

DESIGN SOLUTIONS ON UTILIZATION OF FERROALLOY FINE FRACTIONS AND METAL AND SLAG SEPARATION AT FERROALLOY PLANT

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ABSTRACT

The design and development of case studies of installation and utilization of fines ferroalloys schemes produced is presented. They are introduced into the production line for recycling in induction furnaces, a progressive technology of extracting metal from slag in lump sorting modules (LSM) is presented, a description of the hot material in the pelletizing plants «Kopperrn» (Germany, which significantly reduces the metal loss and increases the percentage of extraction of the leading element in the production of manganese ferroalloys is given.

1 UTILIZATION OF FERROALLOY FINE FRACTIONS

TOPAZ LTD designed a plant equipped with two OTTO JUNKER induction furnaces of 4000 kW each for remelting of ferrosilicomanganese and ferrosilicon fine fractions.

Technical and economic advantages of 250 Hz crucible induction furnaces lie in strict temperature and process control, high capacity due to high power density, low power consumption, low melt loss, high plant operability, low investment cost due to compact arrangement, short installation period permitted by pre-assembly of equipment units, and low labour demand due to melting process automation.

OTTO JUNKER equipment is designed and manufactured in a way that meets all labour and environment safety regulations. One of the most important elements of an induction furnace is an inductor. Use of an inductor ensures high efficiency, reliable protection from voltage breakdown and overloads. Furnaces are equipped with deflector systems, thus, occurrence of magnetic leak fields is substantially lower than acceptable workplace limit. A furnace control system ensures constant monitoring and automatic control of all furnace functions and process stages within the melt cycle. Process cycles and operating parameters are permanently monitored and shown on screen.

Tap water is used for efficient cooling of an inductor and transformers, whereas transducer and capacitor banks are cooled using demineralized water containing some glycol. In cases of power shutdown emergency cooling water supply is provided.

In order to reduce noise, noise-absorbing materials are used along with rigid inductor fixation,.

OTTO JUNKER furnaces are equipped with two-way rotary exhaust system. Irrespective of furnace position, Robin Hood system catches all dust and gas and feeds them to a bag filter.

Inductor should be protected by measuring the temperature of the whole area between crucible and inductor, warning of threatening critical temperature values and temperature curve readings and displays, furnace insulation is controlled to grounding. For emergency discharge a special accumulating pit is provided. The system has a rotating charging device, a weighing system is provided for ferroalloy fine fraction.

These furnaces perform well in melting of ferrosilicomanganese fine fractions. Crucible service life is as long as 1000 melts. The values for FeSi melting are somewhat less (Fig.1).

Hot roller pressing of fine fractions is used in both Germany and the USA.

Roller presses ensure process continuity; they are smaller as compared to rotary or stamping presses. One of leading roller press developers and vendors is Kopperrn GmbH, Germany.

Unfortunately, Ukraine does not have specialized companies and organizations involved in development of such equipment as one of the most important aspects of industrial waste processing and utilization (Fig. 2).

2 DESIGN PECULIARITIES OF METAL/SLAG SEPARATING SKIMMER

Efficient separation of metal from slag is a difficult matter in both convertors, open-hearth furnaces and in ferroalloy furnaces. TOPAZ LTD team developed a design of skimmer - metal/slag separator. Skimmer that comprises a bath for metal/slag separation based on different volume specific weights. Bath dimensions are calculated for each particular furnace and alloy, based on the amount of metal and slag fed to skimmer through tap-hole; bath filling rate is

also calculated individually. The slag exit hole is 15-20 cm higher than bath level. The metal exit hole is calculated as well; it is arranged at bath level and equipped with regulated slide gate.

The slide gate bottom is at the level of metal/slag separation, it is raised or lowered depending on metal level in the skimmer bath. The slide position is controlled visually. We try to ensure automatic control of slide position (Fig. 3).

