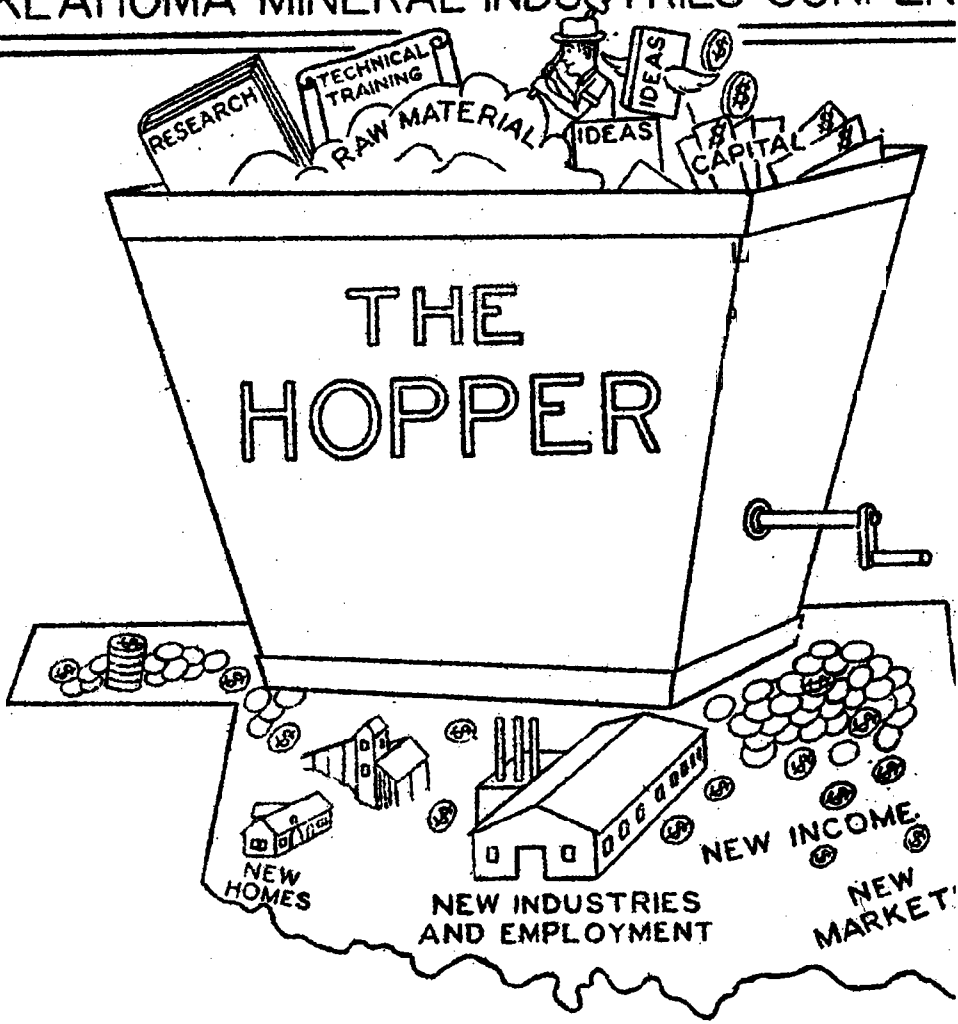
OKLAHOMA MINERAL INDUSTRIES CONFER



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ULTRA-FINE GRINDING

By
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For the Seventh Annual Oklahoma Mineral Industries Conference, Ada, Oklahoma, Nov. 7, 1946.
(Descriptions and illustrations of different types of fine-grinding machines omitted).

For most of us it is quite difficult to visualize what is meant when we say a 2-micron particle or a 44-micron particle. It happens that 44 microns is the dimension of a 325 mesh screen. The surface area of a 44-micron cube is 11616 square microns. The surface of a 2-micron cube is 24 square microns. If a 44-micron cubic particle were split into 2-micron cubes, there would be 10648 such particles. The total surface area of 10648 of the 2-micron particles is 255,552 square microns, about a 22 fold increase. Bear in mind that there are 25,400 microns in an inch. A 20-micron particle is a 20-micron cube or a 625 mesh particle and a 5-micron particle is a 2500 mesh particle (theoretical screen sizes, of course).

