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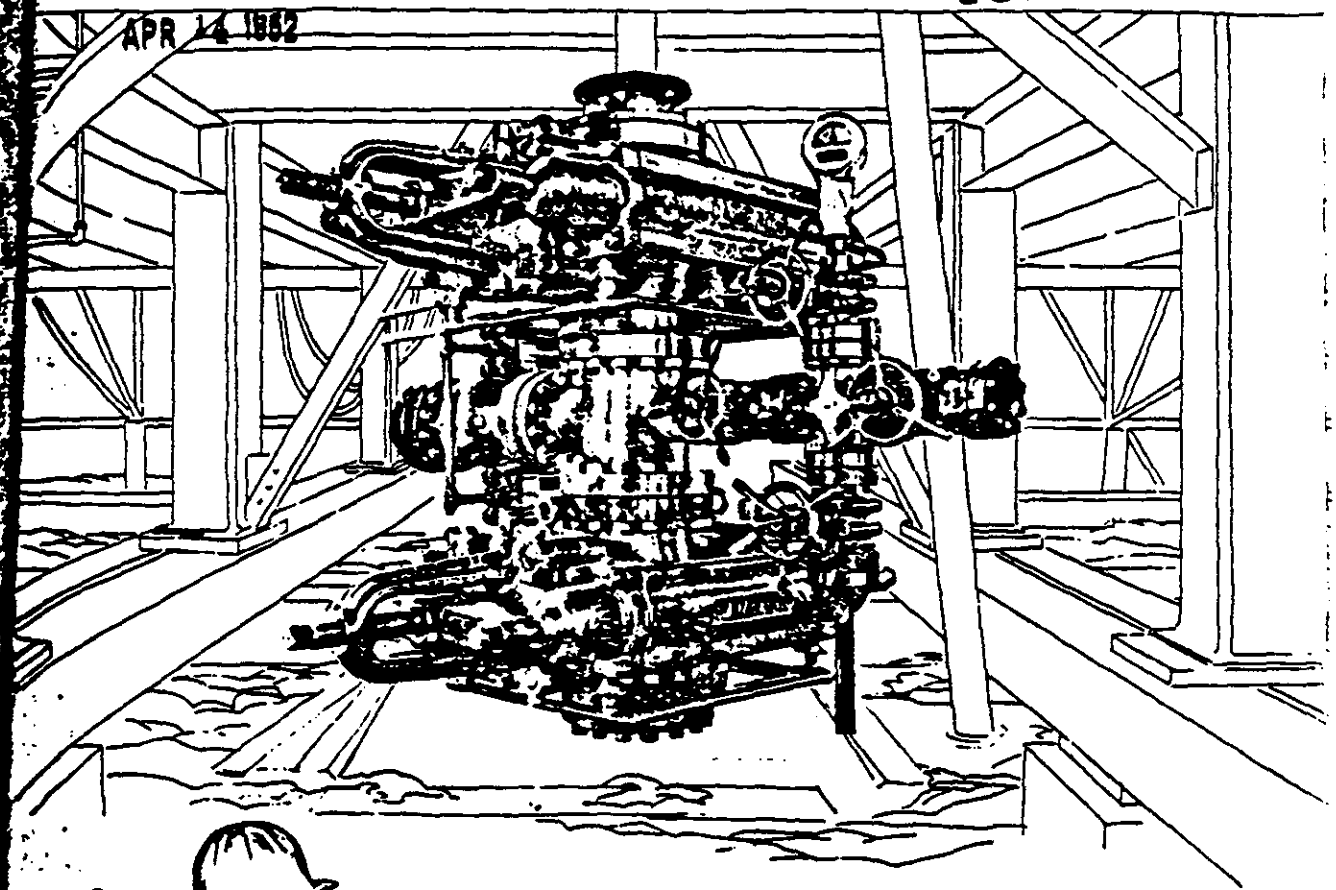
THE Petroleum Engineer

Combined Edition | Drilling and Producing | Refining and Gas Processing | Oil and Gas Pipelining

