrels.</i>		<i>Barrels.</i>
Factories using limestone.....	18	2,282,126	20	3,112,492
Factories using marl.....	11	395,649	11	579,792
Total	29	2,677,775	31	3,692,284

PROCESSES.

The use of the rotary kiln for burning cement continues to increase rapidly, as may be seen from the following table:

Amount of Portland cement made in kilns of various kinds.

[Barrels.]

	1893.	1896.	1897.	1898.
Rotary kilns.....	149,000	632,370	1,311,319	2,170,782
Vertical kilns (continuous and intermittent).....	441,653	910,653	1,366,456	1,521,502
Total	590,653	1,543,023	2,677,775	3,692,284
Per cent of total product burned in rotary kilns....	25.2	41.0	49.0	58.8

More than one-half the whole product of Portland cement in the United States is now burned in rotary kilns. This proportion will be greatly increased in the next two years, as practically all the new plants now building are to be equipped with kilns of the rotary type. Several of the eastern plants which have heretofore used vertical kilns exclusively are now making large additions in which the new type of kiln will be employed.