

New Slide Gate Valve System for Tundish

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Abstract

A conventional slide gate valve system for the tundish can control molten steel flow and the submerged entry nozzle is exchangeable during casting. We have developed a new slide gate system which has the conventional functions and also an additional function which changes the SEN port direction to generate a swirling flow in the mold during casting.

1. Introduction

The tundish slide gate valve system is important because it has a huge effect on steel quality and productivity. It can control molten steel flow and the submerged entry nozzle (aka SEN) or tundish nozzle may quickly be exchanged during casting. To improve steel quality, there is a method of stirring molten steel in the mold with an electromagnetic stirrer.

It gives a good effect on reducing longitudinal facial cracking of steel by forming an even solidified shell, and on improving surface quality of steel by accelerating the floatation of gas bubbles and / or inclusions in the molten steel¹⁾.

However, the electromagnetic stirrer is not inexpensive. There have been no other choices to replace it.

We have developed a new tundish slide gate system (aka SGT) which can control molten steel flow, exchange the SEN quickly, and has a function which changes the SEN port direction during casting to generate a swirling flow of molten steel in the mold. We will report about the system in this paper.

2. SGT Functions and Assembly of SGT Refractories

2.1 Function which changes the SEN port direction

SGT equipment has a unique mechanism which can change the SEN port direction during casting. A SEN is installed on the SEN exchange mechanism in casting condition. At the start of casting, SEN ports are directed to narrow faces of the mold. (Fig.1)

SGT can swivel the whole SEN exchange mechanism during casting. (Fig.2) That means we can change the

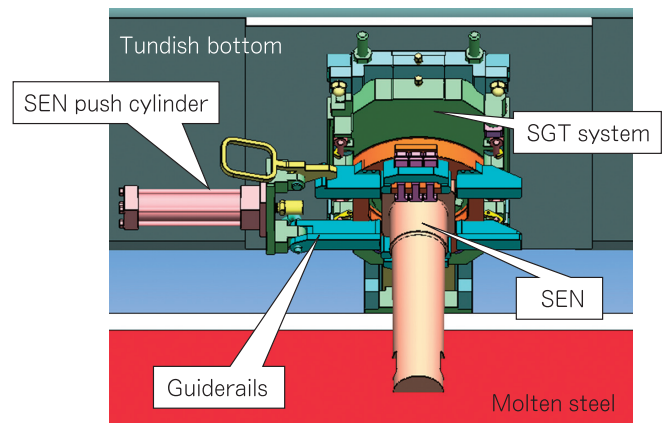


Fig.1 Normal casting conditions.

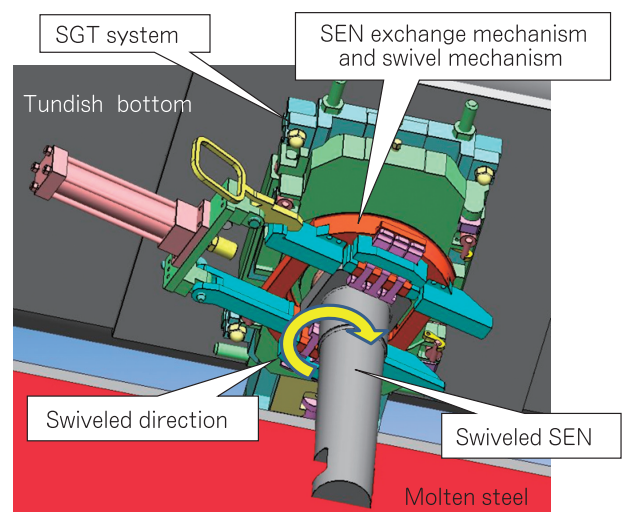


Fig.2 Swiveled condition.

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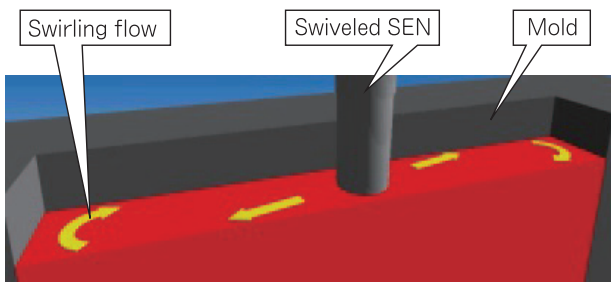


Fig.3 Schematic diagram of swirling flow in casting mold.