For final metal/slag separation new advanced technologies may be applied, such as lump sorting modules (LSM) developed by Promtekhlogiya Company, Kryvyi Rih, Ukraine. LSM serves to sort metal-containing slag so that metal-inclusion pieces might be recovered from bulk mass of material irrespective of their physical properties (density, magnetic properties, etc.)

Grading rate does not depend on bulk material dust or dirt content and is close to theoretical limit.

Main advantages of dry separation method are as follows:

- high capacity - 5 20 tons of initial feed
- high selectivity of metal components (up to 2 mm)
- low power consumption - 0,5 kW/ton initial feed
- easy integration into manufacturing process
- acceptable noise level - 70 dB
- acceptable vibration level - 63 dB
- mass - 7 tons
- small module dimensions -6x3x2,7 m.

Application of LSM creates possibility to solve complicated problems of maximum recovery of a particular element and adequate environment protection (Fig. 4).

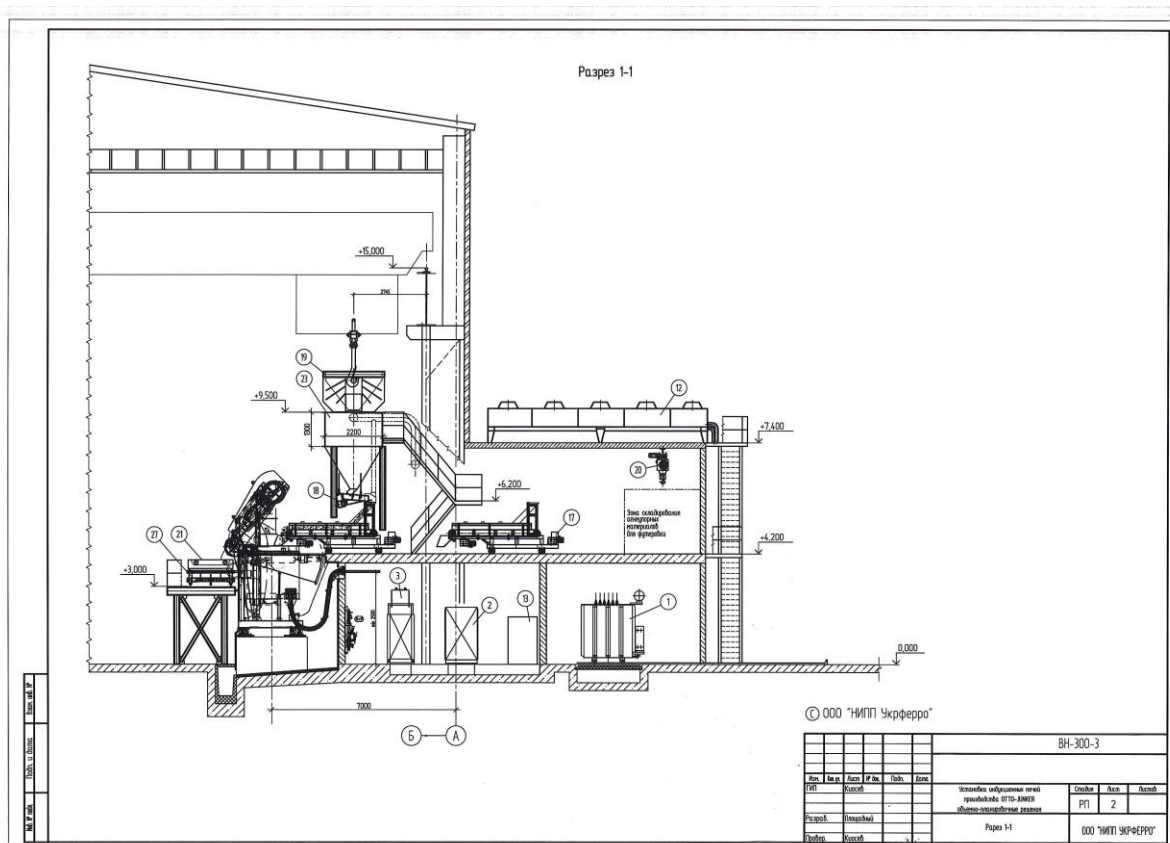


Fig. 1.

