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# GLASS

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# GLASS.

By H. B. PEFFERS.

At the census of 1905 the statistics of the manufacture of glass for establishments engaged in its production from crude materials were based on the same classification as that of the Twelfth Census, which was as follows: (1) Building glass—establishments manufacturing common window glass, plate glass, and all varieties of cast and rolled sheet glass; (2) pressed and blown glassware—establishments manufacturing tableware, jellies,

tumblers, goblets, lamps, chimneys, lantern globes, gas and electric lighting ware, opal ware, cut glass, etc.; (3) bottles and jars—establishments manufacturing bottles and jars in flint, green, and amber glass.

Table 1 is a comparative summary of the statistics for the manufacture of glass, as returned at the censuses of 1850 to 1905, inclusive, with the per cent of increase at each census.

TABLE 1.—GLASS MANUFACTURE—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE: 1850 TO 1905.

	CENSUS.							PER CENT OF INCREASE.					
	1905	1900	1890	1880	1870	1860	1850	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880	1860 to 1870	1850 to 1860
Number of establishments . . .	399	355	294	109	201	112	94	12.4	20.7	74.0	115.9	79.5	19.1
Capital . . . . .	\$89,380,151	\$61,423,903	\$40,066,850	\$18,804,599	\$14,111,642	\$6,133,666	\$3,402,350	45.5	49.9	117.9	33.3	130.1	80.3
Salaries officials, clerks, etc., number . . . . .	3,040	2,268	1,095	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	34.0	107.1	-----	-----	-----	-----
Salaries . . . . .	\$3,040,293	\$2,792,376	\$1,232,561	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	41.1	126.6	-----	-----	-----	-----
Wage-earners, average number . . . . .	63,960	52,818	44,892	24,177	15,822	9,016	5,668	21.1	17.7	85.7	52.8	75.5	59.1
Total wages . . . . .	\$37,288,148	\$27,084,710	\$20,885,061	\$9,144,100	\$7,846,425	\$2,903,832	\$2,094,576	37.7	29.7	128.4	10.5	170.2	38.6
Men 16 years and over . . . . .	54,079	42,173	36,064	17,778	11,505	8,765	5,571	28.2	16.9	102.9	54.5	31.3	57.3
Wages . . . . .	\$35,005,647	\$24,901,233	\$19,546,351	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	40.6	27.4	-----	-----	-----	-----
Women 16 years and over . . . . .	3,455	3,529	1,885	741	715	251	97	12.1	87.2	154.4	3.0	184.9	158.8
Wages . . . . .	\$868,808	\$840,001	\$332,245	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	3.4	152.8	-----	-----	-----	-----
Children under 16 years . . . . .	6,435	7,116	6,043	5,658	3,602	( <sup>4</sup> )	( <sup>4</sup> )	19.6	2.5	22.7	57.1	-----	-----
Wages . . . . .	\$1,413,693	\$1,343,476	\$1,007,365	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	5.2	33.4	-----	-----	-----	-----
Miscellaneous expenses . . . . .	\$5,911,507	\$3,588,641	\$2,267,006	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	64.7	58.3	-----	-----	-----	-----
Cost of materials used . . . . .	\$26,145,522	\$16,731,000	\$12,140,085	\$3,028,021	\$6,133,168	\$2,914,303	\$1,556,833	56.3	37.8	51.2	30.9	110.5	87.2
Value of products . . . . .	\$79,007,998	\$56,539,712	\$41,051,004	\$21,154,571	\$19,235,802	\$8,775,155	\$4,641,676	40.8	37.7	94.1	10.0	119.2	89.1

<sup>1</sup> Decrease.

<sup>2</sup> Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.

<sup>3</sup> Not reported separately.

<sup>4</sup> Not reported.

The general development of the industry is indicated by a comparison of the figures in Table 1. In each census period since 1850, except 1870 to 1880, there was an increase in the number of establishments engaged in the manufacture of glass. There was also an increase in each period in the amount of capital invested, value of products, average number of wage-earners, and wages. For each of the four items other than the average number of wage-earners the per cent of increase was greatest in the decade 1860 to 1870, and smallest in the decade 1870 to 1880. For the average number of wage-earners it was greatest in the decade 1880 to 1890, and smallest in the decade 1890 to 1900. During the fifty-five years there was an increase of 305,

or over threefold, in the number of establishments; \$85,986,801, or more than twenty-five fold, in capital; \$74,966,322, or more than sixteenfold, in value of products; 58,301, or more than tenfold, in average number of wage-earners; and \$35,193,572, or nearly seventeenfold, in wages. The recent development of the industry is indicated by the fact that during the fifteen years following 1890 the increases in capital and value of products were greater than they were during the preceding forty years by \$10,857,801, or 28.9 per cent, and \$2,147,666, or 5.9 per cent, respectively.

The number of active establishments increased 125, or 74 per cent, from 1880 to 1890; 61, or 20.7 per cent, from 1890 to 1900; and 44, or 12.4 per cent, from 1900

to 1905. Of the 294 establishments in operation in 1890, 100 were engaged in the manufacture of building glass; 125 in the manufacture of pressed and blown ware; and 69 in the manufacture of bottles and jars. During 1900 the 355 establishments reporting were engaged as follows: 124 were manufacturing building glass; 84, pressed and blown ware; and 147, bottles and jars. Of the 399 establishments reporting in 1905, 138 produced building glass; 103, pressed and blown glass; and 158, bottles and jars. From 1890 to 1900 the increase in number of establishments engaged in the manufacture of building glass was 24 per cent; and from 1900 to 1905, 11.3 per cent. During the same periods the number of establishments producing pressed and blown ware decreased 32.8 per cent and increased 22.6 per cent, respectively. The increase in number of establishments engaged in the manufacture of bottles and jars was 113 per cent from 1890 to 1900, and 7.5 per cent from 1900 to 1905.

The amount of capital invested increased 49.9 per cent between 1890 and 1900, and 45.5 per cent between 1900 and 1905; while during the same periods the value of products increased 37.7 per cent and 40.8 per cent, respectively. It is thus evident that while the per cent of increase in the number of establishments was much greater between 1890 and 1900 than between 1900 and 1905, the per cent of increase in the amount of capital invested was almost the same for the two periods. The value of products, however, shows a larger per cent of increase for the five years from 1900 to 1905 than for the ten years from 1890 to 1900.

From 1890 to 1900 the number of wage-earners increased 17.7 per cent, and the wages paid, 29.7 per cent; from 1900 to 1905 the number employed increased 21.1 per cent, and the wages paid, 37.7 per cent. The increase in the average number of wage-earners between 1900 and 1905 was confined entirely to the increase in the number of men, for there was a decrease in the number of women and children employed.

While there has been a marked advance in the glass industry since 1850, the development has been in the quality of the glass produced, rather than in the further adaptation of glass to commercial uses, or, until recently, in improvements in the manufacturing process. For many years the industry did not extend beyond the manufacture of window glass, tableware, and bottles, and the methods of making these were practically the same as those used by the early glassmakers. A

few years ago nearly all the articles made, except plate glass, were produced by skilled artisans, practically no machinery being employed in the manufacture. The principal item of expense in glass manufacture was therefore the cost of this skilled labor. Although some important improvements, which promise further changes in the methods of manufacturing various glass articles, have been introduced during the census year, they are of too recent origin to affect the statistics.

Since 1900 the glass manufacturers in the United States have made vast strides in the direction of cheaper production. Machines for mechanical manipulation in the production of window glass, for manufacturing narrow necked bottles, and for conveying ware are some of the latest contributions to the industry. Some of these machines were perfected during the census year and are now in active operation, but their influence on the industry was slight during 1904, as their operation in that year was more or less an experiment. The general improvement in factory construction, furnace equipment, and installation of mechanical blowing machines is generally indicated by the figures presented in Table 1.

As previously stated, the number of women and children employed in 1905 shows a slight decrease, compared with the number reported in 1900, although the wages paid in both instances show an increase. Women are employed in glass establishments in the packing, the finishing, and the decorating departments. The decrease in the number employed was in the packing and the finishing departments. There was, however, an increased demand for women artists in the decorating department, which, together with the fact that this class of employees command higher wages, would in a measure account for the increase in wages, notwithstanding the decrease in number employed. The adoption of child labor laws by the various states was the direct cause for the decrease from 1900 to 1905 in the number of children employed. Many factories were so hampered by the scarcity of this class of labor during the census year that they were compelled to temporarily suspend operations, a condition of affairs which led many manufacturers to experiment with labor saving devices and other means for dispensing with child labor.

Table 2 is a comparative summary showing the totals for glass manufacture, by states, as reported at the censuses of 1880 to 1905, inclusive.

MANUFACTURES.

TABLE 2.—GLASS MANUFACTURE—COMPARATIVE

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.							
				Number.	Salaries.	Total.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
						Average number.	Wages.	Average number.	Wages.	Average number.	Wages.	Average number.	Wages.
United States...	1905	309	\$80,389,151	3,040	\$3,940,293	63,069	\$37,288,148	54,079	\$35,005,647	3,455	\$868,808	6,435	\$1,413,603
	1900	355	61,423,903	2,268	2,792,375	52,818	27,084,710	42,173	24,001,233	3,529	840,001	7,116	1,343,476
	1890	204	40,966,850	1,095	1,232,561	44,892	20,885,961	36,064	10,546,351	1,885	332,245	6,943	1,007,365
	1880	194	10,329,000	(*)	(*)	24,177	9,144,100	17,778	(*)	741	(*)	5,658	(*)
California <sup>6</sup> .....	1905	4	1,244,919	52	65,382	880	498,225	788	463,391	77	37,084	24	7,150
Illinois.....	1905	13	3,576,172	119	151,330	4,768	3,011,632	4,258	2,912,778	127	26,853	383	72,001
	1900	6	2,181,801	75	110,100	3,304	1,621,286	2,607	1,496,801	148	28,456	549	95,939
	1890	13	1,721,878	31	44,710	2,762	1,188,051	2,215	1,121,526	20	3,860	527	62,665
	1880	6	425,000	(*)	(*)	732	342,027	632	(*)	(*)	(*)	100	(*)
Indiana.....	1905	96	13,884,485	432	548,990	12,020	6,638,130	10,662	6,316,351	487	101,018	871	220,761
	1900	110	12,775,389	509	649,227	13,015	7,226,047	10,916	6,808,042	634	120,808	1,471	288,197
	1890	21	3,550,563	70	75,682	3,010	1,460,140	2,633	1,422,104	197	27,811	180	19,234
	1880	4	1,442,000	(*)	(*)	862	284,207	695	(*)	53	(*)	114	(*)
Kansas <sup>7</sup> .....	1905	9	590,006	27	28,610	718	446,771	620	424,201	44	9,758	54	12,812
Maryland.....	1905	6	523,190	28	35,328	649	354,235	502	324,328	34	9,124	113	20,783
	1900	7	581,086	31	38,976	742	330,518	502	313,920	54	8,673	126	16,925
	1890	11	871,111	16	12,176	1,367	606,560	1,045	650,921	24	6,804	328	38,775
	1880	7	406,000	(*)	(*)	612	234,254	524	(*)	(*)	(*)	88	(*)
Massachusetts.....	1905	4	610,763	45	64,988	855	441,541	720	400,741	66	24,500	30	7,300
	1900	5	258,940	30	28,030	387	188,674	343	179,236	19	4,392	25	5,046
	1890	6	365,051	18	17,774	406	201,653	455	195,221	19	3,732	22	2,700
	1880	10	723,000	(*)	(*)	946	383,342	828	(*)	58	(*)	60	(*)
Missouri.....	1905	6	3,216,034	111	158,874	1,561	938,454	1,469	917,620	8	1,800	84	10,034
	1900	3	2,198,316	26	47,448	650	341,375	648	340,825	(*)	(*)	2	550
	1890	5	2,201,353	30	54,082	1,113	542,157	1,016	524,373	(*)	(*)	97	17,784
	1880	6	1,430,000	(*)	(*)	965	381,098	700	(*)	36	(*)	220	(*)
New Jersey.....	1905	22	6,304,455	369	358,988	5,507	3,145,394	4,815	2,690,750	124	20,603	568	119,022
	1900	20	5,397,602	317	284,060	5,383	2,462,745	4,360	2,278,306	170	32,726	847	151,713
	1890	34	3,744,894	152	132,610	5,688	2,730,190	4,601	2,605,798	42	8,405	1,045	115,897
	1880	22	2,508,021	(*)	(*)	3,578	1,300,038	2,762	(*)	46	(*)	770	(*)
New York.....	1905	28	3,455,441	142	202,443	3,153	1,824,570	2,800	1,715,544	103	25,635	250	83,397
	1900	27	2,242,834	117	139,698	2,556	1,305,264	2,201	1,230,971	73	17,841	282	47,462
	1890	30	2,207,699	50	61,413	3,229	1,422,620	2,587	1,319,607	92	17,025	550	85,904
	1880	29	1,875,000	(*)	(*)	3,078	1,046,812	2,116	(*)	50	(*)	912	(*)
Ohio.....	1905	37	9,254,105	300	444,268	7,844	4,511,605	6,321	4,172,470	787	186,605	736	152,530
	1900	28	5,451,513	199	249,029	4,546	2,067,384	3,595	1,844,958	405	90,017	636	126,409
	1890	59	4,094,677	216	230,323	6,435	2,901,255	5,053	2,700,030	538	74,227	844	126,992
	1880	19	1,172,850	(*)	(*)	1,688	644,520	1,170	(*)	81	(*)	437	(*)
Pennsylvania.....	1905	122	40,612,180	1,167	1,507,113	20,794	12,518,440	17,074	11,658,488	1,107	305,140	2,613	554,812
	1900	119	28,287,187	842	1,110,383	19,420	10,287,491	15,136	9,338,261	1,546	414,250	2,738	534,980
	1890	99	20,459,049	424	518,640	18,510	8,728,520	14,824	8,080,926	749	154,689	2,937	482,905
	1880	77	7,609,706	(*)	(*)	9,784	3,897,300	6,969	(*)	294	(*)	2,491	(*)
Virginia <sup>8</sup> .....	1905	4	402,459	11	17,868	472	263,657	404	248,128	(*)	(*)	08	15,529
West Virginia.....	1905	30	4,290,800	180	208,855	3,673	2,054,181	2,777	1,852,741	445	106,695	451	94,745
	1900	16	1,338,084	85	97,551	1,949	780,422	1,319	657,984	468	103,748	162	27,690
	1890	7	825,313	34	46,946	1,371	511,079	970	446,349	190	32,632	211	32,098
	1880	4	559,522	(*)	(*)	346	311,650	615	(*)	100	(*)	231	(*)
All other states.....	<sup>9</sup> 1905	0	1,411,083	30	57,247	1,066	641,317	860	603,107	16	4,393	190	33,817
	<sup>10</sup> 1900	8	711,082	28	36,944	866	455,504	576	402,839	12	4,100	278	48,565
	<sup>11</sup> 1890	0	829,262	30	38,195	881	494,811	665	469,490	14	3,080	292	22,321
	<sup>12</sup> 1880	10	1,127,000	(*)	(*)	986	318,846	728	(*)	23	(*)	235	(*)

<sup>1</sup> Not reported in 1890 and 1880.

<sup>2</sup> While the aggregate value for the respective states is the aggregate value of products reported for all branches of glass manufacture, all of the state totals can not be obtained by adding the amounts given, as the reports of certain products have been suppressed, to avoid disclosing the operations of individual establishments.

<sup>3</sup> Includes 25 establishments idle or in process of construction, with a capital of \$625,100 not reported separately by states in 1880.

<sup>4</sup> Not reported separately.

<sup>5</sup> Not reported in 1880.

<sup>6</sup> Included in "all other states" in 1880, 1890, and 1900.

SUMMARY, BY STATES: 1880 TO 1905.

Miscellaneous expenses.	Cost of materials used.	VALUE OF PRODUCTS.					FURNACES.										
		Total.	Building glass.	Pressed and blown glass.	Bottles and jars.	All other products.	Total.		Pot.		Tank.						
							Number.	Pot capacity.	Number.	Number of pots.	Continuous.			Intermittent.			
											Number.	Number of rings.	Pot capacity.	Number.	Tons capacity.	Pot capacity.	
\$5,911,507	\$26,145,522	\$79,607,908	\$21,697,861	\$21,956,158	\$33,631,063	\$2,322,916	871	12,731	398	4,809	306	3,267	7,447	107	475	475	1
3,583,641	16,731,000	56,539,712	17,096,234	17,076,125	21,070,791	600,562	804	9,941	451	5,107	206	1,750	3,933	147	901	901	2
2,267,696	12,140,085	21,051,004	13,928,206	18,061,244	8,521,464		564	4,632	564	4,932							3
(9)	8,028,021	21,154,571	5,915,018	9,568,520	5,670,433		285	2,421	285	2,421							4
64,242	274,071	915,446	60,000		855,446		8	122			8	57	122				5
370,907	1,400,237	5,019,740	281,550	149,205	4,940,156	230,700	41	763	12	151	24	284	582	5	30	30	6
210,588	674,008	2,834,308	24,000	131,018	2,078,780		28	435	10	129	11	133	206	7	40	40	7
134,625	682,248	2,372,011		640,883	995,907		27	225	27	225							8
(9)	297,842	901,343	373,343		528,000		8	74	8	74							9
710,654	5,558,830	14,706,920	3,700,018	2,860,087	7,213,456	843,768	165	2,484	70	749	91	774	1,707	4	28	28	10
699,165	4,582,141	14,757,883	5,711,048	2,061,787	6,327,408	26,680	237	2,905	125	1,354	75	576	1,331	37	220	220	11
360,384	865,374	2,905,400	1,831,745	672,179	491,435		48	449	48	449							12
(9)	433,733	700,781	725,707		64,984		10	108	10	108							13
41,802	355,003	958,720	381,084	64,007	407,808	105,071	12	178	5	30	7	64	148				14
31,411	158,732	589,580		46,191	536,478	6,020	10	109	8	91	1	5	10				15
26,065	151,500	557,805	103,202	100,000	346,633	8,000	13	113	12	107				1	8	8	16
35,847	205,337	1,250,007		674,900			19	161	19	161					6	6	16
(9)	239,082	587,000	332,000	85,000	170,000		9	68	9	68							17
97,244	316,080	1,011,373		558,911	50,000	402,462	7	52	7	52							19
14,243	137,185	418,458	10,200	382,091	20,107		8	155	7	65							20
35,700	127,180	431,437	72,748				11	69	11	69				1	90	90	21
(9)	320,304	854,345	140,845	704,500			11	99	11	99							22
133,098	707,871	1,781,020	1,036,433	110,010	607,383	18,200	10	204	5	120	5	40	84				23
98,110	231,615	765,504	605,504		200,000		12	183	7	110	5	35	73				24
116,307	657,874	1,215,327					13	148	13	148							25
(9)	351,871	910,827	300,550	136,487	392,790		7	51	7	51							26
475,747	1,856,239	6,450,195	201,922	181,559	6,066,714		80	1,013	23	183	46	381	770	11	60	60	27
241,055	1,488,700	5,093,822	274,011	21,300	4,462,219	340,202	84	1,024	33	255	37	333	690	14	79	79	28
116,009	1,310,953	5,218,132	1,316,170	1,235,425	2,606,556		80	469	80	409							29
(9)	1,088,346	2,810,170	729,155	400,000	1,081,015		44	289	44	289							30
385,487	1,411,073	4,270,708	456,310	1,932,524	1,806,245	24,687	59	720	31	284	24	104	420	4	16	16	31
145,505	800,590	2,756,070	346,790	1,173,784	1,195,270	41,128	51	529	29	247	14	115	230	8	52	52	32
107,900	825,498	2,723,019		1,307,156	693,886		55	400	55	400							33
(9)	944,091	2,420,790	540,903	1,167,571	722,322		43	339	43	339							34
783,562	2,836,521	9,026,208	1,025,120	3,954,060	2,961,727	484,695	93	1,335	43	620	36	303	673	14	42	42	35
155,512	1,253,164	4,547,083	671,422	2,738,289	1,058,955	78,417	60	776	42	539	12	95	212	6	25	25	36
294,744	1,002,599	5,049,182		3,554,370	519,015		85	806	85	806							37
(9)	459,333	1,549,320	358,000	1,076,320	115,000		20	187	20	187							38
2,265,947	9,325,184	27,671,093	12,160,013	9,406,183	5,951,144	145,353	269	4,468	137	1,937	93	018	2,382	39	149	149	39
1,807,870	6,435,403	22,011,130	9,213,545	8,453,550	4,162,990	181,045	261	3,420	168	2,117	44	412	1,029	49	274	274	40
911,178	5,294,002	17,179,137	0,406,024	8,700,124	2,072,089		197	1,982	197	1,982							41
(9)	3,350,060	8,720,584	2,222,513	4,881,312	1,616,759		112	1,029	112	1,029							42
35,679	160,461	540,031			540,031		6	82			6	41	82				43
398,646	1,250,480	4,598,563	1,323,896	2,620,065	602,002	52,000	92	972	49	481	19	101	377	24	114	114	44
112,791	693,251	1,871,795	101,242	1,379,706	381,847	9,000	35	246	15	150				20	90	90	45
40,805	277,033	945,234		945,234			17	144	17	144							46
(9)	208,064	748,500		748,500			8	82	8	82							47
199,901	515,741	1,440,719	371,900	63,406	1,014,413		19	229	8	111	6	45	90	5	28	28	48
26,110	284,492	1,284,250		4,000	792,456		15	155	3	28	8	51	102	4	25	25	40
54,047	301,897	1,065,397	4,300,709	561,972	1,082,726		12	79	12	79							50
(9)	324,535	851,905	93,512	378,830	379,563		13	95	13	95							51

\* None reported in 1880, 1890, and 1900.  
 † Included in "all other states" in 1900. None reported in 1880 and 1890.  
 ‡ Includes establishments distributed as follows: Colorado, 1; Delaware, 1; Georgia, 1; Indian Territory, 1; Michigan, 2; South Carolina, 1; Tennessee, 1; Wisconsin, 1.  
 § Includes establishments distributed as follows: California, 1; Colorado, 1; Delaware, 1; Georgia, 1; Michigan, 1; Virginia, 2; Wisconsin, 1.  
 ¶ Includes establishments distributed as follows: California, 1; Colorado, 1; Delaware, 1; Georgia, 2; Kentucky, 2; Michigan, 1; Wisconsin, 1.  
 \*\* Includes establishments distributed as follows: California, 1; Connecticut, 1; Iowa, 1; Kentucky, 5; Michigan, 1; New Hampshire, 1.

The number of furnaces reported increased from 804 in 1900 to 871 in 1905, or 8.3 per cent, and the pot capacity from 9,941 in 1900 to 12,731 in 1905, or 28.1 per cent. The average pot capacity per establishment in 1900 was 28 pots, while in 1905 it was 32. The substitution of the tank for the pot furnace, noted in 1900, continues. The number of pot furnaces reported decreased from 451 in 1900 to 398 in 1905, or 11.8 per cent, and the number of pots from 5,107 in 1900 to 4,809 in 1905, or 5.8 per cent. The number of continuous tank furnaces reported in 1905 was 366, with a capacity of 7,447 pots, as compared with 206 furnaces, with a pot capacity of 3,933 pots, reported in 1900. The increase in number of

these furnaces was 77.7 per cent, and in pot capacity 89.3 per cent. The number of intermittent tanks reported in 1905 was 107, with a capacity of 475 tons, as compared with 147 furnaces, with 901 tons capacity in 1900, a decrease of 27.2 per cent in number of furnaces and 47.3 per cent in tons capacity.

The figures for states show that since 1890 there has been an increase in capital and in value of products for each glass manufacturing state, except Maryland.

Table 3 shows the states ranked according to the value of glass products at each census from 1880 to 1905, and the percentage which the value of products for each state forms of the total for the United States.

TABLE 3.—GLASS MANUFACTURE—RANK OF STATES BY VALUE OF PRODUCTS, WITH PER CENT OF TOTAL VALUE: 1880 TO 1905.

STATE.	RANK.				VALUE OF PRODUCTS.				PER CENT OF TOTAL VALUE.			
	1905	1900	1890	1880	1905	1900	1890	1880	1905	1900	1890	1880
United States.....					\$70,607,008	\$50,530,712	\$41,051,004	\$21,154,571	100.0	100.0	100.0	100.0
Pennsylvania.....	1	1	1	1	27,671,603	22,011,130	17,170,137	8,720,584	34.8	38.0	41.8	41.2
Indiana.....	2	2	4	8	14,706,920	14,757,883	2,095,400	700,781	18.5	26.1	7.3	3.7
Ohio.....	3	4	2	4	9,026,208	4,547,083	5,040,182	1,549,320	11.3	8.1	13.8	7.3
New Jersey.....	4	3	3	2	6,450,195	5,093,822	5,218,152	2,810,170	8.1	9.0	12.7	13.3
Illinois.....	5	5	6	6	5,610,740	2,834,308	2,372,011	901,343	7.1	5.0	5.8	4.3
West Virginia.....	6	7	9	9	4,598,563	1,871,795	945,234	748,500	5.8	3.3	2.3	3.5
New York.....	7	6	5	3	4,270,700	2,750,078	2,723,010	2,420,706	5.4	4.0	6.6	11.5
Missouri.....	8	8	8	5	1,781,028	765,564	1,215,320	919,827	2.2	1.4	3.0	4.4
Massachusetts.....	9	10	10	7	1,011,373	418,458	431,437	854,345	1.3	0.7	1.0	4.0
Kansas.....	10				958,720	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	1.2			
California.....	11	12	14	13	915,440	( <sup>2</sup> )	( <sup>2</sup> )	140,000	1.1			0.7
Maryland.....	12	9	7	10	580,589	557,805	1,250,607	587,000	0.7	1.0	3.1	2.8
Virginia.....	13	13			549,031	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	0.7			
Wisconsin.....	14	11	13		( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )				
Michigan.....	15	16	17	14	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	90,000				0.4
South Carolina.....	16				( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )				
Colorado.....	17	17	15		( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )				
Tennessee.....	18				( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )				
Georgia.....	19	15	12		( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )				
Delaware.....	20	14	10		( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )				
Indian Territory.....	21				( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )				
Kentucky.....			11	11	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	383,405				1.8
Connecticut.....				12	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	160,000				0.8
New Hampshire.....				15	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	70,000				0.3
Iowa.....				16	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	3,500				( <sup>3</sup> )
All other states <sup>4</sup> .....					1,440,719	924,700	1,065,397		1.8	1.6	2.0	

<sup>1</sup>Not reported.

<sup>2</sup>Included in "all other states."

<sup>3</sup>Less than one-tenth of 1 per cent.

<sup>4</sup>Includes the following states: 1905—Colorado, Delaware, Georgia, Indian Territory, Michigan, South Carolina, Tennessee, Wisconsin. 1900—California, Colorado, Delaware, Georgia, Michigan, Virginia, Wisconsin. 1890—California, Colorado, Delaware, Georgia, Kentucky, Michigan, Wisconsin.

Since the census of 1900 Kansas, South Carolina, Tennessee, and Indian Territory have been added to the list of glass producing states, making a total of 21. Pennsylvania retained first place, with 34.8 per cent of the total value of products of the United States. Indiana was again second, with 18.5 per cent, but Ohio, which was second in 1890 and fourth in 1900, was third in 1905, having changed places with New Jersey since 1900. Illinois, the fifth state

in 1900, retained that position in 1905, but increased its percentage of the total product from 5 per cent in 1900 to 7.1 in 1905. West Virginia, which ranked seventh in 1900, was sixth in 1905, displacing New York, which fell to seventh place. Missouri was eighth, the position it has occupied since 1890.

*Building glass.*—Table 4 presents the comparative statistics of establishments engaged in the manufacture of building glass for 1890, 1900, and 1905.

MANUFACTURES.

TABLE 4.—BUILDING GLASS—COMPARATIVE

STATE.	Cen- sus.	Num- ber of estab- lish- ments.	Capital.	SALARIED OFFI- CIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.							
				Number.	Salaries.	Total.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
						Average number.	Wages.	Average number.	Wages.	Average number.	Wages.	Average number.	Wages.
United States...	1905	138	\$40,600,410	928	\$1,156,071	14,880	\$10,546,000	14,731	\$10,505,257	25	\$7,446	124	\$33,387
	1900	124	26,617,122	615	811,083	11,002	9,020,073	11,801	8,099,613	20	4,901	81	25,159
	1890	100	18,353,576	292	338,112	11,082	7,159,903	11,633	7,073,965	67	20,593	282	65,345
Illinois <sup>1</sup> .....	1905	3	273,827	13	12,080	230	161,153	230	161,153				
Indiana.....	1905	38	7,012,830	148	149,770	2,061	1,009,312	2,027	1,000,501			34	8,811
	1900	51	7,080,415	224	274,105	3,012	3,251,810	3,908	3,250,119			4	1,700
	1890	11	2,897,100	52	45,377	1,530	614,539	1,469	907,201	17	5,860	14	1,478
Kansas <sup>2</sup> .....	1905	4	302,603	10	11,000	258	231,251	258	231,251				
Missouri <sup>2</sup> .....	1905	3	2,600,106	97	133,912	1,002	579,493	994	577,289			8	2,204
New Jersey.....	1905	3	161,743	7	5,530	146	89,705	146	89,705				
	1900	4	218,090	8	6,326	230	163,245	230	163,245				
	1890	12	967,023	22	16,288	1,082	720,184	1,048	717,104			34	3,080
New York <sup>4</sup> .....	1905	8	323,714	12	12,558	306	199,338	299	198,148			7	1,190
	1900	7	334,035	11	15,160	228	164,201	226	163,070			2	312
Ohio <sup>4</sup> .....	1905	8	2,701,472	53	72,134	1,127	828,168	1,127	828,168				
	1900	7	2,030,134	25	22,570	477	376,006	477	376,006				
Pennsylvania.....	1905	51	24,002,320	532	685,794	7,832	5,725,582	7,736	5,698,312	25	7,446	71	10,824
	1900	46	14,661,120	307	436,015	6,459	4,706,720	6,368	4,670,801	20	4,901	71	22,018
	1890	28	9,715,850	104	145,152	5,399	3,258,602	5,172	3,162,078	50	14,733	177	51,881
West Virginia <sup>2</sup> .....	1905	17	1,684,650	43	57,573	699	643,852	698	643,394			1	468
All other states.....	*1905	3	642,836	8	14,160	310	178,236	316	177,336			3	900
	*1900	9	2,283,428	40	58,807	506	367,592	592	366,463			4	1,129
	*1890	40	4,772,703	114	131,295	3,071	2,266,488	3,014	2,257,682			57	8,006

<sup>1</sup> Not reported in 1890.

<sup>2</sup> Included in "all other states" in 1890 and 1900.

<sup>3</sup> None reported in 1890 and 1900.

<sup>4</sup> Included in "all other states" in 1890.

## SUMMARY, BY STATES: 1890 TO 1905.

Miscellaneous expenses.	Cost of materials used.	VALUE OF PRODUCTS.				FURNACES.										
		Total.	Building glass.	Pressed and blown glass and bottles and jars.	All other products.	Total.		Pot.		Tank. <sup>1</sup>						
						Number.	Pot capacity.	Number.	Number of pots.	Continuous.			Intermittent.			
										Number.	Number of rings.	Pot capacity.	Number.	Tons capacity.		Pot capacity.
\$1,210,707	\$8,210,702	\$21,557,531	\$21,380,805	\$53,900	\$123,326	242	4,891	152	2,079	70	913	2,739	11	73	73	1
1,365,805	4,079,084	17,086,254	16,681,082		415,142	241	3,726	193	2,296	34	433	1,299	14	181	131	2
1,069,545	4,021,535	13,928,296	13,820,135		102,161	105	2,024	195	2,024							3
30,207	72,152	281,559	281,559			3	55	1	13	2	14	42				4
212,755	1,406,539	3,700,618	3,700,618			64	950	46	445	14	159	477	4	28	28	5
348,065	1,319,075	5,711,948	5,696,948		15,000	95	1,377	82	825	12	179	537	1	15	15	6
297,127	510,845	1,831,745	1,791,745		40,000	27	333	27	333							7
23,092	81,885	381,084	381,084			6	84	4	24	2	20	60				8
55,785	524,966	1,036,433	1,036,433			7	132	5	120	2	4	12				9
3,614	64,746	163,922	163,922			4	48	3	24	1	8	24				10
12,141	86,720	274,011	267,011		6,400	6	96	3	24	3	24	72				11
40,253	306,203	1,316,170	1,295,100		21,070	24	188	24	188							12
22,065	176,340	447,210	406,310	36,900	4,000	10	172	8	76	2	32	96				13
14,569	120,748	346,790	289,779		57,011	9	65	9	65							14
89,238	602,920	1,575,126	1,575,126			15	359	9	158	6	67	201				15
19,595	168,526	671,422	671,422			15	228	13	162	2	22	66				16
696,334	4,717,404	12,125,783	11,989,457	17,000	119,326	99	2,661	48	978	44	540	1,638	7	45	45	17
867,168	2,697,041	9,213,545	8,881,897		331,648	95	1,745	66	1,014	16	205	615	13	116	116	18
391,847	2,236,306	6,406,924	6,406,924			61	760	61	760							19
46,840	375,028	1,323,896	1,323,896			27	310	22	145	5	55	165				20
29,067	188,724	431,900	431,900			7	120	6	96	1	8	24				21
103,817	206,374	878,518	873,435		5,083	21	215	20	206	1	3	9				22
340,313	1,598,091	4,373,457	4,332,366		41,091	83	753	83	753							23

<sup>1</sup> Included in "all other states" in 1900. Not reported in 1890.

<sup>2</sup> Includes establishments distributed as follows: California, 1; Delaware, 1; Michigan, 1.

<sup>3</sup> Includes establishments distributed as follows: Delaware, 1; Illinois, 1; Maryland, 2; Massachusetts, 1; Missouri, 2; West Virginia, 2.

<sup>4</sup> Includes establishments distributed as follows: Delaware, 1; Illinois, 5; Maryland, 4; Massachusetts, 4; Michigan, 1; Missouri, 3; New York, 9; Ohio, 22.

In 1890 the number of establishments engaged in the manufacture of building glass was 100; in 1900 the number was 124, an increase of 24 per cent; and in 1905 the number reported was 138, an increase of 11.3 per cent between 1900 and 1905 and 38 per cent between 1890 and 1905. Of the 138 establishments reported in 1905, 103, or 74.6 per cent, were engaged in the manufacture of window glass; 17, or 12.3 per cent, plate glass; and 18, or 13.1 per cent, "all other glass."

The amount of capital invested in establishments producing building glass was \$18,353,576 in 1890, \$26,617,122 in 1900, and \$40,666,410 in 1905. The per cent of increase was 45 from 1890 to 1900, 52.8 from 1900 to 1905, and 121.6 from 1890 to 1905. The average amount of capital invested per establishment reported was \$183,536 in 1890, \$214,654 in 1900, and \$294,684 in 1905. In 1890 the proprietors and firm members and their salaries were included with salaried officials, clerks, etc., but they were not so included in 1900 nor in 1905. This fact should be considered in making a comparison with 1890 figures for salaried officials, clerks, etc.

The cost of materials used shows but a slight increase between 1890 and 1900, but from 1900 to 1905 the increase was \$3,531,618, or 75.5 per cent. Of the total cost of materials in 1905, about \$2,000,000 was expended in glass sand, soda ash, and salt cake, about \$2,700,000 in fuel, and about \$1,000,000 in lumber, boxes, etc., which shows that about one-fourth of the total cost was for principal glassmaking materials, one-third for melting materials, and one-eighth for packing materials.

The value of products between 1890 and 1900 increased \$3,167,938, or 22.7 per cent, and between 1900 and 1905, \$4,461,297, or 26.1 per cent. The average value of the total product per establishment was \$139,283 in 1890, \$137,873 in 1900, and \$156,214 in 1905. During the census year 1905 building glass establishments in New York and Pennsylvania produced pressed and blown glass and bottles and jars to the value of \$53,900.

The number of furnaces increased 46, or 23.6 per cent, from 1890 to 1900, while the pot capacity increased 1,702, or 84.1 per cent. Between 1900 and 1905 the number of furnaces increased 1, or four-tenths of 1 per cent, while the pot capacity increased 1,165, or 31.3 per cent. The increase in pot capacity from 1890 to 1905 was 141.6 per cent. The number of pot furnaces decreased 43, or 22.1 per cent, from 1890 to 1905, while the number of pots remained practically the same as in 1890. Between 1900 and 1905 continuous tank furnaces increased in number 45, or 132.4 per cent, and in

pot capacity 1,440, or 110.9 per cent. The figures for total furnaces show that the average pot capacity per furnace was 10 in 1890, 15 in 1900, and 20 in 1905. The average pot capacity of the continuous tank furnaces was 38 in 1900 and 34 in 1905. These figures illustrate the greater capacity of the continuous tank as compared with the pot furnace.

In the manufacture of building glass the states of Pennsylvania and Indiana ranked first and second, respectively, in value of products, capital, and number of establishments; Ohio was third in value of products and capital, and, with New York, fourth in number of establishments; West Virginia was fourth in value of products, fifth in capital, and third in number of establishments; Missouri was fifth in value of products, fourth in capital, and, with New Jersey and Illinois, seventh in number of establishments; New York was sixth in value of products and capital, and, with Ohio, fourth in number of establishments; Kansas was seventh in value of products and capital and sixth in number of establishments; Illinois was eighth in value of products and capital, and, with Missouri and New Jersey, seventh in number of establishments; New Jersey was ninth in value of products and capital, and, with Missouri and Illinois, seventh in number of establishments.

Since the census of 1900 a machine for the manufacture of window glass has been invented, and it is used exclusively by one company, which has acquired rights to the machine in the United States. In 1905 this company operated 15 continuous tank furnaces, equipped with 124 of these machines. The products of these machines had but little effect on the total output of window glass during the census of 1905, as the machine was being perfected during that year. If, as it is claimed, however, the machine is a complete success, the effect on the industry may be inferred, as its operations are entirely automatic.

Plate glass manufacturers have recently taken up the production of glass in imitation of marble. This substitute is peculiarly adapted for use in restaurants, hospitals, and other places where cleanliness is essential, for, unlike marble, it does not absorb moisture. It is cast in the same manner as plate glass and is afterwards ground and polished. Plate glass establishments are also manufacturing a thin plate, which is made in the same way as that of ordinary thickness, except that the original cast is thinner.

*Pressed and blown glass.*—Table 5 is a comparative summary of the statistics for establishments manufacturing pressed and blown glass and bottles and jars, as returned at the censuses of 1890, 1900, and 1905.

## MANUFACTURES.

TABLE 5.—PRESSED AND BLOWN GLASS AND BOTTLES AND JARS—

STATE.	Census.	Number of establishments.	Capital.	SALARIED OFFICIALS, CLERKS, ETC.		WAGE-EARNERS AND WAGES.							
				Number.	Salaries.	Total.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.	
						Average number.	Wages.	Average number.	Wages.	Average number.	Wages.	Average number.	Wages.
1 United States ...	1905	261	\$48,722,741	2,112	\$2,784,222	40,089	\$26,742,058	30,348	\$21,500,390	3,430	\$861,362	6,311	\$1,380,806
2	1900	231	34,806,781	1,653	1,980,393	40,016	18,055,037	30,372	15,901,020	3,509	835,100	7,035	1,318,317
3	1890	194	22,013,274	2,803	2,894,449	32,010	13,726,058	24,431	12,472,386	1,818	311,652	6,661	942,020
4 Illinois.....	1905	10	3,302,345	100	138,350	4,538	2,850,470	4,028	2,751,025	127	26,853	883	72,001
5	1900	5	2,143,658	71	106,600	3,291	1,615,786	2,594	1,491,391	148	28,456	549	65,939
6	1890	8	1,353,978	28	40,210	2,291	937,515	1,747	871,420	20	3,860	524	62,235
7 Indiana.....	1905	58	6,871,646	284	399,220	9,059	4,728,818	7,735	4,415,850	487	101,018	837	211,050
8	1900	59	5,694,974	285	375,122	9,103	3,974,228	7,002	3,557,023	634	129,808	1,467	286,497
9	1890	10	659,463	27	30,305	1,480	554,010	1,134	514,003	180	21,951	166	17,766
10 Kansas <sup>1</sup> .....	1905	5	288,003	17	16,950	460	215,520	362	192,950	44	9,758	54	12,812
11 Maryland.....	1905	6	523,199	28	35,328	649	354,235	502	324,328	34	9,124	113	20,783
12	1900	5	479,534	28	36,570	557	275,354	477	249,756	54	8,073	126	16,025
13	1890	5	371,205	10	9,768	702	358,783	448	317,005	24	6,804	290	34,014
14 Massachusetts <sup>4</sup> .....	1905	4	610,763	45	64,088	855	441,541	729	409,741	96	24,500	30	7,300
15	1900	4	255,949	38	27,000	375	170,329	331	169,801	10	4,392	25	5,046
16 Missouri.....	1905	3	553,928	14	24,002	550	358,061	475	340,331	8	1,800	76	16,830
17 New Jersey.....	1905	19	6,142,712	362	353,458	5,301	3,055,079	4,069	2,007,054	124	20,603	568	119,022
18	1900	22	5,178,672	309	278,634	5,153	2,290,590	4,135	2,115,061	170	32,726	847	151,718
19	1890	22	2,770,971	130	116,331	4,606	2,000,016	3,553	1,888,004	42	8,405	1,011	112,817
20 New York.....	1905	20	3,131,727	130	189,885	2,847	1,625,238	2,501	1,517,306	163	25,035	243	82,207
21	1900	20	1,908,790	106	124,538	2,328	1,140,073	1,975	1,075,092	73	17,831	280	47,150
22	1890	21	1,507,801	45	52,406	2,505	1,054,934	1,869	952,003	92	17,025	544	35,006
23 Ohio.....	1905	29	6,552,723	256	372,134	6,717	3,683,437	5,194	3,344,302	787	180,605	736	152,530
24	1900	21	3,412,370	174	226,459	4,060	1,691,378	3,028	1,468,052	405	96,017	636	120,409
25	1890	37	2,970,987	163	171,519	5,134	2,037,452	3,752	1,830,233	538	74,227	844	126,992
26 Pennsylvania.....	1905	71	15,709,860	635	911,319	12,962	6,702,858	9,338	5,000,176	1,082	207,604	2,542	534,088
27	1900	73	13,626,067	535	675,368	12,901	5,580,771	8,768	4,658,460	1,526	409,349	2,667	512,692
28	1890	71	10,743,190	320	373,488	13,111	5,460,828	9,652	4,808,848	909	139,956	2,760	431,024
29 Virginia <sup>5</sup> .....	1905	4	402,459	11	17,808	472	263,657	404	248,128	.....	.....	68	15,520
30 West Virginia.....	1905	22	2,615,210	141	151,282	2,974	1,410,329	2,079	1,200,347	445	100,695	450	94,287
31	1900	14	1,265,624	80	93,016	1,886	734,076	1,258	693,817	468	103,748	160	27,111
32	1890	7	825,313	34	46,946	1,371	511,070	970	446,340	100	32,632	211	32,098
33 All other states.....	<sup>6</sup> 1905	10	2,013,166	83	108,469	1,636	961,360	1,332	870,102	63	42,077	211	40,067
34	<sup>7</sup> 1900	8	841,125	27	36,420	1,093	563,042	803	510,377	12	4,100	278	48,555
35	<sup>8</sup> 1890	13	1,395,267	46	53,482	1,650	791,941	1,306	740,031	33	6,732	311	30,178

<sup>1</sup>Not reported in 1890.<sup>2</sup>Includes proprietors and firm members with their salaries; number only reported in 1905 and 1900, but not included in this table.<sup>3</sup>Not reported in 1890 and 1900.<sup>4</sup>Included in "all other states" in 1890.<sup>5</sup>Included in "all other states" in 1900. Not reported in 1890.

COMPARATIVE SUMMARY, BY STATES: 1890 TO 1905.

Miscellaneous expenses.	Cost of materials used.	VALUE OF PRODUCTS.					FURNACES.										
		Total.	Pressed and blown glass.	Bottles and jars.	Building glass.	All other products.	Total.		Pot.		Tank. <sup>1</sup>						
							Number.	Pot capacity.	Number.	Number of pots.	Continuous.			Intermittent.			
											Number.	Number of rings.	Pot capacity.	Number.	Tons capacity.		Pot capacity.
\$4,700,710	\$17,034,820	\$58,050,467	\$21,925,258	\$33,603,063	\$317,556	\$2,199,590	629	7,840	246	2,730	287	2,354	4,703	96	402	402	1
2,222,776	12,051,925	30,443,478	17,076,125	21,676,701	.....	690,562	563	6,215	258	2,811	172	1,317	2,634	133	770	770	2
1,108,151	7,510,450	27,122,708	18,601,244	8,521,464	.....	.....	369	2,908	369	2,908	.....	.....	.....	.....	.....	.....	3
349,700	1,328,085	5,338,181	149,205	4,940,156	.....	239,760	38	708	11	133	22	270	540	5	30	30	4
210,329	664,853	2,810,308	131,618	2,678,780	.....	.....	27	423	9	117	11	133	266	7	40	40	5
105,387	566,095	1,945,790	949,833	995,907	.....	.....	18	140	18	140	.....	.....	.....	.....	.....	.....	6
497,899	4,152,300	10,916,311	2,859,087	7,213,456	.....	843,768	101	1,534	24	304	77	615	1,230	.....	.....	.....	7
341,500	3,262,466	9,045,935	2,691,787	6,327,468	.....	26,680	142	1,528	43	529	63	397	794	36	205	205	8
63,257	354,629	1,163,664	672,170	491,485	.....	.....	21	116	21	116	.....	.....	.....	.....	.....	.....	9
18,200	273,208	577,636	64,697	407,868	.....	105,071	6	94	1	6	5	44	88	.....	.....	.....	10
31,411	168,732	589,589	46,191	536,478	.....	6,920	10	109	8	91	1	5	10	1	8	8	11
22,313	120,759	451,633	100,000	316,633	.....	8,000	8	85	7	79	.....	.....	.....	.....	.....	.....	12
15,966	139,971	674,900	674,900	.....	.....	.....	7	77	7	77	.....	.....	.....	.....	.....	.....	13
97,244	316,080	1,011,373	558,911	50,000	.....	402,462	7	52	7	52	.....	.....	.....	.....	.....	.....	14
13,483	130,095	402,258	382,091	20,167	.....	.....	6	137	5	47	.....	.....	.....	1	90	90	15
77,313	182,905	744,593	119,010	607,383	.....	18,200	3	72	.....	.....	.....	.....	.....	.....	.....	.....	16
472,133	1,791,493	6,286,273	181,559	6,066,714	38,000	.....	76	965	20	159	.....	.....	.....	.....	.....	.....	17
229,514	1,401,980	4,819,811	21,300	4,452,210	.....	340,292	78	928	30	231	34	373	746	11	60	60	18
75,761	944,759	3,901,982	1,235,426	2,666,566	.....	.....	56	281	56	281	.....	.....	.....	14	79	79	19
302,822	1,235,633	3,832,550	1,001,624	1,869,245	50,000	20,687	40	548	23	208	22	162	324	4	16	16	20
130,936	778,812	2,410,188	1,173,784	1,195,270	.....	41,128	42	464	20	182	14	115	230	8	52	52	21
89,366	582,180	2,000,842	1,307,156	693,686	.....	.....	39	259	39	259	.....	.....	.....	.....	.....	.....	22
694,324	2,233,601	7,451,082	3,054,660	2,961,727	50,000	484,095	78	970	34	462	30	236	472	14	42	42	23
136,007	1,094,638	3,875,061	2,738,289	1,658,955	.....	78,417	45	548	29	377	10	73	146	6	25	25	24
196,432	1,139,651	4,073,385	3,554,370	619,015	.....	.....	55	521	55	521	.....	.....	.....	.....	.....	.....	25
1,569,613	4,607,789	15,545,010	9,406,183	5,934,144	170,556	26,027	170	1,807	89	959	49	372	744	32	104	104	26
1,000,711	3,738,422	12,797,585	8,453,550	4,162,900	.....	181,045	168	1,075	102	1,103	28	207	414	36	158	158	27
519,331	3,058,506	10,772,213	8,700,124	2,072,089	.....	.....	136	1,232	136	1,232	.....	.....	.....	.....	.....	.....	28
35,670	169,461	540,031	.....	540,031	.....	.....	6	82	.....	.....	6	41	82	.....	.....	.....	29
840,806	884,454	3,274,667	2,620,665	602,002	.....	52,000	65	662	27	336	14	106	212	24	114	114	30
109,904	557,368	1,770,553	1,379,706	381,847	.....	9,000	32	224	12	134	.....	.....	.....	20	90	90	31
40,805	277,033	945,234	945,234	.....	.....	.....	17	144	17	144	.....	.....	.....	.....	.....	.....	32
144,566	601,088	1,933,265	63,406	1,869,859	.....	.....	20	231	2	15	13	94	188	5	28	28	33
28,079	302,497	1,050,456	4,000	1,052,456	.....	.....	17	203	1	12	12	83	166	4	25	25	34
91,856	455,835	1,644,698	561,972	1,082,726	.....	.....	20	138	20	138	.....	.....	.....	.....	.....	.....	35

<sup>1</sup>Includes establishments distributed as follows: California, 3; Colorado, 1; Georgia, 1; Indian Territory, 1; Michigan, 1; South Carolina, 1; Tennessee, 1; Wisconsin, 1.

<sup>2</sup>Includes establishments distributed as follows: California, 1; Colorado, 1; Georgia, 1; Michigan, 1; Missouri, 1; Virginia, 2; Wisconsin, 1.

<sup>3</sup>Includes establishments distributed as follows: California, 1; Colorado, 1; Georgia, 2; Kentucky, 2; Maryland, 2; Massachusetts, 2; Missouri, 2; Wisconsin, 1.

To make the figures comparable and also to avoid disclosing the individual operations of establishments in states in which there were few, the statistics for 1905, like those for 1900, treat as a single branch of the glass industry the manufacture of pressed and blown glass and bottles and jars.

Table 5 shows that the number of establishments engaged in the manufacture of pressed and blown glass and bottles and jars was 194 in 1890, 231 in 1900, and 261 in 1905, an increase of 19.1 per cent between 1890 and 1900, 13 per cent between 1900 and 1905, and 34.5 per cent between 1890 and 1905. The amount of capital invested increased from \$22,613,274 in 1890 to \$34,806,781 in 1900, and to \$48,722,741 in 1905. The increase between 1890 and 1900 was 53.9 per cent; between 1900 and 1905, 40 per cent; and between 1890 and 1905, 115.5 per cent.

The average number of men, women, and children reported, which was 32,910 in 1890, 40,916 in 1900, and 49,089 in 1905, increased 24.3 per cent from 1890 to 1900, 20 per cent from 1900 to 1905, and 49.2 per cent from 1890 to 1905. Wages during the same periods increased from \$13,726,058 to \$18,055,037, and then to \$26,742,058. The per cent of increase was 31.5 per cent from 1890 to 1900, 48.1 per cent from 1900 to 1905, and 94.8 per cent from 1890 to 1905.

The value of products in 1890 was \$27,122,708; in 1900, \$39,443,478; and in 1905, \$58,050,467. The per cent of increase was 45.4 from 1890 to 1900, 47.2 from 1900 to 1905, and 114 from 1890 to 1905. The value of pressed and blown glass manufactured decreased from \$18,601,244 in 1890 to \$17,076,125 in 1900, but increased to \$21,925,258 in 1905. These figures show a decrease of 8.2 per cent between 1890 and 1900, an increase of 28.4 per cent between 1900 and 1905, and an increase of 17.9 per cent between 1890 and 1905. The value of bottles and jars manufactured was \$8,521,464 in 1890, \$21,676,791 in 1900, and \$33,608,063 in 1905. The rate of increase was 154.4 per cent from 1890 to 1900, 55 per cent from 1900 to 1905, and 294.4 per cent from 1890 to 1905. The value of all other products increased from \$690,562 in 1900 to \$2,199,590 in 1905, or 218.5 per cent.

In 1890, 68.6 per cent of the total value of products was pressed and blown glass and 31.4 per cent bottles and jars; in 1900, 43.3 per cent was pressed and blown glass, 55 per cent bottles and jars, and 1.7 per cent all other products; and in 1905, 37.8 per cent was pressed and blown glass, 57.9 per cent bottles and jars, 0.5 per cent building glass, and 3.8 per cent all other products. The average value of products for each establishment in 1890 was \$139,808; in 1900, \$170,751; and in 1905, \$222,416.

The number of furnaces reported in 1890 was 369, as compared with 563 in 1900 and 629 in 1905. The rate of increase was 52.6 per cent from 1890 to 1900, 11.7 per cent from 1900 to 1905, and 70.5 per cent from 1890

to 1905. The total pot capacity of all furnaces increased from 2,908 in 1890 to 6,215 in 1900, and to 7,840 in 1905. The per cent of increase was 113.7 from 1890 to 1900, 26.1 from 1900 to 1905, and 169.6 from 1890 to 1905. The average pot capacity per establishment in 1890 was 15 pots; in 1900, 27 pots; and in 1905, 30 pots. The number of pot furnaces in 1890 was 369; in 1900, 258; and in 1905, 246. The decrease from 1890 to 1900 was 30.1 per cent; from 1900 to 1905, 4.7 per cent; and from 1890 to 1905, 33.3 per cent. Tank furnaces, which were considered an experiment in 1890, were not reported at that census, but at the census of 1900, 172 continuous tank furnaces, with 1,317 rings, equivalent to 2,634 pots, were returned. In 1905, 287 continuous tank furnaces, with 2,354 rings, equivalent to 4,708 pots, were reported. The increase in number of continuous tank furnaces was 66.9 per cent; in number of rings, 78.7 per cent; and in pot capacity, 78.7 per cent. The number of intermittent tank furnaces decreased from 133 in 1900 to 96 in 1905, or 27.8 per cent, and the tons capacity, which is the same as the pot capacity, decreased from 770 to 402, or 47.8 per cent.

The remarkable increase in the average amount of capital invested, number of wage-earners employed, and the pot capacity of establishments engaged in the manufacture of pressed and blown glass and bottles and jars shows the growth and progress of this branch of the glass industry. Since 1890, in addition to the establishment of new plants, old factories have been enlarged, additional furnaces erected, and automatic machinery for blowing bottles and jars and stamping glassware has been installed. These improvements have greatly added to the capacity of the plants of the country and explain the increase in value of products. The increase in the value of all other products was due to the manufacture of paper boxes, packing, etc., caused by the demand of the trade in general for a more attractive and neater package.

The increase since 1900 in the number of establishments manufacturing pressed and blown glass and bottles and jars has been principally in the Western glass producing states. Illinois showed a gain of 5 establishments; Kansas, which appears for the first time as a glass producing state, reported 5; Ohio and West Virginia each gained 8, and Missouri, 2. The number of establishments in Indiana decreased 1. The Eastern states which show gains are Maryland, 1 establishment, and Virginia, 2. New Jersey lost 3 establishments and Pennsylvania, 2.

The rank of states in 1905, according to the number of establishments, amount of capital invested, number of wage-earners employed, and value of products, as shown by Table 5, was: Pennsylvania first, Indiana second, and Ohio third. The rank of New Jersey was fourth in amount of capital invested, number of wage-earners employed, and value of products, and sixth in

number of establishments; Illinois was fifth in number of wage-earners, amount of capital invested, value of products, and seventh in number of establishments; West Virginia was fourth in number of establishments, sixth in number of wage-earners, and seventh in capital invested and value of products; New York was fifth in number of establishments, sixth in capital invested and value of products, and seventh in number of wage-earners; Maryland was eighth in number of establishments, ninth in number of wage-earners, and tenth in capital and value of products; Kansas was ninth in number of establishments, eleventh in value of products, and twelfth in capital and number of wage-earners; Virginia, which with Massachusetts was tenth in number of establishments, was eleventh in capital and number of wage-earners, and twelfth in value of products; Massachusetts, which with Virginia was tenth in number of establishments, was eighth in capital, number of wage-earners, and value of products.