The literature of insecticide and fungicide research is replete with data showing the greater effectiveness of insecticides ground to a particle size of 2 to 3 microns. For instance, 15 percent more 3.5 micron sulfur is retained by a certain species of plant than 6.6 micron sulfur; 24 percent more 3.5 micron sulfur is retained than 10.3 micron sulfur. For control of scab 3.7 micron sulfur gave 40 percent better control than 10.3 micron sulfur. Codling moth was controlled much better with 2-micron sulfur than with 11-micron sulfur.

Grinding inert powders to exceedingly small sizes and then coating them with 1/4 percent to 2 percent of their weight with a toxic material, makes them just as effective a toxic agent as pure ground toxic agent. This, in itself, is a real

justification for the existence of the modern ultra-fine grinding machines. The material can be ground and coated in a single operation. Witness the fact that a single contract for ultra-fine grinding of sulfur coated so as to render it wettable by water involves 8000 tons per year. The selling price of this material is more than $60.00 per ton.

During the war the effectiveness of the sulfa drugs for the Army and Navy was greatly increased by fine-grinding to a particle size of 3 microns. Paint pigments similarly have greater covering power when reduced to an ultra-fine condition. Moreover, they can be coated during the grinding process with various substances which increase their ease of wettability with oil.

In the preparation of enameling clays, it is important that the organic matter be removed from the clay. Wet methods formerly used were quite unsatisfactory. The newer type grinding mill known as the Micronizer has been successfully applied to the grinding and classification of clay materials. Clay particles of 4 micron size free from organic material are regularly obtained by this machine.

It is apparent, where uniformity of mixture of heterogeneous materials is advantageous, that ultra-fine grinding gives the best chance of intimate mixing with other materials. This is especially true of sulfur used in the vulcanization of rubber, in the premixing and grinding in the Micronizer of constituents added to the synthetic rubbers of the GRS type. Tensile strength and elongation of such compounded rubbers are notably increased. Ultra-fine grinding reduces the grittiness and the abrasiveness of hard materials. It would indeed be interesting to compare the wear on drill pipe of micronized drilling mud base with the conventionally ground materials. The advantages of slower settling rate, better suspension, and less abrasiveness should appeal to oil well drilling operators.

True, these finer materials are more expensive, but, in the long run, the equipment in contact with them should last longer.

That important cosmetic article which keeps noses from being shiny must indeed be very fine. It is not unlikely that most of this material has been passed through an ultra-fine grinding mill. That smoothly writing pencil of yours contains in its lead an intimate mixture of finely ground graphite, clay, and other materials. Such good writing qualities are possible because the particles of the original mixture were so very fine that subsequent treatment rendered them an almost homogeneous mass.

Here in the Southwest you must care for many animals. You must control animal diseases and pests by appropriate dusting or medication. To be more effective the dusting material should be exceedingly fine. Just as the sulfa drugs were made more effective for our soldiers, so have the drugs for animal diseases and pest control been made more effective by ultra-fine subdivision.

One reason why insoluble drugs, finely ground, are more quickly effective in dosages is that though insoluble in the ordinary sense, they actually have a greater tendency to go into solution than do larger particles of the same material. Likewise, the tendency to vaporize is greater, the smaller the particle size. Again the finer particles of anything are attracted to a large particle of the same or different substances, because of the influence of the law of gravitational attraction of two bodies. Further, the smaller the particle, the more likely it is to possess an electrical charge.

The present discussion is limited to those modern machines which are capable of producing in quantity dry particles of less than 20 micron size. The selection of a particular mill will ordinarily depend on the abrasive qualities of the material to

be ground. The ball mill, the ring-roll mill, the hammer mill, have long been available to grind materials of varying degrees of abrasiveness; the hammer mill being best adapted to the softer materials, and the ball mill to the more abrasive materials, while the ring-roll mill handles materials of the intermediate abrasive class.

