Introduction of the system has reduced the monthly mean time of slow-speed furnace operation for tapping operations (including those connected with a short notch, notch failure, and notch closure) from 46.25 min to 17.57 min (by 0.066%). The consumption of clay has been reduced from 1.388 to 1.379 kg/ton pig, i.e., by 1.3%.

Figure 2 shows a diagram with a recording of gun operation. The diagram was made during the period of plunger travel.

Introduction of the system has improved the quality of iron notch closure, improved furnace operation, and eliminated the possibility of accidents. Introduction of the system on three blast furnaces has brought savings of about 1000 rubles per furnace.

RAW MATERIALS TESTING STATION FOR THE CHEREPOVETS PLANT

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During the years of the Ninth Five-Year Plan, pig iron production was increased and the unit consumption of coke decreased thanks to both the introduction of new capacities and improvement of the performance indices of existing furnaces. An important role in intensifying furnace operation was also played by the iron ore industry, the growth of which met current technical requirements.

An analysis of the performance of blast furnaces constructed over the last few years by the Institute of Ferrous Metallurgy under the Soviet Ministry of Ferrous Metallurgy showed that the quality of charge material preparation at certain plants— including the Cherepovets, West Siberian, and Novolipetsk plants and the Magnitogorsk combine—made it possible for these facilities to achieve the highest furnace performance indices in the sector.

These high indices were first of all the result of faster smelting, an important prerequisite of which is the use of a charge (sinter, etc.) of optimum coarseness (5–60 mm) and stable chemical composition. This reduces the number of rechargings and disruptions in furnace running to a minimum.

The service at plants responsible for determining the physicochemical and granulometric composition of the iron-bearing component of the blast-furnace charge is an integral part of the blast-furnace shop, making it possible for operators to actively control smelting operations. The taking of the samples and their preparation and transport to the laboratory for analysis is still done by hopper gantry personnel at older metallurgical plants, leading to large expenditures of time and delays in receiving data on the composition of the materials charged into the furnace.

For the blast-furnace charge preparation complex at the West Siberian metallurgical plant, the Siberian State Institute for the Planning of Metallurgical Plants has developed and introduced stations for sampling, preparing, and testing raw materials that are the first of their kind and which make maximum use of sample transport and preparation machinery. The charge materials receiving system at the hopper gantries in the blast-furnace shop provides for continuous transport of materials in close cooperation with the sinter plant at West Siberian.

The samples are taken by a standard mechanized procedure from the flow of iron-ore entering the hoppers from the conveyors. The charge samplers themselves are transshipped on the conveyors that transport the raw material to the material preparation and testing line.

Maximum use of machines has largely eliminated heavy manual labor by lab workers and made it possible to shorten the time required to prepare the material for analysis. This is particularly important for monitoring and actively controlling the work of blast furnaces.


54 0026-0894/80/0102- 0054 $07.50 © 1980 Plenum Publishing Corporation
Fig. 1. Network of machinery in charging materials sampling, preparation, and testing system: I) line to determine mechanical strength of iron-bearing materials; II) line to determine granulometric composition of pellets; IV, VI) same, for sinter; III) line to prepare pallet samples for chemical analysis; V, VII) same, for sinter samples; VIII) line to determine granulometric composition of coke; S, P, C) sinter, pellet, and coke hoppers, respectively; 1) sampler; 2) iron-bearing materials storage hopper; 3') same, Pp20; 3) same, Pp30; 4) coke storage hopper; 5) C 915-11 electrovibrating feeder; 6-10) B560 conveyors; 11) intermediate iron-bearing materials hopper; 12) same, coke; 13, 14) 1:2 riffle; 15) chute with reversing gate; 16) GV06 vibrating screen; 17) quarterer; 18) drum for testing strength of metallic raw materials; 19) RN10Ts-13U scales; 20) press; 21) NPV25 weigh hoppers; 22) same, NPV200; 23) same, NPV50; 24) same, NPV100; 25) ShchDS 2.5×6.0 jaw crusher; 27) same, DLSch 80-150; 26) 1:10 sectional rotating sampler; 28) same, 1:20; 29) DG 200×125 roll breaker; 30) IDA-175 disk grinder; 31) 75T-Dr-M vibrating grinder; 32) 236-BGR vibrating-screen analyzer; 33) flow-switching gate; 34) SNOL 3.5×3.5×3.5/3M 244-2 drier, 35) fines conveyors.

The system of mechanisms for sampling, transporting, and preparing samples has made it possible to separate all of the equipment into a distinct technological unit with its own control panel equipped with a graphic control chart that permits sample preparation to be followed visually up to the work station of the lab technician.

The charge is analyzed to determine its chemical and granulometric compositions at the raw material testing stations in the charge preparation complex at the plant. Samples prepared for chemical analysis are sent to the plant laboratory, and the granulometric composition is conveyed to operators at the furnace control panel by telephone.

During sample preparation, the amount of charge being transported is changed in accordance with standards by means of riffles and screens, reducing the original portion of the material. Charge return conveyors at the test station return screenings to the working channel of the charge preparation complex.

Experience in using the stations has shown that they have advantages over existing methods of charge control. Together with its efficiency, the system has room for improvements in its design.

By 1979, the Siberian institute had developed plans for a charge sampling, preparation, and testing station in the charge materials complex for 5580-m³ blast furnace No. 5 at the Cherepovets Metallurgical Plant (Fig. 1). Based on previous experiences in designing the testing stations at the West Siberian plant, designers considered the features peculiar to charging large blast furnaces, as well as other quantitative and qualitative raw material indices.