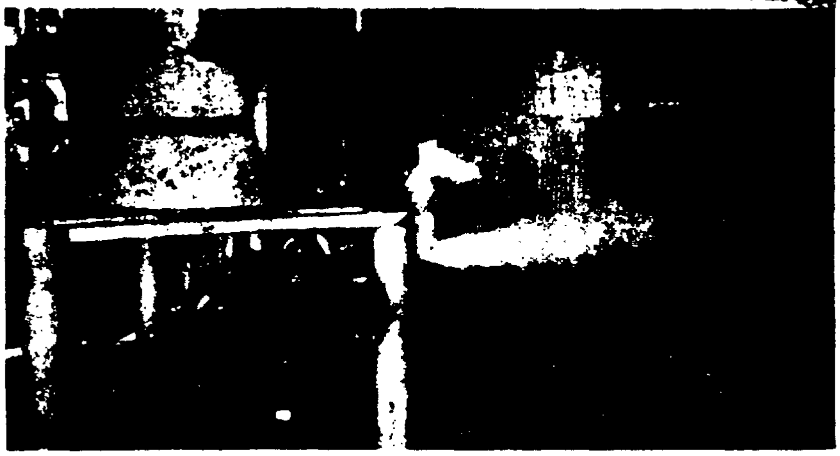
Mineral Wool



Close-up of new water-jacketed cupola showing wheel and ratchet for directing steam jet into melt. Note that molten stream is split and blown into collecting chamber on right

Making a Finer Rock Wool

Waukesha Lime and Stone Co. installs new cupola, and improves method of rock wool manufacture and preparation of bats

Rock wool manufacture has been more or less in an evolutionary stage for the past two years at Waukesha, Wis., where the Waukesha Lime and Stone Co. built a plant in 1939. Out of two years' experience in the proportioning of raw materials and in the melting and blowing of wool, there has been developed a more efficient plant than the original layout. Along with improved plant practice, the quality of the product has been continuously perfected.

The first attempt to make rock wool from limestone and other materials available locally was an experiment. Compressed air was used to fiberize the wool in a local grey-iron foundry, which uses limestone produced by the company as flux.

These experiments proved conclusively that a good grade of rock wool could be manufactured from the materials at hand. Then the plant was built in 1939 and recently changes were incorporated which have perfected the process.

As built in 1939, the plant was typical of many others in operation. It had a vertical cupola, a blowing

Rock wool manufacturing plant, showing new cupola in the center with skip bucket to elevate wheelbarrow loads of materials which are weighed on scale in the foreground. Induced draft fan may be seen to the left

General view of rock wool plant. Storage building on left for finished wool

chamber and a continuous conveyor equipped with cutting knives, to produce loose wool and granular wool and to make insulation bats. A new pre-fabricated steel building was erected for the purpose.

This plant as built had developed a capacity up to 11 tons of rock wool in 24 hr. The cupola was made from a 48-in. diameter boiler shell lined with ordinary fire brick, with cooling water sprayed constantly over the outside of the shell around the melting zone. Alternate layers of raw materials and coke were fed into the top of the cupola by a skip bucket and an air blast to support combustion was introduced through ports by a 30-in. Bailey centrifugal fan into the melting zone.

A 75-hp. hand-fired boiler developed steam under high pressures to blow the wool into a collecting chamber through nozzles of V-shaped section. Capacities up to 12 tons in 24 hr. were arrived at by splitting the molten stream from the cupola into two separate streams, with steam from two separate nozzles fiberizing the material as it was blown into the collecting chamber. At the start, capacity was only five tons a day.

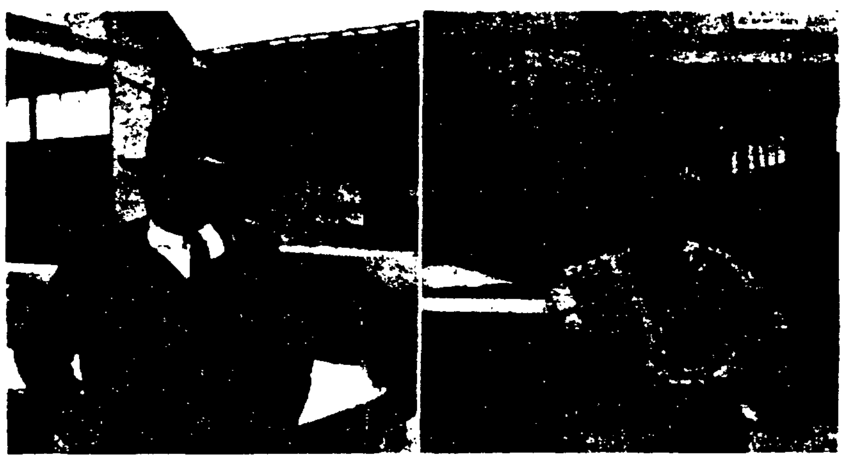
Reduce Fuel Consumption By Plant Improvements

In its entirety, the plant has not been changed much since it was built. However, the cupola has been replaced by a new one of like size that is water-jacketed, and in connection with the new cupola certain important economies have been realized.

