
**MINERAL PRODUCTION IN IOWA FOR
1917 AND 1918**

By JAMES H. LEES



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VALUE OF MINERAL PRODUCTION

1916			
Product	Unit	Quantity	Value
Cement	barrels	4,853,789	\$ 6,165,547
Clay products			7,383,289
Clay, raw	short tons	21,829	2,427 (a)
Coal	short tons	7,260,800	13,530,383
Gypsum	short tons	522,293	1,496,795
Iron ore	long tons	10,151	(b)
Lead	short tons	14	1,932
Mineral waters	gallons sold	148,732	14,404
Natural gas	M cubic feet		275
Sand and gravel	short tons	3,321,691	980,272
Stone and lime			610,534
Zinc	short tons	21	5,628
Miscellaneous (c)			103,875
Total value			\$30,210,284
1917			
Cement	barrels	4,428,765	\$ 6,870,863
Clay products			7,540,213
Clay, raw	short tons	5,488	3,012 (a)
Coal	short tons	8,965,830	21,096,408
Gypsum	short tons	461,864	2,041,997
Iron ore	long tons	22,612	(b)
Lead	short tons	34	5,848
Mineral waters	gallons sold	99,103	12,125
Natural gas	M cubic feet	225	225
Sand and gravel	short tons	2,909,441	1,060,586
Stone and lime			580,750
Zinc	short tons	18	3,672
Miscellaneous (a, c)			478,995
Total value			\$39,336,372
1918			
Cement	barrels	3,188,669	\$ 5,423,926
Clay products			5,315,143
Clay, raw	short tons	5,416	3,705 (a)
Coal	short tons	8,192,195	24,703,237
Gypsum	short tons	327,927	1,946,414
Mineral waters	gallons sold	87,703	3,937
Natural gas	M cubic feet	1,758	245
Sand and gravel	short tons	2,004,444	904,307
Stone and lime			444,800
Miscellaneous (a, c)			1,120,418
Total value			38,742,009

a Value not included in total value for state.

b Value included under "Miscellaneous".

c 1916: Ferroalloys and iron ore; 1917: Ferroalloys and iron ore; 1918: Ferroalloys.

¹ The mineral statistics were compiled by the Iowa Geological Survey in cooperation with the United States Geological Survey. The reports of the federal survey have been freely used in preparing the following statements.

In 1917 the total value of the minerals produced in Iowa was \$39,336,372, and in 1918 the value was \$38,742,009, a decrease of \$594,363. Both of these figures are much the largest in the history of the state and represent both increased production and increased prices due to war conditions. The largest production previous to that of 1917 was gained during 1916, when the value of \$30,210,284 was reached. Mineral production in the state has shown a steady advance, both in amount and value of output, as the following summary sets forth.

VALUE OF MINERAL PRODUCTION IN IOWA, 1909 TO 1918	
1909	\$20,365,721
1910	22,744,572
1911	21,119,111
1912	22,910,066
1913	25,612,345
1914	26,301,865
1915	27,062,950
1916	30,210,284
1917	39,336,380
1918	38,742,009

The table shows that the value of the output at the close of this decade was nearly 48 per cent greater than that at the beginning, and that the production of each year has had a higher value than the production of the preceding year, except those for 1911 and 1918. In the latter case the decrease undoubtedly was due to the abrupt termination of the war and the disturbance of industrial conditions which ensued.

In each of the years 1917 and 1918 coal, cement, clay products, gypsum, and sand and gravel have been the most important products, and have held the rank here indicated except that clay products was second in 1917 and third in 1918, alternating with cement. The rise of the cement industry in Iowa is quite phenomenal and indicates the possibility for its future. The gypsum industry also has had a rapid growth in recent years and has brought the state into prominence in this line of production. This growth is well brought out by the chapter on statistics in the report forming the main part of this volume.

The distribution of the mineral products is given in Table I which shows the total production of the state during the two years here under discussion. This table shows that the mineral production of the state was drawn from eighty-three counties

TOTAL PRODUCTION

7

in 1917 and from the same number in 1918. Twenty of these counties produced coal in 1917 and twenty in 1918; fifty-seven produced clay wares in 1917 and fifty-nine in 1918; twenty produced stone and lime in 1917 and nineteen in 1918; forty-seven produced sand and gravel in 1917 and the same number in 1918.

TABLE I
TABLE OF MINERAL PRODUCTION IN IOWA IN 1917

Counties	No. of Producers	Coal	Clay and Clay Products	Stone and Lime	Sand and Gravel	Other Products ¹	Total
Adams	3	\$ 13,285					\$ 13,285
Allamakee	5		*	\$ 3,523		*	142,167
Appanoose	46	4,318,243	*				*
Audubon	2		*				*
Benton	5		62,791	*			62,791
Black Hawk.....	8			*	17,081		74,822
Boone	9	762,986	*		*		934,086
Bremer	2				*		*
Buena Vista.....	5		30,606		*		30,606
Butler	1				*		*
Carroll	1				*		*
Cass	1		*				*
Cedar	2		*	*			*
Cerro Gordo.....	11		2,011,844		118,782	*	7,094,484
Cherokee	2				*		*
Clay	1				*		*
Clayton	2			*	*		*
Clinton	9		*	*	12,658		26,308
Crawford	1				*		*
Dallas	8	1,430,508	388,870				1,819,378
Des Moines.....	3		*		*		27,213
Dickinson	2				*		*
Dubuque	10		*	59,126	35,805	*	126,138
Emmet	2				*		*
Fayette	2		*		*		*
Floyd	3		*	*			166,237
Franklin	5		*		*		219,213
Greene	2	*					*
Grundy	1		*				*
Guthrie	2	*	*				*
Hamilton	3		*	*			274,075
Hancock	1		*				*
Hardin	4		*	*	*		98,543
Henry	4		*	*			35,846
Howard	4		*	*	*		4,650
Humboldt	1				*		*
Iowa	2		*				*
Jackson	8		*	*	18,824		60,280
Jasper	11	619,040	17,529			*	646,059
Jefferson	4	*	38,097				*

* Included in county values and totals.

¹ Includes iron ore, 22,612 tons; gypsum, \$2,041,997; cement, \$6,870,863; gas, \$225; mineral water, \$12,125; lead, \$5,848; zinc, \$3,672.

TOTAL PRODUCTION

9

TABLE I (Continued)
PRODUCTION IN 1917

Counties	No. of Producers	Coal	Clay and Clay Products	Stone and Lime	Sand and Gravel	Other Products ¹	Total
Johnson	2		*				*
Jones	9		*	72,036	*		92,807
Keokuk	9		261,132				261,132
Kossuth	2		*		*		*
Lee	8		*	87,558	*		124,367
Linn	8		*	*	43,510		51,661
Louisa	3		*	*		*	7,483
Lucas	2	*					*
Lyon	1				*		*
Madison	2			*			*
Mahaska	12	380,478	*		*		453,541
Marion	17	1,148,395	69,501		*		1,229,496
Marshall	5		*	*	*		28,213
Mills	2		*				*
Mitchell	1			*			*
Monroe	18	5,082,822					5,082,822
Muscatine	9		18,558		55,259		73,817
O'Brien	3				1,410		1,410
Osceola	2				*		*
Page	4	*	*		*		45,927
Palo Alto	2				*		*
Plymouth	3				11,090		11,090
Pocahontas	2			*		*	*
Polk	40	4,561,922	932,786		277,355	*	7,652,063
Pottawattamic	1		*				*
Poweshiek	4		35,167				35,167
Sac	3		*		*	*	201,656
Scott	9		*	157,385	*	*	239,995
Sioux	6				53,370		53,370
Story	4		*		*		54,930
Tama	5		43,130				43,130
Taylor	2	*					*
Union	1		*				*
Van Buren	8	19,555	*	*	*		33,150
Wapello	16	844,641	116,119		44,590		1,005,350
Warren	3	*	*				272,705
Washington	4		51,457				51,457
Wayne	1	*					*
Webster	21	*	1,209,863		*	2,041,997	3,325,492
Winnebago	1		*				*
Winneshiek	3		*		*		10,725

* Included in county values and totals.

¹ Includes iron ore, 22,612 tons; gypsum, \$2,041,997; cement, \$6,870,863; gas, \$225; mineral water, \$12,125; lead, \$5,848; zinc, \$3,672.

TABLE I (Continued)
 PRODUCTION IN 1917

Counties	No. of Producers	Coal	Clay and Clay Products	Stone and Lime	Sand and Gravel	Other Products ¹	Total
Woodbury	4		*		*	*	539,625
Wright	4		*		*		19,643
County values representing less than three producers and small coal mines		1,914,533	2,286,391	201,122	367,482	7,016,418	6,477,442
Totals	464	\$21,096,408	\$7,543,225	\$580,750	\$1,060,586	\$9,058,415	\$39,336,372

* Included in county values and totals.

¹ Includes iron ore, 22,612 tons; gypsum, \$2,041,997; cement, \$6,870,863; gas, \$225; mineral water, \$12,125; lead, \$5,848; zinc, \$3,672.