Technology



The Petroleum Engineer

COMBINED EDITION

• Drilling and Producing • Refining and Gas Processing • Oil and Gas Pipelining

APRIL, 1952 • VOLUME XXIV • NUMBER 4

GENERAL

Features

DRILLING AND PRODUCING

Features

REFINING AND GAS PROCESSING

Features

OIL AND GAS PIPELINING

Features

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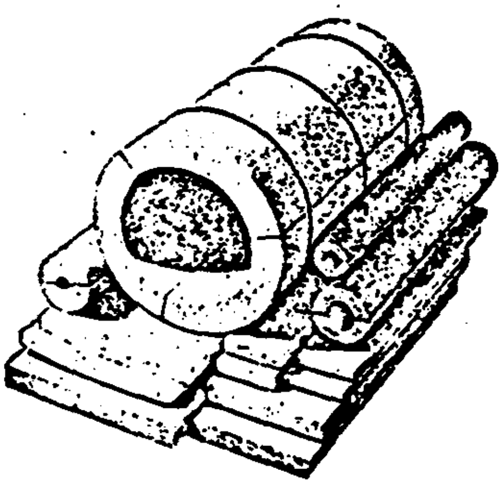
Does Your Present Heat Insulation Have All These Advantages?

PLAINTIFF'S

Kaylo Heat Insulation is a hydrous calcium silicate — a revolutionary heat-saving material — outstanding both in performance and ease of application.



KAYLO PIPE INSULATION is made to Simplified Dimensional Standards of thicknesses and diameters for snug nesting, when necessary.

1 **LOW "K" FACTOR**—Billions of sub-microscopic air spaces which compose the structure of Kaylo Heat Insulation give it exceptional insulating value.

2 **TEMPERATURE RANGE UP TO 1200° F.**—Kaylo Heat Insulation eliminates the need for combination coverings in nearly all operating conditions.

3 **LONG SERVICE LIFE**—Kaylo Heat Insulation remains dimensionally stable, strong and efficient over the years—although exposed to temperatures up to 1200°F.

4 **INSOLUBILITY IN WATER**—Even when saturated, Kaylo Heat Insulation retains about 85% of its strength. It returns to its original strength after drying.

5 **HIGH STRENGTH**—Breakage of Kaylo Heat Insulation is almost negligible in shipping and installation—workmen can walk on insulated equipment without causing breakage.

6 **LIGHT WEIGHT**—Since Kaylo Heat Insulation weighs only 11 pounds per cubic foot, it is exceptionally easy to handle and apply.

7 **WIDE RANGE OF SIZES AND SHAPES**—Kaylo Heat Insulation's unmatched selection of sizes and shapes reduces the number of pieces required per job.

8 **EASE OF CUTTING AND FITTING**—Ordinary tools of the trade are used to install Kaylo Heat Insulation. The material is non-irritating to the skin and non-toxic.

For complete details on all of the advantages of Kaylo Heat Insulation, write Dept. N-249, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.

REFINERY CATALOG

KAYLO ... *first in calcium silicate*

***...pioneered by* OWENS-ILLINOIS Glass Company**

MAIN OFFICE: TOLEDO 1, OHIO—KAYLO SALES OFFICES: ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND
DETROIT • HOUSTON • MINNEAPOLIS • NEW YORK • OKLAHOMA CITY • PHILADELPHIA • PITTSBURGH • ST. LOUIS • WASHINGTON