This cupola consists of an unlined inner shell, fabricated of ⅜-in. firebox steel, with an outer shell made from ¼-in. boiler plate. Cooling water is circulated between the two shells by one of the quarry pumps at the rate of 20 to 30 g.p.m.

In the process of cooling the shell, the circulating water is heated to a maximum of 200 deg. F. and then becomes part of the boiler feed water. By using pre-heated boiler water, the plant coal consumption has been cut from 230 lb. an hour to 180 or 190 lb. A stoker to be installed is expected to reduce the coal required by an additional 25 percent.

Another important saving has been made by pre-heating the blast air for combustion within the cupola. About 1200 c.f.m. of air is forced through the melting zone within the cupola by the Bailey fan, which has a capacity of 2000 c.f.m.



Left: Fred C. Wolf, vice-president and general superintendent. Right: Clarence Wolf, his son, superintendent of the plant

Waukesha Lime and Stone Co., principally a producer of crushed limestone, went into the rock wool business as another outlet for crushed stone. Its quarry contains limestone strata of varying chemical composition. By selective quarrying, limestone for rock wool manufacture is gotten out that contains, on an average, 53.3 percent $CaCO_3$, 43.4 percent $MgCO_3$ and 2.4 percent SiO_2.

Other raw materials mixed in with this limestone are blast furnace slag for silica and $CaCO_3$, a Portland quartzite for SiO_2 and scrap glass when available locally to replace part of the quartzite. The slag averages about 75 percent SiO_2 and the quartzite 80 to 85 percent.

Each material is weighed separately in a wheelbarrow on a Fairbanks scale and is dumped into a skip bucket. When all the ingredients are dumped, a cable hoist raises the skip to dump into the cupola through a chute near the top. Proportions of the feed material are such to approach an approximate analysis of 40 percent SiO_2, 20 percent Al_2O_3, 20 percent CaO and 20 percent MgO.

Coke for the fire is a 4-in. special cupola lump, of high volatility and low in ash. It is also desirable to have sized feed materials that are free from fines, to facilitate the draft and to prevent segregation which would lead to uneven draft conditions and irregular melting. Limestone is a uniformly sized 3-in. product from the commercial crushed stone plant. Slag is obtained in large chunks which are broken down by lifting them with a crane and dropping them to shatter. Average size used in the mix is 6-in. Quartzite is also of uniform size without fines. These materials are mixed fairly well in handling and in the process of dumping into the cupola.

Temperatures of the melt at discharge from the cupola for blowing range from 2800 deg. F. to 3200 deg. F. Heat intensity is varied by adjusting the volume of air forced through the bed in the cupola. Steam pressures for blowing range from 85 p.s.i. to 110 p.s.i. to produce the most ideal fiber length and to still hold down the percentage of shot. Splitting the melt into two thinner streams for blowing is also helpful in eliminating shot. Each of the two steam nozzles is adjustable, through a wheel and ratchet, to change its direction up or down or laterally. Having this positive means of directing the steam jet into the melt is a detail in operation that has proven invaluable in the fiberization process. Shot in the product is very small and is well below permissible amounts by weight.

The collecting chamber is very similar to those used in many other

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Left: Roller compressing blanket as it emerges from chamber. Roller height is adjustable to vary thickness and density of bats. An additional roller has been installed since this picture was taken to further compress the blanket. Right: Showing one of the rollers resting on wool blanket. Steam rising on the opposite side of conveyor is from "hot" roller underneath

plants, but the arrangement for cutting bats is highly perfected. Fibers of wool settle in a loose blanket inside the collecting chamber on a flat steel slat conveyor which is, in effect, a moving floor in the chamber. The chamber measures 16- x 20-ft. in vertical section and is 60-ft. in length.

Wool is slowly moved out into the cutting and packing room on the conveyor as a continuous operation. The loose wool is compressed into a large blanket of desired thickness and density by adjustable rollers as it is conveyed toward the cutting knives. One of these rollers is located where the wool emerges from the chamber and it also serves to seal the collecting chamber. There are also two others at the far end of the conveyor.

The conveyor has a variable-speed drive, consisting of a 3-hp. 1750 r.p.m. Allis-Chalmers motor with a 20,000:1 gear reduction. This drive and the up or down adjustment of the compressing rollers are the means of regulating the thickness of the blanket and for changing from one thickness to another. Bats are made in 2- and 3½-in. thicknesses measuring 15- x 24-in. in size.