TOTAL PRODUCTION

11

TABLE I (Continued)

TABLE OF MINERAL PRODUCTION IN IOWA IN 1918

Counties.	No. of Producers	Coal	Clay and Clay Products	Stone and Lime	Sand and Gravel	Other Products ²	Total
Adams	5	\$ 19,258					\$ 19,258
Allamakee	6		*	\$ 15,381		*	35,729
Appanoose	52	5,076,714	*				*
Audubon	2		*				*
Benton	3		37,189				37,189
Black Hawk.....	6			*	\$ 35,578		*
Boone	11	958,527	*		*		1,095,805
Bremer	1						*
Buena Vista....	5		11,367		*		*
Butler	1				*		*
Carroll	1				*		*
Cass	1		*				*
Cedar	1		*				*
Cerro Gordo....	10		1,278,719		*	*	5,149,729
Cherokee	2				*		*
Clay	1				*		*
Clayton	1				*		*
Clinton	8		*	*	9,300		23,623
Crawford	1				*		*
Dallas	7	1,606,831	354,608				1,961,439
Davis	1	*					*
Des Moines	4		*	*	*		21,412
Dickinson	1				*		*
Dubuque	9		*	44,099	*	*	75,395
Fayette	3		*		*		2,050
Floyd	3		*	*	*		101,991
Franklin	5		*		705		*
Greene	2	*					*
Grundy	1		*				*
Guthrie	2	*	*				*
Hamilton	2		*				*
Hancock	1		*				*
Hardin	7		36,807	*	*		52,901
Henry	3		*	*			24,847
Howard	3		*	*	*		3,293
Humboldt	2		*		*		*
Ida	1				*		*
Iowa	2		*				*
Jackson	4		*	*	*		52,415
Jasper	9	757,046	*			*	764,738

* Included in county values and totals.

² Includes gas, \$245; mineral water, \$3,937; gypsum, \$1,946,414; cement, \$5,423,926.

TABLE I (Continued)
PRODUCTION IN 1918

Counties	No. of Producers	Coal	Clay and Clay Products	Stone and Lime	Sand and Gravel	Other Products ²	Total
Jefferson	3		31,887				31,887
Johnson	4		*		*		17,930
Jones	8		*	58,420	*		68,906
Keokuk	7		169,606	*			*
Kossuth	1		*				*
Lee	6		*	38,060	*		46,712
Linn	7		*	*	25,271		32,081
Louisa	4		*			245	*
Lucas	3	1,388,637					1,388,637
Lyon	1				*		*
Madison	2		*	*			*
Mahaska	13	630,326	*		*		674,362
Marion	18	1,806,146	71,735		*		*
Marshall	4		*	*	*		6,091
Mills	1		*				*
Mitchell	1			*			*
Monroe	15	6,445,648					6,445,648
Montgomery	1				*		*
Muscatine	8		7,445		59,436		66,881
O'Brien	4				3,408		3,408
Osceola	2				*		*
Page	3	*	*				41,708
Palo Alto	2				*		*
Plymouth	3				10,000		10,000
Pocahontas	2			*		*	*
Polk	39	4,504,727	648,501		221,634	*	6,858,485
Pottawattamie	2		*				*
Poweshiek	3		20,400				20,400
Sac	4		*		86,457		*
Scott	10		*	172,758	*		246,059
Sioux	6				49,270		49,270
Story	3		51,810				51,810
Tama	3		31,939				31,939
Taylor	2	*					*
Union	1		*				*
Van Buren	6	43,185	*		*		47,929
Wapello	14	744,667	24,754		*		*
Warren	3	*	*				367,100
Washington	4		42,203				42,203
Wayne	1	*					*
Webster	20	*	1,112,157		*	1,946,414	3,149,366

* Included in county values and totals.

² Includes gas, \$245; mineral water, \$3,937; gypsum, \$1,946,414; cement, \$5,423,926.

TOTAL PRODUCTION

TABLE I (Continued)
PRODUCTION IN 1918

Counties	No. of Producers	Coal	Clay and Clay Products	Stone and Lime	Sand and Gravel	Other Products ²	Total
Winnebago	1		*				*
Winneshiek	3		*		*		9,266
Woodbury	5		*		*	*	373,938
Wright	4		*		8,949		*
County values representing less than three producers and small coal mines		721,525	1,387,721	116,082	385,843	5,427,863	9,238,181
Totals	446	\$24,703,237	\$5,318,848	\$444,800	\$ 904,307	\$7,374,522	\$38,742,009

* Included in county values and totals.

² Includes gas, \$245; mineral water, \$3,937; gypsum, \$1,946,414; cement, \$5,423,926.

COAL MINING.

For many years coal has been the chief mineral product of the state. As early as 1840 coal was being mined from the banks near Farmington. Some of the coal was hauled by team to Keokuk and some was used by the steamboats which came up the Des Moines. In these early days coal retailed at \$4.50 to \$5.00 per ton, but it had difficulty in competing with wood, which was then very plentiful. By 1843 the blacksmiths along Des Moines valley had come to appreciate the value of coal in their work and it was in use in the army forges at Fort Des Moines.

By 1865 the mining industry was well established and since then it has advanced in importance with fairly uniform rapidity. Iowa's coal reserves have proved to be one of the foundations of her material prosperity. The following table gives the production from the earliest recorded date to the present.

PRODUCTION OF COAL IN IOWA 1840-1918

In Short Tons

Years	Tonnage	Years	Tonnage	Years	Tonnage
1840	400	1867	150,000	1893	3,972,220
1841	500	1868	241,453	1894	3,967,253
1842	750	1869	295,105	1895	4,156,074
1843	1,000	1870	263,487	1896	3,954,028
1844	2,500	1871	300,000	1897	4,611,865
1845	5,000	1872	336,000	1898	4,618,842
1846	6,500	1873	392,000	1899	5,177,479
1847	8,000	1874	799,936	1900	5,202,939
1848	10,000	1875	1,231,547	1901	5,617,499
1849	12,500	1876	1,250,000	1902	5,904,766
1850	15,000	1877	1,300,000	1903	6,419,811
1851	18,000	1878	1,350,000	1904	6,519,933
1852	20,000	1879	1,400,000	1905	6,798,609
1853	23,000	1880	1,461,116	1906	7,266,224
1854	25,000	1881	1,960,000	1907	7,574,322
1855	28,000	1882	3,920,000	1908	7,149,517
1856	30,000	1883	4,457,540	1909	7,757,762
1857	33,000	1884	4,370,566	1910	7,928,120
1858	37,500	1885	4,012,575	1911	7,331,648
1859	42,000	1886	4,315,779	1912	7,289,529
1860	41,920	1887	4,473,828	1913	7,525,936
1861	50,000	1888	4,952,440	1914	7,451,022
1862	53,000	1889	4,095,358	1915	7,614,143
1863	57,000	1890	4,021,739	1916	7,260,800
1864	63,000	1891	3,825,495	1917	8,965,830
1865	69,574	1892	3,918,491	1918	8,192,195
1866	99,320				

It will be seen from this table that production of coal in Iowa reached the eight million ton mark for the first time in 1917, and again in 1918 this mark was attained, although with a considerable decrease from the figure of the preceding year. The remarkable increase of 1,705,030 tons in the production for 1917 over that of 1916, an increase of 23.5 per cent, was due to the greatly increased demand for fuel for manufacturing and allied industries connected with the production of war materials. In normal times the demand is seasonal and is greater in the colder months when coal is required for heating. In 1917, however, the demand was good throughout the year as is shown by the fact that the mines were worked 251 days out of a possible 304 days. The severe weather of the winter of 1917-18 was an appreciable factor in maintaining production.

Conditions in 1918 were somewhat different from those prevailing during the preceding year. In the spring of 1918 demand was so slack that some mines were closed for weeks and many miners left the Iowa fields. Hence when production was stabilized through the work of the Fuel Administration there was a shortage of workers. After the signing of the Armistice on November 11 the demand slackened somewhat, and the mild weather of the ensuing winter lessened the demand for heating coal. Because of these factors the output of coal in 1918 was 773,635 tons less than that for 1917, a shrinkage of 8.6 per cent, and the number of employes decreased from 14,266 in 1917 to 13,328 in 1918, while the average number of days worked in 1918 was 245, or six less than in 1917.

The following tables will give the details of production in 1917 and 1918.