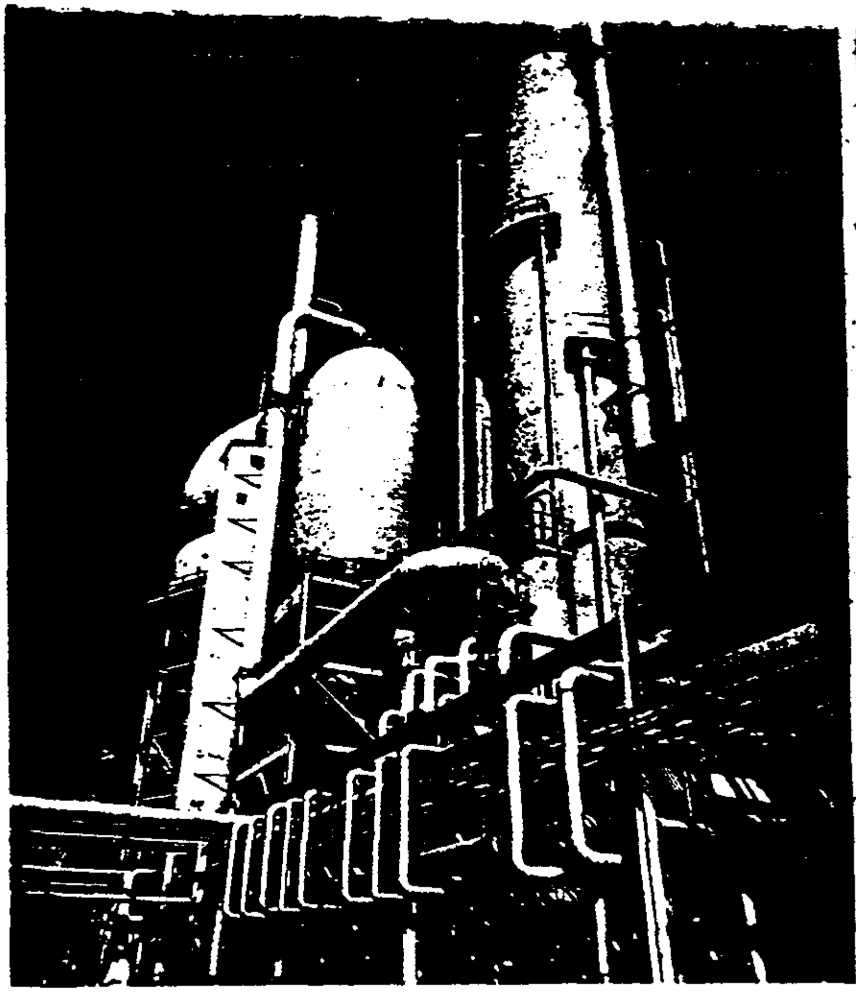
To obtain more information on products advertised see page E-51

ddition to Port Arthur,
of Gulf Oil Corporation,
hydrous calcium silicate.

among the first to recognize improved materials and meth- oil industry has quickly ac- a new heat insulation material of drous calcium silicate type. A ally reacted mixture of lime and containing small amounts of fiber for hinging action. the aterial looks quite similar to other insulating materials commonly industry. It is not glass. In out- appearance, its distinguishing cteristics are an almost chalky ness and a comparatively smooth ce texture, even when sawed.

perly made hydrous calcium sili- is different from other insulating rials now on the market because unique combination of physical cteristics. Although it has a den- of only 11 lb per cubic foot, it has verage flexural strength in excess psi and a compressive strength of psi. Insolubility in water and incom- ibility are two more of its outstand- characteristics. It is effective through- the entire temperature range from to 1200 F. Because its thermal con- tivity is conservatively stated at 0.39 100 mean or 0.54 at 500 mean tem- ature, it is frequent practice to cify ½-in. less thickness for Kaylo lation than for "combination" in- ting materials in the range from 500 1200 surface temperature.

This new material is produced under



P 732.4

Hydrous Calcium Silicate Heat Insulation

Extremely light weight—11 lb per cubic foot—makes handling easy; Simplified Dimensional Standards facilitates nesting and application

E. C. SHUMAN*

ents numbered Re. 23.228, 2.547.127, d other pending patent applications.

Hydrous calcium silicate insulation s been used principally in the medium d high temperature range, because it in this range that the material per- rms to greatest advantage. It may be ed also as a low temperature insula- n, provided proper vapor seals are ployed.

Hydrous calcium silicate insulation oducts of certain types have been anufactured and sold commercially by Owens-Illinois Glass Company since 1943. The story of how this company researched and developed the non-glass insulating material is interesting. It is also an inspiring example of the American Way. Without the vision, resources, and technical know-how of "big business," this material would not be on the market today.

Development of hydrous calcium silicate products began in 1938. The company wanted materials of construction to supplement its Insulux glass block, already well-established, and it had a great deal of manufacturing and engineering experience with the two principal markets used in hydrous calcium silicates—lime and sand.

