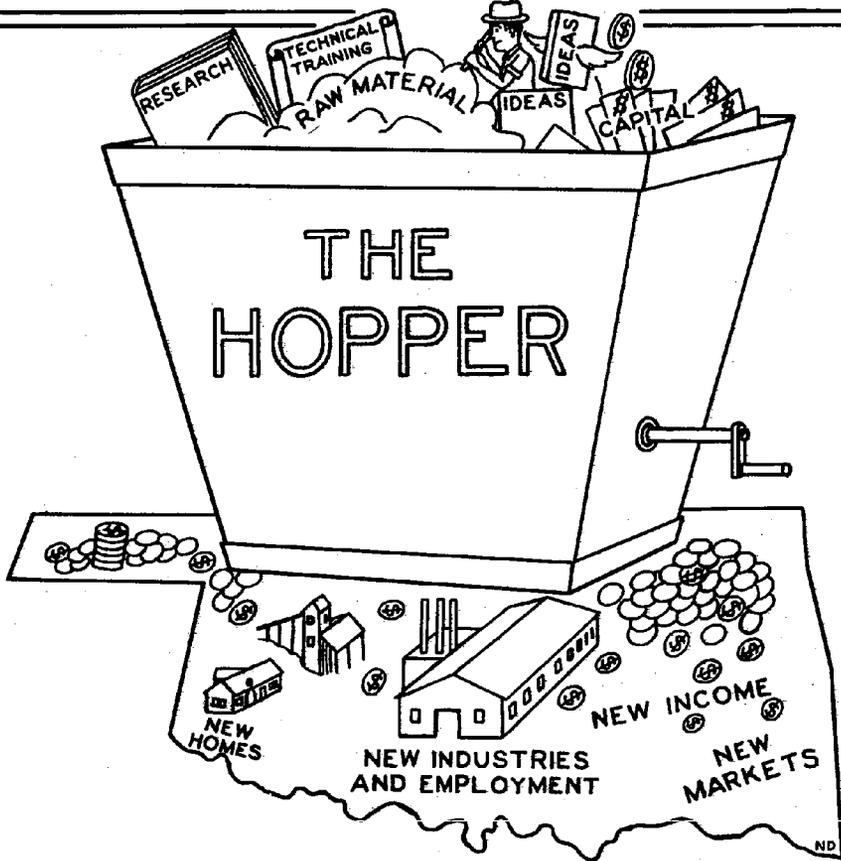

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GLASS, A GROWING INDUSTRY IN OKLAHOMA

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The glass industry is well established in Oklahoma today, with an annual payroll of more than \$12,000,000.

Glass making had its beginning in Oklahoma in 1904 when a plant started operations in Bartlesville, Indian Territory, manufacturing lamp chimneys, lantern globes, and novelties. This first plant, as well as those to follow, was attracted to Oklahoma by an abundance of natural gas.

The original Bartlesville plant started operations with 35 employees. Today there are 17 glass plants covered by the Oklahoma Employment Security Act employing nearly 4,000 workers. Some of the smaller plants do not manufacture glass from raw materials but purchase and refabricate it into such items as decorative, ornamental, or etched glass products. Eleven of the 17 plants mentioned above, however, operate their own tanks and manufacture glass from raw products.

They are located in Ada, Blackwell, Henrvetta, Muskogee, Okmulgee, Sand Springs, and Sapulpa. Of these 11 plants, 3 produce flat glass and 8 manufacture pressed or blown products. In addition to these, there are a few very small plants in the state which have fewer than 8 employees each and are not covered by the Oklahoma Employment Security Act.

Employment in the glass industry is subject to

considerable fluctuations. Much of this is caused by plants shutting down from time to time to rebuild their tanks. Not all the workers are idled, however, when this type of shutdown occurs, as many of them are retained for tank rebuilding work. Slack markets also slow production occasionally, particularly in flat glass.

Despite these ups and downs, however, employment in Oklahoma's glass industry has been moving upward rather steadily over the past few years. For example, average annual employment in 1947 was approximately 2,650 compared with the 1952 average of 3,575. There were 3,900 glass employees in April, 1953, the latest date for which such data are available.

More workers are employed in Oklahoma's glass industry than in either coal mining, lead and zinc mining, or lumbering, all important basic industries.

Another measure of the growth of Oklahoma's glass industry is to be found in its expanding payroll. The total amount of wages and salaries going to glass employees in 1929 was less than \$1,500,000. By 1946 the total payroll amounted to \$5,775,000 and was more than double this figure in 1953 at \$12,500,000. Payroll figures for the intervening years were as follows: 1947, \$6,840,000; 1948, \$3,186,000; 1949, \$8,682,000; 1950, \$11,197,000; 1951, \$12,346,000.

Wage rates in the glass industry run well above the average for manufacturing as a whole. As an example, glass workers earned an average of \$1.79 an hour over the past six months compared with \$1.65 an hour for all manufacturing. Because of a slightly shorter work week in glass, however, there is a smaller spread in the weekly average earnings figures. Glass workers averaged \$72.97 during the past six months compared with the all

manufacturing average of \$69.34. The average hourly work week for glass workers in this period was 40.7 compared with 42 hours in Manufacturing as a whole.

