

# CEMENT.<sup>a</sup>

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## INTRODUCTION.

The total production of hydraulic cement in the United States in 1903 was 29,899,140 barrels, valued at \$31,931,341, an increase of 4,145,636 barrels in quantity and of \$6,564,961 in value as compared with 25,753,504 barrels, valued at \$25,366,380, produced in 1902.

Of the total production in 1903, 22,342,973 barrels, having a value of \$27,713,319, were Portland cement.

The production of natural-rock cement was 7,030,271 barrels, valued at \$3,675,520.

The production of Pozzuolana or slag cement was 525,896 barrels, valued at \$542,502.

The increased production of Portland cement in 1903 resulted in a glutted market, which made the artificial product so low in price in the eastern part of this country as to seriously interfere with the production of natural-rock cement. Many of the plants whose output is exclusively the natural cement were for this reason shut down during a large part of the year.

## PORTLAND CEMENT.

### PRODUCTION.

The production of Portland cement in 1903, 22,342,973 barrels, showed an increase of 5,112,329 barrels over that of 1902. This increase in supply was not entirely justified by the demand, and a quantity of the Portland cement produced during the year was left unsold in the bins when the year closed. Prices fell as a result, only the oldest and best-known brands being able to maintain a rate approximating their usual market value. At the present time the outlook seems to indicate that care is required to avoid over-production.

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<sup>a</sup> The entire statistical canvass and compilation of this report has been conducted by L. L. Kimball, of the United States Geological Survey.—D. T. D.

Following is a table showing the quantity and value of the Portland cement produced in each State during 1901, 1902, and 1903:

*Production of Portland cement in the United States in 1901, 1902, and 1903, by States.*

State.	1901.			1902. <i>a</i>			1903. <i>b</i>		
	Num- ber of works.	Quantity.	Value.	Num- ber of works.	Quantity.	Value.	Num- ber of works.	Quantity.	Value.
		<i>Barrels.</i>			<i>Barrels.</i>			<i>Barrels.</i>	
Alabama .....				1			1		
Arkansas .....	1			1			1		
California ....	<i>c</i> 1	146,848	\$513,968	2	294,156	\$431,910	3	631,151	\$1,019,352
Colorado .....	<i>d</i> 1	585,000	643,500	2	82,044	105,016	1	258,773	436,535
Georgia .....				1			2		
Illinois .....	4	528,925	581,818	4	767,781	977,541	5	1,257,500	1,914,500
Indiana .....	2	218,402	240,242	3	536,706	628,244	3	1,077,137	1,347,797
Kansas .....	1			1	830,050	1,017,824	1	1,019,682	1,285,310
Michigan .....	10	1,025,718	1,128,290	10	1,577,006	2,134,396	13	1,955,183	2,674,780
Missouri .....				1			2	825,257	1,164,834
New Jersey ...	3	1,612,000	1,450,800	2	2,152,158	2,563,355	3	2,693,381	2,944,604
New York ....	7	617,228	617,228	10	1,156,807	1,521,553	12	1,602,946	2,031,310
Ohio .....	<i>e</i> 7	689,852	758,837	7	563,113	685,571	8	729,519	998,300
Pennsylvania ..	13	7,091,500	6,382,350	15	8,770,454	10,130,432	17	9,754,313	11,205,892
South Dakota ..	1			1			1		
Texas .....	<i>f</i> 2	195,752	215,327	2	165,500	234,950	2		
Utah .....	1			1			1		
Virginia .....	1			1	334,869	433,286	1	538,131	690,105
West Virginia ..							1		
Total ...	56	12,711,225	12,532,360	65	17,230,644	20,864,078	78	22,342,973	27,713,319

*a* The States combined for 1902 are mentioned in the text of the report for 1902.

*b* The States combined for 1903 are given in the text below.

*c* Includes product of the single plant in Utah.

*d* Includes product of the only Portland-cement plant in Kansas.

*e* Includes product of the only Portland-cement plant in Virginia.

*f* Includes product of the single plant in South Dakota.

In such States as have but a single plant their production is combined with that of another State, in order that the separate figures of any plant shall not be revealed. In the table above the Portland-cement product of the only plant in Alabama which produces that variety of cement is combined with the product of the plants in Georgia, Virginia, and West Virginia. The plants in Missouri and Arkansas have their products combined; those in Kansas and Texas, and those in Utah, South Dakota, and Colorado also show combined products, and in each case the result is given in connection with the State which was the largest contributor to the total product. There is but one new State shown in this table for 1903, which is West Virginia.



The following table shows the growth of the Portland-cement industry in the United States since 1890:

*Development of the Portland-cement industry in the United States since 1890.*

Section	1890.			1900.			1902.		
	Number of works.	Quantity.	Per cent.	Number of works.	Quantity.	Per cent.	Number of works.	Quantity.	Per cent.
		<i>Barrels.</i>			<i>Barrels.</i>			<i>Barrels.</i>	
New York .....	4	65,000	19.4	8	465,832	5.5	10	1,156,807	6.8
Lehigh and Northampton counties, Pa., and Warren County, N. J. .	5	201,000	60.0	15	6,153,629	72.6	17	10,829,922	62.8
Ohio .....	2	22,000	6.5	6	534,215	6.3	7	563,113	3.3
Michigan .....				6	664,750	7.8	10	1,577,006	9.1
All other sections .....	5	47,500	14.1	15	663,594	7.8	21	3,103,796	18.0
Total .....	16	335,500	100.0	50	8,482,020	100.0	65	17,230,644	100.0

  

Section.	1903.		
	Number of works.	Quantity.	Per cent.
		<i>Barrels.</i>	
New York .....	12	1,602,946	7.2
Lehigh and Northampton counties, Pa. ....	13	9,631,541	43.1
New Jersey .....	3	2,693,381	12.1
Ohio .....	8	729,519	3.3
Michigan .....	13	1,955,183	8.7
All other sections .....	29	5,730,403	25.6
Total .....	78	22,342,973	100.0

As a producer of Portland cement, Pennsylvania is still in the lead by more than 7,000,000 barrels; New Jersey holds second place, as in the preceding year; Michigan ranks third, although one of her large producers was closed down for a time in order so to change the machinery of the plant as to introduce the dry process of manufacture instead of the wet process heretofore used. In the preceding table for 1903 "All other sections" includes the production of Portland cement in Alabama, Arkansas, California, Colorado, Georgia, Illinois, Indiana, Kansas, Missouri, South Dakota, Texas, Utah, Virginia, and West Virginia. In the statement of production for 1890, 1900, and 1902, shown in this table, Warren County, N. J., was included with Lehigh and Northampton counties, Pa., but in the table for 1903 it has been thought best to state separately the output of the counties in Pennsylvania and the output for New Jersey.

#### THE PORTLAND-CEMENT INDUSTRY, BY STATES.

There were 19 States which contributed to the entire output of Portland cement manufactured in the United States in 1903, detailed accounts of which are as follows:

*Alabama.*—The only Portland-cement plant in Alabama is located at



Spocari, near Demopolis, in Marengo County. It was an active producer during the year 1903, being closed down only a short time for necessary repairs. The plant is now undergoing improvements which when finished will double its producing capacity. The other plants in this State are producers of slag cement, and in 1903 they were both under the same management.

*Arkansas.*—The single cement plant in this State produces Portland cement from the deposits of limestone at White Cliffs. The company began producing early in the year, and made a very creditable showing.

*California.*—The new plant in California for the production of Portland cement was finished in time to begin work in April, 1903, and has been running steadily since that time. The success of the venture has led this company to consider the possibility of erecting a second plant at Santa Cruz. There are at the present time three cement mills in this State, all of which are producers of Portland cement. The demand for cement in this part of the country is steady, prices are good, and there is not an over supply.