The more modern machines for fine grinding such as the Mikro-Atomizer, the Raymond vertical high-speed hammer mill, the Micronizer, the Reductionizer, and the Eagle Mill are so built and operated that they hold the fine particles in an intense centrifugal field until they are reduced to the proper size either by collision with one another or with the mechanical grinding of the machine. An excellent description of these machines, their operation, and performance has been published by Dr. C. E. Berry of the E. I. DuPont DeNemours & Company, Inc., in the July 1946 issue of Industrial and Engineering Chemistry.

N. H. Armstrong of New Port, Pennsylvania, has recently applied the principle of jet propulsion to fluid energy grinding machines. In principle Armstrong's method is as follows: An explosive gas-air mixture is metered under pressure to a combustion chamber where a spark plug is continuously actuated. The resultant, pulsating stream of hot exploded gas is fed to a fluid energy mill where its expansive force is used to grind materials that are not heat sensitive. Armstrong has thus eliminated at one stroke the necessity for steam boilers or high pressure air compressors. Improvements in his technique are now being made. It will not be long before the completely engineered grinding equipment using the jet propulsion system will be available. When this happens Oklahoma will have another use for her natural gas.

The field of ultra-fine grinding has opened up commercially since 1936. Improvements in machines

are to be made. Competition and patent suits will be the order of the day for sometime to come. The machines have all rendered real service during the war. New grinding plants and private installations are being constructed each month. There must be but one answer to this; ultra-fine grinding has come to be a recognized necessity in many industries.

It is now being used in the grinding of dyes, talc, bentonite, grain, feldspar, clay, iron ore, paint pigments, insecticides, graphite, phosphates, drugs, magnesite, silica, gypsum, diatomaceous earth, sulfur, and many other substances. The future looks bright, because in general, the finer the particles are, the lower the weight of material needed to accomplish the same purpose, as compared with coarser particles.

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AGSTONE PLANT AT FT. TOWSON

The Choctaw Lime Company, organized by J. W. Trieschmann, Sr., and J. W. Trieschmann, Jr., has a quarry and crushing plant on the Goodland limestone at Ft. Towson, Choctaw County, to produce limestone for agricultural and other uses. It is expected that about 75 percent of production will be agstone. Capacity of the plant is between 300 and 400 tons per day. Company offices are located in Hugo.

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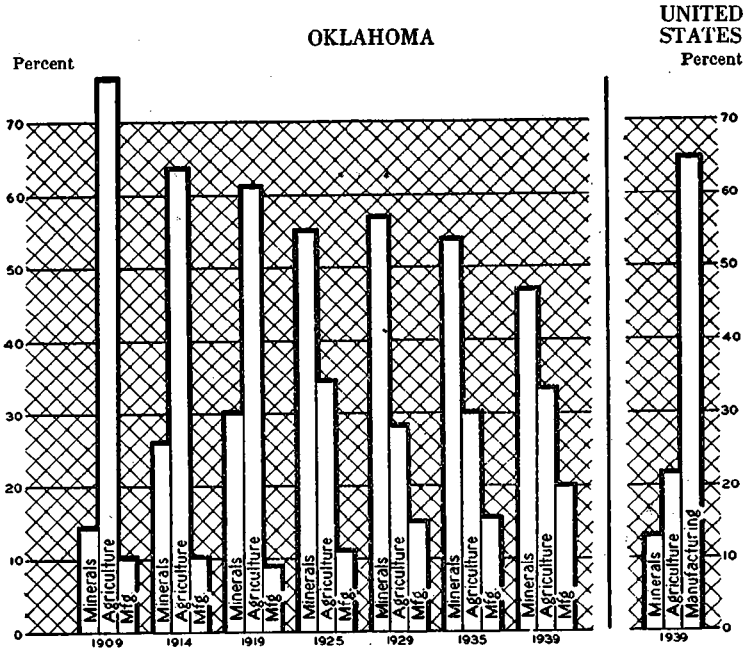
CORNING PLANT STARTED

Construction work has started on the new pyrex glassware plant of Corning Glass Works at Muskogee. The plant will have about 25,000 square feet of space, and will cost $1,700,000.

