THE OPERATION OF CLAY GRINDING MACHINES
IN REFRACTORIES PLANTS

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Toothed-roller clay grinding and clay-shredding machines used in refractories plants have the following disadvantages:

the wet clay sticks to the working parts;
there is a sharp drop in output when frozen clay is being handled and also a rise in the power consumption;
rapid wear and frequent breakage of the working parts owing to the entry of pieces of stone and metal in the machinery.

The moisture content of fireclays being ground varies from 10 to 28%. Wet clay sticks to the discs and knives of the shredder and other parts. The clay sticks to the teeth and drums of the grinders. In winter the moisture content of the clay freezes on to the metal parts of the machinery.

Sticking and freezing diminish the machine's output.

Practice showed that sticking can be overcome by heating the parts of the grinder to 70-100°C. Heating to higher temperatures is not suitable owing to the loss of lubricating properties of the oils.

Clay shredders are heated by burning generator or natural gas, hot air fed from the driers, or by electricity.

The best proved to be gas and hot air which are fed under the disc of the shredder along a pipe with a valve which regulates the amount of heat carrier. A project for heating shredders was developed by the Khar'kov PKB Tyazhprom for the Zaporozhe Refractories Plant (Fig. 1).

A cylindrical housing contains extraction diffusers which facilitate the flow of the combustion products over the cutting disc and the sockets. The combustion products are removed by fans.

The project also provides for cleaning of the knives and windows using a device which consists of two rotary scrapers fitted to a rotating disc. As the cutting disc rotates, the shaft of the cleaning device runs on to a profiled bar which is rigidly fitted into the frame of the machine, and turns the shaft carrying the scraper. The teeth of the scraper then run into the gaps between the knives and clean them. The knives are cleaned during every rotation of the disc.

A cleaning scraper was also used to overcome the sticking of clay on the teeth of grinders. Shafts rotating with different periphery speeds also help to get rid of stuck clay.

Control of the output and consistency of material feed was achieved with a variable-output feeder placed in front of the clay grinder.

This method is used for firing clay into grog in rotary furnaces at the Borovich Combine, the Suvorov Mining Authority, and the Semiluks Plant. The materials are fed from store to grab crane to feeder bunker to clay grinder with toothed rollers or shredder.

The velocity of the plate feeder is varied with a direct-current controllable drive. The control range is 1:3. The capacity of the electric motor is 4.2 kw, the rpm 1460. The output is determined by the performance of the automatic belt scales LT.
Fig. 1. Heat-carrier ducting for heating clay shredding machine: 1) gas feed; 2) air feed.

The Borovich greg-calcining department uses a tray feeder. Output is regulated by changing the amplitude of the tray.

The advantages of the scheme include its suitability for shredding machines and for toothed shafts, the simplicity resulting from the low drive capacity, and the possibility of supplying direct current from small rectifying equipment; the prospects of using stageless variators, various types of which are now produced in Soviet factories; the pan of the clay-cutting machine is open with this method and this makes for easy observation and removal of foreign objects; metal detectors can also be installed over the feeder.

The drawbacks of the scheme include the presence of a superfluous link in the chain (the feeder) and sticking of the clay to the feeder plate.

An experimental unit was used to regulate the output by changing the rpm of the disc on the cutting machine at the Za-porozhe plant where the acceptability of the system was proved [1].

Practice in refractories plants shows that frozen clay behaves differently from clay that is not frozen.

From paper [1] it is seen that a combination of knocking and breaking should be used to grind frozen clays. Cutting is too energy-consuming.

The All-Union Institute of Refractories working at Bogdanovich has determined the energy capacity of a machine used to grind clays frozen at −20°C. The moisture content of the clay was 20.5%. The energy capacity of the shredder and toothed grinder were compared. Experiments were done on clays of the same type with the same machine outputs. The results are given in Fig. 2. The electrical energy consumption per ton of frozen clay when grinding in a toothed grinder is 50% less than when grinding in shredders.