*Colorado.*—In 1903 the only plant producing cement in Colorado was the Portland Cement Company, which, in 1902, bought out the other active plant in the State. In 1903 only 4 kilns were operated by this company, while the machinery of the plant just purchased was brought to the new factory and installed. There are now 6 rotary kilns in active operation, which will increase the output for another year to nearly double its already large production. In addition to its increased facilities for the production of Portland cement, the company has constructed a 3-kettle gypsum factory for the manufacture of gypsum products, and a hydrated lime factory, both of which will be active in 1904.

*Georgia.*—There were two plants in this State which produced Portland cement in 1903. One was devoted exclusively to this cement and one made it a small proportion of its output only, giving precedence to its large production of natural cement. The new plant, which is located at Rockmart, Polk County, was not completed until late in the year, and only commenced operations after the middle of November. The other plant ran continuously during 1903.

*Illinois.*—Four of the 5 plants for the production of Portland cement in Illinois ran continuously throughout the year, with the exception of a few weeks idleness for repairs. The remaining plant was idle nearly all the year on account of the lack of a market. There are 8 cement plants in the State, but 3 of them are devoted exclusively to the production of natural-rock cement. The Illinois Steel Company, which is the largest producer of cement in Illinois, has a new factory at Buffington, Ind., which will be active in 1904. This plant will have sixteen 80-foot by 7-foot kilns installed, which will give



it a capacity of 4,500 barrels per day of Universal Portland cement. The plant in Illinois produces slag as well as Portland cement.

*Indiana.*—The 3 plants which produced all the Portland cement made in this State in 1903 had a combined output of more than a million barrels during that year. The Wabash Portland Cement Company's plant was closed down for about three months, during which time 6 additional rotary kilns were installed. The increase in capacity more than made up for the loss of time, and the output of cement showed an increase over that for the previous year. The other 2 companies operated on full time and produced larger outputs than they had done in 1902. The plant of the Midland Portland Cement Company, at Bedford, was not completed in 1903, though its 10 big rotary kilns were in position. A plant is contemplated at Marengo for the production of Portland cement. One other company producing Portland cement has dissolved and a second one has gone into the hands of a receiver. The production of natural-rock cement is an old industry in this State, but that of Portland cement, which is confined entirely to the northern part of the State, is of very recent date.

*Kansas.*—The new plant for the production of Portland cement, located near Iola, Kans., was not completed until 1904, and therefore its production will be recorded in a future report. The older plant at Iola had a successful year, was not closed down, and increased its production considerably, besides acquiring new Portland-cement property in Texas. The factory contemplated at Independence for the production of Portland cement was not built in 1903. At Chanute, Neosho County, in the southeastern corner of the State, a Portland-cement plant is to be erected, for which ground will probably be broken in December, 1904. The Chanute Cement and Oil Company, which owns at this place nearly 400 acres of lands containing immense beds of high-grade cement rock and shale, is to build the plant. This company is composed of some of the men who were among the very first to start in the cement industry in Michigan; they are among the most successful of the present producers in that State. The fuel for the mills in Kansas is to be natural gas, found in apparently inexhaustible supply on the 4,000 acres of gas and oil property leased by the company, and lying in close proximity to the land containing their deposits of cement rock. The factory is to be equipped with the most modern machinery, and the buildings will be constructed of iron, steel, and concrete. The cement used will be from the company's plants at Bronson and Union City, Mich. The plant will be located so as to connect with three railroads. The oldest plants in the State are producers of natural-rock cement only.

*Massachusetts.*—A number of years ago a charter was obtained for the production of Portland cement by a firm in this State, but no factory was ever erected. A report received this year from the com-



pany states that the project has been definitely abandoned, and that the charter will be canceled or returned.

*Michigan.*—For the year 1903 Michigan stands third in the production of Portland cement in the United States, ranking every State except Pennsylvania and New Jersey. The Keystone State leads all others by millions of barrels, while New Jersey takes second place by but little more than half a million barrels. Michigan is only entitled to third place by about 350,000 barrels; the lack of which, however, leaves New York fourth in rank. There were 13 active plants in Michigan during the year, but several of those were in operation only a part of the time, some of the winter months being so cold as to compel a shut down in the factories, though the cement season there is a fairly long one. Two of the large plants were shut down half the year for reconstruction, and two were not started until late in the summer. Another was idle a month while necessary repairs were being made. One company shut down in October and went into the hands of a receiver. The plant at Alpena had a large production, notwithstanding the fact that important changes in the raw-material part of its mills were made. The changes were such as to admit of the dry process of manufacture, which replaces the wet process formerly used, and increases the production nearly 100 per cent, with no appreciable increase in the cost of manufacture. Reports from 16 other companies were received, none of which had active plants in 1903. Seven factories are under construction: two companies are only organized, having purchased no land as yet; two companies consolidated; one changed hands, and four failed altogether. In 1897 Michigan had but one cement factory; in 1900 the number of plants had increased to 6; in 1903 Michigan takes third place as a producer and has 13 active factories, with a prospect of a large increase in this number for 1904. Portland is the only cement manufactured in this State.

*Missouri.*—The expectations of the company, which started in this State late in 1902, were realized in 1903, and the plant had a large output for the year. The second factory, which began producing in 1903, is a larger one, and had an output slightly in advance of its only competitor in the State. In 1904 there will probably be three factories producing Portland cement in Missouri, as the plant of the Mississippi Valley Portland Cement Company, at Louisiana, in Pike County, will be started in the fall of that year. Only Portland cement is made in the State, and until 1902 no cement of any kind had been produced there.

*New Jersey.*—Of the 7 companies reporting from New Jersey, but 3 were active producers of Portland cement in 1903. The plant at Alpha is a very large and successful one. For six months 20 rotary kilns were continuously active, and during the rest of the year 4 additional ones were in service. The only shut down during 1903 at these



works was for holidays, and the output of cement was very large. The plant at New Village has labored under many difficulties, but succeeded in having a product in 1903. It was idle from March to September reconstructing, after a disastrous fire in the coal plant. Three plants are under construction, but were not ready for operation during the year. The Vulcanite plant has always been a successful producer, and in 1903 it ran ahead of any previous production. The State total for this year is larger than that for the preceding year by several hundred thousand barrels.

*New York.*—The larger proportion of the plants in the Empire State is devoted to the production of natural-rock cement, but in 1903 there were 10 works making Portland cement exclusively, and 2 that made both natural-rock and Portland. Of these two one had a larger production of natural-rock, and one a larger production of Portland cement. One was closed down for about two months for repairs and alterations. Of the 10 active Portland-cement producing plants, one was closed about a month for repairs, and another was idle nearly three months for the same purpose. Another had an overproduction and closed down for a month. One plant spent part of the year in enlarging its capacity, and one was shut down a short time on account of extreme weather. One plant that had been destroyed by fire was rebuilt in time to operate during about half the year. The output of Portland cement for 1903 in New York, as well as the number of plants producing it, showed an increase over the figures for 1902.

*Ohio.*—Five plants made all the Portland cement that this State produced in 1903, and of these only 2 report continuous activity throughout the year. One plant was closed for a time because of the necessity for repairs, and following that because of a strike; another had an overproduction and took advantage of this fact to shut down for several months and make repairs; the third plant closed down for part of the year to make some changes; notwithstanding this, and the further fact that 3 usually productive plants were idle during the whole year, the total output of artificial cement was larger than it has ever been before. Two of the Portland-cement plants changed hands, and were improved and remodeled; one company abandoned its project and dissolved; while the new plant at Manchester was in process of construction, but with no expectation that it would be finished before the fall of 1904. There are 2 plants which make only natural-rock cement, and 2 devoted to the production of slag cement, making 13 plants in all in the State.