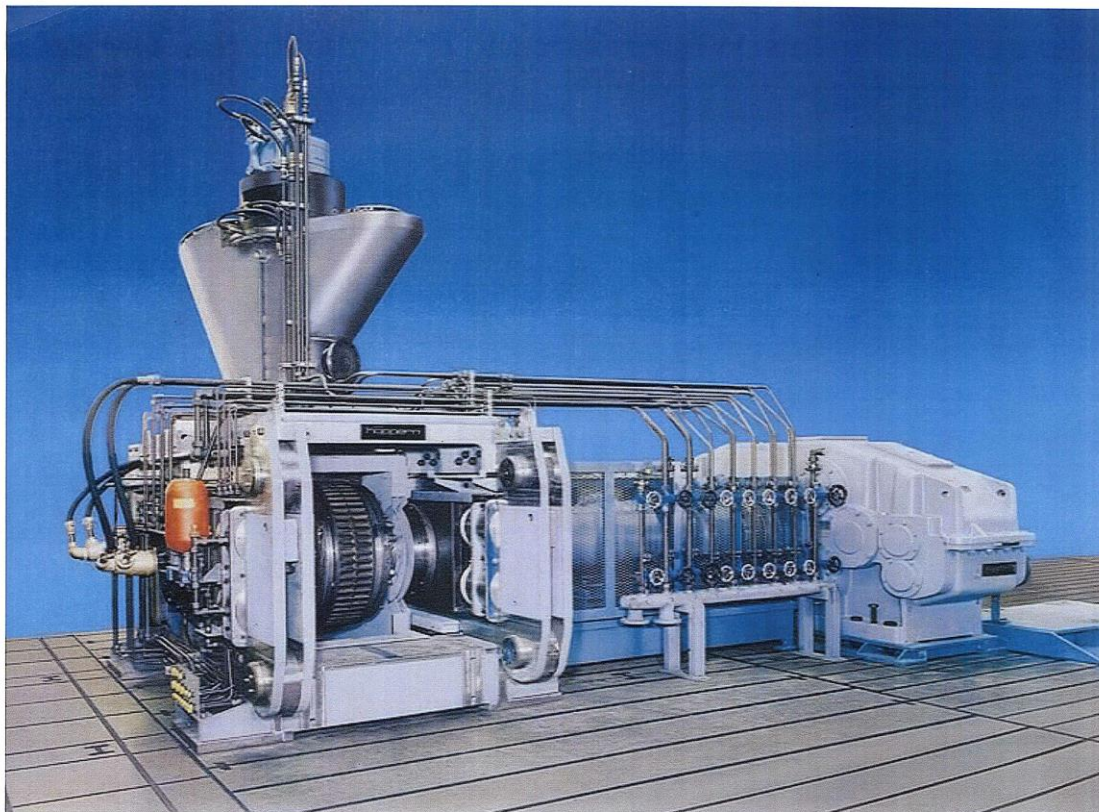


Fig. 2.

