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Chapter 16

Stone, Clay and Glass Products

THE industries in this group all derive their principal materials from the earth in the form of stone, clay and sand, and most of them are located close to their sources of supply. Indeed, in some of the establishment reports, mining and quarrying operations are included because they are inseparable from the manufacturing activities. The processes employed in the industries comprising the group range from the simple cutting of stone to the manufacture of complex glass instruments. The resulting array of products is rather heterogeneous.¹

In terms of value added the group was as important, in 1899, as leather products or chemical products, and in 1937, as important as nonferrous-metal products.

TRENDS IN THE PHYSICAL OUTPUT OF THE STONE, CLAY AND GLASS PRODUCTS INDUSTRIES

Data on physical output of the industries in the group are fragmentary (Table 47 and Chart 18). From 1899 we have indexes for only two of the 23 industries distinguished by the Census. Even for the recent period, 1929-37, indexes are available for no more than nine industries.

Asbestos Products. This classification embraces establishments manufacturing asbestos textiles, asbestos building materials, and other asbestos products. Steam and other packing,

¹ We include roofing in this group (although it is classified in the miscellaneous products group in the 1929 Census) because in the earlier years this industry made asbestos products.

Physical Output: Indexes and Percentage Changes^b

YEAR	INDEX OF PHYSICAL OUTPUT (1929:100)										Total	
	Asbestos Products	Roofing	Cement	Lime	Wall Plaster and Board	Concrete Products	Lime Brick	Clay Products	Glass	Unadjusted	Adjusted	
1899	..	..	7.3	..	..	..	..	77	..	..	..
1904	..	..	19	81	..	..	..	85	..	..	..
1909	..	..	43	91	..	..	..	102	..	..	..
1914	..	..	61	95	..	..	59	83	..	..	..
1919	..	..	57	77	..	..	52	63	..	..	..
1921	..	..	60	58	..	..	34	57	..	..	..
1923	..	..	77	93	..	..	76	99	..	..	..
1925	..	..	94	102	..	..	75	114	106	84	93
1927	73	..	100	101	100	94	115	107	92	98	100	
1929	100	100	100	100	100	100	100	100	100	100	100	
1931	68	62	75	78	65	61	54	48	81	66	67	
1933	56	..	36	..	..	25	8.7	28	78	46	47
1935	78	83	44	67	64	57	26	40	118	67	69	
1937	126	110	68	102	112	92	66	66	163	100	100	
PERIOD	NET PERCENTAGE CHANGE IN PHYSICAL OUTPUT											
1899-1937	..	..	+838	..	..	..	..	-15	..	..	..
1899-1909	..	..	+493	..	..	..	..	+32	..	..	..
1909-1919	..	..	+32	-15	..	..	..	-38	..	..	..
1919-1929	..	..	+75	+30	..	..	+92	+59	..	..	..
1929-1937	+26	+10	-32	+2	+12	-8	-34	-34	+63	0	0	

^a Industries for which there are no adequate quantity data for any of the periods listed above are: steam and other packing; marble and granite; emery wheels; hones; sandpaper; pulp goods; china firing and decorating, not elsewhere done; pottery; crucibles; graphite; minerals and earths; statuary and art goods; glass products, not elsewhere made; and mirrors. These industries are covered by the adjusted total.

^b The indexes have been constructed from basic data in the U.S. Census of Manufactures and other sources, by methods described briefly in Chapter 2 and in detail in Appendix A.