Many other companies and groups have experimented with various hydrous calcium silicate products. Work had been done in Germany in the early 1930's. Several independent research organizations and manufacturing companies in the United States and Canada had attempted to develop commercial materials during this period. One group was able to produce experimentally

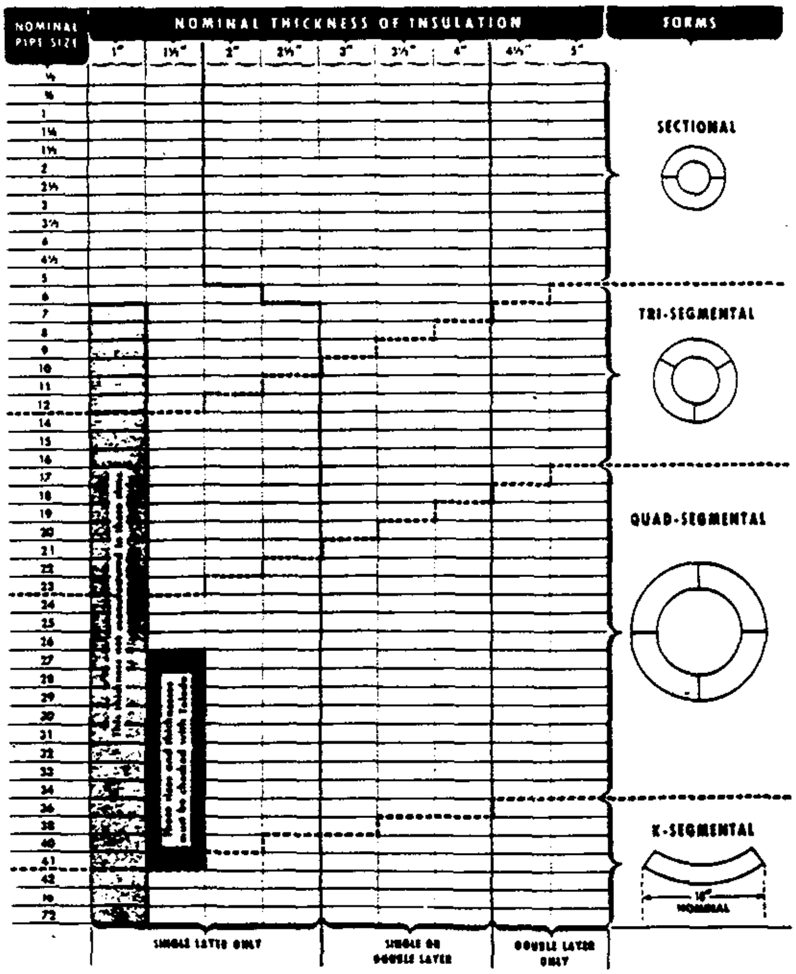
*Director of research, Kaylo Division, Owens-Illinois Glass Company.

EXCLUSIVE

Applicator saws pipe insulation to fit short run.

Standard forms of hydrous clacium silicate heat insulation.

Chart of sizes, forms, and thicknesses of hydrous calcium silicate insulation.



limited quantities of a calcium silicate product which they called Microporite. It was a structural material, and there is an experimental house on Long Island today, which is built almost entirely of this material, except those parts that are exposed to weather.

Until the company's physicists, chemists, and engineers studied the component materials and learned the details of their reactions, however, no one had produced a stable, uniform product with the advantages now found in the hydrous calcium silicate.

Research had reached the pilot plant stage of manufacturing by the outset of World War II. Hydrous calcium silicate heat insulation, then being made at a converted brick plant at Berlin, New Jersey, was approved by the U. S. Navy, which used it for marine insulation. Even in those early days, the material proved stronger, more durable, and easier to handle than others tested.

After the War, construction began on a quarter-mile-long manufacturing plant at Sayreville, New Jersey, and manufacturing of hydrous calcium silicate began there in March, 1948.

The original plant at Berlin, New Jersey, where the forerunner of today's hydrous calcium silicate heat insulation was first produced, has been remodeled and enlarged almost continually to become a sizable and modern factory, from the outside looking much like a typical glass plant. The glassman who enters it, however, finds himself in strange surroundings.

The Sayreville, New Jersey, plant, although little changed on the outside since its construction, has undergone extensive change within during the past four years as the company has perfected improved processes.

Other Calcium Silicates

alcium silicates, of course, are not to the chemist. Portland cement be called a calcium silicate, for ex-le. Even some types of glass can be ed calcium silicates, although being on products, they are not typical bers of the family. Kaylo insula-, however, is a chemically reacted duct, and is a permanently set and le product when it leaves the plant. tland cement is an incompletely re-d chemical compound insofar as mate use is concerned and does not ch its permanent set until mixed h water. Glass is a fused product g no water, its raw materials melted blended at high temperatures.

he manufacturing of hydrous cal-m silicate insulation is essentially a mical reaction operation. Lime, a, asbestos, and water are mixed to m a slurry that is poured into metal lds to shape the desired product. The tion of this slurry is accelerated by use of elevated temperatures in ge pressure vessels called indurators. ter induration, or hardening, the ma-ial is dried to practical commercial limits. It should be noted that, because a chemical reaction is involved, there is no "binder" in any Kaylo insulation.