TABLE II.
COAL PRODUCTION FOR IOWA IN 1917 BY COUNTIES

COUNTY	LOADED AT MINES FOR SHIPMENT		SOLD TO LOCAL TRADE & USED BY EMPLOYEES		USED AT MINE FOR STEAM AND HEAT	
	Short tons	Value	Short tons	Value	Short tons	Value
Adams .....	.....	.....	4,016	\$ 13,285	.....	.....
Appanoose	1,529,622	\$ 4,035,430	85,776	200,336	48,056	\$ 82,477
Boone	181,761	580,997	56,103	169,669	6,857	12,320
Dallas	567,338	1,381,139	8,510	25,062	12,629	24,307
Greene, Lucas, Warren and Wayne	734,649	1,557,482	23,027	68,988	18,644	34,099
Guthrie and Webster	25,876	68,996	3,803	12,330	.....	.....
Jasper	280,532	549,162	22,715	67,728	965	2,150
Mahaska	128,478	344,522	14,107	31,213	3,235	4,743
Marion	459,177	1,051,980	21,187	49,828	24,635	46,587
Monroe	2,331,400	4,872,267	44,365	108,634	70,905	101,921
Page and Taylor	7,500	26,250	10,443	42,200	.....	.....
Folk	1,409,684	3,340,616	403,992	1,158,759	32,163	62,547
Van Buren	2,207	6,860	4,224	12,695	.....	.....
Wapello	296,242	708,245	41,962	113,921	8,305	22,475
Small Mines (a) .....	.....	.....	40,740	104,188	.....	.....
	7,954,466	\$18,523,946	784,970	\$2,178,836	226,394	\$393,626
Average value per ton.....		\$2.33		\$2.78		\$1.74

^a Includes Jefferson county.

TABLE II (Continued)
COAL PRODUCTION FOR IOWA IN 1917 BY COUNTIES

COUNTY	TOTAL QUANTITY		AV. VAL. PER TON	NUMBER OF EMPLOYEES			AV. NO. OF DAYS WK 'D.
	Short tons	Value		UNDER- GROUND	SURFACE	TOTAL	
Adams	4,016	\$ 13,285	\$3.31	26	7	33	141
Appanoose	1,663,454	4,318,243	2.60	3,325	401	3,726	243
Boone	244,721	762,986	3.12	465	57	522	206
Dallas	588,477	1,430,508	2.43	832	109	941	258
Greene, Lucas, Warren and Wayne.....	776,320	1,660,569	2.14	1,063	94	1,157	255
Guthrie and Webster	29,679	81,326	2.74	63	7	70	276
Jasper	304,212	619,040	2.03	397	47	444	255
Mahaska	145,820	380,478	2.61	216	24	240	234
Marion	504,999	1,148,395	2.27	748	130	878	211
Monroe	2,446,670	5,082,822	2.08	2,662	404	3,066	266
Page and Taylor	17,943	68,450	3.81	48	6	54	212
Polk	1,845,839	4,561,922	2.47	2,363	246	2,609	267
Van Buren	6,431	19,555	3.04	14	2	16	223
Wapello	346,509	844,641	2.44	450	60	510	248
Small Mines (a)	40,740	104,188	2.56	.....	.....	.....	.....
	8,965,830	21,096,408		12,672	1594	14,266	251
Average value per ton.....		2.35	2.35				

a Includes Jefferson county.

COAL MINING

TABLE II (Continued)
COAL PRODUCTION FOR IOWA IN 1918 BY COUNTIES

COUNTY	LOADED AT MINES FOR SHIPMENT		SOLD TO LOCAL TRADE & USED BY EMPLOYEES		USED AT MINES FOR STEAM AND HEAT	
	Shorttons	Value	Shorttons	Value	Shorttons	Value
Adams .....	.....	.....	5,405	\$ 19,247	13	\$ 11
Appanoose	1,478,943	\$ 4,837,340	57,084	183,206	23,226	56,162
Boone	211,599	718,360	58,430	222,875	7,590	17,292
Dallas	509,543	1,549,048	10,972	39,142	6,963	18,641
Davis, Greene, Warren and Wayne	129,959	412,988	13,180	43,672	3,733	6,575
Guthrie and Webster	18,889	61,833	11,237	38,152	600	1,000
Jasper	216,148	658,679	22,246	70,485	10,557	27,882
Lucas	485,292	1,330,958	5,993	23,418	12,236	34,261
Mahaska	206,775	589,742	10,285	31,510	4,800	9,074
Marion	566,079	1,694,976	26,114	70,283	17,073	40,887
Monroe	2,212,243	6,191,328	34,143	99,910	71,543	154,410
Page and Taylor	5,645	19,193	10,557	35,874	.....	.....
Polk	1,153,000	3,512,434	258,464	935,197	22,969	57,096
Van Buren	6,017	18,464	6,928	24,159	250	562
Wapello	198,898	611,948	37,212	108,447	9,056	24,272
Small Mines .....	.....	.....	34,306	102,238	.....	.....
	7,399,030	\$22,207,297	602,556	\$2,047,815	190,609	\$448,125
Average value per ton.....		\$3.00		\$3.40		\$2.35

TABLE II (Continued)

COUNTY	TOTAL QUANTITY		AVERAGE PRICE PER TON	NUMBER OF EMPLOYEES			AVERAGE NUMBER OF DAYS WORKED	INCREASE OR DECREASE IN TONNAGE FROM 1917
	Short tons	Value		UNDER- GROUND	SURFACE	TOTAL		
Adams	5,418	\$ 19,258	\$3.55	26	4	30	237	+1,402
Appanoose	1,559,253	5,076,714	3.26	3,082	397	3,479	241	-104,201
Boone	277,619	958,527	3.45	453	115	568	238	+32,898
Dallas	527,478	1,606,831	3.05	799	70	869	234	-60,999
Davis, Greene, Warren and Wayne	146,872	463,235	3.15	240	33	273	197	-125,927 ^a
Guthrie and Webster	30,726	100,985	3.29	65	9	74	236	+1,047
Jasper	248,951	757,046	3.04	359	42	401	227	-55,261
Lucas	503,521	1,388,637	2.76	358	60	418	273	.....^a
Mahaska	221,860	630,326	2.84	274	44	318	258	+76,040
Marion	609,266	1,806,146	2.96	875	134	1,009	240	+104,267
Monroe	2,317,929	6,445,648	2.78	2,743	347	3,090	258	-128,741
Page and Taylor	16,202	55,067	3.40	47	5	52	201	-1,741
Polk	1,434,433	4,504,727	3.14	2,068	228	2,296	251	-411,406
Van Buren	13,195	43,185	3.27	13	16	29	211	+6,764
Wapello	245,166	744,667	3.04	372	50	422	208	-101,343
Small Mines	34,306	102,238	2.98	.....	.....	.....	.....	-6,434
	8,192,195	\$24,703,237	.....	11,774	1,554	13,328	245	-773,635
Average value per ton....			\$3.02					+\$3,606,298

^a Davis, etc., included Lucas in 1917.

COAL MINING

Most of the coal produced in Iowa is used within the state or by railroads. The following table presents interesting data relative to the ultimate distribution of Iowa coal.

USED IN IOWA	QUANTITY, SHORT TONS	
	1917	1918
Used at mines for steam and heat	226,394	190,609
Sold to local trade, not shipped.....	784,970	602,556
Shipped to Iowa points.....	2,876,137	3,026,262
	<u>3,887,501</u>	<u>3,819,427</u>
Percentage of total.....	43.4	46.6
SHIPPED TO OTHER STATES		
Arkansas		2,117
Illinois		1,703
Kansas	15,000	14,265
Louisiana		138
Minnesota	31,000	5,318
Missouri	239,000	271,239
Nebraska	130,000	163,073
Oklahoma		1,254
South Dakota	30,000	15,948
Texas		90
	<u>445,000</u>	<u>475,145</u>
Percentage of total	5.0	5.8
Used by railroads	4,633,329	3,897,623
Percentage of total	51.6	47.6
Total production	8,965,830	8,192,195

It will be seen that the demand by the railroads was considerably less in 1918 than in 1917, the decrease amounting to 735,000 tons. The extension of the market for Iowa coal was on account of the zoning system established by the Fuel Administration in 1918, which prohibited shipments of eastern coal west of the Mississippi. The increase in the average price at the mine was due also to the prices fixed by Presidential order and by the Fuel Administration.

A few facts relative to the source of the coal consumed in Iowa will be of interest as showing the wide range from which the state draws its fuel supplies. It will be noted that coal is brought to Iowa from practically all the producing fields of

the United States except those of the extreme southeast and the far west.

SOURCE	QUANTITY, SHORT TONS	
	1917	1918
Arkansas	9,000	26,044
Colorado	15,000	135,151
Illinois	4,026,000	3,597,048
Indiana	247,000	89,796
Iowa	3,887,501	3,819,427
Kansas	81,000	79,660
Kentucky	297,000	67,956
Missouri	58,000	93,216
Montana and northern Wyoming	324,000	236,013
Oklahoma	2,000	10,983
Tennessee	9,000	.....
Utah and southern Wyoming	54,000	46,622
West Virginia	165,000	28,974
Great Lake docks	271,560	225,000
<hr/>		
Total domestic and industrial	9,446,061	8,455,890
Pennsylvania Anthracite	471,694	.....
Used by railroads	4,633,329	3,897,623

Perhaps the most significant facts in the above table are the great amount of Illinois coal used in Iowa, the amount of "dock" coal and the amount of coal which comes from Utah, Wyoming and Montana. Dock coal is used chiefly in northern Iowa. It originates at Lake Erie ports and is transshipped chiefly from Duluth to the markets of the northwest. The lack of figures for consumption of anthracite in 1918 is due to the order of the Fuel Administration forbidding shipments to the western and southern states.