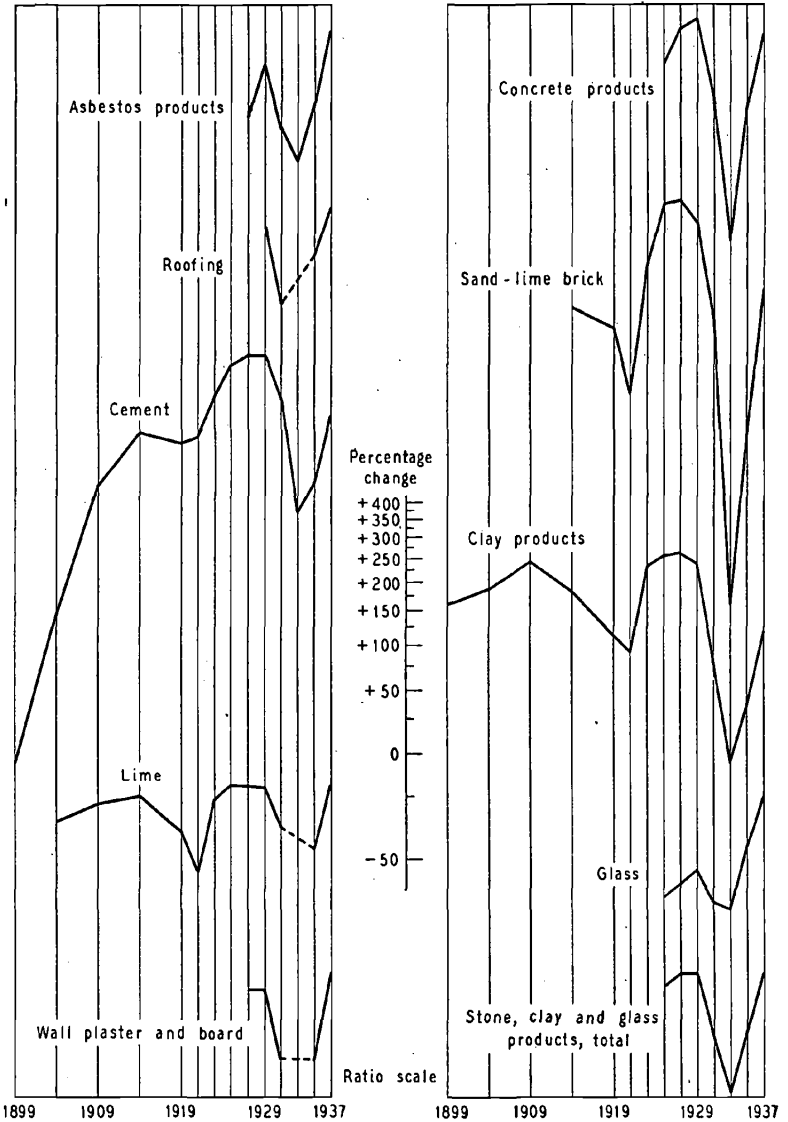
Appendix B presents these data, together with the indexes derived from them. The indexes cited here for individual industries have been adjusted to take account of changes in the coverage of the respective samples, except when such adjustment was impossible.

The percentage changes are not always entirely consistent with the indexes given above because the changes were computed from the indexes in Appendix B, which are carried to one decimal place.

Chart 18

STONE, CLAY AND GLASS PRODUCTS

Indexes of Physical Output



pipe and boiler covering and gaskets are treated elsewhere. The output of the asbestos products industry increased 38 percent from 1927 to 1929, and 26 percent from 1929 to 1937; in the entire decade it rose over 70 percent. Within the industry some products either failed to rise, or actually declined—asbestos cloth, brake lining (not molded), asbestos lumber, and table mats. On the other hand asbestos shingles and molded-asbestos brake lining made tremendous gains.

Cement. For the cement industry our data cover the entire period 1899–1937. In the latter year output was almost ten times as great as it had been in 1899. In the first decade output rose six-fold; between 1909 and 1919 the gain was only 32 percent, and the 1919 level was lower than that of 1914. In the decade between 1919 and 1929 output rose 75 percent, but in the years 1929–37 it fell 32 percent. The peak came in 1927, although output in that year was only fractionally higher than in 1929. A principal theme in the history of cement production from 1899 to 1937 is the gradual displacement of other types of cement by the Portland type. In 1899 the natural, puzzolan and masonry cements made up almost

	<i>Quantity</i> (million barrels)					<i>Percentage Distribution</i>				
	1899	1909	1919	1929	1937	1899	1909	1919	1929	1937
Portland cement	5.7	65.0	80.8	170.6	116.2	36	98	99	99	98
Natural, puzzolan and masonry cement	10.2	1.7	0.5	2.2	1.9	64	2	1	1	2
TOTAL	15.9	66.7	81.3	172.8	118.1	100	100	100	100	100

two thirds of the industry's output. Within ten years Portland cement had forged ahead so rapidly, and the other cements had declined so sharply, that the industry was dominated by Portland cement.

Even a relatively standardized commodity like Portland cement has been improved over the years with respect to both strength and hardening properties. Compression strength of

seven-day-old concrete, in which standard cement is used, increased from 1,460 pounds per square inch in 1916-20 to 3,390 in 1931-35. In six-month-old concrete the compression strength increased from 4,430 to 6,560 pounds per square inch. One cause of this improvement was the enhanced fineness of standard Portland cement. During the period 1916-20 the average fineness of Portland cement, judged by the percentage of cement passing through a 200-mesh-per-inch sieve, was 82; in 1931-35, the corresponding percentage was 93. There was not only a marked quality improvement in standard Portland cement, but also an increase in the percentage that special cements comprised of all Portland cement production. These special cements, characterized by high-early-strength, quick-set, water-proof, color, low-heat, or other properties, constituted less than 2 percent of all cement produced in 1927; in 1937 the percentage was almost eight. Improvements in the quality of standard cements and the development of special cements served to augment the effective construction capacity of a given volume of cement; less cement was required per cubic yard of concrete of a given strength.²

The industry also decreased the amount of fuel used per barrel of cement. In 1909, 186 pounds of coal and coal equivalent were needed to turn out a barrel of hydraulic cement, but in 1935 only 159 pounds were required.³ This reduction, of course, meant that the industry's net output rose even more rapidly than the actual number of barrels of cement produced.