The millions of tiny air spaces per cubic inch that are left in the material after the moisture is driven off give this insulation its light weight and low thermal conductivity. Every cubic foot of insulation contains so many tiny air spaces that the total area of the surface surrounding them is about 100 acres.

By varying the proportion of water in the formulation it is possible to obtain products in various densities. As the density increases, strength becomes greater and insulating value less. The density of 11 lb per cubic foot presently used for heat insulation was established after long research as the one that represents the optimum combination of physical characteristics for that use, from a practical viewpoint.

A 20-lb per cubic foot hydrous calcium silicate is manufactured also, in the form of two building products—insulating roof tile, for roof decking, and core material, for fabrication by other manufacturers into fireproof doors and wall panels.

Unique Combination of Physical Characteristics

The fire resistance of hydrous calcium silicate is due to its mineral composition, which withstands high temperatures. It will withstand service temperatures as high as 1200 F for an indefinite period, without loss of thermal efficiency. Actually, because exposure to high temperatures drives off residual moisture, the thermal efficiency of the material improves after installation and use.

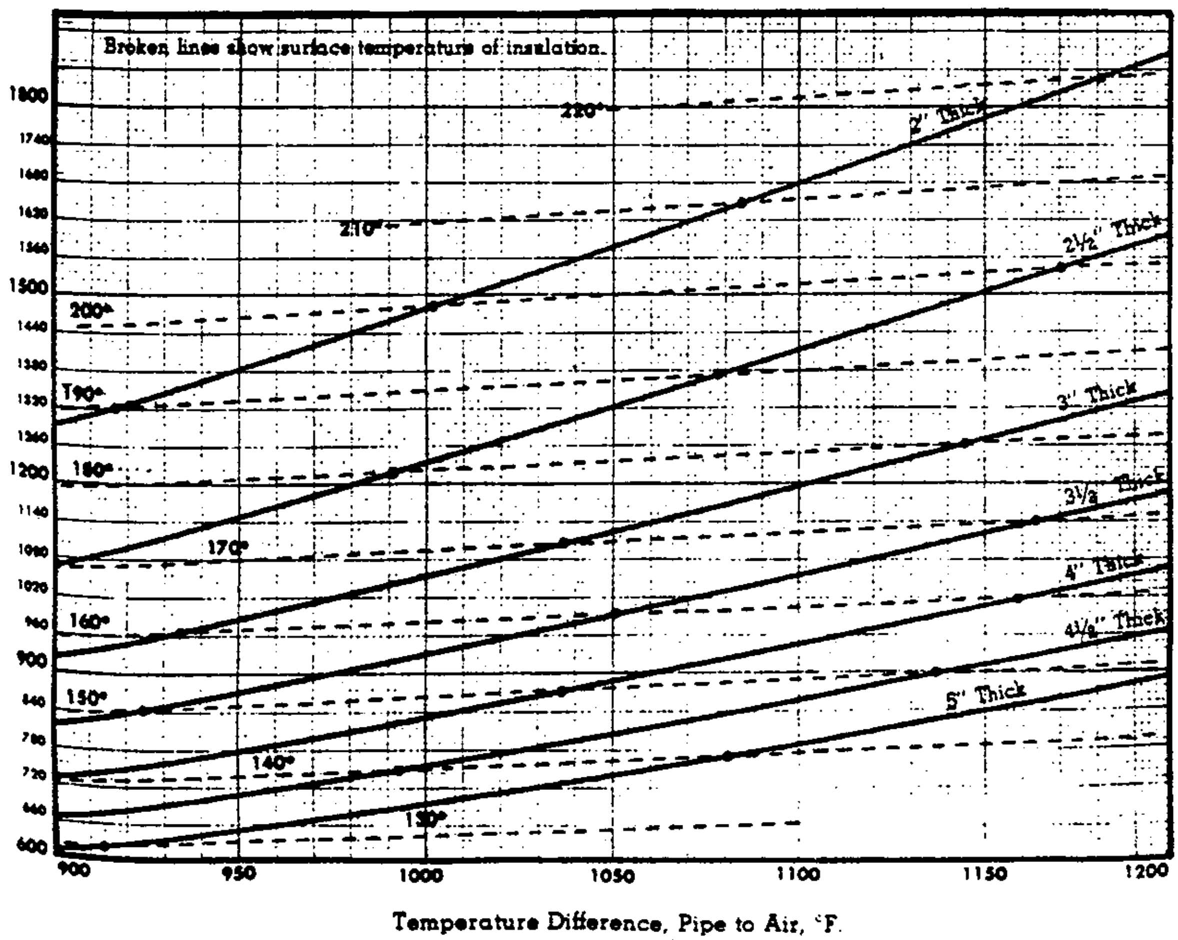
As might be presumed from its structure, hydrous calcium silicate has a high absorption; yet it is not permanently damaged by wetting. Even when saturated, it retains a high proportion of its normal strength, and after drying it regains its normal strength and insulating value. It does not dissolve nor crumble.