*Pennsylvania.*—The condition of manufacture of Portland cement in the very home and center of that industry in 1903 was practically the same as that of the preceding year, except that the product exceeded the output for 1902 by almost a million barrels. There were 9 plants actively engaged in producing Portland cement only; of these,



but 3 ran on full time, the others being closed down for a longer or shorter space of time, for various reasons—among which were the necessity for repairs, time needed to increase capacity, strikes, and, in several cases, overproduction. The 6 factories which manufacture both Portland and natural-rock cement were all active, and in nearly every case the production for 1903 showed an increase over that for 1902. About the same conditions existed in regard to the time each factory was in operation as were stated above in connection with the plants producing Portland cement exclusively. There were 2 companies that abandoned their projected factories, and 2 that were idle. There is but one company in the State that reported a production of natural-rock cement only, and one that reported a production of slag cement. There were 7 companies having plants under construction, most of which are expected to be active producers in 1904. The plant at Sandts Eddy, in the eastern part of Pennsylvania, was incorporated under the laws of New Jersey, and has a capital stock of \$5,000,000. It is reported that when these works are complete, the plant will have a capacity larger than that of any cement factory in the world, and will be able to produce nearly two million barrels of Portland cement per year. There were 26 companies reporting from this State in 1903.

*South Dakota.*—The Portland-cement plant located at Yankton is the only cement works in South Dakota. It was an active producer in 1903, and had an output which was in excess of the one for the previous year.

*Texas.*—There was, in 1903, no production of Portland cement reported from the plant which has formerly been used exclusively for that purpose in this State, owing to the fact that the property changed hands, the Iola Portland Cement and Lime Company, of Kansas, being successors to the old company. There was, however, a production of Portland cement reported from the mills which have for several years made both natural rock and Portland cement, but it was not so large as that of the preceding year.

*Utah.*—There is but one cement plant in this State, and it produces Portland cement exclusively. During more than half of the year 1903 the mills were shut down, in order that they might be reconstructed and enlarged. The works were started up in August, and a good-sized output was the result. It is expected that the production for 1904 will be largely in advance of the record of this plant, which has always been a successful one.

*Virginia.*—The Portland-cement factory in Virginia, which was the only producer in the State in 1903, had a very large output during the year, the effect of the improvements made in the factory in 1902 being apparent in the nearly double production for this year. There were two plants which produced natural-rock cement, and there was one plant idle. A new plant for the production of Portland cement is



contemplated, but as yet the company has not organized. A company which reported as about to build in 1902, has now abandoned the plan, and though not dissolved, is doing nothing.

*Washington.*—No production of cement was made in this State in 1903, though there seems to be a probability that a plant will be built in the near future.

*West Virginia.*—In this State one Portland-cement plant was an active producer in 1903, while another plant was idle, and a third one was engaged in making natural-rock cement only. These 3 are the only cement factories in the State.

#### RELATION OF DOMESTIC PRODUCTION AND CONSUMPTION TO IMPORTS.

The increase in the production of Portland cement in the United States within the last fourteen years, as compared with natural-rock cement and with imported cement, is shown in the following table:

*Comparative production of Portland and of natural-rock cement in the United States and of hydraulic cement imported and entered for consumption, 1890-1903.*

Year.	Natural cement.	Portland cement.	Total of nat- ural and Portland cemer.t.	Imports.
	<i>Barrels.</i>	<i>Barrels.</i>	<i>Barrels.</i>	<i>Barrels.</i>
1890.....	7,082,204	335,500	7,417,704	1,940,186
1893.....	7,411,815	590,652	8,002,467	2,674,149
1895.....	7,741,077	990,324	8,731,401	2,997,395
1897.....	8,311,688	2,677,775	10,989,463	2,090,924
1899.....	9,868,179	5,652,266	15,520,445	2,108,388
1900.....	8,383,519	8,482,020	16,865,539	2,386,683
1901.....	7,084,823	12,711,225	19,796,048	939,330
1902.....	8,044,305	17,230,644	25,274,949	1,961,013
1903.....	6,930,271	22,342,973	29,899,140	2,251,969

This table does not include the production of Pozzuolana or slag cement reported by this Bureau for the last three years, which is as follows: 1901, 272,689 barrels; 1902, 478,555 barrels; 1903, 525,896 barrels.

The following table shows a comparison of the production of Portland cement in the United States with the entire amount of hydraulic cement imported for consumption in 1891, 1900, 1901, 1902, and 1903. The increase in the percentage of total consumption of the home product continues, 1903 marking the highest point yet reached.



*Comparison of domestic production of Portland cement with consumption of all hydraulic cements, 1891-1903.*

	1891.	1900.	1901.	1902.	1903.
	<i>Barrels.</i>	<i>Barrels.</i>	<i>Barrels.</i>	<i>Barrels.</i>	<i>Barrels.</i>
Production in the United States.....	454,613	8,482,020	12,711,225	17,230,644	22,342,973
Imports .....	2,988,313	2,386,683	922,426	1,961,013	2,251,969
Total .....	3,443,126	10,868,703	13,633,651	19,191,657	24,594,942
Exports (domestic and foreign).....		139,939	417,625	373,414	285,463
Total consumption .....	3,443,126	10,728,764	13,216,026	18,818,243	24,309,479
Percentage of domestic production to total consumption in the United States.	13.2	79.1	96.2	91.6	91.9

The production and the annual percentage of increase in the last ten years have been as follows:

*Production of Portland cement, with increase each year, 1894-1903.*

Year.	Quantity.	Increase.	Percent- age of increase.	Year.	Quantity.	Increase.	Percent- age of increase.
	<i>Barrels.</i>	<i>Barrels.</i>			<i>Barrels.</i>	<i>Barrels.</i>	
1894 .....	798,757	208,105	35.2	1899.....	5,652,266	1,959,982	53.1
1895 .....	990,324	191,567	24.0	1900.....	8,482,020	2,829,754	50.1
1896 .....	1,543,023	552,699	55.8	1901.....	12,711,225	4,229,205	50.0
1897 .....	2,677,775	1,134,752	73.5	1902.....	17,230,644	4,519,419	35.6
1898 .....	3,692,284	1,014,509	37.9	1903.....	22,342,973	5,112,329	29.7

The total consumption of all kinds of cement in the United States in 1903 was 30,987,161 barrels, an increase of 2,359,732 barrels over the total consumption of 1902.

#### NATURAL-ROCK CEMENT.

##### PRODUCTION.

The quantity of natural-rock cement manufactured in the United States during 1903 was 7,030,271 barrels, having a value of \$3,675,520, a decrease in quantity of 1,014,034 barrels and in value of \$401,110, as compared with 8,044,305 barrels, valued at \$4,076,630, the production of 1902. Reports for 1903 show that the cause of this decline in quantity of natural-rock cement produced was the overproduction and the consequent lowering in price of Portland cement, particularly in the eastern part of the United States.