Lime increased in output at a very moderate rate from 1904 to 1937. The net rise over the 33 years amounted to only 26 percent. As in cement production, there was a drop

² G. Perazich, S. T. Woal and H. Schimmel, "Mechanization in the Cement Industry," *Report No. M-3* (National Research Project, Dec. 1939), pp. 13, 17-19.

³ N. Yaworski, *et al.*, *op. cit.*, pp. 70-71.

between 1914 and 1919. The output in both 1925 and 1927 was fractionally higher than the 1929 volume, and about equal to that attained in 1937. Hydrated lime rose rapidly between 1909 (the first year for which data on the output of this product are available) and 1937; during the same period the combined output of quicklime and agricultural lime declined.

Wall Plaster and Board. This industry utilizes lime and gypsum to manufacture its chief products. Its output remained constant between 1927 and 1929, then made a net gain of 12 percent from 1929 to 1937. Among the individual products, gypsum plaster-board and lath, fiber wallboard, insulating board and flexible insulations rose rapidly in output, although most of the plasters declined.

Concrete Products (building materials, pipe and conduit, piling, etc.) rose 33 percent from 1925 to 1929, and fell 8 percent from 1929 to 1937. The net gain from 1925 to 1937 was 21 percent. Between 1929 and 1937 culvert pipe, pressure pipe, vaults, and paving materials increased in output. All other products declined, and some of these—brick, cast stone, circular structures, electric conduits, and septic tanks—dropped precipitously.

Clay Products, a very important industry in the group, consists largely of brick and tile enterprises. (Pottery is classified separately.) The output of the industry declined 15 percent from 1899 to 1937. In the first decade it rose 32 percent, then declined between 1909 and 1919 by 38 percent.⁴ Following the recession of 1919–21 it rose sharply to a peak in 1927. In that year, however, output was only 4 percent higher than it had been in 1909. From 1919 to 1929 it gained 59 percent, and in the next period, 1929–37, dropped 34 percent. The only products of the industry which still appear to be rising in output are enameled and faience tile, magnesite and

⁴ Because the 1899–1909 indexes are not adjusted for changes in the coverage of the underlying sample, they are subject to some error. See Appendix B.

chrome brick, and refractory cement. The 1937 output of common brick was two fifths the 1899 production. Vitrified brick fell even more drastically: the 1937 output of this product was only about one sixth as large as the volume turned out in 1899.

Glass, the last industrial category in the list, is represented by establishments engaged in manufacturing glass and glass products. Enterprises which manufacture glassware from purchased glass "blanks" are classified in other industries. Adequate data for the industry as a whole are available only from 1925. Output rose from 1925 to 1929 by 19 percent, and from 1929 to 1937 by 63 percent. There were especially large increases in beverage bottle production. For three products the records go back to 1899: polished plate glass rose from 17 million square feet in 1899 to 177 million in 1935 (the latest year for which separate data are given); window glass, from 217 million square feet in 1899 to 617 million in 1937; and obscured glass, from 13 million square feet to 28 million. All three, as well as polished wire glass (for which data are available beginning with 1914), declined from 1914 to 1919. Rough wire glass is the only product on which we have data that showed a rise between those two years.

Summary. Our index for the entire stone, clay and glass products group dates only from 1925. Total output rose between 1925 and 1929 by 7 percent according to the unadjusted index, and according to the adjusted index by 10 percent. From 1929 to 1937 the group's physical output changed less than 1 percent.

In relation to population growth the output of the cement industry rose over the period 1899-1937. Clay products fell absolutely, and in relation to population as well. As compared with total manufacturing, the clay products industry lagged behind not only in each subperiod but in the entire span of 38 years.

CHANGES IN THE INDUSTRIAL PATTERN OF
STONE, CLAY AND GLASS MANUFACTURE

Because the coverage of the group's industries is inadequate, we must confine our examination of the changes in the composition of the group's physical output to the period beginning in 1925. Between that year and 1937, the cement industry decreased its contribution to the group's output from 17 to 11 percent (Table 48). The decline in the relative contribution of the clay products industry was even more severe: from 22 to 12 percent. Glass raised its share of the total from 15 to 27 percent. These changes occurred for the most part between 1929 and 1937, when the output of the construction-material industries was declining.