MINERALS, AGRICULTURE, MANUFACTURING IN OKLAHOMA

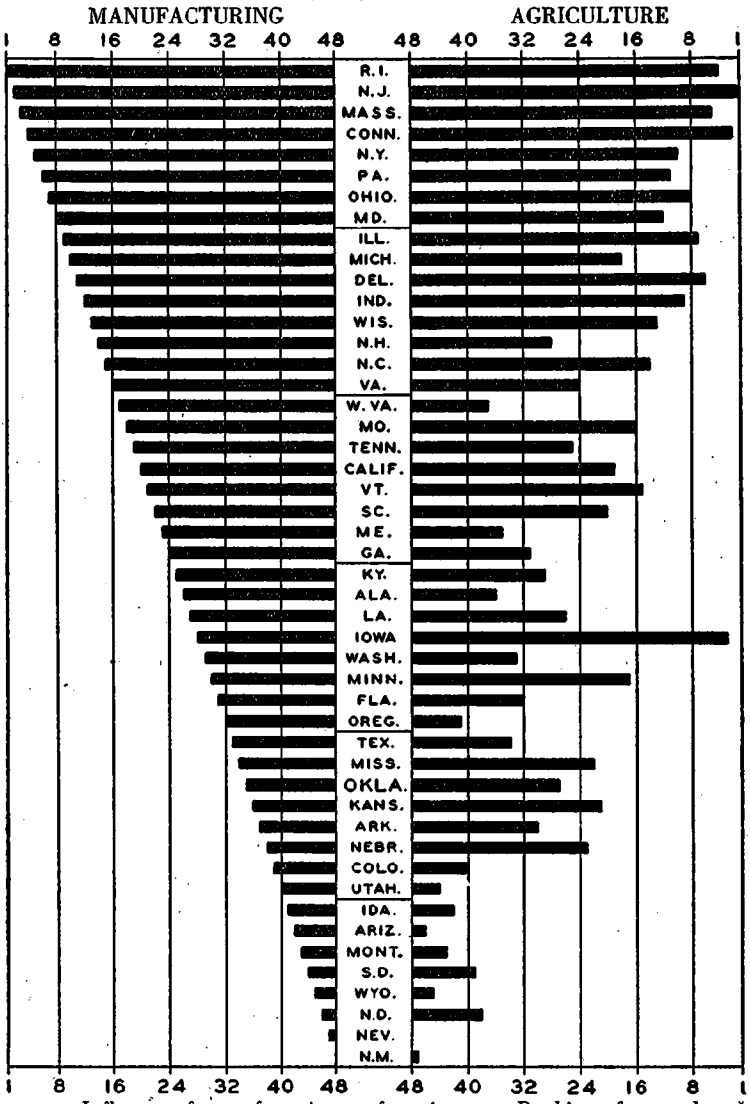
The relationship of mineral production, agriculture, and value added by manufacturing; and a comparison of these phases of our economy with the United States as a whole, are graphically depicted by the following diagram. The second illustration shows the position of Oklahoma, on average value per square mile basis, in comparison with other states of the Nation. Figures reprinted from the 1945-46 Director's Biennial Report of the Oklahoma Geological Survey.



Relative Importance of Values of Minerals, sales of Agricultural Products, and Value Added by Manufacturing in Oklahoma for selected years, compared with the United States for 1939, shown as percent of combined totals. In 1939, the relations of the three factors in Oklahoma were in reverse order to the United States as a whole.

RANKING OF STATES IN MANUFACTURING AND AGRICULTURAL INCOME, 1939

BASED ON INCOME PER SQUARE MILE FOR EACH STATE



Influence of manufacturing on farm income. Ranking of states based on Value Added by Manufacturing per square mile of area, compared with ranking on Value of Sales of Farm Crops and Livestock per square mile, in 1939. For both manufacturing and agriculture, the longest bars show the highest income per square mile, and reflect a basic economic fact that in general, the area with the greatest amount of manufacturing also has the highest agricultural income. Source: U. S. Census Reports.