The following table shows the quantity and value of the natural-rock cement produced in the United States in 1901, 1902, and 1903:

*Production of natural-rock cement in 1901, 1902, and 1903, by States.*

State.	1901.			1902.			1903.		
	Num- ber of works.	Quantity.	Value.	Num- ber of works.	Quantity.	Value.	Num- ber of works.	Quantity.	Value.
		<i>Barrels.</i>			<i>Barrels.</i>			<i>Barrels.</i>	
Georgia.....	2	50,577	\$40,967	2	55,535	\$31,444	2	80,620	\$44,402
Illinois.....	2	469,842	187,936	3	607,820	156,855	3	543,132	178,900
Indiana and Ken- tucky.....	15	2,150,000	752,500	15	1,727,146	869,163	15	1,533,573	766,786
Kansas.....	<i>a</i> 2	175,560	97,002	2	160,000	80,000	2	226,293	169,155
Maryland.....	4	351,329	175,665	4	409,200	150,680	4	269,957	138,619
Minnesota.....	<i>b</i> 2	126,000	63,000	2	150,000	67,500	2	175,000	78,750
Nebraska.....	1								
New York.....	<i>c</i> 18	2,234,131	1,117,066	19	3,577,340	2,135,036	20	2,417,137	1,510,529
North Dakota.....	1			1			1		
Ohio.....	<i>d</i> 1	104,000	62,400	2			2	67,025	46,776
Pennsylvania.....	7	942,364	376,954	6	796,876	340,669	7	1,339,090	576,269
Texas.....	1			1			2		
Virginia.....	1			2	34,000	20,000	2	47,922	25,961
West Virginia.....	1			1	88,475	62,655	1		
Wisconsin.....	2	481,020	182,788	2	437,913	162,628	2	330,522	139,373
Total.....	<i>e</i> 60	7,084,823	3,056,278	<i>f</i> 62	8,044,305	4,076,630	<i>g</i> 65	7,030,271	3,675,520

*a* Includes product of Nebraska and Texas.

*b* Includes product of North Dakota.

*c* The number of companies producing natural cement only, is given, and the number given for 1899 and 1900 has been changed accordingly, as in those years the total number of companies in the State was given.

*d* Includes product of Virginia and West Virginia.

*e* This total includes one plant in North Dakota, which for this year is reported as having a natural cement product.

*f* The States combined for 1902 are noted in the text of the report for 1902.

*g* The States wherein the product of cement was combined with that of some other State for 1903 are given in the text below.

The single cement plant in North Dakota has a production which for 1903 has been combined with that of the only plants producing natural-rock cement in Kansas and Texas. The other States stand in the table exactly as the reported productions are given.

As in other similar tables shown in this report, the total results of combined productions are placed against those States which contributed the greater proportion of cement to make the entire quantity.

New York leads all other States, as usual, in the production of natural-rock cement. As this State is the original home of the cement industry in the United States, that position seems to belong to it by right of discovery.

Second in point of production is the natural-rock cement output from the Louisville district, which is the product of Indiana and Kentucky. Pennsylvania, which stands first as a producer of Portland cement, ranks third in the production of natural-rock cement.



## THE NATURAL-ROCK CEMENT INDUSTRY, BY STATES.

Of the 16 States mentioned below as properly belonging to those noted under the heading of natural-rock cement producers, only 14 were contributors to the total quantity of that product manufactured in the United States in 1903. Following are the detailed accounts of State productions:

*Florida.*—The mills at River Junction remained inactive, and the formation of the company for the improvement and enlargement of the plant is still incomplete. No cement was made in this State in 1903.

*Georgia.*—Of the two plants in Georgia which had a production of natural-rock cement in 1903, one was devoted exclusively to the manufacture of that product, and the other made both Portland and natural-rock cement. The first plant ran ahead of its production for the previous year, and the other factory ran ahead on its natural-rock production only. Both of the plants kept their mills busy during the entire year.

*Illinois.*—Three of the 8 cement plants in Illinois manufacture natural-rock cement only. The two larger of these were continuously operative during 1903, and had an increased production over that of 1902. The smaller and newer factory, was shut down for nearly six months of the year, labor strikes interfering seriously with the operation of the mills.

*Indiana and Kentucky.*—In these 2 States the output of natural-rock cement for 1903 was somewhat smaller than that for 1902. Many of the factories were closed for the greater part of the year, and a number were entirely idle. The low price of Portland cement, an overproduction and lack of demand for natural-rock cement, and some minor labor troubles are given as reasons by the various factories reporting for the slightly decreased output during the year. A new company is reported as having been formed at Louisville, with capital for an extensive plant, to be located there.

*Kansas.*—This State has at present 2 plants which produce natural-rock cement, both of which are located near Fort Scott. Of these, 1 factory was shut down a month because of overproduction, and the other was in operation throughout the year. Their combined production was largely in advance of that for the year 1902.

*Maryland.*—One of the factories which has for years been among the steady producers of natural-rock cement in the State of Maryland was burned in the early part of 1903, and up to the end of that year had not been made ready for use. One factory was idle, as it has been for several years, and the natural-rock production was, therefore, from the 3 remaining factories which manufacture that product. Of



these plants 1 was closed nearly two months for repairs, 1 was shut down after November because the low price of Portland cement rendered competition unprofitable, and 1 was idle nearly one-half of the year on account of labor troubles. The State produces both natural-rock and slag cement.<sup>a</sup>

*Minnesota.*—The only cement produced in this State is natural-rock cement, and there were but 2 plants manufacturing there in 1903. Of these, 1 ran ahead of its production for the year before and was active continuously, except for the months during which it was too cold to operate the mill. The other factory had a production which equaled that of the previous year, and was idle for repairs only a month. In this section of the country the demand for good cement is constant.

*New Mexico.*—The new plant producing cement at Ancho, in this State, in 1903 proved to be one for the manufacture of a kind of cement made from gypsum, which product is not reported by this Bureau.

*New York.*—There were 20 plants for the manufacture of natural-rock cement in the State of New York in 1903, two of which also produced Portland cement. Of the 18 remaining factories, 3 were idle during the year and 15 were used for the production of natural-rock cement only. A company which formerly manufactured natural-rock cement at Lefever Falls has closed down the works there and will for the present burn cement at their Rosendale factory only. One company reporting a product considerably larger than its output for 1902 was closed for a time to repair damage caused by a fire. The plant at Warners, which was burned in 1902, was active again in 1903, and had a good production of cement. One plant was sold during the year, but continued to run except through the coldest weather. Several of the plants that had a production report having been idle a number of months on account of the insufficient demand, and 2 companies report their factories as having been shut down a few months because of labor troubles. Strikes among the building trades, as well as those among the workmen at the factories, were in part

<sup>a</sup>On p. 755 of *Mineral Resources U. S. for 1902* the statement occurs that no attempt to manufacture Portland cement had been made in the State of Maryland, notwithstanding the presence in that State of much material suitable for such an industry. It would have been more strictly in accordance with the facts to state that no record of such an attempt appears in this office, and that no report of such a production was made to the Bureau. The superintendent of the Cumberland Hydraulic Cement and Manufacturing Company has informed the office, since the issue of the annual report for 1902, that his company did manufacture a true Portland cement at Cumberland, Md., as far back as 1896; that they erected a dome kiln of 150-barrel capacity, ground the necessary cement from their limestone and cement quarry, and manufactured a kiln full of Portland cement, which is at the present time under test both in briquettes and laboratory, and also in one pavement. It is further intimated that the manufacture of Portland cement may be begun by this company in the near future.—L. L. KIMBALL.



accountable for the lack of demand and supply in the cement business in 1903.<sup>a</sup>

*North Dakota.*—The output of the only cement plant in North Dakota is a high-grade natural-rock cement exclusively, and for 1903 it showed an increase over the production of 1902. The factory was idle during about three months in the winter because of difficulty in transportation and to make some improvements in the plant.

*Ohio.*—The new plant which was projected in this State for the manufacture of natural-rock cement in 1902 did not develop, and there seems to be no immediate prospect that it will do so. The plant at Defiance, which was idle in 1902, remained idle in 1903, its owner being averse to operating the mill on account of his advanced age. The plant near Lisbon, which manufactures only natural-rock cement, was active part of the year, being closed down about six weeks in all for various reasons, among which was the flooding of their mine. The production was about the same as that of the preceding year. Ohio has 1 cement factory devoted to the manufacture of slag cement.

*Pennsylvania.*—In 1903 the production of natural-rock cement in Pennsylvania ran ahead of its production for the year before, as did the output of Portland cement. There was 1 plant which manufactured only natural-rock cement, and 6 which made both natural-rock and Portland cement. There was also 1 plant which made only slag cement. Of the 6 factories which had a production of both natural-rock and Portland cement, 2 ran on full time, 2 were closed a short time for repairs and improvements, and 2 were idle about a month on account of accumulated stock. One new factory is reported, but the nature of the cement to be manufactured is not stated.

