

ABOUT a century ago in Hawaii an Oklahoma industry was born. A number of scientists sent out by the United States Government, while visiting the crater of Kilauea, the world's largest volcano, discovered a soft, woolly substance blanketing the side of the mountain.

"Pele's hair," was the response of the natives when questioned about it. "When the Goddess Pele becomes angry, she pulls out her hair by the handfuls and casts it out of the crater."

The scientists smiled, then frowned, then investigated. They found that the fibrous substance was created when strong jets of steam blew up through the molten lava. That was information enough.

Back in the United States, they went to their laboratories and simulated the process. Research men tried variations of method and variations of material until they brought forth a product that found its way into commercial manufacture under the name "rock wool." An industry made up of small units appeared. Centralization was not practical. The finished product was too bulky to be shipped cheaply and it could not be compressed and baled like cotton.

By 1935 a plant had been erected in Texas. Its owner, in the course of business, sought to locate nearby sources of "woolrock." A railroad interested in finding suitable rock in the area served by its lines aided in the search.

It was with this prelude that J. D. Kerr, Jr., natural resources development agent for the railroad, in the summer of 1935 came to the offices of the Oklahoma Geological Survey in Norman. Robert H. Dott, newly appointed director of the Survey, welcomed him.

"Is there any rock in Oklahoma suitable for the making of rock wool?" Mr. Kerr asked the geologist.

Mr. Dott had scarcely more than heard of rock wool. As an insulator it was a new thing. In fact, the building insulation idea itself was still rather uncommon.

Mr. Kerr explained that the kind of rock needed was impure limestone, the impurities consisting principally of sand or other forms of silica. Pure limestone, he said, when heated forms only crumbly lumps. With the impurities in it, it melts and can then be blown by steam into tiny fibers or "wool." Pure silica, on the other hand, forms glass. A proper mixture of silica and limestone is necessary to produce the flexible, wool-like fibers.

Visions of the answer to a great problem of Oklahoma and the Southwest gradually took shape in Mr. Dott's mind. The area is subjected to extremes of both heat and cold that effect living comfort, especially in homes of low-cost construction. There is particular need for a moderately-priced, efficient insulating medium. Rock wool produced locally would find a ready market throughout the region.

Pele's Hair

By SIGFRID FLOREN

The Stimulating Story of How An Entirely New Industry Has Been Established in Oklahoma

Mr. Dott pondered. It is his job to recognize the part that undeveloped natural resources may play in the future of the state; to consider the possibilities of establishing new industries that will make use of those resources; to examine geological deposits in the state and investigate their potentialities.

Mr. Kerr, as a representative of his railroad, was just as keenly interested in getting new industries started in Oklahoma. The two men envisioned the same possibilities—had the same hopes.

They both knew at once that the first thing was to determine whether there was suitable rock available, and where, and in what quantities. Yes, the first thing—but one of the many things that the Oklahoma Geological Survey finds easier to discuss than to accomplish. The matter was forced to lie dormant for several months. A limited staff and limited funds did not permit Mr. Dott to undertake all the work he felt was needed.

Then in February, 1936, Director Dott attended the annual meeting of the Association of American State Geologists in Washington, D. C. As if plotted by Destiny, the subject of rock wool was thrown

onto the conference table by the chief of the Illinois Geological Survey, Dr. M. M. Leighton.

Mr. Dott had not anticipated any mention of the matter, but there it was—authoritative information ably presented. He went to Dr. Leighton after the meeting adjourned and explained his interest in it.