One of the recent improvements in the manufacture of pressed ware is in the production of glass for signal purposes. Although many attempts have been made to produce a solid red glass for use in signals, they have been attended with but little success. The red glass heretofore produced and used in the manufacture of signal roundels, lenses, etc., was so black when used in the solid state that it hardly permitted any rays of light to penetrate it. It was necessary, therefore, to spread this red glass in very thin layers or films on transparent glass of the desired shape, a method technically known as the "plating," "casing," or "flashing" process. Recently an acknowledged expert in colored glass stated that after experimenting many years he had succeeded in producing a signal glass in solid red which would meet all requirements. He also stated that he had recently produced a glass which is unaffected by sudden changes of temperature. Although articles of this quality of glass are not yet produced for commercial use, it is claimed that its advantages over the present commercial glass had been demonstrated by heating a globe made by his new formula, and while it was hot sprinkling it with cold water. The result of such treatment of ordinary glass is well known, but the globe so tested failed to show the slightest crack.

During the past five years many machines for the manufacture of bottles have been invented. One of these machines has been very successful and seems to meet all the requirements of the bottle industry, as it can be built to produce a narrow or wide neck bottle of any shape. This machine has so recently come into use that it was not a factor in the production of bottles during the census year. At present it is employed in the manufacture of beer bottles, a branch of the industry in which the demand is for a uniform pint or quart bottle. As the beer industry consumes more bottles than any other commercial enterprise, it is evident that the object of the machine manufacturers was to enter

the most remunerative field of bottle production and at the same time to develop their machine in the manufacture of the simplest and most uniform bottle. The mechanical production of the other forms of bottles will be taken up as rapidly as the development of the machine permits. It is also probable that this machine will invade the fields already occupied by other glass blowing machines, for it is entirely automatic, not only in blowing, but in collecting its own glass, and with the perfection of a ware conveyor attachment, bottles will be manufactured and annealed entirely by machinery. The capacity of this machine is estimated at 12 bottles per minute. One man, a machine tender, can take care of three machines. As the speed of the machines is not sufficient for them to run hot, they can be operated twenty-four hours per day, which would make the output about 360 gross of bottles per day at a labor expense of three machine tenders on eight hour turns, or two on twelve hour turns.

*Materials.*—Table 6 is a comparative summary showing the quantity and cost of materials used in the manufacture of glass for 1900 and 1905.

TABLE 6.—Glass manufacture—quantity and cost of materials used, with per cent of increase, 1905 and 1900.

	1905	1900	Per cent of increase.
Materials used, total cost.....	\$26,145,522	\$10,731,000	56.3
Glass sand:			
Tons.....	769,792	581,720	32.3
Cost.....	\$1,547,147	\$840,822	82.7
Soda ash (carbonate of soda):			
Tons.....	215,462	157,779	36.6
Cost.....	\$4,068,804	\$2,250,939	80.0
Salt cake (sulphate of soda):			
Tons.....	53,905	53,257	1.2
Cost.....	\$802,611	\$518,590	54.8
Nitrate of soda:			
Tons.....	11,915	10,770	10.6
Cost.....	\$511,854	\$320,937	59.5
Limestone:			
Tons.....	115,655	91,015	27.1
Cost.....	\$274,209	\$181,717	50.9
Lime:			
Hundredweight.....	633,074	794,679	17.4
Cost.....	\$241,755	\$147,901	63.5
Arsenic:			
Pounds.....	2,676,950	2,349,261	13.9
Cost.....	\$92,674	\$112,630	17.8
Carbon:			
Tons.....	3,750	4,155	10.7
Cost.....	\$22,333	\$17,000	31.4
Manganese:			
Pounds.....	3,096,939	1,493,538	107.4
Cost.....	\$101,279	\$57,493	76.2
Litharge (red lead):			
Pounds.....	9,613,649	8,386,106	14.6
Cost.....	\$555,130	\$490,200	13.2
Potash or pearlash:			
Pounds.....	5,446,338	4,406,211	23.6
Cost.....	\$228,008	\$186,847	22.4
Grinding sand:			
Tons.....	410,856	265,438	54.8
Cost.....	\$332,013	\$166,040	100.0
Rouge:			
Pounds.....	1,098,566	837,536	31.2
Cost.....	\$29,809	\$24,747	20.7
Plaster of Paris:			
Tons.....	33,930	23,066	47.1
Cost.....	\$109,938	\$108,531	56.6
Fire clay or pot clay:			
Pounds.....	42,910,286	32,151,017	33.5
Cost.....	\$200,444	\$221,183	31.3
Pots, not including those made at works:			
Number.....	9,343	8,941	4.5
Cost.....	\$432,591	\$381,147	13.5
Flattening stones:			
Number.....	410	272	50.7
Cost.....	\$22,266	\$16,344	36.2
Fuel:			
Total cost.....	\$6,243,006	\$3,203,146	94.9
Natural gas, cost.....	\$2,777,157	\$1,575,278	76.3

<sup>1</sup>Decrease.

TABLE 6.—Glass manufacture—quantity and cost of materials used, with per cent of increase: 1905 and 1900—Continued.

	1905	1900	Per cent of increase.
Materials used, total cost—Continued.			
Fuel—Continued.			
Total cost—Continued.			
Oil—			
Gallons.....	18,340,660	12,090,850	44.6
Cost.....	\$520,868	\$409,158	28.8
Coal—			
Tons.....	1,488,476	755,463	97.0
Cost.....	\$2,748,769	\$1,074,074	155.9
All other fuel.....	\$190,215	\$144,636	31.5
Rent of power and heat.....	\$42,164	\$62	.....
Lumber, casks, barrels, boxes, etc.....	\$4,750,213	\$3,300,627	40.1
Caps, metal trimmings, and rubber supplies.....	\$1,096,145	\$1,522,017	11.4
Supplies used in repairs on tanks and furnaces.....	\$741,953	\$531,916	39.5
Mill supplies.....	\$265,444	\$138,434	91.7
All other materials.....	\$2,102,528	\$901,751	121.1
Freight.....	\$400,504	\$894,088	45.1

<sup>1</sup> Decrease.

Table 6 shows that the cost of materials used increased from \$16,731,009 in 1900 to \$26,145,522 in 1905, an increase of \$9,414,513. The per cent of increase was 56.3.

The amount of each ingredient used in glassmaking, except carbon, increased between 1900 and 1905. The proportional increase in the amount used was greatest for manganese, for which the per cent of increase was 107.4, and smallest for salt cake, for which the per cent of increase was 1.2. The cost of each item, with the exception of arsenic, also increased, the percentages of increase varying from 82.7 for sand to 13.2 for litharge. The differences between the percentages of increase in quantity and in cost suggest that the average cost per unit has increased in a marked degree for all of the principal constituents and decreased only in the case of a few auxiliary materials.

Silica in the form of sand is the only constituent of glass that is absolutely essential and enters the composition of all varieties of glass as its true foundation. Silica as sand occurs in nature very abundantly. Vast deposits are found in the New England states, Pennsylvania, New Jersey, Maryland, Illinois, Missouri, and Minnesota. Many of these deposits show by analysis 99 per cent silica. The proportion of silica used varies according to the character of glass desired. An increase in the percentage of silica in any glass increases the resistance of the glass to corrosion and decay and also increases the resistance to melting and fusing. As the various grades of sand contain different percentages of impurities, only the finest grade of sand is used when a colorless and brilliant glass is desired. Iron, alumina, and organic matter are the principal impurities present, alumina generally being present as clay and gravel. Many of these impurities are removed by washing and roasting, but the iron and organic matter can be removed or neutralized only by chemicals. Iron when present imparts to glass a greenish tint, but this can be corrected by the use of manganese. The or-

ganic matter carbonizes in the pot or tank during the "melt" and is removed by the use of arsenic.

The quantity of glass sand reported in 1900 was 581,720 tons, and in 1905, 769,792 tons, an increase of 32.3 per cent. The cost increased from \$846,822 in 1900 to \$1,547,147 in 1905, or 82.7 per cent for the five-year period. The average cost in 1905 was \$2.01 per ton, as compared with \$1.46 in 1900, an increase of 55 cents per ton.

The bases used include sodium carbonate, sodium sulphate, nitrate of soda, calcium carbonate, litharge, and potash.

Sodium carbonate, or soda ash, is the principal base of nearly all modern commercial glass. It was also used by the ancient glassmakers in the form of natron, which was obtained from the natron lakes in Egypt. This natron contained carbonate, sulphate, and chloride of sodium (common salt), and was generally impure. Soda ash, obtained from the ashes of weeds and plants, was also in use, but seldom contained over 30 per cent of soda. In 1790 glassmaking was stimulated by the discovery of a process by Nicholas Le Blanc, whereby chloride of sodium was converted into soda. Soda ash made by this process remained in general use until 1863, when it was supplanted by a process devised by Ernest Solvay, which consists of decomposing sodium chloride by ammonium bicarbonate. It is claimed by glassmakers that soda ash made by the Solvay process does not contain as much iron or carbon as does that obtained by the Le Blanc process. The principal supply of soda ash used in glassmaking in the United States was formerly imported, but in recent years it has been supplied by domestic factories. Since 1900 additional establishments have engaged in the manufacture of soda ash, and the result has been a still further decrease in the amount imported. The report of the Bureau of Statistics, of the Department of Commerce and Labor, shows that 78,571,850 pounds of soda ash were imported in 1900 and 17,930,376 pounds in 1905. Soda ash is used in glassmaking as 48 per cent, 58 per cent, and dense 48 per cent and 58 per cent. Dense soda ash is less bulky, and in many cases is preferred for that reason; also because its carbonic acid is not driven off too rapidly, or before the glass has had sufficient time to clear. During the "melt" 100 pounds of soda ash loses about 30 per cent by volatilization.

The quantity of soda ash, or carbonate of soda, used in 1900 was 157,779 tons, and in 1905, 215,462 tons, an increase of 36.6 per cent. The cost increased from \$2,259,939 in 1900 to \$4,068,804 in 1905, or 80 per cent. The average cost in 1900 was \$14.32 per ton, and in 1905, \$18.88 per ton, an increase of \$4.56 per ton, or 31.8 per cent.

Salt cake, or sodium sulphate, is used as a base principally in the manufacture of window glass. It is prepared by the decomposition of chloride of sodium by

sulphuric acid. Manufacturers were originally induced to adopt salt cake as a base from motives of economy, but they now seldom use it except as noted above. It has been demonstrated that its decomposition by silicic acid is slow and difficult, and requires a high temperature. Auxiliary agents are often employed to aid fusion when it is used as a base.

The quantity of salt cake used in 1905 increased but 648 tons, or 1.2 per cent. The amount reported in 1900 was 53,257 tons, and in 1905, 53,905 tons. The cost, however, increased from \$518,590 in 1900 to \$802,611 in 1905, an increase of \$284,021, or 54.8 per cent. The average cost per ton in 1900 was \$9.74, and in 1905, \$14.89 per ton, a gain of \$5.15 per ton, or 52.9 per cent.

Sodium nitrate is used in the manufacture of glass as an auxiliary base. Its oxidizing properties facilitate fusion and also aid in expelling carbonaceous matter. It loses about 50 per cent during the melt.

In 1905 the amount of nitrate of soda reported was 11,915 tons, costing \$511,854, as compared with 10,770 tons, costing \$320,937, in 1900, an increase in quantity of 1,145 tons, or 10.6 per cent, and in cost of \$190,917, or 59.5 per cent. The average cost per ton in 1900 was \$29.80, and in 1905, \$42.96, a gain of \$13.20 per ton, or 44.3 per cent.

In glassmaking, calcium carbonate in the form of limestone and lime is used as a base. The action of limestone is to harden the glass and make it less soluble. Limestone is often used in preference to lime, as it gives off more carbonic acid gas during the melt. Combined with soda, limestone causes a violent agitation of the melted materials, which drives off cords, blisters, etc., tending to produce a more uniform glass. The action of lime in glassmaking is somewhat similar to that of limestone.

The quantity of limestone used in 1900 was 91,015 tons, costing \$181,717, as compared with 115,655 tons, costing \$274,209, in 1905, an increase in quantity of 24,640 tons, or 27.1 per cent, and in cost of \$92,492, or 50.9 per cent. The average cost in 1900 was \$2 per ton, and in 1905, \$2.37 per ton.

There were 794,679 hundredweight of lime used in 1900, costing \$147,901, compared with 933,074 hundredweight in 1905, costing \$241,755, an increase in quantity of 138,395 hundredweight, or 17.4 per cent, and in cost of \$93,854, or 63.5 per cent.

Lead in the form of litharge or red lead was first used in glassmaking in the seventeenth century, and its introduction is generally credited to English glassmakers. Its use was brought about by the change from open to closed pots, in order to protect the glass from impurities originating from the use of a fuel which had been substituted for wood. The use of covered pots retarded the fusion of the materials to such an extent that a better flux was required. Lead is used as a base in combination with potash, soda, etc., but potash is usually its co-base. It is used in the manufacture of

glassware, artificial gems, and optical glasses. Red lead was formerly imported, but the greater portion of the quantity now used is of domestic manufacture.

In 1900 the quantity of litharge used was 8,386,106 pounds, valued at \$490,200, and in 1905 the amount reported was 9,613,649 pounds, costing \$555,130. The increase in quantity was 14.6 per cent, and in cost 13.2 per cent. The average cost per pound both in 1900 and 1905 was 6 cents.

Potash or pearlash is used in glassmaking, principally in combination with litharge. Potash is more effective in facilitating fusion than soda, and in addition it has another property that can not be overlooked or underestimated, in that it exerts no color action. Since the discovery of the processes for manufacturing soda ash, the use of potash has decreased on account of the cost. During the melt 100 pounds of 72 per cent potash loses 20 per cent.

The amount of potash reported in 1900 was 4,406,211 pounds, costing \$186,847, and in 1905 the quantity was 5,446,338 pounds, costing \$228,608. The quantity used in 1905 increased 23.6 per cent, and the cost, 22.4 per cent. The average value per pound was 4 cents in both years.

Other auxiliary chemicals used in glassmaking are arsenic, carbon, and manganese. Arsenic, although a material greatly used in glassmaking, is not essential. It is an auxiliary used to purify the glass. As it acts directly on the carbonaceous impurities present, it is known in the glass world as the "great decarbonizer." Carbon is employed in glassmaking for two purposes: to lower the fusing point when salt cake is used as a base and to impart color when a glass from a straw yellow to a dark amber is desired. Manganese dioxide, generally known as manganese, is used in glassmaking principally as a "decolorizer" to neutralize the greenish tint imparted to glass by iron, hence it has been named the "great decolorizer." Since it parts very readily with a portion of its oxygen, manganese is also a powerful oxidizing agent.

The quantity of arsenic reported in 1900 was 2,349,261 pounds, costing \$112,630, as compared with 2,676,650 pounds in 1905, costing \$92,574; and thus, while the quantity used increased 13.9 per cent, the cost decreased 17.8 per cent.

In 1900 the quantity of carbon reported was 4,155 tons, costing \$17,000, and in 1905 the quantity was 3,750 tons, costing \$22,333, a decrease of 9.7 per cent in quantity and an increase of 31.4 per cent in cost.

The quantity of manganese reported in 1900 was 1,493,538 pounds, costing \$57,493, and in 1905 the amount was 3,096,939 pounds, costing \$101,279, an increase of 107.4 per cent in quantity and of 76.2 per cent in cost. The average cost per pound was 4 cents in 1900, and 3 cents in 1905.

The increase shown by the figures for 1905, as compared with those for 1900, in quantity and cost of

grinding sand, rouge, plaster of Paris, fire clay, pots, and flattening stones is substantial and is justified by the increase in production.

The question of fuel is undoubtedly the one most important to the glassmaker. With the aid of a good fuel a glassmaker can produce a comparatively good glass from impure materials, but he can not produce a good glass with a poor fuel, no matter how pure the materials may be. Since the establishment of the first glass factory in Virginia in 1608, manufacturers of glass have been influenced to a great extent in the location of their plants by the supply of fuel. The glass industry of the United States was situated east of the Alleghenies until the adoption of coal as a fuel in glassmaking by an establishment located in Pittsburg in 1797. After this date the attraction of cheap fuel in abundance caused manufacturers to locate their plants farther westward, and the tendency since that time has been to follow the fuel supply. The discovery of natural gas in western Pennsylvania caused many new factories to be located in the vicinity of the gas fields, and also induced many manufacturers in the east to move their plants to that locality. The excellent supply of fuel in Pennsylvania has enabled that state to maintain its prestige in the glass industry. The discovery of natural gas in Ohio again drew manufacturers westward, but the supply was soon exhausted. The discovery of natural gas in Indiana, together with the large bonuses and cheap or free gas offered by cities in that state, brought Indiana rapidly to the front as a glass producing state, but in the last few years the supply of natural gas has been gradually failing, and many factories have suspended operations or moved to new fields. Many manufacturers realize, however, that natural gas, although an ideal fuel in glassmaking, is unreliable, and that on account of the present construction of modern glass factories and the large increase in the amount of machinery used, plants can not be dismantled and moved as easily now as in former years. These considerations have caused manufacturers located in good coal districts to equip their factories with producer gas systems, thereby giving to factory locations a stability which was lacking when the location was determined by the presence of natural gas as a fuel. The discovery of natural gas in Kansas and West Virginia drew several glass factories from Indiana, and also induced many new concerns to locate in those states.

Gas, either natural or artificial, is the ideal fuel in glassmaking because it is not only the cleanest but also the one which furnishes better than any other fuel the even temperature so necessary in the manufacture of glass.

Natural gas is preferred to artificial because it is cheaper and gives more heat, but as the supply is unreliable, factories using it are compelled, sooner or later, to move or to adopt a new fuel. Producer gas, therefore, is probably the best fuel when everything is considered. Its heat is intense, its supply reliable, and as it is produced from slack coal, it is, at the same time, economical. There are many different producer systems in use, but the principle of each is practically the same.

Oil, which furnishes an intense and easily regulated heat, is becoming more generally used in glass manufacture, but it is more expensive than either gas or coal. The use of coal as a fuel in melting glass materials dates from the seventeenth century. While the heat produced is intense, it can not be distributed nor regulated as successfully as that generated from the other fuels, and, moreover, when used for direct heat, a costlier grade of coal is required than is necessary for making producer gas.

The cost of fuel is the largest item of expense in glassmaking. In 1900 it constituted 19.1 per cent of the total cost of materials, and in 1905, 23.9 per cent. The total cost of fuel in 1900 was \$3,203,146, of which \$1,575,278 was for natural gas, \$409,158 for oil, \$1,074,907 for coal, and \$144,636 for "all other fuel." In 1905 the total cost was \$6,243,006, of which \$2,777,157 was for natural gas, \$526,868 for oil, \$2,748,766 for coal, and \$190,215 for "all other fuel." The increase in the cost of total fuel was 94.9 per cent; of natural gas, 76.3 per cent; of oil, 28.8 per cent; of coal, 155.9 per cent; and of "all other fuel," 31.5 per cent. The proportions that the cost of the different items formed of the total cost for fuel at each census are as follows: Natural gas, 49.2 per cent in 1900 and 44.5 per cent in 1905; oil, 12.8 per cent in 1900 and 8.4 per cent in 1905; coal, 33.5 per cent in 1900 and 44 per cent in 1905; and "all other fuel," 4.5 per cent in 1900 and 3.1 per cent in 1905. The cost of fuel, however, in these tables represents only the amount paid for fuel which is purchased and does not represent all the fuel used, much of which is taken from premises owned or controlled by the establishments reporting.

The cost of lumber, casks, barrels, boxes, etc., was the second largest item of expense. In 1900 the cost was \$3,390,627, or 20.3 per cent of the total cost of all materials used, and in 1905 the amount reported was \$4,750,213, or 18.2 per cent of the total cost. The increase in cost in 1905 was 40.1 per cent.

*Products.*—Table 7 is a comparative summary showing the quantity and value of glass products for the United States, as returned at the censuses of 1900 and 1905, with the percentages of increase.

TABLE 7.—Glass manufacture—quantity and value of products, with per cent of increase: 1905 and 1900.

	1905	1900	Per cent of increase.
Products, aggregate value.....	\$70,607,998	\$56,539,712	40.8
Building glass:			
Total value.....	\$21,697,861	\$17,006,234	26.9
Window glass—			
50-foot boxes.....	4,852,315	4,341,282	11.8
Value.....	\$11,610,851	\$10,879,355	6.7
Obscured glass—			
100-foot boxes.....	70,774	.....	.....
Value.....	\$370,030	.....	.....
Plate glass—			
Total cast, square feet.....	34,804,980	134,758,004	0.1
Rough made for sale—			
Square feet.....	17,784	628,084	297.2
Value.....	\$3,529	\$75,887	205.3
Polished—			
Square feet.....	27,293,138	16,883,578	61.7
Value.....	\$7,978,253	\$5,158,598	54.7
Cathedral—			
Square feet.....	6,615,683	8,846,361	25.2
Value.....	\$293,623	\$567,252	48.2
Skylight—			
Square feet.....	15,255,541	3,679,694	314.6
Value.....	\$678,301	\$165,086	310.9
All other building glass, value <sup>1</sup> .....	\$757,184	\$250,056	202.8
Pressed and blown glass:			
Total value.....	\$21,956,158	\$17,076,125	28.6
Tableware—			
100 pieces.....	1,283,974	655,141	96.0
Value.....	\$4,897,537	\$2,617,784	87.1
Jellies, tumblers, and goblets—			
Dozens.....	7,346,214	8,544,050	14.0
Value.....	\$1,630,167	\$2,007,386	218.3
Lamps—			
Dozens.....	487,017	807,705	239.7
Value.....	\$1,247,028	\$1,498,075	216.8
Chimneys—			
Dozens.....	7,039,759	6,901,192	2.0
Value.....	\$3,001,334	\$2,719,583	12.6
Lantern globes—			
Dozens.....	1,765,247	1,044,816	69.0
Value.....	\$852,823	\$497,021	71.6
Globes and other electrical goods <sup>4</sup> —			
Dozens.....	1,001,415	.....	.....
Value.....	\$1,106,317	.....	.....
Shades, globes, and other gas goods <sup>4</sup> —			
Dozens.....	878,244	2,673,854	267.2
Value.....	\$1,049,000	\$2,497,885	222.0
Blown tumblers, stemware, and bar goods—			
Dozens.....	6,282,006	6,127,367	2.5
Value.....	\$2,028,198	\$1,598,652	83.2
Opal ware—			
Dozens.....	1,091,208	3,750,443	170.9
Value.....	\$870,221	\$1,581,731	245.0
Cut glass—			
Dozens.....	83,736	134,726	237.8
Value.....	\$987,556	\$672,463	46.9
All other pressed and blown glass, value.....	\$2,416,308	\$1,384,945	74.5
Bottles and jars:			
Total value.....	\$33,631,003	\$21,676,791	55.1
Prescription vials and druggists' wares—			
Gross.....	3,202,586	2,423,032	32.1
Value.....	\$6,638,508	\$4,005,007	42.3
Beers, sodas, and minerals—			
Gross.....	2,351,852	1,351,118	74.1
Value.....	\$7,027,287	\$5,075,068	56.2
Liquors and flasks—			
Gross.....	2,157,801	985,374	119.0
Value.....	\$5,555,815	\$2,403,447	131.2
Milk jars—			
Gross.....	253,651	146,142	73.6
Value.....	\$1,160,743	\$720,008	59.2
Fruit jars—			
Gross.....	1,061,829	789,298	34.5
Value.....	\$3,436,047	\$2,935,036	17.1
Battery jars and other electrical goods—			
Gross.....	19,974	.....	.....
Value.....	\$105,632	.....	.....
Patent and proprietary—			
Gross.....	1,057,372	1,206,131	27.9
Value.....	\$3,706,510	\$2,002,976	42.5
Packers and preservers—			
Gross.....	1,237,065	784,588	57.7
Value.....	\$2,989,557	\$2,119,221	41.1
Demijohns and carboys—			
Dozens.....	64,450	83,243	222.6
Value.....	\$247,856	\$206,061	20.3
All other bottles and jars, value.....	\$1,860,108	\$940,277	97.8
All other products, value.....	\$2,322,916	\$690,562	286.4

<sup>1</sup> Includes the number of square feet of cathedral, skylight, and wire glass cast in 1900, but not included in 1905.

<sup>2</sup> Decrease.

<sup>3</sup> In order to avoid disclosing the operations of individual establishments, the value of wire glass has been included in the value of "all other building glass."

<sup>4</sup> Electrical and gas goods were not reported separately in 1900.

In order to avoid disclosing the value of products of individual establishments the statistics of production by states have been omitted from Table 7.

The aggregate value of all products of establishments engaged in the manufacture of glass was \$79,607,998 in 1905, and \$56,539,712 in 1900, an increase of 40.8 per cent. The value of products of establishments engaged in the manufacture of building glass in 1905 was \$21,697,861, or 27.3 per cent of the value of the total output of all establishments reporting in that year. The value of products of establishments producing pressed and blown glass was \$21,956,158, or 27.6 per cent of the total; of establishments manufacturing bottles and jars, \$33,631,063, or 42.2 per cent of the total.

In addition to the establishments engaged primarily in the manufacture of glass, two others reported it as a by-product, the value of which was \$9,663. This amount is credited not to the glass industry, but to the industries in which the two establishments were primarily engaged.

During the census year 1905 the number of establishments engaged in the manufacture of window glass was 103, as compared with 100 in 1900. There were 4,852,315 boxes of window glass, valued at \$11,610,851, produced in 1905, as compared with 4,341,282 boxes, worth \$10,879,355, manufactured in 1900. The increase in number of boxes was 11.8 per cent, and in value, 6.7 per cent. The average value in 1900 was \$2.51 per box, and in 1905, \$2.39 per box.

The production of polished plate glass was 27,293,138 square feet, valued at \$7,978,253, in 1905, as compared with 16,883,578 square feet, valued at \$5,158,598, in 1900. The increase between 1900 and 1905 was 61.6 per cent in the quantity of polished plate produced, and 54.6 per cent in the value. The price per square foot in 1905 was 29 cents, as compared with 31 cents in 1900. In addition to the polished plate made, 17,784 square feet of rough plate, valued at \$3,529, was sold in 1905, as compared with 628,684 square feet, valued at \$75,887, in 1900. The decrease in quantity was 97.2 per cent, and in value 95.3 per cent. Rough plate is used for skylights, but it is being displaced by wire glass. The average value per square foot in 1905 was 20 cents, and in 1900, 12 cents. The increased demand for polished plate glass is general. In a marked degree it is taking the place of common glass in large buildings, in which plate glass was formerly used to only a limited extent. The use of plate glass in residences is also rapidly increasing.

In 1900 the value of pressed and blown glass was \$17,076,125, and in 1905, \$21,956,158, an increase of 28.6 per cent. A comparison of the production of pressed and blown glass establishments in 1900 and 1905 reveals many changes, all of which are the natural results of progression. The development of the manufacture of tableware in the United States has

been rapid. Most of the tableware produced during the census year was of the thick, heavy flint variety, in imitation of cut glass. The brilliancy, design, and workmanship of this glass has reached such a point that its resemblance to cut glass is remarkable. In 1905, 1,283,974 hundred pieces of tableware, valued at \$4,897,537, were produced. In 1900 the production was 655,141 hundred pieces, valued at \$2,617,784. The increase was 96 per cent in quantity produced and 87.1 per cent in value. The value was \$3.81 per hundred pieces in 1905 and \$4 in 1900.

Jellies, tumblers, and goblets produced in 1905, as compared with those produced in 1900, show a decrease of 14 per cent in quantity and 18.3 per cent in value. This decrease is attributed to the increased use of fruit jars. The average value was 23 cents per dozen in 1900 and 22 cents in 1905.

The use of oil lamps in the United States is decreasing, due to the wider use of gas and electricity. The cost of installing a gas or an electric plant has been so reduced that many small towns and cities are now equipped with one or both of these systems and have discarded the oil lamp. In 1905 the number of lamps produced was 487,017 dozens, valued at \$1,247,628, and in 1900 the number was 807,765 dozens, valued at \$1,498,675, a decrease of 39.7 per cent in quantity and 16.8 per cent in value. The fact that the per cent of decrease in value is considerably less than that in number is illustrated by the increase in average price per dozen, which was \$1.86 in 1900 and \$2.56 in 1905. This increase is caused by the increase in number of fancy lamps produced. Notwithstanding the decrease in number of lamps produced, the number of chimneys manufactured increased 2 per cent in quantity and 12.6 per cent in value. This increase is probably ac-

counted for by the number exported, as lamp chimneys form a considerable portion of the glass exports from the United States. The lantern globes produced in 1905, as compared with those reported in 1900, show an increase of 69 per cent in number and 71.6 per cent in value. The value in each year was 48 cents per dozen.

In 1900 the number and value of globes and other electrical goods and the number and value of shades, globes, and other gas goods, were not reported separately, as in 1905. The statistics for these two items combined show 2,779,659 dozens, valued at \$3,055,386 in 1905, as compared with 2,673,854 dozens, valued at \$2,497,885 in 1900, an increase of 4 per cent in quantity and 22.3 per cent in value. Opal ware produced in 1905, as compared with that reported in 1900, decreased 70.9 per cent in quantity and 45 per cent in value. This decrease was caused by the increased use of cheap china ware. The decrease in quantity of cut glass manufactured is due to the fact that a number of establishments which did a small amount of cutting on drinking glasses, shades, globes, etc., in 1900, did not report any cut glass in 1905. These facts partially explain the increase in the average value, which was \$4.99 per dozen in 1900 and \$11.79 per dozen in 1905.

The growth of the bottle and jar industry since 1900 has been vigorous, the increase of 55.1 per cent in total value of products being an evidence of the prosperity enjoyed by bottle and jar establishments. The value per gross of nearly all items shows a decrease, but this is readily accounted for by the use of the blowing machine, which has materially lessened the cost of production.

*Imports and exports.*—Table 8 presents the value of glass imported and exported, 1869 to 1905.

TABLE 8.—VALUE OF GLASS IMPORTED AND OF DOMESTIC GLASS EXPORTED: 1869 TO 1905.<sup>1</sup>

YEAR.	IMPORTS.										EXPORTS.		
	Total value.	Bottles, vials, carboys, etc. <sup>2</sup>	Cylinder and common window glass, unpolished.	Cylinder and crown glass, polished.		Plate glass.			Glass plates or disks for optical instruments. <sup>4</sup>	All other.	Total value.	Window glass. <sup>3</sup>	All other.
				Unsilvered.	Silvered. <sup>3</sup>	Fluted, rolled, or rough.	Cast, polished, unsilvered.	Cast, polished, silvered.					
1905.....	\$5,048,839	\$971,600	\$627,618	\$289,708	\$2,393	\$28,657	\$1,184,088	\$4,096	\$177,457	\$2,063,123	\$2,252,799	\$65,869	\$2,186,930
1904.....	4,583,168	540,460	1,381,104	322,492	7,004	28,140	945,048	6,631	215,683	3,136,706	1,978,481	71,498	1,906,983
1903.....	7,255,879	409,712	1,702,767	525,380	1,532	57,990	1,432,297	6,991	217,612	2,757,598	2,150,699	59,519	2,091,180
1902.....	6,205,052	458,454	1,827,498	356,518	641	12,281	999,934	6,528	191,089	2,351,809	1,960,106	51,952	1,908,154
1901.....	5,010,075	505,283	908,044	456,947	488	5,931	787,450	18,819	161,512	2,166,201	2,126,309	55,288	2,071,023
1900.....	5,037,931	494,483	1,555,924	530,082	286	7,915	226,295	12,413	125,449	2,106,084	1,936,110	36,218	1,899,901
1899.....	4,393,660	371,394	1,275,184	521,957	622	9,528	233,190	419	119,832	1,771,534	1,503,651	32,690	1,470,961
1898.....	3,782,617	338,861	953,116	569,380	66,768	9,830	161,637	562	107,572	1,574,841	1,211,084	23,480	1,187,604
1897.....	5,603,868	600,308	1,181,680	301,412	772,296	18,245	285,425	21,870	94,242	2,328,314	1,208,187	13,369	1,194,816
1896.....	7,528,420	382,101	1,067,999	190,704	1,168,321	23,486	773,250	34,119	92,628	3,805,812	1,062,225	14,994	1,047,231
1895.....	6,627,473	531,904	835,730	61,212	782,778	23,990	684,131	16,740	85,794	3,605,194	946,381	11,740	935,241
1894.....	5,288,097	506,183	1,067,787	22,314	786,004	38,121	449,086	75,106	71,881	2,272,215	922,072	19,311	902,761
1893.....	8,082,639	739,037	1,496,326	91,559	1,679,185	70,493	829,596	154,404	60,898	2,961,141	973,827	10,229	963,598
1892.....	8,828,952	827,761	1,674,679	158,464	1,549,968	56,162	887,626	119,201	69,988	3,485,103	942,802	10,228	932,064
1891.....	8,463,955	920,010	1,475,338	91,248	1,912,391	78,030	1,351,808	183,015	99,623	2,346,472	868,374	11,244	857,130
1890.....	7,411,343	925,704	1,461,736	74,546	1,529,401	84,715	931,323	249,819	58,830	2,108,269	882,677	8,010	873,767
1889.....	7,724,662	825,411	1,441,082	91,105	756,577	130,172	983,316	1,243,455	10,741	2,238,903	894,200	16,864	877,336
1888.....	7,867,263	815,564	1,397,808	95,147	59,208	131,224	1,258,736	1,801,514	12,538	2,295,434	881,628	10,733	870,895
1887.....	7,336,771	739,240	1,420,159	85,500	1,262	90,809	1,191,134	1,647,154	16,876	2,144,547	893,504	15,955	867,549
1886.....	6,358,085	600,435	1,360,055	27,807	.....	107,057	907,267	1,528,370	19,988	1,797,197	773,878	8,246	765,632
1885.....	6,256,194	590,160	1,630,844	18,287	180	118,693	900,461	1,192,147	.....	1,805,413	783,916	10,055	773,860
1884.....	7,552,498	521,787	2,431,068	28,695	.....	101,777	959,817	1,387,728	.....	2,121,626	839,765	18,665	821,091
1883.....	7,762,543	.....	1,736,700	62,630	.....	62,898	1,145,709	1,226,432	.....	3,528,174	998,857	.....	998,857
1882.....	6,634,371	.....	1,387,257	27,117	.....	56,407	1,183,482	943,706	.....	3,036,402	864,235	.....	864,235
1881.....	5,878,025	.....	1,414,709	57,754	.....	32,422	979,452	833,385	.....	2,560,303	756,022	.....	756,022
1880.....	5,221,511	.....	1,439,447	15,601	.....	22,799	835,496	911,144	.....	1,997,024	749,866	.....	749,866
1879.....	3,222,479	.....	595,679	11,110	.....	5,527	609,459	575,549	.....	1,334,764	768,644	.....	768,644
1878.....	3,345,149	.....	812,612	7,168	.....	5,685	885,823	572,066	.....	1,061,795	869,682	.....	869,682
1877.....	3,936,786	.....	1,006,456	8,482	.....	14,405	1,263,864	552,899	.....	1,090,680	658,061	.....	658,061
1876.....	4,806,948	.....	1,292,020	5,448	.....	29,069	1,358,881	773,423	.....	1,348,107	628,121	.....	628,121
1875.....	5,805,115	.....	1,650,040	21,166	.....	47,205	1,620,032	887,847	.....	1,572,765	691,310	.....	691,310
1874.....	6,257,964	.....	1,881,368	14,933	.....	34,237	1,655,909	961,512	.....	1,710,005	631,827	.....	631,827
1873.....	7,420,044	.....	2,769,728	21,217	.....	34,180	1,550,857	823,076	.....	2,230,986	627,562	.....	627,562
1872.....	5,834,712	.....	2,103,827	23,931	.....	17,697	1,063,810	803,487	.....	1,821,900	547,112	.....	547,112
1871.....	4,209,620	.....	1,447,292	16,738	.....	26,191	919,435	651,487	.....	1,208,477	466,447	.....	466,447
1870.....	4,157,634	.....	1,450,067	18,501	.....	24,684	820,252	615,347	.....	1,219,783	530,654	.....	530,654
1869.....	3,995,739	.....	1,466,138	25,885	.....	22,173	717,952	625,338	.....	1,038,253	580,718	.....	580,718

<sup>1</sup> Commerce and Navigation of the United States, Bureau of Statistics, Department of Commerce and Labor.<sup>2</sup> Included in "all other" glass and glassware imported previous to 1884.<sup>3</sup> Included in "unsilvered" cylinder and crown glass, polished, previous to 1885.<sup>4</sup> Not reported separately previous to 1886.<sup>5</sup> Included in "all other" glass and glassware exported previous to 1884.

The fluctuation in value of glass imported from 1869 to 1905 is shown in Table 8. The value of imports rose steadily from \$3,895,739 in 1869 to \$7,420,044 in 1873, after which it declined until 1879, when it was \$3,222,479, the lowest amount reported during the thirty-seven years covered by the statistics. From that date the general tendency, not always consistent, was upward, and lasted until 1892, when the value of imports, \$8,828,952, was the highest reached during the period. After 1892 there was an irregular downward movement which ended with \$3,782,617 in 1898. The next high point was reached in 1903 with imports valued at \$7,255,879. In 1905 the value was \$5,948,839.

The most noticeable changes shown by Table 8 are in the value of polished, cylinder, crown, and plate glass imported. The first marked decline in the imports of silvered polished plate glass, known as French mirror plate, was caused by the large increase in imports of the cheaper silvered polished cylinder and crown glass, known as German looking-glass. The German article is inferior to the French plate and is imported in small sizes, while the French plate is im-

ported in large sizes. In 1888 the value of French silvered plate imported was \$1,801,514, but in the next three years it had fallen to \$183,015. During the same period the imports of German looking-glass increased from \$59,208 to \$1,912,391. From 1892 to 1897 the value of imports of the German looking-glass fluctuated, but in 1898 the decline was remarkable, and practically ended the importation of silvered glass into the United States. In 1891 the total value of polished cylinder, crown, and plate glass, silvered and unsilvered, imported was \$3,538,462, and in 1900, \$778,076. This decrease was due largely to low prices during that period, caused by overproduction. Good industrial conditions in the United States were responsible for the increase in importations, 1900 to 1905.

Glass interests give various reasons for the importations of polished cylinder and plate glass. The principal reason, and the one which would in a measure account for the low prices of imported glass, which are, it is asserted, from 30 to 50 per cent lower for the United States than for Europe, is that the prevailing wages in the industry in Europe are so low that it is

necessary to give the glassworkers continuous employment, and in order to do this manufacturers sell their surplus product, produced by continued operation, at shop cost. This is a practice often resorted to by manufacturers in different countries in order to dispose of a surplus stock, as the fixed expenses, such as salaries, taxes, etc., must necessarily be the same, regardless of the amount of time a factory is in operation during the year. This practice on the part of the European manufacturers was the cause for the assertion that the United States is a "dumping ground" for European glass. It is asserted that a greater part of the polished cylinder and plate glass imported is used for mirrors, that two-thirds of it is in sizes under 10 square feet, that 70 per cent of this amount is under 5 square feet; and that while a considerable amount of small sized plate glass is annually produced in the United States, it is incidental, being caused by defects in casting and by breakage, etc., and is sold at a loss.

Notwithstanding all these claims made by American glassmakers, European glassmakers have always considered the United States an excellent market, and the value of glass imported from year to year, as shown by Table 8, is proof of this. The condition of the glass industry in Europe during the past decade was such that foreign glassmakers could not afford to export glass to the United States at a loss. European glass manufacturers are well aware of the fact that the glass industry in all its branches is firmly established in the United States and that the resources of the country are such that its possibilities of future development are far greater than those of Europe. However, European glass manufacturers esteem American trade so highly that the manufacturers of that country have met and discussed ways and means whereby they can hold their American trade. The following is from the German "Glasshuette," of Dresden, under date of October 19, 1903:

For several years past there has existed a bitter struggle between the Belgian glass industry and the gigantic American plate glass trust, which controls the largest factories there, and the present unsatisfactory condition of the Belgian glass production is, in the main, directly attributable to American competition. While heretofore the competition has centered in the manufacture of window glass, the pressure has now been extended so as to include the manufacture of plate glass. Heretofore the American plate glass manufacturers have maintained high prices, and therefore presented comparatively little competition to the Belgian industry in its export trade; but lately the American factory ring has decided to reduce prices materially and to engage in a life and death competitive struggle with Belgium. As Belgian manufacturers have heretofore exported to America about 3,000,000 francs worth of plate glass and mirrors annually, an amount which will now be considerably reduced, owing to the low prices made by the Americans, the seriousness of existing conditions is apparent. The industry in Belgium has been unprofitable for years past, and the procedure of the American manufacturers can not fail to inflict a heavy blow to an already prostrated industry, evidence of which event is already presented in the panic like despondency of the plate glass manufacturers who attended the recent meeting at Brussels.

In addition the "Glasshuette" stated in its issue of October 21 of the same year that the meeting of the Belgian glass manufacturers held in Brussels discussed ways and means looking to the formation of a trust embracing all glass manufacturers, and that the conclusion was reached that such an industrial combination had become necessary in order to purchase the required raw materials at a lower cost, to establish and maintain a standard of prices, and, most important of all, to hold their own in the world's market against the growing competition of American manufacturers. The meeting appointed a committee for the purpose of devising and submitting to a future meeting a working plan on the lines indicated by the sense of the meeting. As the plate glass manufacturers of the United States have never competed with European glass manufacturers in foreign markets, the above must refer more particularly to their trade in the United States.

In reviewing the situation it would appear that the importation is due more to the high prices maintained by the American manufacturers because of the cost of production than to the desire of European manufacturers, regardless of cost of production, to "dump" in the United States their products, which are and have always been well made and of good quality. The attitude of the European manufacturers when plate glass prices in this country were reduced is evidence that there must be a fair profit in glass exported to the United States, notwithstanding the claim of low prices.

The annual value of common window glass imported since 1869 shows considerable variation. Practically the same conditions that govern the imports of polished cylinder and plate glass govern the imports of window glass. The increase in imports in 1902 and 1903 was caused by the good industrial conditions in the United States during those years. The decrease in 1904 and 1905 was caused by labor troubles in Belgium. The value of imports in 1902 was the largest since 1884, and, in 1905, the lowest since 1879.

The annual value of imports of fluted, rolled, or rough plate decreased almost steadily from 1888, when the value of imports was \$131,224, until 1901, when the value was \$5,931. In 1903 the value increased to \$57,990, but in 1905 it had fallen to \$28,657.

The value of bottles, vials, carboys, etc., imported, changes every few years, governed principally by the importations of bottled goods, as the importation of empty bottles is very limited.

Imports of glass for optical purposes, on which there is no duty, increased in value from \$125,449 in 1900 to \$177,457 in 1905, or 41.5 per cent. Very little has been done by the glass manufacturers of this country to secure this trade, as the possible returns in the industry are small when compared with the difficulties of manufacture, without taking into consideration the competition of the long established foreign factories.

Glass imported under the head of "all other" consisted chiefly of chemical ware, cheap Bohemian glassware, both colored and decorated, and glass balls such as are used in Christmas decorations. A glassworker, formerly of Germany, stated that much of the cheap glassware imported into the United States is made in the farming districts of Germany. The glassworker is often assisted by his children and sometimes by his wife. These assistants receive little or no compensation. The products of these factories are collected and sold in lots at a very low figure. Chemical ware has long been supplied by England and France, but these importations are decreasing to some extent because of the manufacture of this class of ware in the United States.

In addition to the value of glass imported, Table 8 shows the value of glass exported. From 1869 to 1905 the value of glass exported has increased \$1,672,081. No data regarding the export of glass previous to 1826 are obtainable, but in that year the value of glass exports was \$44,557, and in 1905, \$2,252,799, an increase of \$2,208,242 in seventy-nine years. The export of \$44,557 worth of glass in 1826 was a great achievement for the early glass manufacturers, inasmuch as the glass industry in the United States was not firmly established until about 1810. The early exports consisted chiefly of bottles, tumblers, and decanters. Window glass was not exported until about 1884 and the

growth since that time has been slow. From 1826 to 1896, a period of seventy years, the exports of glass reached the million dollar mark but once, and that was in 1865 when they were valued at \$1,268,533. In 1896, after a lapse of thirty-one years, exports again reached the million dollar mark, and five years later reached the two million mark. Since 1900 exports of glass have increased from \$1,936,119 to \$2,252,799 in 1905, or 16.4 per cent. Exports of "all other" glass have almost steadily increased since 1869, at which time the value of glass exports was \$580,718; in 1905 the amount was \$2,186,930, an increase of \$1,606,212 since 1869. The increase from 1900 to 1905 was \$287,029, or 15.1 per cent.

Most of the glass exported from the United States consisted of pressed and blown ware, such as tableware, lamp chimneys, tumblers, bowls, etc. Since American manufacturers have established show and sales rooms abroad, and the excellent quality and workmanship of our pressed and blown glass have become known, it is safe to assume that our export trade in this particular line is safe for some time to come.

The detailed statistics for the industry are shown in Table 9. Table 10 presents the condensed statistics of building glass and Table 11 the condensed statistics of pressed and blown glass and bottles and jars.

TABLE 9.—GLASS—DETAILED

	United States.	California.	Illinois.	Indiana.	Kansas.
1 Number of establishments.....	300	4	13	90	9
2 Capital:					
3 Total.....	\$80,380,151	\$1,244,919	\$3,576,172	\$13,884,485	\$500,000
4 Land.....	\$0,500,407	\$101,500	\$100,505	\$553,005	\$37,500
5 Buildings.....	\$21,324,811	\$102,254	\$972,612	\$3,073,781	\$213,071
6 Machinery, tools, and implements.....	\$21,230,870	\$210,476	\$379,000	\$3,843,755	\$02,149
7 Cash and sundries.....	\$37,260,097	\$680,029	\$2,003,050	\$5,513,344	\$277,686
8 Proprietors and firm members.....	90		8	18	
9 Salaried officials, clerks, etc.:					
10 Total number.....	3,040	52	119	432	27
11 Total salaries.....	\$3,040,293	\$65,382	\$151,330	\$548,000	\$28,610
12 Officers of corporations—					
13 Number.....	543	6	16	112	9
14 Salaries.....	\$1,340,701	\$10,700	\$40,800	\$233,467	\$10,700
15 General superintendents, managers, clerks, etc.—					
16 Total number.....	2,497	46	103	320	18
17 Total salaries.....	\$2,500,532	\$48,682	\$101,530	\$315,532	\$17,910
18 Men—					
19 Number.....	2,107	35	80	287	10
20 Salaries.....	\$2,408,172	\$42,324	\$90,080	\$290,737	\$10,030
21 Women—					
22 Number.....	300	11	23	33	2
23 Salaries.....	\$101,300	\$6,358	\$13,850	\$15,705	\$980
24 Wage-earners, including pieceworkers, and total wages:					
25 Greatest number employed at any one time during the year.....	87,586	1,153	6,766	17,020	1,107
26 Least number employed at any one time during the year.....	55,612	841	3,270	10,258	679
27 Average number.....	63,000	880	4,768	12,020	718
28 Total wages.....	\$37,288,148	\$408,225	\$3,011,632	\$6,638,130	\$140,771
29 Men 16 years and over—					
30 Average number.....	54,070	788	4,258	10,662	620
31 Wages.....	\$35,005,617	\$453,301	\$2,012,778	\$0,316,351	\$124,201
32 Women 16 years and over—					
33 Average number.....	3,455	77	127	497	44
34 Wages.....	\$808,808	\$37,084	\$26,853	\$101,018	\$9,768
35 Children under 16 years—					
36 Average number.....	6,435	24	383	871	54
37 Wages.....	\$1,413,693	\$7,150	\$72,001	\$220,761	\$12,812
38 Average number of wage-earners, including pieceworkers, employed during each month:					
39 Men 16 years and over—					
40 January.....	60,455	924	4,350	12,200	604
41 February.....	61,041	937	5,479	12,347	825
42 March.....	62,843	932	5,443	12,584	818
43 April.....	63,108	926	5,392	12,182	794
44 May.....	62,130	852	5,307	11,857	784
45 June.....	56,377	823	4,445	10,832	788
46 July.....	24,336	252	1,501	4,215	98
47 August.....	26,708	191	1,480	4,817	158
48 September.....	50,516	856	4,462	10,892	550
49 October.....	58,780	902	4,840	11,510	600
50 November.....	60,452	904	3,782	12,092	698
51 December.....	61,242	957	4,294	12,347	673
52 Women 16 years and over—					
53 January.....	3,614	88	150	540	42
54 February.....	3,595	89	150	548	42
55 March.....	3,743	89	149	558	42
56 April.....	3,738	74	150	532	46
57 May.....	3,737	79	147	524	46
58 June.....	3,541	66	112	511	46
59 July.....	1,704	60	5	150	1
60 August.....	2,044	52	8	180	10
61 September.....	3,701	68	158	608	60
62 October.....	4,012	77	166	567	61
63 November.....	4,057	86	165	564	63
64 December.....	3,914	66	164	544	64
65 Children under 16 years—					
66 January.....	7,080	5	386	1,035	60
67 February.....	7,372	32	506	1,052	74
68 March.....	7,418	32	507	1,002	73
69 April.....	7,470	32	490	973	45
70 May.....	7,440	32	473	966	45
71 June.....	7,067	31	388	920	45
72 July.....	2,140	28	148	210	
73 August.....	2,563	28	146	269	
74 September.....	6,373	31	366	1,016	40
75 October.....	7,327	10	448	969	85
76 November.....	7,453	3	340	1,017	86
77 December.....	7,496	15	390	1,023	86
78 Miscellaneous expenses:					
79 Total.....	\$5,011,507	\$64,242	\$370,007	\$710,054	\$41,892
80 Rent of works.....	\$46,393	\$1,000	\$3,612	\$2,432	
81 Taxes.....	\$320,728	\$1,752	\$14,238	\$62,010	\$2,314
82 Rent of offices, interest, insurance, and all other sundry expenses not hitherto included.....	\$5,407,538	\$59,490	\$302,057	\$60,612	\$39,578
83 Contract work.....	\$56,818			\$75	
84 Materials used:					
85 Total cost.....	\$26,145,522	\$274,071	\$1,400,237	\$5,558,830	\$355,003
86 Glass sand—					
87 Tons.....	709,792	0,975	62,150	193,000	10,518
88 Cost.....	\$1,547,147	\$32,550	\$65,040	\$310,205	\$25,021
89 Soda ash (carbonate of soda)—					
90 Tons.....	215,462	3,688	21,691	55,249	2,548
91 Cost.....	\$1,068,804	\$85,597	\$369,809	\$1,039,241	\$58,288
92 Salt cake (sulphate of soda)—					
93 Tons.....	53,905	212	559	9,063	1,476
94 Cost.....	\$802,611	\$2,332	\$7,288	\$157,341	\$24,400
95 Nitrate of soda—					
96 Tons.....	11,015	106	900	2,150	108
97 Cost.....	\$511,854	\$8,242	\$38,087	\$98,801	\$6,855
98 Limestone—					
99 Tons.....	115,655	1,617	8,013	27,120	1,319
100 Cost.....	\$274,200	\$8,803	\$13,745	\$54,055	\$5,138
101 Lime—					
102 Hundredweight.....	933,074	86	79,419	170,433	18,366
103 Cost.....	\$241,755	\$32	\$20,545	\$50,492	\$7,247

SUMMARY, BY STATES: 1905.

Maryland.	Massachusetts.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Virginia.	West Virginia.	All other states. <sup>1</sup>	
0	4	6	22	28	37	122	4	39	9	1
\$523,199	\$610,763	\$3,219,034	\$6,304,455	\$3,455,441	\$9,254,105	\$40,612,180	\$402,450	\$4,209,860	\$1,411,083	2
\$45,705	\$46,200	\$40,800	\$408,530	\$326,081	\$545,455	\$3,280,074	\$14,000	\$255,400	\$240,062	3
\$193,058	\$159,600	\$735,327	\$1,312,007	\$559,257	\$2,906,244	\$11,638,343	\$60,000	\$1,087,021	\$255,676	4
\$77,819	\$46,400	\$1,172,245	\$637,839	\$570,947	\$2,168,579	\$10,738,412	\$180,584	\$786,157	\$346,518	5
\$180,717	\$358,503	\$870,062	\$3,046,019	\$1,999,156	\$3,543,917	\$14,855,351	\$138,875	\$2,171,192	\$567,927	6
5	2		5	9	10	32	2	5		7
28	45	111	360	142	309	1,167	11	189	30	8
\$35,328	\$64,988	\$158,874	\$358,088	\$202,443	\$444,268	\$1,597,113	\$17,868	\$208,855	\$57,247	9
5	7	18	42	34	66	169	3	40	7	10
\$14,500	\$21,944	\$51,200	\$110,260	\$84,440	\$179,750	\$469,951	\$9,000	\$76,772	\$15,247	11
23	38	93	327	108	243	998	8	140	32	12
\$20,828	\$43,044	\$107,074	\$248,008	\$118,003	\$264,518	\$1,127,162	\$8,868	\$132,083	\$42,000	13
21	27	88	249	94	191	879	6	107	27	14
\$20,064	\$38,186	\$104,890	\$224,796	\$110,721	\$237,481	\$1,055,374	\$7,882	\$119,097	\$40,010	15
2	11	5	78	14	52	119	2	33	5	16
\$704	\$4,858	\$2,784	\$23,902	\$7,282	\$27,037	\$71,788	\$986	\$12,986	\$1,900	17
905	998	1,886	7,358	4,142	11,130	27,843	593	5,100	1,417	18
600	872	1,107	5,570	2,987	5,318	19,302	518	3,265	902	19
049	855	1,561	5,507	3,153	7,844	20,794	472	3,673	1,066	20
\$354,235	\$441,541	\$938,454	\$3,145,384	\$1,824,576	\$4,511,005	\$12,518,440	\$263,657	\$2,054,181	\$641,317	21
502	720	1,469	4,815	2,800	6,321	17,074	404	2,777	800	22
\$324,328	\$400,741	\$917,020	\$2,996,759	\$1,715,544	\$4,172,470	\$11,658,488	\$248,128	\$1,852,741	\$603,107	23
34	96	8	124	103	787	1,107		445	16	24
\$9,124	\$24,500	\$1,800	\$20,003	\$25,635	\$186,005	\$305,140		\$106,695	\$4,393	25
113	30	84	568	250	736	2,613	68	451	100	26
\$20,783	\$7,300	\$19,034	\$119,022	\$53,397	\$152,530	\$554,812	\$15,529	\$94,745	\$33,817	27
476	694	1,679	4,675	3,342	7,328	19,326	471	3,224	904	28
474	720	1,657	4,715	3,413	7,603	19,113	465	3,203	900	29
479	714	1,643	4,927	3,460	7,679	19,578	484	3,166	936	30
476	739	1,472	5,884	3,360	7,521	19,742	491	3,105	1,024	31
508	739	1,563	5,795	3,334	7,397	19,462	496	3,039	997	32
532	717	1,567	4,803	3,029	7,194	17,302	463	2,676	906	33
185	674	928	2,437	1,209	2,115	8,946	29	1,430	314	34
219	674	1,127	2,277	1,225	2,818	10,178	33	1,228	334	35
621	680	1,212	4,677	2,398	5,036	15,728	477	2,274	753	36
731	799	1,585	5,573	2,823	6,920	17,987	472	3,071	1,007	37
740	807	1,485	5,920	2,997	7,188	18,863	476	3,472	1,022	38
683	791	1,710	6,091	3,010	7,053	18,663	491	3,436	1,043	39
15	88	9	120	118	841	1,104		468	22	40
17	94	9	76	119	847	1,104		480	20	41
13	103	9	130	127	869	1,163		470	21	42
13	102	9	133	129	836	1,205		488	21	43
22	97	7	141	124	830	1,209		495	16	44
20	99	7	141	117	798	1,132		467	16	45
18	88		80	61	469	603		288	1	46
30	93	8	83	60	518	761		225	1	47
30	88	8	132	90	810	1,223		418	9	48
70	92	10	146	95	890	1,284		533	21	49
80	103	10	150	100	910	1,290		514	22	50
71	105	10	158	96	886	1,206		494	22	51
119	31	97	582	301	805	2,850	81	483	245	52
116	28	97	579	306	860	2,938	89	459	245	53
117	27	99	573	317	880	2,972	80	489	250	54
119	24	96	676	316	900	2,959	86	501	253	55
137	29	93	690	310	910	2,940	86	495	240	56
141	31	94	677	296	936	2,755	81	473	199	57
26	40	9	150	101	184	909		275	6	58
38	30	04	145	102	379	1,102		165	5	59
120	34	04	578	204	582	2,606	80	497	215	60
139	31	00	693	217	752	2,995	82	553	245	61
143	29	08	732	264	810	3,116	80	533	184	62
141	26	08	741	266	825	3,064	80	549	193	63
\$31,411	\$97,244	\$133,098	\$475,747	\$385,487	\$783,562	\$2,265,947	\$35,079	\$396,646	\$109,991	64
\$14	\$1,000	\$2,555	\$1,538	\$7,300	\$2,944	\$10,578		\$220	\$1,200	65
\$2,932	\$6,910	\$12,093	\$25,386	\$14,870	\$46,337	\$109,581	\$716	\$15,219	\$6,361	66
\$28,465	\$89,334	\$118,450	\$448,823	\$347,909	\$723,420	\$2,116,810	\$33,431	\$381,207	\$102,430	67
			\$15,408	\$10,855	\$28,978	\$1,532				68
\$158,732	\$316,080	\$707,871	\$1,856,239	\$1,411,973	\$2,836,521	\$9,325,184	\$169,401	\$1,259,480	\$515,741	69
3,035	1,852	23,760	53,191	45,167	81,541	219,958	12,579	37,292	14,278	70
\$8,730	\$9,329	\$20,578	\$93,246	\$95,598	\$179,157	\$568,762	\$27,406	\$88,473	\$20,386	71
1,447	600	7,653	20,825	10,496	19,683	56,742	1,924	7,927	4,989	72
\$26,608	\$12,034	\$140,404	\$410,785	\$197,252	\$372,030	\$1,072,229	\$37,845	\$152,469	\$93,013	73
		505	338	1,042	5,547	28,749		4,709	145	74
		\$7,800	\$5,227	\$21,258	\$87,946	\$422,246		\$64,464	\$2,123	75
207	51	82	816	936	1,376	3,451	186	1,217	233	76
\$9,220	\$2,323	\$3,338	\$34,277	\$40,692	\$59,146	\$140,835	\$7,977	\$51,518	\$10,483	77
228		6,524	5,057	3,429	11,704	45,974		4,270	500	78
\$1,430		\$11,725	\$21,669	\$10,484	\$11,562	\$111,514		\$10,488	\$3,500	79
4,374	9,656	6,330	116,008	41,816	104,321	265,453	17,571	42,667	57,084	80
\$562	\$2,414	\$2,000	\$27,003	\$11,489	\$21,281	\$98,545	\$4,951	\$12,125	\$13,079	81

<sup>1</sup>Includes establishments distributed as follows: Colorado, 1; Delaware, 1; Georgia, 1; Indian Territory, 1; Michigan, 2; South Carolina, 1; Tennessee, 1; Wisconsin, 1.