*Texas.*—The only active cement mill in Texas in 1903 was the one producing both natural-rock and Portland cement. The production of the former variety ran considerably ahead of that for the preceding year, while the output of the latter variety was not equal to that of the year before by some thousands of barrels. This plant was closed down during part of the year on account of the lack of demand for cement and on account of labor strikes. There are 2 other plants in this State, 1 of which manufactures Portland cement and the other produces only natural-rock cement. Both were idle in 1903.

<sup>a</sup> On p. 800 of Mineral Resources U. S. for 1902 the building of the Buffalo cement plant in 1874 is mentioned. Since the issue of that volume, Mr. Bennett, the president of the Buffalo Cement Company, has informed this Bureau of the fact that the production of the plant mentioned was only a continuation of the manufacture of cement from that particular ledge of rock, which had been worked many years. Mr. Bennett says: "In the fall of 1824 a cement works was constructed at Williamsville, Erie County, N. Y., which is now standing. It was owned and operated by Timothy Hopkins and John S. King, and was afterwards known as the Williamsville Cement Works. This cement was used in the construction of the locks of the Erie Canal at Lockport, and was hauled to that place by wagon. It was afterwards used in the first United States Government stone breakwater in Buffalo, in 1828. On this same ledge, 6 miles nearer Buffalo, the Buffalo Cement Works was afterwards constructed, so that cement has been manufactured continuously on this ledge for the last eighty years."—L. L. KIMBALL.



The former plant has been purchased by the Iola Portland Cement Company, of Kansas, and is being improved and reorganized. It will probably have a production in 1904.

*Virginia.*—The record of this State for 1903 is an almost exact repetition of its record for 1902, so far as the cement industry is concerned. There were 4 plants in the State, 2 of which produced only natural-rock cement, and their joint production ran ahead of that for the previous year by many thousands of barrels. One of them was idle in order to make improvements, and the other shut down a short time for lack of a market. The third plant is a Portland-cement plant, and the fourth was idle throughout the year. A new company, reporting in 1902, does not return a report for 1903.

*West Virginia.*—The only plant which produced natural-rock cement in West Virginia was running less than 5 months in 1903, owing to the fact that improvements were being made in the factory. As stated in the report of 1902, the plant which was active at Shepherdstown for many years as a producer of natural-rock cement, has been idle since the death of the proprietor. Negotiations for its purchase by some Baltimore capitalists are pending.

*Wisconsin.*—This State had an output of natural-rock cement only, there being no Portland or slag cement produced. In 1903 the two cement plants in operation had a production which fell short of the one for the preceding year.

#### POZZUOLANA OR SLAG CEMENT.

##### PRODUCTION.

In giving the production of slag cement for 1903 it is not possible to itemize the State productions without disclosing individual figures. The following table shows the total production of slag cement in the United States and the number of plants in each State:

*Production of slag cement in the United States in 1903, by States.*

State.	1903.		
	Number of works.	Quantity.	Value.
		<i>Barrels.</i>	
Alabama .....	2	.....	.....
Illinois .....	1	.....	.....
Maryland.....	1	.....	.....
New Jersey .....	1	.....	.....
Ohio.....	1	.....	.....
Pennsylvania.....	1	.....	.....
Total .....	7	525,896	\$542,502



## THE POZZUOLANA OR SLAG-CEMENT INDUSTRY, BY STATES.

The account in detail of the 6 States contributing to the total quantity of slag cement manufactured in the United States in 1903 is as follows:

*Alabama.*—This State is the only one which had in 1903 more than one slag-cement plant. Both the plants engaged in this industry last year were operated under the same management, the Southern Cement Company having leased the plant of the Birmingham Cement Company. The mills were busy almost continuously, being shut down only a few weeks for repairs.

*Illinois.*—The plant in this State which produced Pozzuolana or slag cement is located at North Chicago, and ran on full time the entire year. A plant owned by the same company but used for making Portland cement is located in South Chicago. The output of slag cement for 1903 was considerably in excess of that for 1902.

*Maryland.*—For the year 1903 the plant manufacturing slag cement at Sparrows Point was idle only a short time while making necessary repairs; except for this, the works were active all the year. Their output of cement was not quite as large as that for the preceding year.

*New Jersey.*—The production of slag cement in this State is carried on at Perth Amboy. The works were idle a few weeks on account of labor troubles, and the production of slag cement for 1903 was not quite equal to that of 1902. This plant has a number of rotary kilns.

*Ohio.*—There was but 1 plant actively engaged in making slag cement in Ohio in 1903; but in 1904 the new plant which has been in process of construction will probably be in condition to run. The output of the plant at Youngstown was not nearly as large as that for the previous year, and the cement works were idle about half the year.

*Pennsylvania.*—The new plant at Sharon had its initial run in 1903 and produced a fair output of slag cement. The works were not operated throughout the entire year, however, and the production for 1904 will probably be larger. This is the first time that Pennsylvania appears in the list of producers of slag cement.\*

## TOTAL PRODUCTION OF HYDRAULIC CEMENTS IN THE UNITED STATES.

The manufacture of natural-rock cement in the United States greatly antedates that of Portland cement, the former beginning about 1818, in New York State, and the latter about 1870, in Pennsylvania. Although the phenomenal growth of the Portland-cement industry within the last few years has made a large increase in the total output of that product, yet by far the greater total stands against the production of natural-rock cement, as shown by the following table:



## CEMENT.

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*Total production of natural-rock, Portland, and slag cement in the United States, 1818-1903.*

[Barrels.]

Year.	Natural.	Portland.	Pozzuolana or slag.
1818 to 1830 .....	300,000	.....	.....
1830 to 1840 .....	1,000,000	.....	.....
1840 to 1850 .....	4,250,000	.....	.....
1850 to 1860 .....	11,000,000	.....	.....
1860 to 1870 .....	16,420,000	.....	.....
1870 to 1880 .....	22,000,000	82,000	.....
1880 .....	2,030,000	42,000	.....
1881 .....	2,440,000	60,000	.....
1882 .....	3,165,000	85,000	.....
1883 .....	4,190,000	90,000	.....
1884 .....	4,000,000	100,000	.....
1885 .....	4,100,000	150,000	.....
1886 .....	4,186,152	150,000	.....
1887 .....	6,692,744	250,000	.....
1888 .....	6,253,295	250,000	.....
1889 .....	6,531,876	300,000	.....
1890 .....	7,082,204	335,000	.....
1891 .....	7,451,535	454,813	.....
1892 .....	8,211,181	547,440	.....
1893 .....	7,411,815	590,652	.....
1894 .....	7,563,488	798,757	.....
1895 .....	7,741,077	990,324	.....
1896 .....	7,970,450	1,543,023	12,265
1897 .....	8,311,688	2,677,775	48,329
1898 .....	8,418,924	3,692,284	150,895
1899 .....	9,868,179	5,652,266	335,000
1900 .....	8,388,519	8,482,020	446,609
1901 .....	7,084,823	12,711,225	272,689
1902 .....	8,044,305	17,230,644	478,555
1903 .....	7,030,271	22,342,973	525,896
Total .....	209,132,526	79,608,196	2,270,238

The figures for natural-rock and Portland cement in this table through the year 1896 are taken from a statement made by Mr. Uriah Cummings, president of the Cummings Cement Company, of Akron, N. Y., in his volume entitled *American Cements*, 1898, on page 288. The remainder of the table is compiled from the reports in this Office on the production of cement.