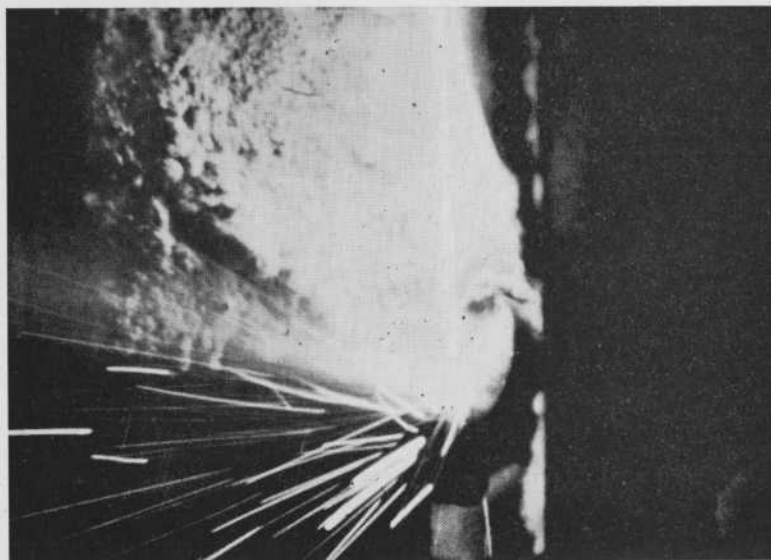
The Illinois Survey, he learned, had done considerable work in the field and in the laboratory with woolrock, and all the information it had accumulated was available as a foundation for any Oklahoma work. Dr. Leighton, enthusiastic about rock wool possibilities in other sections of the country, was glad to lend whatever aid he could to the Oklahoma Geological Survey. He invited Mr. Dott and other representatives of the Survey to attend the Illinois Mineral Industries Conference in April.

Mr. Dott and F. C. Wood, mining and metallurgical engineer of the O. G. S., were at the scene of the conference a day early. Dr. Leighton, the Illinois geologists and chemists spent the day showing their guests the laboratory equipment used in their work with wool rock and in describing technical and economics phases of rock wool production.

The Oklahomans came back to the state with a store of information in their minds and copies of the Illinois Geological Survey's published report on woolrock in their brief cases. Illinois investigators had worked out criteria for rock suited to wool production. They had devised tests and equipment. In fact, as far as the scientific basis was concerned, everything was ready to be applied to Oklahoma geology.

Again inadequacy of time and funds threatened to stymie the study of the state's rock wool possibilities. Direct work on the problem was out of the question at the moment, but a W. P. A. pro-

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The artificial volcano that has perfected nature's way of making rock wool

cadets to complete the ten weeks course successfully.

RENEGAR-MILLS: Miss Geraldine Renegar, '40ba, and John Dwight Mills, '40bs, were married November 29. She is a member of Chi Omega sorority. Mr. Mills is a member of Alpha Tau Omega fraternity. They live in Jackson, Mississippi, where he is a geologist with the Carter Oil Company.

ROSS-LAWRENCE: Miss Clara Key Ross and John H. Lawrence, '40m.ed, were married December 25. She attended Central State College. They live in Ardmore, where he is a member of the Lincoln School faculty.

SCOTT-AMBRISTER: Miss Rebekah Louise Scott, '40journal, and Charles Alexander Ambrister, '40bus, were married December 25 in Purcell. She has been employed in the advertising department of the *Altus Times-Democrat*. They live in Oklahoma City, where he is employed by the Oklahoma Natural Gas Company.

John F. Shirk, '40, Oklahoma City, second lieutenant in the Reserve Corps, has been called to extended active duty at Fort Sill.

SHIRLEY-GARNER: Miss Faye Miller Shirley, '40bus, and Everett L. Garner, '40journal, were married November 23 in Yukon. They live in Oklahoma City, where he is employed by Rothschilds B. and M. Company.

TAYLOR-CASEY: Miss Mary Naomi Taylor and Orben J. Casey, '40bus, were married November 30. They live in Oklahoma City, where he is associated with Armour and Company.

VANDEVER-CLARK: Miss Eleanor Vandever, '40bus, and Beryl Clark, '40bs, were married December 30 in Tulsa.

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Pele's Hair

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ject already under way promised invaluable aid in time.

In December of the preceding year the Survey had secured approval for the project. It was known as the State Mineral Survey. Its object was to gather just as much information as possible about the mineral resources of the state. Approximately six hundred persons were employed, of whom some ten per cent were non-relief, technical supervisors, geologists and engineers. They worked in every county of the state gathering ten to thirty pound samples of every type of rock present in an area.

Samples poured into Norman. Six chemists, also a part of the project, analyzed each, with the result that the Survey had a file of between 3,000 and 4,000 analyses of state rock when the work was completed in July, 1937.

It was a large undertaking and required virtually all of the time of the Survey staff. They were still giving what attention they could to the problem of rock wool—but that was very little. Finally, with the W. P. A. mineral survey finished, the green light was on. F. C. Wood, the mining and metallurgical engineer of the Survey who had accompanied Director Dott to Illinois, went to work on rock wool.