TABLE D.—GLASS—DETAILED

	United States.	California.	Illinois.	Indiana.	Kansas.	
<b>Materials used—Continued.</b>						
<b>Total cost—Continued.</b>						
82	Arsenic—					
83	Pounds.....	2,676,650	34,411	61,804	548,711	20,516
	Cost.....	\$92,574	\$1,453	\$2,980	\$21,210	\$1,376
84	Carbon—					
85	Tons.....	3,750	23	95	901	63
	Cost.....	\$22,333	\$267	\$1,722	\$5,203	\$716
86	Manganese—					
87	Pounds.....	3,096,937	78,024	402,500	735,802	15,900
	Cost.....	\$101,270	\$2,832	\$10,391	\$25,232	\$766
88	Litharge (red lead)—					
89	Pounds.....	9,613,649	809	80,300	700,500	15,000
	Cost.....	\$555,130	\$18	\$1,320	\$41,106	\$1,200
90	Potash or pearl ash—					
91	Pounds.....	5,446,338	8,585		435,100	6,000
	Cost.....	\$228,608	\$644		\$19,181	\$270
92	Grinding sand—					
93	Tons.....	410,850	1,020		58,678	
	Cost.....	\$332,013	\$610		\$42,213	
94	Rouge—					
95	Pounds.....	1,008,566	7,080		150,278	
	Cost.....	\$20,809	\$354		\$4,321	
96	Plaster of Paris—					
97	Tons.....	33,939	38		5,291	1
	Cost.....	\$109,088	\$133		\$25,831	\$42
98	Fire clay or pot clay—					
99	Pounds.....	42,910,286	252,000	876,400	5,896,010	300,000
	Cost.....	\$200,444	\$3,600	\$4,972	\$36,824	\$2,454
100	Pots, not including those made at works—					
101	Number.....	9,343		244	1,580	100
	Cost.....	\$432,501		\$10,027	\$67,263	\$6,516
102	Flattening stones—					
103	Number.....	410	5		111	8
	Cost.....	\$22,266	\$260		\$7,115	\$700
104	Fuel—					
105	Total cost.....	\$6,243,000	\$41,784	\$311,406	\$1,008,225	\$24,104
	Natural gas.....	\$2,777,157			\$556,967	\$23,837
	Oil—					
106	Gallons.....	18,346,660	4,913,240	1,048,613	657,446	
107	Cost.....	\$520,808	\$9,859	\$60,181	\$24,609	
	Coal—					
108	Tons.....	1,488,476		105,719	274,785	65
109	Cost.....	\$2,748,706		\$240,665	\$477,862	\$267
110	All other fuel.....	\$100,245	\$925	\$11,560	\$8,787	
111	Rent of power and heat.....	\$42,104	\$4,718	\$1,260	\$850	
112	Lumber, casks, barrels, boxes, and nails.....	\$4,750,213	\$20,418	\$272,260	\$1,231,220	\$80,309
113	Caps, metal trimmings, and rubber supplies.....	\$1,600,145	\$7,584	\$66,525	\$712,312	\$74,084
114	Supplies used in repairs on tanks and furnaces.....	\$741,953	\$8,289	\$64,557	\$189,500	\$12,838
115	Milk supplies.....	\$205,444	\$1,335	\$4,266	\$45,871	\$1,630
116	All other materials.....	\$2,102,528	\$2,120	\$64,163	\$200,076	\$11,149
117	Freight.....	\$400,504	\$31,578	\$98,311	\$98,311	\$5,000
118	<b>Products:</b>					
119	Total value.....	\$79,607,908	\$915,440	\$5,619,740	\$14,706,929	\$958,720
120	Building glass.....	\$21,607,891	\$60,000	\$281,559	\$3,700,018	\$381,084
121	Pressed and blown glass.....	\$21,956,158		\$149,265	\$2,850,087	\$64,697
122	Bottles and jars.....	\$33,631,033	\$855,446	\$4,949,156	\$7,243,456	\$407,868
	All other products.....	\$2,322,916		\$230,760	\$843,798	\$105,071
123	<b>Equipment and characteristics of works:</b>					
124	Pot furnaces—					
125	Operated, number.....	349		8	63	5
126	Pots, number.....	4,192		104	670	30
	Idle, number.....	49		4	7	
	Pots, number.....	617		47	79	
127	Tanks—					
128	Continuous—					
129	Operated, number.....	340	8	24	87	7
130	Rings, number.....	3,076	57	284	749	64
131	Pot capacity, number.....	7,050	122	582	1,657	148
132	Idle, number.....	26			4	
	Rings, number.....	191			25	
	Pot capacity, number.....	397			50	
	Intermittent—					
133	Operated, number.....	64		4	3	
134	Ton capacity, number.....	406		20	20	
135	Pot capacity, number.....	406		20	20	
136	Idle, number.....	13		1	1	
137	Ton capacity, number.....	60		10	8	
138	Pot capacity, number.....	69		10	8	
139	Building glass—					
140	Flattening ovens, number.....	325	2	5	73	7
141	Blow furnaces, number.....	165		1	43	8
142	Casting tables, number.....	160		4	26	
143	Annealing ovens, number.....	603		1	161	1
144	Bending ovens, number.....	18			5	
145	Lehrs, number.....	332	2	4	71	6
146	Grinding machines, number.....	239			41	
147	Polishing machines, number.....	307			64	
	Sand blast machines, number.....	2			1	
148	Glassware and bottles—					
149	Shops, number.....	6,087	80	608	1,391	81
150	Flory holes, number.....	1,680	20	170	348	10
151	Annealing ovens, number.....	843	15	47	30	
152	Lehrs, number.....	1,493	18	134	327	23
153	Decorating kilns, number.....	72				
154	Decorating lehrs, number.....	22			3	
155	Presses, hand, number.....	815		15	114	
156	Presses, mechanical, number.....	101		2	39	12
157	Blowing machines, number.....	321	0	48	96	10
158	Finishing machines, number.....	115			26	3
159	Crimping machines, number.....	307		1	118	
160	Mechanical polishers, number.....	32		2	5	
161	Sand blast machines, number.....	78			5	
162	Grinding machines for fruit jar tops, number.....	78	1	3	23	
	Clay grinding mills, number.....	58			16	1



TABLE 9.—GLASS—DETAILED

	United States.	California.	Illinois.	Indiana.	Kansas.
Equipment and characteristics of work—Continued.					
163	Grinding and engraving machines, number.....	75			
164	Mechanical stokers.....	123		8	1
165	Horses and mules.....	461	45	31	
166	Wagons, carts, and drays.....	454	43	33	
Power:					
167	Number of establishments reporting.....	387	4	13	91
168	Total horsepower.....	107,662	481	2,033	18,121
Owned—					
Engines—					
Steam—					
169	Number.....	742	8	30	100
170	Horsepower.....	76,599	420	1,495	8,229
Gas or gasoline—					
171	Number.....	207		1	98
172	Horsepower.....	13,947		30	6,265
Water wheels—					
173	Number.....	2			
174	Horsepower.....	20			
Water motors—					
175	Number.....	2			
176	Horsepower.....	11			
Electric motors—					
177	Number.....	900		33	138
178	Horsepower.....	16,186		450	3,465
179	Other power, horsepower.....	316		20	150
Rented—					
Electric motors—					
180	Number.....	65	8	4	1
181	Horsepower.....	533	61	38	12
182	Other kind, horsepower.....				
183	Furnished to other establishments, horsepower.....	1,531		60	



TABLE 10.—BUILDING GLASS, BY STATES: 1905.

	United States.	Illinois.	Indiana.	Kansas.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	West Virginia.	All other states. <sup>1</sup>
Number of establishments.....	138	3	38	4	3	3	8	8	51	17	3
Capital.....	\$40,060,410	\$273,827	\$7,012,839	\$302,903	\$2,060,100	\$161,743	\$323,714	\$2,701,472	\$24,902,320	\$1,084,050	\$642,836
Salaried officials, clerks, etc.:											
Number.....	928	13	148	10	97	7	12	53	532	48	8
Salaries.....	\$1,150,071	\$12,080	\$140,770	\$11,600	\$133,012	\$5,530	\$12,558	\$72,134	\$685,794	\$57,573	\$14,100
Wage-earners, including pieceworkers, and total wages:											
Average number.....	14,880	230	2,061	258	1,002	146	300	1,127	7,832	990	319
Total wages.....	\$10,640,000	\$161,153	\$1,909,312	\$231,251	\$579,493	\$89,705	\$100,338	\$828,168	\$5,725,582	\$643,852	\$178,236
Men 16 years and over—											
Average number.....	14,731	230	2,027	258	994	140	299	1,127	7,730	998	316
Wages.....	\$10,505,257	\$161,153	\$1,900,501	\$231,251	\$577,289	\$89,705	\$108,148	\$828,168	\$5,008,312	\$643,394	\$177,336
Women 16 years and over—											
Average number.....	25								25		
Wages.....	\$7,440								\$7,440		
Children under 16 years—											
Average number.....	124		34		8		7		71	1	3
Wages.....	\$33,387		\$8,811		\$2,204		\$1,100		\$19,824	\$458	\$900
Miscellaneous expenses.....	\$1,210,707	\$30,207	\$212,755	\$28,092	\$65,785	\$3,614	\$22,065	\$89,238	\$600,334	\$40,840	\$29,067
Materials used:											
Total cost.....	\$8,210,702	\$72,152	\$1,406,539	\$81,885	\$524,900	\$64,746	\$170,340	\$602,020	\$4,717,404	\$375,026	\$188,724
Glass sand—											
Tons.....	247,948	2,783	40,739	3,610	15,800	1,011	4,008	22,645	135,014	16,108	3,740
Cost.....	\$499,323	\$2,715	\$84,073	\$8,826	\$16,357	\$2,300	\$5,102	\$49,405	\$285,800	\$15,505	\$8,084
Soda ash (carbonate of soda)—											
Tons.....	39,881	512	6,090	101	4,775	381	314	2,582	25,022	1,202	902
Cost.....	\$744,369	\$9,137	\$122,220	\$2,392	\$89,472	\$7,533	\$6,558	\$37,414	\$420,832	\$23,257	\$10,554
Salt cake (sulphate of soda)—											
Tons.....	51,013	430	9,737	1,351	505	322	1,030	4,220	27,000	4,451	347
Cost.....	\$759,059	\$5,500	\$154,583	\$22,495	\$7,800	\$4,975	\$21,057	\$67,910	\$412,387	\$58,474	\$4,332
Nitrate of soda—											
Tons.....	457	10	70		32		70	11	211	44	
Cost.....	\$19,107	\$323	\$3,353		\$1,270		\$3,270	\$372	\$8,758	\$1,752	
Limestone—											
Tons.....	74,787	925	11,820	1,310	5,274	294	1,378	5,991	43,721	3,851	205
Cost.....	\$107,043	\$1,447	\$28,054	\$5,138	\$9,203	\$853	\$2,409	\$10,547	\$103,159	\$10,111	\$972
Lime—											
Hundredweight.....	97,513	4,030	8,704			7,129	1,530	7,838	50,708	2,004	16,000
Cost.....	\$20,004	\$741	\$2,720			\$1,500	\$441	\$1,255	\$10,234	\$503	\$2,070
Arsenic—											
Pounds.....	1,050,472	2,040	328,274	21,290	123,546	7,298	10,180	125,162	843,212	143,930	30,540
Cost.....	\$55,223	\$82	\$12,783	\$900	\$3,965	\$248	\$644	\$4,134	\$26,328	\$4,789	\$1,230
Carbon—											
Tons.....	3,130	15	807	61	42	12	33	242	1,573	313	32
Cost.....	\$16,072	\$172	\$4,451	\$700	\$507	\$81	\$179	\$1,108	\$7,402	\$1,224	\$248
Manganese—											
Pounds.....	325,902	60,088	12,710		38,000		7,115	70,492	101,797	20,700	
Cost.....	\$7,159	\$958	\$579		\$822		\$321	\$908	\$2,827	\$744	
Grinding sand—											
Tons.....	306,755		57,894		28,741		35	38,080	203,255	150	8,000
Cost.....	\$320,718		\$39,594		\$17,145		\$25	\$26,288	\$231,570	\$180	\$6,000
Pots, not including those made at works—											
Number.....	3,443		998	140	22	19	102	10	1,513	579	
Cost.....	\$98,381		\$32,777	\$5,716	\$994	\$441	\$5,812	\$431	\$33,027	\$18,323	
Fuel.....	\$2,719,100	\$24,229	\$495,345	\$12,454	\$189,986	\$32,478	\$82,187	\$214,025	\$1,498,380	\$70,541	\$101,875
Lumber casks, barrels, boxes, etc.	\$1,041,064	\$15,217	\$188,191	\$18,865	\$28,187	\$7,005	\$27,370	\$72,358	\$595,237	\$80,556	\$7,418
All other materials, including mill supplies, freight, and rent of power and heat.....	\$1,743,380	\$11,541	\$242,303	\$4,339	\$168,172	\$6,005	\$20,899	\$115,615	\$1,071,557	\$63,007	\$39,281
Products:											
Total value.....	\$21,557,531	\$281,550	\$3,790,618	\$381,084	\$1,036,433	\$163,922	\$447,210	\$1,575,126	\$12,125,783	\$1,323,890	\$431,900
Building glass.....	\$21,330,305	\$281,550	\$3,790,618	\$381,084	\$1,036,433	\$163,922	\$406,310	\$1,575,126	\$11,089,457	\$1,323,890	\$431,900
Other glass products.....	\$53,000						\$30,900		\$17,000		
All other products.....	\$123,226						\$4,000		\$119,326		
Furnaces:											
Pot furnaces—											
Operated, number.....	139	1	42	4	5	3	6	9	42	22	4
Pots, number.....	1,898	13	407	24	120	24	57	158	894	145	64
Idle, number.....	13		4				2		5		2
Pots, number.....	181		38				10		92		32
Tanks—											
Continuous—											
Operated, number.....	78	2	14	2	2	1	2	6	43	5	1
Rings, number.....	895	14	159	20	4	8	32	47	531	55	8
Pot capacity, number.....	2,694	42	477	60	12	24	24	201	1,593	105	24
Idle, number.....	1								1		
Rings, number.....	15								15		
Pot capacity, number.....	45								45		
Intermittent—											
Operated, number.....	10		3						7		
Tons capacity, number.....	65		20						45		
Pot capacity, number.....	65		20						45		
Idle, number.....	1		1						46		
Tons capacity, number.....	8		8								
Pot capacity, number.....	8		8								

<sup>1</sup>Includes establishments distributed as follows: California, 1; Delaware, 1; Michigan, 1.

TABLE 11.—PRESSED AND BLOWN GLASS

	United States.	Illinois.	Indiana.	Kansas.
1 Number of establishments.....	261	10	58	5
2 Capital.....	\$48,722,741	\$3,302,345	\$0,871,040	\$288,003
3 Salaried officials, clerks, etc.:				
4   Number.....	2,112	106	284	17
5   Salaries.....	\$2,784,222	\$138,350	\$399,229	\$10,950
6 Wage-earners, including pieceworkers, and total wages:				
7   Average number.....	49,089	4,538	9,059	460
8   Total wages.....	\$20,742,054	\$2,850,479	\$4,728,818	\$215,520
9   Men 16 years and over—				
10     Average number.....	39,348	4,028	7,735	362
11     Wages.....	\$24,500,390	\$2,751,025	\$4,415,850	\$192,952
12   Women 16 years and over—				
13     Average number.....	3,430	127	487	44
14     Wages.....	\$801,303	\$20,853	\$101,018	\$0,758
15   Children under 16 years—				
16     Average number.....	6,311	383	837	54
17     Wages.....	\$1,380,303	\$72,001	\$211,950	\$12,812
18 Miscellaneous expenses.....	\$4,700,710	\$349,700	\$497,899	\$18,200
19 Materials used:				
20   Total cost.....	\$17,034,820	\$1,328,085	\$4,152,300	\$273,208
21   Glass sand—				
22     Tons.....	521,844	59,373	152,861	6,908
23     Cost.....	\$1,047,824	\$62,931	\$231,592	\$10,195
24   Soda ash (carbonate of soda)—				
25     Tons.....	175,581	21,179	49,159	2,447
26     Cost.....	\$3,324,435	\$300,672	\$917,021	\$55,896
27   Salt cake (sulphate of soda)—				
28     Tons.....	2,892	129	226	125
29     Cost.....	\$42,912	\$1,098	\$2,758	\$1,095
30   Nitrate of soda—				
31     Tons.....	11,458	890	2,080	108
32     Cost.....	\$492,747	\$37,704	\$95,505	\$0,855
33   Limestone—				
34     Tons.....	40,868	7,088	15,291	.....
35     Cost.....	\$107,160	\$12,298	\$31,001	.....
36   Lime—				
37     Hundredweight.....	835,561	75,410	161,729	18,366
38     Cost.....	\$221,001	\$19,804	\$47,772	\$7,247
39   Arsenic—				
40     Pounds.....	1,026,178	89,764	220,437	8,226
41     Cost.....	\$37,351	\$2,908	\$8,427	\$416
42   Carbon—				
43     Tons.....	620	80	94	2
44     Cost.....	\$0,261	\$1,350	\$842	\$16
45   Manganese—				
46     Pounds.....	2,771,037	342,412	723,002	15,900
47     Cost.....	\$94,120	\$9,433	\$24,653	\$760
48   Litharge (red lead)—				
49     Pounds.....	9,480,863	86,400	763,660	15,000
50     Cost.....	\$548,800	\$4,320	\$30,433	\$1,200
51   Potash or pearlsh—				
52     Pounds.....	5,232,307	.....	427,100	6,000
53     Cost.....	\$219,020	.....	\$18,821	\$270
54   Pots, not including those made at works—				
55     Number.....	5,900	234	591	20
56     Cost.....	\$334,210	\$10,027	\$34,486	\$800
57   Fuel.....	\$3,523,900	\$317,177	\$572,880	\$11,050
58   Lumber, casks, barrels, boxes, etc.....	\$3,709,149	\$256,083	\$1,043,029	\$61,444
59   Caps, metal trimmings, and rubber supplies.....	\$1,090,069	\$60,525	\$712,312	\$78,984
60   All other materials, including mill supplies, freight, and rent of power and heat.....	\$2,535,159	\$158,195	\$371,708	\$29,474
61 Products:				
62   Total value.....	\$58,050,407	\$5,338,181	\$10,010,311	\$577,036
63   Pressed and blown glass.....	\$21,025,258	\$149,205	\$2,859,087	\$64,097
64   Bottles and jars.....	\$33,008,063	\$4,949,150	\$7,213,450	\$407,868
65   Building glass.....	\$317,555	.....	.....	.....
66   All other products.....	\$2,199,590	\$239,760	\$843,768	\$105,071
67 Furnaces:				
68   Pot furnaces—				
69     Operated, number.....	210	7	21	1
70     Pots, number.....	2,294	91	263	6
71     Idle, number.....	36	4	3	.....
72     Pots, number.....	436	47	41	.....
73   Tanks—				
74     Continuous—				
75       Operated, number.....	262	22	78	5
76       Rings, number.....	2,178	270	590	44
77       Pot capacity, number.....	4,350	540	1,180	88
78       Idle, number.....	25	.....	.....	.....
79       Rings, number.....	176	.....	25	.....
80       Pot capacity, number.....	352	.....	50	.....
81     Intermittent—				
82       Operated, number.....	84	4	.....	.....
83       Tons capacity, number.....	341	20	.....	.....
84       Pot capacity, number.....	341	20	.....	.....
85       Idle, number.....	12	1	.....	.....
86       Tons capacity, number.....	61	10	.....	.....
87       Pot capacity, number.....	61	10	.....	.....

<sup>1</sup> Includes establishments distributed as follows: California, 3; Colorado, 1; Georgia, 1; Indian Territory, 1; Michigan, 1; South Carolina, 1; Tennessee, 1; Wisconsin, 1.

AND BOTTLES AND JARS, BY STATES: 1905.

Maryland.	Massachusetts.	Missouri.	New Jersey.	New York.	Ohio.	Pennsylvania.	Virginia.	West Virginia.	All other states. <sup>1</sup>	
6	4	3	10	20	29	71	4	22	10	1
\$523,100	\$010,763	\$558,928	\$6,142,712	\$3,131,727	\$6,552,723	\$15,709,860	\$402,459	\$2,615,210	\$2,013,166	2
28	45	14	362	130	256	635	11	141	83	3
\$35,328	\$64,988	\$24,062	\$353,458	\$189,885	\$372,134	\$011,319	\$17,868	\$151,282	\$108,469	4
640	855	550	5,361	2,847	6,717	12,962	472	2,074	1,636	5
\$364,235	\$441,541	\$358,961	\$3,055,679	\$1,625,238	\$3,683,437	\$6,792,858	\$263,667	\$1,410,329	\$661,306	6
502	720	475	4,060	2,501	5,194	9,338	404	2,079	1,332	7
\$324,328	\$409,741	\$340,331	\$2,907,054	\$1,517,396	\$3,344,302	\$5,960,176	\$248,128	\$1,209,347	\$879,162	8
34	90	8	124	103	787	1,082		445	93	9
\$9,124	\$24,500	\$1,800	\$29,663	\$25,635	\$186,605	\$297,694		\$106,695	\$42,077	10
113	30	70	568	243	736	2,542	68	450	211	11
\$20,783	\$7,300	\$16,830	\$110,022	\$82,207	\$152,530	\$534,888	\$15,520	\$94,287	\$40,007	12
\$31,411	\$97,244	\$77,313	\$472,133	\$362,822	\$694,324	\$1,569,613	\$35,679	\$340,806	\$144,566	13
\$158,732	\$316,080	\$182,005	\$1,701,493	\$1,235,033	\$2,233,601	\$4,607,780	\$169,461	\$884,454	\$601,088	14
3,035	1,852	7,800	51,280	40,559	58,896	84,044	12,579	21,184	20,513	15
\$8,730	\$9,329	\$10,221	\$90,940	\$90,496	\$129,202	\$272,962	\$27,406	\$62,908	\$44,852	16
1,447	600	2,878	20,444	10,182	17,101	33,720	1,024	6,725	7,775	17
\$20,608	\$12,034	\$50,932	\$403,252	\$190,694	\$335,216	\$642,397	\$37,845	\$129,212	\$162,656	18
			16	12	1,327	789		258	10	19
			\$252	\$201	\$20,036	\$9,859		\$5,990	\$123	20
207	51	50	816	857	1,365	3,240	186	1,173	420	21
\$9,220	\$2,323	\$2,068	\$34,277	\$37,410	\$58,774	\$132,077	\$7,977	\$49,796	\$18,725	22
228		1,250	4,763	2,051	5,713	2,253		419	1,812	23
\$1,430		\$2,432	\$20,813	\$8,015	\$11,015	\$3,355		\$377	\$11,421	24
4,374	9,650	9,320	108,879	39,786	96,483	214,745	17,571	40,603	41,570	25
\$552	\$2,414	\$2,000	\$25,503	\$11,048	\$20,026	\$58,311	\$4,951	\$11,622	\$10,441	26
8,058	8,040	2,000	112,192	54,733	212,268	153,284	9,000	85,015	61,991	27
\$282	\$455	\$98	\$3,733	\$1,746	\$7,914	\$5,773	\$360	\$2,888	\$2,351	28
19			117	7	86	25	52	115	23	29
\$95			\$1,424	\$164	\$838	\$107	\$546	\$341	\$538	30
25,335	1,497	23,500	174,798	208,690	259,712	547,129	92,500	100,689	255,783	31
\$642	\$45	\$875	\$4,791	\$6,528	\$13,838	\$17,285	\$1,912	\$3,875	\$9,457	32
42,000	581,600		33,959	1,114,620	2,441,307	3,941,160		458,378	2,779	33
\$2,475	\$40,988		\$2,201	\$62,373	\$140,837	\$223,999		\$26,072	\$112	34
48,000	398,500		28,382	742,000	1,331,355	1,787,839	5,000	409,636	8,585	35
\$2,027	\$16,921		\$1,266	\$29,496	\$57,820	\$72,575	\$250	\$18,924	\$644	36
138	170		168	422	1,060	2,563		534		37
\$5,859	\$10,185		\$7,150	\$18,756	\$71,489	\$138,684		\$30,774		38
\$45,598	\$57,861	\$53,513	\$533,431	\$305,201	\$403,872	\$861,946	\$46,138	\$153,100	\$161,449	39
\$29,260	\$19,632	\$22,735	\$273,174	\$190,234	\$551,048	\$979,583	\$29,658	\$191,051	\$61,318	40
\$9,529		\$3,000	\$110,128	\$32,180	\$109,675	\$478,935	\$2,905	\$79,175	\$9,721	41
\$19,416	\$144,173	\$35,031	\$279,068	\$251,085	\$301,935	\$699,932	\$9,513	\$128,289	\$107,280	42
\$580,589	\$1,011,373	\$744,593	\$6,286,273	\$3,832,556	\$7,451,082	\$15,545,910	\$549,031	\$3,274,667	\$1,933,265	43
\$46,191	\$58,911	\$119,010	\$181,559	\$1,901,624	\$3,954,660	\$9,406,183		\$2,620,665	\$63,408	44
\$536,478	\$50,000	\$607,383	\$6,066,714	\$1,860,245	\$2,961,727	\$5,934,144	\$549,031	\$602,002	\$1,869,859	45
			\$38,000	\$50,000	\$60,000	\$179,556				46
\$6,920	\$492,462	\$18,200		\$20,687	\$484,665	\$26,027		\$52,000		47
6	7		16	22	30	77		21	2	48
74	52		123	200	393	829		248	15	49
2			4	1	4	12		6		50
17			36	8	69	130		88		51
1		3	34	20	28	44	6	13	13	52
5		36	302	147	216	333	41	100	94	53
10		72	604	294	432	666	82	200	188	54
			11	2	2	5		1		55
			71	15	20	39		6		56
			142	30	40	78		12		57
1			11	3	12	29		19	5	58
8			60	10	33	62		90	28	59
8			60	10	33	62		90	28	60
				1	2	3		5		61
				6	9	12		24		62
				6	9	12		24		63

## AMERICAN ART GLASS.

The interest in art products in the United States has increased greatly in recent years. Formerly most of these art products were of foreign manufacture, but more and more our American manufacturers are devoting their attention to the production of wares that compare favorably with those from abroad. This is conspicuously the case with the glass products now made in the United States, as the following report will show.

### HISTORY.

The discovery of glass was doubtless accidental, although the exact facts are not known, as glass was used in most remote times. At first glass seems to have been used only for ornamental purposes, as imitation gems and beads are to be found among early remains in the Orient. According to Pliny and Strabo the glassworks of Sidon and Alexandria were famous in their times and produced beautiful articles, which were cut, engraved, gilded, and stained with the most brilliant colors, in imitation of precious stones. The making of glass objects reached a very high degree of perfection in Egypt; and in that country the art of using oxides, especially cobalt, for coloring was very early acquired. Indeed, until the time of Tiberius the making of glass was largely an Egyptian monopoly; but during his reign the industry was introduced into Rome. Thence it passed to Gaul, Spain, and Britain. For a time after the fall of the Roman Empire the manufacture of glass declined, but its many applications soon led to its revival. Thus, although the use of window glass was known to the Romans, as is shown by the specimens found in Herculaneum, it was not until the Middle Ages that this application came into general use in most European countries, reaching perhaps its most conspicuous development in the stained windows of the great cathedrals. The making of art glass reached a high degree of perfection in Venice, where such extraordinary skill in manipulation was attained by the glass blowers that in 1291 they were all placed on the island of Murano, so that the secrets of the craft might not be carried to foreign lands. Here also, about 1300, amalgam of tin was first applied to the backs of glass plates, and Venetian mirrors became the wonder of the world.

It is not necessary to pursue further the history of the progress of the making of glass, for the manufacture gradually extended throughout the civilized

world. From Europe the industry came to the New World, where curiously enough no glass was previously known. Of more than passing interest is the fact that the first industrial enterprise established in the territory of the present United States was a glass bottle factory, which was erected in the Virginia colony soon after October, 1608. According to Dr. E. A. Barber, "eight glassworkers, Welshmen and Poles, were brought over to operate it." The house stood in the woods about half a mile from Jamestown, near Powhatan creek. This manufacture seems to have proved unsuccessful, and a second glasshouse was erected in 1621. In that year Capt. William Norton brought to Virginia four Italians to manufacture all kinds of glass, among which were beads for trade with the Indians.

The application of chemistry to the industrial arts has done much to increase our knowledge of them. This is especially true of glassmaking, for by chemical analysis the exact ingredients of a particular kind of glass may be determined, and this knowledge, when applied constructively, results in the production of the desired mass. The old haphazard selection of proper constituents to form the glass now has given place to exact selection made possible by knowledge obtained by scientific methods.

It is a far cry from Venice in the Old World to New York in the New, but the art glass of the famous artisans of Murano must now yield its prestige to the beautiful results obtained by the scientific makers of the exquisite Favrite glass.

### MANUFACTURE.

The most important ingredient in the manufacture of glass is silica. In the early history of glassmaking, the silica known to yield a satisfactory quality of glass was naturally favored. The fact was soon realized, however, that the purer sand produced the better glass, and therefore an effort was made to free the silica from its impurities. At present, for the finer qualities of glass, the sand is subjected to a purification by washing, firing, and sifting.

In addition to silica, lime in the form of calcium carbonate or limestone, and an alkali, such as sodium sulphate or potassium carbonate, are the principal constituents of glass. Formerly these ingredients were brought together in a somewhat careless manner, but at present the utmost care is exercised in obtaining

exactly the proportions that are best suited to yield the desired result, chemical analysis being used to determine the proper mixture. An important addition to the mass is always a small quantity of broken glass, or cullet, which acts as a flux, causing the materials employed to react on one another at a lower temperature than they would if melted together without it. The mixing of the ingredients may be accomplished by turning over the various components with a wooden shovel and then sifting, or more satisfactorily, by using a mixer. A convenient mixer consists of a hollow drum with blades disposed like the floats of a paddle, revolving in a box of which the lower half is cylindrical.

The mass is melted in pots or crucibles, which are made of very refractory fire clay and should withstand a very high temperature. These crucibles, usually 8 to 12 in number, are assembled in a circular furnace at the base of a large chimney. Formerly the heat was obtained by the direct contact of the fuel and the pots, but now regenerative furnaces are commonly used, which burn gas, or, in the United States, to a larger extent, natural gas or petroleum.

When the mass has become molten and is of proper consistency it is collected in a soft ball on the end of an iron tube. Then this mass is shaped, either by carefully manipulating it by twisting it and by blowing into the tube, or else by forcing it into an iron mold where it is pressed. The details of this portion of the process naturally vary according to the article to be made.

The object, after it has been shaped, is cooled in an annealing oven in which the temperature is so regulated that the cooling proceeds with extreme slowness. The artificial heat, which is applied at the outset, is gradually diminished until the temperature becomes normal. The special object of the process is to allow the pores, which have been distended by heat, to contract evenly throughout the material, instead of closing more rapidly on the surface than on the inside.

By definition, glass is the transparent solid that is formed by the fusion of a siliceous material, such as sand, and an alkali. It may be further defined as consisting of one or more insoluble silicates with an excess of silica. There are two principal varieties of glass, crown or plate glass and flint glass. The former consists of silica with either potash or soda and lime, and the latter of silica with either potash or soda and a lead salt. Thus there are four possible varieties of glass, each one of which may be made gradually to approach the others in properties by varying the proportions of its constituents. These varieties are as follows, beginning with the one least fusible: (1) Potash lime glass, (2) soda lime glass, (3) potash lead glass, and (4) soda lead glass.

There are three principal varieties of art glass in which the glassmakers of the United States have distinguished themselves. They are stained glass, cut glass, and miscellaneous art glass.

*Stained glass.*—Originally stained glass, especially that used in windows, was in reality a mosaic formed of bits of colored glass attached to each other by means of leaden frames. A later development was the art of painting on glass—that is, of applying with the brush fusible pigments that were fixed by heat. The perfection of this art reached its culmination among the French in the thirteenth century, and its application was extended throughout Europe in the making of cathedral windows. The demand for such glass became so great that the work was entrusted to artisans, a step which first led to the debasement of the art and ultimately, in the seventeenth century, to its decadence. In recent years it has been revived, notably in the United States, for the assertion is justly made that John La Farge has “done more than any others during the last decade to replace glass painting again in the sphere of real art.” The principal places for the manufacture of stained glass in this country are New York city and Chicago.

*Cut glass.*—The details of the process of making cut glass may perhaps best be summarized by the two words “painstaking carefulness.” The materials that are used in the composition of the glass are selected with careful consideration. After being mixed, these ingredients are for thirty-six hours subjected to the heat of the furnace. Absolute homogeneity is essential. The mass is liquid, but it is sufficiently viscous to be so plastic and pliable as to lend itself most satisfactorily to the manipulations of the blower and modeler. This artisan gathers the lump of molten glass on the end of his hollow pipe, through which he blows until the glass globule has been distended to the desired proportions. Care, great care, must be exercised so that the glass shall be entirely free from any bubbles or other defects. Then the necessary smooth surface is obtained by rubbing the glass upon a flat slab of iron. Annealing then follows, and as the glass is extremely sensitive to the slightest change of atmosphere, again the utmost care must be exercised. A defect in the annealing would inevitably mean a defect in the glass. Therefore, although the process of cooling the glass to normal temperature is slow and tedious, frequently in the case of large and delicate pieces a double system of annealing is practiced that is, the pieces are packed a second time in a kiln, again fired, and then allowed to cool.

The blank glass now goes to the cutter. All that has gone before is simply preparatory. The pattern to be followed is traced on the blank, and the design is cut by an iron wheel against which the blank is pressed. Deeper and deeper the wheel cuts into the glass. “He dare not veer nor vary a hairsbreadth in curve or circle, groove, or angle—else is the symmetry of the design completely ruined. His nerve and his hand must be strong and steady as iron, so that he may gauge the exact effect of every contact between the glass and the wheel.” Days and even weeks are

sometimes required to grind a single piece of glass, and then it is only in the rough state. The design has been ground out by the wheel, but it has to be brought to the perfection of smoothness and polish. To accomplish this the smoother applies the glass to a sandstone wheel in order to clean out every particle of sand that may have clung to the glass, and to remove every roughness. Then, and only then, is the article ready to be polished into full brilliancy and beauty. This last process is done on a swiftly revolving wheel sprinkled with putty powder. As the wheel turns, the dullness of the blank gradually disappears and is replaced, as if by magic, by the sparkle and brilliancy of the perfect finished product.

In the United States about twelve producers have combined to form a national association of cut glass manufacturers. Most of these cut glass makers purchase the blanks and confine their operations simply to the cutting, although three make their own glass.

A variety of glass, originally made in England, but now produced by nearly all cut glass makers in the United States, is called "rock crystal." It is made of the same body as the ordinary cut glass, but is said to be ground with an emery wheel instead of a stone wheel. In this rock crystal the incision is not so deep as in the true cut glass. Flower and fruit effects that are exceedingly artistic are produced in this manner, and some very attractive results are obtained by the further addition of dull or mat effects. The amount of rock crystal made in this country does not exceed one-tenth of the entire output of art glass.

*Miscellaneous.*—Thus far in the United States the making of art glass, with one notable exception, has not been a marked success. The reason for this is very simple. The novelties produced have been so easily imitated that almost immediately upon their introduction rival firms have undertaken their imitation, and in their haste to secure their share of the market have practically destroyed the value of the product. A case in point may be cited. Some years ago an exceedingly pleasing variety of art glass, called "amberina," was made. Its chief attraction was its color, which was of a rich red at the top, passing gradually into yellow at the base, with all the shades of pink and orange between. It was a success at once, but so many imitations were put upon the market that the original maker, to save himself from loss, was compelled to sell his entire stock to department stores at reduced prices. This glass is now a rarity. Such an experience is by no means an isolated one in the history of American art wares, whether glass or pottery.

The one successful variety of art glass invented in the United States is the most original produced in the world since the time of the famous Venetian glass blowers. For reasons that are obvious from what has been said in the preceding paragraph, the secret of its manufacture is carefully preserved. Enough of its his-

tory is known, however, to permit the statement that after experimenting for a number of years, its inventor succeeded in obtaining a body that possessed the power of absorbing the vapors of metallic oxides which on cooling produced the beautiful iridescence that is one of the principal characteristics of the ware. Its chief individuality lies in its diversified radiance of iridescence and in the use of glass of various colors to produce design as an integral part of the structure of the object. An important feature in this glass is that all the decoration, except cutting and engraving, is done while the glass is in the plastic condition before it has been annealed. That is to say, there is no painting on of color, or luster, or texture; whatever effect is to be observed in the piece is one produced by true glass blowing and not by painting. This glass is particularly fitted for windows and mosaics, owing to its limitless range of color, diversity of tone, and endless variety of texture; also, for like reasons, it is extensively used for making blown, cast, rolled, wrought, and cut objects in ornamental glass. Its artistic suggestiveness and the readiness with which it combines with itself, color with color, and glass over glass, has led to the production of vases, lamps, bowls, and numerous other articles, made on purely original lines, and each one marked by a strong individuality. The objects made of this glass are, without exception, blown instead of being molded, as is the usual practice in glassware.

No such beautiful variety of glassware could remain long without attempts being made to reproduce it, and successful efforts were made both in Europe and in this country. Of the American imitations one made in New York city is particularly successful. It closely resembles the original, of which it has become a competitor in the market of art wares. Besides being made up into vases and other objects of art, the imitation finds extensive use in the manufacture of mosaic lamp shades.

One of the largest glass plants in New England, in addition to cut glass, which is perhaps its chief product, makes a crystal glass decorated with attractive designs of fruits and flowers, the outlines of which are traced in gold and fired. The objects made are for table and other household uses, and the designs are confined to fruits and flowers. Formerly this establishment made some interesting varieties of colored art glassware, three types of which were noteworthy. Two were shaded glasses, the first passing from a light canary yellow into a bright pink, while the second began as a delicate gray-blue and slowly developed into a pink. Both of these glasses were made either with brilliant or with dull mat effects. The third was a dark body in which were inlaid bright bits of colored glass, suggesting inlaid gems. Several varieties of iridescent and opalescent glassware were formerly made by this corporation. In some varieties a dark body was used, and in others the iridescence appeared on a plain crystal. More re-

cently they have introduced a new variety of glassware that finds a market as lamp shades. It consists of an ordinary glass body molded so as to bring out in relief various flowers or fruits which are painted with enamel colors so as to resemble the simulated objects as closely as possible and then fired. The finished product is a very brilliantly colored lamp shade which over a light closely resembles a bouquet in natural colors.

Two interesting varieties of glass manufactured in Connecticut are made up into novelties, such as fern dishes, jewel boxes, etc. One is an opalescent glass body, with a dark ground of solid color, such as brown, drab, or green, which is decorated by hand, usually with designs of flowers, and then fired in a kiln. The objects, such as jewel cases, have metal trimmings which are gold plated. The second is identical with the foregoing except that it possesses lighter or more daintily colored body.

A special ware is produced in Pennsylvania by methods similar to those followed in Nancy and Baccarat in France, and in certain places in Bohemia. The technical processes are quite simple. First, the body is produced in a shape which is satisfactory. After a pattern has been painted with a brush on the body, the object is immersed in a bath of hydrofluoric acid which will eat away the glass except where it is protected by the pattern, which, owing to its power of withstanding the acid, is called a "resist." Engraving then follows, which consists of the incision of the pattern by the use of a small rotating disk fed with emery and oil. This disk, sometimes not larger than the head of a pin, forms the point of the engraving tool against which the glass object is pressed to shape the incision, while the disk itself rotates on a fixed axis. Gilding is the application of gold to the glass direct, to a pattern previously etched, or to an enamel put upon the glass in order to form a design in relief. The gold thus applied is finally fused to the glass by heat. The color effect depends on the variously tinted layers of glass partly removed by the artisan, and on the etched surface, which shows a beautiful iridescence. This art glass made in Pennsylvania includes engraved, etched, or gilded glassware, and often the decoration embraces a combination of all these methods, sometimes with enamel in addition. As this glass is all handmade from beginning to end, it shows the artist's individuality expressing itself in the actual material.

One factory in Massachusetts has earned well deserved recognition for the high grade of its art glass. Although the variety of glass which it produces can hardly be called distinctive, still the excellent quality of the body (for only the most carefully selected materials are used) is readily recognized, and the shapes, some of which are adapted from antique and medieval forms, are well chosen. This company makes art glassware, such as vases, decanters, rose bowls, drinking glasses, and finger bowls in crystal, and also in green,

ruby, and opal, either plain or decorated with gold. The application of gold is perhaps the most distinctive feature of this company's products, although the bronze-green objects made by it are unique. Specimens with a glint or iridescence suggesting the hues of a variegated silk are remarkably praiseworthy.

A company in Ohio manufactures an extensive variety of crystal, colored, and opalescent tableware and novelties. The objects made are molded or pressed, and the ornamentation is accomplished by using shapes that are susceptible of special decoration. In a sweet-pea vase the color will be green and perhaps shaded, passing from a light tint to a darker one and ending with an opalescent border. The decoration frequently includes colored designs, perhaps flowers, painted on a solid background, often blue or ruby. Gilding is freely resorted to, and the beauty of the colored glass is enhanced by gold bands or lines. Flashed effects, spots of various colors artistically arranged with gilt borders, are sometimes used, and an opal glass with ivory tints decorated with flowers and gold is one of the special products of this company. These goods are naturally of a general commercial character and do not compete with the more distinctive art wares.

A corporation in West Virginia makes a special variety of art glass. This glass consists of either a plain or colored body in which metal is incorporated and over which a thin film of iridescence is made to appear irregularly. Color, metal, and iridescence serve to produce the decorative effects. This glass is made up into vases and into fancy household and table wares. Some varieties of this glass consist of a plain body having an engraved pattern, the incised portions of which are filled with gold and color, a process which yields especially attractive effects when flowers or garlands are used in the design.

*Special varieties.*—The following varieties of glass, while not of an artistic nature, are included as worthy of description on account of their peculiar properties.

The fact that glass is soluble in water and other liquids has been frequently urged as an objection to its use for vessels employed in making chemical analyses. Makers of chemical glass have at times introduced varieties of glassware which have been said to possess great resisting properties. The so-called Jena glass from Germany is perhaps the best known of these.

One American glass deserves mention on account of the resistance which it offers to the action of chemical reagents and because of its wide use in consequence of these properties for flasks, beakers, and other articles of glass necessary in chemical operations. A series of comparative tests showed that a liter of distilled water dissolved 4.6 milligrams of the American glass, as compared with 6.3 milligrams of Jena glass, while a solution of 10 parts of sulphuric acid and 10 parts nitric

acid in 80 parts of distilled water dissolved 48.1 milligrams of the American glass as compared with 33.4 milligrams of Jena glass and 113.4 milligrams of Schilling glass. In comparison with other glasses commonly used the American product "has been found to show the greatest resistance to the corrosive action of water and alkaline reagents."

Of some interest also is a variety of glass called variously "hot cast glass" or "hot cast porcelain." It is composed of cryolite 30 parts, sand 100 parts, and zinc oxide 10 parts, a compound which when heated in a crucible yields a white opaque glass that melts at a low temperature. In consequence of this property it was for a time rather widely used in the manufacture of souvenir vases and other objects that were readily produced in a mold. It was also used to some extent in the form of slabs as a substitute for marble. More recently it has been employed to make containers for certain corrosive acids, such as hydrofluoric or hydrofluosilicic acids.

*Improvements in methods.*—Although no radical changes in the methods of glassmaking are to be noted, minor improvements tending toward the production of a better article are conspicuous. A more careful selection of the crude materials is now generally required in the manufacture of the better qualities of glass. The application of chemical analysis for the purpose of demonstrating the absence of impurities in the constituents, or for the determination of the causes of a peculiar effect in the finished product, should be

mentioned as one of the steps in advance. The replacing of hand labor by mechanical devices is found to save time and also to reduce the cost of an object. In the manufacture of cut glass the multiplication of the pattern is accomplished mechanically; thus, the pattern is first drawn on steel, then etched, and transferred to the glasses mechanically instead of being drawn on each piece of glass by hand. Also, in engraving art glass the foot lathe formerly used has been replaced by a power lathe. The greatest improvement, however, consists in the better division of labor, the training of a man to be a specialist in one operation rather than a less skilled worker in all. On this point one glassmaker writes: "The main improvement, however, has to be looked for in the training of workmen and chemical research. Both tasks are beyond individual efforts, as is shown by the numerous trade schools serving also as experiment stations subsidized by the government in countries where this industry flourishes."

*Quality of products.*—The information obtained shows very clearly that the quality of the stained glass and the cut glass made in the United States is superior to that of the imported glass. In the miscellaneous art glass the results have not been so satisfactory, although one variety is conceded to be unsurpassed as an original product, and another to be of high grade. The remaining varieties are excellent so far as they go, but they are neither novel nor of better quality than the imported.

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# CLAY PRODUCTS

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(875)

# CLAY PRODUCTS.

By CHARLES E. HALL.

At the census of 1905 the schedules of inquiry sent to establishments manufacturing brick, pottery, and other articles of which clay is the principal material, in addition to the general schedule which was sent to all manufacturing establishments, consisted of a supplemental schedule intended only for reports of establishments manufacturing chiefly brick and drain-tile, and another special schedule for establishments having as their principal product pottery, terra cotta,

and fire clay products. In addition to special inquiries this latter schedule contained all the inquiries of the former, as establishments classified as potteries manufacture, in many instances, the usual products of brickyards.

Table 1 is a comparative summary of the statistics for the clay industry in its entirety as returned at the censuses of 1850 to 1905, with percentages of increase.

TABLE 1.—CLAY PRODUCTS—COMPARATIVE SUMMARY, WITH PER CENT OF INCREASE; 1850 TO 1905.

	CENSUS.							PER CENT OF INCREASE.					
	1905	1900	1890	1880	1870	1860	1850	1900 to 1905	1890 to 1900	1880 to 1890	1870 to 1880	1860 to 1870	1850 to 1860
Number of establishments.....	5,507	6,423	6,535	6,383	3,959	2,240	2,121	114.3	11.7	2.4	61.2	76.7	5.6
Capital.....	\$230,882,077	\$148,038,323	\$108,705,070	\$85,039,939	\$20,776,011	\$9,707,952	\$5,217,231	56.0	36.2	210.2	30.0	175.8	86.1
Salaried officials, clerks, etc., number.....	7,442	5,203	5,291	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	43.0	217.3	.....	.....	.....	.....
Salaries.....	\$8,158,213	\$5,030,105	\$4,264,043	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	62.0	18.4	.....	.....	.....	.....
Wage-earners, average number.....	118,440	105,603	123,156	70,370	50,107	24,509	19,801	12.1	114.2	60.8	62.6	104.2	24.1
Total wages.....	\$53,823,070	\$30,575,070	\$38,578,389	\$17,044,259	\$13,332,547	\$5,224,859	\$4,890,422	36.0	2.0	126.3	27.8	155.2	6.8
Men 16 years and over.....	100,054	98,127	115,000	69,014	46,333	24,038	19,139	12.1	115.1	72.8	47.6	88.6	25.6
Wages.....	\$51,470,320	\$37,957,248	\$37,420,873	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	35.0	1.4	.....	.....	.....	.....
Women 16 years and over.....	5,389	4,557	2,235	1,210	570	531	062	31.4	103.9	83.8	111.1	8.5	210.8
Wages.....	\$1,870,000	\$1,142,579	\$530,209	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	03.7	118.1	.....	.....	.....	.....
Children under 16 years.....	2,500	3,009	5,321	8,440	4,258	( <sup>1</sup> )	( <sup>1</sup> )	216.7	243.5	37.0	98.4	.....	.....
Wages.....	\$470,045	\$475,243	\$615,247	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	0.8	222.8	.....	.....	.....	.....
Miscellaneous expenses.....	\$14,025,214	\$0,845,040	\$7,111,770	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	113.7	43.2	.....	.....	.....	.....
Cost of materials used.....	\$32,007,001	\$22,021,384	\$18,257,008	\$12,053,897	\$9,531,102	\$2,930,547	\$1,708,374	43.6	25.5	43.9	33.1	225.2	65.7
Value of products.....	\$135,352,854	\$95,533,802	\$80,827,785	\$41,810,920	\$30,308,151	\$13,957,825	\$8,180,359	41.7	6.4	114.8	15.0	160.0	70.8

<sup>1</sup> Exclusive of the statistics of 2 establishments engaged primarily in the manufacture of other products that made clay products, to the value of \$290,452.  
<sup>2</sup> Decrease.  
<sup>3</sup> Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905, but not included in this table.  
<sup>4</sup> Not reported separately.  
<sup>5</sup> Not reported.

The decrease since 1900 in the number of establishments shown in the above table is noteworthy, and was caused largely by the consolidation of a number of plants under a single management. Notwithstanding this decrease in the number of establishments reporting, the capital increased \$82,844,654, or 56 per cent, between 1900 and 1905. Of this increase \$44,974,133, or 54.3 per cent, was in the pottery, terra cotta, and fire clay products branch of the industry, and \$37,870,521, or 45.7 per cent, in the brick and tile branch. The increase in the former over 1900 was 68.2 per cent, and in the latter 46.1 per cent.

The concentration of the industry is further indicated by the increase of 37.5 per cent in the average number of employees per establishment between 1900 and 1905, and by the fact that the total value of products from the 5,507 establishments in 1905 exceeds that from the 6,423 establishments reported in 1900

by \$39,818,992, or 41.7 per cent. This increase during five years is largely in excess of that shown for any ten-year period since 1850, with the single exception of that of \$48,016,865 between 1880 and 1890. The steady increase in the price of lumber, the growing demand of builders and investors for building material that affords the greatest protection against fires, and the increasing appreciation of the products of American potteries, are conditions favorable to a rapid growth of the manufacture of clay products.

At the census of 1905 compared with that of 1900 there was an increase in the number of salaried officials and in the amount of salaries. The number of wage-earners employed also showed an increase, although there was a decrease of 16.7 per cent in the average number of children under 16 years of age, which was due largely to the operation of compulsory education and factory laws of the various states and to the introduction of labor saving machinery.

When the increase in the cost of materials used is compared with that of the value of products, the figures show that from 1890 to 1900 the cost of materials increased 25.5 per cent and the value of products only 6.4 per cent; and that during the following five years

the cost of materials increased 43.6 per cent and the value of products 41.7 per cent.

Table 2 is a comparative summary of the manufacture of clay products in 1900 and 1905, by states and territories and geographic divisions.

TABLE 2.—CLAY PRODUCTS—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES AND GEOGRAPHIC DIVISIONS: 1905 AND 1900.