## IMPORTS.

The table showing the imports of cement into the United States in 1903, by countries, is as follows:

*Imports of hydraulic cement into the United States in 1899, 1900, 1901, 1902, and 1903, by countries.*

Country.	1899.	1900.	1901	1902.	1903.
	<i>Barrels.</i>	<i>Barrels.</i>	<i>Barrels.</i>	<i>Barrels.</i>	<i>Barrels.</i>
United Kingdom.....	199,633	267,921	37,390	79,087	146,994
Belgium.....	624,149	826,289	303,180	615,793	737,576
France.....	15,649	32,710	11,771	14,922	14,865
Germany.....	1,193,822	1,155,550	555,038	1,259,265	1,377,414
Other European countries.....	68,348	75,827	19,077	17,956	27,415
British North America.....	4,398	4,517	6,066	3,611	4,421
Other countries.....	2,389	23,869	6,808	4,153	9,265
Total.....	2,108,388	2,386,683	939,330	1,994,787	2,317,950

The figures used in compiling this table are those which show the total imports, and the figures used elsewhere in this report as imports are those which show the imports withdrawn from the warehouse for consumption in the United States. In 1903 England stands third in the list of foreign countries which sent cement to America. From 1871 to 1876 nearly all importations of foreign cement were from England. In the four years following Germany gradually assumed an important place as rival, and in 1882, while England sent one-half the cement exported to the United States, Germany sent three-fourths of the remainder. Ten years later Germany was the leading foreign country sending cement to America, and since then has held that position.

## PRODUCTION OF CEMENT IN CANADA.

The total production of cement in Canada in 1903, according to the preliminary statement of the geological survey of Canada, was 719,993 barrels, valued at \$1,166,497. Of this amount 92,252 barrels were natural-rock cement, worth \$75,655, and 627,741 barrels were Portland cement, worth \$1,090,842.

These figures show an increase in the production of Portland cement in 1903 over that in 1902 of 33,147 barrels, and a decrease in the amount of natural-rock cement produced in 1903, as compared with that produced in 1902, of 32,148 barrels. In 1902 the increase in the production of Portland cement amounted to over 100 per cent and the decrease in the production of natural-rock cement to about 6.5 per cent, as compared with the production for 1901.



## PORTLAND CEMENT IN GERMANY.

The condition of the cement industry in Germany is of deep interest to this country, in view of the fact that more than half of the imports of cement into the United States are from that country.

The following extract is from a report made by Mr. F. H. Mason, consul-general at Berlin:<sup>a</sup>

The cement manufacture may be designated as that one of the great long-established industries in this country in which the capacity of production is most excessive and disproportionate to the normal consumptive power of the people. There were in operation in this country at the close of 1899, 261 cement factories, and their number has increased rather than diminished since that time.

During the year 1901 there was consumed in Germany 14,600,000 barrels of cement, while the reports of the several syndicates show that the collective productive capacity of all their factories for the same period was 29,000,000 barrels per annum. The power of production had thus, in respect to Portland cement, outgrown the actual home demand by 100 per cent. Just how much cement was really produced in that year is difficult to ascertain. The cement factories of Germany are divided into several syndicates, which fight each other with persistent valor and reveal as little of the inside workings of their several organizations as possible; but from all indications and estimates there must have been in 1901 a surplus of from 10,000,000 to 12,000,000 barrels, of which there was exported 506,652 tons, leaving a large excess, which broke down the market, reduced profits to a pittance, and brought on a crisis in the industry from which it has not yet recovered.

In tracing the causes which led up to this result, it is noticeable that during the 10 years from 1890 to 1900 all kinds of construction which use cement were phenomenally active in Germany, and the consumption was enormous and steadily increasing. Millions of barrels were used in the construction of the Kaiser Wilhelm and the Ems canals and in improvements in the Rhine, Weser, and other rivers. It was expected that the Midland Canal would also be authorized, and the cement factories made preparations to meet that additional demand, so that the failure and postponement of the project were among the contributing causes to the overproduction of that period. The situation led to a new effort to unite the several local syndicates and groups into which the cement makers were divided into one national and all-embracing combination, which could restrict the output, shut down superfluous factories, and, by getting the industry thoroughly in hand, restore prices to a profitable basis. All such efforts proved futile, and the war between the competing factories was bitter and unrelenting.

The year 1902 brought no substantial relief. The supply of cement everywhere exceeded the demand. Building operations slackened under the general industrial and financial depression, while labor and fuel—two of the principal factors in cement production—maintained practically undiminished values since the prosperous years preceding 1900. The only outlet for the surplus was through exports, and these slowly increased from 497,780 metric tons<sup>b</sup> in 1898 to 528,676 tons in 1899, 543,991 tons in 1900, and 641,520 tons in 1902. Of this large export the United States takes a larger share than any other nation, the shipments to our country aggregating 197,174 tons in 1900, 108,596 tons in 1901, and 246,726 tons in 1902. Next in order of importance in this respect comes the Netherlands, which last year took 66,837 tons of German cement; British South Africa, 36,720 tons; Great Britain, 33,534 tons, and Brazil, 18,209 tons.

<sup>a</sup> Advance Sheets Cons. Repts., No. 1691, July 8, 1903.

<sup>b</sup> 1 metric ton=2,205 pounds.



Under the present tariff cement is free of duty when imported into Germany, and there was a small influx of 51,947 tons in 1902, which came across the border at points in Belgium, Denmark, France, Austria, and Switzerland, where factories near the frontier were geographically tributary to German territory. To shut out this slight competition the new German tariff imposes a duty of 50 pfennigs (about 12 cents) per 100 kilograms (\$1.20 per metric ton) on cement, as against \$4.04 per ton duty assessed by Russia, \$2.38 in Austria and Switzerland, \$1.42 in Sweden, and \$1.76 in the United States.

The sum of all recent information is that only the oldest and largest factories in Germany, which enjoy every advantage of location for obtaining raw material and handling their product, are able under present conditions to earn any substantial profit. Many of the newer and smaller establishments are working at a loss. Early in the present year there was a meeting in Berlin of cement manufacturers from all parts of the Empire, which, after a long secret session, appointed a commission to consider and report in April upon a plan for the organization of the entire industry under a cartel or syndicate, which should control output and manage the market. Thus far it would appear that the commission has not reported, and its continued silence is construed as an indication that the differences between local syndicates and individual factories have again been found irreconcilable, and that no general basis of combination can be reached.

In connection with the subject of the manufacture of Portland cement in Germany, it may be of interest to note that the Association of German Portland Cement Manufacturers has adopted the following definition of Portland cement:

An hydraulic cementing material having a specific gravity of not less than 3.10 in the calcined condition, and containing not less than 1.7 parts by weight of lime to one part each of silica, alumina, and ferric oxide, the material being prepared by intimately grinding the raw ingredients, calcining them to not less than clinkering temperature, and then reducing this clinker to a proper fineness.

#### METHODS OF SHIPPING CEMENT.

The transportation of cements was formerly made in barrels, that being considered the best means that could be used. At present, however, the large proportion of all cement made in this country is shipped in cotton or paper bags. To such an extent is this true that the immense stave industry which was built up in former years at Cherryfield, Me., has been abandoned and the mills shut down, there being an insufficient demand to make the business profitable. In a pamphlet entitled "The Inspection and Testing of Cements," by Mr. R. L. Humphrey, the author says:<sup>a</sup>

Cement is usually shipped in cotton sacks or paper bags, although about 25 per cent of the shipments are in wood. Where cement is going to be used immediately and will not be held long in storage, the bag shipments are undoubtedly more convenient and satisfactory, besides being more easily handled on the work. Such ship-

<sup>a</sup> Humphrey, R. L., The inspection and testing of cements: Jour. Franklin Inst., vol. 1, 1901, pp. 450-451.



ments can also be sampled much more thoroughly. Cement was shipped in barrels in this country in the early days, as it was generally accepted that cement must be kept in tight packages, as it deteriorated in the air; and, besides, nearly all the early natural-cement mills were located along canals, and the cement had to be placed in wooden packages for water shipments. Again, prior to 1893 foreign Portland cement was used very extensively in this country, and on account of the ocean voyage it was absolutely necessary to pack the cement in tight, well-coopered barrels in order to avoid damage to the cement from sea-water, and to the barrel from the handling it received in loading and unloading. When the American cements began to replace the foreign Portland cements the American engineers had become so accustomed to cement in barrels that they continued to insist on shipments of cement being delivered in wood. This sentiment is, however, undergoing a change, and bag shipments are becoming the rule. Another advantage of having cement delivered in sacks is the reduced cost of the package.