He went to the file of the newly accumulated analyses of rock deposits over the state and selected the rocks with the approximate chemical composition shown to be necessary by the Illinois report. A twenty to thirty per cent carbon dioxide content was the principal characteristic

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called for. The search netted about one hundred different rocks or rock mixtures that had at least this first requisite of woolrock.

Next thing was to dig out the sacks of the proper samples from the thousands that had been stored under the east side of Owen Field stadium. From those Mr. Wood took a 1000-gram sample to be put to the blowing test, the test to determine whether a rock could be melted in a commercially feasible manner, and would form "wool" when steam was shot into it.

Investigation was near the stage that would reveal whether any of the numerous limestone deposits of Oklahoma could be used in the manufacture of rock wool. The staff of the Geological Survey, members of the University faculty and Oklahoma business men were watching developments.

Needless to say, a special furnace and special crucible, or container, was necessary to heat the rock samples to a temperature exceeding 1600 degree centigrade. After two or three hours in the furnace, when the sample contained no unmelted inclusions and appeared to be a homogeneous mixture, it was ready for blowing. The crucible, with its molten contents, was transferred quickly to the pouring rack and tilted by hand. A uniform stream the size of a pencil was poured into a jet of steam emitted from a slotted steel nozzle with 80 pounds pressure per square inch behind it.

Success! The process actually did produce rock wool! The method was crude and the results far from uniform, but the experimenters felt they were on the right track.

Before the tests were completed on all the samples, an improvement in the process was made which has been carried over into commercial usage: the development of a V-shaped nozzle utilizing the "restricted throat principle." It not only provides a better stream of steam but also permits the reduction of steam pressure to sixty pounds per square inch.

Another change—and improvement as far as Oklahoma is concerned—from the method of the Illinois investigators is the use of a gas furnace. Dr. Leighton had used electricity. Coke, another possibility, was already being used to secure high temperatures in the large industrial furnaces of the east. But use of coke in Oklahoma for the commercial production of rock wool was out of the question; the expense of securing it would have been prohibitive. So, when the Oklahoma Geological Survey successfully used gas, the answer to fuel requirements was obvious in the state's large reserves of natural gas available to industry at low cost.

After the approximately one hundred samples had been put to the blowing test, and the blown wool collected from the floor and sacked, eighty of them had produced wool of good commercial grade.

Mr. Wood found, on turning to the files again, that these eighty different rock mixtures are widely scattered over the state and represent a large quantity of woolrock. Even this, he stated, is little more than indicative, because many more deposits will undoubtedly be discovered by further prospecting.

Northeastern counties of Ottawa, Delaware, Mayes, Cherokee, Adair, Tulsa and Rogers have the most abundant deposits of the proper material. Other counties with large amounts are Latimer and McCurtain in the southeast; Grady in the central part of the state; and Kiowa, Washita, Woodward and Texas counties in the west.

Even with this amount of work done, development of an operating commercial enterprise was still a distant objective. Several interested men in the state with capital to invest had considered rock wool commercial possibilities and had worked with the Geological Survey. One Oklahoma City business man had paid an assistant to aid Mr. Wood in making the blowing tests, but factors appeared later in the work that discouraged his carrying the work to a commercial stage.

Other prospective sponsors appeared as the work progressed, but by the time the investigation was completed, they were still doubtful or had dropped the matter altogether.

A small, paper-bound booklet released by the Oklahoma Geological Survey in late summer, 1939, began to set the stage for the drama's denouement. It was "Bulletin No. 60, Rock Wool Possibilities in Oklahoma" by F. C. Wood, a scientific and economic discussion of the raw materials, fuel, transportation and markets for rock wool in the state.

Copies of the report went to newspapers, to the railroad officials responsible for instigating the investigation, and to the chambers of commerce of towns in counties having deposits of woolrock. Newspapers sent reporters to more fully cover the work that the Oklahoma Geological Survey had done, and to photograph the laboratory. Publicity was acquainting the people of the state with a previously unknown potentiality.

Next act of the drama had its setting in Tulsa where a newspaper had printed a story of the Geological Survey's investigation. Three men came together, Marvin Hurley, then industrial manager of the Tulsa Chamber of Commerce, F. J. Pierce and R. H. Clarkson, president and secretary-treasurer, respectively, of the Federal Building Material Company, an insulating materials firm.

Mr. Pierce and Mr. Clarkson, already operators of a thermal wool plant at Sand Springs, went straight to the point.

