in shop No. 5 is now being completed.

Mechanization and automation of the loading of compacts into the shaft-type kilns is being carried out on the basis of the completed work.

Shop No. 5 will be the first one at the combine to become fully automated, and control of production in it will be completely automatic.

The mechanization and automation shop includes groups working on dust prevention and ventilation.

Laboratory reports on the dust content of the air in different production sectors are being used as a basis for studying the origin of the dust and for outlining measures to combat it.

A great deal of attention is being given to making machinery, chutes and places where pulverized material is poured as airtight as possible, to moisten the chamotte and to setting up exhaust fan systems.

Sleeve filters have been installed in the grinding section at powder outlet points; a ventilation system has been set up in the pressing section; a through-flow and exhaust ventilation system has been set up in the shaft-type furnaces; and a grid filter has been installed in the pressing section.

These measures have helped to reduce the amount of dust in the air.

One of the most important jobs in the shop is the manufacture and assembly of foam filters in the grinding section in Shop No. 5. These jobs are being financed mainly through State Bank loans, the plant's own funds and to a slight extent by capital investments.

The required standard equipment — electric motors, gears, automation devices, and so on — are being acquired by the combine on the basis of annual supplies.

Experience has shown that the mechanization and automation of production is proceding faster than before.

In order to complete the extensive work planned for the next few years, the shop will have to be further equipped with various machinery.

The staff of the mechanization and automation shop are competing for the title of Communist Labor Shop. The workers are improving their knowledge by studying at home and at technical schools and also at evening courses for young workers. The workers are making certain that the measures outlined for mechanization and automation and the installation of new equipment are completed ahead of schedule.

COMPLEX MECHANIZATION AND AUTOMATION OF REFRACTORY PRODUCTION

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The editorial board of "Ogneupory" is right in its assessment of both the topicality and the complexity of mechanizing and automating refractory production; it was with good reason that the editors published the article "Basic Trends in Complex Mechanization and Automation in the Refractory Industry"[1] and initiated a discussion of this important problem.

The authors of the article quite rightly recommend the use of tensometric scales for weighting material on the production line. While not inferior in accuracy to lever scales, tensometric scales are considerably cheaper, do not require any great alteration of the line machinery, can easily be adopted to inspection and control devices, and do not need frequent or difficult adjustment.

For controlling the production of the clay cutters, we recommend mechanical variators or direct-current drives with separate silicon-diode rectifiers.

The use of mechanical variators cannot be justified since they are cumbersome and neither last very long, nor work reliably on account of friction coalescence.

Mechanical variators cannot provide a constant torque for the varying moment of resistance typical of clay cutters.

The use of direct current drives with separate silicon rectifiers is hardly advisable.

Silicon rectifiers working on 100-200 amps are only made in industry with diodes; i. e., they are not controllable. For smooth variation in the motor speed within wide limits, use can be made of an auto-transformer with a separate controllable drive or a saturation choke with a high amplification factor. They both have to be installed on the alternating current side, which is not only uneconomical, but also awkward for the clay cutters.

The most suitable drive for clay cutters is a direct-current drive working according to the system D-G-D. To make this system more economical, the motor-generator should be replaced by two slave motors with an automatic switch-over for the reserve.

Automatic control of the clay feed to the disintegrators by

[1] R. S. Bernshteyn, and others. Ogneupory, 1960, No. 10.

the current can hardly be considered satisfactory, since, first, the moisture content of the clay reaching the disintegrators is not constant, and, second, the differential between the empty-run current and the working current for asynchronous motors up to 10 kw is so slight that it is extremely difficult to detect it at all.

The suggestion that shaft-type mills should be used for preparing clay powders is worthy of mention, since it provides an answer to the problem of producing powders of a present moisture content and grain composition.

Control of the loading of tubular mills by means of electro-acoustic regulators can only be satisfactorily effective in the case of one unit. If there are several mills close together, the effectiveness is sharply reduced since an expansive and cumbersome sound-screening system is required.

Instead of complex automatic systems on the mixing aggregates, it is more advisable to ensure that the moisture content of the initial materials is constant. To solve this problem the drying drums and rotary kilns should be automated.

Recommendations and views regarding the heating units are fully substantiated and endorsed by many years of experience in operating rotary and tunnel-type kilns. The recommendation that the heat regime of the drying drums be automated is alone questionable. The authors consider it better to control on the basis of temperature with stabilization of the feed of materials.

The most effective way of control is control based on oscillation. The oscillating values in the given case are the product of the moisutre content of incoming material and its weight. The problem should be worked out along these lines.

Determining the moisture content of the clay on the assembly line is a big obstacle in the way of this, but the effectiveness gained from automating the drying drums will enable expenses on constructing a moisture gauge to be recovered.

The authors' recommendations on estabishing central control points are extremely valid and to the point.

It should be pointed out in conclusion that the authors have not devoted sufficient attention to the construction of specialized plants for the development and manufacture of equipment and apparatus for the refractory industry.

Without plants of this kind the mechanization and automation of the refractory industry will be a half-hearted, for it is extremely difficult, and sometimes just impossible, to cope with this important problem without outside help.

REFRACTORIES IN USE

LIFE OF NOZZLES IN CONTINUOUS STEEL CASTING

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This article gives results of the study of the life of nozzles in intermediate ladles used in an experimental plant for continuous steel casting at the Donets Metal Works.

Table 1 gives the characteristics of the nozzles.

The temperature of the boiling steel just before tapping was 1610-1660°; in the ladle, the temperature was 1560-1620°, and in the intermediate ladle, 1520-1560°. The temperature of the killed steel in the furnace just before reduction was 1605-1670°; in the ladle, 1545-1585°; and in the intermediate ladle, 1510-1565°.

Just before the casting the intermediate ladles were heated up to 1000-1350° for 2 or 3 hours. If the surface of the lining of these ladles is heated to higher temperatures, the metal does not cool down to the same degree (Figure 1).

To reduce the heat transfer from the metal to the nozzle and to improve the service conditions for steel pouring parts it is advisable to heat up the lining of the intermediate ladle to 1300-1400° [1-4].

SP-14 chamotte nozzles with high alumina, magnesite and zirconium inserts (Figure 2) [5], chamotte-kaolin double-layer nozzles with high-alumina working layers and chamotte-kaolin nozzles were tested during the casting of boiling steel.

The wear in the inserts averages 2-5 mm per hot hour, the wear of the high-alumina layer in the chamotte-kaolin stoppers averaged 2-6 mm, and 22 mm for the chamotte-kaolin nozzles.

The high-alumina inserts ensured the most stable stream of steel throughout the pouring operation. The relationship between the pouring rate and the duration (mean data) is a straight line (Figure 3) and as a first approximation can be expressed by the straight line equation

$$Q = a + b\tau$$

where Q is the pouring rate, t/min;
a is the initial pouring rate, t/min;
b is the increase in rate during the pouring, t/min;
τ is the duration of the pouring operation, min.

The increase in the pouring rate was not the same for all the inserts and nozzles with a high-alumina working layer; the chamotte-kaolin nozzles showed intensive errosion and by the end of the pouring the rate had been practically doubled.

The dependence of the erosion of the high-alumina and magnesite inserts on the apparent porosity is shown in Figure 4. The apparent porosity was determined for specimens cut from the bottom of the insert after service. The greater