Iowa maintained very nearly the same relative rank among the coal-producing states as she has held for several years past. The rank and output of the eleven leading states are shown by the following table:

STATE	1917		1918	
	SHORT TONS	VALUE	SHORT TONS	VALUE
Pennsylvania				
Anthracite	99,611,811	\$283,650,723	98,826,084	\$336,480,347
Bituminous	172,448,142	421,268,808	178,550,741	436,159,736
West Virginia	86,441,667	200,659,368	89,935,839	230,508,846
Illinois	86,199,387	162,281,822	89,291,105	206,860,291
Ohio	40,748,734	100,897,148	45,812,943	118,095,518
Kentucky	27,807,971	60,297,653	31,612,617	80,666,842
Indiana	26,539,329	52,940,106	30,678,634	70,384,601
Alabama	20,068,074	45,616,992	19,184,962	54,752,329
Colorado	12,483,336	27,669,129	12,407,571	33,404,743
Virginia	10,087,091	20,125,713	10,289,808	25,865,895
Iowa	8,965,830	21,096,408	8,192,195	24,703,237
Wyoming	8,575,619	16,593,283	9,438,688	22,581,019
Total for U. S.	651,402,374	1,532,923,560	678,211,904	1,828,290,287

CLAY PRODUCTS.

The value of the output of clay wares in 1917 was \$7,543,225. This represents an increase over the preceding year of \$161,509, or 2.18 per cent. Inasmuch as the output in 1916 was the greatest in the history of the industry the increase here recorded was decidedly gratifying. In 1918, however, the production was considerably less, amounting to \$5,318,848. This meant a drop of \$2,225,377 in the output, a decrease of 29 per cent. These conditions simply reflect a condition which was nation-wide, for the nation was at war and building operations were restricted to governmental needs and essential war industries. Under these conditions the output of nearly all branches of the industry decreased in value in 1918 as compared with the output in 1917. Manufacturing operations were affected severely by high cost and scarcity of materials, uncertainty and high prices of labor, unfavorable transportation conditions and fuel restrictions imposed by the Fuel Administration. It was reported by that organization that whereas the average annual consumption of coal at Iowa clay manufacturing plants from 1915 to 1917 was 399,183 tons, in the first half of 1918 the coal consumed amounted to only 140,609 tons, a reduction of over fifty per cent.

CLAY PRODUCTION

23

The development of the clay industry during the preceding decade is shown by the following table:

	DRAIN TILE	FIREPROOFING	COMMON BRICK	TOTAL
1909	\$2,830,910	\$ 304,398	\$1,072,340	\$4,916,513
1910	3,457,455	94,366	1,088,266	5,335,030
1911	2,468,962	374,628	1,025,011	4,436,839
1912	2,293,084	535,254	1,017,097	4,524,492
1913	2,798,816	762,563	1,052,036	5,575,581
1914	3,180,836	1,083,397	1,067,746	6,405,995
1915	3,802,599	1,008,457	898,851	6,749,088
1916	3,986,163	1,141,291	947,247	7,375,716
1917	4,004,989	1,542,884	1,045,790	7,543,225
1918	2,256,200	1,550,076	749,325	5,318,848

The distribution of the output of clay ware is shown in greater detail in the following table:

PRODUCT	1913		1914		1915	
	Quantity in M	VALUE	Quantity in M	VALUE	Quantity in M	VALUE
Common brick	143,263	\$1,052,036	143,534	\$1,067,746	125,752	\$ 898,851
Vitrified brick or block	16,398	222,105	14,997	211,905	30,573	300,785
Face brick	14,078	181,911	11,183	148,394	11,916	153,324
Drain tile		2,798,816		3,180,836		3,802,599
Sewer pipe		503,360		558,751		448,721
Fireproofing		762,563		1,083,397		1,008,457
Other products		32,192		150,716		130,878
Pottery and clay		22,598		37,000		10,898
		\$5,575,581		\$6,405,995		\$6,749,088

	1916		1917		1918	
	QUANT. IN M	VALUE	QUANT. IN M	VALUE	QUANT. IN M	VALUE
Common brick	132,676	\$ 947,247	119,984	\$1,045,790	67,292	\$ 749,325
Vit. brick or block....	24,265	393,038	5,927	83,310	6,793	116,522
Face brick	22,112	283,559	18,425	282,840	11,383	188,041
Drain tile		3,986,163		4,004,989		2,256,200
Sewer pipe		494,428		455,561		398,848
Fireproofing		1,141,291	261,488 tons	1,542,884	238,789 tons	1,550,076
Other products		127,563		72,145		33,206
Pottery and clay		6,427		7,912		5,454
		\$7,375,716		\$7,543,225		\$5,318,848

The table shows some fluctuation in the output of common brick although the value maintained a fairly high plane. Similar fluctuation is shown in the case of vitrified brick, especially during the last two years. Drain tile has experienced a marked growth in value of output and the same is true of fireproofing materials, which have increased in value even during the last two troubled years. Since 1914 drain tile, fireproofing and common brick have held rank as first, second and third in importance of output. As in previous years Iowa led the United States in value of drain tile manufactured and Cerro Gordo county was the banner county of the state. The output from this county in 1917 was valued at \$1,640,020 and in 1918 at \$810,037. In 1917 the leading states in drain tile manufacture were: Iowa, \$4,004,989; Ohio, \$1,696,763; Indiana, \$1,564,542; and Illinois, \$1,314,006. In 1918 the production was less in all these states although Iowa suffered the most. Their output was: Iowa, \$2,256,200; Ohio, \$1,572,996; Indiana, \$1,427,237; and Illinois, \$1,077,861.

The total production and the rank of the ten leading states are shown in the appended table.

TEN LEADING STATES IN VALUE OF CLAY PRODUCTS IN 1917 AND '18

STATE	1917				1918			
	Rank	Number of firms reporting	Value not including clay sold	Percentage of total	Rank	Number of firms reporting	Value not including clay sold	Percentage of total
Ohio	1	470	\$51,957,043	22.3	1	424	\$52,899,180	23.8
Pennsylvania	2	315	38,743,105	16.7	2	288	40,467,104	18.2
New Jersey	3	142	22,529,232	9.7	3	132	20,741,244	9.3
Illinois	4	207	17,190,753	7.4	4	168	12,459,777	5.6
New York	5	167	11,428,399	4.9	6	141	10,892,954	4.9
Missouri	6	77	10,291,977	4.4	7	65	9,155,088	4.1
Indiana	7	178	9,718,752	4.2	8	157	7,950,926	3.6
West Virginia	8	57	9,608,065	4.1	5	56	10,988,677	5.0
Iowa	9	137	7,540,213	3.2	10	123	5,313,394 ^a	2.4
Kentucky	10	55	5,037,636	2.2	9	47	6,172,554	2.8
Total for U. S.		3,153	232,512,773			2,783	221,884,651 ^b	

^a Pottery not included.

^b Decrease from 1917, \$10,628,122.

The noteworthy features of this table are the marked decline in Iowa's output, which caused her to drop from ninth to tenth place, and the notable advance of West Virginia from eighth place to fifth. It should be noted that in the production of brick and tile proper Iowa ranked seventh in 1917 and eighth in 1918.

The average price of common brick rose from \$8.72 per thousand in 1917 to \$11.14 in 1918, vitrified brick rose from \$14.06 to \$17.15, front brick rose from \$15.35 to \$16.52 and hollow building tile and fireproofing rose from \$5.90 per ton to \$6.49.

Table III will show the output of the various classes of clay ware as distributed among the counties of the state.

TABLE III
VALUE OF IOWA CLAY PRODUCTS IN 1917
TABULATED BY COUNTIES

County	No. of Producers	Common Brick	Drain Tile	Fireproofing and Hollow Building Tile	Other Products*	Total Value
Allamakee.....	1	*	*	*		*
Appanoose.....	1	*				*
Audubon.....	2	*	*	*		*
Benton.....	4	*	\$ 43,593	*		\$ 62,791
Boone.....	2	*	*	*	*	*
Buena Vista.....	3	*	30,357			*
Cass.....	1	*	*	*		*
Cedar.....	1	*	*	*		*
Cerro Gordo.....	7	\$ 20,150	1,640,020	\$351,674		2,011,844
Clinton.....	2	*	*			*
Dallas.....	5	*	273,154	107,916	*	388,870
Des Moines.....	1	*	*	*		*
Dubuque.....	2	*				*
Fayette.....	1	*		*		*
Floyd.....	1	*	*	*		*
Franklin.....	1	*	*	*		*
Grundy.....	1	*			*	*
Guthrie.....	1		*	*		*
Hamilton.....	2	*	*	*	*	*
Hancock.....	1		*			*
Hardin.....	2		*	*	*	*

* Included under "Counties with less than three producers."