STATE, TERRITORY, OR GEOGRAPHIC DIVISION.	Census.	Number of establishments.	Capital.	WAGE-EARNERS AND WAGES.								Miscellaneous expenses.	Cost of materials used.	Value of products.
				Total.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.				
				Average number.	Wages.	Average number.	Wages.	Average number.	Wages.	Average number.	Wages.			
United States..	1905 1900	5,607 6,423	\$230,882,977 148,038,323	118,449 106,693	\$53,823,070 39,576,070	109,954 98,127	\$51,470,320 37,957,248	5,989 4,567	\$1,870,099 1,142,579	2,506 3,009	\$476,645 475,243	\$14,625,214 6,845,040	\$32,007,061 22,021,384	\$135,352,854 95,533,892
North Atlantic division.	1905 1900	1,160 1,250	87,945,484 60,856,038	41,205 39,580	19,094,449 15,838,193	38,464 80,828	18,351,807 15,190,046	1,766 1,757	529,909 456,545	975 995	213,113 185,002	5,135,378 3,145,726	11,228,432 9,083,014	46,958,848 37,562,045
Maine.....	1905 1900	60 74	599,016 623,335	330 547	164,719 232,330	328 540	164,172 232,250	1 .....	437 .....	1 1	110 80	21,721 61,719	117,500 163,742	420,111 682,235
New Hampshire..	1905 1900	36 57	932,579 702,713	527 632	228,979 241,915	524 622	228,493 239,412	1 2	305 399	2 8	181 2,104	51,287 26,964	151,118 158,234	529,008 570,287
Vermont.....	1905 1900	0 16	100,085 180,298	108 122	46,811 44,842	108 119	46,811 44,442	..... .....	..... .....	..... 8	..... 400	9,815 8,487	20,724 29,137	104,235 131,525
Massachusetts...	1905 1900	89 110	4,052,595 3,946,239	1,665 2,013	789,717 884,452	1,593 1,957	707,778 867,797	61 54	19,354 15,004	11 7	2,585 1,591	257,153 166,938	504,039 588,043	1,888,965 2,181,510
Connecticut.....	1905 1900	39 45	2,178,196 1,862,138	1,182 1,107	536,621 489,488	1,147 1,130	526,395 489,363	27 19	7,940 4,396	8 9	2,280 1,729	124,520 74,964	236,921 218,035	1,225,327 1,074,202
New York.....	1905 1900	235 269	16,065,277 12,843,227	9,432 9,007	4,494,260 3,637,462	8,983 8,570	4,363,346 3,529,338	407 342	123,144 89,154	42 95	7,770 18,970	1,184,602 895,878	2,240,304 1,031,003	10,719,042 8,073,769
New Jersey.....	1905 1900	153 157	24,087,865 18,932,379	11,434 10,487	5,506,212 4,077,059	10,181 9,327	5,151,852 4,348,418	962 929	286,990 287,089	201 231	67,370 41,552	1,354,865 972,866	3,202,701 2,703,606	13,547,183 10,786,678
Pennsylvania....	1905 1900	528 528	39,593,593 21,815,909	16,230 15,605	7,192,127 5,633,045	15,303 14,553	6,967,517 5,454,020	307 411	91,799 60,443	620 641	132,811 110,170	2,031,054 938,196	4,508,060 3,589,924	18,039,187 14,081,844
Not distributed by states <sup>1</sup> .	1905	5	336,279	267	135,003	297	135,008	.....	.....	.....	.....	99,761	155,775	485,790
South Atlantic division.	1905 1900	506 619	19,422,362 12,797,905	11,633 11,665	3,906,570 3,249,971	10,748 10,746	3,703,827 3,081,203	440 356	144,582 98,341	445 563	58,161 70,427	1,041,458 474,829	2,432,905 1,061,703	10,041,749 7,677,880
Delaware.....	1905 1900	21 25	272,325 283,637	200 215	85,941 70,063	207 211	85,437 69,338	..... 1	..... 100	2 3	504 625	32,611 7,772	20,485 22,439	205,286 167,692
Maryland.....	1905 1900	66 63	6,484,484 5,074,263	2,389 2,583	923,073 837,798	2,222 2,326	878,000 778,876	81 80	29,080 31,287	86 177	15,393 27,635	168,224 92,946	364,820 352,299	1,948,801 1,079,166
District of Columbia.	1905 1900	14 17	765,330 702,040	368 546	141,380 204,077	357 546	140,220 204,077	..... .....	..... .....	11 .....	1,151 .....	30,320 43,332	68,332 90,954	267,201 481,145
Virginia.....	1905 1900	87 85	3,267,056 1,840,713	2,045 1,518	697,561 427,588	1,933 1,432	682,156 416,692	7 2	2,240 567	105 84	13,165 10,329	180,050 66,899	458,814 220,108	1,880,901 1,089,899
West Virginia....	1905 1900	54 56	4,229,633 2,219,842	2,033 1,819	963,554 684,820	1,645 1,498	844,810 610,536	352 263	113,262 64,949	36 58	5,482 9,335	302,485 145,304	555,933 316,103	2,150,485 1,541,239
North Carolina..	1905 1900	117 178	742,617 527,925	1,163 1,546	266,698 292,928	1,097 1,442	259,407 283,435	..... 2	..... 300	66 102	7,231 9,193	42,088 25,964	193,102 173,507	802,145 725,016
South Carolina...	1905 1900	53 86	614,347 366,711	963 1,191	203,865 251,106	932 1,130	200,679 245,094	..... 5	..... 563	31 56	3,186 5,440	46,818 26,324	191,139 136,986	667,047 596,693
Georgia.....	1905 1900	80 91	2,704,713 1,311,880	2,038 1,988	515,900 414,092	1,937 1,912	504,639 407,255	..... 3	..... 575	101 71	11,261 6,292	219,523 60,274	509,361 306,280	1,817,299 1,259,577
Florida.....	1905 1900	14 18	341,857 200,885	425 261	108,598 67,499	418 249	107,810 65,900	..... .....	..... .....	7 12	788 1,599	19,439 5,954	64,010 34,018	236,034 137,953
North Central division.	1905 1900	2,826 3,433	98,777,325 62,015,347	51,048 41,878	24,495,361 16,332,274	46,707 38,903	23,182,302 15,600,538	3,711 2,425	1,184,526 583,334	630 850	128,533 139,402	6,744,399 2,500,142	15,131,721 9,797,007	61,141,674 39,911,855
Ohio.....	1905 1900	795 934	38,408,918 22,907,596	22,638 17,223	10,618,467 6,967,817	19,108 14,861	9,472,692 6,401,288	3,355 2,154	1,110,277 528,863	175 208	35,498 37,666	2,886,589 1,026,550	6,455,844 4,211,061	25,656,870 16,480,812
Indiana.....	1905 1900	430 607	9,285,363 6,030,788	5,354 4,859	2,383,817 1,726,732	4,974 4,535	2,313,115 1,667,866	301 200	57,438 38,703	79 124	13,264 20,223	645,408 241,275	1,027,858 804,042	6,461,377 4,222,529
Illinois.....	1905 1900	480 619	19,596,095 12,710,709	7,879 7,229	4,296,138 2,971,907	7,758 7,034	4,265,458 2,938,064	34 37	11,960 9,250	87 168	18,720 24,593	1,355,840 499,355	2,437,581 1,601,742	10,802,721 7,224,915
Michigan.....	1905 1900	175 186	2,298,557 1,777,532	1,639 1,592	752,099 530,930	1,608 1,542	745,495 523,054	3 19	930 3,277	28 31	5,674 4,599	211,498 65,844	468,539 275,327	1,940,907 1,280,590

<sup>1</sup> Includes only brick and tile. Pottery, terra cotta, and fire clay products are included in total "not distributed by states."

<sup>2</sup> Includes 2 establishments in Rhode Island manufacturing brick and tile.

<sup>3</sup> Includes figures for 5 establishments (2 in Maine, 2 in New Hampshire, and 1 in Vermont) manufacturing pottery, terra cotta, and fire clay products.

CLAY PRODUCTS.

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TABLE 2.—CLAY PRODUCTS—COMPARATIVE SUMMARY, BY STATES AND TERRITORIES AND GEOGRAPHIC DIVISIONS: 1905 AND 1900—Continued.

STATE, TERRITORY, OR GEOGRAPHIC DIVISION.	Consus.	Number of establishments.	Capital.	WAGE-EARNERS AND WAGES.								Miscellaneous expenses.	Cost of materials used.	Value of products.
				Total.		Men 16 years and over.		Women 16 years and over.		Children under 16 years.				
				Average number.	Wages.	Average number.	Wages.	Average number.	Wages.	Average number.	Wages.			
North Central division—Continued.	1905	145	\$3,070,566	1,650	\$990,095	1,003	\$682,821	3	\$255	44	\$7,019	\$133,811	\$550,637	\$1,863,085
	1900	172	2,233,353	1,470	545,754	1,418	534,552	1	100	60	11,102	95,638	731,574	1,310,200
Minnesota.....	1905	105	2,084,000	1,306	651,844	1,287	647,739	3	630	16	3,475	141,256	485,166	1,789,861
	1900	112	1,570,098	1,276	481,403	1,232	473,632	10	2,181	34	5,680	50,775	339,662	1,217,743
Iowa.....	1905	309	4,037,604	2,711	1,282,613	2,664	1,274,173	4	1,130	43	7,310	313,450	866,669	3,440,225
	1900	356	3,437,013	2,220	862,159	2,175	854,392	1	360	44	7,407	140,459	517,580	2,224,020
Missouri.....	1905	195	12,835,085	4,809	2,364,205	4,737	2,332,683	5	1,280	127	30,032	787,799	1,420,021	5,682,267
	1900	256	9,003,185	4,047	1,514,674	3,891	1,492,566	.....	.....	156	22,108	362,296	842,077	3,650,400
North Dakota ...	1905	14	204,497	117	59,825	116	59,625	.....	.....	1	200	11,121	34,345	170,257
	1900	13	218,950	121	50,977	114	55,377	3	600	4	1,000	3,865	34,734	158,874
South Dakota ...	1905	10	174,635	49	27,401	49	27,401	.....	.....	.....	.....	6,837	20,305	83,756
	1900	11	94,125	48	19,687	48	19,687	.....	.....	.....	.....	1,378	12,625	46,150
Nebraska.....	1905	99	1,565,889	905	471,425	882	466,285	1	210	22	4,930	61,343	277,174	1,131,913
	1900	107	1,270,933	857	328,244	839	324,056	.....	.....	18	3,288	41,434	203,865	841,305
Kansas.....	1905	99	3,708,807	1,031	890,442	1,021	894,515	2	416	8	1,511	189,441	480,982	2,088,735
	1900	90	774,410	927	325,850	914	324,114	.....	.....	13	1,736	58,273	162,118	753,410
South Central division.	1905	643	11,060,594	9,706	3,335,510	9,244	3,263,922	70	10,820	302	60,708	978,675	2,308,324	9,403,978
	1900	726	9,408,437	9,124	2,372,516	8,573	2,303,495	12	2,209	539	66,812	367,285	1,352,737	6,010,975
Kentucky.....	1905	109	3,080,448	2,426	817,728	2,303	799,372	68	10,600	55	7,756	255,451	523,007	2,133,291
	1900	100	1,594,000	1,759	484,800	1,676	473,326	10	1,729	74	9,745	64,875	326,262	1,355,094
Tennessee.....	1905	92	1,385,975	1,531	500,030	1,481	499,702	.....	.....	50	6,328	167,627	344,165	1,409,673
	1900	100	1,062,993	1,452	384,752	1,366	374,533	.....	.....	83	10,169	111,544	240,063	944,610
Alabama.....	1905	70	1,478,722	1,309	388,192	1,217	375,392	2	220	90	12,580	94,666	232,393	1,120,259
	1900	93	631,334	1,349	323,370	1,201	304,018	.....	.....	143	19,352	42,858	102,455	883,179
Mississippi.....	1905	74	846,508	903	271,806	831	259,048	.....	.....	72	12,758	48,095	177,423	782,842
	1900	78	506,214	929	207,463	872	201,605	.....	.....	57	5,868	26,337	103,145	540,725
Louisiana.....	1905	67	1,388,467	1,003	410,514	1,013	401,538	.....	.....	50	8,976	102,773	217,252	1,003,477
	1900	61	683,093	1,064	267,021	961	254,631	2	480	101	11,910	47,989	107,993	553,465
Arkansas.....	1905	58	966,827	547	194,177	528	191,348	.....	.....	19	2,829	90,736	200,183	812,076
	1900	65	388,310	494	127,252	474	124,532	.....	.....	20	2,670	8,634	63,537	336,899
Indian Territory.	1905	27	410,536	217	104,219	216	104,099	.....	.....	1	150	23,176	51,461	248,931
	1900	13	26,077	45	17,900	43	17,658	.....	.....	2	302	2,281	6,410	35,075
Oklahoma.....	1905	23	321,974	184	81,559	183	81,259	.....	.....	1	300	32,757	76,476	261,438
	1900	36	109,825	173	62,902	170	62,263	.....	.....	3	639	3,459	24,420	149,712
Texas.....	1905	114	1,787,137	1,526	561,285	1,472	552,194	.....	.....	54	9,091	168,394	435,994	1,631,391
	1900	171	1,496,066	1,859	496,996	1,811	490,829	.....	.....	48	6,167	59,308	278,393	1,212,266
Western division.....	1905	309	12,845,920	4,797	2,946,313	4,732	2,929,506	2	802	63	15,945	714,998	1,774,558	7,712,555
	1900	389	5,960,001	3,440	1,782,116	3,377	1,766,966	7	2,150	62	13,000	267,058	1,026,923	4,371,107
Montana.....	1905	14	240,100	97	76,005	95	76,020	.....	.....	2	645	13,788	38,069	178,675
	1900	28	451,709	220	150,892	223	149,942	1	350	2	600	15,165	91,606	314,340
Idaho.....	1905	10	91,257	72	44,891	71	44,480	.....	.....	1	411	8,762	27,415	112,770
	1900	24	51,882	44	18,144	44	18,144	.....	.....	.....	.....	1,214	8,805	46,609
Wyoming.....	1905	3	14,090	6	5,714	6	5,714	.....	.....	.....	.....	2,553	2,413	17,195
	1900	4	9,775	11	4,900	11	4,900	.....	.....	.....	.....	216	1,033	8,450
Colorado.....	1905	74	1,808,140	971	590,656	958	586,116	2	802	11	3,738	123,527	460,808	1,603,837
	1900	75	1,381,710	812	452,949	806	451,304	1	350	5	1,295	60,167	247,049	1,071,388
New Mexico.....	1905	10	41,700	64	31,409	57	29,896	.....	.....	7	1,513	1,768	17,605	80,910
	1900	11	55,395	122	48,586	121	48,486	.....	.....	1	100	1,553	22,878	108,090
Arizona.....	1905	5	79,428	30	20,380	30	20,380	.....	.....	.....	.....	10,959	16,476	45,881
	1900	19	56,945	89	46,980	83	45,752	1	70	5	1,153	9,950	15,202	101,753
Utah.....	1905	45	529,414	325	192,475	306	188,877	.....	.....	19	3,593	35,136	97,446	422,691
	1900	56	209,407	285	100,151	263	96,300	.....	.....	22	3,851	11,146	38,862	216,049
Nevada.....	1905	5	78,005	21	15,816	21	15,816	.....	.....	.....	.....	2,697	6,265	37,905
	1900	7	19,905	14	9,885	14	9,885	.....	.....	.....	.....	541	3,499	17,850
Washington.....	1905	57	1,953,760	674	419,382	672	419,088	.....	.....	2	294	116,743	270,092	1,090,909
	1900	40	806,885	455	245,762	448	244,286	1	600	6	876	36,938	110,593	583,857
Oregon.....	1905	46	542,424	320	168,153	316	167,103	.....	.....	4	1,050	41,848	107,145	445,008
	1900	51	407,824	277	124,873	267	122,415	1	276	9	2,182	17,876	60,278	317,978
California.....	1905	91	7,412,005	2,217	1,880,772	2,200	1,376,078	.....	.....	17	4,696	357,212	780,855	3,676,774
	1900	74	2,512,164	1,111	578,994	1,097	575,552	2	504	12	2,938	112,302	427,113	1,585,738
Not distributed by states or divisions <sup>2</sup> .	1905	3	225,283	60	45,467	59	45,342	.....	.....	1	125	10,306	82,021	93,750

<sup>1</sup> Includes only brick and tile. Pottery, terra cotta, and fire clay products are included in total "not distributed by states or divisions."  
<sup>2</sup> Includes figures for 3 establishments (2 in Mississippi and 1 in Montana) manufacturing pottery, terra cotta, and fire clay products.

The figures shown in this table for Maine, Mississippi, Montana, New Hampshire, and Vermont for 1905 include only brick and tile; the statistics for pottery, terra cotta, and fire clay products appearing in the groups "not distributed by states" to avoid disclosing the operations of individual establishments.

The North Central division of states leads in the production of clay wares both in 1900 and 1905, producing 41.8 per cent of the total value for the United States at the former period and 45.2 per cent at the latter. Next in importance is the North Atlantic division, which contributed 39.3 per cent of the total value for the country in 1900 and 34.7 per cent in 1905. The combined products of these two divisions amounted in 1905 to

\$108,100,822, or 79.9 per cent of the total of all clay products. Of the remainder, the South Central division produced 7 per cent, the South Atlantic division 7.4 per cent, and the Western division 5.7 per cent. Although the relative positions of the different divisions have not changed since 1900, the North and South Atlantic divisions each report a smaller per cent of the total product in 1905 than in 1900, which would indicate a more rapid growth of the industry throughout the states to the west.

Table 3 shows for states and territories the value of products, their relative rank, and the per cent of the total each produced at the censuses of 1890, 1900, and 1905.

TABLE 3.—CLAY PRODUCTS—RANK OF STATES BY VALUE OF PRODUCTS, WITH PER CENT OF TOTAL: 1890 TO 1905.

STATE OR TERRITORY.	1905			1900			1890		
	Rank.	Value of products.	Per cent of total.	Rank.	Value of products.	Per cent of total.	Rank.	Value of products.	Per cent of total.
United States.....	.....	\$135,352,854	100.0	.....	\$65,533,862	100.0	.....	\$80,827,785	100.0
Ohio.....	1	25,086,870	18.0	1	16,480,812	17.3	2	10,800,938	12.1
Pennsylvania.....	2	18,039,187	13.3	2	14,081,844	14.7	1	11,143,068	12.4
New Jersey.....	3	13,547,183	10.0	3	10,780,073	11.3	4	7,001,011	8.9
Illinois.....	4	10,802,721	8.0	5	7,224,015	7.6	5	7,050,082	8.9
New York.....	5	10,719,042	7.0	4	8,073,700	8.5	3	8,800,273	9.8
Indiana.....	6	6,461,377	4.8	6	4,222,520	4.4	7	3,142,454	3.5
Missouri.....	7	5,682,267	4.2	7	3,050,400	3.8	6	4,782,610	5.3
California.....	8	3,676,774	2.7	12	1,585,738	1.7	9	2,206,014	2.5
Iowa.....	9	3,440,225	2.6	8	2,224,020	2.3	14	1,775,165	2.0
West Virginia.....	10	2,156,485	1.6	13	1,541,239	1.6	35	304,865	0.3
Kentucky.....	11	2,133,291	1.6	14	1,355,004	1.4	22	1,206,181	1.3
Kansas.....	12	2,088,736	1.6	25	753,411	0.8	28	690,574	0.8
Maryland.....	13	1,948,801	1.4	11	1,070,166	1.8	12	1,085,828	2.2
Michigan.....	14	1,940,007	1.4	15	1,280,500	1.3	17	1,407,057	1.6
Massachusetts.....	15	1,888,065	1.4	9	2,181,510	2.3	8	2,810,700	3.1
Virginia.....	16	1,880,001	1.4	10	1,080,300	1.1	18	1,361,438	1.5
Wisconsin.....	17	1,863,085	1.4	10	1,810,206	1.9	13	1,785,442	2.0
Georgia.....	18	1,817,209	1.4	16	1,259,877	1.3	16	1,412,792	1.6
Minnesota.....	19	1,789,861	1.3	17	1,217,743	1.3	19	1,331,339	1.5
Texas.....	20	1,631,301	1.2	18	1,212,266	1.3	20	1,311,270	1.5
Colorado.....	21	1,603,837	1.2	21	1,071,388	1.1	10	2,238,618	2.5
Tennessee.....	22	1,409,673	1.0	22	644,610	1.0	21	1,277,307	1.4
Connecticut.....	23	1,225,327	0.9	26	1,074,202	1.1	24	863,040	1.0
Nebraska.....	24	1,131,613	0.8	24	841,305	0.9	11	2,173,032	2.4
Alabama.....	25	1,120,259	0.8	23	883,129	0.9	27	802,331	0.9
Washington.....	26	1,090,009	0.8	20	683,857	0.6	15	1,529,470	1.7
Louisiana.....	27	1,008,477	0.7	31	553,465	0.6	34	330,405	0.4
Arkansas.....	28	812,676	0.6	34	330,899	0.4	29	520,734	0.6
North Carolina.....	29	802,145	0.6	26	725,010	0.8	32	346,270	0.4
Mississippi.....	30	782,842	0.6	32	540,725	0.6	33	339,939	0.4
Maine.....	31	420,111	0.3	27	602,235	0.7	26	804,074	0.9
South Carolina.....	32	697,047	0.5	28	596,093	0.6	30	279,889	0.3
New Hampshire.....	33	529,008	0.4	30	670,287	0.6	25	835,150	0.9
Oregon.....	34	445,008	0.3	35	317,978	0.3	30	401,048	0.5
Utah.....	35	422,601	0.3	37	215,040	0.2	31	421,058	0.5
District of Columbia.....	36	297,201	0.2	33	481,145	0.5	23	961,587	1.1
Oklahoma.....	37	261,438	0.2	40	149,712	0.2	44	11,500	(*)
Montana.....	38	178,675	0.1	36	314,340	0.3	38	238,610	0.3
Indian Territory.....	39	248,031	0.2	47	35,075	(*)	.....	.....	.....
Florida.....	40	236,634	0.2	41	137,953	0.1	40	119,260	0.1
Delaware.....	41	205,230	0.2	38	167,692	0.2	37	268,534	0.3
North Dakota.....	42	170,257	0.1	39	153,874	0.2	42	45,775	(*)
Vermont.....	43	104,235	0.1	42	131,525	0.1	41	119,039	0.1
Idaho.....	44	112,770	0.1	45	46,609	0.1	45	0,800	(*)
South Dakota.....	45	83,756	0.1	46	40,150	(*)	39	134,050	0.1
New Mexico.....	46	80,010	0.1	43	108,090	0.1	.....	.....	.....
Arizona.....	47	45,881	(*)	44	101,758	0.1	40	4,300	(*)
Nevada.....	48	37,005	(*)	48	17,850	(*)	.....	.....	.....
Wyoming.....	49	17,105	(*)	49	8,450	(*)	43	25,900	(*)
Not distributed by states.....	.....	579,540	0.4	.....	.....	.....	.....	315,300	0.4

1 Includes products of 2 establishments in Rhode Island in 1905 and 1 in 1900.  
 2 Figures shown are for brick and tile, although in determining the rank of states, pottery, terra cotta, fire and other clay products were taken into account.  
 3 Less than one-tenth of 1 per cent.  
 4 In 1905, includes pottery, terra cotta, and fire clay products for establishments in Maine, Mississippi, Montana, New Hampshire, and Vermont; in 1890, brick and tile for establishments in Indian Territory and Rhode Island; and pottery, terra cotta, and fire clay products for establishments in Delaware, Florida, Nebraska, Oregon, Rhode Island, and Utah, to avoid disclosing individual operations.

Ohio not only continues to be the leading state in the value of clay products, but the state's proportion of the total for the United States has increased from 12.1 per cent in 1890 to 19 per cent in 1905. In 1905 its products were valued at \$25,686,870, or 19 per cent of the total for the country, as compared with \$16,480,812, or 17.3 per cent of the total, in 1900. From 1900 to 1905 it increased its production \$9,206,058, or 55.9 per cent, while the increase for the country as a whole was only 41.7 per cent.

In 1905 Pennsylvania retained second place, with products valued at \$18,039,187, or 13.3 per cent of the total for the country, an increase over 1900 of \$3,957,343, or 28.1 per cent. New Jersey was third with 10.1 per cent of the total product, and an increase of \$2,760,510, or 25.6 per cent. Illinois with a gain of 49.5 per cent, and producing 8 per cent of the total value of products, advanced from fifth rank in 1900 to fourth in 1905, displacing New York, which produced only 7.9 per cent of the total, and reported an increase of only 32.8 per cent.

In 1905 the proportion for the four states, Ohio, Pennsylvania, New Jersey, and Illinois, aggregate 50.3 per cent of the total value of all clay products manufactured in the United States. In 1905 compared with 1900 the percentages of increase for Ohio and Illinois were greater than that for the country as a whole, while those for New Jersey, New York, and Pennsylvania were considerably less.

Indiana and Missouri stood sixth and seventh, in the order named, both in 1905 and in 1900. California, twelfth in 1900, displaced Iowa from eighth rank in 1900 to ninth in 1905. The most noteworthy advance is that of Kansas from twenty-fifth rank in 1900 to twelfth in 1905, the increase for this state in value of

products being 177.2 per cent. Decreases were shown only for Arizona, the District of Columbia, Massachusetts, Montana, and New Mexico. The figures of the table indicate decreases also for Maine, New Hampshire, and Vermont, but from these figures for 1905, pottery, terra cotta, and fire clay products had to be excluded to avoid disclosing individual operations. If they had been included, these states would have shown increases.

Table 4 shows the total cost of materials used in the manufacture of clay products in 1900 and 1905.

TABLE 4.—Clay products—cost of materials used, with amount and per cent of increase: 1905 and 1900.

	1905		1900		INCREASE.	
	Cost.	Per cent of total.	Cost.	Per cent of total.	Amount.	Per cent.
Total.....	\$32,907,961	100.0	\$22,921,384	100.0	\$9,986,577	43.6
Clay.....	5,345,357	16.2	3,548,336	15.5	1,797,021	50.6
Fuel.....	20,147,612	61.2	12,633,680	55.1	7,513,932	59.5
Packing materials...	848,867	2.6	586,198	2.6	262,669	44.8
All other materials...	6,566,125	20.0	6,163,170	26.8	412,955	6.7

The cost of all materials in 1905 was \$32,907,961 as compared with \$22,921,384 in 1900, an increase of \$9,986,577, or 43.6 per cent. The cost of fuel was the largest item, amounting to \$20,147,612, or 61.2 per cent of the total, as against \$12,633,680, or 55.1 per cent of the total, in 1900. This is an increase of \$7,513,932, or 59.5 per cent. Clay was purchased to the amount of \$5,345,357, or 16.2 per cent of the total cost of materials, an increase of \$1,797,021 over 1900.

Table 5 is a comparative summary of the kind and value of the principal clay products for 1890, 1900, and 1905, with the amount and the per cent of increase.

TABLE 5.—CLAY PRODUCTS—COMPARATIVE SUMMARY, KIND AND VALUE OF PRODUCTS, WITH AMOUNT AND PER CENT OF INCREASE: 1890 TO 1905.

	DATE OF CENSUS.			INCREASE.		PER CENT OF INCREASE.	
	1905	1900	1890	1900 to 1905	1890 to 1900	1900 to 1905	1890 to 1900
Aggregate value.....	\$135,352,854	\$95,533,862	\$89,827,785	\$39,818,992	\$5,706,077	41.7	6.4
Brick, tile, and terra cotta:							
Total value.....	109,518,341	78,336,447	77,488,493	31,181,894	847,954	39.8	1.1
Common brick.....	51,230,871	39,074,740	48,810,271	11,565,122	19,135,522	29.2	118.7
Red front brick (both pressed and wire cut)	3,904,847	2,537,912	5,973,902	1,366,935	3,435,990	53.9	157.5
Fancy or ornamental brick.....	3,430,664	2,032,580	187,020	798,084	2,444,660	30.3	1,300.9
Enamelled brick.....	445,985	329,009	(?)	116,016		35.2	
Vitrified paving brick.....	7,250,088	4,828,456	982,440	2,427,632	3,846,016	50.3	391.5
Fire brick.....	11,752,625	8,636,562	6,318,770	3,116,063	2,317,792	36.1	36.7
Electrical conduits.....	602,682	685,273	53,500	182,591	631,773	112.1	1,180.9
Sewer pipe.....	8,416,000	4,560,334	5,394,921	3,855,675	1,834,587	84.5	115.5
Drain tile.....	5,522,198	3,662,184	5,009,804	1,860,014	1,347,620	50.8	120.9
Fireproofing, including terra cotta, lumber, and hollow building tile or blocks.....	4,317,312	1,665,031	402,750	2,652,281	1,262,281	159.8	313.4
Roofing, flooring, and encaustic tile.....	2,725,717	1,276,300	795,958	1,449,417	450,342	113.6	90.3
Architectural terra cotta.....	3,792,763	2,027,532	1,431,228	1,765,231	596,904	87.1	41.7
All other brick, tile, and terra cotta products.....	8,111,580	5,819,565	2,127,029	292,015	3,692,536	5.0	173.6
Pottery products:							
Total value.....	25,834,513	17,197,415	12,339,292	8,637,098	4,858,123	50.2	39.4
Red earthenware.....	821,605	762,260	(?)	59,435		7.8	
Stoneware.....	3,274,914	1,970,710	2,089,463	1,304,204	1,355,753	66.2	14.2
Yellow and Rockingham ware.....	206,607	159,563	439,553	47,054	1,230,000	20.5	163.7
C. C. or cream colored ware and white granite ware, including semivitrificous porcelain ware.....	9,195,703	6,370,351	3,571,847	2,819,352	2,804,504	44.2	78.5
China (porcelain).....	3,370,627	1,255,978	460,334	2,114,640	795,644	168.4	172.8
Bone china, Delft, and Belleek ware.....	108,000	42,000	(?)	66,000		157.1	
Sanitary ware, including porcelain bath tubs, laundry tubs, etc.	3,932,503	2,211,877	(?)	1,720,629		77.8	
Porcelain electrical supplies.....	1,500,283	470,365	(?)	1,029,928		219.0	
Porcelain doorknobs and hardware trimmings.....	78,696	126,861	(?)	148,265		138.0	
All other pottery products.....	4,345,582	3,821,470	5,811,095	1,475,888	1,989,625	112.5	334.2

1 Decrease. 2 Not reported separately in 1890. 3 Includes sand-lime brick to the value of \$698,003. 4 Includes art pottery and porcelain to the value of \$726,980.

The separation made in this table is between products used for building and construction and the characteristic products of pottery establishments. To the total increase of \$39,818,992 between 1900 and 1905 the coarser products, as brick, tile, terra cotta, etc., contributed \$31,181,894, or 78.3 per cent, and the pottery products \$8,637,098, or 21.7 per cent. In 1905 the coarser products showed an increase of 39.8 per cent over 1900, whereas in 1900 they showed an increase of only 1.1 per cent over 1890. The only item under this head with a diminution in value of products was electrical conduits, which showed a decrease of \$82,591, or 12.1 per cent.

There were increases of 29.2 and 53.9 per cent, respectively, in common and red front brick over the figures for 1900, when the census showed a marked decrease in these products as compared with 1890. But while there has been complete recovery and a positive advance in the production of common brick, the production of red front brick in 1905 was still below that in 1890.

Fancy and ornamental brick, enameled brick, vitrified paving brick, and fire brick all showed substantial increases over 1900, but the highest percentages were in such products as fireproofing and hollow building tile or blocks; roofing, flooring, and encaustic tile; and architectural terra cotta. Fireproofing and hollow building tile or blocks showed an increase in value of \$2,652,281, or 159.3 per cent. From 1890 to 1900 the increase was \$1,262,281, or 313.4 per cent. The production of roofing, flooring, and encaustic tile also showed the large increase of \$1,449,417, or 113.6 per cent, from 1900 to 1905, as compared with the much smaller one of \$480,342, or 60.3 per cent, between 1890 and 1900. The value of architectural terra cotta increased from \$2,027,532 in 1900 to \$3,792,763 in 1905, or 87.1 per cent, while the increase for the preceding decade was only 41.7 per cent.

The fact that fireproofing products, the principal materials used in buildings of fireproof construction, have more than doubled in value during the period from 1900 to 1905, is evidence of their rapidly increasing popularity.

The general increase in the production of the coarser wares extends also to sewer pipe, draintile, and all other products not classified, but peculiar to the brick, tile, and terra cotta industry. At the census of 1905 compared with that of 1900 sewer pipe increased \$3,855,675, or 84.5 per cent, as compared with a decrease of \$834,587, or 15.5 per cent, for the decade ending 1900. Draintile, which between 1890 and 1900 showed a decrease of \$1,347,620, or 26.9 per cent, was

credited in 1905 with an increase of \$1,860,014, or 50.8 per cent.

At the census of 1900 pottery products reported a gain of \$4,858,123, or 39.4 per cent, over 1890, while between 1900 and 1905 the increase was \$8,637,098, or 50.2 per cent. It has taken about fifteen years for the potteries to double the value of their products, but if the same activity that characterized the past five years obtains throughout the next five the potters of the country will have the satisfaction of seeing the value of their products more than double during a period of ten years.

In pottery products, as in brick, tile, terra cotta, etc., a general increase in the value of production is noted, though the greatest increase is shown in the higher grades. The only items showing a decreased production were porcelain doorknobs and hardware trimmings, which decreased \$48,265, or 38 per cent, and "all other pottery products," which decreased \$475,888, or 12.5 per cent.

The value of the china porcelain products more than doubled during the five years. From a total value of \$1,255,978 in 1900 it had grown to \$3,370,627 in 1905, an increase of \$2,114,649, or 168.4 per cent. Bone china, Delft, and Belleek ware also made a large gain—from \$42,000 in 1900 to \$108,000 in 1905, an increase of \$66,000, or 157.1 per cent. Porcelain electrical supplies, which were first separately classified in 1900, show an increase of \$1,029,928, or 219 per cent.

The growth in the production of sanitary ware is noteworthy, and the demand in foreign countries for such goods of American make is increasing. From 1900 to 1905 the increase in value of products was \$1,720,629, or 77.8 per cent. C. C., or cream colored ware, and white granite ware, including semivitreous ware, show a large gain since 1890, the increase amounting to \$2,819,352, or 44.2 per cent, as compared with one of \$2,804,504, or 78.5 per cent, for the decade ending 1900.

Stoneware, and yellow and Rockingham ware, which showed decreases between 1890 and 1900, made gratifying increases in 1905. However, the value of yellow and Rockingham ware produced in the latter year was still less than half what it was fifteen years before.

Notwithstanding the fact that in 1900 art pottery was separately reported to the value of \$629,402 it was not deemed advisable to continue the inquiry in 1905, since most of the art pottery is an earthenware product reported under several classifications and the value shown would be much less than the actual production.

Table 6 shows the average cost per ton for clays purchased in 1905, by states and territories.

TABLE 6.—CLAY PRODUCTS—AVERAGE COST PER TON OF CLAY PURCHASED, BY STATES AND TERRITORIES: 1905.

STATE OR TERRITORY.	CHINA.		BALL.		Stone-ware.	Slip.	Fire.	Pipe.	Terra-cotta.	Brick.	All other.
	Domestic.	Foreign.	Domestic.	Foreign.							
United States.....	\$9.72	\$12.82	\$5.74	\$9.76	\$1.55	\$7.21	\$1.18	\$0.98	\$1.27	\$0.55	\$1.52
Alabama.....					1.45	12.32	.79			1.00	.20
Arkansas.....					.80	14.44				.36	
California.....		29.16		36.50	2.95	28.54	2.43	2.31	.67	1.77	1.27
Colorado.....	10.00				2.39	10.00	1.95	1.00	1.17	.68	6.00
Connecticut.....	5.02						.78			.04	
Delaware.....										.89	
Florida.....										.14	
Georgia.....	16.50				1.78	18.00	.52	1.87	1.60	.56	.78
Illinois.....	12.64		6.10	16.66	1.23	6.25	1.01		1.67	.43	1.30
Indian Territory.....										1.00	
Indiana.....	12.62	11.02	4.47	11.68	1.27	5.17	.90	.37	2.00	.36	2.95
Iowa.....				40.00	.91	11.57				.53	.75
Kansas.....					2.29	9.56	3.50			.33	
Kentucky.....	4.48		3.52		1.57	3.52	1.07	1.00		.72	1.00
Louisiana.....					1.50		3.57		1.33		1.27
Maine.....					2.03	7.50		1.40		.89	.93
Maryland.....	14.05	11.77		8.00	1.25	5.00	.75		1.46	.51	2.48
Massachusetts.....	11.09	17.20	11.47		2.71	5.69	2.81		2.32	.86	
Michigan.....							3.44			.23	.92
Minnesota.....				16.00	1.07	6.00				2.17	1.00
Mississippi.....						23.10				.81	1.05
Missouri.....	7.50	12.30	2.43		1.83	13.03	.92	.90	1.07	.87	.79
Montana.....										1.00	
Nebraska.....										1.10	
Nevada.....										1.00	
New Hampshire.....	13.75			11.70			2.00			.21	5.00
New Jersey.....	9.14	11.93	7.74	9.41	3.17	7.00	1.67		1.03	.37	1.40
New York.....	10.05	14.70	6.64	10.27	1.50	4.20	2.03		1.81	.88	1.01
North Carolina.....					1.99	10.00				.41	
Ohio.....	9.91	12.95	5.19	9.80	1.38	6.15	.64	.32	.63	.60	.93
Oklahoma.....										2.66	
Oregon.....		11.00			4.00		5.50			3.13	1.30
Pennsylvania.....	8.50	12.28	5.67	9.30	2.00	7.97	1.50	.65	1.13	.67	4.11
South Carolina.....						15.27				.96	
Tennessee.....			40.00		1.11	11.30	4.00			.63	1.00
Texas.....					.59	15.38	1.00			.42	2.00
Utah.....							1.82	2.00			
Vermont.....										1.00	
Virginia.....	5.25	11.00								1.27	
Washington.....					3.00	10.00	1.00		1.00	1.00	1.00
West Virginia.....	8.90	13.52	6.29	10.00	1.09	12.69	3.87			.40	4.70
Wisconsin.....									1.50	.40	

Only a small proportion of the total quantity of clay used is purchased, the greater part being owned and mined by the establishments reporting. It will be observed that the prices for the higher grades differ greatly in the various states. This is probably due to

the physical properties of the clay, the conditions under which it is mined, and to the general conditions of demand, distance from market, competition, etc.

Table 7 is a statement of the average value of brick and other products, by states and territories, 1905.

## MANUFACTURES.

TABLE 7.—BRICK AND OTHER PRODUCTS.—AVERAGE VALUES, BY STATES AND TERRITORIES: 1905.

STATE OR TERRITORY.	Common brick.	Red front brick (both pressed and wire-cut).	Fancy or ornamental brick.	Vitrified paving brick.	Enameled brick.	Sand-lime brick.	Fire brick.	Stoneware.	Fireproofing, including terra cotta, lumber, and hollow building tile or blocks.
	Per 1,000.	Per 1,000.	Per 1,000.	Per 1,000.	Per 1,000.	Per 1,000.	Per 1,000.	Per gallon.	Per ton.
United States.....	\$5.90	\$9.00	\$14.82	\$10.14	\$35.01	\$7.95	\$17.33	\$0.05	\$4.74
Alabama.....	5.06	8.17	22.00	10.43		8.82	13.29	.05	
Arizona.....	7.21					7.44			
Arkansas.....	7.17	6.85		10.00		7.87	12.75	.04	
California.....	6.08	12.77	46.97	35.00		9.28	12.64	.08	7.10
Colorado.....	6.52	8.78	17.80	8.53		17.33	17.50	.07	8.25
Connecticut.....	5.55	15.00		14.00			21.00		5.00
Delaware.....	8.06	12.51							
District of Columbia.....	7.58	15.00	8.50						6.77
Florida.....	5.08					6.45			
Georgia.....	5.09	9.57	8.00	9.00			14.11	.06	6.00
Idaho.....	7.54	15.00	25.00	25.00			30.00		
Illinois.....	5.20	9.90	14.27	9.28	65.32		13.65	.04	5.18
Indian Territory.....	5.01	11.33	10.50	14.00			13.48		
Indiana.....	5.04	7.39	7.56	10.77		5.18	11.01	.04	4.81
Iowa.....	6.89	9.25	13.15	9.26	12.00		15.00	.06	4.97
Kansas.....	4.35	8.76	8.93	7.79		7.00	9.47	.07	7.00
Kentucky.....	5.61	8.04	10.00	12.03	21.08	7.00	18.15	.06	
Louisiana.....	6.34	15.00	9.27	10.00					
Maine.....	6.25	8.23							
Maryland.....	6.55	15.94	29.07	14.00		8.00	17.59		6.00
Massachusetts.....	6.24	8.15	50.33				28.65	.06	5.00
Michigan.....	5.74	8.13	9.60	12.27	20.00	5.20			9.01
Minnesota.....	6.00	7.52	13.78	10.00		8.00		.04	4.00
Mississippi.....	6.56	13.09				8.70		.06	5.00
Missouri.....	5.92	11.33	34.55	10.25	34.23		16.48	.05	7.76
Montana.....	8.00	20.00	35.00	18.00			35.00		
Nebraska.....	6.98	10.07	15.66	8.53					
Nevada.....	9.12								
New Hampshire.....	6.41	11.00							
New Jersey.....	5.83	14.46	17.89	13.30	54.77	8.75	22.84	.06	4.83
New Mexico.....	6.80	7.05							
New York.....	5.52	9.72	17.00	12.72		5.00	28.26	.09	6.10
North Carolina.....	5.56	7.80	12.50			10.00	11.09	.06	
North Dakota.....	7.43	17.71	147.13						7.50
Ohio.....	5.82	8.70	11.44	10.00	12.00	7.29	14.71	.04	3.77
Oklahoma.....	7.16	8.91		9.26					
Oregon.....	7.74	29.93	30.00	15.00			20.00	.08	15.00
Pennsylvania.....	6.17	9.44	12.36	10.27	21.11	8.00	17.03	.06	4.06
South Carolina.....	5.14	10.19	10.00			8.00	10.63	.06	
South Dakota.....	8.10			35.00		7.00			6.19
Tennessee.....	5.92	8.35	16.20	10.00		12.50	10.92	.05	
Texas.....	5.87	9.48	13.19	10.00		6.50	17.14	.06	
Utah.....	6.28	9.75	8.50				30.20		6.00
Vermont.....	5.70								
Virginia.....	6.33	10.49	20.27	10.00		10.08	15.37		
Washington.....	7.39	13.19	18.37	16.23		28.71	29.56	.08	10.00
West Virginia.....	6.23	8.33		14.45			9.33	.05	
Wisconsin.....	6.62	8.55	7.71			7.00			5.99
Wyoming.....	8.34		10.50						

The average value per thousand for common brick for the United States was \$5.90 in 1905 and \$5.18 in 1900. The value ranged from \$9.12 per thousand in Nevada, to \$4.35 per thousand in Kansas where natural gas is extensively used as fuel. Though there has been a general rise in the value of brick throughout the country, the value in Kansas during the five-year period fell 79 cents per thousand, or 15.4 per cent. The only other divisions in which the price of brick declined were the District of Columbia, Indian Territory, and New Mexico. Illinois, New York, Ohio, and New Jersey were among the fifteen states in which the average

value of common brick was slightly below that for the United States.

Red front brick ranged from \$29.93 per thousand in Oregon to \$6.85 in Arkansas, while the average value for the United States was \$9.90, as against \$8.98 in 1900. Sand-lime brick varied from \$28.71 per thousand in Washington, to \$5.18 in Indiana, the average for the United States being \$7.95. The average price per gallon for stoneware was 5 cents. The highest average price, 9 cents, was reported by New York. In Arkansas, Illinois, Indiana, and Minnesota, the average value fell to 4 cents.

Table 8 shows the value of earthenware, china, brick, and tile imported and entered for consumption in the United States from 1867 to 1904, inclusive.

TABLE 8.—Value of earthenware, china, brick, and tile imported and entered for consumption in the United States: 1867 to 1904.<sup>1</sup>

YEAR ENDING—	Total.	Brown earthen and common stone ware.	China and porcelain, not decorated.	China and porcelain, decorated.	Other earthen, stone, or crockery ware, glazed, etc.	Brick, fire brick, and tile.
June 30:						
1867.....	\$5,187,850	\$48,018	\$418,493	\$439,824	\$4,280,924	.....
1868.....	4,005,681	47,208	300,960	403,555	3,244,958	.....
1869.....	4,450,540	34,260	400,894	555,425	3,468,970	.....
1870.....	4,400,228	47,457	420,442	530,805	3,401,524	.....
1871.....	4,632,355	90,095	391,374	571,032	3,573,254	.....
1872.....	5,308,893	127,346	470,749	814,134	3,896,004	.....
1873.....	5,751,944	115,253	479,617	867,206	4,280,868	.....
1874.....	4,831,724	70,544	397,730	676,656	3,686,794	.....
1875.....	4,441,210	68,501	436,883	654,065	3,280,867	.....
1876.....	4,112,050	36,744	400,530	718,156	2,948,517	.....
1877.....	3,772,050	30,403	326,056	668,514	2,746,186	.....
1878.....	4,096,725	18,714	380,133	667,485	3,031,393	.....
1879.....	4,044,876	19,868	206,591	813,850	2,914,567	.....
1880.....	5,500,388	31,504	334,371	1,185,847	3,945,666	.....
1881.....	6,383,326	27,586	321,259	1,621,112	4,413,369	.....
1882.....	6,806,779	36,023	316,811	2,075,708	4,438,237	.....
1883.....	8,086,061	43,804	368,943	2,537,545	5,685,769	.....
1884.....	4,363,497	50,172	682,490	2,664,231	( <sup>2</sup> )	\$606,595
1885.....	4,606,175	44,701	823,334	2,834,718	.....	963,422

<sup>1</sup>United States Geological Survey, "Mineral Resources of the United States," 1904, page 898.

<sup>2</sup>Not separately classified after 1883.

TABLE 8.—Value of earthenware, china, brick, and tile imported and entered for consumption in the United States: 1867 to 1904—Con.

YEAR ENDING—	Total.	Brown earthen and common stone ware.	China and porcelain, not decorated.	China and porcelain, decorated.	Other earthen, stone, or crockery ware, glazed, etc.	Brick, fire brick, and tile.
December 31:						
1886.....	\$5,204,704	\$37,820	\$365,440	\$3,350,145	.....	\$951,293
1887.....	5,907,042	43,079	907,694	3,838,509	.....	1,008,360
1888.....	6,204,324	55,558	1,054,854	4,207,598	.....	886,314
1889.....	6,565,562	48,824	1,148,026	4,580,321	.....	789,391
1890.....	5,167,776	56,730	974,627	3,562,851	.....	563,568
1891.....	8,663,450	99,983	1,621,643	6,288,058	.....	353,736
1892.....	9,021,509	63,003	2,022,814	6,555,172	.....	380,520
1893.....	8,375,896	57,017	1,732,481	6,248,255	.....	338,143
1894.....	7,180,343	47,114	1,550,950	5,392,648	.....	189,631
1895.....	10,445,795	61,424	2,117,425	8,055,473	.....	211,478
1896.....	9,530,524	41,685	1,511,542	7,729,942	.....	247,455
1897.....	8,642,175	*32,227	1,406,019	7,057,261	.....	146,668
1898.....	7,079,934	*54,672	1,002,729	5,905,209	.....	117,324
1899.....	8,041,631	*40,164	1,125,892	6,740,884	.....	134,691
1900.....	8,912,073	*65,214	1,059,152	7,617,756	.....	169,951
1901.....	9,681,411	*51,551	1,094,078	8,385,514	.....	150,268
1902.....	9,806,271	*58,926	1,016,010	8,455,698	.....	235,737
1903.....	11,456,290	*95,890	1,234,228	9,897,588	.....	228,589
1904.....	11,488,411	*81,951	1,329,146	9,859,144	.....	218,170

\* Including Rockingham ware.

Table 9 shows the exports of clay wares from 1895 to 1904, inclusive.

TABLE 9.—EXPORTS OF CLAY WARES OF DOMESTIC MANUFACTURE FROM THE UNITED STATES: 1895 TO 1904.<sup>1</sup>

YEAR. <sup>2</sup>	Aggregate value.	BRICK.			POTTERY.			
		Total value.	Building.		Total value.	Earthen and stone ware (value).	China (value).	
			Quantity, by thousands.	Value.				Fire (value).
1895.....	\$262,758	\$123,461	4,787	\$34,732	\$88,720	\$130,297	\$114,425	\$24,872
1896.....	304,738	135,305	5,258	32,756	102,636	169,343	144,641	24,702
1897.....	348,012	141,009	4,606	30,383	110,626	207,603	177,320	30,283
1898.....	430,770	178,949	4,708	32,317	146,632	251,821	212,769	39,052
1899.....	803,890	292,158	9,872	77,783	214,375	511,732	467,925	43,807
1900.....	1,281,831	723,087	12,526	128,800	594,237	558,794	489,942	68,852
1901.....	1,068,469	541,589	9,072	74,210	437,379	526,320	476,957	49,363
1902.....	1,106,080	501,434	3,995	31,304	470,130	604,646	555,340	49,306
1903.....	1,028,278	439,277	8,783	63,774	375,503	589,001	527,689	61,312
1904.....	1,379,124	587,385	25,012	179,866	407,519	791,739	697,381	94,358

<sup>1</sup>United States Geological Survey, "Mineral Resources of the United States," 1904, page 899.

<sup>2</sup>Years ending December 31.

## BRICK AND TILE.

The detailed summary for the brick and tile branch of the industry is found in Table 17, following the text of this report. Illinois led in value of products, reporting 10.6 per cent of the total for the country. In 1900 Illinois held third rank among the states, while Pennsylvania, which was first, reported 10.2 per cent of the total for the country. As in 1900, New York occupied second place, with 10.4 per cent of the total for the country in 1905, and Ohio fourth, with 10 per cent; while Indiana, Iowa, and Missouri followed in the order named.

Table 10 shows for 1900 and 1905 the kind and cost of materials used in brick and tile manufacture, the percentage each is of the total cost, and the amount and per cent of increase.

TABLE 10.—Brick and tile—cost of materials, with amount and per cent of increase: 1905 and 1900.<sup>1</sup>

	1905		1900		INCREASE.	
	Cost.	Per cent of total.	Cost.	Per cent of total.	Amount.	Per cent.
Total.....	\$16,316,499	100.0	\$11,006,148	100.0	\$5,310,351	48.2
Clay, purchased.....	476,288	2.9	335,068	3.1	140,020	41.0
Coal used as an ingredient.....	141,301	0.9	131,668	1.2	9,633	7.3
Sand.....	247,241	1.5	189,803	1.7	57,438	30.3
Manganese.....	50,880	0.3	19,004	0.2	31,876	167.7
Salt.....	10,503	0.1	6,400	0.1	4,043	62.6
Fuel.....	13,583,834	83.2	8,774,852	79.7	4,808,982	54.8
Rent of power and heat.....	45,126	0.3	9,708	0.1	35,358	362.0
Mill supplies.....	565,427	3.5	411,035	3.7	153,492	37.3
All other materials.....	657,234	4.0	521,055	4.7	136,179	20.1
Freight.....	538,605	3.3	605,945	5.5	\$77,280	\$11.1

<sup>1</sup>Exclusive of the statistics of establishments engaged primarily in the manufacture of pottery, terra cotta, and fire clay products, that also produced brick and tile.

<sup>2</sup>Decrease.

The cost of clay and sand covers only that actually purchased and includes neither royalties, which are reported under miscellaneous expenses, nor its cost where pits are owned by the plants reporting, the cost of mining clay and sand being included in the amount paid wage-earners. A similar method was followed also in reporting the cost of fuel, where wood, coal, or natural gas was obtained on premises owned or controlled by the establishments reporting.

The total cost of materials for 1905 was \$16,316,499, as compared with \$11,006,148 in 1900, an increase of \$5,310,351, or 48.2 per cent. The only item showing a decrease was that of freight, which item represents only the amount not included in the cost of materials. The great amount of fuel used for power, for artificial drying, and for burning the products easily makes this the material of greatest cost, amounting to \$13,583,834, or 83.2 per cent of the total.

Table 11 shows for 1900 and 1905 the value of the brick and tile products of brickyards alone, by kind,

and the percentage each kind is of the brick and tile products, as well as of the total clay products.

TABLE 11.—Brick and tile—kind and value of products: 1905 and 1900.<sup>1</sup>

	1905			1900		
	Value.	Per cent of total.	Per cent of total of all clay products. <sup>2</sup>	Value.	Per cent of total.	Per cent of total of all clay products. <sup>3</sup>
Total.....	\$71,152,002	100.0	52.6	\$51,270,476	100.0	53.7
Common brick.....	50,438,486	70.9	37.3	38,650,478	75.4	40.5
Red front brick.....	3,432,815	4.8	2.5	2,397,171	4.7	2.5
Sand-lime brick.....	659,157	0.9	0.5	( <sup>4</sup> )		
Fancy colored front brick (all except red front).....	2,693,842	3.8	2.0	1,601,441	3.1	1.7
Ornamental shaped brick (all not plain rectangular).....	487,589	0.7	0.4	429,588	0.9	0.5
Vitrified paving brick.....	6,510,134	9.2	4.8	3,857,179	7.5	4.0
Drain tile.....	4,960,672	7.0	3.7	3,195,434	6.2	3.3
All other products.....	1,939,367	2.7	1.4	1,139,185	2.2	1.2

<sup>1</sup>Exclusive of the statistics of establishments engaged primarily in the manufacture of pottery, terra cotta, and fire clay products, that also produced brick and tile.

<sup>2</sup>Total value of all clay products, \$135,352,854.

<sup>3</sup>Total value of all clay products, \$95,533,862.

<sup>4</sup>Not reported separately in 1900.

Though the volume of production of brickyards increased in value \$19,881,586, or 38.8 per cent, during the five-year period, their percentage of the total value of all clay products suffered a slight decrease. This was due largely to the falling off in the production of common brick, which in 1900 contributed 40.5 per cent to the total value of all clay products, and in 1905 only 37.3 per cent. More ornamental materials are largely displacing common brick from use on the exterior of buildings, and modern methods of iron and steel construction from their use in the interior. Clay products, such as terra cotta, hollow building tile and blocks, etc., were not called for on the schedule for brickyards but on that for pottery, terra cotta, and fire clay products. Had this class of building materials which are not strictly pottery products been included with those shown in Table 11, for brickyards, the value of the products of that branch of the industry would have been greatly increased.

## POTTERY, TERRA COTTA, AND FIRE CLAY PRODUCTS.

The detailed summary, by states and territories, of the manufacture of pottery, terra cotta, and fire clay products in 1905 is found in Table 18, following the text of this report. Ohio led in value of products, with \$18,550,840, or 28.9 per cent of the total for the country. This state likewise led in 1900, with 26.8 per cent of the total. At both censuses New Jersey stood second, with 18.3 per cent of the total in 1905 and 20.2 per cent in 1900; and Pennsylvania, third, with 16.8 per cent in 1905, and 18.4 per cent in 1900. New York held fourth place in 1905, with 5.1 per cent of the total, while Illinois, Missouri, and Indiana followed in the order named.

# CLAY PRODUCTS.

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Table 12 shows for 1900 and 1905 the kinds and cost of materials used in the manufacture of pottery, terra cotta, and fire clay products, the percentage each is of the total cost, and the amount and percentage of increase.

TABLE 12.—POTTERY, TERRA COTTA, AND FIRE CLAY PRODUCTS—COST OF MATERIALS, WITH AMOUNT AND PER CENT OF INCREASE: 1905 AND 1900.

	1905		1900		INCREASE.	
	Cost.	Per cent of total.	Cost.	Per cent of total.	Amount.	Per cent.
Total.....	\$16,591,462	100.0	\$11,915,236	100.0	\$4,676,226	39.2
Clay purchased, total.....	4,869,069	29.3	3,212,068	27.0	1,656,401	51.6
China clay (domestic).....	453,556	2.7	300,804	3.3	62,752	16.1
China clay (foreign).....	354,931	2.1	171,790	1.4	183,141	106.6
Ball clay (domestic).....	124,034	0.8	113,954	1.0	10,080	8.2
Ball clay (foreign).....	205,737	1.2	110,629	1.0	89,108	70.4
Stoneware clay.....	255,913	1.5	171,161	1.4	84,752	40.5
Slip clay.....	35,112	0.2	17,530	0.2	17,582	90.9
Fire clay.....	2,151,847	13.0	1,554,228	13.0	597,619	38.5
Pipe clay.....	173,638	1.0	150,489	1.3	23,149	15.4
Terra cotta clay.....	174,621	1.1	133,339	1.1	41,282	31.0
Brick clay.....	100,743	1.0	101,913	1.0	125,170	131.1
All other clay.....	772,932	4.7	200,526	1.7	572,406	286.5
Sand.....	99,008	0.6	92,017	0.8	7,991	8.2
Flint (quartz).....	400,549	2.4	325,434	2.7	75,115	23.1
Feldspar.....	438,585	2.6	265,231	2.2	173,354	65.4
Plaster.....	184,240	1.1	120,545	1.0	63,695	32.8
Salt.....	31,611	0.2	24,750	0.2	6,865	27.7
Manganese.....	11,825	0.1	25,914	0.2	14,089	154.4
Iron.....	11,216	0.1	13,184	0.1	1,968	14.9
Lime.....	9,012	0.1	(*)			
Liquid and coin gold.....	225,024	1.4	117,422	1.0	108,202	92.1
Oxide of lead, zinc, and cobalt.....	370,941	2.2	225,099	1.9	145,842	64.8
Packing materials.....	848,867	5.1	589,198	4.9	262,009	44.8
Fuel.....	6,563,778	39.6	3,858,828	32.4	2,704,950	70.1
Rent of power and heat.....	30,018	0.2	11,689	0.1	18,329	152.5
Mill supplies.....	405,998	2.4	346,613	2.9	59,385	17.1
All other materials.....	1,598,785	9.6	1,473,414	12.4	120,371	8.2
Freight.....	490,135	3.0	1,216,024	10.2	1,719,888	159.2

\* Decrease.

\* Not reported separately in 1900.

The total cost of the materials for this branch of clay manufacture was \$16,591,462 in 1905, as compared with \$11,915,236 in 1900, an increase of \$4,676,226, or 39.2 per cent. The only items showing decreases are brick clay, manganese, iron, and freight on materials used. Fuel constituted by far the largest item of expense, \$6,563,778, or 39.6 per cent of the total, as compared with \$3,858,828, or 32.4 per cent in 1900, an increase of \$2,704,950, or 70.1 per cent. In 1905

foreign clay was purchased costing \$560,668, an increase of \$272,249 or 94.4 per cent. The cost of fire clay, which formed 44.2 per cent of all purchased clays in 1905 and 48.4 per cent in 1900, increased \$597,619, or 38.5 per cent.

Table 13 shows the kind and value of pottery, terra cotta, and fire clay products for 1900 and 1905, with the percentage each value is of the total, and also of the total value of all clay products.

TABLE 13.—POTTERY, TERRA COTTA, AND FIRE CLAY PRODUCTS—KIND AND VALUE OF PRODUCTS, WITH PER CENT OF TOTAL VALUE: 1905 AND 1900.