There is considerable fluctuation both in hourly and weekly earnings in the glass industry. This is caused partially by changes in the average length of the work week. Another factor is that glass cutters are paid on a piece rate basis and when there is a great deal of work their earnings are high and when work is slack, these earnings drop.

All major glass plants in Oklahoma are unionized. The pressed and blown glass plants operate under agreements with AFL unions. The flat glass plants are organized by the CIO, except for cutters who are affiliated with the AFL.

The products of Oklahoma's glass industry are many and varied. The more important products can be grouped in two general categories, flat glass and pressed and blown glass. Flat glass production mostly goes into window glass of various types. The most common usages are for automobile windows and windows for homes and business establishments.

Pressed and blown glass products from Oklahoma are very numerous. Included is a long list of food containers such as fruit jars, salad, mayonnaise, and pickle containers, salt shakers, etc. Cookware, including coffee makers, table ware, beverage bottles, containers for pharmaceutical products, cosmetic jars and bottles, bakers' ware, and lamps; these constitute but a small portion of the many glass items produced in this state. The whole list would be much too long to enumerate in this article.

These types of glass products are shaped by the use of molds. Molten glass usually heated to 2600° F. and above, is poured into the molds where it cools and hardens, creating a specific product.

such as a container, a bottle, etc. A separate mold is required for each size or shape of product.

Early expansion in Oklahoma's glass industry was fairly rapid. Following the lead of the Bartlesville plant in 1904, five additional glass factories were operating in the state in 1913. The sharpest growth, however, was recorded during the next six years as there were 16 plants employing approximately 1,700 workers and turning out products valued at \$4,750,000 annually in 1919.

Although there was a decrease in the number of plants operating in Oklahoma in the years following 1919, the value of products manufactured continued increasing. By 1937 there were just 10 plants operating in the state, but they turned out \$6,200,000 worth of glass products. The increase in production between 1919 and 1937 undoubtedly was greater than the dollar value would suggest in that the dollar would buy considerably more in the 1930's than in 1919.

The 1947 census of manufactures gives data only for pressed and blown glassware. In that year the value added by manufacture of these types of glass was \$7,924,000; no figure was given for the total value of products sold. Though no reliable data have been published since 1947, we can be sure that the amount and value of glass products in this state have increased very rapidly since that date.

Employment, for example, has risen 47 percent since 1947. Production unquestionably has risen more rapidly than employment since that date because of increased worker efficiency brought about by technological advances. More work now is being done by machines and less by hand than was the case a few years ago.

Market outlets for glass produced in Oklahoma cover a wide area. A great deal of the container

type glass is sold in Oklahoma and other Southwestern states. Local food processors, for example, contract with glass manufacturers for containers which are made to specifications, frequently with a trade name stamped on them. Much of the glass, however, goes to various parts of the United States.

A large portion of the flat glass is shipped to plants outside Oklahoma for further processing into automobile windows, then is reshipped to automobile manufacturers in Michigan. Increased automobile production is not the only reason for rising demands for this type of glass. New model cars use substantially more glass than did the models of a few years back, thereby improving the market for flat glass.

The glass industry was first attracted to Oklahoma by an abundance of cheap natural gas. Next to fuel, the most important element in the manufacture of glass is sand. When the glass industry first located in Oklahoma, the closest known deposits of commercial glass sand were in east central Missouri. The cost of shipping the sand to Oklahoma was approximately four times its market price at the quarries and deliveries often were uncertain.

It was not until 1913 when the Oklahoma Geological Survey released reports showing that there were high-grade glass sand deposits in bountiful quantities in Oklahoma, that the glass industry of this state was placed on a sound footing. The most important glass sand deposits discovered were in the Arbuckle Mountains near Roff, Mill Creek, and Sulpur.

Not just any sand can be used in glass manufacturing, but only that which has a very high silica content and which has very little impurities, such as iron oxide. Glass producers usually specify sand having 98 percent silica, preferring that containing 99 percent or more. There are large

deposits in the Arbuckle area that test 99.8 percent silica after washing, with a low iron oxide content. Virtually all glass sands are washed at the quarry site before being shipped to the factories for consumption.

The first commercial glass sand mined in Oklahoma was near Roff in 1913, a few months after the release of the Geological Survey report on the area. Discovery of commercial glass sand deposits in Oklahoma probably was the most important factor in the rapid expansion of the glass industry in this state which followed. For example, the increase from 6 to 16 plants between 1913 and 1919 is attributed largely to the production of sand in Oklahoma.

There are large reserves of glass sand in the Arbuckle area lying near a railroad. These sands are in deep deposits under an overburden usually from 3 to 20 feet thick eliminating the need for large-scale excavating before reaching the usable deposits.