* Includes: Vitrified brick, \$83,310; front brick, \$282,840; sewer pipe, \$455,561; fire brick, \$4,000; roofing tile, stove lining fancy brick, sewer block, segment block, brickbats, \$89,928; flue lining, \$18,940; wall coping, \$7,071; pottery and clay, \$7,912.

TABLE III (Continued)

County	No. of Producers	Common Brick	Drain Tile	Fireproofing and Hollow Building Tile	Other Products ^a	Total Value
Henry.....	2	*	*	*		*
Howard.....	1	*	*	*		*
Iowa.....	2	*	*	*		*
Jackson.....	1			*	*	*
Jasper.....	4	5,229	12,300			17,529
Jefferson.....	3	*	32,232	*		38,097
Johnson.....	2	*	*			*
Jones.....	2	*	*	*		*
Keokuk.....	8	*	189,652	*	\$ 65,673	261,132
Kossuth.....	1		*			*
Lee.....	2	*			*	*
Linn.....	2	*	*			*
Louisa.....	1	*	*	*		*
Mahaska.....	2	*	*	*	*	*
Marion.....	4	10,559	19,865	39,077		69,501
Marshall.....	2	*	*	*		*
Mills.....	2	*				*
Muscatine.....	7	8,150	*	*	*	18,558
Page.....	1	*	*	*		*
Polk.....	9	203,367	200,661	184,826	343,932	932,786
Pottawattamie.....	1	*	*	*		*
Poweshiek.....	4	576	30,705	3,886		35,167
Sac.....	1	*	*	*		*
Scott.....	2	*	*	*	*	*
Story.....	2	*	*	*	*	*
Tama.....	5	15,400	16,408	*	*	43,130
Union.....	1	*	*	*		*
Van Buren.....	2	*	*	*		*
Wapello.....	3	39,765	*	*	3,799	116,119
Warren.....	1		*	*		*
Washington.....	4	6,597	37,635	7,225		51,457
Webster.....	11	51,218	477,715	376,876	304,054	1,209,863
Winnebago.....	1		*			*
Winneshiek.....	1	*				*
Woodbury.....	2	*		*	*	*
Wright.....	1		*			*
Pottery and clay sold						7,912
Counties with less than three producers		684,779	988,992	471,404	232,104	2,286,381
Totals.....	142	1,045,790	4,004,989	1,542,884	949,562	7,543,225

* Included under "Counties with less than three producers."

^a Includes: Vitrified brick, \$83,310; front brick, \$282,840; sewer pipe, \$455,561; fire brick, \$4,000; roofing tile, stove lining fancy brick, sewer block, segment block, brickbats, \$89,928; flue lining, \$18,940; wall coping, \$7,071; pottery and clay, \$7,912.

TABLE III (Continued)
 VALUE OF IOWA CLAY PRODUCTS IN 1918
 TABULATED BY COUNTIES

County	No. of Producers	Common Brick	Drain Tile	Fireproofing and Hollow Building Tile	Other Products ^b	Total Value
Allamakee.....	1	*	*	*		*
Appanoose.....	1	*				*
Audubon.....	2	*	*	*		*
Benton.....	3	*	*	9,787		37,189
Boone.....	2	*	*	*	*	*
Buena Vista.....	3	*	*			11,367
Cass.....	1	*	*	*		*
Cedar.....	1	*	*	*		*
Cerro Gordo.....	7	33,045	810,037	435,637		1,278,719
Clinton.....	2	*	*			*
Dallas.....	4	*	133,125	211,612	*	354,608
Des Moines.....	1		*			*
Dubuque.....	1	*				*
Fayette.....	1					*
Floyd.....	1	*	*	*		*
Franklin.....	2	*	*	*		*
Grundy.....	1	*			*	*
Guthrie.....	1		*	*		*
Hamilton.....	2	*	*	*	*	*
Hancock.....	1		*			*
Hardin.....	3	*	*		*	36,807
Henry.....	2	*	*	*		*
Howard.....	1	*	*	*		*
Humboldt.....	1		*			*
Iowa.....	2	*	*			*
Jackson.....	1			*	*	*
Jasper.....	2	*	*			*
Jefferson.....	3	*	27,084	*		31,887
Johnson.....	2	*	*			*
Jones.....	2	*	*	*		*
Keokuk.....	6	*	126,950	2,784	*	169,606
Kossuth.....	1		*			*
Lee.....	1	*				*
Linn.....	1		*			*
Louisa.....	1	*	*	*		*
Madison.....	1	*	*			*
Mahaska.....	2	*	*	*	*	*
Marion.....	3	5,070	32,085	34,580		71,735
Marshall.....	2	*				*

^b Includes: Vitrified brick or block, \$116,522; front brick, \$188,041; sewer pipe, \$398,848; flue lining, \$12,852; wall coping, \$4,208; roofing tile, segment block, fittings, broken ware, \$37,322; pottery and clay, \$5,454.

TABLE III (Continued)

County	No. of Producers	Common Brick	Drain Tile	Fireproofing and Hollow Building Tile	Other Products ^b	Total Value
Mills.....	1	*				*
Muscatine.....	4	6,575			*	7,445
Page.....	1	*	*	*		*
Polk.....	7	89,537	79,493	144,489	334,982	648,501
Pottawattamie.....	2	*	*	*		*
Poweshiek.....	3	*	17,708	*		20,400
Sac.....	1	*	*	*		*
Scott.....	2	*	*	*		*
Story.....	3	*	*	*	*	51,810
Tama.....	3	16,916	*	*	*	31,939
Union.....	1	*	*	*		*
Van Buren.....	1		*	*		*
Wapello.....	3	9,438	*	*	3,316	24,754
Warren.....	1		*	*		*
Washington.....	4	4,604	29,344	8,255		42,203
Webster.....	10	45,251	429,205	381,178	256,523	1,112,157
Winnebago.....	1		*			*
Winneshiek.....	1	*				*
Woodbury.....	2	*		*	*	*
Wright.....	1		*			*
Pottery and clay sold.....						5,454
Counties with less than three producers.....		538,889	571,169	321,754	168,426	1,387,721
Totals.....	127	749,325	2,256,200	1,550,076	763,247	5,318,848

* Included under "Counties with less than three producers."

^b Includes: Vitrified brick or block, \$116,522; front brick, \$188,041; sewer pipe, \$398,848; flue lining, \$12,852; wall coping, \$4,208; roofing tile, segment block, fittings, broken ware, \$37,322; pottery and clay, \$5,454.

STONE AND LIME.

The value of the stone and lime produced in Iowa in 1917 was \$580,758 and the value of the output of 1918 was \$444,800. Both of these figures represent a considerable decline in the industry from 1916 when the output was valued at \$610,534. The decline in this industry reflects the unfavorable conditions which were general in building trades and particularly in the uses for crushed stone. Building stone forms a relatively insignificant element of Iowa's stone output and hence the increase in value of this class as well as of rubble and riprap

was insufficient to offset the large decline in output of stone crushed for use in roadmaking and concrete. The output of railroad ballast was negligible in the two years here considered and the same is true of sandstone, of which there was no production reported in 1918. One of the redeeming features shown by the tables is the marked increase in the use of crushed limestone for agricultural purposes. The slump in this industry in 1918 doubtless will be regained in succeeding years.

In considering the output of limestone in this state the fact must be borne in mind that large quantities are quarried annually for use in cement making and that of this amount no record appears in the tables or discussion here presented.

The following table will show in summarized form the output of stone in the past three years and its distribution in the various branches of industry.

	1916	1917	1918
Limestone used for			
Building	\$ 12,018	\$ 15,101	\$ 22,749
Rubble and riprap	93,259	59,998	71,879
Crushed stone			
Road making (a)	88,303	50,215	52,179
Concrete	342,082	339,622	192,869
Agriculture	9,630	24,584	19,273
Other purposes (b)	65,242	90,930	85,851
Total	\$610,534	\$580,758	\$444,800

^a Includes railroad ballast.

^b Includes sandstone, lime, paving, flagging, curbing, flux, sugar factories, paper mills, whiting, uses not stated.

As lime is produced in Iowa by only two firms, the Eagle Point Lime Works of Dubuque and the Alfred Hurst Estate of Maquoketa, Jackson county, it is not possible to reveal figures of output but it is of interest to note the uses to which the product is put. The statements show that much the larger part of the output of these plants is used by the building trades, that a smaller share is taken by paper mills and that a few hundred tons annually are used in metallurgical plants. Wood is used as fuel for the most part, though some coal is burned.

Iowa does not hold a high rank among the stone producing states of the union. In 1917 she stood thirtieth and in 1918 thirty-third. The state contributed 0.63 per cent to the total

value of the output in 1917 and 0.46 in 1918. The rank of the state in the lime industry is a little higher as in 1917 she stood twenty-fifth in quantity and twenty-sixth in value with an average price per ton of \$6.45 as compared with a national average of \$6.29. In 1918 her rank was twenty-third in quantity and twenty-fourth in value with an average price per ton of \$7.65 compared with a national average of \$8.36.