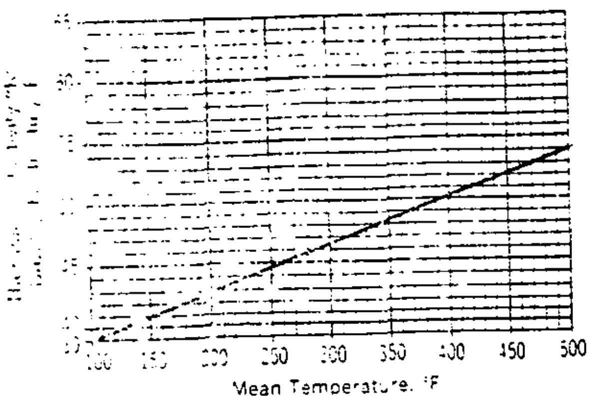
Its hygroscopicity is low. After six hours exposure in an atmosphere of 120 F and 90 per cent relative humidity, for example, it absorbs only 0.9 per cent moisture by volume.

With a —pH factor of about 10, Kaylo insulation is rust-inhibitive. Contact with metal coverings or fasteners, therefore, offers no problem. This includes even

Heat loss and surface temperatures of various thicknesses of hydrous calcium silicate pipe insulation applied to 20-in. pipe.

Ambient still air 80°F.





Relationship between temperature and the conductivity constant, "K."

aluminum, unless the insulation is saturated.

The material has remarkable dimensional stability. Linear shrinkage after 24 hours' exposure to a temperature of 750 F is only 0.8 per cent, and only 1.5 per cent after exposure to 1200 for the same length of time.

Wide Range of Forms

Hydrous calcium silicate heat insulation is made in two basic forms in which heat insulating block and pipe insulation are further divided into many other forms. All units are 36 in. long.

For the insulation of flat surfaces there is flat block. For the insulation of vessels from 6 to 60 ft in diameter, there is curved block. Thicknesses from one through five inches in increments of one-half inch are available for both forms. Widths are three, six, nine, twelve, and eighteen inches.

For insulation of pipes and tubes from one-half inch to six feet in diameter, Kaylo insulation is made in numerous forms, all to Simplified Dimensional Standards (successive layers "nest"). For tubes and pipes through twelve inches in diameters, it is made in sectional form (two pieces to the circumference). For diameters through 24 in., it is made in tri-segmental form (three pieces to the circumference). For diameters through 41 in., it is made in quad-segmental form (four pieces to the circumference). For diameters to 6 ft, it is made in k-segmental form (pieces nominally 18 in. wide and with various radii of curvature).

Thicknesses range from one inch through five inches, in increments of one-half inch.

The tri, quad, and k-segmental forms are unique, and are made possible only by the high strength and light weight of the material. On larger pipes, they permit the user to reduce greatly the number of pieces applied to insulate a given surface of pipe and reduce the number of units. The applicator therefore, handles fewer pieces, yet the light weight of the material makes these larger units easy to lift and handle.