	1905			1900		
	Value.	Percent of total.	Percent of total value of all clay products. <sup>1</sup>	Value.	Percent of total.	Percent of total value of all clay products. <sup>2</sup>
Aggregate.....	\$64,200,792	100.0	47.4	\$44,263,386	100.0	46.3
Pottery products:						
Total value.....	25,831,013	40.2	10.1	17,222,040	38.9	18.0
Red earthenware.....	818,195	1.3	0.6	762,260	1.7	0.8
Stoneware.....	3,274,814	5.1	2.4	1,970,710	4.4	2.1
Yellow and Rockingham ware.....	209,007	0.3	0.1	159,553	0.4	0.2
C. C. or cream colored ware and white granite ware including semivitreous porcelain ware.....	9,196,703	14.3	0.8	6,376,351	14.4	6.7
China (porcelain).....	3,370,627	5.3	2.5	1,255,978	2.8	1.3
Bone china, Delft, and Belleek ware.....	108,000	0.2	0.1	42,000	0.1	(*)
Sanitary ware, including solid porcelain bath tubs, laundry tubs, etc.....	3,932,506	6.1	2.9	2,211,877	5.0	2.2
Porcelain electrical supplies.....	1,500,283	2.3	1.1	470,355	1.1	0.5
Porcelain doorknobs and hardware trimmings.....	78,596	0.1	0.1	128,861	0.3	0.1
All other pottery products.....	3,345,582	5.2	2.5	3,846,095	8.7	4.0
Terra cotta, fire, and other clay products.....	37,854,744	59.0	27.9	26,420,354	59.7	27.7
All other products.....	515,035	0.8	0.4	620,992	1.4	0.6

<sup>1</sup>Total value of all clay products, \$135,352,854.

<sup>2</sup>Total value of all clay products, \$95,533,862.

\* Less than one-tenth of 1 per cent.

A comparison of this table with Table 11, which deals with the brick and tile branch of the industry, shows that, while the decrease in the relative importance of brick and tile products was due largely to the falling off in one item, common brick, the corresponding increase shown in Table 13 is more complex, made up of fluctuations in many different items. China (porcelain) advanced the most in relative importance and those products classed as "all other pottery" noticeably declined.

Table 14 is a comparative summary of the manufacture of pottery, terra cotta, and fire clay products for 1890, 1900, and 1905, at the two great pottery centers of the United States, Trenton, N. J., and East Liverpool, Ohio. In making this comparison only those establishments within the corporate limits of these two cities are considered, rather than those located in what are indefinitely called the "East Liverpool district" and the "Trenton district."

TABLE 14.—POTTERY, TERRA COTTA, AND FIRE CLAY PRODUCTS—COMPARATIVE SUMMARY, TRENTON, N. J., AND EAST LIVERPOOL, OHIO: 1905, 1900, AND 1890.

	TRENTON.			EAST LIVERPOOL.		
	1905	1900	1890	1905	1900	1890
Number of establishments.....	40	20	32	34	30	23
Capital:						
Total.....	\$8,488,854	\$7,000,775	\$4,875,507	\$5,950,688	\$4,202,845	\$2,127,281
Value of plants.....	\$4,806,411	\$4,028,952	\$2,728,013	\$3,330,250	\$2,281,104	\$1,219,543
Cash and sundries.....	\$3,682,443	\$2,107,823	\$2,146,504	\$2,620,429	\$2,011,681	\$907,738
Proprietors and firm members.....	24	34		12	17	
Salaries of officials, clerks, etc.:						
Number.....	281	108	1 100	251	251	1 93
Salaries.....	\$305,545	\$200,011	\$203,669	\$323,199	\$265,107	\$89,844
Wage-earners, including pieceworkers, and total wages:						
Average number.....	4,571	4,289	3,035	4,850	3,908	2,062
Wages.....	\$2,475,090	\$2,343,754	\$2,144,032	\$2,480,720	\$1,835,110	\$977,060
Miscellaneous expenses.....	\$527,361	\$385,750	\$434,354	\$519,158	\$187,839	\$157,421
Materials used:						
Total cost.....	\$1,446,300	\$1,106,291	\$1,198,000	\$1,567,180	\$1,108,982	\$600,357
Clay.....	\$302,749	\$202,500	\$285,202	\$350,015	\$218,780	\$171,954
Fuel.....	\$471,540	\$287,108	\$261,580	\$335,910	\$209,213	\$130,448
Packing materials.....	\$125,884	\$128,760	\$170,374	\$210,307	\$168,990	\$93,043
Miscellaneous.....	\$546,187	\$487,914	\$474,874	\$604,897	\$581,993	\$273,912
Products:						
Total value.....	\$5,882,701	\$4,785,142	\$4,631,202	\$5,373,852	\$4,105,200	\$2,137,063
Yellow and Rockingham ware.....				\$77,258	\$98,034	
C. C. or cream colored ware, white granite ware, and semivitreous porcelain ware.....	\$1,200,768	\$1,565,357		\$4,344,468	\$3,520,604	
China (porcelain).....	\$361,360	\$494,870		\$311,511	\$197,144	
Bone china, Delft, and Belleek ware.....	\$108,000	\$42,000				
Sanitary ware, including solid porcelain bath tubs, laundry tubs, etc.....	\$2,436,851	\$1,942,332				
Porcelain electrical supplies.....	\$326,524	\$154,807		\$407,627	\$142,447	
Porcelain doorknobs and hardware trimmings.....	\$16,141	\$44,500		\$9,000	\$40,333	
All other pottery products.....	\$1,080,511	\$453,899		\$111,337	\$51,211	
Terra cotta, fire, and other clay products.....	\$240,674	\$83,160		\$112,651	\$38,470	
All other products.....	\$15,872	\$4,217			\$1,888	
Machinery and kilns:						
Pottery—						
Disintegrators.....	83	60		00	77	
Agitators.....	82	70		71	73	
Slip pumps.....	84	60		00	05	
Lawns.....	61	48		58	44	
Clay presses—						
Iron.....	29	26		85	65	
Wood.....	50	39			3	
Pug mills—						
Regular.....	57	45		43	30	
Sagger.....	37	28		35	31	
Wad mills.....	37	31		35	32	
Jiggers.....	178	166		258	221	
All other machines.....	386	562		311	101	
Kilns—						
Up draft.....	172	152		201	169	
Down draft.....	45	33		32	10	
Muffle—						
Large.....	55	24		6		
Decorating.....	71	56		106	73	
All other kilns.....	4	4		5	2	
Terra cotta, tile and brick—						
Clay grinding machines—						
Disintegrators.....	2	4				
Dry pans.....	7	3		4	3	
All other.....	1	2				
Clay tempering machines—						
Pug mills.....	3	5			1	
Wet pans.....	1	7		2	2	
Molding machines—						
Stiff mud.....	3				1	
Dry presses.....		12				
Shape brick power presses.....	3	2				
Hand presses.....	13	6				
Sewer pipe presses.....				2	2	
Kilns, down draft, round.....	11	11		17	17	
Dryers.....	3	2		4	2	
Idle machines.....	24	21		7		

<sup>1</sup> Includes proprietors and firm members, with their salaries; number only reported in 1900 and 1905.

Deducting the value of terra cotta, fire clay, and "all other products" from the total it is found that in 1905 these two pottery centers produced a value of

\$10,881,356, or 42.1 per cent of the total value of the pottery products of the United States shown in Table 16. In 1900 they produced a value of \$8,762,598, or

50.9 per cent of the total. While the value of their strictly pottery products thus increased \$2,118,758, or 24.2 per cent, during the five-year period, it is evident that these two centers are to some degree losing their preeminence in this industry, which is being built up rapidly in other parts of the country.

Owing to difference in the classification of products at the census of 1890 it is impossible to make a comparison of the various classes with that year.

In East Liverpool a greater number of wage-earners were employed per establishment and the amount paid for materials was larger, although the value of products reported was \$508,849 less, than for Trenton. The average production per kiln for Trenton was valued at \$16,432, as compared with \$14,643 for East Liverpool.

A comparison of Table 14 with Table 18 reveals the fact that in 1905 all the bone china, Delft, and Belleek ware reported for the United States was the product of Trenton. Formerly Belleek ware, as well as an extremely attractive variety of decorated bone china, was made in East Liverpool, but neither was reported from that city at the later census year. Belleek ware was also formerly manufactured at other places in America.

The much smaller amount spent for fuel in East Liverpool is due to the fact that natural gas is the only fuel employed.

Table 15 shows the kind and total value of the coarser products, including brick, tile, terra cotta, and fire clay products, by states and territories, for 1905. This table is a combination of the products that are common to both branches of the industry.

## MANUFACTURES.

TABLE 15.—BRICK, TILE, TERRA COTTA, FIRE, AND OTHER CLAY PRODUCTS—SUMMARY OF KIND,

STATE OR TERRITORY.	Aggregate.	BRICK.							
		Total.		Common brick.		Red front brick (both pressed and wire cut).		Fancy or ornamental brick.	
		Thousands.	Value.	Thou- sands.	Value.	Thou- sands.	Value.	Thou- sands.	Value.
1 United States.....	\$109,518,341	10,853,689	\$70,624,011	8,033,897	\$51,230,871	394,532	\$3,904,847	231,560	\$3,430,664
2 Alabama.....	1,085,893	152,745	977,223	134,305	760,810	355	2,900	5	110
3 Arizona.....	45,881	6,280	45,881	3,680	20,530				
4 Arkansas.....	709,070	110,195	798,452	101,809	730,962	1,550	10,625		
5 California.....	3,020,804	305,708	2,399,761	202,108	1,751,030	13,238	169,112	3,127	146,876
6 Colorado.....	1,557,187	139,982	1,102,967	99,827	650,420	22,171	104,594	3,104	55,236
7 Connecticut <sup>1</sup> .....	1,130,252	186,075	1,118,447	179,175	995,147	2,500	37,500		
8 Delaware.....	205,236	23,970	198,030	22,735	183,190	1,235	15,450		
9 District of Columbia.....	284,001	24,489	185,748	24,414	184,948	25	375	50	425
10 Florida.....	236,034	414,745	2,318,322	34,712	197,222				
11 Georgia.....	1,702,822	204,187	1,423,380	247,978	1,293,158	7,368	70,494	90	720
12 Idaho.....	112,770	13,618	112,770	12,005	98,000	110	1,050	154	3,850
13 Illinois.....	9,037,261	1,157,468	6,022,327	990,302	5,147,950	39,090	363,280	14,535	207,406
14 Indian Territory.....	248,031	35,702	223,423	33,250	196,078	1,425	10,160	800	8,400
15 Indiana.....	5,098,090	414,745	2,818,051	308,133	1,831,601	20,493	217,912	617	4,097
16 Iowa.....	3,367,376	255,857	1,879,525	213,501	1,471,507	7,250	67,106	1,213	15,953
17 Kansas.....	2,048,235	333,724	1,880,150	215,051	938,858	13,211	115,697	10,850	90,985
18 Kentucky.....	1,979,881	187,548	1,506,009	134,725	756,103	0,832	79,078	5	50
19 Louisiana.....	1,002,773	149,846	963,823	145,400	922,573	150	2,250	4,100	38,000
20 Maine <sup>2</sup> .....	420,111	65,622	415,600	62,552	391,166	2,970	24,440		
21 Maryland.....	1,550,191	180,720	1,431,200	159,407	1,044,651	2,285	36,423	1,802	52,379
22 Massachusetts.....	1,595,322	185,674	1,271,038	177,071	1,110,510	3,400	27,700	900	30,200
23 Michigan.....	1,900,718	255,408	1,500,881	238,141	1,360,406	3,498	28,436	160	1,550
24 Minnesota.....	1,542,228	187,262	1,187,195	173,153	1,039,712	2,710	20,380	6,139	84,594
25 Mississippi <sup>2</sup> .....	782,842	116,173	773,269	114,372	750,406	1,640	21,544		
26 Missouri.....	5,053,797	376,955	3,195,007	257,500	1,524,049	22,055	250,728	6,243	215,711
27 Montana <sup>2</sup> .....	177,675	17,479	154,675	16,855	134,835	20	400	4	140
28 Nebraska.....	1,131,913	149,638	1,128,070	132,000	921,114	2,590	20,080	8,018	125,582
29 Nevada.....	37,005	4,125	37,025	4,125	37,625				
30 New Hampshire.....	529,008	81,217	528,590	70,412	508,741	1,805	19,855		
31 New Jersey.....	7,084,559	392,143	3,490,753	303,117	1,766,460	28,726	415,441	18,002	322,113
32 New Mexico.....	80,010	11,880	80,010	7,740	49,230	4,140	31,680		
33 New York.....	9,350,948	1,284,952	7,791,254	1,226,501	6,795,209	8,779	85,290	16,831	286,200
34 North Carolina.....	795,718	122,050	691,808	120,349	608,573	350	2,750	150	1,875
35 North Dakota.....	170,257	20,679	169,897	10,109	142,646	1,472	20,074	8	1,177
36 Ohio.....	13,781,160	861,513	7,139,014	492,059	2,694,172	38,769	340,707	58,135	664,866
37 Oklahoma.....	261,438	34,441	250,821	31,541	225,860	1,100	9,800		
38 Oregon.....	417,528	35,710	300,027	33,714	260,839	424	12,690	550	10,500
39 Pennsylvania.....	16,713,606	1,405,080	14,140,733	809,154	4,093,194	71,514	675,039	54,027	675,108
40 South Carolina.....	684,847	126,602	671,182	122,400	629,201	1,050	10,700	20	200
41 South Dakota.....	83,756	10,243	82,035	8,433	68,335				
42 Tennessee.....	1,275,685	172,044	1,108,110	150,522	891,517	10,900	91,059	1,459	23,635
43 Texas.....	1,506,173	210,344	1,317,417	193,141	1,162,216	5,830	55,249	1,269	16,742
44 Utah.....	420,791	50,807	379,320	41,007	257,478	7,048	74,595	820	6,070
45 Vermont.....	104,235	17,588	100,235	17,588	100,235				
46 Virginia.....	1,830,901	240,406	1,822,016	202,458	1,281,103	15,200	160,400	13,501	273,631
47 Washington.....	1,050,971	87,955	790,470	73,765	545,101	3,332	43,065	1,436	26,378
48 West Virginia.....	1,046,891	99,402	977,562	53,330	332,434	600	5,000		
49 Wisconsin.....	1,850,158	230,407	1,538,477	220,007	1,401,292	4,470	38,210	2,330	17,975
50 Wyoming.....	17,195	1,855	17,195	1,055	8,795			800	8,400
51 Not distributed by states <sup>2</sup> .....	505,125	6,207	154,073						

<sup>1</sup> Includes 2 establishments in Rhode Island.

<sup>2</sup> Includes only brick and tile; terra cotta, fire and other clay products are shown in "all other states."

<sup>3</sup> Includes figures for the manufacture of any of the several classes of products shown in Table 15, where there were less than 3 establishments reporting.

CLAY PRODUCTS.

QUANTITY, AND VALUE, BY STATES AND TERRITORIES: 1905.

BRICK—continued.						Drain-tile.	Sewer pipe.	Fireproofing, including terra cotta, lumber, and hollow building tile or blocks.	Archi-tectural terra cotta.	Roofing, floor, and encaustic tile.	All other terra cotta, fire and other clay products.	All other products.	
Vitrified paving brick.		Fire brick.		All other brick.									
Thou-sands.	Value.	Thou-sands.	Value.	Thou-sands.	Value.								
715,550	\$7,256,088	678,362	\$11,752,625	140,729	\$1,040,816	\$5,522,108	\$8,416,009	\$4,317,312	\$3,702,763	\$2,725,717	\$4,704,390	\$515,035	1
6,753	70,430	9,631	127,997	1,696	14,967	217	101,580				6,873		2
				2,600	19,351								3
25	250	759	9,675	5,962	46,940	1,000					224		4
25	575	23,453	206,443	3,817	35,425	36,864	679,804	113,336	223,000	25,250	151,749	100	5
6,340	54,103	4,034	70,014	4,500	78,000	9,604	308,386	3,300			180,175	4,755	6
3,000	42,000	2,000	43,800					6,500			5,230	75	7
						0,600							8
						3,400	30,440	61,013			3,100		9
						2,707					515		10
7,000	63,000	1,701	24,008	5,000	30,100	7,000	174,000	18,000	102,308	59,984	8,080		11
				50	2,000								12
300	7,500	50	1,770										13
101,017	942,766	12,041	176,700	1,323	84,156	1,042,056	391,453	348,053	804,554	241,563	166,162	21,093	14
50	700	46	620	125	875						25,508		15
47,608	512,629	15,374	169,102	13,520	82,150	1,235,585	257,018	576,903	38,000	483,213	287,526	1,200	16
34,177	316,409	10	150	700	8,400	1,200,766	94,200	92,001			2,034	350	17
													18
90,102	702,277	74	701	3,770	25,041	9,858	98,015	3,988	500	32,000	22,815		19
3,729	44,867	36,017	664,019	2,637	51,292	29,624	118,458			214,124	21,666		20
100	1,000					300					38,050		21
						3,000					605		22
340	4,700	16,513	200,482	313	2,505	3,090		14,021	34,840		34,800	31,550	23
													24
		3,603	103,228					92,385	10,840	89,543	130,310	600	25
4,185	51,340			9,424	53,150	221,502	165,420	10,150			2,765		26
200	2,000			5,000	40,500	18,112	285,616	49,580			1,725		27
				155	1,349	7,102		100			2,341		28
50,528	518,137	38,834	640,133	1,195	40,909	84,563	792,710	192,222	185,623	64,539	905,830	232,043	29
													30
100	1,800	500	17,500				14,000				9,000		31
1,530	13,050			5,500	42,250						3,687		32
											280		33
											412		34
3,223	43,168	31,057	709,396	8,018	234,175	39,967	20,352	1,279,121	1,216,400	245,518	723,064	69,384	35
													36
													37
13,208	107,901	16,274	459,017	3,299	26,677	115,532	143,738	207,680	815,893	48,665	159,141	9,045	38
		301	3,010	1,500	15,000	7,760	95,000				1,150		39
						300		60					40
189,734	1,015,139	87,926	1,288,872	24,563	232,258	1,174,200	2,939,772	917,176		988,630	592,917	32,301	41
													42
600	5,555			1,200	9,000						10,617		43
400	6,000	622	12,068			31,461	60,000	15,000			2,040		44
91,040	941,588	350,066	6,280,231	21,473	566,573	14,089	809,374	243,089	341,077	215,688	873,482	70,004	45
		2,472	26,281	000	4,800	10,000					930	2,735	46
60	2,100			1,750	12,250			1,071					47
													48
5,984	59,840	3,239	35,369	540	0,000	19,004	142,999				5,572		49
100	1,000	1,034	17,210	10,000	65,000	691	171,966				16,099		50
		1,332	40,307			7,306	25,000	3,639			3,154	2,372	51
											4,000		
2,440	24,400	1,827	28,085	4,881	54,187	4,890					3,287	708	
7,705	125,000	780	23,320	928	26,046	13,027	214,720	4,643	19,632		7,579		
42,122	608,858	3,350	31,260			57,500		2,781		17,000	52,339		
				3,000	21,000						251,400		
553	5,530	5,054	140,137			2,381	282,488				35,583	30,000	

Table 16 shows the kind and value of pottery products, by states and territories for 1905. The total value here reported is slightly in excess of that shown

in Table 18 because of the necessity of including red earthenware, manufactured in brickyards, having a value of \$3,500.

TABLE 16.—POTTERY PRODUCTS—KIND AND VALUE, BY STATES AND TERRITORIES: 1905.

STATE OR TERRITORY.	Total.	Red earthenware.	Stoneware.	C. C. ware and white granite ware, including semivitreous porcelain ware.	China (porcelain).	Bone china, Delft, and Belleek ware.	Sanitary ware, including solid porcelain bath tubs, laundry tubs, etc.	All other pottery products.
United States.....	\$25,834,513	\$821,605	\$3,274,014	\$9,195,703	\$3,370,627	\$108,000	\$3,032,506	\$5,131,088
Alabama.....	34,366		32,854					1,512
Arkansas.....	13,000		13,000					
California.....	46,910	24,133	7,777				15,000	
Colorado.....	46,650		26,500					20,150
Connecticut.....	95,075	43,500						51,575
District of Columbia.....	12,600	12,600						
Georgia.....	24,477	5,161	19,320					6
Illinois.....	866,460	16,850	723,971					124,039
Indiana.....	763,281	2,700	71,501	211,417			415,613	62,050
Iowa.....	72,340	9,200	63,140					
Kansas.....	40,500		40,500					
Kentucky.....	153,410	24,000	129,410					
Louisiana.....	704	704						
Maryland.....	308,700	12,700		108,000				220,000
Massachusetts.....	203,643	181,771	36,980	66,000	5,000			3,892
Michigan.....	40,189	20,600						19,589
Minnesota.....	247,633		241,107					6,526
Missouri.....	28,470	8,340	20,130					
New Jersey.....	6,462,624	30,634	58,819	1,200,768	301,380	108,000	3,006,406	1,606,637
New York.....	1,308,094	31,275	48,748	105,076	499,485		46,804	546,107
North Carolina.....	6,427	40	6,347					40
Ohio.....	11,905,710	183,236	1,040,378	6,167,494	2,279,374		197,225	2,038,003
Oregon.....	27,480	4,700	22,600					280
Pennsylvania.....	1,325,581	136,532	338,156	547,798	30,000		86,058	187,037
South Carolina.....	12,200		11,500					700
Tennessee.....	133,988	2,000	131,988					
Texas.....	125,218	3,452	121,766					
Utah.....	1,900	1,900						
Virginia.....	50,000							50,000
Washington.....	30,638	1,750	38,188					
West Virginia.....	1,100,564		16,850	550,551	195,408		165,400	181,355
Wisconsin.....	12,627	12,627						
All other states <sup>2</sup> .....	79,415	51,000	13,475					10,940

<sup>1</sup> Includes red earthenware to the value of \$3,500 made in brickyards, and distributed as follows: Kentucky, \$1,000; Montana, \$1,000; Ohio, \$1,500.  
<sup>2</sup> Includes establishments distributed as follows: Maine, 2; Mississippi, 2; Montana, 1; New Hampshire, 2; Vermont, 1.

## HISTORICAL AND DESCRIPTIVE.<sup>1</sup>

### BRICK AND TILE.

The manufacture of brick goes back to prehistoric times. Ruins of brick buildings have been found dating from 4000 B. C. The brick of many different shapes found by archeologists on the site of ancient Babylon, the enameled or glazed brick found of the period of Nebuchadnezzar, the burned brick used in the construction of the Great Wall of China, and the red, yellow, and blue brick discovered among the architectural decorations of the Egyptians, all bear witness to the skill of the brickmakers of the early ages. Unlike the modern product, these early bricks were large and cumbersome and far from uniform in size and shape. Probably not until the fourth century of the Christian era did they assume a size anywhere near that of the brick now in use, and not until much later did they become uniform in size.

In ancient Babylonia brick was the only building material available. Owing to the scarcity of fuel, they

were generally unburned. The clay would be mixed with chopped grass or hay and allowed to dry in the sun for several months. In Egypt stone quarries were abundant and therefore the use of brick was limited. The Greeks also had an abundant supply of building stone and with them bricks found little favor. Next to the Babylonians, among the great nations of antiquity, the Romans made most use of brick. Their favorite mode of construction was a wall of concrete faced with brick. The nations of northern Europe learned brickmaking from the Romans.

In the Middle Ages, with the rise of Gothic architecture, the use of brick greatly declined. It was not until the reign of Queen Elizabeth that the manufacture again flourished in England, and not until the year 1625 that bricks began to be made uniform in size and shape.

In this country brick were probably first burned in the colony of Virginia as early as 1612. In New England brick and tile making seems to have been

<sup>1</sup> For much of the data used in the preparation of this report, acknowledgment is made to the following: "Pottery and porcelain of the United States," by Dr. E. A. Barber. "A practical treatise on the manufacture of bricks, tiles, terra cotta, etc.," by Mr. Charles T. Davis. "Brick," monthly trade journal published in Chicago, Ill., by the Kenfield Publishing Company. Reports of Mr. F. T. Fitzpatrick, consulting architect of the International Society of State and Municipal Building Commissioners and Inspectors.

followed as an independent calling about the year 1647. Though the product was of good quality the industry did not thrive, as money was scarce and timber plentiful, and it was not until after the Revolutionary War that homemade bricks came into general use. With increasing prosperity the desire and necessity for more substantial structures arose. The growth of the industry from year to year naturally provided a stimulus for the invention of machinery that would produce better brick, new shapes, and different sizes; and in turn these new inventions contributed to further the growth of the industry. The earliest record of a patent issued by the United States Patent Office for brickmaking is dated May 15, 1800, and was for a brick and tile machine invented by G. Hadfield, residence not recorded. Other patents issued about that time were one to E. Miller, July 17, 1802, for a brick machine; one to N. and P. W. Miller, January 5, 1804, for a brick and tile machine; one to W. Hodgson, Richmond, Va., May 22, 1805, for an apparatus for making tile, brick, etc.; and one to J. F. Gould, Newburyport, Mass., March 1, 1806, for a brick machine. The first patent granted for a brick-kiln was issued to H. Read, of Kensington, Pa., June 17, 1840; and the first for a brick dryer, to S. M. Parish, of Baldwinsville, N. Y., August 16, 1864.

Although much the same process for making brick and tile has been used for ages, the evolution of the industry through the use of improved methods and machinery has brought about a great change in the character of the product. It is a long stride from the use of hand pick and shovel to steam shovel in uncovering the clay bed; from the old-fashioned ring pit to the machine that grinds, tempers, and molds; from the use of a hand mold to the machine with a capacity of 100,000 bricks per day; from the open air system, or a weather beaten drying shed, to the utilization of artificial heat for drying; from the temporary to the patented continuous kilns; and from the poorly made product of years ago to the firm, straight-edged, and otherwise well finished product of to-day. Of the \$119,956,959 capital invested in this industry, the machinery, tools, and implements represent \$33,295,324, or 27.8 per cent, an increase in five years of \$16,045,486, or 93 per cent.

By reference to Table 15, which shows the total number and value of all kinds of brick made by the two branches of the industry, classified respectively as "brickyards" and "potteries," it is found that almost eleven billion brick were made in 1905, having a value of \$79,524,911, nearly ten times the total value of all clay products reported at the census of 1850. This value was nearly six times that of all clay products in 1860, more than twice that of 1870, and nearly twice that of 1880. It exceeded by \$4,416,715 the total value of all the earthenware, china, brick, and tile imported and entered for con-

sumption in the United States for the eight years beginning 1897 and ending 1904.

*Common brick.*—Enormous quantities of common brick are being manufactured in all sections of the country. Surface clays are generally used, and more attention is given to the volume than to the color and general qualities of the product, as the price is low and the brick used mostly in ordinary wall construction and foundation work. The quality of the brick, however, largely determines the price, and it appears that common brick made in brickyards averaged \$5.90 per thousand, while that made in potteries averaged \$6.05. The quantity made by establishments under the latter classification was not, however, sufficient to change the average value per thousand for the United States, which was \$5.90 in 1905, as compared with \$5.18 in 1900. New York, Illinois, Pennsylvania, Ohio, and Indiana led in the production of common brick in the order named.

*Sand-lime brick.*—The sand-lime brick industry has passed the experimental stage, and though still in its infancy there is every reason to believe that it will eventually rank among the foremost of the country.

The successful manufacture of sand-lime brick in foreign countries appears to antedate that in this country by several years. According to United States Consul-General Mason, at Berlin, the discovery that freshly pressed bricks of sand and lime could be hardened in a few hours by heat and pressure of steam was made in Potsdam, Germany, about 1880. Plants on a large scale were subsequently constructed, and the industry extended throughout Germany and Great Britain.

In the United States the industry has grown from one plant, established in Michigan City, Ind., in 1901, to 50 establishments in 1905. In some instances these brick were made in establishments having clay products as their chief output, while in others they were products of plants exclusively confined to the manufacture of sand-lime brick. As this product was not reported at the census of 1900, comparisons can not be made.

In 1905 the total production of sand-lime brick was 87,778 thousand brick, valued at \$698,003, an average of \$7.95 per thousand, or \$2.05 above the average price of common brick for the United States. The establishments reporting this product were not confined to any particular region, but scattered through 25 states. Michigan led with 6 plants; Pennsylvania and Virginia reported 5 each; California, 4; Indiana and New York, 3 each; Alabama, Arkansas, Colorado, Florida, and Washington, 2 each; and Arizona, Kansas, Kentucky, Maryland, Minnesota, Mississippi, New Jersey, North Carolina, Ohio, South Carolina, South Dakota, Tennessee, Texas, and Wisconsin, 1 each.

The color of sand-lime brick is usually gray, although a comparatively pure quartz will produce a

brick almost white. By the addition of mineral oxide almost any color can be obtained. The weather and fire resisting properties of the brick compare favorably with those of other building material, as is shown by the following observations and experiments of Prof. S. V. Peppel:

*Resistance to weather.*—The resistance of sand-lime brick to weather is shown by its behavior in buildings which have been erected in severe climates and have shown no signs of disintegration in a number of years. The writer has observed the condition of a house built in Michigan City, Ind., early in the winter of 1901. This house was inspected late that winter, again in 1902, and again late in the winter of 1903, and no signs of weakness or attack due to the action of frost could be detected. There are buildings in northern Germany which have been standing eight or ten years and which show no signs of disintegration. Severe freezing tests have been applied to sand-lime brick by the Ohio geological survey and no evidence of weakness has resulted. The experience of Prof. Ira Woolson, of Columbia University, in testing commercial samples, has confirmed the work of the writer. The freezing tests which were applied were very severe. Blocks were saturated with water, then frozen rapidly by artificial means, then removed from the freezing can and immediately plunged into warm water, and as soon as completely thawed out they were at once introduced into the freezing can again. This was repeated as many as twenty times. The bricks were then dried, and their crushing strength was compared with that of duplicates which had been manufactured at the same time and had not been frozen or otherwise exposed to the weather. In every case, except when the bricks contained considerable quantities of clay, there was practically no falling off in the crushing strength. From the foregoing it is evident that, if properly manufactured, sand-lime brick is not at all susceptible to the ravages of frost and moisture.

*Fire resisting properties.*—Numerous tests have been made to determine the behavior of sand-lime bricks under the action of fire and water. In every case they have come out with a favorable record. The result may be summed up in the following statement: The application of great heat, followed by sudden quenching with water, destroys to some extent the bond on the surface and to a little depth beneath, but leaves the brick safe and intact. There was seldom any cracking or breaking of the brick, and the softening did not seem to penetrate the brick to any great extent. This is perfectly natural, since the brick are largely made of quartz, which is a poor conductor of heat.

*Red front brick.*—In the production of red front brick great care is exercised in the selection of raw materials and in the process of manufacture. The clay must be well tempered; the brick molded free from flaws or sand cracks; the method of drying be more complete than for common brick; and the repressing and subsequent drying, setting in kiln, and burning, skillfully and systematically managed. This additional attention necessarily increases the cost of production and the selling price, the latter averaging \$9.90 per thousand for the United States. Every state reported the manufacture of red front brick except Florida, Nevada, South Dakota, Vermont, Wyoming and the territory of Arizona. The state of Pennsylvania ranks first in value of product, New Jersey second, Illinois third, Ohio fourth, and Missouri fifth.

*Fancy and ornamental brick.*—Fancy colored and ornamental brick are primarily pressed brick. The different shades of color in the former are produced

by the addition of artificial coloring materials or by the manipulation of the kiln fires, while the distinguishing feature of ornamental bricks are the designs in relief or depression upon the surface to be exposed, in addition to a variety of shapes and sizes not found in ordinary pressed brick.

The average value per thousand in 1905 was \$14.82, ranging from \$147.13 in North Dakota to \$7.56 in Indiana. This wide difference for the various states can be attributed largely to the fact that the greater part of these bricks were made to supply special orders, very few plants carrying them in stock. Pennsylvania, Ohio, New Jersey, New York, and Virginia led in value of products, in the order named.

*Paving brick.*—In Holland, brick have been used to pave both roads and city streets since the seventeenth century, and are said to have been used for pavements in Japan for more than a hundred years. In the United States the first brick pavement on a roadway was laid at Charleston, W. Va., in 1870, and in 1873 the city adopted it for certain streets. This example was followed by many cities of the central west, but Philadelphia, in 1887, was the first large city to use brick for paving. The first patent on brick for pavements was granted R. Wright, of Philadelphia, Pa., December 17, 1867.

In his work, "Clays of the United States," Prof. Heinrich Ries says:

Most of the bricks of this class are made from fine grained ferruginous shales, these being found to yield the best results. In some cases a certain quantity of low grade fire clay is added—in fact, during the early stages of the industry, fire clays alone were considered necessary. The stiff mud method is now preferred by most paving brick manufacturers on account of its greater capacity.

The great increase in the production of vitrified paving brick is sufficient evidence of the growing demand for its use, and of the high state of perfection attained in its manufacture. In value of products, Ohio ranks first, Illinois second, Pennsylvania third, Kansas fourth, and West Virginia fifth. These five states produced 70.4 per cent of the entire value of the product of the thirty-two states engaged in the manufacture. The average value per thousand for the United States was \$10.14, the value in different states varying from \$35 in California and South Dakota to \$7.79 in Kansas.

*Fire brick.*—As the name implies, fire brick are used where intense heat must be withstood, as in cupolas, blast and glass furnaces, coke ovens, locomotive fire boxes, etc. The utility of the appliances just mentioned depends largely, if not altogether, on construction out of materials which will stand intense heat without fusing, cracking, or yielding in any way. In value of products Pennsylvania leads. Ohio is second in rank, New Jersey third, Kentucky fourth, and Missouri fifth. These five states produced 81.6 per cent of the total for the country. The average value per thousand for the United States was \$17.32, ranging from \$35 in Montana to \$9.33 in West Virginia.

A new fire brick made from ashes has been produced by a Michigan firm. The ashes are united by a powerful binder, molded, and the product conveyed straight to the drying room. It is claimed that the brick are ready for laying five days after manufacture; that they have been tested in fire and water with satisfactory results; and, further, that the product is two-fifths lighter than terra cotta, and yet stands considerable crushing force.

*Enameled brick.*—The value of enameled brick showed an increase of 35.2 per cent during the half decade. These bricks are ornamental, and in addition to being used for external decoration in the construction of buildings, are extensively used for sanitary purposes, their glazed and vitreous surfaces rendering them waterproof and easy to clean. As the surface of the brick to be enameled must be smooth and free from sand, pressed and fire brick are most often used. New Jersey leads in value of products. Illinois ranks second, Pennsylvania third, and Kentucky fourth. Missouri, Iowa, Ohio, and Michigan follow in the order named. Only these eight states reported enameled brick as a part of their products, the industry being comparatively new in the United States.

*Hollow building tile and blocks, and fireproof brick.*—On December 9, 1856, a patent was issued to M. and J. H. Buck and F. A. Cushman, of Lebanon, N. H., for a machine for pressing hollow building brick or building tile. This industry, though yet in its infancy, is rapidly growing in importance, as the product is essential to the construction of modern fireproof buildings. No separate classification has yet been made of this product, which is included with fireproofing and terra cotta lumber.

Possibly nothing has contributed more to the demand for burnt clay products, and brought more clearly to the attention of the public their value as a fire retardant, than the recent great fires in Baltimore, Rochester, and San Francisco. Without considering, however, these occasional catastrophes, it is estimated that the United States yearly sustains a fire loss of \$250,000,000, a sum almost double the combined value of all clay products manufactured in this country during the same time and nearly three times the total value of all the brick, fireproofing, terra cotta lumber, hollow building blocks or tile, and roofing, floor, and encaustic tile. With such an enormous annual property loss, and with the thinning out of the forests of the country, it is reasonable to believe that a change in building methods is imminent, and that the new era of construction will be of immeasurable benefit to those engaged in the manufacture of burnt clay building materials.

It is claimed that the annual fire loss in this country during the past five years amounted to about \$2.50 per capita, as against only 33 cents per capita in the larger European countries. This unsatisfactory showing for

the United States has resulted in a growing demand for a fireproof brick that can be used in the construction of moderate priced dwellings, and several large plants are now making a specialty of such an article. In this connection it is interesting to note that in 1807 a patent was granted by the United States Patent Office to E. Jenks, of Canaan, Conn., for a "fireproof brick machine." It is more than probable, however, that this machine was a contrivance for making fire brick rather than fireproof brick for building purposes, as a patent for making fire brick was issued to the same person on April 17 of the same year. Some time afterwards, in 1823, a patent for making fireproof brick was issued to T. Caldwell, of Philadelphia, Pennsylvania.

In an article in "Brick" for July, 1906, Mr. George E. Walsh, in referring to fireproof brick, says:

The bricks are burned at a temperature so high that a modern conflagration could not materially injure them. Architects have learned to depend upon them, and experience has demonstrated their value as a fire retardant. A further improvement in this direction is needed in the manufacture of fireproof bricks with ornamental facings. The ordinary fireproof brick is too often an ugly thing. It does not look well in solid walls, and as a consequence architects will not order it except for factories, warehouses, and similar buildings, where no attempt at beauty is desirable. \* \* \*

In our large cities brick buildings must continue to be built to conform to the building laws, but in the country and in small villages and towns frame buildings must be eventually superseded by the brick, stone, and concrete houses. This is imperative, both as a matter of protection from fire losses and as a result of the increasing cost of lumber.

It is estimated by Mr. F. W. Fitzpatrick, of the International Society of State and Municipal Building Commissioners and Inspectors, that of the 14,000,000 or more buildings in this country not more than 4,000 are moderately fireproof and not more than 20 can be called anywhere near absolutely fireproof.

*Drain-tile.*—The manufacture of drain-tile also dates back to early ages, and many instances of its general use by the ancients have been found. That it was used, probably in a crude form, by the early settlers of this country can not be doubted, as patents were issued for its improved manufacture in the year 1800. On account of the various sizes of drain-tile manufactured, it was found impossible to establish a unit of measure that would be of any practical value in determining the quantity made.

The four states, Iowa, Indiana, Ohio, and Illinois, produced 86 per cent of the total value of all drain-tile, as compared with 87 per cent in 1900. The change in rank of these states since 1900 is noteworthy. Iowa, which was fourth in rank in 1900, now occupies first place, with 23.5 per cent of the total value of all drain-tile manufactured in the country, changing places with Illinois, with 18.9 per cent of the total product in 1905. Indiana, with 22.4 per

cent of the total product, changed places with Ohio, with 21.3 per cent. In 1905 compared with 1900 there was an increase of 50.8 per cent in the total value of this product.

*Machinery.*—An interesting feature of the statistics of the manufacture of brick and tile in Table 17 is the number and kinds of machines and kilns. The grinding and the tempering machines reported separately are of course detached, the combination machines being included under the head of molding machines. There were 3,263 grinding machines. Of these, disintegrators were most numerous, although the number in use decreased 502, while the number of dry pans increased 406. Machines used in tempering the clay numbered 3,927. Ring pits decreased 556 and wet pans 34, while pug mills increased 288.

Of molding machines, the soft mud type was still in most general use in 1905, although showing a decrease of 302 during the five years, while the stiff mud type increased 286. The number of dry presses increased 99. Shape brick power presses, hand presses, sewer pipe presses, and tile machines showed great decreases. All other molding machines, consisting largely of combination brick and tile machines and of hand molds, showed an increase of 2,227. Apparently the use of mold sanders has decreased, there being 918 less in use in 1905 than in 1900.

At the census of 1905 only the number of dryers using artificial heat were tabulated, whereas at previous censuses racks and pallets and open air drying sheds were counted. Of the 1,110 dryers reported, 654 were classified as steam, 176 hot air, 122 waste heat, and 158 direct heat and other kinds. Pennsylvania led in the number of steam dryers, followed by Ohio, Georgia, Iowa, Indiana, and Illinois. The greatest number of hot air dryers was reported by Pennsylvania, followed by Illinois, Missouri, Ohio, and Indiana. Ohio led in waste dryers, followed by Illinois and Pennsylvania; and Kansas in the use of gas dryers, having almost twice the total of the other five divisions reporting—Indiana, Indian Territory, Iowa, Pennsylvania, and West Virginia. In the use of direct heat Illinois and Kansas led, each reporting the same number.

*Kilns.*—Of the 17,124 kilns in operation during the year covered by this report, 4,208 were clamps, 4,332 round down draft, 1,936 rectangular, 40 muffle, 254 continuous, and 6,354 "all other," including temporary kilns.

#### POTTERY.

The following brief outline of the history of the industry in the United States begins with the early struggles of the colonists, rather than with the crude but interesting efforts of the native tribes and prehistoric races.

In his work on American pottery Prof. E. A. Barber says:

The potter's art was probably first practiced in this country by the earlier emigrants in Virginia. Numerous small potteries sprang up to supply the modest needs of the simple-minded inhabitants, which furnished coarse earthenware utensils for culinary and other purposes. \* \* \* Previous to 1649 there were a number of small potters in Virginia who carried on a thriving business in the communities in which they operated; and the first Dutch settlers in New York brought with them a practical knowledge of pottery, and are said to have made a ware equal in quality to that produced in the ancient town of Delft, hardly a white ware but such as could be produced from the natural clays which abounded in the country.

It is recorded that a white ware was produced at a pottery erected in Burlington, N. J., in 1685 by the American agents of Dr. Daniel Coxe, of London. However, it is not likely that the ware made at this pottery was white, general opinion being that it was yellow and cream colored, as at that time no other ware was known except the porcelain which came from China, and was known as "china ware." Ordinary household pottery and ornamental vases for flowers were made in West Whiteland, Chester county, Pa., as early as 1753; a pottery and glass works was in operation in Germantown, New Quincy, Mass., in 1760; and a pottery in South Carolina in 1765. Cream colored ware, both plain and decorated in blue, was made in Philadelphia in 1770.

It appears however, that the potteries established before the Revolutionary War did not meet with marked success, and that this industry, like the manufacture of brick, did not assume commercial importance until after that war, when a period of new economic and industrial life began. About this time many enterprises were launched, including a number of potteries. About 1780 a stoneware pottery was established in Norwalk, Conn.; in 1791 John Curtis was making a good quality of pottery in Philadelphia; in 1793 John and William Norton established in Bennington, Vt., a pottery for the manufacture of red earthenware; and in 1808 the Columbian Pottery was making queensware in Philadelphia.

Philadelphia appears to have been the center of the pottery industry about this time, and it was in this city at the first exhibit of the Franklin Institute in 1824 that Mr. Abraham Miller, the son of Andrew Miller, who conducted a pottery in Philadelphia previous to 1791, showed some specimens of his art that were commended by the judges as being equal, if not superior, to imported articles of like description. His exhibit included "red and black glazed teapots, coffeepots, and other articles of the same description; also a sample of platinated or luster pitchers, with a specimen of porcelain and white ware." It is said that some excellent porcelain was produced by Mr. Miller, but that little attempt was made to develop it along commer-

cial lines, probably because of foreign competition, the tariff not having at that time been adjusted for the full protection of home industries.

In 1825 the Jersey Porcelain and Earthenware Company of Jersey City was incorporated, and the following year was awarded a silver medal at the Franklin Institute, Philadelphia, for the manufacture of "the best china from American materials."

To Mr. William E. Tucker, of Philadelphia, probably belongs the credit of being the first potter to supply the home market with porcelain. In 1825, after several years of experimenting with American clays, he established a pottery in Philadelphia "for the manufacture of a full line of goods." He seems to have met with many disheartening troubles, as shown in a paper prepared in 1868 by his brother, Mr. Thomas Tucker, for the Pennsylvania Historical Society. "He burned kiln after kiln, with very poor success. The glazing would crack, and the body would blister, and, besides, we discovered we had a man who placed the ware in the kiln who was employed by some interested parties in England to impede our success. Most of the handles were found in the bottom of the saggars after the kilns were burned. We could not account for it until a deaf and dumb man in our employment detected him running his knife around each handle as he placed them in the kiln. At another time every piece of the china had to be broken before it could be taken out of the seegar. We always washed the round O's, the article in which the china was placed in the kiln, with silex; but this man had washed them with feldspar, which, of course, melted and fastened every article to the bottom."

The wares produced by this pottery were of sufficient excellence to attract the attention of the English potters. Gen. Hector Tyndale gives the following description: "The products were white and decorated table and tea services, and decorative wares. The body was very good, being hard, dense, tough, and translucent, quite vitreous, with sharp and clear ring, and withstanding great and rapid changes of temperature. In appearance it somewhat resembled the French (Limoges) porcelain of that day, and in durability and use, that of Berlin, and quite equal to either. The glaze was good, and well adapted to receive colors." The pottery, however, was not a success from a financial standpoint, and in a few years ceased operations.

Among the other potteries erected about this time should be mentioned Nash's in Utica, N. Y., established 1819; Perrine's stoneware works in Baltimore, Md., 1827; John Hancock's yellow ware factory in South Amboy, N. J., 1828; Lewis's queensware and china pottery in Louisville, Ky., 1829; and Homer

& Shirley's flintware works in New Brunswick, N. J., 1831.

In 1830 an appeal for aid was made to the Government. Greater protection for the industry was asked, but in 1833 Congress passed a bill generally decreasing the tariff instead of increasing it. Although discouraging to the manufacturer of the higher grade wares, the industry on the whole did not suffer greatly, and the number of potteries steadily increased. In 1837 the Indiana Pottery Company was established in Troy, Ind., and two years subsequently, the first pottery in East Liverpool, Ohio, was erected by Mr. James Bennett, an Englishman, formerly at the Indiana pottery, and by Mr. Anthony Kearns, who furnished the capital. The first pottery was not built in Trenton, N. J., until 1852, when Messrs. Taylor, Speeler, and Bloor opened their establishment.

The influence of the tariff on the industry is thus explained by Mr. John Moses: "It was not, indeed, until the first real protection by the tariff ever accorded the potteries was enacted, as a war measure, that the American maker found himself able to enter the field against the English potter, especially in the two staple lines of *white granite* and *C. C.* The premium on gold, doubling, as it did, the increased duty, gave the potters the long needed opportunity, and new establishments sprang up in Trenton during the decade succeeding the war."<sup>1</sup>

Prior to 1890 the clay working industries were not the subject of a special Census report, being included in general tables. At the census of 1850 no division of the value of products was attempted further than as follows: Brick, \$6,610,731; fire brick, \$12,009; earthenware, \$100,556; and pottery, \$1,466,063. In 1860 the value of products was reported as follows: Brick, \$10,253,734; fire brick, \$493,400; draintile, \$516,013; terra cotta ware, \$18,000; pottery and stoneware, \$2,463,681; and porcelain ware, \$243,000. In 1870 brick was reported to the value of \$29,028,359; drainpipe, \$1,294,256; and stone and earthenware, \$6,045,536. At the census of 1880 the value of clay products was reported as follows: Brick and tile, \$32,833,587; stone and earthenware, \$7,942,729; drain and sewer pipe, \$480,261; and terra cotta ware, \$554,343. At the census of 1890, for the first time, the report was commensurate with the importance of the industry.

Table 17 is a detailed summary of the statistics for the manufacture of brick and tile, for 1905, by states and territories.

Table 18 is a detailed summary for the manufacture of pottery, terra cotta, and fire clay products, for 1905, by states and territories.

<sup>1</sup> One Hundred Years of American Commerce, page 290.

MANUFACTURES.

TABLE 17.—BRICK AND TILE—DETAILED SUMMARY.

	United States.	Alabama.	Arizona.	Arkansas.	California.	Colorado.	Connecticut. <sup>1</sup>
1	Number of establishments.....	4,634	63	5	55	69	34
2	Capital:						
3	Total.....	\$119,956,059	\$1,033,277	\$79,428	\$642,803	\$3,028,001	\$1,880,852
4	Land.....	\$27,752,437	\$123,348	\$9,900	\$144,526	\$1,213,060	\$514,455
5	Buildings.....	\$25,522,601	\$178,750	\$12,820	\$179,908	\$776,606	\$411,063
6	Machinery, tools, and implements.....	\$33,295,324	\$306,250	\$27,058	\$205,083	\$1,030,159	\$320,123
7	Cash and sundries.....	\$33,386,697	\$334,929	\$28,750	\$331,376	\$907,876	\$637,311
8	Proprietors and firm members.....	5,295	60	5	68	40	34
9	Salaried officials, clerks, etc.:						
10	Total number.....	3,600	74	.....	30	101	33
11	Total salaries.....	\$3,630,474	\$71,874	.....	\$37,525	\$101,048	\$64,429
12	Officers of corporations—						
13	Number.....	903	17	.....	8	30	5
14	Salaries.....	\$1,160,404	\$21,805	.....	\$10,350	\$35,015	\$8,600
15	General superintendents, managers, clerks, etc.—						
16	Total number.....	2,787	57	.....	28	71	28
17	Total salaries.....	\$2,370,070	\$50,069	.....	\$27,175	\$60,033	\$30,800
18	Men—						
19	Number.....	2,008	54	.....	27	68	20
20	Salaries.....	\$2,209,093	\$48,050	.....	\$20,575	\$64,553	\$20,000
21	Women—						
22	Number.....	170	3	.....	1	3	2
23	Salaries.....	\$70,977	\$1,410	.....	\$900	\$900	\$2,150
24	Wage-earners, including pieceworkers, and total wages:						
25	Greatest number employed at any one time during the year.....	115,000	1,788	52	1,045	2,174	927
26	Least number employed at any one time during the year.....	59,940	1,069	42	514	1,188	696
27	Average number.....	60,021	1,044	30	525	1,367	495
28	Total wages.....	\$28,640,005	\$301,234	\$20,380	\$180,308	\$826,340	\$322,235
29	Men 16 years and over—						
30	Average number.....	64,612	866	30	508	1,342	484
31	Wages.....	\$28,400,967	\$288,766	\$20,380	\$183,779	\$821,075	\$318,497
32	Women 16 years and over—						
33	Average number.....	36	2	.....	.....	.....	.....
34	Wages.....	\$8,650	\$220	.....	.....	.....	.....
35	Children under 16 years—						
36	Average number.....	1,373	869	.....	17	15	11
37	Wages.....	\$230,382	\$12,248	.....	\$2,520	\$4,271	\$3,738
38	Average number of wage-earners, including pieceworkers, em-						
39	ployed during each month: <sup>2</sup>						
40	Men 16 years and over—						
41	January.....	25,431	590	20	224	813	227
42	February.....	26,030	648	35	230	807	222
43	March.....	30,713	795	35	319	801	265
44	April.....	61,240	1,015	35	581	1,317	341
45	May.....	87,355	1,103	48	651	1,597	710
46	June.....	94,667	1,139	40	716	1,634	773
47	July.....	90,692	1,227	35	723	1,747	777
48	August.....	94,603	1,234	35	601	1,817	762
49	September.....	88,887	1,143	29	604	1,601	723
50	October.....	74,855	1,004	21	540	1,450	520
51	November.....	51,514	859	12	437	1,167	280
52	December.....	37,067	715	12	320	1,113	209
53	Children under 16 years—						
54	January.....	307	44	.....	4	8	3
55	February.....	345	54	.....	6	8	3
56	March.....	570	63	.....	8	12	3
57	April.....	1,328	107	.....	19	13	3
58	May.....	2,094	122	.....	27	18	4
59	June.....	2,314	127	.....	16	20	4
60	July.....	2,375	111	.....	27	23	5
61	August.....	2,202	104	.....	27	23	5
62	September.....	2,053	89	.....	27	19	5
63	October.....	1,543	103	.....	22	14	5
64	November.....	778	63	.....	14	11	5
65	December.....	471	45	.....	7	10	4
66	Miscellaneous expenses:						
67	Total.....	\$6,000,161	\$76,445	\$10,059	\$89,012	\$210,795	\$67,349
68	Rent of works.....	\$395,405	\$4,190	.....	\$902	\$2,739	\$8,335
69	Taxes.....	\$503,951	\$4,677	\$437	\$4,000	\$11,387	\$8,843
70	Rent of offices, interest, insurance, and all sundry	\$5,775,935	\$65,162	\$10,522	\$82,240	\$179,080	\$94,048
71	expenses not hitherto included.....						
72	Contract work.....	\$203,870	\$2,416	.....	\$2,050	\$17,580	\$9,550
73	Materials used:						
74	Total cost.....	\$16,310,499	\$204,026	\$10,475	\$100,543	\$334,017	\$108,159
75	Clay purchased—						
76	Tons.....	985,749	4,135	.....	3,350	21,455	2,400
77	Cost.....	\$470,288	\$4,135	.....	\$1,190	\$19,030	\$5,140
78	Coal, used as an ingredient—						
79	Tons.....	76,418	.....	.....	1	126	6,781
80	Cost.....	\$141,301	.....	.....	\$2	\$630	\$8,684
81	Sand—						
82	Tons.....	322,824	4,981	.....	1,903	3,501	7,260
83	Cost.....	\$247,241	\$2,856	.....	\$1,928	\$9,168	\$3,853
84	Lime—						
85	Tons.....	13,141	294	400	650	728	60
86	Cost.....	\$78,313	\$1,802	\$5,980	\$3,593	\$7,634	\$400
87	Manganese—						
88	Pounds.....	4,555,625	.....	.....	.....	.....	155,025
89	Cost.....	\$50,880	.....	.....	.....	.....	\$1,982
90	Salt—						
91	Tons.....	2,348	1	.....	.....	3	15
92	Cost.....	\$10,503	\$2	.....	.....	\$31	\$205
93	Fuel.....	\$13,583,834	\$180,001	\$9,001	\$180,725	\$268,811	\$132,502
94	Rent of power and heat.....	\$45,126	.....	.....	\$910	\$9,520	\$1,856
95	Mill supplies.....	\$565,429	\$7,547	\$415	\$6,097	\$8,975	\$5,495
96	All other materials.....	\$578,021	\$6,109	\$419	\$1,795	\$4,325	\$2,794
97	Freight.....	\$538,665	\$1,514	.....	\$300	\$5,587	\$1,105

<sup>1</sup> Includes 2 establishments in Rhode Island.

<sup>2</sup> The average number of women 16 years and over employed during each month is not shown in the table on account of the small number reported.

# CLAY PRODUCTS.

BY STATES AND TERRITORIES: 1905.