At the far end of the blanket from the collecting chamber, the metal conveyor transfers to six short conveyors parallel to the length of the main conveyor. Over these belts, seven circular discs on a single shaft turn at a high rate of speed in a vertical plane between the six conveyors to slice off six 15-in. widths of wool. Edges trimmed off are put through a granulator. Granulated wool is sold in bulk.

An automatic cross-cut saw of original design is timed according to the movement of the main conveyor to cut the strips of wool into bats 24-in. long. It consists of a 22-in. circular blade connected to the shaft of a 3-hp. reversible motor turning at 1750 r.p.m. A drive shaft is attached to and driven from the motor by chain and gears to support the entire assembly on parallel gear tracks spanning across the conveyor. Twenty-four inches of travel of the rock wool conveyor automatically trips an electrical contact and a clutch is engaged automatically to the drive shaft at the proper motor speed to send the blade across the blanket of wool. Near the end of the gear track, a switch is tripped and the carriage is stopped by a spring bumper. The following 24-in. of travel of the conveyor sends the saw back in the other direction, with the motor turning in the reverse direction.

End of conveyor showing six widths of bats coming to the operators for boxing. Note cross-cut saw directly across table, ventilator hood in the background, and piles of trim, to the right, which are granulated

Bats are packed in cardboard boxes holding 25-sq. ft. of the standard 4-in. bat. Loose wool is made by raising the compression rollers over the conveyor and is packed in cloth bags.

About 60 percent of the production of rock wool bats is made plain, the rest having a paper covering on one side. This paper has one sticking surface and is threaded from a paper roll between the under side of the bats as they come off the conveyors and a roller which is heated through its length by live steam from within. The heat melts the gummed surface of the paper so that it will adhere to the wool.

Loose rock wool is treated with lubricating oil to make it dustless, and various types of chemicals are used as binders. Among them are solutions with bases of melted resin and creosote. These chemicals are blown into the mass of fibers as the wool is blown into the collecting chamber, but from a separate nozzle.

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Fumes from the various chemicals are exhausted from the packing room through a hood over the wool blanket on the conveyor. The hood is connected by a duct to a 2700 c.f.m. exhaust fan.

Future Improvements

Since the original plant was built, a 52- x 82-ft. warehouse has been built, which will accommodate a week's run of the plant. A second roller near the first one over the conveyor has been installed, for further compressing, since the wool when first compacted tends to "spring" back into its original loose state.

It is planned t house-in the conveyor and to m ke changes to the conveyor to dry e wool before cutting it and then o cool it, first by a blast of heated air and then by a blast of cold air. Fans will force the air through the wool blanket on the conveyor. This is desired in order to maintain a uniform product as shipped in boxes. Otherwise the lowest bat in the box becomes compressed and assumes a thickness that makes it too dense.

Waukesha rock wool is sold principally in the Milwaukee area and in nearby counties. The bulk of the sales are through insulating contractors. The plant was designed by Fred C. Wolf, vice-president and general superintendent, and Clarence Wolf, superintendent. Most of the equipment was built in the company's shops.

Rock wool is just one of many products of the Waukesha Lime and Stone Co. The company has been in business for 36 years and has built its business on a policy of diversification. The products include sand and gravel, crushed stone aggregates; flux stone; paving and rip-rap stone; pulverized stone for agricultural stone and for asphaltic surfacing; "sealcote" stone, chips and screenings; poultry, chicken and canary grit; standard and non-slip barn lime; terrazzo stone; hand cut random ashler veneer building stone; rubble stone; Io-Cal, a health-building cow food which is an iodized tube-milled 200-mesh limestone and others. The company is headed by Mrs. M. O. Gillen, president and general manager.

Talc Industry Grows

SALES OF TALC, pyrophyllite, and ground soapstone reached another new high in 1940, exceeding the peak of 1939, by over 27,000 short tons.

The total sales, as reported to the Bureau of Mines, were 281,375 short tons valued at $3,008,320, increases of 11 percent in both quantity and value over 1939. Sales of all classes increased in quantity and value, the greatest increase being in the sales of ground products.

Eleven states reported sales of talc, pyrophyllite, and ground soapstone (and a little pinite) in 1940 compared with 1939. Eight of these states, located in the East, supplied 86 percent of the sales; Western States accounted for the remaining 14 percent. All time highs were again established in California, Georgia, North Carolina, and New York. New York was by far the leading state, with California, North Carolina, and Vermont of about equal importance, but each supplying only about a third as much as New York.

Five industries — paint, ceramics, roofing, paper, and rubber—consumed 75 percent of the talc, pyrophyllite, and ground soapstone of domestic origin. The paint industry—the leading market for these materials—took only 24 percent of the total sales in 1940 as compared with 27 percent in 1939. The ceramic industry increased its hold on second place, while rubber dropped to fifth place in 1940 after being tied with the roofing and paper industries for third place in 1939.