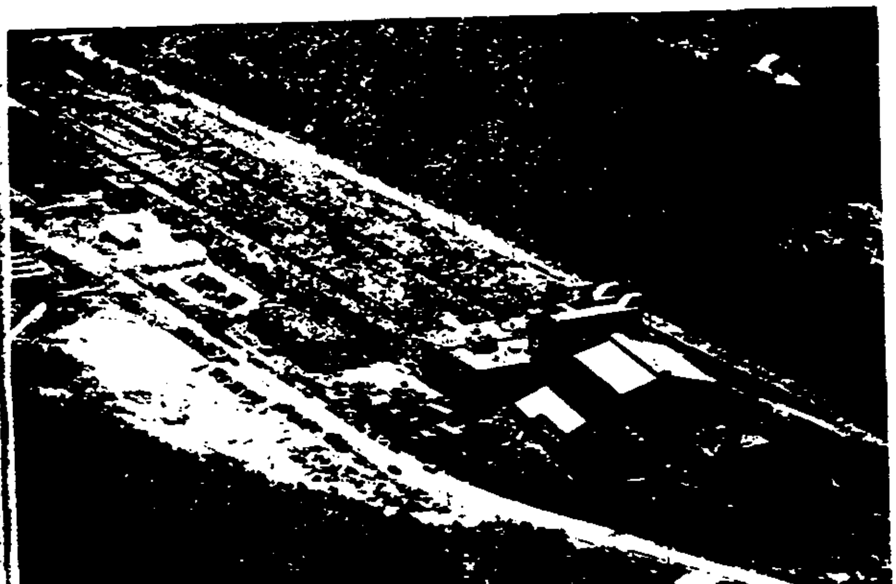
For large pipes with temperatures above 500 F the number of pieces to be applied is reduced even further. In this range it is customary to apply double thicknesses of other insulating materials—a diatomaceous earth type next to the surface in sufficient thickness to reduce the temperature to 500 or lower, and 85 per cent magnesia or other material as an outer layer. Up to 1200, a single layer of hydrous calcium silicate (usually of lesser thickness than the former combination covering) is all that is needed.

A standard 20-in. pipe with a temperature of 700 is a good example of the labor saved by the use of hydrous calcium silicate insulation. With other standard forms and types of heat insulation, the applicator must handle 25 pieces for each 3 ft of pipe. With k-segmental insulation, he handles only three.

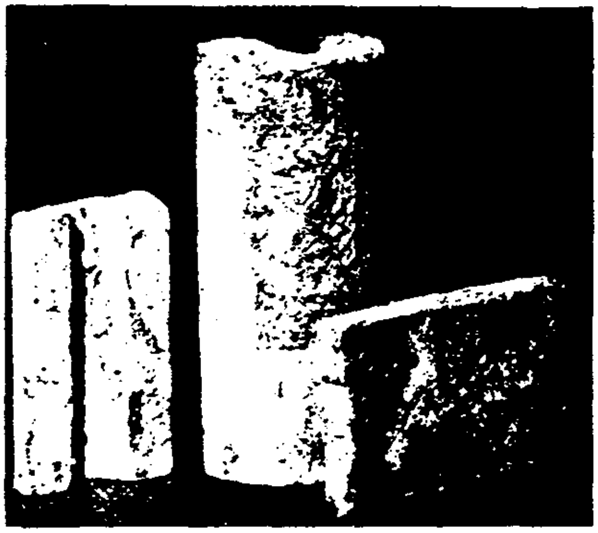
All sizes and thicknesses of this pipe insulation are made to Simplified Dimensional Standards. This system was devised by Ray Thomas, staff engineer for Union Carbide and Carbon Corporation, as a means of simplifying the application and storage of pre-formed heat insulation. At the time that Thomas first published his proposal for the system, this company was considering similar ideas. Hydrous calcium silicate was among the first, if not the first, heat insulation to be manufactured in conformance with his system. It is gradually being adopted by other manufacturers.

Under the Simplified Dimensional Standards system, every piece of pipe insulation is made with an outside diameter that corresponds to that of a standard pipe. Under the old system, pipe insulation is made in what are called standard and double standard thicknesses. So-called standard and double standard thicknesses are constant through certain ranges of pipe diameters. Because standard pipe sizes are often actually larger than their nominal diameters (e.g., "one-inch" pipe has an actual OD of 1.32 in., "six-inch" pipe an OD of 6.63 in.), pipe insulation made to the old system will not always nest.