Delaware.	District of Columbia.	Florida.	Georgia.	Idaho.	Illinois.	Indian Territory.	Indiana.	Iowa.	Kansas.	
21	8	14	59	19	435	27	392	302	65	1
\$272,325	\$422,235	\$341,857	\$1,813,042	\$91,257	\$12,988,293	\$410,536	\$5,448,696	\$4,800,594	\$3,473,415	2
\$28,105	\$133,750	\$30,300	\$457,417	\$15,000	\$2,620,265	\$11,850	\$900,382	\$806,217	\$541,689	3
\$13,725	\$51,200	\$90,465	\$206,266	\$15,950	\$3,541,648	\$110,781	\$1,414,403	\$1,430,012	\$448,119	4
\$51,450	\$76,452	\$138,116	\$638,356	\$24,130	\$3,890,412	\$238,801	\$1,608,115	\$1,397,790	\$1,623,719	5
\$140,045	\$100,833	\$73,080	\$511,903	\$36,167	\$2,945,938	\$49,044	\$1,516,796	\$1,166,575	\$850,888	6
21	8	15	77	21	509	27	498	366	85	7
13	9	19	99	2	303	17	176	165	109	8
\$12,840	\$10,084	\$17,220	\$91,565	\$2,900	\$349,845	\$19,540	\$172,824	\$145,564	\$117,212	9
6	1	5	31	-----	58	3	45	43	29	10
\$6,000	\$2,400	\$5,800	\$40,550	-----	\$99,139	\$3,390	\$55,487	\$51,273	\$37,345	11
7	8	14	68	2	245	14	131	112	80	12
\$6,840	\$7,684	\$11,420	\$51,015	\$2,900	\$250,706	\$16,150	\$116,837	\$94,291	\$79,867	13
7	7	14	68	2	233	14	128	107	71	14
\$6,840	\$7,164	\$11,420	\$51,015	\$2,900	\$243,351	\$16,150	\$114,817	\$92,414	\$75,307	15
-----	1	-----	-----	-----	12	-----	3	5	9	16
-----	\$720	-----	-----	-----	\$7,355	-----	\$2,020	\$1,877	\$4,560	17
421	446	552	2,454	189	8,867	501	5,016	4,693	2,443	18
130	67	312	1,252	117	4,008	294	3,237	2,415	1,362	19
209	257	425	1,440	72	5,463	217	3,335	2,633	1,800	20
\$85,941	\$90,528	\$108,508	\$350,104	\$44,891	\$3,052,436	\$104,219	\$1,402,850	\$1,241,596	\$840,079	21
207	246	418	1,361	71	5,388	216	3,272	2,591	1,704	22
\$85,437	\$89,377	\$107,810	\$340,895	\$44,480	\$3,038,348	\$104,069	\$1,398,450	\$1,234,940	\$839,623	23
-----	-----	-----	-----	-----	1	-----	1	-----	-----	24
-----	-----	-----	-----	-----	\$102	-----	\$121	\$146	-----	25
2	11	7	85	1	74	1	62	41	6	26
\$504	\$1,151	\$788	\$9,209	\$411	\$13,925	\$150	\$9,279	\$6,510	\$1,050	27
50	54	357	768	3	1,937	84	1,371	720	1,401	28
50	43	398	709	4	1,814	116	1,331	780	1,414	29
85	112	472	1,121	4	2,961	162	1,828	1,201	1,671	30
258	304	469	1,546	47	5,322	233	3,115	2,461	1,816	31
343	367	469	1,801	106	7,080	334	4,396	3,508	1,870	32
354	405	465	1,819	183	7,600	350	4,756	3,963	1,948	33
327	407	465	1,737	171	7,643	338	4,972	4,014	1,905	34
331	387	430	1,670	119	7,558	250	4,933	4,016	2,023	35
287	373	368	1,569	112	7,420	237	3,807	3,807	2,034	36
231	270	372	1,448	67	6,002	189	3,795	3,188	1,964	37
106	135	303	1,130	29	4,881	170	2,408	2,078	1,802	38
62	89	350	904	7	3,838	120	1,716	1,287	1,680	39
-----	7	2	25	1	10	-----	-----	5	2	40
-----	8	2	24	1	15	-----	-----	9	2	41
-----	0	2	50	1	35	-----	2	10	5	42
3	16	8	103	1	61	-----	49	36	6	43
4	16	8	120	1	109	-----	106	66	6	44
5	13	8	130	1	127	-----	117	80	8	45
4	14	13	126	1	127	-----	2	131	76	9
3	14	14	122	1	128	-----	2	128	72	10
4	14	11	115	1	104	-----	3	111	69	9
1	14	10	102	1	78	-----	2	71	38	7
-----	3	3	70	1	50	-----	2	23	21	6
-----	2	3	33	1	44	-----	1	6	10	5
\$32,511	\$20,820	\$10,439	\$167,608	\$8,762	\$891,300	\$23,176	\$328,430	\$297,636	\$169,855	52
\$1,595	\$302	-----	\$3,087	\$50	\$35,375	\$565	\$9,764	\$13,276	\$11,124	53
\$438	\$1,319	\$978	\$6,151	\$553	\$38,560	\$1,502	\$27,322	\$20,465	\$21,042	54
\$30,477	\$8,208	\$18,461	\$109,210	\$4,959	\$753,004	\$21,109	\$282,534	\$259,737	\$125,208	55
-----	\$10,007	-----	\$49,100	\$3,200	\$4,394	-----	\$8,810	\$4,158	\$11,881	56
\$26,485	\$46,218	\$64,019	\$305,009	\$27,415	\$1,705,475	\$51,461	\$981,880	\$838,139	\$444,161	57
800	-----	3,500	1,965	-----	93,926	105	143,101	88,907	115,412	58
\$710	-----	\$487	\$925	-----	\$40,208	\$105	\$52,050	\$20,741	\$38,220	59
3	-----	-----	-----	-----	14,093	-----	1,351	69	4	60
\$9	-----	-----	-----	-----	\$29,058	-----	\$2,166	\$156	\$9	61
376	465	-----	175	-----	7,481	80	13,806	11,400	6,262	62
\$426	\$460	-----	\$175	-----	\$8,053	\$105	\$16,062	\$6,543	\$2,834	63
-----	-----	1,150	-----	-----	1	-----	1,242	862	205	64
-----	-----	\$8,900	-----	-----	\$13	-----	\$6,948	\$3,426	\$1,640	65
-----	-----	-----	-----	-----	144,177	-----	92,000	200	-----	66
-----	-----	-----	-----	-----	\$1,472	-----	\$930	\$2	-----	67
-----	-----	-----	-----	7	44	6	291	187	-----	68
-----	-----	-----	-----	\$69	\$285	-----	\$1,205	\$1,123	-----	69
\$23,042	\$44,827	\$46,408	\$321,032	\$22,683	\$1,506,416	\$45,877	\$695,464	\$735,506	\$349,291	70
-----	-----	-----	\$450	\$2,400	\$1,712	-----	\$1,211	\$600	-----	71
\$245	\$911	\$1,851	\$17,888	\$398	\$58,107	\$3,739	\$27,116	\$20,625	\$21,158	72
\$430	\$727	\$7,273	\$2,849	\$1,865	\$34,773	\$1,540	\$72,989	\$37,078	\$17,433	73
\$320	-----	-----	\$21,750	-----	\$25,378	-----	\$105,658	\$21,739	\$13,576	74

MANUFACTURES.

TABLE 17.—BRICK AND TILE—DETAILED SUMMARY,

	United States.	Alabama.	Arizona.	Arkansas	California.	Colorado.	Connecticut.
75 Products: Aggregate value.....	\$71,152,062	\$840,866	\$45,881	\$702,426	\$1,915,561	\$817,019	\$1,081,147
76 Brick—							
77 Total—							
Thousands.....	9,872,420	141,414	6,280	109,655	265,504	108,428	184,675
78 Value.....	\$64,470,190	\$839,776	\$45,881	\$701,702	\$1,833,945	\$808,716	\$1,074,647
79 Common—							
80 Thousands.....	8,551,403	132,005	3,680	101,809	257,108	70,318	179,175
81 Value.....	\$50,438,486	\$751,369	\$26,530	\$730,962	\$1,728,530	\$400,906	\$905,147
82 Sand-lime—							
83 Thousands.....	86,450	1,696	2,600	5,962	3,817	4,000	.....
84 Value.....	\$660,157	\$14,967	\$19,351	\$46,940	\$35,425	\$64,000	.....
85 Red front (both pressed and wire cut)—							
86 Thousands.....	358,518	355	.....	1,550	4,538	21,471	2,500
87 Value.....	\$3,432,815	\$2,000	.....	\$10,625	\$69,140	\$184,694	\$37,500
88 Fancy colored front (all except red front)—							
89 Thousands.....	195,805	.....	.....	.....	40	2,997	.....
90 Value.....	\$2,693,842	.....	.....	.....	\$840	\$51,275	.....
91 Ornamental shaped (all not plain rectangular)—							
92 Thousands.....	25,720	5	.....	.....	1	77	.....
93 Value.....	\$457,580	\$110	.....	.....	\$10	\$3,361	.....
94 Vitrified paving—							
95 Thousands.....	640,469	0,753	.....	.....	.....	81	3,000
96 Value.....	\$6,510,134	\$70,430	.....	.....	.....	\$720	\$42,000
97 Fire brick—							
98 Thousands.....	0,719	.....	.....	244	.....	484	.....
99 Value.....	\$180,795	.....	.....	\$3,175	.....	\$7,751	.....
100 Enameled brick—							
101 Thousands.....	4,195	.....	.....	.....	.....	.....	.....
102 Value.....	\$73,381	.....	.....	.....	.....	.....	.....
103 Drain tile.....	\$4,900,672	\$217	.....	\$500	\$27,715	\$3,790	.....
104 All other products.....	\$1,685,101	\$6,873	.....	\$224	\$53,901	\$4,523	\$6,500
105 Power:							
106 Number of establishments reporting.....	3,476	55	2	31	52	33	31
107 Total horsepower.....	255,832	3,360	143	1,851	5,067	2,192	3,254
108 Owned—							
109 Engines—							
110 Steam—							
111 Number.....	4,113	61	1	35	60	32	46
112 Horsepower.....	246,200	3,341	125	1,841	4,589	2,081	3,199
113 Gas or gasoline—							
114 Number.....	222	2	1	.....	7	.....	.....
115 Horsepower.....	5,245	0	18	.....	113	.....	.....
116 Water wheels—							
117 Number.....	15	.....	.....	.....	2	.....	1
118 Horsepower.....	457	.....	.....	.....	75	.....	10
119 Water motors—							
120 Number.....	1	.....	.....	.....	.....	.....	.....
121 Horsepower.....	1	.....	.....	.....	.....	.....	.....
122 Electric motors—							
123 Number.....	43	.....	.....	.....	.....	.....	.....
124 Horsepower.....	470	.....	.....	.....	.....	.....	.....
125 Other power, horsepower.....	481	10	.....	.....	.....	.....	.....
126 Rented—							
127 Electric motors—							
128 Number.....	85	.....	.....	2	11	3	2
129 Horsepower.....	2,566	.....	.....	10	290	111	45
130 Other kind, horsepower.....	412	.....	.....	.....	.....	.....	.....
131 Furnished to other establishments, horsepower.....	100	.....	.....	.....	.....	.....	.....
132 Machinery:							
133 Clay grinding machines—							
134 Disintegrators.....	1,531	23	.....	15	20	12	26
135 Dry pans.....	1,002	5	.....	8	20	28	.....
136 All other.....	730	8	1	10	12	2	11
137 Clay tempering machines—							
138 Ring pits.....	1,260	22	.....	5	4	0	4
139 Pug mills.....	2,368	32	20	26	65	90	28
140 Wet pans.....	118	2	.....	.....	5	.....	.....
141 All other.....	172	2	.....	1	2	.....	1
142 Molding machines—							
143 Soft mud.....	2,381	16	1	21	53	22	43
144 Stiff mud.....	1,574	40	.....	15	24	18	8
145 Dry presses.....	533	4	1	13	3	27	1
146 Shape brick power presses.....	329	6	.....	4	8	4	1
147 Hand presses.....	740	11	.....	3	10	6	.....
148 Sower pipe presses.....	24	.....	.....	.....	.....	.....	.....
149 Tile machines.....	865	2	.....	1	4	2	.....
150 All other.....	2,862	37	13	18	29	54	15
151 Mold sanders.....	1,191	5	.....	5	35	5	42
152 Kilns—							
153 Clamp.....	4,208	135	1	58	29	90	52
154 Down draft—							
155 Round.....	4,332	74	.....	10	22	48	.....
156 Rectangular.....	1,936	14	.....	16	21	11	7
157 Muffle.....	40	.....	.....	1	.....	.....	.....
158 Continuous.....	254	.....	.....	.....	19	1	0
159 All other.....	16,354	26	11	43	115	98	174
160 Other machinery—							
161 Dryers.....	1,110	27	.....	11	19	5	1
162 All other.....	1,740	29	4	19	19	11	4
163 Idle machinery.....	645	7	1	7	13	5	1

<sup>1</sup> Includes temporary kilns.



## MANUFACTURES.

TABLE 17.—BRICK AND TILE—DETAILED SUMMARY,

	Kentucky.	Louisiana.	Maine.	Maryland.	Massachu- setts.	Michigan.	Minnesota.
1 Number of establishments.....	88	02	00	50	04	100	101
2 Capital:							
3 Total.....	\$1,502,056	\$1,343,017	\$509,015	\$5,330,963	\$2,400,083	\$2,181,805	\$1,688,273
4 Land.....	\$300,844	\$316,630	\$109,170	\$2,210,387	\$671,413	\$480,072	\$443,233
5 Buildings.....	\$228,318	\$312,373	\$130,075	\$1,384,138	\$586,236	\$303,473	\$405,429
6 Machinery, tools, and implements.....	\$573,347	\$385,712	\$108,740	\$1,137,322	\$386,703	\$728,236	\$318,774
7 Cash and sundries.....	\$460,147	\$328,302	\$251,030	\$608,116	\$816,571	\$580,024	\$520,837
8 Proprietors and firm members.....	00	58	03	50	03	200	132
9 Salaried officials, clerks, etc.:							
10 Total number.....	07	05	18	76	47	80	52
11 Total salaries.....	\$47,004	\$50,541	\$12,881	\$77,708	\$41,372	\$73,222	\$42,781
12 Officers of corporations—							
13 Number.....	24	11	5	23	3	20	0
14 Salaries.....	\$10,220	\$8,700	\$4,280	\$44,165	\$8,200	\$25,203	\$13,250
15 General superintendents, managers, clerks, etc.—							
16 Total number.....	43	54	13	53	44	03	43
17 Total salaries.....	\$28,474	\$41,781	\$8,601	\$33,633	\$33,172	\$48,010	\$20,531
18 Men—							
19 Number.....	42	52	12	50	43	60	39
20 Salaries.....	\$27,874	\$41,021	\$8,205	\$32,801	\$33,028	\$47,019	\$27,531
21 Women—							
22 Number.....	1	2	1	3	1	3	4
23 Salaries.....	\$600	\$700	\$330	\$832	\$144	\$1,000	\$2,000
24 Wage-earners, including pieceworkers, and total wages:							
25 Greatest number employed at any one time during the year.....	2,183	1,805	780	2,401	2,326	2,043	2,382
26 Least number employed at any one time during the year.....	1,085	055	418	904	805	1,540	1,070
27 Average number.....	1,114	1,027	330	1,404	1,098	1,430	993
28 Total wages.....	\$302,138	\$308,784	\$104,719	\$534,002	\$495,750	\$650,040	\$400,478
29 Men 16 years and over—							
30 Average number.....	1,077	982	328	1,458	1,000	1,406	974
31 Wages.....	\$358,072	\$300,270	\$104,172	\$533,152	\$495,000	\$644,186	\$402,373
32 Women 16 years and over—							
33 Average number.....	1	2	1	3	1	3	3
34 Wages.....			\$437		\$400	\$930	\$930
35 Children under 16 years—							
36 Average number.....	37	45	1	0	1	27	16
37 Wages.....	\$4,000	\$8,508	\$110	\$850	\$200	\$5,524	\$3,475
38 Average number of wage-earners, including pieceworkers, em- ployed during each month:							
39 Men 16 years and over—							
40 January.....	327	383	22	540	274	493	127
41 February.....	324	520	10	530	274	477	128
42 March.....	610	863	20	327	341	570	215
43 April.....	1,048	1,157	119	1,439	892	1,108	547
44 May.....	1,407	1,282	581	1,988	1,706	2,218	1,045
45 June.....	1,003	1,343	602	2,007	2,050	2,482	2,053
46 July.....	1,777	1,384	608	2,184	2,100	2,484	2,090
47 August.....	1,757	1,356	683	2,039	1,915	2,305	1,980
48 September.....	1,404	1,282	610	2,002	1,636	2,055	1,456
49 October.....	1,223	1,051	307	1,063	1,064	1,393	900
50 November.....	744	716	145	1,237	549	719	346
51 December.....	424	447	40	632	291	508	192
52 Children under 16 years—							
53 January.....	5	15					2
54 February.....	5	17					2
55 March.....	12	41					2
56 April.....	38	55		7	2	7	7
57 May.....	60	66	2	7	2	47	35
58 June.....	04	70	3	10	2	57	40
59 July.....	75	73	3	10	2	63	37
60 August.....	70	68	3	11	2	05	34
61 September.....	55	58	1	10	2	50	23
62 October.....	46	45		12		27	8
63 November.....	11	18		4		6	1
64 December.....	4	14		1		2	1
65 Miscellaneous expenses:							
66 Total.....	\$109,381	\$101,506	\$21,721	\$85,103	\$112,412	\$134,706	\$94,822
67 Rent of works.....	\$2,231	\$7,590	\$1,852	\$3,074	\$4,354	\$12,100	\$525
68 Taxes.....	\$6,455	\$7,564	\$4,035	\$10,081	\$10,791	\$11,984	\$8,238
69 Rent of offices, interest, insurance, and all sundry expenses not hitherto included.....	\$95,345	\$80,358	\$15,134	\$63,388	\$87,876	\$91,932	\$73,036
70 Contract work.....	\$5,350	\$75	\$700	\$0,820	\$301	\$18,774	\$13,023
71 Materials used:							
72 Total cost.....	\$175,002	\$200,062	\$117,500	\$227,140	\$320,805	\$425,142	\$200,302
73 Clay purchased—							
74 Tons.....	18,270		8,251	0,850	0,193	38,085	346
75 Cost.....	\$13,164		\$3,773	\$3,403	\$5,010	\$8,094	\$757
76 Coal, used as an ingredient—							
77 Tons.....	33	24		100	1,207	329	147
78 Cost.....	\$50	\$72		\$600	\$2,590	\$795	\$404
79 Sand—							
80 Tons.....	6,518	695	6,138	5,013	8,302	8,243	1,557
81 Cost.....	\$4,068	\$705	\$3,918	\$7,001	\$5,351	\$6,058	\$1,056
82 Lime—							
83 Tons.....	200	62		30		1,840	500
84 Cost.....	\$845	\$316		\$150		\$8,185	\$4,000
85 Manganese—							
86 Pounds.....				2,500	5,000	50,000	130,000
87 Cost.....				\$25	\$150	\$405	\$1,300
88 Salt—							
89 Tons.....		1					2
90 Cost.....		\$5					\$10
91 Fuel.....	\$145,502	\$189,817	\$103,016	\$206,352	\$300,871	\$366,351	\$202,059
92 Rent of power and heat.....	\$125		\$587			\$800	\$760
93 Mill supplies.....	\$5,895	\$13,084	\$1,618	\$6,144	\$6,897	\$9,567	\$5,831
94 All other materials.....	\$3,065	\$5,328	\$4,638	\$2,607	\$1,754	\$12,828	\$8,702
95 Freight.....	\$1,778	\$275		\$783	\$1,182	\$12,059	\$8,554

CLAY PRODUCTS.

BY STATES AND TERRITORIES: 1905—Continued.

Mississippi.	Missouri.	Montana.	Nebraska.	Nevada.	New Hamp- shire.	New Jersey.	New Mexico.	New York.	North Caro- lina.	
74	102	14	90	5	36	63	10	192	111	1
\$846,508	\$7,457,011	\$240,100	\$1,505,880	\$73,005	\$932,579	\$3,040,470	\$41,700	\$10,954,096	\$651,492	2
\$136,084	\$1,431,111	\$101,300	\$205,424	\$18,150	\$146,042	\$714,337	\$2,050	\$4,027,416	\$127,415	3
\$204,449	\$559,552	\$20,800	\$421,068	\$4,100	\$141,454	\$569,638	\$3,900	\$1,869,826	\$110,495	4
\$279,689	\$1,888,997	\$47,450	\$313,868	\$23,535	\$285,214	\$799,328	\$13,100	\$2,422,524	\$235,184	5
\$226,285	\$3,568,251	\$64,550	\$624,929	\$27,220	\$359,869	\$957,167	\$22,050	\$2,634,330	\$178,398	6
88	181	13	120	9	32	73	11	213	146	7
63	161	8	50	1	19	70	4	248	46	8
\$44,895	\$179,025	\$13,400	\$40,873	\$3,000	\$18,739	\$67,974	\$3,600	\$281,207	\$24,631	9
7	41	1	13	.....	3	14	2	76	12	10
\$5,400	\$93,676	\$3,000	\$9,220	.....	\$6,400	\$22,400	\$3,000	\$127,296	\$8,568	11
56	120	7	37	1	16	56	2	167	34	12
\$30,405	\$115,449	\$9,500	\$31,653	\$3,000	\$12,339	\$45,574	\$600	\$153,911	\$16,118	13
55	112	7	30	1	16	51	2	155	34	14
\$38,005	\$111,419	\$9,800	\$30,153	\$3,000	\$12,339	\$42,807	\$600	\$149,195	\$16,118	15
1	8	.....	1	.....	.....	6	.....	12	.....	16
\$500	\$4,030	.....	\$1,500	.....	.....	\$2,767	.....	\$4,716	.....	17
1,645	3,820	260	1,758	66	1,145	3,278	118	12,094	2,618	18
1,053	2,085	187	628	41	364	967	99	5,583	1,310	19
903	2,337	97	905	21	527	1,947	64	6,737	1,070	20
\$271,800	\$1,118,690	\$70,665	\$471,425	\$15,816	\$228,979	\$784,202	\$31,409	\$3,169,797	\$247,050	21
831	2,233	95	882	21	524	1,920	57	6,713	1,018	22
\$250,048	\$1,090,521	\$76,020	\$406,285	\$15,816	\$228,493	\$778,425	\$29,896	\$3,155,063	\$240,422	23
.....	.....	.....	1	.....	1	4	.....	.....	.....	24
.....	.....	.....	\$210	.....	\$305	\$858	.....	.....	.....	25
72	104	2	22	.....	2	23	7	24	61	26
\$12,758	\$22,169	\$645	\$4,030	.....	\$181	\$4,919	\$1,513	\$5,734	\$6,618	27
202	1,165	7	210	.....	133	533	34	1,132	200	28
221	1,188	7	227	.....	87	557	34	1,088	210	29
515	1,054	10	380	.....	117	874	41	1,800	410	30
903	2,206	79	928	.....	248	1,709	62	4,694	1,311	31
1,081	2,055	167	1,401	14	959	2,396	95	10,055	1,620	32
1,202	2,835	180	1,529	57	982	2,705	84	11,117	1,787	33
1,223	2,808	222	1,403	57	948	2,849	65	11,325	1,830	34
1,204	2,955	199	1,888	49	985	2,987	56	11,033	1,747	35
1,101	2,804	128	1,257	40	887	2,959	57	10,505	1,442	36
1,037	2,545	80	977	25	572	2,692	52	9,372	1,003	37
728	2,181	43	534	5	228	1,758	52	5,262	404	38
405	1,050	0	281	5	142	1,121	52	3,083	243	39
28	27	.....	.....	.....	.....	1	5	.....	4	40
20	30	.....	.....	.....	.....	1	5	.....	0	41
61	47	.....	4	.....	.....	1	5	.....	37	42
80	98	.....	17	.....	.....	33	5	.....	78	43
93	147	3	30	.....	5	39	8	35	114	44
100	147	3	48	.....	4	39	9	47	125	45
93	164	8	46	.....	3	39	8	49	121	46
96	160	7	46	.....	3	39	8	50	103	47
91	161	3	38	.....	4	39	8	52	75	48
85	134	.....	25	.....	3	37	8	37	54	49
70	85	.....	2	.....	1	7	8	11	9	50
88	39	.....	.....	.....	1	1	7	1	6	51
\$43,005	\$357,540	\$13,788	\$61,343	\$2,697	\$51,287	\$144,401	\$1,768	\$730,066	\$35,574	52
\$522	\$9,848	\$410	\$1,310	\$163	\$270	\$11,000	\$180	\$84,297	\$1,525	53
\$5,359	\$28,133	\$1,491	\$6,677	\$202	\$3,817	\$12,848	\$346	\$52,319	\$3,400	54
\$36,525	\$207,530	\$8,387	\$53,056	\$2,332	\$44,950	\$118,567	\$1,242	\$578,370	\$26,970	55
\$1,689	\$22,026	\$3,500	\$300	.....	\$2,250	\$1,386	.....	\$15,080	\$3,637	56
\$177,423	\$668,876	\$38,060	\$277,174	\$6,265	\$151,118	\$336,988	\$17,605	\$1,368,045	\$167,476	57
25,685	13,152	1,000	1,461	50	5,324	61,821	.....	35,448	3,043	58
\$21,264	\$14,234	\$1,000	\$1,000	\$50	\$1,110	\$19,364	.....	\$31,037	\$1,243	59
10	1,012	.....	2,878	.....	.....	7,516	.....	30,239	82	60
\$10	\$2,025	.....	\$8,040	.....	.....	\$11,394	.....	\$56,081	\$127	61
3,759	2,253	3,820	2,139	25	2,770	11,232	.....	127,064	1,264	62
\$3,928	\$3,183	\$3,627	\$1,828	\$25	\$913	\$8,523	.....	\$82,498	\$637	63
56	.....	.....	266	.....	.....	625	.....	494	187	64
\$513	.....	.....	\$400	.....	.....	\$2,906	.....	\$2,712	\$1,250	65
.....	604,045	.....	125,850	.....	.....	176,000	.....	708,400	.....	66
.....	\$6,518	.....	\$2,517	.....	.....	\$1,859	.....	\$7,265	.....	67
.....	20	36	54	.....	.....	1,074	.....	77	.....	68
.....	\$130	\$570	\$408	.....	.....	\$3,050	.....	\$309	.....	69
\$140,770	\$579,075	\$25,503	\$248,103	\$4,990	\$142,484	\$256,779	\$15,986	\$977,849	\$154,538	70
\$710	.....	\$1,500	.....	\$1,125	.....	\$897	.....	\$5,618	\$62	71
\$5,135	\$16,027	\$373	\$10,251	\$75	.....	\$7,306	.....	\$34,774	\$4,388	72
\$4,581	\$39,805	\$3,000	\$2,034	.....	.....	\$17,424	.....	\$60,358	\$4,219	73
\$512	\$7,219	\$2,000	\$484	.....	.....	\$6,886	.....	\$109,544	\$1,012	74

TABLE 17.—BRICK AND TILE—DETAILED SUMMARY,

	Kentucky.	Louisiana.	Maine.	Maryland.	Massachu- setts.	Michigan.	Minnesota.
75 Products: Aggregate value .....	\$886,736	\$972,523	\$420,111	\$1,097,072	\$1,170,710	\$1,050,988	\$1,227,135
76 Brick—							
77 Total—							
Thousands.....	145,952	149,840	65,522	162,094	181,071	255,258	187,202
Value.....	\$857,382	\$963,823	\$415,000	\$1,093,877	\$1,168,410	\$1,497,281	\$1,186,695
78 Common—							
79 Thousands.....	134,254	145,496	62,552	158,667	177,071	238,141	173,153
Value.....	\$753,282	\$922,573	\$391,100	\$1,030,051	\$1,110,510	\$1,300,405	\$1,030,712
80 Sand-lime—							
81 Thousands.....	400			300		9,224	5,000
Value.....	\$2,800			\$2,400		\$48,550	\$40,000
82 Red front (both pressed and wire cut)—							
83 Thousands.....	7,527	150	2,070	2,285	3,400	3,408	2,710
Value.....	\$56,028	\$2,250	\$24,440	\$36,423	\$27,700	\$28,436	\$20,380
84 Fancy colored front (all except red front)—							
85 Thousands.....		4,000		396	400	150	6,040
Value.....		\$36,000		\$7,946	\$10,000	\$1,350	\$80,664
86 Ornamental shaped (all not plain rectan- gular)—							
87 Thousands.....	5	100		106	200	10	99
Value.....	\$50	\$2,000		\$3,297	\$14,200	\$200	\$3,900
88 Vitrified paving—							
89 Thousands.....	3,719	100		340		4,185	200
Value.....	\$44,627	\$1,000		\$4,700		\$51,340	\$2,000
90 Fire brick—							
91 Thousands.....	47						
Value.....	\$595						
92 Enameled brick—							
93 Thousands.....						50	
Value.....						\$1,000	
94 Drain tile.....	\$27,824	\$300	\$3,000	\$3,000		\$138,392	\$15,035
95 All other products.....	\$1,530	\$8,400	\$605	\$105	\$2,300	\$15,315	\$24,805
96 Power:							
97 Number of establishments reporting.....	57	52	29	29	48	158	83
Total horsepower.....	3,008	3,215	880	4,353	3,745	8,147	4,132
98 Owned—							
99 Engines—							
Steam—							
Number.....	63	66	11	60	53	172	83
Horsepower.....	3,084	3,215	657	4,346	3,600	7,904	3,874
Gas or gasoline—							
Number.....	3		14	1	3	9	13
Horsepower.....	12		133	4	10	141	173
100 Water wheels—							
101 Number.....			1		1	2	
Horsepower.....			15		25	25	
102 Water motors—							
103 Number.....							
Horsepower.....							
104 Electric motors—							
105 Number.....							1
Horsepower.....							3
106 Other power, horsepower.....			10	3	20		20
107 Rented—							
108 Electric motors—							
Number.....			4			1	2
Horsepower.....			65			7	62
109 Other kind, horsepower.....	2					70	
110 Furnished to other establishments, horsepower.....			75				
111 Machinery:							
112 Clay grinding machines—							
113 Disintegrators.....	20	37	24	18	44	75	53
114 Dry pans.....	5	3		8		9	2
115 All other.....	11	3	33	11	20	36	10
116 Clay tempering machines—							
117 Ring pits.....	46	17	7	40	11	35	23
118 Pug mills.....	50	41	20	40	45	77	31
119 Wet pans.....	4	16	15	6		1	1
All other.....	11	1	2	2	0	7	2
120 Molding machines—							
121 Soft mud.....	43	19	86	28	62	94	59
122 Stiff mud.....	22	30	11	30	11	68	41
123 Dry presses.....	7	5		2	5	6	6
124 Shape brick power presses.....	6	3	4	4	4	12	3
125 Hand presses.....	10	4	5	33	5	15	10
126 Sewer pipe presses.....						1	1
127 Tile machines.....	13		2	2		61	9
128 All other.....	166	99	17	12	29	81	96
Mold sanders.....	28	13	6	28	49	29	13
129 Kilns—							
Clamp.....	143	112	36	113	18	105	82
130 Down draft—							
131 Round.....	39	34	4	29	6	78	10
132 Rectangular.....	30	28	13	21	7	23	42
133 Muffle.....	2	1					1
134 Continuous.....	4		11	1		10	11
All other.....	62	17	90	33	332	289	184
135 Other machinery—							
136 Dryers.....	6	16	2	20	3	25	
137 All other.....	20	3	2	1	5	50	25
Idle machinery.....	11	3	7	9	13	87	5

CLAY PRODUCTS.

BY STATES AND TERRITORIES: 1905—Continued.

Mississippi.	Missouri.	Montana.	Nebraska.	Nevada.	New Hampshire.	New Jersey.	New Mexico.	New York.	North Carolina.	
\$782,842	\$2,608,801	\$178,675	\$1,131,913	\$37,905	\$520,008	\$1,830,080	\$80,910	\$7,430,151	\$695,708	75
116,173	336,552	17,479	144,138	4,125	81,217	256,925	11,880	1,255,242	122,649	76
\$773,290	\$2,530,506	\$154,675	\$1,085,826	\$37,625	\$528,596	\$1,788,208	\$80,910	\$7,278,586	\$691,798	77
114,372	256,730	16,855	132,000	4,125	79,412	231,388	7,740	1,212,281	120,349	78
\$750,400	\$1,518,659	\$134,835	\$921,114	\$37,625	\$508,741	\$1,360,126	\$49,230	\$6,676,811	\$608,573	79
155						1,758		3,086	1,500	80
\$1,340						\$15,380		\$18,100	\$15,000	81
1,640	22,655	20	2,500		1,805	4,427	4,140	8,779	350	82
\$21,544	\$250,728	\$400	\$20,080		\$19,855	\$77,089	\$31,680	\$85,290	\$2,750	83
	2,280		7,885			17,724		16,815	160	84
	\$42,952		\$122,257			\$310,068		\$285,350	\$1,875	85
	3,903	4	133			278		16		86
	\$172,750	\$140	\$3,325			\$12,045		\$850		87
	40,729	100	1,530			1,350		12,030		88
	\$507,499	\$1,800	\$13,050			\$13,500		\$152,589		89
		500						2,285	300	90
		\$17,500						\$59,506	\$3,600	91
	1,195									92
	\$40,009									93
\$7,102	\$38,580		\$150			\$16,430		\$95,787	\$2,760	94
\$2,441	\$20,775	\$24,000	\$45,937	\$280	\$412	\$25,442		\$55,778	\$1,150	95
48	80	8	70	1	9	52		169	79	96
2,398	0,078	589	3,610	120	1,315	5,979	163	19,110	3,222	97
51	120	8	67		13	85		201	84	98
2,305	6,729	424	3,281		1,210	5,886	155	18,443	3,222	99
1	5		12			2		5		100
3	214		199			25		77		101
			1					1		102
			30					50		103
										104
										105
	2					8		1		106
	33					80		20		107
								25		108
		4		2				10		109
	2	165		120		85		195		110
								300		111
								75		112
32	88	1	23	1	31	32	2	89	30	113
	20	2	8	1		1	2	35		114
5	51		18			9	1	24	34	115
27	51		22		43	122		160	16	116
29	58	12	45	8	9	22	12	109	28	117
		1	1			4		2		118
3	3				1	7		4	14	119
10	42	15	37		80	120	1	479	9	120
31	55	3	49	2	7	20	1	36	46	121
5	69	1	8	1		7	3	9		122
	6	1	2	1		5		15	12	123
5	20	4	11		4	51	2	29	16	124
		1				1		25		125
	13	1	1			5		15	4	126
81	126		53	4	65	16	44	27	152	127
10	8	4	6		4	62		383	11	128
128	212	5	125	4	24	48	6	138	77	129
22	76	8	70			40		98		130
9	122		8	1	2	54	5	127	42	131
	4							6		132
	4	1	25		2	4		21		133
23	130	20	34	7	89	206	3	1,246	279	134
5	32		5			1		35	3	135
9	81	2	6	4		2		29	7	136
14	25	3	12	1		12	2	30	7	137

TABLE 17.—BRICK AND TILE—DETAILED SUMMARY.

	North Dakota.	Ohio.	Oklahoma.	Oregon.	Pennsylvania.	South Carolina.	
1	Number of establishments.....	14	500	23	43	370	
2	Capital:						
3	Total.....	\$204,497	\$12,048,500	\$321,074	\$366,347	\$13,886,709	\$516,909
4	Land.....	\$12,000	\$2,130,195	\$28,425	\$87,050	\$3,606,816	\$70,784
5	Buildings.....	\$13,700	\$3,348,050	\$35,627	\$54,793	\$2,868,940	\$75,501
6	Machinery, tools, and implements.....	\$83,252	\$3,240,078	\$109,503	\$80,024	\$3,810,833	\$234,458
7	Cash and sundries.....	\$95,545	\$3,322,076	\$88,359	\$133,080	\$3,601,180	\$130,188
8	Proprietors and firm members.....	10	704	20	56	445	52
9	Salaried officials, clerks, etc.:						
10	Total number.....	15	416	17	10	424	36
11	Total salaries.....	\$10,200	\$300,159	\$14,060	\$8,750	\$355,133	\$20,072
12	Officers of corporations—						
13	Number.....	7	127	6	2	93	6
14	Salaries.....	\$5,050	\$153,000	\$5,105	\$1,050	\$81,277	\$5,820
15	General superintendents, managers, clerks, etc.—						
16	Total number.....	8	289	11	8	331	30
17	Total salaries.....	\$4,250	\$237,009	\$9,405	\$7,100	\$263,856	\$23,252
18	Men—						
19	Number.....	8	203	11	7	281	30
20	Salaries.....	\$4,250	\$220,773	\$9,405	\$6,000	\$251,013	\$23,252
21	Women—						
22	Number.....		26		1	50	
23	Salaries.....		\$10,326		\$500	\$12,243	
24	Wage-earners, including pieceworkers, and total wages:						
25	Greatest number employed at any one time during the year.....	301	10,571	306	648	11,431	1,592
26	Least number employed at any one time during the year.....	167	6,244	216	285	6,173	806
27	Average number.....	117	6,719	184	264	7,561	875
28	Total wages.....	\$59,825	\$2,041,685	\$81,559	\$131,553	\$3,212,820	\$184,292
29	Men 16 years and over—						
30	Average number.....	116	6,052	183	201	7,414	851
31	Wages.....	\$59,025	\$2,020,460	\$81,259	\$130,053	\$3,186,661	\$181,806
32	Women 16 years and over—						
33	Average number.....		6				
34	Wages.....		\$1,046				
35	Children under 16 years—						
36	Average number.....	1	61	1	3	147	24
37	Wages.....	\$200	\$10,579	\$300	\$900	\$26,168	\$2,486
38	Average number of wage-earners, including pieceworkers, employed during each month: <sup>1</sup>						
39	Men 16 years and over—						
40	January.....	10	3,327	130	51	3,682	454
41	February.....	10	3,844	125	54	3,757	486
42	March.....	20	4,313	230	57	5,042	612
43	April.....	33	6,402	261	265	7,619	1,007
44	May.....	188	8,431	303	435	9,290	1,106
45	June.....	253	9,052	237	508	9,474	1,212
46	July.....	268	9,300	185	575	9,718	1,199
47	August.....	274	9,176	174	470	9,768	1,128
48	September.....	168	8,802	173	324	9,543	1,058
49	October.....	82	7,565	153	159	8,807	785
50	November.....	52	5,668	111	100	6,887	604
51	December.....	34	4,384	114	68	5,381	471
52	Children under 16 years—						
53	January.....		6			22	6
54	February.....		7			26	6
55	March.....		8			39	13
56	April.....		45		2	116	36
57	May.....		101	6		220	41
58	June.....		3	6		254	45
59	July.....		123	6		202	42
60	August.....		135		8	244	89
61	September.....		122		6	232	92
62	October.....		103		5	175	16
63	November.....		63		1	99	12
64	December.....		13		1	60	6
65	Miscellaneous expenses:						
66	Total.....	\$11,121	\$601,707	\$32,757	\$26,024	\$578,788	\$42,034
67	Rent of works.....	\$677	\$19,314	\$485	\$1,850	\$114,041	\$1,788
68	Taxes.....	\$492	\$56,505	\$1,776	\$2,154	\$47,030	\$2,994
69	Rent of offices, interest, insurance, and all sundry expenses not hitherto included.....	\$3,333	\$561,497	\$30,496	\$22,020	\$70,673	\$37,252
70	Contract work.....	\$1,619	\$24,391			\$6,235	
71	Materials used:						
72	Total cost.....	\$34,345	\$1,082,821	\$76,476	\$63,000	\$1,599,252	\$177,268
73	Clay purchased—						
74	Tons.....		157,129	145	45	99,233	800
75	Cost.....		\$73,036	\$386	\$212	\$55,049	\$800
76	Coal, used as an ingredient—						
77	Tons.....		943			3,009	
78	Cost.....		\$1,563			\$3,034	
79	Sand—						
80	Tons.....	400	14,432	117	621	25,537	
81	Cost.....	\$585	\$15,630	\$69	\$492	\$21,373	
82	Lime—						
83	Tons.....		277	10		600	100
84	Cost.....		\$1,000	\$125		\$2,100	\$480
85	Manganese—						
86	Pounds.....		1,458,067			218,759	250
87	Cost.....		\$16,667			\$2,470	\$10
88	Salt—						
89	Tons.....		433	4	11	73	
90	Cost.....		\$1,650	\$40	\$122	\$365	
91	Fuel.....	\$32,883	\$1,371,519	\$70,779	\$50,002	\$1,259,529	\$148,765
92	Rent of power and heat.....		\$362			\$517	\$1,270
93	Mill supplies.....	\$342	\$69,335	\$1,378	\$1,090	\$104,899	\$5,148
94	All other materials.....	\$25	\$41,317		\$5,090	\$74,144	\$4,595
95	Freight.....	\$560	\$40,652	\$3,199	\$1	\$75,442	\$10,102

# CLAY PRODUCTS.

BY STATES AND TERRITORIES: 1905—Continued.

South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	
10	84	92	39	9	84	51	37	141	3	1
\$174,535	\$1,200,304	\$1,008,653	\$438,476	\$100,085	\$3,145,805	\$966,470	\$1,962,217	\$3,051,666	\$14,006	2
\$41,370	\$253,901	\$253,345	\$56,116	\$19,200	\$801,053	\$223,358	\$220,219	\$700,863	\$350	3
\$41,044	\$189,275	\$330,911	\$139,470	\$20,330	\$646,375	\$182,556	\$675,963	\$495,628	\$500	4
\$54,100	\$304,352	\$507,872	\$143,200	\$20,835	\$785,635	\$203,462	\$391,342	\$1,004,048	\$9,500	5
\$37,121	\$392,776	\$450,725	\$99,600	\$30,220	\$912,742	\$297,094	\$608,693	\$851,327	\$3,446	6
9	108	71	53	11	84	52	29	140	2	7
6	68	81	15	7	128	45	48	84	2	8
\$3,080	\$64,769	\$73,860	\$12,630	\$5,180	\$117,808	\$37,150	\$55,502	\$73,628	\$940	9
2	13	13	6	2	27	11	12	17		10
\$900	\$20,090	\$15,320	\$6,010	\$2,400	\$34,315	\$15,510	\$19,790	\$18,260		11
4	55	68	9	5	101	34	36	67	2	12
\$2,180	\$44,079	\$58,540	\$6,020	\$2,780	\$83,493	\$21,040	\$35,712	\$55,368	\$940	13
4	50	68	8	5	99	32	35	62	2	14
\$2,180	\$42,024	\$58,540	\$6,120	\$2,780	\$82,993	\$21,240	\$35,232	\$53,152	\$940	15
	5		1		2		1	5		16
	\$1,755		\$500		\$500	\$400	\$480	\$2,216		17
132	2,100	2,271	609	224	3,382	971	1,251	3,188	20	18
88	1,333	1,179	260	89	1,650	521	507	1,502	6	19
49	1,234	1,308	291	108	1,904	512	763	1,738	6	20
\$27,401	\$375,043	\$470,007	\$172,508	\$40,811	\$680,140	\$305,839	\$329,995	\$685,725	\$5,714	21
40	1,185	1,257	273	108	1,872	510	754	1,591	6	22
\$27,401	\$371,808	\$401,540	\$160,052	\$40,811	\$667,661	\$305,545	\$328,284	\$677,551	\$5,714	23
					1		1	3		24
					\$240		\$162	\$255		25
	49	51	18		91	2	8	44		26
	\$6,235	\$8,467	\$3,540		\$12,239	\$294	\$1,549	\$7,910		27
	400	709	91	4	882	213	262	335		28
	567	805	108	5	957	218	293	360		29
	810	1,073	139	16	1,337	366	519	513		30
29	1,245	1,255	220	77	2,045	503	961	1,051	4	31
82	1,610	1,459	350	202	2,420	692	1,012	2,377	4	32
110	1,013	1,028	474	205	2,598	700	1,103	2,784	15	33
110	1,677	1,092	488	198	2,609	799	1,087	2,890	24	34
115	1,079	1,681	453	199	2,600	736	954	2,814	23	35
81	1,687	1,430	398	180	2,544	682	910	1,841	2	36
42	1,263	1,279	285	152	2,171	504	577	1,841		37
10	908	1,114	183	46	1,301	373	692	1,071		38
	773	899	87	12	1,002	299	375	516		39
	11	38	3		15		1	4		40
	11	34	3		16		1	5		41
	17	48	4		22		11	6		42
	53	58	9		112		9	22		43
	70	32	32		133	5	9	68		44
	73	41	41		150	5	10	83		45
	94	39	39		152	3	14	81		46
	94	59	34		142	5	13	98		47
	81	50	28		147	4	13	85		48
	40	44	15		122	2	13	45		49
	20	4	4		45		6	19		50
	12	34	4		36		3	9		51
\$6,837	\$112,728	\$94,780	\$22,013	\$9,815	\$176,890	\$60,645	\$101,405	\$150,430	\$2,553	52
	\$6,516	\$462	\$804	\$2,300	\$2,186	\$595	\$1,148	\$5,200		53
\$823	\$4,043	\$5,020	\$1,202	\$404	\$11,281	\$4,830	\$5,100	\$17,614	\$58	54
\$6,014	\$74,615	\$87,181	\$19,967	\$4,293	\$151,649	\$54,020	\$95,247	\$107,011	\$1,295	55
	\$20,655	\$1,167		\$2,818	\$11,774	\$1,200		\$605	\$1,200	56
\$20,305	\$264,971	\$365,613	\$68,270	\$20,724	\$428,621	\$149,339	\$200,971	\$553,370	\$2,413	57
	3,770	32,215		95	8,782	600	17,600	5,236		58
	\$2,365	\$13,450		\$95	\$11,146	\$500	\$7,100	\$1,958		59
				213	446			272		60
				\$415	\$756			\$342		61
1,922	2,761	2,147	656	3,070	5,271	340	2,145	6,093		62
\$1,732	\$2,419	\$1,187	\$533	\$795	\$3,576	\$255	\$1,581	\$5,722		63
200	85	500			832	15	100	375		64
\$1,400	\$389	\$4,500			\$4,213	\$300	\$694	\$1,400		65
	154,782				540,000					66
	\$1,815				\$5,493					67
		2				4		1	2	68
		\$10				\$50		\$9	\$25	69
\$15,478	\$235,405	\$318,054	\$58,946	\$18,079	\$359,213	\$128,844	\$146,620	\$508,374	\$2,348	70
		\$6,540		\$230		\$4,638		\$125		71
\$440	\$12,240	\$7,371	\$2,230	\$215	\$12,687	\$4,072	\$18,072	\$15,026	\$40	72
\$215	\$10,338	\$8,390		\$345	\$8,883	\$2,035	\$36,056	\$10,225		73
\$1,031		\$12,781	\$21	\$550	\$22,604	\$7,950	\$348	\$3,589		74

TABLE 17.—BRICK AND TILE—DETAILED SUMMARY,

	North Dakota.	Ohio.	Oklahoma.	Oregon.	Pennsylvania.	South Carolina.
75 Products: Aggregate value.....	\$170,257	\$7,186,030	\$261,438	\$315,122	\$7,279,915	\$655,831
76 Brick—						
77 Total—						
Thousands.....	20,679	725,793	33,241	34,530	1,010,498	124,130
Value.....	\$169,807	\$5,415,604	\$241,221	\$290,677	\$7,144,971	\$644,901
78 Common—						
79     Thousands.....	19,199	459,443	31,541	33,464	801,487	122,460
Value.....	\$142,040	\$2,075,314	\$225,800	\$259,230	\$4,942,845	\$329,201
80 Sand-lime—						
81     Thousands.....		1,200			7,732	600
Value.....		\$8,750			\$68,788	\$4,800
82 Red front (both pressed and wire cut)—						
83     Thousands.....	1,472	38,769	1,100	424	71,454	1,050
Value.....	\$26,074	\$340,707	\$9,800	\$12,090	\$874,281	\$10,700
84 Fancy colored front (all except red front)—						
85     Thousands.....		43,783			50,344	
Value.....		\$515,724			\$607,277	
86 Ornamental shaped (all not plain rectangular)—						
87     Thousands.....	8	11,987		550	3,177	20
Value.....	\$1,177	\$109,770		\$10,500	\$57,343	\$200
88 Vitrified paving—						
89     Thousands.....		167,888	600		73,502	
Value.....		\$1,714,293	\$5,555		\$703,928	
90 Fire brick—						
91     Thousands.....		3,373		92	802	
Value.....		\$48,040		\$2,248	\$10,441	
92 Enamelled brick—						
93     Thousands.....		250			2,000	
Value.....		\$3,000			\$20,072	
94 Drain tile.....	\$300	\$1,111,138		\$22,705	\$14,099	\$10,000
95 All other products.....	\$60	\$809,288	\$20,217	\$1,740	\$120,845	\$930
96 Power:						
97 Total horsepower.....	10	504	17	25	309	45
Owned—	432	33,430	1,224	706	31,271	2,531
Engines—						
Steam—						
Number.....	11	575	19	25	373	52
Horsepower.....	372	32,247	1,224	704	20,744	2,256
Gas or gasoline—						
Number.....	3	82		1	27	
Horsepower.....	35	1,018		2	1,224	
Water wheels—						
Number.....		1			2	
Horsepower.....		25			100	
Water motors—						
Number.....						
Horsepower.....						
Electric motors—						
Number.....	1	10			3	
Horsepower.....	25	130			36	
Other power, horsepower.....					37	
Rented—						
Electric motors—						
Number.....		1			4	6
Horsepower.....		1			130	275
Other kind, horsepower.....						
Furnished to other establishments, horsepower.....					10	
98 Machinery:						
99 Clay grinding machines—						
100     Disintegrators.....	2	129	4	7	106	18
101     Dry pans.....	2	174	10	2	260	
102     All other.....	3	80	2	17	40	18
103 Clay tempering machines—						
104     Ring pits.....		62		21	93	
105     Pug mills.....	3	218	11	12	264	33
106     Wet pans.....	1	12			12	
107     All other.....		9			8	1
108 Molding machines—						
109     Soft mud.....	12	215	2	17	167	8
110     Stiff mud.....	2	154	8	9	143	34
111     Dry presses.....	2	54	13	3	49	8
112     Shape brick power presses.....		42	4		50	1
113     Hand presses.....	1	40	0	4	143	4
114     Sewer pipe presses.....		3			2	
115     Tile machines.....		277	1	10	5	
116     All other.....		214	1	12	150	14
117 Mold sanders.....	5	75		8	122	
118 Kilns—						
119     Clamp.....	1	256	38	26	345	47
120     Down-draft—						
121         Round.....	1	1,090	9	18	485	27
122         Rectangular.....	2	815	7	8	287	9
123     Muffle.....		6			5	
124         Continuous.....		12			14	
125         All other.....	36	820	13	42	333	67
126 Other machinery—						
127     Dryers.....		153			182	9
128     All other.....		90	3		76	7
129 Idle machinery.....	1	56	4	7	57	13

# CLAY PRODUCTS.

BY STATES AND TERRITORIES: 1905—Continued.

South Dakota.	Tennessee.	Texas.	Utah.	Vermont.	Virginia.	Washington.	West Virginia.	Wisconsin.	Wyoming.	
\$83,756	\$1,100,398	\$1,304,063	\$345,800	\$104,235	\$1,803,680	\$675,124	\$870,200	\$1,847,727	\$17,195	75
10,243	160,895	215,310	40,475	17,588	238,498	79,637	82,949	230,407	1,855	76
\$82,685	\$1,080,371	\$1,301,157	\$330,013	\$100,235	\$1,788,875	\$630,007	\$850,092	\$1,538,477	\$17,195	77
8,433	150,522	197,941	41,007	17,588	202,458	73,065	50,080	220,607	1,055	78
\$68,335	\$891,517	\$1,160,616	\$257,478	\$100,235	\$1,281,163	\$544,401	\$314,034	\$1,461,202	\$8,795	79
1,750	500	10,000			4,720	100		3,000		80
\$12,250	\$6,250	\$05,000			\$47,559	\$1,800		\$21,000		81
	10,900	5,830	7,648		15,290	3,332	600	4,470		82
	\$91,059	\$55,249	\$74,505		\$160,460	\$43,965	\$5,000	\$38,210		83
	1,443	1,263	820		13,083	1,403		2,330	800	84
	\$23,235	\$10,612	\$6,970		\$255,741	\$24,820		\$17,075	\$8,400	85
	10	6			418	33				86
	\$400	\$130			\$17,800	\$1,552				87
60	5,084	100			2,449	933	31,022			88
\$2,100	\$59,840	\$1,000			\$24,490	\$16,567	\$534,858			89
	530	170			80	171	347			90
	\$8,070	\$2,550			\$1,572	\$5,986	\$5,200			91
										92
	\$18,512				\$4,890	\$5,940		\$57,500		93
\$1,071	\$1,515	\$3,500	\$6,793	\$4,000	\$9,915	\$30,087	\$11,108	\$251,750		94
8	48	50	8	7	69	36	34	103	1	96
365	3,165	3,406	737	258	4,977	1,480	3,447	5,095	65	97
7	64	54	8	5	80	33	48	117		98
320	3,165	3,307	814	210	4,832	1,256	3,391	5,745	65	99
2				1	3		2	10		100
35				18	145		56	149		101
			2					1		102
			65					37		103
										104
										105
1		3						3		106
10		0						44		107
										108
			13	2		6				109
			368	30		230		20		110
										111
										112
6	22	22	6	1	47	30	20	63		113
	7	35	1		8	2	33	7	1	114
	11	8	2	1	14	14	4	17		115
7	17	27	2		30	5	1	44		116
7	37	82	60	2	52	35	38	67	0	117
	2	10	3		4	2	3	1		118
	3					2	3	7		119
2	30	21	6	10	20	18	17	83		120
7	23	17	5	2	38	27	26	37		121
	21	44	8		8	5	3	9	1	122
1	4	2	2		23	2	13	5		123
6	30	8	4	2	62	15	5	13		124
						1				125
	4		1		3	3		20		126
	44	150	86	5	45	13	15	92	4	127
1	9	4	1	2	17	4	9	53		128
7	111	185	35		161	64	37	120	3	129
4	40	22			24	14	140	27		130
3	34	20	48		50	3	24	41		131
	1				1					132
1	2	7	2		2	5		4		133
7	57	62	32	52	53	44	32	209	7	134
										135
1	19	4	2	2	27	22	30	17		136
8	8	16	1		80	4	9	7		137
	9	15	5	1	14	64	11	10		137

TABLE 18.—POTTERY, TERRA COTTA, AND FIRE CLAY

	United States.	Alabama.	Arkansas.	California.	Colorado.	Connecticut.	District of Columbia.
1 Number of establishments.....	878	16	3	22	11	5	6
2 Capital:							
3 Total.....	\$110,920,018	\$445,445	\$23,934	\$3,484,004	\$832,306	\$288,344	\$343,095
4 Land.....	\$18,637,403	\$118,985	\$700	\$435,254	\$125,400	\$36,190	\$102,102
5 Buildings.....	\$34,947,500	\$126,309	\$3,800	\$1,195,524	\$232,150	\$84,647	\$187,618
6 Machinery, tools, and implements.....	\$21,195,402	\$107,971	\$10,500	\$741,934	\$235,700	\$96,531	\$25,064
7 Cash and sundries.....	\$30,175,713	\$92,120	\$8,934	\$1,111,292	\$238,996	\$70,976	\$58,251
8 Proprietors and firm members.....	550	19	3	10	4	2	10
9 Salaried officials, clerks, etc.:							
10 Total number.....	3,752	21	71	31	15	8	8
11 Total salaries.....	\$4,027,739	\$10,905	\$90,488	\$51,410	\$19,418	\$5,385	\$5,385
12 Officers of corporations—							
13 Number.....	763	6	17	10	8	8	8
14 Salaries.....	\$1,699,760	\$8,800	\$41,440	\$23,530	\$12,614	\$5,385	\$5,385
15 General superintendents, managers, clerks, etc.—							
16 Total number.....	2,989	15	54	21	7	7	7
17 Total salaries.....	\$2,057,979	\$11,105	\$58,048	\$27,880	\$6,804	\$5,385	\$5,385
18 Men—							
19 Number.....	2,007	12	51	18	5	7	7
20 Salaries.....	\$2,775,848	\$10,125	\$50,548	\$24,040	\$5,920	\$4,960	\$4,960
21 Women—							
22 Number.....	382	3	3	3	2	1	1
23 Salaries.....	\$182,131	\$1,040	\$1,500	\$2,040	\$884	\$416	\$416
24 Wage-earners, including pieceworkers, and total wages:							
25 Greatest number employed at any one time during the year.....	63,666	368	28	1,019	600	160	130
26 Least number employed at any one time during the year.....	42,683	237	13	723	403	122	91
27 Average number.....	52,428	205	22	860	470	141	111
28 Total wages.....	\$25,177,665	\$86,908	\$7,809	\$555,426	\$268,421	\$61,416	\$50,352
29 Men 16 years and over—							
30 Average number.....	45,342	261	20	858	474	116	111
31 Wages.....	\$23,000,350	\$86,636	\$7,500	\$555,001	\$267,619	\$54,474	\$50,352
32 Women 16 years and over—							
33 Average number.....	5,953	2	2	2	2	21	2
34 Wages.....	\$1,802,043	\$802	\$802	\$802	\$802	\$6,006	\$6,006
35 Children under 16 years—							
36 Average number.....	1,133	4	2	2	2	4	4
37 Wages.....	\$246,263	\$332	\$300	\$425	\$425	\$936	\$936
38 Average number of wage-earners, including pieceworkers, employed during each month:							
39 Men 16 years and over—							
40 January.....	40,604	173	11	900	437	112	90
41 February.....	42,021	180	13	911	453	113	91
42 March.....	44,247	207	18	886	515	114	99
43 April.....	45,411	201	21	843	482	110	120
44 May.....	46,712	264	23	839	485	118	120
45 June.....	47,172	310	23	834	507	123	125
46 July.....	45,735	330	24	790	497	120	125
47 August.....	47,295	296	23	865	511	117	125
48 September.....	47,523	291	23	844	469	111	123
49 October.....	47,173	270	21	866	462	108	121
50 November.....	45,966	234	20	860	426	117	97
51 December.....	43,955	243	20	843	404	120	90
52 Women 16 years and over—							
53 January.....	5,634	2	2	2	2	13	2
54 February.....	5,971	2	2	2	2	17	2
55 March.....	6,105	2	2	2	2	18	2
56 April.....	6,115	2	2	2	2	23	2
57 May.....	5,980	2	2	2	2	27	2
58 June.....	5,880	2	2	2	2	29	2
59 July.....	5,275	2	2	2	2	32	2
60 August.....	5,952	2	2	2	2	17	2
61 September.....	6,130	2	2	2	2	19	2
62 October.....	6,172	2	2	2	2	15	2
63 November.....	6,199	2	2	2	2	21	2
64 December.....	6,017	2	2	2	2	21	2
65 Children under 16 years—							
66 January.....	967	1	2	2	2	4	4
67 February.....	971	1	2	2	2	4	4
68 March.....	1,033	2	2	2	2	4	4
69 April.....	1,118	6	2	2	2	4	4
70 May.....	1,183	6	2	2	2	4	4
71 June.....	1,176	6	2	2	2	4	4
72 July.....	1,154	6	3	2	2	4	4
73 August.....	1,170	7	2	2	2	4	4
74 September.....	1,182	7	2	2	2	4	4
75 October.....	1,200	3	2	2	2	4	4
76 November.....	1,209	3	2	2	2	4	4
77 December.....	1,233	2	2	2	2	4	4
78 Miscellaneous expenses:							
79 Total.....	\$7,656,053	\$18,221	\$824	\$146,417	\$50,178	\$13,294	\$6,404
80 Rent of works.....	\$111,053	\$220	\$564	\$564	\$4,132	\$1,500	\$1,500
81 Taxes.....	\$436,839	\$1,306	\$59	\$11,967	\$16,547	\$743	\$900
82 Rent of offices, interest, insurance, and all sundry expenses not hitherto included.....	\$7,007,680	\$16,695	\$765	\$138,486	\$36,449	\$12,551	\$7,034
83 Contract work.....	\$100,581			\$400			
84 Materials used:							
85 Total cost.....	\$16,691,462	\$78,367	\$3,640	\$396,238	\$290,310	\$38,762	\$22,114
86 Clay purchased—							
87 China (domestic)—							
88 Tons.....	46,641				1	200	
89 Cost.....	\$453,556				\$10	\$1,005	
90 China (foreign)—							
91 Tons.....	27,692			6			
92 Cost.....	\$354,931			\$175			
93 Ball (domestic)—							
94 Tons.....	21,596						
95 Cost.....	\$124,034						
96 Ball (foreign)—							
97 Tons.....	21,077			4			
98 Cost.....	\$205,737			\$146			
99 Stoneware—							
100 Tons.....	165,808	1,796	400	491	1,086		
101 Cost.....	\$255,913	\$2,601	\$320	\$1,450	\$2,400		
102 Slip—							
103 Tons.....	4,873	50	18	22	40		
104 Cost.....	\$35,112	\$616	\$260	\$623	\$400		

# CLAY PRODUCTS.

PRODUCTS—DETAILED SUMMARY, BY STATES: 1905.

