MODERN SLIDE-GATE SYSTEMS FOR METAL STREAM CONTROL

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Abstract

Nowadays there is a tendency of pouring practice development in metallurgy industry. It bases on resource-saving technology and improvement in turnover of ladles. It needs to use high quality casting slide-gate systems. Slide-gate systems and other advanced foreign models satisfy requirements for pouring systems of last generation. These systems are produced by Russian companies (Vulkan-TM, Tula) and by western companies (“Interstop”, “Vesuvius”). New slide-gate systems are logical continuation of VTM development. They generalize great experience of the most successful products. Gates systems of the last generation produced recently at NPP “Vulkan-TM” represent verified engineering solutions suitable for technical re-equipment of steel casting industry and recommended as substitutes of modern imported technologies.

MAIN SECTION

Nowadays there can be easily traced a tendency of metal pouring methods based on resource-saving and ladle turnover increasing in metallurgy, which in turn appeals for the necessity of steel-pouring gate systems of a higher quality level.

Modern machines of continuous casting of ingots (MCCI) comprise a system of automated regulation of metal level, which consists of steel ladle gate systems, tundishes, dipper tubes or nonswirl nozzles fast replacement devices united by a uniform control system.

Existing technical variants of continuous casting systems do not fit high-performance MCCI due to a considerable increase of total time of casting through one heat-resistant set, much tougher temperature operating conditions, new construction and refractory materials application, which are not in lot production in CIS countries.

The necessity of technical re-equipment of steel casting with gate systems of last generation that meet the following requirements, is obvious:

- ladle turnover increase;
- automated regulation of metal level;
- multiple use of gate plates;
- cassette replacement of refractories;
- minimization of staff for gate system servicing;
- breakdown rate decrease.

Gate systems of Russian producers (OOO NPP “Vulkan-TM”, Tula and ZAO “Shiber”, Moscow) as well as some models produced by western companies (“Interstop”, “Vesuvius”) meet the requirements for steel casting systems of the last generation.

Today there is some evident lag in technical equipment of domestic steel plants in the field of continuous casting comparing to their western counterparts. Effectiveness and reliability of steel casting can be raised by technical re-equipment of the branch and
implementation of continuous steel casting (CSC) systems of new generation with a cassette replacement of refractories basing on domestic achievements (Zolotukhin V., 2007).

Undoubtedly foreign sliding shutters have got a full range of merits, but cost of modern western shutters and corresponding refractory materials considerably exceeds their Russian analogues that together with bulkiness of structure and ceramics, specific character of servicing considerably complicates their large application.

Technical and economical analysis of costs of OOO NPP “Vulkan-TM” gate systems in comparison to the offers of foreign companies (sliding shutters of “Stopink AG”, “Magnesitwerk Aken”, “Vesuvius” etc.) made it clear that sliding shutters made in OOO NPP “Vulkan-TM” are preferable, as new generation of VTM shutters allow to reduce costs of equipment and renewal of shutters stock by factor of 4.1 in comparison to the foreign companies offers, and costs of refractory materials, at the condition that the exchangeable refractory set life is two melts, by the factor of 2.12.

Now, when Russian metallurgy is being reconstructed, our domestic producers have lots of tasks which can be realized only if centralized production of gate systems of new generation is created. Then a development of an engineering methodology of rational design of sliding shutters is indispensable, which must be based on structure elements unification level raising, co-operation with leaders in refractories production and application of gates ceramics of guaranteed life not less than 4 melts, application of modern control systems (Provotorov D., 2007).

Within the period of 1997 up to the present NPP “Vulkan-TM” has been developing and implementing to the lot production MCCI sliding shutters of new generation adapted to the production conditions of modern electric furnace and converter steelmaking.

New sliding shutters represent a further development of VTM gates and they synthesize the experience of the most successful models. They have changed their design in connection with creation of original schemes of independent pressing of a lower refractory plate to the upper one minimum in 4 points equidistant from the axis of casting channel.

Engineering solutions decreasing mass of domestic models of cassette gates and their cost as well as increasing their most important units reliability are used while their development.

Thanks to their modular design VTM sliding shutters are adapted concerning their servicing and can be applied in metallurgical production of different operating conditions. Modular design and cassette principle of refractory set use allow its replacing without removal of the gate from ladle (Figure1). So there is no more need of a special gates repair shop.

Fig. 1. New slide gate VTM 50
Taking into account the high-temperature operating conditions of the gates NPP “Vulkan-TM” developed a production technology for heat-resistant springs with 300 melts of life.

In 1996 – 2002 to unify dispensing system design, to increase refractories life and their fast replacement ability “Vulkan-TM”, Tula scientific and production enterprise, has designed a production technology of refractory plates sets in metal bandages. Metal bandages are mounted with guaranteed tightness on sides of one piece and compound refractory plates for their precise setting into the seats not using any refractory intermediary to prevent any thermal destruction. The plates are provided with some register ledges symmetrical to the plate long axis on the bandages curved elements outer surface to make their geometry parameters stable and to center casting outlets precisely (Figure 2).

![Fig. 2. Refractory plate in metal bandage with register ledges](image)

VTM sliding shutters usage experience showed that gates ceramics of high quality and good production preparation are the main condition to provide VTM shutters systems with precise control of metal flow, required refractory life and ladles turnover.

Nowadays NPP “Vulkan-TM” delivers sets of modern steel-casting systems with participation of leading works of the RF and EC countries.

Gates systems of the last generation produced recently at NPP “Vulkan-TM” represent verified engineering solutions suitable for technical re-equipment of steel casting industry and recommended as substitutes of modern imported technologies.

**LITERATURE REFERENCES**