"We are in a favorable position to expand our plant for rock wool," they announced, "if our own investigation should bear out the accuracy of the newspaper accounts."

Mr. Hurley placed them in immediate contact with Mr. Dott in Norman and with O. J. Nelson, a combustion engineer in Kansas. The Tulsans met with the two men. Result was a decision to undertake the manufacture of rock wool on an experimental commercial scale. Source of the raw material chosen under Mr. Dott's direction was the limestone deposits in Grady County, south of Chickasha. Lying close to the surface, the rock would be inexpensively quarried, an important advantage not found in the abundant northeastern Oklahoma deposits.

Final experiments proved satisfactory. The industrialists began preparation for installation of a permanent plant in the spring of 1940.

Then something happened that almost spelled doom for the entire plan. Fire destroyed the Sand Springs thermal wool plant of Federal Building Material Company just before the rock wool equipment was to be installed. The loss was great, general discouragement greater.

But Mr. Pierce and Mr. Clarkson resolved to go ahead with the new enterprise after rebuilding their thermal wool plant in a new location. First test runs were made in the rockwool plant in July. Then, August 10, 1940, the furnace fire was re-lighted and production begun in earnest.

The Oklahoma Geological Survey was being widely commended. Its assistance, however, in commercial development of rock wool in the state wasn't finished. The plant was only beginning to operate. Difficulties were bound to arise that had not been anticipated, and the Survey was prepared to aid further in whatever way it could.

One such difficulty was soon apparent. The furnace was working satisfactorily so that the rock was being melted; the steam nozzle was proving itself by properly governing the three-fourths inch "blow"; but the step between the two was causing trouble. The molten rock had to flow only three inches in a small groove, out the end of the groove and into the steam—a three-inch problem, but the biggest one of the entire enterprise.

This pouring lip, or spout, by which the flow was directed from the furnace to the steam, was made first from cast iron. That was quickly found unsuitable. Several different kinds of firebrick were tried. All had the same fault to a greater or less degree: they could not withstand the combination of heat and the corrosive chemical action of the melted material. A lip lasted from thirty minutes to two hours; then it was necessary to shut down for almost an hour to replace it.

Malcom C. Oakes, Oklahoma Geological Survey field geologist, then working in Tulsa County, was spending part of his time at the plant in observation and study. He was there to offer any advice he could, based on the experience of the Survey and on his own knowledge.

When the pouring lip problem was added to the discouragement that attended the launching of the new industry, Mr. Oakes insisted a solution would be found. About that time it was discovered that corrosion by the melted woolrock was about to eat through the sides of the furnace in several spots. Trouble seemed to descend in sheets.

Again the Oklahoma Geological Survey was able to serve. Mr. Oakes' observation led him to call Mr. Dott at Norman for the Survey's optical pyrometer, an instrument for checking temperature at various spots in the interior of a furnace. With that instrument it was determined what portions inside the furnace needed building up to counteract the corrosion and heat.

But the pouring lip problem was still unsolved.

Another call to Director Dott brought Lawrence S. Reid, consulting chemical engineer of the Survey, to the plant. Finally, the combined judgment was that a new refractory material must be obtained. Mr. Reid worked out specifications and contacted a manufacturer. It wasn't long then, until the manufacturer had prepared a type of refractory block that could "take it." Now a pouring lip lasts thirty days or longer.

Of course the process, even after six months of operation and of overcoming obstacles, is far from perfection. Yet the record of the little plant is something of a marvel. Its condition today is encouraging to its owners.

Total number of men employed in the plant is about twenty. Three others are busy at the quarry. No calculation has been attempted of the number who aid in transportation of the raw material and the finished product and the number engaged in supplying fuel to the plant. An estimate by Mr. Pierce, based on the present scale of operations, placed the annual payroll figure near \$21,000. The fuel bill, he says, usually exceeds \$600 a month. Amount of rock wool produced each day is approximately seven tons.

Hawaiian natives had a name for it, had a legend about it. Really it was Nature's rock wool. Oklahomans have commercialized the same product. With a mechanized process and with Oklahoma materials Pele's hair has become rock wool insulation.

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Heads Tax Court

J. I. Goins, '28law, district judge from Marietta, has been elected presiding judge of the State Court of Tax Review for this year. The post is rotated among district judges serving on the count and does not effect his tenure as district judge.

Judge Goins was county judge of Love county for six years before being elected to the district judgeship. He is a life member of the University of Oklahoma Association.

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