Georgia.	Illinois.	Indiana.	Iowa.	Kansas.	Kentucky.	Louisiana.	Maryland.	Massachusetts.	Michigan.
21	45	38	7	4	21	5	16	25	6
\$800,771	\$6,007,832	\$3,830,007	\$130,010	\$235,392	\$1,517,702	\$45,450	\$1,147,521	\$1,591,612	\$116,752
\$100,843	\$1,170,621	\$473,725	\$10,200	\$21,230	\$212,253	\$16,500	\$229,584	\$294,637	\$25,200
\$202,425	\$1,802,787	\$1,037,045	\$04,000	\$01,874	\$406,968	\$8,500	\$389,168	\$435,954	\$22,000
\$234,484	\$1,341,173	\$877,007	\$32,850	\$48,945	\$283,248	\$6,800	\$255,389	\$273,304	\$23,450
\$203,019	\$2,197,251	\$1,408,200	\$20,200	\$73,343	\$605,323	\$14,150	\$323,380	\$587,607	\$40,102
19	34	35	9		14	7	14	22	6
37	200	140	7	15	80	1	58	55	15
\$48,170	\$320,355	\$183,179	\$7,930	\$18,197	\$92,301	\$975	\$54,920	\$60,609	\$9,900
16	43	32	4	1	28		12	9	2
\$30,025	\$127,190	\$91,029	\$3,500	\$6,000	\$43,585		\$10,220	\$15,588	\$1,010
21	217	114	3	14	54	1	46	46	13
\$18,145	\$202,165	\$122,150	\$4,460	\$12,197	\$48,716	\$675	\$38,700	\$45,021	\$8,950
20	106	99	2	13	40	1	44	40	11
\$17,745	\$102,829	\$115,596	\$4,250	\$11,872	\$47,088	\$975	\$38,140	\$41,759	\$8,556
1	21	15	1	1	5		2	6	2
\$400	\$9,330	\$9,554	\$210	\$325	\$1,028		\$560	\$3,262	\$394
707	2,076	2,416	130	168	1,624	45	1,152	704	244
458	1,951	1,553	48	95	1,017	36	988	496	174
592	2,410	2,010	78	131	1,312	36	925	567	208
\$105,700	\$1,243,702	\$980,997	\$41,017	\$55,763	\$455,590	\$11,730	\$389,071	\$293,958	\$101,459
576	2,370	1,702	73	127	1,226	31	764	497	202
\$163,744	\$1,227,110	\$910,605	\$30,233	\$54,892	\$441,300	\$11,262	\$345,448	\$272,709	\$101,309
	33	300	3	2	68		81	60	24
	\$11,798	\$57,317	\$984	\$416	\$10,600		\$20,080	\$18,954	\$18,954
16	13	17	2	2	18	5	80	10	1
\$1,002	\$4,794	\$3,985	\$800	\$455	\$3,690	\$468	\$14,543	\$2,295	\$150
522	1,034	1,431	51	106	1,131	26	683	501	176
525	1,082	1,430	45	99	1,152	26	721	503	172
560	2,157	1,640	48	110	1,265	28	807	501	178
571	2,246	1,555	60	128	1,193	35	890	493	200
601	2,399	1,634	72	135	1,314	34	820	510	222
645	2,518	1,785	73	143	1,248	34	779	491	243
628	2,383	1,701	76	144	1,263	33	633	491	234
632	2,549	1,818	76	130	1,236	34	668	491	225
577	2,639	1,870	91	131	1,218	34	774	514	213
551	2,088	1,883	116	135	1,255	33	817	511	216
557	2,577	1,875	87	137	1,233	28	775	480	170
537	2,368	1,787	81	126	1,204	27	741	468	176
	30	273	2	3	53		87	63	40
	31	275	2		68		97	66	41
	31	283	1		75		111	63	42
	31	289	1	2	63		111	64	43
	30	275	3	2	75		91	62	44
	31	299	3	3	65		91	62	45
	25	275	4	3	59		10	68	46
	39	317	4	3	70		20	67	47
	37	314	4	3	75		91	64	48
	37	314	4	2	75		97	51	49
	37	330	4	1	65		89	44	50
	37	356	4	4	73		77	46	51
14	11	9	2	1	18	5	72	8	1
14	11	9	2	2	18	5	77	7	1
14	11	18	2	2	18	5	88	7	1
15	11	18	2	2	18	5	95	7	1
16	11	20	2	2	18	5	88	10	1
17	11	20	2	2	15	5	84	10	1
17	15	20	2	2	19	5	64	16	1
17	15	20	2	2	19	5	69	14	1
17	15	19	2	2	20	5	83	9	1
17	15	19	2	3	17	5	85	12	1
17	15	17	2	2	18	5	81	12	1
17	15	15	2	2	18	5	74	8	1
\$51,915	\$524,537	\$310,978	\$15,514	\$19,586	\$146,070	\$1,177	\$83,061	\$144,741	\$76,702
	\$878	\$443				\$540	\$4,447	\$5,974	
\$4,028	\$18,019	\$16,548	\$649	\$1,040	\$5,495	\$64	\$11,625	\$8,897	\$1,775
\$47,812	\$450,522	\$295,910	\$14,722	\$18,546	\$140,575	\$573	\$60,989	\$119,382	\$74,927
\$75	\$55,118							\$10,488	
\$144,292	\$732,106	\$645,969	\$28,530	\$36,821	\$347,315	\$7,590	\$137,680	\$174,834	\$48,897
2	25	1,909			1,800		596	301	
\$33	\$310	\$24,105			\$8,073		\$3,375	\$3,338	
		1,080					376	10	
		\$12,883					\$4,428	\$172	
	270	3,065			450			302	
	\$1,084	\$13,703			\$1,595			\$3,463	
	42	280	30				460		
	\$700	\$3,342	\$120				\$3,722		
140	34,994	5,570	9,293	1,280	6,235	800	75	1,873	
\$250	\$42,890	\$7,104	\$8,370	\$2,931	\$9,886	\$1,200	\$94	\$5,078	
11	219	75	37	25	94		2	22	
\$198	\$1,368	\$388	\$427	\$239	\$923		\$10	\$125	

TABLE 18.—POTTERY, TERRA COTTA, AND FIRE CLAY

	United States.	Alabama.	Arkansas.	California.	Colorado.	Connecticut.	District of Columbia.
Materials used—Continued.							
Clay purchased—Continued.							
Fire—							
82	Tons.....	1,827,276	17,713	32,405	22,772	7,630	
83	Cost.....	\$2,151,847	\$14,098	\$78,806	\$43,372	\$5,853	
Pipe—							
84	Tons.....	177,110		16,030	38,814		
85	Cost.....	\$173,038		\$30,205	\$38,645		
Terra cotta—							
86	Tons.....	137,703		5,854	406		
87	Cost.....	\$174,021		\$3,944	\$176		
Brick—							
88	Tons.....	183,134		2,908	55,485	1,105	
89	Cost.....	\$166,748		\$5,548	\$30,742	\$1,104	
All other—							
90	Tons.....	509,304	19,419	10,052	25		
91	Cost.....	\$772,932	\$3,884	\$12,918	\$150		
Sand—							
92	Tons.....	63,339	187	320	145	1,207	
93	Cost.....	\$90,008	\$262	\$600	\$224	\$973	
Flint (quartz)—							
94	Tons.....	58,804	557	2	1	138	
95	Cost.....	\$400,549	\$2,150	\$60	\$13	\$909	
Feldspar—							
96	Tons.....	40,029		1	37	132	
97	Cost.....	\$438,585		\$72	\$132	\$1,250	
Plaster—							
98	Tons.....	22,512		307	23	1	
99	Cost.....	\$184,240		\$5,775	\$220	\$25	
Salt—							
100	Tons.....	8,302	116	384	200		27
101	Cost.....	\$31,611	\$304	\$1,736	\$1,200		\$115
Manganese—							
102	Pounds.....	485,479		9,478	50		
103	Cost.....	\$11,825		\$198	\$1		
Iron—							
104	Pounds.....	3,458,742					
105	Cost.....	\$11,216					
Lime—							
106	Barrels.....	11,334	150	40	533		
107	Cost.....	\$9,012	\$122	\$50	\$288		
Liquid and coin gold.....							
108	Value.....	\$225,024					
Oxide of lead, zinc, and cobalt.....							
109	Value.....	\$370,941			\$2,012	\$330	\$742
Packing materials (crates, hogsheds, etc.).....							
110	Value.....	\$848,867	\$10	\$60	\$3,514	\$4,309	\$4,150
Fuel.....							
111	Value.....	\$0,593,778	\$45,318	\$2,750	\$181,910	\$139,343	\$11,009
Rent of power and heat.....							
112	Value.....	\$30,018			\$4,563	\$2,822	\$726
Mill supplies.....							
113	Value.....	\$405,998	\$2,284	\$26	\$9,835	\$7,383	\$440
All other materials.....							
114	Value.....	\$1,593,785	\$6,158	\$25	\$17,429	\$3,275	\$1,025
115	Freight.....	\$406,136		\$120	\$24,434	\$14,575	\$7,985
Products:							
116	Aggregate value.....	\$64,200,702	\$273,303	\$20,250	\$1,701,213	\$780,818	\$144,180
Pottery—							
117	Total value.....	\$25,831,013	\$34,306	\$13,000	\$40,010	\$40,650	\$95,075
118	Red earthenware.....	\$318,195			\$24,133		\$43,500
Stoneware—							
119	Gallons.....	67,725,234	637,733	330,000	65,133	388,000	
120	Value.....	\$3,274,914	\$32,854	\$13,000	\$7,777	\$26,500	
121	Yellow and Rockingham ware.....	\$200,607			\$7,777	\$150	
122	C. C. or cream colored ware and white granite ware, including semivitreous porcelain ware.....	\$9,195,703					
123	China (porcelain).....	\$3,370,627					
124	Bone china, Delft, and Belleek ware.....	\$108,000					
125	Sanitary ware, including solid porcelain bath tubs, laundry tubs, etc.....	\$3,932,506			\$15,000		
126	Porcelain electrical supplies.....	\$1,500,283					\$38,327
127	Porcelain doorknobs and hardware trimmings.....	\$78,596					
128	All other pottery products.....	\$3,345,582	\$1,512			\$20,000	\$13,248
Terra cotta, fire, and other clay products—							
129	Total value.....	\$37,854,744	\$239,027	\$7,250	\$1,714,203	\$735,413	\$40,030
130	Architectural terra cotta.....	\$3,773,131			\$223,000		\$08,853
Fireproofing, including terra cotta lumber, and hollow building tile or blocks—							
131	Tons.....	770,421			12,822	400	9,144
132	Value.....	\$3,701,971			\$92,141	\$3,300	\$61,913
133	Roofing, floor, and encaustic tile.....	\$2,707,772			\$25,250		
Fire brick—							
134	Thousands.....	668,043	9,031	515	23,453	3,550	2,000
135	Value.....	\$11,571,830	\$127,997	\$6,500	\$260,443	\$62,863	\$43,800
136	Drain tile.....	\$531,526		\$500	\$9,149	\$5,824	\$3,400
Sewer pipe—							
137	Tons.....	1,333,600	20,500		58,106	27,938	3,290
138	Value.....	\$8,299,809	\$101,680		\$670,804	\$300,386	\$30,440
139	Electrical conduits.....	\$602,682			\$12,800		
Brick—							
Enameled—							
140	Thousands.....	8,225					
141	Value.....	\$372,604					
Vitrified paving—							
142	Thousands.....	75,000		25	25	6,265	
143	Value.....	\$745,954		\$250	\$875	\$53,374	
Fancy or ornamental—							
144	Thousands.....	9,945				30	
145	Value.....	\$249,233				\$000	
Red front, both pressed and wire cut—							
146	Thousands.....	36,064				700	
147	Value.....	\$472,032			\$90,972	\$9,000	
Sand-lime—							
148	Thousands.....	1,328				500	
149	Value.....	\$38,846				\$14,000	
Common—							
150	Thousands.....	132,434	1,700		5,000	20,509	
151	Value.....	\$801,335	\$9,450		\$22,500	\$153,514	
152	All other terra cotta, fire, and other clay products. <sup>1</sup>	\$3,985,909			\$106,183	\$125,652	\$5,230
153	All other products.....	\$515,035			\$100	\$4,755	\$75

<sup>1</sup> Including adobes, aquarium ornaments, art tile, assayers' furnaces, bakers' tile, cement blocks, chimney tops, clay crucibles, coke oven tile, fire cement, flat-tening stones, flue lining, furnace blocks, garden furniture, gas logs, glass tile, insulators, kiln tile, lot and grave markers, melting pots, mufflers, open-hearth runner

# CLAY PRODUCTS.

PRODUCTS—DETAILED SUMMARY, BY STATES: 1905—Continued.

Georgia.	Illinois.	Indiana.	Iowa.	Kansas.	Kentucky.	Louisiana.	Maryland.	Massachusetts.	Michigan.		
15,150	27,149	51,763		30	99,072	319	17,858	11,582		0	82
\$7,825	\$27,471	\$40,595		\$105	\$104,190	\$1,139	\$13,493	\$32,582		\$31	83
3,100		4,000			6,445						84
\$5,790		\$1,500			\$6,478						85
891	9,225	3,000									86
\$1,330	\$15,409	\$7,200				75	1,451	1,512			87
	1,162	100			1,160						88
	\$850	\$200	250		\$888		100	500	1,200		89
			\$150				\$100	\$725	\$1,050		90
32	17,143	3,009	400		10,644	275	604			600	91
\$25	\$22,200	\$8,800	\$300		\$10,711	\$350	\$1,502			\$553	92
222	1,093	932	314	70	2,374	305	773	1,426		54	93
\$325	\$1,507	\$1,549	\$240	\$101	\$1,453	\$312	\$1,544	\$3,542		\$27	94
14	453	2,862	18	10	607		634	153			95
\$108	\$5,427	\$18,062	\$161	\$200	\$3,723		\$4,881	\$1,625			96
13	595	2,176	70	18	470		367	311			97
\$118	\$7,542	\$22,542	\$600	\$300	\$4,311		\$3,756	\$3,110			98
351	3,248	415	124	14	63	1	318	45	114		99
\$3,701	\$18,495	\$3,838	\$833	\$186	\$820	\$18	\$3,211	\$518	\$617		100
235	385	430		100	36			2			101
\$1,500	\$1,730	\$1,121		\$291	\$130			\$14			102
31,590	20,990	12,786			4,800		25,030	10,400			103
\$575	\$782	\$410			\$240		\$250	\$178			104
54,500	3,124,000				0,000						105
\$430	\$3,125				\$75						106
1,150	100			20							107
\$915	\$105			\$50							108
\$118	\$330	\$2,132			\$30		\$5,393	\$500			109
\$67	\$20,007	\$12,347	\$2,600	\$450	\$3,841		\$4,428	\$1,407			110
\$1,020	\$20,175	\$34,775	\$1,394	\$1,973	\$5,387		\$8,348	\$3,598	\$2,567		111
\$86,574	\$428,144	\$297,737	\$12,540	\$22,030	\$168,706	\$2,336	\$55,613	\$76,726	\$36,941		112
	\$3,730						\$198	\$25			113
\$7,074	\$16,598	\$12,284	\$401	\$1,043	\$5,533		\$4,128	\$3,636	\$730		114
\$9,431	\$72,125	\$12,546	\$16	\$6,853	\$13,134		\$12,082	\$20,720	\$726		115
\$15,989	\$19,378	\$20,116	\$300		\$7,188		\$110	\$9,607	\$130		116
\$479,927	\$3,250,312	\$2,643,139	\$78,449	\$181,392	\$1,246,555	\$30,954	\$851,729	\$718,255	\$289,910		117
\$24,477	\$805,490	\$703,281	\$72,349	\$40,500	\$152,410	\$704	\$398,700	\$293,643	\$40,189		118
\$5,151	\$16,850	\$2,700	\$9,200		\$23,000	\$704	\$12,700	\$181,771	\$20,000		119
312,000	16,180,879	1,705,100	1,089,433	592,000	2,319,800			590,855			120
\$10,320	\$723,971	\$71,591	\$63,149	\$40,500	\$129,410			\$36,980			121
	\$26,850										122
		\$211,417					\$166,000	\$66,000			123
								\$5,000			124
		\$415,613									125
		\$45,000									126
											127
86	\$97,789	\$17,050					\$220,000	\$3,892	\$19,589		128
\$455,450	\$2,300,759	\$1,878,658	\$5,750	\$140,892	\$1,094,145	\$30,250	\$421,479	\$424,012	\$249,730		129
\$102,398	\$804,554	\$38,000		\$500			\$34,840	\$10,846			130
3,000	60,314	116,296		570			2,437	18,477	133		131
\$18,000	\$343,805	\$558,150		\$3,988			\$14,621	\$92,385	\$1,200		132
\$59,934	\$241,563	\$482,113		\$32,000	\$214,124			\$80,543			133
1,701	12,858	15,324	10	18	36,570		16,513	3,603			134
\$24,008	\$175,610	\$108,092	\$150	\$210	\$664,024		\$290,482	\$108,228			135
\$9,000	\$170,035	\$59,776		\$3,825	\$1,800				\$83,110		136
21,800	76,327	45,597		28,260	22,642						137
\$174,000	\$301,453	\$257,618		\$98,915	\$118,458				51,216		138
		\$14,800		\$1,454					\$105,420		139
	1,283				2,237						140
	\$53,806				\$48,492						141
7,000					10						142
\$63,000					\$240						143
	1,158						1,300				144
	\$11,011						\$41,136				145
					2,305						146
					\$23,050						147
											148
											149
	813	982	700		471		800				150
	\$4,428	\$5,843	\$5,000		\$2,821		\$5,800				151
\$8,000	\$142,288	\$298,606			\$21,136	\$30,250	\$34,800	\$128,010			152
			\$380								153
	\$21,093	\$1,200					\$31,550	\$600			154

brick, radial chimney brick, refractory shapes, retorts, saggars, salt glazed building brick, scoriifers, silica brick, stone pumps, tank blocks, tile dental plates, toy marbles, wall coping, etc.

## MANUFACTURES.

TABLE 18.—POTTERY, TERRA COTTA, AND FIRE CLAY

	United States.	Alabama.	Arkansas.	California.	Colorado.	Connecticut.	District of Columbia.
Power:							
154 Number of establishments reporting.....	751	7	1	18	10	4	4
155 Total horsepower.....	107,755	805	25	2,282	2,108	145	295
Owned—							
Engines—							
Steam—							
Number.....	1,082	7	1	18	10	3	5
Horsepower.....	99,086	795	25	2,011	2,027	129	291
Gas or gasoline—							
Number.....	91	2		3			1
Horsepower.....	3,165	10		10			4
Water wheels—							
Number.....	4						
Horsepower.....	355						
Water motors—							
Number.....							
Horsepower.....							
Electric motors—							
Number.....	191			0		3	
Horsepower.....	2,837			87		16	
Other power, horsepower.....	112						
Rented—							
Electric motors—							
Number.....	74			4	4		
Horsepower.....	1,847			165	81		
Other kind, horsepower.....	353						
Furnished to other establishments, horsepower.....	80						
Machinery and kilns:							
Pottery—							
Disintegrators (blunger).....	401			4	4	1	
Agitators.....	480			6	1	1	
Slip pumps.....	517	3		7	5	1	
Lawns.....	337			1	2	1	
Clay presses—							
Iron.....	401			6	2		
Wood.....	81	1				1	1
Pug mills—							
Regular.....	438	10		9	3	4	2
Sagger.....	1,170	1					
Wad mills.....	189					1	
Jiggers.....	1,400	1		6	5	10	2
Batters.....	428						
Dry presses.....	642					15	
Polishers.....	80					1	
Lathes.....	640	10		10	3	1	
All other machines.....	624	7	2	9	6	1	3
Kilns—							
Up draft.....	1,085	2	2	3	1	1	2
Down draft.....	809	20	1	42	9	5	1
Muffle—							
Large.....	171			3			
Decorating.....	388				1		
All other.....	60	5				5	
Terra cotta, tile, and brick—							
Clay grinding machines—							
Disintegrators.....	172	1		2		2	3
Dry pans.....	565	6	1	25	18	2	
All other.....	125	1	1	1			1
Clay tempering machines—							
Ring pits.....	71			4			
Pug mills.....	448	4	1	11	12	3	5
Wet pans.....	539	6		22	7		
All other.....	78			1			
Molding machines—							
Soft mud.....	129	1	1				
Stiff mud.....	202	3	1	7	8		1
Dry presses.....	155	4		12	7		
Shape brick power presses.....	150		1	13	7		
Hand presses.....	850	5		23	20	7	
Sewer pipe presses.....	198	2		15	5		4
Tile machines.....	144		1	3	1		2
All other.....	200					1	
Mold sanders.....	74	1					
All other machinery.....	88			1			
Kilns—							
Clamp.....	206	5			22		
Down draft—							
Round.....	2,426	24	3	73	68	5	16
Rectangular.....	930	1		10	5		
Muffle.....	143			11			
Continuous.....	33						
All other.....	240						
Dryers.....	431	7	1	3	4	2	
Idle machinery.....	282	1		8	16		

CLAY PRODUCTS.

PRODUCTS—DETAILED SUMMARY, BY STATES: 1905—Continued.

Georgia.	Illinois.	Indiana.	Iowa.	Kansas.	Kentucky.	Louisiana.	Maryland.	Massachusetts.	Michigan.	
7	35	36	6	4	17	5	15	20	6	154
2,075	6,112	5,408	280	560	2,799	101	1,484	1,241	372	155
14	57	53	5	3	29	6	18	24	5	156
2,055	5,100	5,340	268	440	2,786	101	1,474	1,105	362	157
	2	1	2	2	1		1	2		158
	18	40	12	120	8		6	16		159
	2									160
	275									161
										162
										163
1	20	6						1		164
20	107	111						25		165
	70	1					1			166
	6									167
	177				1		3	4	1	168
	275				5		3	35	10	169
										170
11	7	28	6	1	9		9	6		171
	20	20	2	4	5		12	1		172
1	37	21	3	3	14		0	5		173
	9	18	1	1	4		6	1		174
1	24	18	5	2	9		6			175
2	1	1			1		5	3		176
0	10	10	6	1	5	1	7	13	2	177
	2	6	1		3		3	2		178
	1	6	1		2		3	3		179
3	115	25	15	8	13	5	29	23	5	180
		32								181
		01								182
										183
4	17	17		8	14		2	1		184
	37	13	3	1	8		3	0		185
							1	6		186
15	10	39	2		25		22	14	2	187
12	08	50	11	4	23		1	12	3	188
1	2	18	1		1		4			189
	1	9			1		7			190
1	2	1	1	1	1					191
3	2	14			5	1	3	4		192
1	32	30	1	3	12		3	7	2	193
7	1	8			11		1	4	1	194
3	3	4			1		5	9	1	195
10	15	34	1	2	3	4	4	10	4	196
0	21	8	2	3	21		5	2	4	197
2	12			1	4			1		198
2	2	2					3	1		199
1	9	7	1		1		1	10		200
	8	1	1		6		2	6		201
4	3	1			2			1		202
4	8	2			76	2	33	15		203
6	12	10		1	3			1	2	204
5	18	19	1	4	2			2	6	205
1	2	1	3			1				206
1							1	2		207
	15	6			9			5		208
			2				2	14		209
52	137	143	1	12	32	2	11	12	36	210
5	40	6		4	25		23	15		211
	33						1	5		212
7	9				1			8		213
1	11	33	1	7	10	2	1	5	2	214
3	30	24	2		13		6	10	2	215
3	3	6						9		

TABLE 18.—POTTERY, TERRA COTTA, AND FIRE CLAY

	Minnesota.	Missouri.	New Jersey.	New York.	North Carolina.	Ohio.	Oregon.	
1	Number of establishments.....	4	33	90	43	6	205	3
2	Capital:							
3	Total.....	\$996,336	\$5,378,074	\$21,047,395	\$5,111,181	\$91,125	\$26,360,319	\$176,077
4	Land.....	\$169,790	\$907,868	\$3,561,420	\$883,169	\$7,230	\$3,525,324	\$40,300
5	Buildings.....	\$274,363	\$1,609,591	\$6,368,505	\$1,279,553	\$12,485	\$3,575,764	\$33,600
6	Machinery, tools, and implements.....	\$195,684	\$973,338	\$3,426,119	\$1,116,029	\$10,470	\$4,709,551	\$43,700
7	Cash and sundries.....	\$356,499	\$1,887,277	\$7,091,351	\$1,832,430	\$60,940	\$8,540,680	\$58,477
8	Proprietors and firm members.....	1	18	42	28	7	106	1
9	Salaried officials, clerks, etc.:							
10	Total number.....	18	178	648	256	6	1,047	7
11	Total salaries.....	\$34,000	\$251,014	\$842,773	\$328,073	\$12,000	\$1,176,748	\$11,060
12	Officers of corporations—							
13	Number.....	5	34	123	50	2	212	3
14	Salaries.....	\$21,800	\$75,880	\$314,520	\$132,725	\$0,000	\$366,950	\$7,800
15	General superintendents, managers, clerks, etc.—							
16	Total number.....	13	144	525	200	4	835	4
17	Total salaries.....	\$12,200	\$175,134	\$528,253	\$105,348	\$0,000	\$770,798	\$3,260
18	Men—							
19	Number.....	11	137	475	171	4	668	2
20	Salaries.....	\$10,750	\$170,754	\$503,084	170,820	\$0,000	\$702,473	\$2,400
21	Women—							
22	Number.....	2	7	50	35	2	167	2
23	Salaries.....	\$1,540	\$4,380	\$24,260	\$15,510	.....	\$77,325	\$850
24	Wage-earners, including pieceworkers, and total wages:							
25	Greatest number employed at any one time during the year.....	342	2,011	11,060	3,226	123	18,690	90
26	Least number employed at any one time during the year.....	270	2,207	7,703	1,030	82	13,301	30
27	Average number.....	313	2,532	6,487	2,695	84	15,919	56
28	Total wages.....	\$185,366	\$1,245,005	\$4,722,010	\$1,833,433	\$10,048	\$7,070,782	\$36,600
29	Men 16 years and over—							
30	Average number.....	313	2,504	8,261	2,270	79	12,456	55
31	Wages.....	\$185,366	\$1,236,462	\$4,373,427	\$1,208,283	\$10,035	\$6,643,232	\$36,450
32	Women 16 years and over—							
33	Average number.....	5	58	407	123	.....	3,340	.....
34	Wages.....	.....	\$1,280	\$280,132	\$123,144	.....	\$1,108,031	.....
35	Children under 16 years—							
36	Average number.....	.....	23	268	18	5	114	1
37	Wages.....	.....	\$7,863	\$62,451	\$2,030	\$913	\$24,919	\$150
38	Average number of wage-earners, including pieceworkers, employed during each month:							
39	Men 16 years and over—							
40	January.....	274	2,441	7,415	2,185	3	11,400	24
41	February.....	275	2,467	7,548	2,137	74	12,007	30
42	March.....	260	2,572	7,910	2,235	76	12,278	45
43	April.....	324	2,562	8,167	2,102	70	12,548	51
44	May.....	336	2,499	8,384	2,279	78	12,852	53
45	June.....	336	2,408	8,505	2,301	101	12,921	66
46	July.....	336	2,472	8,685	2,294	103	12,107	66
47	August.....	336	2,528	8,672	2,317	102	13,117	73
48	September.....	332	2,507	8,688	2,358	104	13,028	74
49	October.....	331	2,510	8,691	2,330	80	12,753	64
50	November.....	317	2,478	8,367	2,368	77	12,572	54
51	December.....	200	2,484	8,100	2,208	74	11,880	51
52	Women 16 years and over—							
53	January.....	.....	2	972	400	.....	3,124	.....
54	February.....	.....	2	978	420	.....	3,366	.....
55	March.....	.....	6	993	418	.....	3,425	.....
56	April.....	.....	6	970	413	.....	3,433	.....
57	May.....	.....	6	964	412	.....	3,345	.....
58	June.....	.....	6	949	407	.....	3,290	.....
59	July.....	.....	6	937	297	.....	2,954	.....
60	August.....	.....	6	934	304	.....	3,449	.....
61	September.....	.....	5	938	411	.....	3,468	.....
62	October.....	.....	5	939	420	.....	3,407	.....
63	November.....	.....	5	965	452	.....	3,484	.....
64	December.....	.....	5	948	422	.....	3,353	.....
65	Children under 16 years—							
66	January.....	.....	20	245	26	.....	102	.....
67	February.....	.....	20	245	20	3	99	.....
68	March.....	.....	22	258	20	4	100	.....
69	April.....	.....	22	276	15	5	105	.....
70	May.....	.....	22	291	16	5	110	2
71	June.....	.....	24	286	16	7	110	2
72	July.....	.....	25	270	17	7	128	2
73	August.....	.....	24	277	17	7	137	2
74	September.....	.....	27	272	17	7	136	2
75	October.....	.....	24	273	12	5	121	2
76	November.....	.....	22	266	15	5	112	.....
77	December.....	.....	24	251	13	5	108	.....
78	Miscellaneous expenses:							
79	Total.....	\$40,434	\$430,253	\$1,210,464	\$454,536	\$0,514	\$2,194,882	\$14,924
80	Rent of works.....	.....	\$7,085	\$17,315	\$24,407	\$30	\$7,867	.....
81	Taxes.....	\$5,391	\$30,813	\$66,142	\$20,137	\$460	\$122,651	\$1,502
82	Rent of offices, interest, insurance, and all sundry expenses not hitherto included.....	\$41,043	\$392,355	\$1,126,987	\$394,090	\$0,015	\$2,064,114	\$9,302
83	Contract work.....	.....	.....	.....	.....	.....	.....	.....
84	Materials used:							
85	Total cost.....	\$104,804	\$751,745	\$2,955,803	\$872,250	\$25,026	\$4,823,023	\$44,136
86	Clay purchased—							
87	China (domestic)—							
88	Tons.....	90	8,083	1,754	.....	.....	24,560	.....
89	Cost.....	\$975	\$73,912	\$17,042	.....	.....	\$243,447	.....
90	China (foreign)—							
91	Tons.....	18	6,412	1,873	.....	.....	14,286	16
92	Cost.....	\$160	\$76,547	\$27,542	.....	.....	\$186,099	\$170
93	Ball (domestic)—							
94	Tons.....	449	4,512	586	.....	.....	11,025	.....
95	Cost.....	\$1,088	\$34,938	\$3,892	.....	.....	\$57,261	.....
96	Ball (foreign)—							
97	Tons.....	20	4,546	855	.....	.....	11,630	.....
98	Cost.....	\$320	\$42,786	\$8,781	.....	.....	\$114,026	.....
99	Stoneware—							
100	Tons.....	17,385	226	17,078	3,948	211	39,742	850
101	Cost.....	\$18,048	\$413	\$54,205	\$6,271	\$420	\$55,113	\$3,400
102	Slip—							
103	Tons.....	10	37	177	96	1	2,910	.....
104	Cost.....	\$60	\$482	\$1,250	\$412	\$10	\$17,892	.....

# CLAY PRODUCTS.

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PRODUCTS—DETAILED SUMMARY, BY STATES: 1905—Continued.

Pennsylvania.	South Carolina.	Tennessee.	Texas.	Utah.	Virginia.	Washington.	West Virginia.	Wisconsin.	All other states. <sup>1</sup>	
158	6	8	22	6	3	6	17	4	8	1
\$25,700,824	\$97,438	\$185,581	\$178,484	\$90,938	\$121,251	\$987,290	\$2,267,416	\$24,000	\$561,562	2
\$5,673,402	\$3,500	\$13,850	\$20,135	\$19,900	\$450	\$98,375	\$300,400	\$4,750	\$38,000	3
\$9,323,017	\$27,050	\$43,500	\$27,532	\$21,400	\$28,000	\$171,755	\$700,281	\$8,075	\$50,150	4
\$4,004,150	\$38,800	\$53,210	\$52,010	\$25,888	\$49,000	\$317,025	\$453,837	\$7,500	\$113,082	5
\$5,815,355	\$28,088	\$74,925	\$78,798	\$23,750	\$43,801	\$399,235	\$312,808	\$3,585	\$330,480	6
87	4	7	24	3	4	1	5	2	4	7
610	6	14	11	5	6	19	71	3	18	8
\$737,908	\$4,800	\$19,265	\$10,200	\$6,000	\$4,683	\$26,476	\$134,695	\$3,000	\$23,762	9
116	2	3	1	1	1	4	17		3	10
\$228,403	\$1,800	\$5,600	\$1,800	\$1,500	\$333	\$7,200	\$74,818		\$2,100	11
603	4	11	10	4	5	15	54	3	15	12
\$500,505	\$3,000	\$13,065	\$8,400	\$4,500	\$4,350	\$19,276	\$59,877	\$3,000	\$21,062	13
465	4	11	10	3	5	14	42	3	14	14
\$489,651	\$3,000	\$13,065	\$8,400	\$4,110	\$4,350	\$18,670	\$52,532	\$3,000	\$21,142	15
38										
\$10,864				\$480		\$600	\$7,345		\$520	16
11,645	110	320	296	46	132	199	1,588	20	414	18
6,078	60	208	192	29	40	156	1,047	10	277	19
8,060	88	297	218	34	81	162	1,270	12	357	20
\$3,070,298	\$10,573	\$127,937	\$91,278	\$19,877	\$17,421	\$113,543	\$633,559	\$5,270	\$180,470	21
7,889	81	206	215	33	61	102	891	12	356	22
\$3,780,856	\$18,873	\$127,894	\$90,654	\$19,825	\$14,495	\$113,543	\$516,525	\$5,270	\$180,345	23
307					6		351			24
\$91,799					\$2,000		\$113,100			25
473	7	1	3	1	14		28		1	26
\$100,043	\$700	\$93	\$924	\$52	\$926		\$3,933		\$125	27
0,937	70	270	215	27	64	166	784	9	318	28
7,055	60	283	212	22	50	153	870	9	329	29
7,510	65	292	243	26	68	151	921	9	351	30
8,114	87	291	210	35	75	158	935	9	360	31
8,413	93	295	215	28	61	166	996	14	360	32
8,318	95	287	220	32	65	160	951	16	367	33
8,105	94	308	219	37	61	166	856	15	363	34
8,151	90	317	214	41	59	178	935	10	351	35
8,270	88	306	208	39	63	181	921	13	365	36
8,187	93	304	220	37	57	160	908	11	353	37
7,068	79	301	204	34	59	159	847	10	366	38
7,584	91	298	200	38	50	140	768	10	359	39
232					6		363			40
246					6		386			41
292					6		381			42
308					6		384			43
297					6		383			44
290					6		353			45
281					6		316			46
300					6		326			47
340					6		347			48
341					6		367			49
391					6		333			50
390					6		273			51
371	8	2	3	1	14		24		1	52
375	7	1	3	1	5		30		1	53
395	7	1	3	1	11		28		1	54
458	8	1	3	1	9		27		1	55
490	9	1	3	1	18		27		1	56
490	8	1	3	1	18		22		1	57
475	8	1	3	1	12		22		1	58
490	7	1	3	1	22		27		1	59
470	7	1	3	1	20		30		1	60
510	6	1	3	1	12		36		1	61
540	5	1	3	1	15		34		1	62
615	4		3	1	12		29		1	63
\$1,152,804	\$4,784	\$54,899	\$73,664	\$13,123	\$3,100	\$56,103	\$200,990	\$3,381	\$110,067	64
\$16,220	\$238	\$102	\$190		\$200			\$80	\$16,892	65
\$82,550	\$314	\$1,096	\$335	\$495	\$100	\$3,514	\$8,185	\$138	\$4,800	66
\$1,037,722	\$3,232	\$53,731	\$72,699	\$9,593	\$2,860	\$52,589	\$192,805	\$3,163	\$98,366	67
\$16,350	\$1,000			\$3,035						68
\$2,009,408	\$13,871	\$70,194	\$70,351	\$29,176	\$30,293	\$120,723	\$345,962	\$3,267	\$187,796	69
4,410					200		704		2,000	70
\$37,809					\$1,050		\$6,266		\$27,500	71
501					200		2,859			72
\$9,889					\$2,200		\$38,660			73
742		30					169			74
\$4,210		\$1,200					\$1,000			75
475							2,679		50	76
\$4,410							\$26,793		\$585	77
8,298		8,242	3,600			1,000	683		602	78
\$10,043		\$9,156	\$2,153			\$3,000	747		\$1,220	79
783	18	88	66			5	52		15	80
\$6,239	\$275	\$965	\$1,015			\$50	\$534		\$316	81

<sup>1</sup>Includes establishments distributed as follows: Maine, 2; Mississippi, 2; Montana, 1; New Hampshire, 2; Vermont, 1.

TABLE 18.—POTTERY, TERRA COTTA, AND FIRE CLAY

	Minnesota.	Missouri.	New Jersey.	New York.	North Carolina.	Ohio.	Oregon.
Materials used—Continued.							
Clay purchased—Continued.							
82	Fire—						
83	Tons	174,086	147,440	48,840		538,013	
	Cost	\$161,708	\$245,860	\$99,122		\$345,410	
84	Pipe—						
85	Tons	20,540				52,876	
	Cost	\$18,486				\$17,002	
86	Terra cotta—						
87	Tons	4,740	50,900	26,957		2,205	
	Cost	\$5,007	\$61,832	\$48,787		\$1,444	
88	Brick—						
89	Tons	22,627	3,273	100		28,220	
	Cost	\$17,042	\$4,735	\$150		\$38,100	
90	All other—						
91	Tons	42,300	90,004	33,464	10,520	120,682	10,000
	Cost	\$42,380	\$71,010	\$40,707	\$10,750	\$112,720	\$13,000
92	Sand—						
93	Tons	300	4,400	7,727	3,043	6,848	15
	Cost	\$240	\$2,080	\$15,598	\$9,488	\$10,004	\$20
94	Flint (quartz)—						
95	Tons	85	9	13,161	2,187	31,274	3
	Cost	\$385	\$67	\$100,004	\$22,157	\$193,932	\$66
96	Feldspar—						
97	Tons	190	51	12,710	2,231	18,106	22
	Cost	\$3,040	\$600	\$125,661	\$23,761	\$201,810	\$665
98	Plaster—						
99	Tons	148	455	5,098	3,220	4,739	20
	Cost	\$2,407	\$2,478	\$50,411	\$24,400	\$48,714	\$320
100	Salt—						
101	Tons		713	348	112	8,224	45
	Cost		\$2,420	\$1,420	\$723	\$8,632	\$225
102	Manganese—						
103	Pounds		54,085	184,806	70,800	54,168	1,000
	Cost		\$809	\$4,721	\$1,750	\$1,516	\$250
104	Iron—						
105	Pounds		15,835	155,000		2,407	
	Cost		\$283	\$4,277		\$101	
106	Lime—						
107	Barrels			3	71	631	
	Cost			\$14	\$58	\$2,086	
108	Liquid and coin gold						
109				\$30,700	\$8,004	\$148,103	
110				\$78,705	\$9,988	\$109,579	\$203
111	Packing materials (crates, hogsheds, etc.)						
112		\$500	\$4,503	\$101,853	\$32,467	\$535	\$314
113	Fuel	\$120,750	\$300,144	\$1,170,070	\$302,361	\$20,830	\$1,011,664
114	Rent of power and heat		\$300	\$7,012	\$2,680		\$3,931
115	Mill supplies	\$2,459	\$25,532	\$08,872	\$18,553	\$205	\$2,009
	All other materials	\$775	\$74,494	\$380,375	\$167,921	\$5	\$521,288
	Freight		\$100	\$05,350	\$21,444	\$3,008	\$155,723
116	Products:						
	Aggregate value	\$562,726	\$3,083,406	\$11,717,103	\$3,288,801	\$106,437	\$18,550,840
117	Pottery—						
118	Total value	\$247,633	\$28,470	\$6,462,624	\$1,368,004	\$6,427	\$11,904,210
	Red earthenware		\$8,340	\$30,634	\$31,275	\$40	\$181,736
	Stoneware						\$4,700
119	Gallons	5,630,337	422,102	010,500	554,360	113,490	24,006,285
120	Value	\$241,107	\$20,130	\$58,819	\$48,748	\$6,347	\$1,040,378
121	Yellow and Rockingham ware						
122				\$25,000		\$106,340	\$22,500
	C. C. or cream colored ware and white granite ware, including semivitreous porcelain ware			\$1,200,768	\$195,675	\$6,167,494	
123	China (porcelain)						
124				\$361,300	\$409,485	\$2,279,374	
125	Bone china, Delft, and Belleek ware						
				\$108,000			
126	Sanitary ware, including solid porcelain bath tubs, laundry tubs, etc.						
				\$3,006,400	\$40,804	\$107,225	
127	Porcelain electrical supplies						
				\$328,524	\$452,010	\$584,243	
128	Porcelain doorknobs, and hardware trimmings						
				\$58,825	\$10,771	\$9,000	
	All other pottery products	\$9,526		\$1,210,288	\$58,317	\$40	\$1,338,420
129	Terra cotta, fire, and other clay products—						
130	Total value	\$315,093	\$2,822,293	\$5,185,095	\$1,011,752	\$100,010	\$6,014,209
	Architectural terra cotta		\$185,623	\$1,210,400	\$815,893		\$102,406
	Fireproofing, including terra cotta lumber, and hollow building tile or blocks—						
131	Tons	6,750	24,593	202,620	38,032	158,560	1,000
132	Value	\$27,000	\$100,922	\$1,266,969	\$232,507	\$577,014	\$15,000
133	Roofing, floor, and encaustic tile						
			\$64,530	\$245,518	\$48,665	\$971,785	
134	Fire brick—						
135	Thousands		38,834	31,057	13,980	84,253	530
136	Value		\$640,133	\$709,390	\$400,321	\$1,240,826	\$10,750
	Drain tile	\$2,477	\$45,983	\$23,537	\$19,745	\$5,000	\$3,756
137	Sewer pipe—						
138	Tons	30,000	90,479	1,700	20,456	12,000	522,199
	Value	\$286,616	\$792,710	\$20,352	\$143,738	\$95,000	\$2,939,772
139	Electrical conduits						
			\$20,000	\$331,020	\$47,121	\$167,200	\$60,000
140	Brick—						
141	Enameled—						
	Thousands		3,530				
142	Value		\$103,355				
143	Vitrified paving—						
	Thousands		799	1,873	1,178	21,846	400
	Value		\$10,638	\$29,668	\$15,372	\$200,846	\$6,000
144	Fancy or ornamental—						
145	Thousands						
	Value					3,265	
146	Red front, both pressed and wire cut—						
	Thousands					\$39,372	
147	Value			24,299			
	Common—			\$338,352			
148	Thousands						
149	Value						
150	Sand lime—						
	Thousands		770	71,729	14,280	3,213	250
151	Value		\$5,890	\$406,334	\$88,308	\$18,858	\$1,600
152	All other terra cotta, fire, and other clay products						
			\$306,865	\$404,194	\$99,992	\$395,444	\$300
153	All other products						
			\$232,043	\$69,384	\$9,045	\$32,361	

# CLAY PRODUCTS.

PRODUCTS—DETAILED SUMMARY, BY STATES: 1905—Continued.

Pennsylvania.	South Carolina.	Tennessee.	Texas.	Utah.	Virginia.	Washington.	West Virginia.	Wisconsin.	All other states.	
501,200										
\$880,808		1,070	1,450	4,720		12,000	410		2,717	82
5,050		\$7,880	\$1,465	\$7,990		\$12,000	\$1,023		\$0,301	83
\$3,180				3,120					28,285	84
18,005				\$0,240					\$37,052	85
\$20,434										
59,097	50	60	80			2,190		500		86
\$51,210	\$20	\$60	\$32			\$2,196		\$750		87
84,404								250	4,709	88
\$347,348		10,444	100					\$250	\$7,783	89
		\$10,444	\$200			33,601	3,106		1,876	90
28,471			11	515	250	\$33,001	\$14,608		\$1,877	91
\$47,521		200	\$7	\$1,015	\$400		242			92
2,052		34	20		200		\$616	2	837	93
\$18,001		\$427	\$010		\$1,500	6	3,444	\$2	\$852	94
1,354		77	92			\$208	\$22,753		90	95
\$13,033		\$1,031	\$2,415		250	20	1,606		20	96
2,033		92	23		\$2,250	\$046	\$18,922		\$235	97
\$9,034		\$760	\$209			19	504	2	176	98
958		100	152	507		\$275	\$5,820	\$14	\$1,013	99
\$4,080		\$510	\$501	\$2,576		165			62	100
4,036			500	30		\$728			\$407	101
\$128			\$10	\$2						102
1,000			100,000							103
\$25			\$2,900							104
8,181			6							105
\$5,503			\$27				20		340	106
\$0,700							\$25		\$349	107
\$14,220		\$1,347					\$23,314		\$55	108
\$04,800		\$1,238	\$700	\$32	\$800	\$200	\$12,703		\$52	109
\$1,021,937	\$11,818	\$30,180	\$708		\$1,250	\$792	\$42,351		\$3,410	110
\$1,474	\$30		\$47,073	\$9,817	\$7,418	\$60,096	\$92,052	\$2,187	\$78,838	111
\$77,435	\$1,703	\$5,303		\$720					\$250	112
\$137,525	\$25	\$2,125	\$2,002	\$784	\$1,405	\$3,290	\$4,827	\$55	\$2,027	113
\$100,901		\$200	\$1,519		\$20	\$1,193	\$27,301		\$11,914	114
			\$5,935		\$12,000	\$1,818	\$4,858		\$4,200	115
\$10,759,272	\$41,210	\$309,275	\$320,728	\$70,885	\$77,221	\$415,785	\$1,286,285	\$15,358	\$570,540	116
\$1,325,581	\$12,200	\$133,088	\$125,218	\$1,900	\$50,000	\$39,938	\$1,109,594	\$12,027	\$74,415	117
\$130,532		\$2,000	\$3,452	\$1,900		\$1,750		\$12,027	\$50,000	118
5,002,796	205,000	2,410,000	2,193,147			400,284	330,000		265,000	119
\$338,150	\$11,500	\$131,088	\$121,706			\$38,188	\$16,850		\$13,475	120
\$48,267										121
\$547,798										122
\$30,000							\$550,551			123
\$80,058							\$195,408			124
\$2,170							\$165,400			125
					\$50,000					126
\$180,000	\$700						\$181,385		\$10,940	127
\$9,357,027	\$20,281	\$175,287	\$201,510	\$72,613	\$26,513	\$375,847	\$176,691	\$2,431	\$475,125	128
\$341,077										129
48,078										130
\$198,437						219				131
\$215,088						\$2,188		406		132
							\$17,000	\$2,431		133
355,864	2,472	2,709	834	1,332	1,747	618	3,003		5,654	134
\$0,278,790	\$20,281	\$27,200	\$14,600	\$40,307	\$26,513	\$17,334	\$26,060		\$149,137	135
		\$402	\$691	\$7,300		\$7,987			\$2,381	136
117,602		35,749	14,074	7,500		18,730			62,775	137
\$300,374		\$142,099	\$171,966	\$25,000		\$206,720			\$282,488	138
\$8,107										139
1,175										140
\$40,951										141
18,144						6,772	10,200		563	142
\$177,002						\$108,493	\$74,000		\$5,536	143
1,109										144
\$10,488										145
00										146
\$758										147
						828				148
						\$24,840				149
7,007			200			100	3,250			150
\$50,340			\$1,000			\$700	\$18,400			151
\$1,210,880		\$4,407	\$12,593			\$7,579	\$41,231		\$35,583	152
\$76,004	\$2,735			\$2,372	\$708				\$30,000	153

TABLE 18.—POTTERY, TERRA COTTA, AND FIRE CLAY

	Minnesota.	Missouri.	New Jersey.	New York.	North Carolina.	Ohio.	Oregon.
<b>Power:</b>							
154	Number of establishments reporting	4	28	83	39	1	200
155	Total horsepower	775	6,190	14,964	4,370	325	25,182
Owned—							
Engines—							
Steam—							
156	Number	10	67	128	46	4	270
157	Horsepower	775	6,051	12,612	3,595	325	23,231
Gas or gasoline—							
158	Number		3	1	12		33
159	Horsepower		28	10	307		1,342
Water wheels—							
160	Number						
161	Horsepower						
Water motors—							
162	Number						
163	Horsepower						
Electric motors—							
164	Number		7	80	15		37
165	Horsepower		110	1,501	158		428
166	Other power, horsepower			20	20		
Rented—							
Electric motors—							
167	Number		1	30	1		8
168	Horsepower		10	821	200		136
169	Other kind, horsepower				30		45
170	Furnished to other establishments, horsepower						30
<b>Machinery and kilns:</b>							
<b>Pottery—</b>							
171	Disintegrators (blunger)		1	102	20		227
172	Agitators	6	7	103	20		197
173	Slip pumps	10	8	107	13		192
174	Lavins	1		82	15		153
Clay presses—							
175	Iron		17	41	17		241
176	Wood	3	1	51	2	1	1
Pug mills—							
177	Regular		9	83	15	2	141
178	Sagger			844	13		84
179	Wad mills			49	10		91
180	Jiggers		4	105	72		602
181	Batters	20		60	4		251
182	Dry presses			221	148		111
183	Polishers		7	16	2		58
184	Lathes	2		102	47	4	189
185	All other machines	7	15	113	67	10	205
Kilns—							
186	Up draft		8	230	48	3	443
187	Down draft	30	34	78	35	19	281
188	Muffle						
189	Large			74	12		43
190	Decorating			72	16		212
191	All other			0	4	2	14
<b>Terra cotta, tile, and brick—</b>							
<b>Clay grinding machines—</b>							
191	Disintegrators	5	8	20	21	2	22
192	Dry pans	2	39	34	19	2	153
193	All other		10	11	11		18
<b>Clay tempering machines—</b>							
194	Ring pits		1	10	5		5
195	Pug mills	2	40	55	27		47
196	Wet pans	6	35	37	12	5	134
197	All other	2		47			4
<b>Molding machines—</b>							
198	Soft mud		2	53	5		11
199	Stiff mud		11	36	15		24
200	Dry presses		14	30	3		10
201	Shape brick power presses		3	30	4		31
202	Hand presses		52	128	20	1	83
203	Sewer pipe presses	2	16	12	7	2	61
204	Tile machines	1	10	11	12	1	30
205	All other		2	3	3		23
206	Mold sanders			47	5		9
207	All other machinery	3	9	3	15		10
<b>Kilns—</b>							
208	Clamp		4	77	7		14
Down draft—							
209	Round						
210	Rectangular	4	150	200	52		880
211	Muffle		55	22	14		98
212	Continuous		28	41	24		
213	All other		6	4	2		
214	Dryers	3	14	21	18		25
215	Idle machinery	5	30	41	20	1	83
			6	42	66		27



## AMERICAN ART POTTERY.

The Centennial in Philadelphia in 1876 gave rise to an increased interest in the art pottery of the United States. At first this manifested itself in the production of meretricious objects that were unworthy of recognition, but, on the other hand, the seed that was then planted resulted in time in the manufacture of a higher grade of goods, even in some instances winning deserved recognition from connoisseurs and art critics of the Old World. This development has been perhaps most conspicuous in the production of art pottery.

In order to comprehend clearly the results obtained, a brief summary of the history of pottery, processes of manufacture, and definitions of the principal varieties of wares is essential.

### HISTORY.

The art of pottery began when moistened clay was fashioned into shape by primitive man and the product hardened by the heat of the sun. That it must have been one of the very first arts acquired is obvious. Its first applications were of course purely utilitarian, and even before sun dried bricks were used in ancient Babylonia doubtless moistened clay was spread over frames to shelter man from the elements. The substitution of artificial fire for the heat of the sun was a distinct advance, from which in the years that followed came the kiln. The employment of sticks to aid the hand in giving form to objects was the first step toward the wheel, with the use of which pottery rose to the dignity of an art. In the course of time it was found that clays containing iron burned red; those containing magnesia, white, and that with the addition of burned wood or carbon under certain conditions the product was black. Thus was developed a knowledge of the value of different clays. Environment also had to do with the development of pottery. Certain localities were found to produce better ware than others. In time decorating in color with opaque enamel made in part of an oxide of tin began, notably in Egypt. The Assyrians deserve the credit for the first employment of lead enamels.

The highest perfection, both as to form and decoration, in glazed and unglazed earthenware was attained by the Greeks in the fourth century B. C. Thousands of Greek vases have been found in Mediterranean lands dating from this remote period, vastly superior to the

ware produced under the Roman Empire. Persia, from 500 years B. C. down through the Middle Ages, has produced notable specimens of the potter's art and has exerted a strong influence on the later manufacture of the western world. Before the Christian era splendid examples of enameled earthenware were made in Persia, which, as faience, reached its greatest development in France and Italy in the seventeenth century.

Porcelain was made in China before 1000 A. D., largely due, it is believed, to the existence of beds of clay of proper qualities. It was not, however, until 1710 that a European, Johann Böttger, in the employ of the Elector of Saxony, discovered the secret of its manufacture and produced for his royal patron the first specimens of true hard porcelain ever made in Europe. The manufacture began at Sevres, France, in 1768 and at Plymouth and Bristol, England, before the beginning of the nineteenth century.

### MANUFACTURE.

*Clay.*—The chief material from which pottery is made is clay, a product of the disintegration or weathering of siliceous rocks, such as feldspar, hornblende, and mica. These minerals, largely made up of compounds of bases such as alumina, potassa, soda, lime, and magnesia with silicic acid, and of iron oxide, when subjected to the long continued action of carbon dioxide and water, decompose. The insoluble aluminum silicate remains in situ, while the other silicates and bicarbonates, being soluble, are more or less dissolved out by percolating water.

It is seldom that a pure aluminum silicate, or clay, is found in nature. Many causes combine to prevent the complete disappearance of varying quantities of alumina, silica, iron oxide, lime, magnesia, and alkalies, the presence of which impurities affects the physical properties of the clay and indirectly the utility. Thus the greater the proportion of silica the less the amount of shrinkage, and the greater the proportion of alumina the greater the amount of shrinkage.