SEN port direction to generate swirling flow in the mold during casting. (Fig.3)

A SEN is installed in SGT, and SEN flange is fixed automatically. Therefore this system can swivel SEN exactly.

2.2 Quick exchanging of SEN

SGT system can exchange an in-use SEN for new one during casting. SGT equipment has a pair of guiderails at the bottom for SEN exchange. This enables the SEN to move parallel to the mold.

SEN exchange is carried out as follows.

- 1) The SEN push cylinder is set on a guiderail and swung to a position that doesn't block installation of the new SEN.
- 2) New SEN is put on the guiderails.
- 3) The SEN push cylinder is swung back and the SEN is exchanged.

- 4) The used SEN is taken out from the gate.
- 5) The SEN push cylinder is swung to a position that doesn't block the installation of a new SEN.

Operation flow chart is shown in Fig. 4²⁾.

2.3 Assembly of refractories

The refractory assembly is composed of an upper nozzle, upper plate, middle plate, lower nozzle, and SEN. At the time of SEN exchanging and swiveling, a working SEN moves at the joint surface between lower nozzle and SEN. It is very important to maintain airtightness at the joint surface between lower nozzle and SEN. Therefore the lower nozzle has a groove on the lower surface, and the joint of the lower nozzle and SEN is sealed by inert gas to prevent air ingress. (Fig.5)

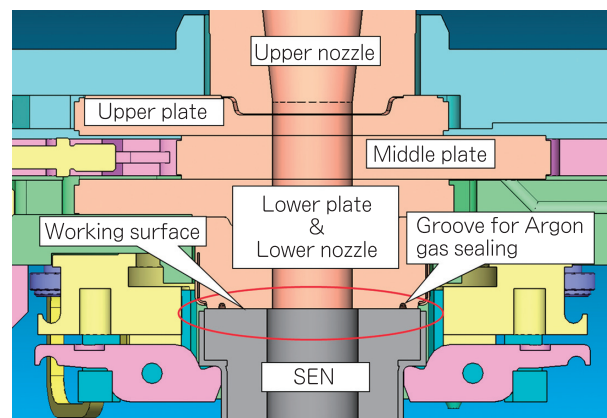


Fig.5 Assembly of SGT refractories.

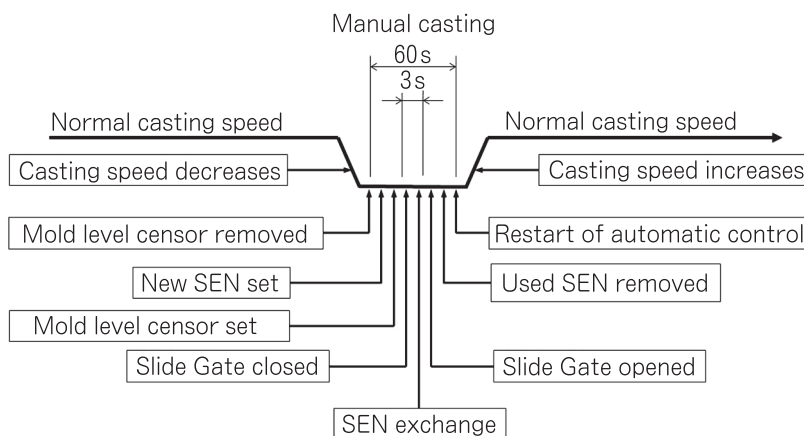


Fig.4 Operation flow diagram of SEN exchange.

3. Advantages of SGT

SGT system can change SEN port direction. It generates a swirling flow in the mold. An effect similar to that of an electromagnetic stirrer is created by SGT system. Furthermore SGT system can exchange the SEN during casting. Therefore, a longer casting sequence and higher productivity will be also realized.

4. Summary

We have developed a new type of tundish gate system. That is SGT system. SGT system can control the molten steel flow, generate a swirling flow in the mold and exchange the SEN during casting.

SGT system is expected to improve steel quality similar to electromagnetic stirrer and longer casting sequence and higher productivity.

References

- 1) J. Nakashima, T. Toh: Shinnittetsu Giho, [394] 42-47 (2012).
- 2) Y. Kurashina and M. Osada: Shinagawa Technical Report, 46 77-86 (2003).