From data on value added, available as far back as 1899, it

TABLE 48

STONE, CLAY AND GLASS PRODUCTS

Relative Contributions of Component Industries to the
Physical Output of the Entire Group^a

Industry	Percentage Distribution, Comparable Pairs of Years					
	1925	1937	1925	1929	1929	1937
Cement	17.0	11.2	16.3	15.7	16.0	11.0
Lime	2.6	2.4	2.5	2.2	2.1	2.1
Concrete	4.0	4.4	4.3	5.2	4.9	4.5
Sand-lime brick	0.2	0.1	0.2	0.2	0.2	0.1
Clay products	21.9	12.3	21.3	18.4	19.5	12.9
Glass	15.4	27.0	16.3	17.7	16.7	27.3
Asbestos products					2.8	3.5
Roofing					3.7	4.1
Wall plaster and board	38.8	42.5	39.1	40.6	4.1	4.6
All other products					30.0	29.8
TOTAL ^b	100.0	100.0	100.0	100.0	100.0	100.0

^a Derived from Table 47. For an explanation of the derivation of the measurements see footnote 10, Chapter 4.

^b The columns do not add up to 100.0 in every instance because they contain rounded percentages.

TABLE 49

STONE, CLAY AND GLASS PRODUCTS

Relative Contributions of Component Industries to the Value Added by the Entire Group^a

Industry	Percentage Distribution, Comparable Pairs of Years							
	1899	1909	1909	1919	1919	1929	1929	1937
Asbestos products	4.5	3.4	3.3	6.9	1.5	2.7	2.7	3.5
Steam and other packing					2.4	2.1	2.0	1.8
Roofing					4.4	3.7	3.7	4.1
Cement	9.0	9.4	9.4	12.9	12.8	15.3	15.1	11.6
Lime		3.1	3.1	2.6	2.6	2.0	1.9	2.2
Wall plaster and board		1.9	1.9	2.0	2.0 ^b	3.8	3.8	5.2
Concrete products	21.6	3.2	3.2	2.7	2.4	5.2	5.2	4.2
Marble and granite		21.0	20.9	10.7	10.4	12.0	11.8	5.4
Emery wheels		0.5	1.1	1.1	2.5	1.8	2.5 ^c	5.0
Hones	0.1	0.1	0.1	0.1	*			
Sand paper	0.3	0.6	0.6	0.6	0.8			
Pulp goods	0.3	0.2	0.2	1.6	1.6 ^b	1.4	2.7	4.7
Sand-lime brick				^d	0.1	0.2	0.2	0.1
China firing and decorating, n.e.d. ^e	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pottery	16.6	15.1	14.9	7.3	7.2	7.4	7.3	7.1
Clay products	20.7	19.2	19.0	19.2	19.0	19.0	18.9	13.1
Crucibles	0.5	0.2	0.2	0.1	0.1	0.2		
Graphite	0.1	0.2	0.2	0.1	0.1	0.2	0.2	*
Minerals and earths	1.1	0.7	0.7	4.0	4.0 ^g	0.8	0.7	1.6
Statuary and art goods		^h	0.8	0.5	0.5	0.7	0.7	0.2
Glass	20.4	16.7	16.5	23.0	22.8	17.8	17.6	25.3
Glass products, n.e.m. ⁱ	2.7	2.8	2.7	1.9	1.8	1.5	2.9	4.8
Mirrors	1.5	1.0	1.0	1.1	1.1	1.4		
TOTAL ^j	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Less than half of one percent.

^a Basic data are given in Appendix C.^b Between 1921 and 1923 there was a shift of some establishments from pulp goods to wall plaster.^c Not comparable with 1937, owing to a shift in the classification of an important establishment.^d Prior to 1914, included in clay products.^e N.e.d. denotes not elsewhere done.^f Between 1909 and 1914 there was an important shift from pottery to clay products.^g Including mining operations before 1929, but not in 1929 or later years.^h Included in several other industries in 1899.ⁱ N.e.m. denotes not elsewhere made.^j The columns do not add up to 100.0 in every instance because they contain rounded percentages.

is possible to sketch the rough outlines of the movements in the composition of the entire group. As Table 49 shows, there was a pronounced rise in the relative contribution of cement, from 9 percent in 1909 to 15 percent in 1929, followed by a decline from 1929 to 1937. The contribution of the glass industry fell from 1899 to 1909 (4 points), rose sharply from 1909 to 1919 (6.5 points), fell again from 1919 to 1929 (5 points), then rose from 1929 to 1937 (8 points). The net rise was 5 percent. In pulp goods also there was a substantial increase of over 4 points. Asbestos products, concrete products, emery wheels, and minerals and earths all increased their relative contributions, but in smaller degree.

The largest relative decline was that of marble and granite. The contribution of this industry fell from 21 percent of the total value added by the group in 1909 to 5 percent in 1937. Pottery and clay products also dropped off. The combined contribution of these two industries declined from 37 percent in 1899 to 20 percent in 1937.