Plasticity, or the capacity of being molded when moistened with water, and the property of hardening under fire are the two qualities which give clay its great value for the making of pottery. Clays low in plasticity are said to be lean, meager, or short, while those most plastic are called fat, or long. Clay contains water in chemical combination, and it is the driv-

ing out of this water by burning that causes it to harden. The burnt clay, if ground to a powder and soaked in water, never regains its plasticity.

When clay is heated, it softens gradually, and if the heat is sufficiently intense it will become like molten iron. The more fusible clays soften at 1,500° F., while fire clays and kaolin require a temperature of 3,000° or more.

Clays are classified according to their uses, as brick clay, pipe clay, sagger clay, slip clay, and terra cotta clay. These names signify that the clay thus designated is specially adapted to the use indicated. Kaolin is a nearly pure aluminum silicate and is used chiefly in the manufacture of porcelain and other white wares. Ball clay is a plastic white-burning clay used as a binding in white ware and porcelain. Slip clay contains a large per cent of alkalis and lime, which gives a low fusing point, and hence it is valuable for glazing.

*Slip.*—Clay to be used in the manufacture of pottery is first prepared by weathering for several months or even years, washing, grinding, or screening. Often a combination of these methods is employed. After this preliminary treatment it is mixed with such other ingredients as may be necessary. Thus in the manufacture of one variety of hard porcelain the essential ingredients are kaolin as a body, quartz to prevent excessive shrinkage on drying, and a flux, consisting of feldspar or gypsum, to fuse and bind the whole together. According to Prof. Charles F. Chandler, the ingredients used in 1863 in the manufacture of hard porcelain at the Royal Porcelain Works in Berlin were: Kaolin, 28 parts; quartz, 66.6; ferrous oxide, 0.7; magnesia, 0.6; and lime, 0.3.

The proportions of the ingredients used vary with every potter and are naturally a secret known only to the principal foreman or superintendent. So jealously is this knowledge guarded that in some potteries the amount of an ingredient required is not entrusted to any workman, but the scales used indicate automatically when enough of each ingredient has been deposited.

After this mixture the mass is again ground into an impalpable powder, freed from any particles of iron or other foreign substances by screening, and passes to the pug mills or blungers, where it is mixed with water and worked thoroughly by many knives attached to a revolving shaft so as to form a uniform cream like mass called "slip." This slip may then be passed through wire cloth or fine silken lawn to remove all the coarser particles, and falls into the "agitators," tanks provided with paddle wheels to keep the clay, held in suspension by the water, from being deposited at the bottom. From these tanks the clay in suspension is forced into the press, consisting of canvas lined pens or boxes. The water is forced through the canvas by means of compressed air, and the clay then removed in

large cakes, ready to be formed, or to go again to the pug mill for further tempering.

The number of processes through which clay has to pass before being ready for shaping differs with the quality of the clay and the use to which it is to be put. That intended for the manufacture of the highest grades of pottery passes, naturally, through the greatest number of processes.

The slip was formerly either heated for the removal of the superfluous water by evaporation, or passed over beds of plaster of Paris, by which the water was absorbed, but this drying is now accomplished by means of the filter pans.

Before shaping, the moist mass is slapped, kneaded, and trodden, to make it uniform. Formerly it was put away in damp cellars to undergo a sort of decay or fermentation to make it more plastic.

It is in these purely mechanical operations that the greatest attention is required, as the quality of the ware depends on the knowledge and care exercised in the mixing room; and it is here that the skill and ingenuity of American mechanical experts have made the greatest improvements in the manufacture.

A New Jersey establishment now makes a complete slip in one machine, which comprises one double blunger, one double sifter, one agitator, one filter press, and one slip pump. The different ingredients are thrown through a hopper into the blunger, which is filled with the proper amount of water from a pipe entering at the top. When the ingredients have become mixed with water in the proper proportion, generally about 22 to 28 ounces to the pint, the valve on the pipe leading to the sifter is opened, and the liquid clay or slip allowed to run through the sifter, which removes all the coarse foreign ingredients. The slip then passes into the agitator, which keeps it constantly in motion, thus preventing the clay from settling to the bottom. It is then pumped from the agitator into the filter press until the water ceases to flow from the press, making it evident that the press is full, or "pumped up," and ready to empty. With a few turns of the handwheel, the press can be opened, and the cakes of clay removed, ready for use. This machine, made for the special purpose of testing clays, or the manufacture of special bodies, is ordinarily too small for a large plant, but the separate parts are made of such size as to be suitable for any works.

The pugging machines accomplish in one hour work that would ordinarily require one man's labor for two days. Abroad this process is still entirely done by the hand blunger, a peculiarly shaped shovel. Thus machinery of American manufacture is gradually taking the place of hand labor, and doing the work more satisfactorily.

*Forming.*—The shaping of the object is accomplished by means of either a potter's wheel or molds. The potter's wheel is thus described by Wagner in his "Chem-

ical Technology:" "The potter's wheel consists of a vertical iron axis on which is a horizontal disk, which is made to revolve by the feet of the operator on a lower disk, or by steam. A lump of the plastic mass is placed upon the wheel, the thumb being placed in the center of the lump and pressed downward; a hollow is thus formed which is widened or the walls continued vertically according to the shape of the vessel to be made. The constant revolution of the wheel easily allows the molder to obtain a perfectly cylindrical form. By thus humoring the clay, elongating the vessel, again depressing it, widening it, and by continued manipulations in this manner, the most exquisite shapes are produced. To form the ridges or sharp edges of the vessel, a small piece of iron, a strip of horn, or wood, termed "a bridge," is used. The perfectly formed vessel is cut away from the wheel by a piece of brass wire."

For centuries this process has remained essentially unchanged. Modifications have been adopted in recent times. Thus either steam or electricity has almost entirely superseded foot power. The tools, however, remain the same, and consist of pieces of smooth wood.

Molded ware involves the use of molds, which are usually made in the pottery itself. From the clay model of the article, e. g., a pitcher, a "block mold" in two exactly fitting portions is made of plaster of Paris. From this a plaster replica of the model is made, and from this replica in turn as many working molds as may be required. Modeling and mold making demand not only knowledge, skill, and time, but foresight and experience, as the workman must allow for shrinkage in firing, which averages one-seventh of the size, and guard against the use of forms that will warp or sink in the fire. Besides the molds used in casting, it is necessary to make various articles, such as rings and stands, to hold the forms in shape while they are being fired.

For the making of a molded article, the slip is thinned with water until it attains the consistency of thick cream. This liquid is poured into the mold, and allowed to stand until, through the absorption of water by the plaster of Paris, the mold becomes lined with a firm layer of the paste of the desired thickness. The central mass, still fluid, is poured out, and the solid layer allowed to stand until sufficiently firm, when the mold is opened and the object taken out. Handles, tops of vases, stands, and bases are all modeled and cast separately, so that to complete one piece of ware frequently requires four or five molds. The texture of drapery is imitated by means of a piece of tulle which is imbedded in the surface of the mass and burned off in firing. When all the parts have been combined, and the article carefully finished with tools, it is allowed to dry.

*Firing.*—The "green ware," as the dried objects are called, next passes to the firing process, and in order to

protect the objects from ashes and smoke they are placed in fire clay boxes called "saggers," in which they rest on sand or flint, different shapes requiring beds of one or the other of these materials. A strip or "wad" of moist clay is then laid around the edge of the sagger, and it is placed in the kiln close to the side. Another sagger is set on the first, and so on to the crown of the kiln, each of these upright tiers being called a "bung." The wads serve not only to protect the ware from the fumes and smoke, but also to steady the bung. When the kiln is full, the door is bricked up and plastered over with clay and the fire started. Heat is applied gradually at first, but is finally brought to a strong red. The length of time required for a biscuit firing varies from twenty-four to one hundred hours, according to the body and composition of the ware. This temperature is maintained for the allotted time, and then the kiln is opened. After being allowed to cool gradually for several days, the saggers are removed and the ware taken out. The fuel used is believed to have an influence upon the ware, and in some cases, especially in certain art wares, as will be shown hereafter, gaseous fuel is preferred to wood or coal.

The kiln itself is generally a conically shaped structure of brick lined with fire brick, about 16 feet in diameter outside and about the same height to the crown. Above the crown or ceiling the walls narrow as they go upward. The brick walls of the kiln are bound by heavy iron hoops or girdles to give greater strength. Around the base at equal distances are the fire holes, some eight or more in number, communicating with the interior by openings above and below.

*Glazing.*—The biscuit, as the pottery is called after passing through the first firing, is carefully examined in order to remove any defective pieces and is then rubbed with sandstone, polished with sandpaper, and brushed until it is perfectly smooth and absolutely free from dust. It is then ready for the glaze. Frequently, especially in many of the varieties of American faience that will be referred to hereafter, the decoration is now applied, consisting usually of mineral pigments. After decoration, the biscuit is subjected to a preliminary firing at a red heat, which is called "hardening." The glaze, or glass forming compound, is prepared with great care. Certain properties are essential. For instance, as in the case of porcelain, it must resemble the ware as nearly as possible, except that it must be more fusible. The composition must be similar to that of the body of the ware to prevent cracking and chipping. The ingredients, the proportions of which are obviously secret, are assembled and melted together, forming a "frit," which is then ground into a fine powder and mixed with certain other necessary ingredients. This mixture is again ground with water until the mass has the consistency of a heavy creamy liquid, into which the

article is dipped, care being taken to distribute the coating evenly and to avoid an excess. The part held by the hand is coated by means of a brush. The object is then set on a rack to dry, being carefully guarded from dust and foreign substances.

*Firing of the biscuit ware.*—When thoroughly dry, the objects are fired for a second time in the glaze or glaze kiln. Here again great care has to be exercised. As before, the articles are placed in saggars, but each sagger must be washed with a special glaze, and the articles must be so arranged that they will touch neither each other nor the sides of the saggars. Flat pieces are set on fire clay pins, and stilts are used to enable the fire to reach the bottom of the object. The arrangement in "bungs" is the same as in the firing of the green ware, and the degree of heat required is gauged by means of small clay rings called "trials" inserted through little openings made for that purpose in the kiln walls. Through other small openings called "spy holes" the interior of the kiln may be seen and the condition of the firing determined by the potter. In time the heat is lowered, and after the kiln has cooled the saggars are opened and the fired product removed. These articles are again critically examined for defects and only those that are perfect offered for sale. In some potteries such articles as are only slightly injured are sold as seconds.

In cases where overglaze decoration is applied the ware is again fired.

#### CLASSIFICATION.

The classification of pottery is not easy, but it is possible at the outset to make two very complete divisions—namely, "unglazed" or "simple" pottery, and "glazed" or "composite" pottery. Each of these divisions may again be divided into "opaque" and "translucent" pottery. In opaque varieties there are many very distinct differences. First, the color varies greatly; again, some are "soft," some "hard," and others "very hard," the latter forming the gradation between soft and translucent pottery. Differences in the temperature at which fired produce in some cases the differences in the varieties of pottery, so that pastes of the same composition may at varying degrees of heat offer the characteristics of all distinct varieties of ware. All translucent varieties have some common characteristics. They are always very hard and generally perfectly white.

Brogniart,<sup>1</sup> the great French authority, classifies pottery and porcelain according to the characteristics derived from the paste or body, and also according to the properties derived from the glaze. This classification is essentially as follows:

1. Porcelain, white semitransparent, only fused at a high temperature.

(a) Hard porcelain: Natural kaolin covered with a feldspar glaze; example, porcelain of China and Japan.

(b) Soft porcelain: Artificial paste covered with a lead vitreous glaze; example, early Sèvres porcelain.

2. Stoneware, very hard and infusible.

(a) Very siliceous clay covered with a lead vitreous glaze; example, old gray Flemish ware.

(b) Siliceous clay covered with a salt glaze; example, ordinary stoneware jugs or crocks.

3. Soft pottery or earthenware, easily fusible.

(a) Biscuit: Simple baked clay, porous and without glaze; example, common flowerpots.

(b) Glassy: Fine clay covered with an almost imperceptible vitreous glaze; example, early Greek vases.

(c) Glazed: Clay covered with a perceptible coating of glass; example, common white earthenware plates.

(d) Enameled: Clay covered with a vitreous coating made opaque by white oxide of tin; example, Italian majolica.

Each of the varieties of pottery just mentioned is divided into many subvarieties, all of which gradually merge one into the other. The addition of a little more of one ingredient and a little less of another in the composition of the paste has brought about such a condition in the classification that frequently a name given to a variety of pottery is either entirely a misnomer or else a mere trade name.

Nevertheless an effort will be made to describe the various art products under the three principal headings previously designated.

*Porcelain.*—It is of interest to recall that from 1825 to 1838 Tucker's pottery in Philadelphia successfully produced true porcelain of such excellent quality that it compared "favorably with the best French china," to which it was further pronounced "superior in whiteness and gilding."<sup>2</sup> In 1848 there was established in Greenpoint, N. Y., now a part of New York city, the Cartlidge Porcelain Works, which continued to exist until 1856, and produced a number of portrait busts in biscuit porcelain. The heads of Daniel Webster and Zachary Taylor were among the best of these.<sup>3</sup> From 1880 to 1890 there existed in New Orleans a pottery that made true porcelain from materials imported from France, and employed French workmen, but all traces of this ware have since disappeared except the few specimens now in the hands of collectors.

The only pottery in the United States now making true hard porcelain in considerable quantities is in New York city. In this pottery greater progress has

<sup>2</sup> A brief account of this pottery is given by Thomas Tucker, a surviving owner, in Reports and Awards, International Exposition, 1876, III, page 13. More complete, however, is the description by Dr. E. A. Barber, in his valuable work on "Pottery and Porcelain of the United States."

<sup>3</sup> See Historical Sketch of the Greenpoint, N. Y., Porcelain Works of Charles Cartlidge & Co., by E. A. Barber, Indianapolis, 1895. (Pamphlet reprint from the Clay Worker.)

been made in the use of machinery than perhaps in any other in the United States. One of the improvements introduced is the making of an oval dish by machinery, accomplished by applying the eccentric principle to the potter's wheel. The output is chiefly commercial ware, including the lighter grades of hotel china. It is found that such articles made of porcelain are much more durable than the cheaper variety, having less tendency to chip or crack, and the product is much in demand in high grade restaurants and hotels.

Although no attempt has been made by this pottery to place art ware on the market, some beautiful objects have been produced. A "poet's pitcher," designed by Karl Muller, is an exceedingly artistic piece of workmanship. It is of graceful form and embellished with relief portraits of Homer, Virgil, Milton, Ossian, Shakespeare, and Dante. A finely modeled "liberty cup" with embossed figures of Mercury and Justice, surrounded by the corn plant of the North and the tobacco plant of the South, with handle representing the Goddess of Liberty standing on an eagle with outspread wings, is also worthy of mention. Several reproductions of famous pieces of statuary, and some interesting busts of prominent Americans have been made.

This pottery was the first in the United States to apply to hard porcelain the underglaze method of decoration, although this was not practiced to a great extent, and the overglaze method is now usually employed. Much of this ware is white, but a tea service in Japanese style shown at the Centennial in 1876 was commented on by the jury as showing "colors reproduced with some success." Another product in colors is a vase adapted from the American pitcher plant.

An art ware of true porcelain has recently been made in Syracuse, N. Y. The body of the ware is a pure hard porcelain consisting exclusively of kaolin, feldspar, and quartz, all of which are obtained from deposits in the United States. The kaolin comes from Florida and Georgia, the feldspar from Pennsylvania, and the quartz from Maryland. At first a kaolin imported from England was used, but a satisfactory native clay was soon found and is now solely employed. The temperature at which both the body and the glazes are fired is about 2,400° F. An important feature of this firing is that it is accomplished in a closed muffle and with kerosene as fuel, which process represents an entirely new departure in the making of hard porcelain and in the developing of "grand feu" glazes. At the famous porcelain potteries in Sèvres, Berlin, Copenhagen, and elsewhere in Europe, and also in China, where the ox blood, peachblow, and celadon glazes are developed, wood is the fuel used. As opaque or semi-opaque flowing glaze is used, making it impossible to paint under it, the decorations are restricted to carved, incised, or raised designs. Many of the pieces are simple shapes covered with a fine glaze, and in such

cases the color is the only decoration. Indeed at the high temperature fired, the range of color effects is so extensive that they themselves constitute the best decoration. The glazes employed at this pottery yield both mat and crystalline effects, which are developed in a strictly oxidizing atmosphere and for which the particular fuel used seems to yield the best results.

In 1905 there was located at Newark, N. J., an art pottery, the management of which had previously been connected with the production of the Lonhuda art pottery in Steubenville, Ohio. Having in mind the growing appreciation of the older oriental pottery which relies upon the beauty and charm of its glaze and color for its effectiveness, the trend of modern art potters is in the direction of reproducing these effects, especially those obtained by Chinese and Japanese potters with crystallized glazes by the art of the fire (art du feu). Accordingly a ware was produced which was given the name of "Crystal Patina." It consists of a close dense white body, resembling true porcelain coated with a crystalline glaze suggesting the patina on bronze; hence its name. According to the manufacturer:

The first Crystal Patina was in one coloring, a pale green so closely resembling the green oxidation of bronze that the name "Crystal Patina" was thereby suggested. Later a greater variety of colors has been obtained in overflow and running blended effects, the varied beauty of which is the development of the "art of the fire;" consequently there is an ever changing and variable beauty, imparting thereby, individuality to each piece. The soft tones of Crystal Patina harmonize with most color schemes and furnishings of modern homes. The forms are mostly adaptations from the best oriental wares, designed with a view to their use, proportion, and grace.

This pottery also makes a "Robin's-egg Blue Ware" which has the same dense white body as the Crystal Patina, but is coated with a mat glaze. The color of the glaze is indicated by the name of the ware. A third variety of art ware is made at this pottery, to which the name of "Clifton Indian Ware" is given. It consists of a red earthenware body that is fired close and hard and decorated with Indian designs. It has a jet-black glaze inside of the object. The special features of this ware are the forms and decorations. The forms are entirely taken from original pieces made by native American Indians, so that they are exact reproductions of the aboriginal pottery of this country. The decoration simulates Indian patterns, but is not always exact; that is, it is frequently an adaptation. The red clay used for the body of this ware is from New Jersey, while the white clays used in the Crystal Patina and Robin's-egg Blue Ware are mixtures of foreign and native clays.

*Stoneware.*—The wares included under this heading are characterized by a dense mass. They are hard, not scratched by a knife, sonorous, fine grained, homogeneous, showing incipient fusion, scarcely translucent on the edges, and may be white or colored. Stoneware

is not well fitted for the production of art wares except in a very few instances. A so-called "Flemish ware" of a silver-gray body with decorations embossed and in dark blue is now made in this country. Beer mugs, tankards, wine jugs, decorated canteens, and umbrella stands are among the articles produced, all closely resembling the old Flemish grès. This ware, however, differs from the ordinary stoneware in that the body is of finer texture and the finish more artistic.

At Haddonfield, N. J., is the only pottery in the United States where artistic stoneware with salt glaze is made. American clays, mostly from New Jersey, are used, and the glaze is obtained by adding salt to the kiln both from the top and the bottom, which, vaporizing, forms the glaze by combining with the clay body at a high temperature. The products are limited, however, to jardinières and beer mugs in imitation of the old Flemish ware.

*Earthenware.*—Earthenware consists of an earthy mass or body with open texture, and is porous, medium hard, and only slightly sonorous. Under this class come most of the American art wares, since they consist essentially of earthenware bodies coated with glazes, usually opaque, which constitutes them a faience ware. As has already been shown, it is not easy to classify these wares correctly, for the reason that the composition of the body is not only a secret, but varies with different potters, and at different times with the same potter. By increasing the proportion of certain ingredients and firing at a high temperature, a ware almost equivalent to stoneware is obtained; while, on the other hand, the composition of the mass may be so diluted as to resemble common earthenware.

It is said that the only crackleware produced outside of the Orient is made by a pottery located at Dedham, Mass. At present two kilns are operated and only two chief varieties of pottery are produced. Both have a gray body, resembling true porcelain, and are fired at a high temperature. To one of these is applied the colored glazes discovered by the proprietor, some of which possess a great depth and brilliancy, while others have an exquisite softness of color. Both varieties of coloring are the result of the intense heat of from 2,000° to 2,500° F., at which they are fired. These glazes are all dark colored, and range through various shades of red, green, and olive. The other product of this pottery is the gray crackleware, similar to that just described, except in color, and usually decorated in blue. This ware is characterized by a crackle comparable to that of the best Chinese and Japanese potteries.

In 1887 a plant was established in Boston for the manufacture of tiles, and five years later the use of plastic molds for the production of these tiles was introduced. The proprietor, who has been most active in the development of this ware, early came under the influence of the modern French grès, and began experiments that have resulted in the production of the full

or lusterless surfaces that are so well known. The results of his investigations were applied to architectural decorations, to garden pottery, such as jardinières and lanterns, and especially to art pottery. The latter is a hard, dense ware, fired at great heat, and possesses as its characteristic quality an enamel of great delicacy and softness. All this ware is modeled by hand, and the motives of the designs are taken from common forms in plant life, such as the mullein leaf, slender marsh grasses, the lotus or the tulip, which are treated in a conventional way. The product is further enriched by decoration in low relief, done while the clay is still in a plastic state. The designs are drawn and incised or modeled upon the surface, after the form or profile of the vase has been fixed by the potter. The colors are greens, pinks, and yellows. A special claim for recognition comes from the fact that this ware is made exclusively from American clays, coming from deposits in New Jersey and at Marthas Vineyard.

A pottery was established at Keene, N. H., in 1871 and now operates two kilns. Originally the output consisted of flowerpots decorated in colors by hand and then glazed, forming a majolica ware. Later the semiporcelain body was introduced, possessing a light dull finish or tone resembling the Royal Worcester ware, so highly regarded some years ago. A number of specialties were made of this ware, notably the "Longfellow jug" and the "witch jug," sold in Salem, Mass., as a souvenir. The success of these souvenirs for tourists led to the making of a large line of such articles, especially with colored glazes, such as blue, mahogany, and a "Hampshire" olive green, all of which were characterized by an effect resembling graining, produced in the firing. These souvenirs had an extended vogue, especially those having on the ware the name of the locality or resort in gilt, and successfully competed with the cheaper products of foreign potteries. Possibly an important element in the success of these wares was the satisfactory shapes employed, nearly all of which were modernized forms derived from early Greek and Egyptian models.

The latest successes of this pottery have been with the dull mat effects now so prevalent. The body, originally an earthenware, has in recent years gradually approached the composition of semiporcelain, and consequently requires a higher temperature in firing. Foreign clays, especially English ball clays, are used, although for some varieties of ware domestic clays from New Jersey and southern Florida are used. The colors employed are greens, blues, browns, and yellows. Many of the greens have a soft, warm, velvety surface, heightened by a lace like effect, the result of the high temperature in firing, which apparently produces minute white crystals. A crackle effect is also produced by a peculiar treatment during the firing. A characteristic feature of the Hampshire ware is the bright glazing inside the vessel, due to the fact that the ware

is designed for practical employment and not exclusively for decoration or ornament.

In 1902 a pottery was established in Colorado in which, from the first, the efforts of the potter were directed toward obtaining a glaze of dull finish, and his experiments in this direction were successful. The ware is a product of hard fire, and the high temperature obtained gives to the dead glaze a texture and quality seldom found except among the older Chinese wares. The glaze ranges from a dead finish to a dull gloss. Yellows, browns, greens, blues, pinks, grays, and blacks, in many shades and varieties of effects, represent the wide extent of color. Flowers, and human and animal forms, are used in decoration, always for the purpose of adding to the charm of the original line of the object, and never merely for the sake of decoration.

An art ware made in Terracotta, Ill., is the result of many years experimenting by the president of the establishment. Originally, it consisted of a porcelain like body with a crystalline glaze, but this variety is no longer produced. The present ware has a hard body approaching stoneware, evidently fired at a high temperature, with a mat glaze characterized by a velvety finish without gloss, and a soft moss green crystalline color. Green is the only color in which the ware is produced, and no painted decoration is used. The richness of the color scheme, and the simplicity and grace of the designs selected, merit the approbation of the connoisseur. The forms are largely derived from nature, particularly from aquatic plants cultivated in the vicinity of the pottery to afford motives to the designers. Naturally the mechanical treatment depends upon the design, so that certain pieces are thrown upon the wheel while others are molded. The clay that constitutes the body of the ware comes almost entirely from Brazil, Indiana.

After an absence of a quarter of a century, there has recently returned to Cincinnati a gentleman whose experiments, about 1880, resulted in the production of some valuable glazes, which he applied to certain varieties of earthenware. Resuming the making of art pottery, he has been successful in producing a ware characterized by a colored mat glaze over relief work, chiefly in dark shades of green. Specimens of his work showing a splashed effect of green, dark blue, or black are noteworthy. This establishment also makes garden pottery of antique forms in old ivory shades.

The oldest, and likewise the first, of American potteries to devote exclusive attention to the manufacture of an art ware is also in Cincinnati—the first not only because it is the oldest, but also because it is at this pottery that there has been produced an original ware, the beauty of which has been conceded by the leading connoisseurs of the world. Made by Americans from American clays, the ware stands preeminent as the first distinctively American art pottery. In

December, 1905, the pottery celebrated the twenty-fifth anniversary of its founding. Its existence has been brief, yet very significant to the development of art pottery in this country.

In 1875 an interest in ceramic matters was aroused in a number of the young women of Cincinnati, which found its first conspicuous expression in some decorated cups and saucers sold at a Centennial Tea Party held a year later for the benefit of the Mount Vernon Ladies' Association. From this beginning grew the Pottery Club, of which Miss M. Louise McLaughlin and Miss Laura A. Fry were original members, both of whom now receive the homage of worthy recognition of what they have done for the development of American art pottery. Contemporaneous with this movement, and its enthusiastic supporter, was Mrs. Maria Longworth Storer, who, however, worked independently, and built a pottery of her own, where she hoped to produce from "our native clay a new pottery, original and different from all others, by applying color decoration on the material itself before firing, and then to protect and enrich this with appropriate glazes."

It is not necessary to follow the history of this pottery in detail, although it may be mentioned that in 1889 the works became self-supporting, and Mrs. Storer transferred her interest to a company under the control of a gentleman associated with her since 1883. The clays in use for all purposes are entirely American. Originally they came from the Ohio valley, but subsequently other clays were found more satisfactory. At present much of the clay used in the making of the body is mined in Missouri. At first the clays inclined the color toward yellows, browns, and reds. The decorative medium lent itself to a rather luxuriant style of ornament in arrangements of warm color, in all of which the transparent glazes merge in mellow tones. With time came the production of deep greens and blues, and then more recently the exquisite mat glazes. As the body is principally of clay, the ware may be classed primarily as an earthenware; and as it is glazed, it may be further considered as a faience.

By a happy combination of artistic, scientific, and commercial elements there has been a constant improvement in the varieties of wares produced at this pottery. The earliest and best known of these varieties is the so-called "Standard," especially characterized by its low tones, usually yellow, red, and brown in color, with flower decorations painted in warm colors under a brilliant glaze. From a comparatively light and golden color the arrangement varies to red, brown, and green combinations in subdued tones. Closely related to these are the remarkable glaze effects first produced in 1884, and a series of solid color pieces. Another variety is characterized by a limpid, opalescent, sea-green effect, on which a favorite decoration is a fish moving under water. In floral designs under this

glaze blues, yellows, and sometimes reds are used. Combinations of blues and greens relieved by touches of golden yellow, red, and other warm colors mark this style.

A beautiful class of effects, extending over a considerable range of color, is also based upon a warm gray tone. The methods of preparation are the same as for the "Standard" ware, with such modifications as come from the light body decorated with grays, pinks, soft blues, greens, and yellows. The lighter color scheme, the more delicate body, and the white over a delicate decoration produce a softness that is almost suggestive of porcelain.

The "mat glaze" varieties were the next development, and these are characterized by the absence of a glossy surface. The elements of the glazes are built up so as to yield in the fire not only those effects which can previously be determined, but also those unexpected variations which appear at a very high temperature. The result is a delightful play of color, which gives individuality to every piece, even though otherwise undecorated. Above all, however, and in distinction from other types, is the beauty of texture in the substance of the glaze. These varieties include mat glaze painting, on which the decorations painted in rich reds, yellows, blues, and greens are suggestive of flowing enamels, but with a mat texture. The conventional mat glaze is a mat glaze with flat conventional decoration in colors. The incised mat glaze and modeled mat glaze wares take their names from the decoration, which is incised or modeled, according to the variety, and in single colors or in combinations.

The vellum ware, first exhibited at the World's Fair in St. Louis in 1904, is the latest product of this pottery. It is devoid of luster, though without dryness, and presents the qualities of old parchment. To the eye the texture is softer and closer than in other mat glazes, and to the touch it has a fineness and a solidity suggestive of an ivory without high polish. In some specimens of this ware the decoration is painted, in some modeled, and in some both painted and modeled. The glaze lends itself equally well to all three treatments. The success of these mat wares has led to a demand for faience panels, flat and in relief, in all the combinations in which the architect or the decorator may use such effects of color as are possible in this glaze. The manufacture of complete mantels, mantel facings, wall panels, drinking fountains, and architectural reliefs for interior decoration of public or private buildings has been taken up. The use of modeling, combined with color under a mat glaze, makes it possible to secure an endless variety of effects in these different kinds of architectural ornaments.

In Zanesville, Ohio, there are several potteries where art wares are made. It may be said in this connection that not long after the success of the brown faience wares had been achieved there was established in

Stuebenville, Ohio, a pottery at which a somewhat similar ware was made. After a few years the production of this ware was discontinued and one of the members of the firm who was credited with the best knowledge of the potter's art established himself in Zanesville, where the production of the brown faience wares was continued.

Another potter of Zanesville began the manufacture of art wares about the year 1896. For his bodies he used American clays almost entirely, and especially a clay found in the immediate vicinity of his pottery. However, clays from Georgia, Pennsylvania, Tennessee, and West Virginia, are also employed. The products are chiefly of earthenware bodies, covered with a colored glaze, thus placing them in the class of faience wares. Several varieties of ware are produced. The owner states that over twenty different styles of ware have been originated in his pottery. The earliest of these is characterized by a high glaze, generally in red or brown colors. It is usually decorated by hand with flower and fruit designs or portraits, frequently of Indians, while the background colors are sprayed on with an atomizer. Upon some of this ware the background colors are applied by means of a brush instead of an atomizer. It is attractive in appearance and comes in cream, red, and yellow colors, with hand decoration, usually of fruits and flowers.

Another variety of wares are of light body and have the background colors blended on with an atomizer. Pale and delicate blue, gray, and green color effects are its characteristics. The decorations are of flowers, fruits, and human figures. Sometimes the last mentioned are in relief, affording a pleasing effect.

The most interesting product, however, is an art ware with a remarkable metallic luster. A description of it follows: "The vases are first treated all over with a secret metallic preparation and then decorated in floral and other art effects with chemically prepared metallic pigments, which when fired at a great heat (by natural gas instead of coal) are transformed into the most beautiful metallic lusters, the light and shade of which make the most perfect color schemes and which are absolutely permanent."

The latest products from this pottery have been mat wares. These have a dull, mat finish and are turned out both decorated and undecorated. The decoration is applied on the biscuit ware instead of on the unfired wares, and striking results have recently been obtained by incised designs, especially in greens. For example, a fish in outline under the glaze appears to be swimming in a green sea. The ceramic art wares of this pottery are of high character and deserve commendation.

Still another Zanesville pottery, conspicuous in the manufacture of art ware, was established in 1892. For these wares American clays are chiefly used for the body, although some English china clay is used. The body is faience earthenware with a colored glaze.

This pottery produces a ware with a splendid red colored glaze, like the famous rich red of the Chinese, known as "ox blood," which has long been sought after by western potters, and was first produced satisfactorily in this country by Robertson, of Chelsea, Mass., whose results, while wonderfully successful, were so costly that it was impossible for him to secure a price for his products that was commensurate with their cost.

In 1885 a pottery was established in Roseville, Ohio, where the making of flowerpots was carried on in a modest way. In 1891 it moved to Zanesville, where the production of majolica flowerpots was begun, and since then the development of its wares has been rapid. It now possesses a large plant, and has probably produced more varieties of art ware than any other American pottery. The articles made are jardinières, flowerpots, and pedestals, umbrella stands, fern dishes, tobacco boxes, and many fancy novelties. American clays are used, chiefly those from Ohio and Tennessee. All the wares have an earthen body and vary according to their special treatment during the manufacture. One of the earliest successes was ware characterized by a brown shaded glaze, beneath which is the decoration, consisting of heads of American Indians, of animals, such as horses, dogs, and kittens, and sometimes of flowers. This ware has an individuality of its own, but may be classed with other wares already mentioned, and like them is also produced in light shades of blue, pink, and brown, due to the tints imparted to the glazes used.

An interesting product is a ware characterized by soft tints in blue, green, and brown, with an overglaze, free-hand decoration on a mat finish. The designs are chiefly flowers and fruits. This pottery also makes a faience on which the designs are cut while the clay is still moist and the incisions filled with plastic decorations in color. This ware resembles the famous Faience d'Oiron made in France between the years 1524 and 1537, and of which only fifty-three pieces are known to exist. The very intricate patterns of this old ware were suggested principally by the highly ornate book covers of that period, and many of them bore the royal chiffre of the French monarch. A variety of other ware that reflects credit on the pottery industry is made at this establishment.

A little more than a decade ago there was established in New Orleans, La., a pottery which is a development of the art department of a college located in that city. The body of its ware is made of clay taken from the Bayou Tchulakabaufa, in Mississippi, and is coated with a glaze having frequently a metallic luster, showing flowing effects. The subjects of the designs are found in the indigenous products of the South in general and Louisiana in particular.

The ware may be described as faience with an opaque decorative glaze.

The ware produced at a pottery in Westhampton, N. Y., belongs to the class of earthenwares known as faience. The body is made from deposits of clay found in the vicinity. The special characteristic is described by the inventor under the term "fire painting," an expression which he employs because of the peculiar methods used by him in firing the glazes on the earthenware body so as "to match and retain the prismatic hues of the spectrum with a true rainbow iridescence." He asserts that the surface finish and the color schemes are controlled by the method that he has invented. He has also achieved considerable success in the production of a ware in which pure gold leaf lies embedded between layers of glaze, giving brilliancy to the coloring employed. The objects produced are molded by hand, and no decoration is attempted other than that accomplished by "fire painting."

With the view of exploiting the abundant mineral resources of California, and also of developing the clay industries of that state, a pottery was recently established in San Francisco in which the clay, kaolin, feldspar, quartz, and other materials used come exclusively from that state. The ware is a faience, with soft glazes in various shades of green, buff, dull blues, and warm grays. Of special interest is a red in the biscuit, made from a very delicate clay obtained in Monterey county. The pieces are fired only once, and often decorated with white slip in engobe style. This red ware is produced in different shades, according to the degree of heat at which it is fired, and has a very beautiful satiny finish, the slip firing a very white mat. The decoration, which is simple and original, frequently consists of animal forms, such as lizards, frogs, horned toads, and birds, as well as of flowers, all of California species. The mushroom decoration is particularly effective in the biscuit on a pale pink body, the modeled part being in white, deep pink, and brown. Only clays are used, and no mineral colors. The shapes are all thrown on the wheel.

Located at Detroit, Mich., is a pottery which after several years of experimenting has succeeded in producing a body with strong plastic qualities when unfired, and with a tenacious structure when fired. Its fracture is very similar to porcelain, so that it can be classed as neither earthenware nor porcelain. This ware is fired in an open muffle kiln, without sagger, and with kerosene oil as a fuel. It is a product of high temperature, which suggests its close relationship to wares previously mentioned. While the composition of the body is secret, it is admitted, in a general way, that American clays, chiefly from Florida, Michigan, North Carolina, and Virginia, are used, as well as some

imported clays from England. The body thus obtained will accept both bright and dull glazes, although the latter have been employed to the greater extent. The mat glaze was originally used, but more recently the ivory and brown colorings, together with some soft gray and blue glazes, have more often characterized the product. All the shapes are thrown by hand, and modeled decoration is applied when the objects are in a plastic state. The coloring material is in the glaze, which is applied from two to four times, in order to give good depth and pleasing texture. Some of the most interesting effects are produced by the application of various colors, each one being fired separately. The decoration, especially in the earlier products, simulated leaf forms in two tones of monochrome.

The product of an art pottery at East Liverpool, Ohio, is a faience, with a mat glaze, the peculiarity of which is the production of different tones or shades, or even of colors, on the same piece, thus avoiding the monotony of color of the usual mat glazes, which by this pottery are not considered true to nature, where, as on a green leaf, all shades and tones of that color appear. This result has been obtained by a radical departure from precedent in the manipulation of the coloring oxides. The proprietor has been successful with greens, blues, yellows, oranges, pinks, crimsons, and black, and hopes to add reds to the list. By a little variation in the composition of the glazes he finds it possible to get the same results on bodies made of common Ohio yellow ware clay, or New Jersey marl, or on an earthenware body similar to that used for making tableware. It is the purpose of this pottery to produce articles of everyday use rather than merely ornamental pieces. For example, if a vase is to be made, a primary consideration in determining the shape is the flower it is intended to hold.

A faience ware that has attracted considerable interest is made in Biloxi, Miss. All the products are thrown on the wheel, and in consequence no two are made exactly alike. They possess the unique feature of being exceedingly thin, almost equal in this respect to some specimens of Trenton Belleek. The metallic glazes are excellent. Among the specialties are various vegetable shapes.

*Miscellaneous.*—Under this heading are grouped descriptions of certain art and other wares made at potteries whose chief output is objects of use and service. To the proprietor of a pottery established in Trenton, N. J., in 1889, great credit is due for his perseverance in producing a high grade of art china. This establishment has acquired a special reputation for its Belleek and bone china ware. Belleek ware, which takes its name from Belleek, County Fermanagh, Ireland, where it was successfully made as early as 1863, is thin, glazed porcelain, rivaling in translucency the "egg shell" of the Far East, and possessing a pearly luster said to be

produced by solutions of metal washed over the glaze and subsequently fired. It is obvious that this extremely thin ware could not be thrown on the wheel or made in a dry mold, but is molded by the process heretofore described. Much of it is decorated, and both overglaze and underglaze processes are employed. Belleek ware was the chief product of this pottery until about 1904, when it began to turn out a fine grade of bone china, sometimes called English artificial porcelain, which consists largely of bone ash in combination with kaolin and feldspar. In perfecting the manufacture of this ware the same persistency was shown that gained for this pottery's Belleek a reputation second to none. A specialty was formerly made of college steins or beer mugs decorated with baseball and other sport designs, and frequently with college seals. Notable among these products was a series in monochrome blue that was exceedingly rich in coloring. More recently very attractive results have been obtained by painting designs on the blue underglazed ware with metallic silver and then firing. Subsequently the silver paint receives an additional coating, which is then polished or engraved, showing the metal against a dark background. Similarly designs in gilt have been obtained by depositing a thin layer of gold on the silver by means of electroplating. These wares are produced with both a Belleek and a bone china body. It is interesting to note that this company uses largely clays of American mining, chiefly from Florida, mixed with English china clay. The feldspar that is used comes from Maine.

A Trenton corporation, whose principal business is the manufacture of sanitary plumbing and toilet and table wares and jardinières, claims it has developed the process of making bone china until commercial articles, such as tableware, can be produced in Trenton equal to the best English ware. This bone china is also made up into attractive furnishings for bathrooms, including such articles as cups and soap dishes, and designed to replace furnishings hitherto made extensively of nickel. At these works, as in other potteries, there have been made from time to time special pieces of art ware that should not be overlooked. Among these are four large vases that were exhibited at the Louisiana Purchase Exposition in 1904; made of vitrified china—that is, with a dense nonabsorbent body, they stand three feet in height and rest on pedestals of similar material. The decorations are elaborate and handsome. On a background of mazarine blue, similar to bleu de roi of Sevres, are numerous hand-painted scenes and figures. The most interesting of the four vases is that decorated with views from the life of Washington, including, as the most conspicuous picture, his famous "Crossing of the Delaware," after the painting of Leutze.

In 1870 there was established in Trenton a pottery

that produces an excellent quality of semiporcelain table, toilet, and hotel ware, the last named somewhat heavier and therefore less liable to breakage than the usual tableware. This pottery makes a specialty of underglaze decoration and has created a style that is not so heavy as the English or so delicate as the French. By furnishing designs that are between these two extremes, a characteristic style has been developed that is both dainty and effective, as well as popular. The ware itself compares favorably in quality with the best English ware. Besides the commercial wares already mentioned, this establishment has produced some souvenir plates of notable events, including the bicentenary of Trinity Church, Philadelphia, in 1898; the sesquicentenary of the initiation of George Washington as a Mason, in 1902; and the William Penn and Benjamin Franklin plates of the Pennsylvania Society of New York city. The bulk of the clay used in this pottery is of American origin, coming chiefly from South Carolina and Florida. It is combined, for the body of the ware, with china clay from England.

Another pottery in Trenton makes an excellent quality of white earthenware and Belleek ware in addition to the regular commercial line of household crockery. While a fair proportion of the output is decorated, and some attractive specimens of Dresden decoration are produced, still most of its art pottery is sold undecorated to amateurs by whom it is claimed better results may be had with the American article than with the foreign, although the latter is usually cheaper. This company thus endeavors to produce the forms most desired by American decorators.

A high grade of "hotel ware"—that is, a hard vitrified china—is manufactured by a pottery established in Trenton in 1802. The decorations are chiefly from French and German designs. The product is furnished to such well-known hotels as the Manhattan in New York, the Jefferson in St. Louis, and the St. Charles in New Orleans. The process of manufacture involves an improvement that is worthy of mention. No stilts are used in firing, and hence the marks on the ware usually indicating their presence are absent. American clays, chiefly from Florida, are employed, combined with china clay from England.

A Baltimore, Md., pottery, established in 1846, deserves recognition as one of the oldest surviving potteries in the United States. The class of goods produced is mostly semiporcelain, C. C. or cream colored ware, made into commercial products, such as high-grade dinner and tea sets and toilet articles. Nevertheless, some art products worthy of mention are turned out. Domestic clays from Florida, Pennsylvania, and North Carolina are used in combination with the imported ball and china clays from England. Here was first produced, in 1851, the famous "Rebekah

at the Well" teapot, showing in relief the figure of a young woman with a water jar standing or resting at a well. It was made of Rockingham ware<sup>1</sup> and sold very extensively throughout the country. In recent years a "Brown Betty" or "Martha Washington" teapot, with silver ornamentations largely sold by jewelers, was also made. Some excellent specimens of majolica ware were produced in the early days, but the demand was slight and their production discontinued.

A line of beer mugs, tankards, and the like, with a vitrified cane-colored body resembling the Mettlac ware of Germany, frequently with designs in relief, are of more recent date. In this ware a mug decorated with the figure of the battle ship *Maine* was turned out during the Spanish-American War and had a large sale. A plaque showing a view of Pickett's charge at Gettysburg, with portraits of Meade and Lee and of Hancock and Longstreet, in an ornamental border, was produced in white ware with the design in blue. Also in the same ware was the McKinley jug or pitcher, popular during the campaign of 1896.

Another interesting product is an earthenware body on which a peculiar graining or flowing effect is produced by the blending of the colors of the glaze during firing. This ware is made in jardinières, pedestals, etc. The same articles of excellent quality have been produced in deep ultramarine blue and olive-green glazes. A variety of this ware with designs depicting Oriental life and painted with clays merits commendation as a distinctively art ware. At one time some interesting modeled pieces by James Priestman were made both in terra cotta and Parian. Some of these, representing animal heads, are as fine from an artistic as from a ceramic point of view.

The principal output of another pottery established in Baltimore in 1882 is semiporcelain ware, in which is made a large variety of clock cases, fern dishes, jardinières, umbrella stands, and other specialties. The clays used come chiefly from Florida and New Jersey, and are combined with ball clay imported from England, a Florida clay having been found quite as serviceable as the English china clay. Majolica ware, in great demand at one time, was the first product of this pottery. This was followed by different varieties, each of which was popular for a time. In the year 1885 a ware with a fine, thoroughly vitreous body of a grayish olive tint was first produced. It secured the following well deserved praise from Dr. William C. Prime: "No one who is interested in the art of pottery can fail to note this ware as marking an era in the history of American ceramics." During the same year there was made a series of modeled flowers, panels with heads in

<sup>1</sup> A yellow ware covered with a dark-brown glaze, usually mottled by spalling before it is fired. So called from the original ware made in 1796 at the Swinton works belonging to the Marquis of Rockingham.

relief, and medallions of Thorwoldsen's Seasons in Parian ware, that were highly praised. The Calvert vase, shown at the Columbian Exposition in Chicago in 1893, attracted much attention on account of both its excellent design and its exquisite finish. About that time a mat or a satin finish in solid colors, such as rich reds and dark olive greens, was introduced, and has more recently been used in combination with their earlier styles of decoration. A striking ware is that on which the decoration, beginning with a solid yellow color, passes into a vivid green, while on the yellow portion are shown Dutch scenes. This pottery has produced ware of increasing merit in quality, characterized by uncommon, yet pleasing shapes, by designs that were simple and unobtrusive, and by colors usually of subdued tints in light blues, greens, and reds. It would be greatly to the advantage of American art if all potters had done as much toward the improvement of the quality of their wares as has the owner of this pottery.

A pottery established in Wheeling, W. Va., in 1879 is one of the largest plants in the United States, having 19 kilns in active service. Its principal output consists of a full line of semiporcelain, mostly decorated, in table and utilitarian wares. A recent production of bone china resembles in many respects the best qualities of English manufacture. The early art wares produced here include some excellent decorated vases and pitchers with a beautiful mazarine blue glaze. At the time of the Spanish War a series of plates with pictures of the leading American war vessels was turned out, and also a red, white, and blue tobacco jar representing a miniature capstan, decorated with a portrait of Dewey and a picture of the *Olympia*. More recently this pottery has obtained the original block molds of the celebrated Greatbach pitcher, modeled by Daniel Greatbach in 1833 for the American Pottery Manufacturing Company, of Jersey City, and has placed on the market facsimiles with a green mat opaque glaze.

Another pottery, in Wheeling, was established in 1887, and is under the management of the skilled son of a veteran potter. American clays from Delaware, Florida, and North Carolina are used in making the body of the ware, although mixed with a certain amount of English ball clay which yields a semiporcelain tableware of unusual excellence that is decorated with decalcomanie from designs prepared for and owned exclusively by this pottery. Art ware is also produced in an extended line of specialties. The body is semiporcelain, with underglaze decoration of decalcomanie, finished in shading which gradually passes from a dark-brown tint to the most delicate ivory. A royal blue ware, with old mazarine blue glaze, made in vases and other articles is worthy of mention.

*Encaustic tile.*—The beginning of the making of tiles like that of brick dates back to prehistoric times. These ceramic products, used in building construction,

are found in Babylonian, Egyptian, Persian, and other ancient ruins. The only difference between the ancient brick and tile was one of shape. Tiles were thinner and broader, bricks thicker. The Mohammedans in the Middle Ages were the first to produce high art tiles. In western Europe, also, some tile floors of great beauty were laid during this period. The extensive use of decorative tiles for floors and walls, however, did not come in until the nineteenth century, about the middle of which the tile industry became an important one in England. Prior to 1876 the tiles used in the United States were almost entirely imported; but the exhibits of European manufactures at the Centennial led to a determination on the part of American potters to produce a tile equal to any, and at an exhibition held in Crewe, England, three years later, a gold medal was awarded to the American made low art tiles. From then until the present, progress in the development of a better grade of goods has been continuous.

For floor and wall tiles very hard clays are selected, and a combination with barite is found desirable. Chemical analysis is employed to determine the composition of the clays, and experience is always a potent factor in estimating their value. The clay is prepared the same as for the making of pottery, except that it goes to the shaper in the form of a dry powder. The design is cut with a metal die, and the tile struck under a screw press, either by hand or by steam power. Great pressure is exerted. The tile is then glazed and fired. Manipulation of the tile in the kiln produces important results. If the colored glaze be transparent and the tile have a modeled surface and be placed level, the result is a monochrome, the high lights and shadows of which are perfect. On the other hand, if the tile be canted it gives a result in lights and shadows that can not be foretold. Accidents or some freak of the fire produce marvelously beautiful effects which could not be obtained by design and often no efforts can reproduce.

The average kiln will hold twelve million pieces, and the firing is continued for three or four days at a temperature of 3,000° F. When the tiles are small and used to form a pattern, as in a mosaic, the individual pieces are laid out on a strip of wood or a rubber mat having indentations of proper dimensions, into each of which a tile is placed. When the pattern is completed, the pieces are attached to a sheet of stiff paper by means of paste.

The use of tiles is rapidly increasing in this country, and they are now largely employed for floors, wainscoting, etc., as well as for the exterior decoration of buildings. Their interior use is urged on the ground that they are aseptic, sanitary, and fireproof.

A large tile factory is located in Zanesville, Ohio, and operates 35 kilns. This factory was established in 1875, and uses American clays, chiefly from Florida, Kentucky, New Jersey, North Carolina, Ohio, and Ten-

nessee. Every known variety of tile is made, including those for floors, wainscoting, and walls, as well as for art purposes. A number of small portrait tiles, showing heads of presidential candidates, and having a blue glaze, were produced during the campaign of 1896. The well known floor, representing a Navajo blanket, in the Indian room in the hotel Astor, New York city, was made by this company.

In 1877 a tile works was established at Indianapolis. The fuel used is natural gas, and 35 kilns are operated. The clays are chiefly American, coming from deposits in Florida, Georgia, Indiana, Kentucky, New Jersey, North Carolina, Ohio, Pennsylvania, and South Carolina. A high grade clay is preferred, as it is found that such clays stand a higher degree of heat. Every kind of tile is made, the variety extending from a high art tile to one for paving. A mechanical improvement known as the "anchor" back has been introduced, which permits the tiles which are used in wainscoting, etc., to adhere firmly to the cement or wall to which they are attached. The mat effects now so prevalent in art pottery have extended to tiles, and excellent results in greens and blues have been achieved. The tiling for the St. Regis hotel in New York city was made at these works.

In 1882, in the city of Trenton, a factory was established for the manufacture of wall, floor, and mantel tiles, as well as tiles for the decoration of furniture, for chemical laboratories, and for refrigerator linings. For the body of these tiles a combination of American and English china clay is used. The native clays come from deposits in Florida, Kentucky, Maryland, New Jersey, and Tennessee. This company has made a specialty of certain glazes, notably a series of stanniferous enamels that do not craze or crackle, and of which the colorings are rich reds, greens, browns, oranges, yellows, blues, and pinks, as well as delicate tones and shades of these colors. Another variety is a series of dull crystalline glazes in moss, leaf, Nile and dark greens, orange, lemon, gobelin and pastel blues, pink, ivory, and white. The application of metals, such as copper, gold, and silver to tiles has recently been taken up by this pottery.

In 1892 there was established in Zanesville a factory that makes a specialty of vitreous, encaustic, and ceramic flooring tiles from American clays. The characteristic feature of these tiles is a peculiar corrugated effect, which shows most conspicuously, perhaps, in those carrying a colored pattern. Such designs are produced by sifting colored clays through a stencil, using a different one for each color, then pressing under a hydraulic press and firing. Some very elaborate mosaics have been produced, involving the use of a large number of tiles. A notable one is that representing the landing of Columbus, after the painting by John Vanderlyn in the Rotunda of the Capitol, at Wash-

ington. A tile simulating granite, used for flooring, is an interesting product of this company.

One of the most artistic of the modern developments of pottery is the so-called Moravian tile, made in Doylestown, Pa. This pottery was established in 1900 by a gentleman who has devoted many years to the study of archeology both in this country and abroad. He conceived the idea of making mosaic tiles by a process which he has patented. In place of using tiles of an exact size or shape, he assembles fragments of any convenient sizes that serve his purpose. To use his own language: "The tesseras, not rectangular as in Roman or Byzantine mosaics, but cut in multiform shapes to suit the potter's process, and whose contours themselves help to delineate the design, are set in cement in the pottery. After the manner of the leaded glass designs of the earlier stained windows, these novel weather and time proof clay pictures burned in brown, gray, white, red, black, green, yellow, and blue clay, and strongly outlined in their pointing of cement, serve to decorate a floor or wall in the richest and most lasting manner."

The designs produced range from 1 foot to 20 in diameter, and consist of pieces of clay burned in many colors, superficially or throughout the body, and either glazed or unglazed. In some mosaics the figures of men or animals are of life size. This potter's long residence abroad has resulted in an extensive series of designs, obtained from original wall tiles in Spain, mural patterns in Italy and the East, and floor tiles of the fifteenth century in England, Germany, and France. He shows designs also from the colonial period in America. At this pottery some interesting drinking mugs with medieval designs are made. The clays used are of American origin, coming almost exclusively from Pennsylvania and New Jersey.

A factory in Chelsea, Mass., began the manufacture of art tiles about the year 1877, and for some years its products were famous. Dr. E. A. Barber writes that "their tiles were characterized by a marked originality, both in style and design, which has caused them to be extensively imitated both at home and abroad." Gradually, however, the firm's interest in tiles declined, and they turned their attention to the manufacture of art tile soda fountains, in the production of which they achieved a high reputation. Within the last few years, however, they have renewed their interest in the earlier work, and have produced both modeled and pressed tiles, made from New Jersey and Pennsylvania clays in combination with foreign clays, and characterized by highly colored glazes. They also produce some art faience ware that deserves mention.

*Terra cotta.*—Under this designation is included the lowest class of ceramic wares, with the exception of common brick. The properties of terra cotta are that the mass is not uniform, always colored, very soft,

porous, and open, slightly sonorous, opaque, fusible at a high temperature, and sometimes glazed. The growing interest in gardens has led to the manufacture of so-called "garden pottery," some of which merits consideration.

A Philadelphia pottery makes a specialty of terra cotta ware for garden decoration, comprising vases, statuary, fountains, balustrades, railings, tazzas, hermes, sundials, flower boxes, Italian flowerpots, and the like. American clays are used chiefly from local deposits and from near by deposits in Delaware and New Jersey. The designs are mostly classical, and include "antique," Grecian, Pompeian, and Oriental examples.

*Tobacco pipes.*—Clay pipes for smokers are made at various places all over the United States. The general process consists in passing a selected clay through the pugging mill and then forcing the resulting worked clay into a mold. Iron molds are used for the simpler forms and brass for the more highly ornamental varieties. When the pipe comes from the mold it is allowed to dry, and is then fired in a sagger. In 1868 a pottery for the making of clay pipes was established in Brooklyn, N. Y., which has made a specialty of portrait pipes. The series includes heads of Cleveland, Harrison, Bryan, McKinley, Roosevelt, Dewey, and John Mitchell. American clays are used, chiefly from New Jersey. For the most part these pipes are white, though sometimes colored to imitate meerschauams, or decorated with colors.

#### CONCLUSION.

From the detailed statements in this report the following facts may be summarized in regard to the raw materials, processes of manufacture, and products:

*Raw materials.*—It appears that American clays, chiefly those from deposits in Florida, Georgia, New Jersey, North Carolina, and Tennessee, are used by

nearly every potter, and along with them, generally, a certain amount of ball or china clay imported from England. Further, many potters use clays from the immediate vicinity of their plants, but almost always mix them with the imported variety.

*Processes of manufacture.*—These show the use of native fuels, especially natural gas when available, as in East Liverpool, Ohio, and other pottery centers in the natural gas region. Considerable advance has been made in labor saving devices, such as the use of machinery in place of human labor, and the use of steam and electricity whenever possible. The introduction of system and sequence in the plants must be noted as an American innovation. Thus, at a pottery in Buffalo, N. Y., the procedure is such that "from the time the clay has started on its journey from the clay bank until it is transformed into a dainty bit of tableware ready for use in the home, there is never a move backward and never a motion wasted." This pottery may be mentioned as the only one in the world operated entirely by electricity, the powerhouse supplying power, light, and heat to all the buildings.

*Products.*—Considering these under the three principal types of pottery, it may be said that porcelain as an art ware is not made on a commercial scale in the United States, although art ware with a porcelain body has been successfully produced, and promises much for the future. At present it must be regarded rather as an experiment than as an established product. In stoneware certain American varieties of Flemish grès in beer mugs, wine jugs, etc., are manufactured. Most of the art pottery made in the United States is earthenware, chiefly the variety known as faience. This product is worthy of the highest praise, not only for its originality and art qualities, but also for the careful and painstaking methods by which it has been developed and improved.