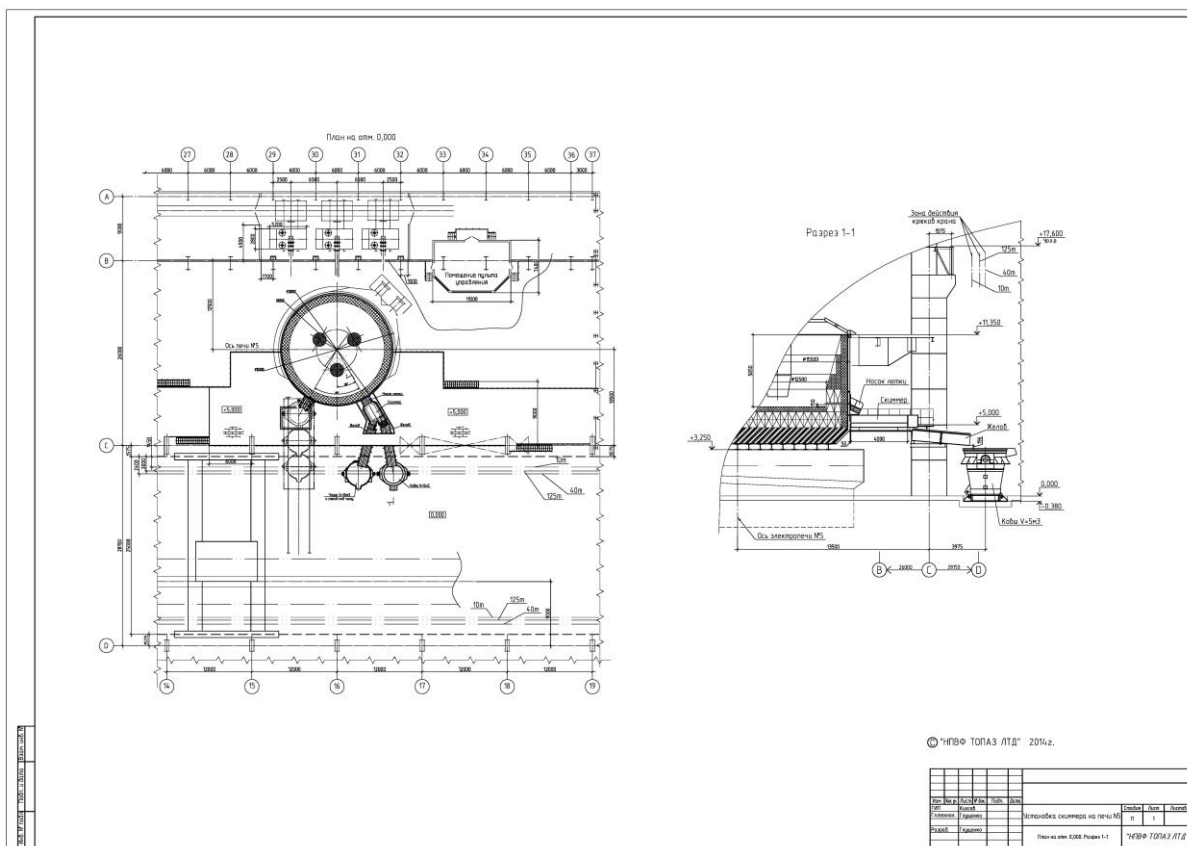


Fig. 3

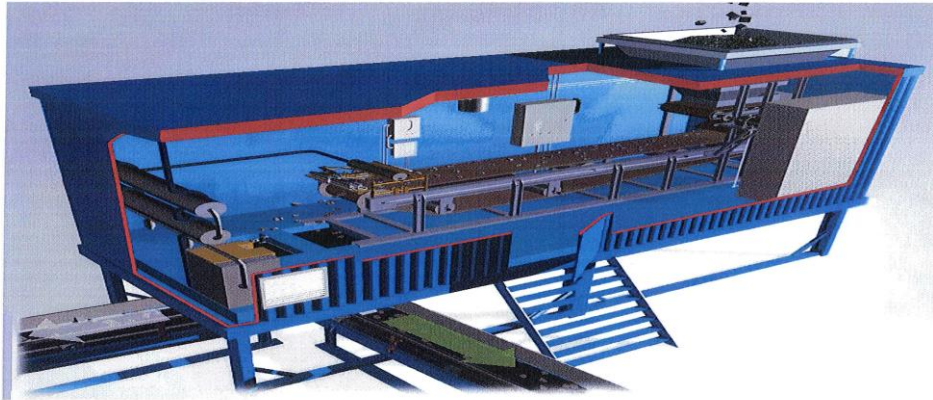


Fig. 4.