Table IV shows in detail the production by counties for 1917 and 1918.

TABLE IV
PRODUCTION OF STONE AND LIME IN 1917

Counties	No. of Producers	Build- ing Stone	Rubble and Riprap	Crushed Stone			Other Uses*	Total Value
				Road Making and Railroad Ballast	Con- crete	Agricul- tural		
Allamakee	3	*	*	*	\$ -----	\$ -----	\$ -----	\$ 3,523
Benton	1						*	*
Black Hawk.....	2	*		*	*	*		*
Cedar	1			*	*			*
Clayton	1				*	*		*
Clinton	1	*	*					*
Dubuque	6	*	13,688	*	*		*	59,126
Floyd	2						*	*
Hamilton	1						*	*
Hardin	1				*	*		*
Henry	2		*		*			*
Howard	1	*		*				*
Jackson	1						*	*
Jones	5	10,885	9,060	*	49,631	1,126	*	72,036
Lee	4	*	29,325	*	32,792	*	*	87,558
Linn	2			*	*			*
Louisa	1	*						*
Madison	2				*	*	*	*
Marshall	1		*	*	*			*
Mitchell	1						*	*
Pocahontas	1				*			*
Scott	4		4,630	6,065	116,122	14,662	15,906	157,385
Van Buren	2	*						*
Counties with less than three producers		4,216	3,295	44,450	141,077	8,796	75,024	201,122
Total	46	\$ 15,101	\$ 59,998	\$ 50,515	\$339,622	\$ 24,584	\$ 90,930	\$580,750

* Includes: Lime and sandstone, \$60,817; flux, \$18,895; sugar factories, paper mills, whiting, \$7,353; paving, curbing and miscellaneous, \$3,865.

TABLE IV (Continued)
 PRODUCTION OF STONE AND LIME IN 1918

Counties	No. of Producers	Build- ing Stone	Rubble and Riprap	Crushed Stone			Other Uses*	Total Value
				Road Making and Railroad Ballast	Con- crete	Agricul- tural		
Allamakee	4	\$ *	\$ 11,381	\$ *	\$	\$	\$	\$ 15,381
Black Hawk	1	.....	.....	.....	*	*	.....	*
Clinton	1	*	*	.....	.....	.....	.....	*
Des Moines	1	.....	*	.....	.....	.....	.....	*
Dubuque	5	*	8,947	*	*	.....	*	44,099
Floyd	1	.....	.....	.....	.....	.....	*	*
Hardin	1	.....	.....	*	.....	.....	.....	*
Henry	1	.....	*	.....	*	.....	.....	*
Howard	1	.....	.....	.....	*	.....	.....	*
Jackson	2	.....	.....	*	.....	.....	*	*
Jones	4	*	12,977	*	*	*	.....	58,420
Keokuk	1	.....	.....	.....	*	.....	.....	*
Lee	3	*	*	*	14,300	*	.....	38,060
Linn	2	.....	.....	*	*	*	.....	*
Madison	1	.....	.....	.....	*	.....	.....	*
Marshall	1	.....	*	*	.....	.....	.....	*
Mitchell	1	.....	.....	.....	.....	.....	*	*
Pocahontas	1	.....	*	.....	*	.....	.....	*
Scott	6	.....	15,014	*	130,320	14,381	*	172,758
Counties with less than three producers .....	.....	.....	23,560	.....	48,249	4,892	.....	116,082
Total	38	\$ 22,749	\$ 71,879	\$ 52,179	\$ 192,869	\$ 19,273	\$ 85,851	\$ 444,800

* Includes: Lime, and stone sold to sugar factories, \$71,613; flux, \$14,238.

SAND AND GRAVEL.

The value of sand and gravel produced in Iowa in 1917 was somewhat in advance of that produced in 1916. In the earlier year the production amounted to \$980,272, while in the later year it was \$1,060,586. In the same period, however, the production diminished from 3,321,691 tons in 1916 to 2,909,441 tons in 1917. In 1918, on the other hand, the output was smaller both in volume and in value than in 1917, for it amounted to 2,004,444 tons with a value of \$904,307.

Iowa ranked eleventh among the states in value of output in 1917 and twelfth in 1918. Forty-seven counties of the state

reported production in both 1917 and 1918 and each year Polk county was well in the lead in both quantity and value of output. Clayton county is the leader in the finer grades of sand, as the St. Peter sandstone yields sand of exceptional fineness and purity of quality combined with ease of recovery. Most of the sand and gravel produced in Iowa, however, is derived either directly or indirectly from the glacial drift.

The following table will summarize briefly the distribution of the output.

KIND	1916		1917		1918	
	TONS	VALUE	TONS	VALUE	TONS	VALUE
Sand used for						
Building	1,181,505	\$388,080	1,194,878	\$ 372,756	903,425	\$391,120
Engines	19,177	5,296	21,093	6,146	33,283	14,748
Railroad ballast	924,191	164,800	471,822	119,223	397,795	71,356
Paving	231,300	72,571	191,099	67,497	62,577	30,202
Molding		3,080	72,844	26,028	29,219	13,469
Filters	31,948	9,250	26,735	8,616	10,686	5,649
Glass sand, grinding and pol- ishing, fire or fur- nace sand		4,678	4,000	3,000	9,561	5,286
Miscellaneous	68,880	23,218	48,052	12,798	33,357	11,277
Gravel	853,277	309,299	878,918	444,522	524,541	361,200
Total.....	3,321,691	\$980,272	2,909,441	\$1,060,586	2,004,444	\$904,307

Apparently the most valuable sand regained in the state is "fire or furnace sand", which is valued at one dollar per ton. Glass sand ranks next with a valuation of ninety cents per ton. On the other hand some of the railway companies value their ballast at only ten cents per ton and one company valued the entire output from one pit at only one dollar. These low figures of course tend to reduce the total output much below its true value as indicated by the service it performs.

Table V gives in detail the statistics of production by counties in-so-far as these can be revealed:

TABLE V
PRODUCTION OF SAND AND GRAVEL IN 1917

Counties	No. of Producers	Building Sand	Engine Sand* and R.R. Bal'st Sand†	Paving Sand	Other Sand ^b	Gravel	Quantity Tons	Value
Black Hawk	6	*	\$	\$	\$	\$ 10,470	55,819	\$ 17,081
Boone	1	*		*		*	*	*
Bremer	2	*		*			*	*
Buena Vista	2	*				*	*	*
Butler	1	*					*	*
Carroll	1	*					*	*
Cerro Gordo	3	*	*†	*	*	69,523	252,301	118,782
Cherokee	2	*	†		*	*	*	*
Clay	1	*				*	*	*
Clayton	1	*			*		*	*
Clinton	6	*	*			9,054	30,090	12,653
Crawford	1	*	*			*	*	*
Des Moines	2	*		*		*	*	*
Dickinson	2	*	†			*	*	*
Dubuque	3	15,446	*			*	55,926	35,805
Emmet	2	*	†				*	*
Fayette	1	*					*	*
Franklin	4	*				*	3,109	1,370
Hardin	2	*				*	*	*
Howard	2	*				*	*	*
Humboldt	1	*	†		*	*	*	*
Jackson	6	10,178	†	*		5,692	49,718	18,824
Jones	2	*	*				*	*
Kossuth	1	*					*	*

* Includes: Engine sand, \$6,146; railroad ballast, \$119,223.

^b Includes: Glass sand, grinding and polishing sand, fire or furnace sand, \$3,000; molding sand, \$26,028; filter sand, \$8,616; uses not specified, \$12,798.

† Included under Counties with less than three producers.

SAND AND GRAVEL

TABLE V (Continued)

Counties	No. of Producers	Building Sand	Engine Sand* and RR. Bal' st Sand†	Paving Sand	Other Sand ^b	Gravel	Quantity Tons	Value
Lee	2	*		*		*	*	*
Linn	4	*				*	141,346	43,510
Lyon	1	*		*		*	*	*
Mahaska	1	*	*			*	*	*
Marion	2	*			*	*	*	*
Marshall	2	*		*		*	*	*
Muscatine	3	*	*	*	*	30,737	153,664	55,259
O'Brien	3	*				*	2,580	1,410
Osceola	2	*	†				*	*
Page	1	*					*	*
Palo Alto	2	*		*		*	*	*
Plymouth	3	*					29,981	11,090
Polk	12	67,499	104,465	2,196	24,321	78,874	747,225	277,355
Sac	2	*			*		*	*
Scott	2	*					*	*
Sioux	6	25,311	*	*	*	19,688	113,353	53,370
Story	2	*				*	*	*
Van Buren	1	*					*	*
Wapello	4	22,281	*	*	*	*	133,247	44,590
Webster	3	*		*			11,117	*
Winneshiek	2	*				*	*	*
Woodbury	1	*					*	*
Wright	3		†			*	36,228	*
Counties with less than three producers.....		232,041	20,905	65,301	26,121	220,484	1,093,737	367,482
Total	119	\$ 372,756	\$ 125,369 ^a	\$ 67,497	\$ 50,442	\$ 444,522	\$ 2,909,441	\$ 1,060,586

^a Includes: Engine sand, \$6,146; railroad ballast, \$119,223.