The danger of inferior cement being rebagged is readily avoided by requiring the cement manufacturer to seal his bags with a lead seal, such as is the custom in France and other foreign countries. The packages should state plainly the brand, name, and place of manufacture, and all shipments of cement which are not properly labeled should not be inspected.

#### ACKNOWLEDGMENTS.

It is desired to acknowledge here the almost unfailing courtesy which has been extended to this Bureau by the gentlemen engaged in the manufacture of cement in the United States in 1903. In nearly every instance where information additional to that already given was requested it was forwarded without delay. As these statistics are compiled from data sent by the different manufacturers of cement only, and as no estimates or statements outside of those from the factories themselves are included in the figures showing either production or values, the importance of prompt responses to requests can be readily appreciated. The ability to forward the issue of such a pamphlet as this hinges very largely upon the facility with which returns can be received from cement manufacturers.

#### PORTLAND CEMENT IN MICHIGAN, 1903.

By L. L. KIMBALL.

Marl has been known and utilized as a fertilizer and for producing lime in Michigan for many years, and it was used as the principal ingredient in manufacturing Portland cement just across the State line at South Bend, Ind., by Mr. Millen in 1877; and yet it is only within the last seven years that it has been successfully used in producing Portland cement in Michigan. There was a factory started at Kalamazoo in



1872 for the manufacture of Portland cement from the marl beds located near that city, but the old set or dry kiln process proved to be so expensive that this site was ultimately abandoned. At Bronson, where marl was discovered by a section foreman while piles were being sunk for a railroad bridge, and at Union City the first successful marl plants were started, and cement was first produced in 1897. Following these plants were those at Coldwater and Quincy in 1898. The next active mill was at Wyandotte, where, however, the cement is manufactured from limestone brought from Alpena. This mill began producing in 1899. In 1900 the factory at Mosherville first had an output of cement made from marl. At the close of 1903 the total of five marl-using factories which reported in 1900 had increased to thirteen companies reporting production for that year in Michigan, of which ten were using marl as a principal ingredient for their cement and three were using limestone. In addition, the number of plants projected amounted to as many more in all stages of development, ranging from a company which has been organized simply for the purpose of holding certain cement properties and with no immediate intention of building a plant to companies naming the specific dates on which their factories are to begin the manufacture of Portland cement. This astonishing growth of the cement industry, which was the immediate result of the discovery of an abundance of marl in the State and which in 1903 put Michigan third in rank among the States manufacturing Portland cement, received a slight check from the fall in prices paid for cement in 1903 and the early part of 1904. This fall in price made greater economy in manufacture necessary. The further fact that experience began to prove that the difference in quality of the marl deposits was an important consideration and one which could not be safely ignored also tended to render caution in production necessary.

#### MATERIALS.

In no other State are the calcareous marls so generally used for the manufacture of Portland cement as in Michigan. Cement is manufactured from marl by four companies in New York, by three companies in Ohio, and by two companies in Indiana, but in Michigan it is produced from marl to the exclusion of other materials except at Alpena, Elk Rapids, and Wyandotte, where limestone is used. At the cement plant in Alpena it was at first intended to use the marl deposits on land containing the clay belonging to this company; but the quality as well as the inexhaustible quantity of their limestone deposit altered the original intention, and the plant was erected with machinery adapted to the production of cement from limestone rather than marl, though the wet process of manufacture was used. As stated in another part of this



report, the factory has recently been remodeled, so that the dry process could be used instead of the wet.

The numerous deposits of marl in Michigan differ greatly in both quality and quantity, and actual experience in using these deposits sometimes develops difficulties which do not appear in preliminary examinations. In one place where a successful plant has been operating for some years a marl is used for producing cement which has a coarse grain, is loosely constructed, and is of a dirty, grayish color; but it is comparatively free from stones and organic matter; the water drops out of it readily; it is easily separated from its organic matter, and it is not very sticky to handle. This last consideration means much in the economy of a cement factory. This is shown by the experience of another plant located somewhat farther north, in which the machinery is practically a duplicate of that used in the one just mentioned. Although the marl is conveniently located with reference to manufacturing and handling, the output is not nearly so large as that at the other plant, because the marl, fine and white in appearance, works into a compact, sticky mass that requires more fuel for moving, more wetting, and consequently more drying, and is far more expensive and troublesome in every way to handle than the coarse gray marl of the deposit first mentioned. Considerations of this kind make the possession of a large bed of marl a thing of much more doubtful value than was at first supposed. Where the marl is found to contain an excess of organic matter the process of eliminating it and the water it carries becomes one of great expense. Furthermore, the thickness of the deposit must be taken into account. A bed only 8 or 10 feet in depth will be much less economical to handle than one of three times that depth, because in each case the surface growth will be mixed with the marl and will have to be burned to an ash in the kilns, involving an additional cost for fuel. Then there will be a small percentage of marl at the bottom of the deposit which can not be profitably dredged on account of its admixture with the sand or gravel on which it rests. Hence the thicker the deposit of marl between the surface and the bottom layers the greater the supply of available material to be had at the least expense.

These and other considerations in the manufacture of Portland cement in Michigan have raised a question as to whether rock or marl may be used to greater advantage in this State, and the erection of several of the contemplated factories is at the present time being held in abeyance until their stockholders shall have reached a decision in the matter. One company having large holdings of marl land near Frankfort decided to use rock instead of marl, and has bought over 400 acres on which are enormous deposits of limestone, cement rock, shale, and clay. The limestone and cement-rock deposits are near



Charlevoix, in the northern part of the southern peninsula of Michigan, and border on Lake Michigan. The following are analyses of these raw materials:

*Analyses of limestone and cement rock from Charlevoix, Mich.*

Constituent.	Limestone.		Cement rock.	
	1.	2.	1.	2.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Silica .....	1.54	1.93	5.74	6.11
Oxide of iron and alumina .....	1.60	1.21	2.40	2.73
Carbonate of lime .....	95.64	96.03	87.86	87.42
Carbonate of magnesia .....	None.	None.	None.	None.
Sulphuric acid .....	.53	.40	.72	.69
Organic matter .....	.47	.36	2.98	2.73
Moisture by difference .....	.22	.07	.30	.32
Total .....	100.00	100.00	100.00	100.00

The conditions at Charlevoix are favorable for the manufacture of Portland cement, and the materials to be used yield a better quality of cement than could be made for the same expenditure of capital at Frankfort. Two other companies in the State are contemplating a change in their plants to enable them to substitute rock for marl.

#### PROCESSES.

Although the cement mills in Michigan all turn out practically the same product, and although that product bears almost an unvaryingly good reputation, yet the methods employed in arriving at this result differ in detail at nearly every plant in the State. The various managers find it expedient to alter their processes to meet individual needs and conditions.