POPULATION TRENDS

Substantiation of facts and conclusions presented in previous issues of THE HOPPER and in the Biennial Reports of the Oklahoma Geological Survey regarding the importance of a proper industrial development to balance agricultural and mineral raw material production is contained in various recent articles and reports. An article in the March 28 issue of the United States News, recent releases by the Midwest Research Institute, and others are calling attention to the influence of these factors in the shifting of population in the United States.

The United States News published a map showing the effects of reported population shifts on the various states, using estimates based on a census report of July, 1945, and the Midwest Research Institute is calling attention to these shifts, and the necessity for encouraging industry to move into the Mid-West, if the region is to maintain its position among the states.

On the basis of these estimates, the United States as a whole gained 7.3 percent in population from 1940 to 1947. Estimates for Oklahoma showed a loss from 1940 to 1947 of 11.6 percent. In the 10 years from 1930 to 1940, Oklahoma had lost 2.5 percent. Most southern and mid-western states have either had a net loss, or have gained less than the national average. If the estimates regarding population shifts are erroneous, efforts should be made to present the true picture immediately. It does not seem possible that Oklahoma could have lost 11.6 percent in population since 1940, but the statements are getting nation-wide circulation.

These studies indicate that the trend of population shift from the farm is continuing, and that the shift is to industrial areas offering greatest employment opportunities. Discussing the effect on agricultural states, the writer for the United

States News states: "Agricultural areas, too, get something of a break, theirs from population declines. (Putting the economy into better balance--Ed.) The shift from the farms is draining off the population surplus that results from high birth rates and from mechanization that reduces the need for farm labor. That gain is being turned into a loss, however, when migrants must leave a State to find other jobs."

It is pointed out that industrial population appears to be increasing, in general, and for this reason those areas with substantial manufacturing industries are increasing in population. The West Coast, parts of the Gulf Coast area, and the big industrial region from the Great Lakes to New England are the areas of major population growth.

Shifting of population from the farm is nothing new. It has been going on in this country for more than a century. The only thing that need concern any State or region is whether it has a desire to maintain its population and has the resources upon which to build industries that will provide employment for the population it desires to retain. The decrease in the percent of the population of the United States engaged in agriculture is an established fact. How far it can go, no one knows, but the movement is still in progress; and so long as it continues no state that is primarily agricultural can hope to hold even its present population. To some extent, the same thing has happened in mineral production.

The unemployed worker, regardless of home ties, migrates to those areas where there are employment opportunities.

This matter is of particular significance to Oklahoma at the present time. It brings us squarely to a time for decision. It puts squarely before the people of this state the question: "Does

Oklahoma want to hold her population?" Partial decisions and partial answers have been made. The legislature has modified the income tax, the corporation code, and other laws with the deliberate and avowed purpose of making the political atmosphere of this state more attractive to industry. This is an important step.

Another well-conceived plan that may have far-reaching consequences in expanding industries to hold our population is the Oklahoma Industrial Tour scheduled for June 25-July 12, which will take the mountain to Mohammed and show the industrial north and east why Oklahoma is an attractive area for new industrial plants.

There are still many things that should be done. Among them is better support for the research and fact finding agencies of the state that supply the basic information on resources of production, the availability of which is just as important in attracting industries as favorable taxes. Legislation has been passed by the present legislature as a token of the state's now friendly attitude toward industry. Industry will be still more impressed by more convincing evidence of the state's appreciation and support of research agencies that have been established to serve industry.

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RATES REDUCED ON SODA ASH

Freight rates on soda ash from the Gulf Coast to Oklahoma points will go into effect in June, under an Interstate Commerce Commission order, according to recent reports. Soda ash is the major expense item that has to be imported to Oklahoma for making glass, and the new rates will help give Oklahoma factories an equal break with surrounding glass plants.