^b Includes: Glass sand, grinding and polishing sand, fire or furnace sand, \$3,000; molding sand, \$26,028; filter sand, \$8,616; uses not specified, \$12,798.

* Included under Counties with less than three producers.

TABLE V (Continued)
 PRODUCTION OF SAND AND GRAVEL IN 1918

Counties	No. of Producers	Building Sand	Engine Sand* and RR. Bal' st Sand†	Paving Sand	Other Sand ^b	Gravel	Quantity Tons	Value
Black Hawk	5	\$ 18,860	\$ *	\$	\$ *	\$ 13,185	81,443	\$ 35,578
Boone	1	*				*	*	*
Bremer	1	*					*	*
Buena Vista	2					*	*	*
Butler	1	*					*	*
Carroll	1	*					*	*
Cerro Gordo	1	*	*†	*		*	*	*
Cherokee	2	*	†	*	*	*	*	*
Clay	1	*			*		*	*
Clayton	1				*		*	*
Clinton	5	*	*			6,340	18,992	9,300
Crawford	1		*				*	*
Des Moines	2	*		*		*	*	*
Dickinson	1	*		*			*	*
Dubuque	2	*				*	*	*
Fayette	2	*				*	*	*
Floyd	1	*	*				*	*
Franklin	3	*		*			2,032	705
Hardin	3			*	*	*	13,580	4,094
Howard	1	*					*	*
Humboldt	1	*	†		*	*	*	*
Ida	1	*					*	*
Jackson	1	*				*	*	*
Johnson	2	*				*	*	*

* Includes: Engine sand, \$14,748; railroad ballast, \$71,356.

^b Includes: Glass sand and fire or furnace sand, \$2,525; molding sand, \$13,469; grinding and polishing sand, \$2,761; filter sand, \$5,649; uses not specified, \$11,277.

* Included under Counties with less than three producers.

SAND AND GRAVEL

TABLE V (Continued)

Counties	No. of Producers	Building Sand	Engine Sand*and RR.Bal'st Sand†	Paving Sand	Other Sand ^b .	Gravel	Quantity Tons	Value
Jones	2	*	*†				*	*
Lee	2	*					*	*
Linn	4	*				*	57,599	25,271
Lyon	1	*				*	*	*
Mahaska	1	*	*	*		*	*	*
Marion	2	*				*	*	*
Marshall	1	*				*	*	*
Montgomery	1	*		*			*	*
Muscatine	4	*	*		1,200	28,580	117,247	59,436
O'Brien	4	*				*	3,776	3,408
Osceola	2	*	†				*	*
Palo Alto	2	*					*	*
Plymouth	3	10,000					18,648	10,000
Polk	11	85,180	25,442	6,481	15,674	88,857	534,955	221,634
Sac	3	*	†			*	230,006	86,457
Scott	2	*		*			*	*
Sioux	6	21,636	*			*	71,867	49,270
Van Buren	1	*					*	*
Wapello	2	*	*†	*	*	*	*	*
Webster	3	*			*	*	9,075	4,362
Winneshiak	2	*				*	*	*
Woodbury	2	*				*	*	*
Wright	3		†			*	53,330	8,949
Counties with less than three producers.....		255,444	60,662	23,721	18,807	224,238	791,894	385,843
Total	106	\$ 391,120	\$ 86,104 ^a	\$ 30,202	\$ 35,681	\$ 361,200	2,004,444	\$ 904,307

^a Includes: Engine sand, \$14,748; railroad ballast, \$71,356.

^b Includes: Glass sand and fire or furnace sand, \$2,525; molding sand, \$13,469; grinding and polishing sand, \$2,761; filter sand, \$5,649; uses not specified, \$11,277.

* Included under Counties with less than three producers.

GYPSUM.

Iowa maintained its rank as the second producer of gypsum and its products in the United States in both 1917 and 1918, being exceeded by New York alone. The value of the output during 1917 was the largest in the history of the industry to date, even though the amount of crude gypsum mined and also of the finished product was less than that of the year before. This increase in value was due to the increased costs of production, including labor charges, costs of fuel and supplies and the abnormal conditions attending the prosecution of a great war. These abnormal conditions became especially marked during the later months of 1917 and through 1918.

All of the gypsum mined in the state was produced by the five mills at Fort Dodge, as the mill at Centerville was not operated during the two years here under discussion. The mill of the Wasem Plaster Company was burned May 16, 1918, but was rebuilt as a fireproof structure later during the year. Iowa, being far from the industrial centers which were most benefited by the war, showed a decline in 1918 in both quantity of raw material and finished product handled and in the total value of the output as compared with some of the eastern states. Thus the decrease in quantity mined in 1918 in Iowa as compared with that mined in 1917 was 29 per cent and the decrease in the value of the output was 5 per cent during the same period. In New York, on the contrary, the decrease in quantity mined in 1918 was 12 per cent but the value of the output increased 16 per cent over the 1917 output.

One of the encouraging features of the gypsum industry in Iowa is the increasing use of the crude rock for agricultural fertilizer. In 1916 there was sold 12,923 tons valued at \$18,428. In 1917 the amount was increased to 14,194 tons valued at \$30,253 and in 1918, while the amount decreased to 10,546 tons, its value increased to \$37,823. There seems to be no doubt that as the valuable qualities of raw gypsum as a fertilizer become better known the demand for it will increase largely. It will be of interest to compare the production of the leading states for 1916, 1917 and 1918 as shown in the following table:

MINERAL PRODUCTION IN 1917 AND 1918

State	TONS MINED		
	1916	1917	1918
New York	579,827	606,268	531,038
Iowa	522,293	461,864	327,927
Michigan	457,375	375,803	286,763
Ohio	286,678	270,538	199,456
Texas	197,785	257,328	157,388
Total for the United States.....	2,757,730	2,696,226	2,057,015

SOLD CRUDE

State	1916		1917		1918	
	TONS		TONS		TONS	
New York	195,246	\$292,032	223,392	\$ 420,071	183,107	\$ 466,639
Iowa	60,846	59,294	65,012	110,741	57,719	160,148
Michigan	80,298	90,973	68,155	116,653	46,608	131,438
Ohio	11,615	18,683	10,610	28,380	14,005	48,572
Texas						
Total for U. S.....	547,119	\$790,430	623,995	\$1,124,370	470,192	\$1,236,552
Average price per ton.....		\$1.44		\$1.80		\$2.63

STATE	SOLD CALCINED						TOTAL VALUE		
	1916		1917		1918		1916	1917	1918
	TONS		TONS		TONS				
New York	311,264	\$1,167,555	295,646	\$1,872,347	275,333	\$ 2,213,460	\$ 1,459,587	\$ 2,293,418	\$ 2,670,099
Iowa	373,416	1,437,498	322,198	1,931,256	218,178	1,786,266	1,496,795	2,041,997	1,946,414
Michigan	292,109	975,626	257,588	1,452,002	207,059	1,629,711	1,066,599	1,568,655	1,761,149
Ohio	247,802	909,176	219,679	1,276,117	162,626	1,191,077	927,859	1,304,497	1,239,649
Texas	163,444	653,288	220,983	996,262	129,034	834,560	653,288	996,262	834,500
Total for U. S. ...	1,805,814	\$7,168,602	1,677,390	\$9,992,082	1,328,209	\$10,234,302	\$7,959,032	\$11,116,452	\$11,470,554
Average price per ton.....		\$3.97		\$5.96		\$7.70			

GYPSUM

The nearness of the New York mills to the great Portland cement manufacturing districts of the east gives the state a fine market for crude gypsum to be used as a retarder in the finished cement. Nearly 45 per cent of the gypsum used in the United States for this purpose comes from New York. Nearly forty per cent of the gypsum used for land plaster comes from Virginia, while Iowa ranks second and Nevada third in sales of gypsum used for this purpose. Iowa furnishes about 15 per cent of the calcined gypsum used in plate-glass manufacture, Michigan produces 25 per cent and Ohio furnishes the other 60 per cent.

The following table will show in some detail the output of gypsum in Iowa in 1917 and 1918 and the various uses to which it was applied. The Iowa Paint Company of Fort Dodge, which used ground raw gypsum as the base of its paints, was not operating during 1917 or 1918. The Fort Dodge mill of the Acme Cement Plaster Company was burned previously and has not been rebuilt.

VALUE OF GYPSUM PRODUCED IN IOWA.