Glass sand production in Oklahoma has expanded rapidly in recent years. Production between 1920 and 1930 averaged approximately 25,000 tons annually according to the Oklahoma Geological Survey. The output in 1944 amounted to approximately 130,000 tons. It is estimated that as much silica sand has been quarried from the Arbuckle deposits since 1945 as was produced between 1913 and 1945. Sand from the Arbuckle deposits supplies glass plants in Oklahoma, in neighboring states and some shipments are made to more distant points. There are sufficient deposits of high-grade sand in the area to supply a much larger market than the present one for many years without exhausting reserves.

Small amounts of silica sand produced in Oklahoma are used for other purposes than the manufacture of glass. A portion of this sand is shipped to foundries where it is used as molding sand.

Some of the silica is ground for use as a base in the manufacture of ceramics and many other manufactured products.

In addition to glass sand, Oklahoma has large deposits of two other minerals used in the production of glass; namely, dolomite and limestone. There are an estimated 150,000,000 tons of very high-grade dolomite in one section of the Arbuckle Mountains. The deposits would yield many times this amount if underground mining were used.

There are large deposits of limestone in Sequoyah County suitable for use in the manufacture of glass. An estimated 50,000,000 tons could be produced from open-cut quarries in this area. These deposits are rather deep and many times this amount could be obtained by underground mining, should the demand require it.

Both dolomite and limestone are now being produced in Oklahoma.

(Special acknowledgment is made to Mr. Marcel LeFebvre of Okmulgee and to representatives of several glass companies for information pertaining to the glass industry in Oklahoma. Most of the information in this article relative to glass sands in the State was obtained from Dr. William E. Ham, Director of the Oklahoma Geological Survey, and from various publications of that agency.)

PROVED RESERVES OF PETROLEUM
MAKE GAINS IN OKLAHOMA IN 1952

Estimated proved reserves of petroleum in Oklahoma continued to show gains through 1952, according to the Report of the American Petroleum Institute's Committee on Petroleum Reserves. Proved reserves as of December 31, 1952, were estimated at 1,557,620,000 barrels, a gain of 81,163,000 over December 31, 1951. Production during the year was given as 188,898,000 barrels, and new discoveries and extensions of old fields amounted to 270,061,000 barrels, or an addition to proved reserves of 81,163,000 barrels more than the production for the year. Although several states had a drop in proved reserves during the year, Texas was the only one of the five states producing more than 100 million barrels that had a decline in proved reserves.

A report of the Committee on Natural Gas Reserves of the American Gas Association gives Oklahoma an estimated proved recoverable reserve of natural gas of 11,764,829 millions of cubic feet, as of December 31, 1952. Production for 1952 was reported at 800,892 millions of cubic feet. New discoveries did not quite keep up with production of natural gas in Oklahoma in 1952 and there was a decrease in proved reserves at the end of the year as compared with December 31, 1952.

In addition to petroleum and natural gas, Oklahoma produced 26,472,000 barrels of natural gas liquids in 1952. Estimated proved reserves at the end of the year were 284,906,000 barrels.

Of the five states with an annual production of more than 100,000,000 barrels, four are in a region of which Oklahoma is somewhat centrally located. The same general relationship applies to natural gas. Hence, Oklahoma is located in the midst of the greatest production and known reserves of petroleum and natural gas on the continent.

OKLAHOMA COKING COAL
GOES TO DISTANT MARKETS

Tests on coking properties of Oklahoma coals have resulted in the establishment of a definite market outlet for certain grades of coal from Oklahoma. The tests were made as a cooperative project by the Oklahoma Geological Survey and the U. S. Bureau of Mines. Results of these tests were given in Oklahoma Geological Survey Mineral Report 12, published in 1941, and Mineral Report 15, published in 1943.

This work demonstrated that satisfactory metallurgical coke could be made from blends of low volatile coals from eastern Oklahoma and high volatile coals. Later it was found that Oklahoma low volatile coals could be successfully blended with high volatile coals from other areas. This fact has resulted in Oklahoma low volatile coals being shipped as far as California for blending with other coals to make a strong coke. Practically all coke made from Oklahoma coal has been used in Oklahoma glass plant furnaces or for smelting iron ore.

A statistical report on coke and coal chemistry in 1952, released by the U. S. Bureau of Mines as its Mineral Report M. M. S. No. 2186 shows that Oklahoma shipped 987,739 tons of coking coal to other states during last year. The market value of this coal was not given but figures from other sources indicate an average price of \$6.05 per ton for coal mined from underground in Oklahoma. This means that the experimental work on Oklahoma coal brought approximately 6 million dollars to coal operators and miners in one year from a market that did not previously exist for our coal.

The breakdown of shipments of Oklahoma coal for two coke ovens is as follows:

California	72,384 tons
Texas	792,495 "
Utah	<u>122,930</u> "
Total	987,739 tons

Total coal production in Oklahoma for the year 1951 was approximately 2,350,000 tons. The coal from Oklahoma which is being used for making coke is about one-third of the total present production. The importance of the investigations leading to the development of a market for Oklahoma coking coal can best be evaluated by the fact that at least one-third of the state's coal-mining activity at the present time would be closed down were not shipments being made to coke ovens.