At one plant the marl is dropped from the dredge into large buckets standing on a car and is conveyed by cable into the factory just as it comes from the lake, the first process inside the buildings being to put it through the hopper of a separator, where stones, roots, sticks, and other materials likely to break the blades of the mixers and agitators through which the material goes later are taken out. At another plant the dredge is placed on a float, to which is fastened a scow equipped with machinery necessary to remove the undesirable matter immediately, so that the marl is dumped from the dredge directly into the separator. It flows out from this machine in thin streams through pipes and is discharged into scows lying next to the machine. Thence it is towed across the lake to the mill by a steam tug, and here it is drawn up by compressed air through large pipes into the storage tanks inside the buildings. At still another plant the marl deposit adjacent to the mill is not used at present, but,



instead, marl is brought by railroad from a lake about 30 miles distant from the factory, experience having proven that the quality of the distant marl is so greatly superior to that of the near-by bed as to quantity of organic matter contained, as to quality of cement produced, and as to the ease with which it can be handled that the cost of moving it is much more than covered by the increased output resulting therefrom. At another plant the marl is brought to the mill by compressed air through tubes, and is not dealt with by hand from the time it is dredged until it is turned out into the storage bins as a finished product.

All the cement plants now operating in Michigan burn their cement in rotary kilns. There is, however, a new plant near Chelsea which is practically completed and will probably be in operation before this report is printed, which is equipped with vertical or dome kilns only. The reason for this is that the manager at this plant believes that a more uniformly even and perfect burning can be accomplished by drying the marl in bricks and packing it between layers of coke for burning than by putting it through a process where inequalities in the size of the clinker affect the degree of perfection to which it can be burned. There is also at this plant an economical and very interesting arrangement of pipes for the utilizing of most of the heat that is usually waste heat. Economy has been observed in many ways, and the results at this mill will be of general interest. The deposit of marl covers over 700 acres of ground, much of which was a marsh and part of which was a shallow lake. This lake is now reduced by drainage to a mere pond, and it is intended ultimately to drain it completely, so that the marl will be practically dry when it is brought to the mill. The property now owned by this company was originally held by the West German Portland Cement Company, and was sold to the present owners because of the failure of that company to develop as was expected.

The problem of thoroughly utilizing the waste heat in the cement factories for the purpose of drying marl is one which engages the attention of most of the managers in Michigan, especially during the prevalence of present prices, and if the problem can be more successfully solved than has yet been done a great step will be taken toward a more economical production of cement in the State. For, although it is entirely possible to dry the marl before it is burned, and although if dried it takes less fuel to burn than is required when it is wet, the drying has usually proved to be so expensive a process as to be unprofitable. Where the wet process is employed a kiln will burn 125 barrels of cement per day, as against 200 barrels burned in the same time where the marl is dried; but the cost of fuel for drying is usually more than double the profit gained on the 75 additional barrels. A plant which is at the present time shut down has machinery



for drying the marl which is about as extensive and as expensive as the machinery required for making the cement, and after the marl is dried it has to be carried nearly 60 miles in order to reach the factory. The company owning this plant also owns a large deposit of limestone near Alpena, in the northern part of the State, and if it is decided to change the material of manufacture from marl to limestone, which is a plan in favor with a majority of the stockholders, the stone will be brought by rail or by boat to the plant from this deposit.

In the making of Portland cement by the wet process, one of the most interesting parts of the whole operation is the transformation that goes on inside the rotary kilns from the time the slurry enters until it drops out as clinker. At the upper or elevated end of the kiln is a small hole; in looking through it the slurry that is being fed into the kiln is first seen as a sort of spray, dropping in coarse and fine lumps into the clouds of brownish, lurid steam and smoke that fill the big rotary, and seeming to vanish there. The smoke is dense and thick toward the sides of the kiln, flame and light showing mostly toward the center. At the other and lower end of kiln, where a flame made usually of powdered coal is forced into and through the long tube, nothing but a glare of light can be seen if the eyes are uncovered. It is necessary to use smoked glasses to distinguish objects within the kiln from this end, and when they are used, in looking into the roaring mass of intense heat and flame, it is possible to distinguish small blue-white balls of clinker that seem to leap about hurriedly as they are driven hither and thither by long tongues of fire, but always travel toward the opening at the end of the kiln, through which they finally drop as red-hot clinker. As the huge kiln slowly and steadily revolves at the rate of about one revolution each minute, the larger balls of clinker are broken by falling against its sides, and gravity compels them downward, so that as they leave the kiln, there is rarely a piece to be found larger than an English walnut. After emerging from the kiln, the clinker is cooled, crushed, ground into a fine, almost impalpable powder, and stored in bins, whence it is packed in barrels or sacks for shipment.

To describe in a general way the processes of any one plant where cement is made from marl and burned in rotary kilns is to describe them all, except in so far as they differ in small details. In each case the marl is first put through the hopper of the separator, whether this is done in or out of the factory. It is then conveyed to large storage tanks, where it is kept in a state of agitation by blades that constantly stir it. Meantime the clay or shale has been brought to the mill, crushed, ground, and stored. The marl then is pumped into a vat, where it is thoroughly mixed with clay, and water is added in proper proportions, from which vat a chemist takes samples in order to regulate the proportions of the mixture. In nearly all factories this sam-



pling and testing goes on throughout practically the whole process of manufacture. The mixture, or slurry, is then run into large tanks, being mixed and ground still more thoroughly on its way over the tube mills, and is again tested in its passage. From the vats, where it is kept in motion to prevent it from settling, it is pumped into the rotary kilns, whence it emerges as clinker. About 1 per cent of gypsum is generally added. The buildings covering the machinery for this process are usually of brick, steel, and concrete construction, and the fuel used is nearly always powdered coal.

#### USES AND PRICES.

The various uses to which Portland cement is constantly being put appear to justify the statement that it is now regarded as among the chief building materials of the twentieth century. It is daily becoming a greater factor in the industrial development of the United States, and nowhere is this fact more forcibly illustrated than in the State of Michigan. The matter of the abolition of grade crossings which is now agitated there has caused thousands of barrels of cement to be used, and in almost every town, even in the very small ones, are found miles of cement sidewalk. It is also used for poles, both for telephone and telegraph service; for piles, railroad ties, foundations for fence posts, and even for the posts themselves; for curbs and street crossings, for smoke stacks, grain elevators, water tanks, sewer pipe, dams, reservoirs, tiles, brick, and for piers, docks, and tunnels. Much important bridge work has been done through the use of cement, in Michigan, and it is largely used in all railroad work done in the State. Nearly all the cement made in the State is of a good quality and has so far stood the test of the years admirably, no failures and few complaints being reported.

The low prices that prevailed during the season of 1903-4 have caused some anxiety to managers of Michigan cement plants. Some of the plants have decreased their output until such time as prices should rise, and the result of this has been that nearly all of the factories running on full time are behind in their orders and can only promise delivery from a week or ten days to two weeks after the order is placed. The advantage of an enormous output is largely governed by the market a plant finds during a dull season or when prices have fallen. For, although a mill producing a quantity of cement sufficient only to supply a comparatively small field might dispose of its entire product at a fair profit, if it manufactured three times the quantity, it would be necessary to enlarge its territory in like proportion to place its output profitably.

In view of the prevailing low price of cement and for other reasons the building of several of the proposed plants in Michigan has been



postponed for a year, and several companies that were incorporated have abandoned their projects. Among them are the Zenith Portland Cement Company, which built the foundation of a plant at Grasslake, but failed to interest a sufficient amount of capital to proceed after the fall in cement prices; the West German Portland Cement Company, that was to build a plant near Chelsea, but sold out to the White Portland Cement Company; and the German Portland Cement Company, which proposed to build a plant at White Pigeon.

#### ACKNOWLEDGMENTS.

In closing a necessarily brief and limited account of some of the most important features of the Portland cement industry in Michigan it is proper to express appreciation of the invariable courtesy extended to the writer during a trip to the cement plants in the State. In no case was information withheld or refused, and the intelligence and cordiality which were met with in each factory visited were a most welcome assistance in gathering the data for this sketch.