

# Hot Charging and Transporting to Continuous Discussion on Casting Slab at Tanggang

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**Abstract.** This paper introduces technological design and equipment of hot delivery and hot charge in Tanggang and Steel Co and its notable economic benefit. At the same time, the difficulty and problems in realizing hot delivery and charge are pointed out.

## 1 Foreword

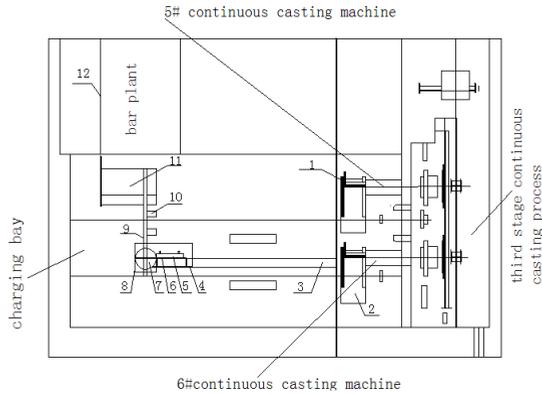
Hot charging and hot delivery process of continuous casting billet has the advantages of saving energy, improving the production capacity of heating furnace, reducing the burning loss of billet, decreasing the rolling fault, improving the rate of finished products, speeding up the logistics movement, reducing billet storage warehouse and liquidity occupation etc. It is widely used in many iron and steel enterprises [1]. The basic conditions for the realization of hot delivery and hot charging of continuous casting billet is [2]:

- 1) Continuous casting process of high temperature defect-free billet production technology;
- 2) The production capacity of steel rolling can match the production capacity of steel making;
- 3) The process of steel making, continuous casting and steel rolling is stable and efficient;
- 4) The shape, size and temperature of the billet can meet the rolling product varieties and specifications;
- 5) Set up a throughout production management and quality assurance system which can realize process integration.

The continuous casting billet hot delivery form that Tanggang originally used is hot delivery and hot charging rolling. First, we need putting the high temperature cleaned billet into the soaking pit offline, then dispatching billet from the soaking pit according to the rolling plan and placing them into the heat furnace (charging temperature is about 400°C-700°C) to heat, and then rolling. In this way, it costs much time for the hot delivery and has a great loss of the slab temperature, it also can't make full use of the heating furnace production capacity. In view of this situation, technical personnel redesigned a new equipment to realize the continuous casting billet hot delivery and hot charging rolling. It can directly put the high temperature cleaned billet into the heat furnace (charging temperature is about 400°C-700°C) to heat according to the order of billet, and then rolling. It removed the soaking pit buffer storage between the steel making—continuous casting and steel rolling, only retained the heating furnace as the production rhythm buffer means of regulation [3]. Compared with the original hot delivery and hot charging rolling, direct hot charging rolling improved the degree of continuous and the energy saving effect of the steel making—continuous casting and steel rolling, truly realizing the continuous casting billet hot delivery and hot charging.

## 2 Hot delivery and hot charging process layout of the continuous casting billet

Tanggang bar plant can match with the second Tanggang steel making plant of on its third stage continuous casting process. It is very suitable for hot delivery and hot charging process of the continuous casting billet. From the layout in Figure 1, we can see that the 6# continuous casting machine of the second Tanggang steel making plant and the heating furnace steel loading station of Tanggang bar plant are propped in the same bay, getting a good natural conditions for heat delivery. In order to realize hot delivery and hot charging of the continuous casting billet, we set up a special roller table for continuous casting billet hot delivery between the terminal of the coticaster ejection roller table and the inlet of the heating furnace in the design process, so that the coticaster can integrate with the rolling system, forming a new production line. The new production line retained the whole original coticaster system and the heating furnace steel charging system, making full use of the function of the billet transfer car of the coticaster and the roller table of the heating furnace entrance. Not only can it save the project investment, but also it makes the whole production line more flexible. Under normal circumstances, we can use the heat delivery roller table for hot charging, under special circumstances, we can use the original system to produce cold billet and conduct cold charging.