	1917		1918	
	TONS	VALUE	TONS	VALUE
Crude gypsum mined	461,864		327,927	
Sold crude				
To Portland Cement Mills	50,818	\$80,488	46,259	\$119,583
As land plaster	14,194	30,253	10,546	37,823
To paint mills and for other purposes	-----	-----	914	2,742
Total sold crude	65,012	110,741	57,719	160,148
Sold calcined as stucco	59,916	232,813	20,115	128,977
As mixed wall plaster	224,893	1,371,012	159,322	1,225,924
As plaster of paris, Keene's cement, to plate glass works, to				

Portland Cement mills, and for uses not specified	885	6,045	1,975	14,997
As boards, tile or blocks	36,504	321,386	36,766	416,368
Total sold calcined	322,198	1,931,256	218,178	1,786,266
Total	387,210	2,041,997	275,897	1,946,414

CEMENT.

As was the case in most branches of the mineral industry cement manufacture in Iowa was adversely affected by the war as may be seen from the following summarized table:

	1916		1917		% change in quantity, 1917	1918		% change in quantity, 1918
	Barrels	Value	Barrels	Value		Barrels	Value	
Shipments	4,853,789	\$6,165,547	4,408,765	\$6,870,863	-8.8	3,188,669	\$5,423,926	-28.0
Production	4,703,213		4,626,141		-1.6	3,626,455		-21.6

This decrease in both quantity and value of production prevailed in spite of the gradual increase of the price per barrel of the finished cement, which rose from \$1.270 in 1916 to \$1.551 in 1917 and to \$1.701 in 1918. This condition prevailed throughout the commercial district in which Iowa belongs and which includes also Missouri and Minnesota. In this district the decline in value of shipments from 1917 to 1918 was 24.3 per cent though the average factory price per barrel rose 9.8 per cent. The per capita consumption in Iowa has decreased correspondingly. In 1916 Iowa led the states of the Union with a

consumption of 1.77 barrels per capita; in 1917 she had dropped to second place with a consumption of 1.57 barrels per person, while Montana led with a per capita consumption of 1.69 barrels. In 1918 the leader was the District of Columbia with a per capita consumption of 1.61 barrels while Iowa had gone down to seventh place, as her consumption was only 1.03 barrels per capita. The total consumption in the state during these years was as follows:

	1916	1917	1918
Population (estimated)	2,220,321	2,224,771	2,224,771
Consumption (barrels)	3,930,325	3,501,871	2,298,157
Estimated consumption per capita	1.77 bbls.	1.57 bbls.	1.03 bbls.

The year 1917 was marked by the introduction in the field of the Fort Dodge Portland Cement Corporation, with mill at Gilmore, Pocahontas county, where an excellent quality of limestone is readily available in practically unlimited quantities. Shale is obtained from just below Fort Dodge. This plant has two kilns 8 by 125 feet in dimensions and has a daily capacity of 1500 barrels of cement. There are now four cement factories in Iowa with a total of twenty-six kilns and a daily capacity of 15,100 barrels, a total of 4,900,000 barrels for the year. Three of the companies use the dry process, namely the Lehigh and Northwestern States of Mason City and the Fort Dodge of Gilmore. The Hawkeye Portland Cement Company of Des Moines uses the wet process.

The following table will show the importance of the industry in the United States and the rank of the ten leading states.

SHIPMENT OF PORTLAND CEMENT BY TEN LEADING STATES

STATE	ACTIVE PLANTS		1917		1918		PERCENTAGE OF CHANGE IN QUANTITY IN 1918	AVERAGE PRICE PER BARREL	
	1917	1918	BARRELS	VALUE	BARRELS	VALUE		1917	1918
Pennsylvania	21	21	27,709,442	\$ 34,512,388	22,238,689	\$ 33,600,956	-19.7	\$1.246	\$1.511
Indiana	5	5	8,148,678	11,084,930	6,205,326	9,580,563	-23.8	1.360	1.544
Missouri	5	5	5,800,988	8,248,007	4,515,695	7,132,470	-22.2	1.422	1.579
California	9	10	5,659,547	7,426,097	4,238,424	7,091,789	-25.1	1.312	1.673
New York	9	8	5,408,708	7,050,656	4,074,159	6,568,746	-24.7	1.304	1.612
Michigan	11	10	4,313,771	6,122,887	3,618,088	6,078,167	-16.1	1.419	1.680
Iowa	4	4	4,428,765	6,870,863	3,188,669	5,423,926	-28.0	1.551	1.701
Illinois	4	4	4,378,233	6,090,158	3,703,471	5,695,186	-15.4	1.391	1.538
Kansas	8	7	3,772,884	5,271,721	2,586,834	4,219,203	-31.4	1.397	1.631
Texas	5	5	2,358,944	3,661,328	1,918,919	3,297,977	-18.7	1.552	1.719
Total of United States	118	115	90,703,474	122,775,085	70,915,508	113,153,513	-21.8	1.354	1.596

PORTLAND CEMENT

In 1917 the United States Geological Survey began the collection of statistics on the production of "concrete stone" in the United States in response to numerous requests for information on the subject. These figures show that the industry is one of considerable importance and that Iowa ranks among the leading states in the use of cement for this purpose. The output in Iowa was chiefly in the form of concrete blocks and bricks. In 1917 there were made 1,407,824 of these blocks and bricks which were valued at \$193,480. A small quantity of "Architectural stone" was made also. The output for 1918 was 2,401,772 blocks and bricks with a value of \$225,054. The total production for the United States was valued at \$3,127,937 in 1917 and at \$3,372,277 in 1918, an increase of 8 per cent.

LEAD AND ZINC.

The lead and zinc industry of Iowa has not been in a flourishing condition for some years. Even the great demand for these metals in war time did not stimulate mining here as it did in some districts. The reports to the United States Geological Survey show that during 1917 about a thousand tons of lead-zinc ore was produced and treated. From this ore there were derived 60 tons of zinc carbonate and silicate concentrates which yielded 18 tons of metallic zinc, and 43 tons of lead sulphide concentrate which yielded 34 tons of lead. At the average prices received—8.6 cents per pound for lead in New York and 10.2 cents per pound for zinc of all grades—the value of these metals would be \$5,848 for the lead and \$3,672 for zinc, a total of \$9,520.

No production of either lead or zinc was reported in 1918.

MINERAL WATER.

During 1917 and 1918 there were five active mineral springs in Iowa from which water was sold. These were Fry's well and the Grand Hotel Mineral Springs at Colfax, the Hawkeye Hygeia Well at Sioux City, the Lime Rock Spring near Dubuque and the White Sulphur Spring at Linwood, Scott county. No report of sales from the last of these was received in 1918 and the Dubuque spring was a new addition in 1918.

The reported output from these springs for 1917 was as follows: The total mineral water sold was 99,103 gallons, valued at \$12,125, an average price of twelve cents per gallon. These figures, compared with sales of 148,732 gallons valued at \$14,404 in 1916, show a decrease of 33 per cent in quantity and 16 per cent in value, as the average price received in 1916 was ten cents per gallon. In addition 144,443 gallons of mineral water was used in 1917 in making soft drinks. One mineral water bathing establishment and one resort were maintained. The waters sold were classed as medicinal, valued at \$4,375, and table waters, valued at \$7,750.

In 1918 there was sold 87,703 gallons at an average price of four cents per gallon, giving a total value of \$3,937, of which sum \$2,479 was received for medicinal waters and \$1,458 for table waters. The decrease in quantity and value amounted to 12 per cent and 68 per cent respectively. About 215,000 gallons of mineral water was used in making soft drinks.

POTASH.

It is interesting to note that in 1918 some potash was recovered from the waste material resulting from beet sugar refining. This potash is recovered by the Steffens process, which consists in diluting the beet-sugar molasses, precipitating the remaining sugar content with lime, and filtering. This filtrate contains about 0.35 per cent of potash along with other solids and these are concentrated after removal of the lime. This concentrate is sold for fertilizer and contains the nitrogenous matter originally present. From 10 to 34 per cent of potash is present in the final product, depending on the degree of concentration.

NATURAL GAS.

For many years Iowa has been a small but persistent producer of natural gas from wells in the glacial materials. These wells are all shallow and range from ninety to one hundred twenty feet in depth. They are situated near Herndon, Guthrie county, and near Letts in Louisa county. In 1917 the total production was 225,000 cubic feet valued at \$225. Six

wells were reported as being active on January 1, and seven at the close of the year.

The production in 1918 was much larger, amounting to 1,758,000 cubic feet, but the price per thousand feet was so much lower—from twelve to fifteen cents per thousand feet—that the value was only \$245.

IRON ORE.

The Mississippi Valley Iron Company of St. Louis continued operations at its mine near Waukon and in 1917 it marketed 22,612 tons of beneficiated brown ore, with an average metallic iron content of about 51 per cent.

In 1918 over 7000 tons of ore was mined, but in the latter part of the year the plant was closed on account of adverse market conditions due to the war. It is worthy of note that the price received for Iowa ore is higher than the average from other states for ores of the same class.

The manufacture of ferrosilicon during 1916, 1917 and 1918 was reported by one Iowa firm.