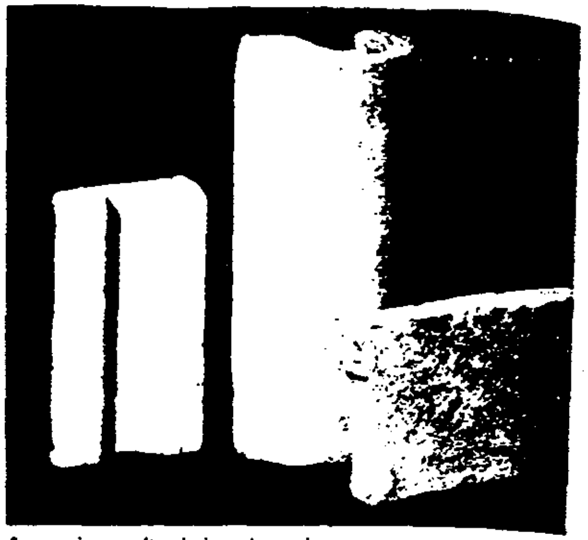
To overcome this handicap, the Simplified Dimensional Standards system varies the thickness of the insulation from nominal thickness. So-called "one-inch" thick insulation for a "one-inch" pipe is actually 1.08 in. thick. "One-inch" thick insulation for a "six-inch" pipe is actually 0.94 in. thick. These variations are insignificant as to thermal conductance (and our heat loss charts take actual thickness into account). Th



Owens-Illinois plant at Sayreville, New Jersey, one of two plants devoted entirely to the production of hydrous calcium silicate.



Pieces of insulation under water a week, after being pulled out of mud left by Missouri River flood at Kansas City.



Same pieces after being cleaned under a stream of tap water and dried.

result is that insulation made to this system will always nest. Any size or thickness will fit snugly over either a standard pipe or another size or thickness of insulation.

Savings by S.D.S. System

The savings anticipated by Thomas in creating the system have proved practical. Because of the interchangeability of insulation made to this system, the number of sizes and thicknesses required to do a given job is greatly reduced. This is particularly beneficial to the user who keeps inventories of material for maintenance. He no longer need keep in stock all sizes and thicknesses that might be required for his insulated equipment. *Instead, he can stock only enough sizes and thicknesses to make up the necessary combinations.*

If processes are changed after equipment has been insulated, thereby necessitating greater insulation thickness, the user can simply apply another layer to his existing insulation. He need not remove the first insulation and apply a new, thicker covering.

It is worth noting that the 1200 F *effective* temperature limit of hydrous calcium silicate also applies here. Often insulations must be removed from equipment because new operating temperatures exceed 500 or *600 F limits* of the material.

Savings in Application

To the engineers who design and specify and to the workmen who apply, the advantages of Kaylo heat insulation products *are many*, the limitations few.

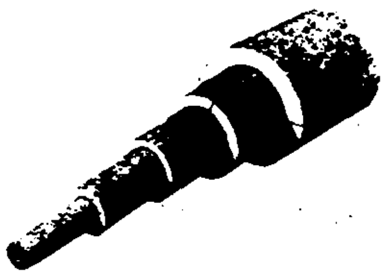
The "limitations" are tied up with the advantages. One is that the material is so strong and rigid that it cannot be broken and shaped easily around irregular surfaces, a not uncommon practice, though not considered good workmanship. On the other hand, it is this strength combined with light weight that makes it possible to manufacture and apply the insulation in larger sizes than has been previous practice. This same strength makes it possible for the applicator to cut hydrous calcium silicate insulation to fit irregular surfaces or odd spaces with an ordinary saw, or even with a knife. Applicators who use it *learn* the new "tricks of the trade" quickly.

Applicators appreciate the fact that hydrous calcium silicate is non-toxic and "easy on the hands."

And this high strength makes it possible to walk on insulated pipes and equipment during installation, and also reduces the amount of insulation breakage during construction. The insulation foreman on a large refinery project in Illinois where this insulation was used throughout, remarked recently that the wasted insulation for the entire job could be hauled away in a pick-up truck. *Estimators are learning to use a* smaller breakage factor when hydrous calcium silicate is specified.

It is not unusual for applicators to mix crushed magnesia insulation with water to form a paste and force it into small areas to be insulated. Hydrous calcium silicate, being insoluble in water, cannot be used this way. This

Telescope of sectional hydrous calcium silicate pipe insulation, illustrating how Simplified Dimensional Standards allows nesting.



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