**Fig.1.** Process plan.

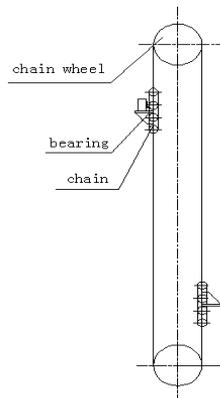
- 1— Slab transfer car 2—Step by step turn cooling bed  
 3—Hot roller 4—Weighing roller 5—chain elevator  
 6—The transition table 7—rotary disk 8—dead plate  
 9—The heating furnace roller 10—With steel table  
 11—heating furnace 12—main rolling line

To guarantee the continuous casting billet hot charging temperature, the time to send heat is critical. The shorter the time is, the smaller the casting billet's temperature drop. The temperature of the casting billet when it arrives the hot delivery track is about 850°C, and the temperature to ensure hot charging is 700°C, the delivery time should be less than 10 minutes<sup>[3]</sup>. The distance from the third phase of continuous casting to bar factory is 140m. The slab is delivered from hot delivery roller bed 3 to 7, raised 5 meters up by chain hoist 4 to transition roller bed 3 and delivered to turntable 4. The casting blank is rotated 90° and put into the hot stove [4]. In order to finish this process within 10 minutes, we adopted the following technical measures in our design:

1) Instead of using single roll to drive the hot roller, we divide the rollers into 12 groups. Each group uses drive. To achieve stable operation and reduce noise, the speed is set to 1.5m/s. In this way it takes only 1 minute and a half which save the investment in equipment and guarantee the slab temperature.

2) Chain hoist installs two hold claw on the chain which is shown in Figure 2. It raises the billet 5m, shipments the casting to the transition roller and increases the speed to 0.25m/s.

3) We don't use the normal gear transmission in the turntable, because the turntable needs frequent start-braking. Although the gear transmission is smooth, the turntable only rotates 90° each time. The big gear bears uneven force on the circumference of the circle and it is easily damaged in the mesh. The processing manufacturing of big gear is difficult and costs high. Thus we designed a new organization which is shown in Figure 3. The turntable's center is used as shaft, and the wheel is installed under the turntable. The wheel is driven by the motor and operates on the circular orbit. The turntable is designed to be able to turn positive and negative 90° whose rotation angle is controlled by the proximity switch. This design can solve the problem of cable winding, which has simpler structure compared with gear transmission structure. It also has the advantage of less investment, easy maintenance and performs well in practice.



**Fig.2.** Schematic diagram of chain hoist.

### 3 Other problems

Because the whole hot charging line control is a very complicated system. Each production link is closely related to another. The disorder of a target value will influence the global process [5-6]. To ensure the realization of the hot charging process, the following problems should be concerned.

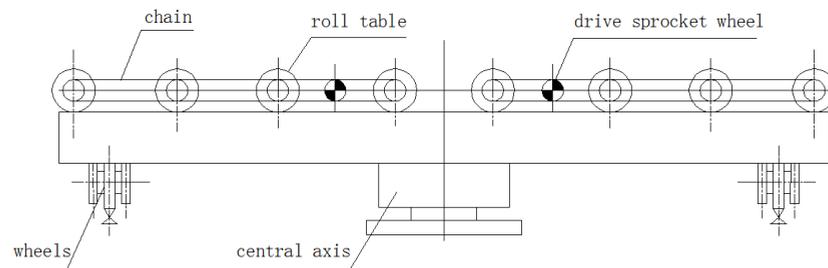
1) Steelmaking, continuous casting and steel rolling workshop should be scheduled together, thus the maintenance of two workshop can be carried out at the same time.

2) Mill roll change should better be done between mill's minor repair time. In general, the change of roll and groove should also be arranged in the time when the continuous casting billet is not offering heat or in the gap of continuous casting.

3) The management of steelmaking, continuous casting and steel rolling workshop should be strengthened. Operation should be standardized to guarantee the stability of production.

4) Set in the heating furnace or before the heating furnace of steel rolling the billet insulation and caching facilities in order to improve the rate of hot charging.

When estimating the casting billet hot charging rate, in addition to consider the stable relation of production per hour between continuous casting and rolling, we should also consider the working systems of two workshops. There are many factors influencing the production. If productions of two workshops match well, the hot charging scheme is reasonable, the enterprise's management level is high, the continuous casting billet hot charging rate can reach 80% - 90%.



**Fig.3.** Turntable structure diagram.

## 4 Conclusion

It usually takes 2~3 hours from the casting blank of Tang Gang 3 period continuous casting being casted to being poured out to the furnace, and the degree decreases a lot. By adopting this set of equipment, it only takes 4~5 minutes from the third phase of continuous casting to bar feeding platform, and the temperature when the billet is in the furnace can reach 700°C above, or even higher. Assuming the hot charging temperature is 700°C, the hot charging rate is 90%, then each ton of steel can save 8kg heavy oil. Therefore, the benefit of it is obvious and the efficiency is greatly improved.

Production practice proves that the equipment has simple structure, less investment, reliable and stable operation which realizes the process of hot charging.

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