ANALELE UNIVERSITĂȚII
"EFTIMIE MURGU" REȘIȚA
ANUL XVI, NR. 1, 2009, ISSN 1453 - 7397

Marius Tufoi, Ion Vela, Constantin Marta

Optimization of the Withdrawal of Profiles at the Horizontal Continuous Casting Plant

In present, the withdrawal profiles *at horizontal continuous casting plant is using a system which consists of a pair of parallel rollers electro-driven and executing a rotational movement with a sequential mechanism motor step-by-step reduction. The withdrawal roller has some major shortcomings: large size of the whole step by step motor-reduction requiring a pneumatic mechanism for raising the profile of the rolls, rolls are striated to pull the bar mold, which leads to visible traces on the profile shot. The proposed system uses instead of rollers (they have smaller surface contact) tanks that have adjustable horizontal surface contact plane. This profile provides a withdrawal force necessary to withdrawal without creating defects.*

Keywords: *role, tanks, proportional cylinders, control system, PLC*

1. Introduction

Schedule of a horizontal continuous casting installation is presented in Figure 1. Continuous casting process, in essence, is the direct conversion of liquid metal in solid form under various geometrical: bars, blank, pipes, wires. Alloy liquid metal in the furnace to maintain the channel induction (1) under its own weight (metallo-static pressure) flows into a mold-crystalline (2) and is cooled with cold water, solidification took place. The solidification result is to obtain of an identical section of the profile with the mold. The resulting profile pass to an intermediate support (3) from where through the intermediate cooling system (4) is cooled, and then is discharged through the profile withdrawal installation system (5).

The process is continuing, as the metal solidified in the mold is evacuated, molten alloy falling metallo - static pressure in the mold and the process continues. After withdrawal the profile with the withdrawal plant, the profile is transferred to the guillotine cutter, saw or cloth disc (6), where is debited to the desired length. Then, the profile is transferred to the final support (7) consisting of a roller bed where the obtained product is subjected to final cooling and control. Today,

withdrawal profiles in installations using horizontal continuous casting system which is constructed from a pair of parallel rollers electro-driven and executing a rotational movement with a sequential mechanism motor step-by-step reduction. The withdrawal roller has some major shortcomings: large size of the whole step by step motor-reduction requiring a pneumatic mechanism for raising the profile of the rolls, rolls are striated to pull the cast bar from mold which leads to visible traces on profile shot.

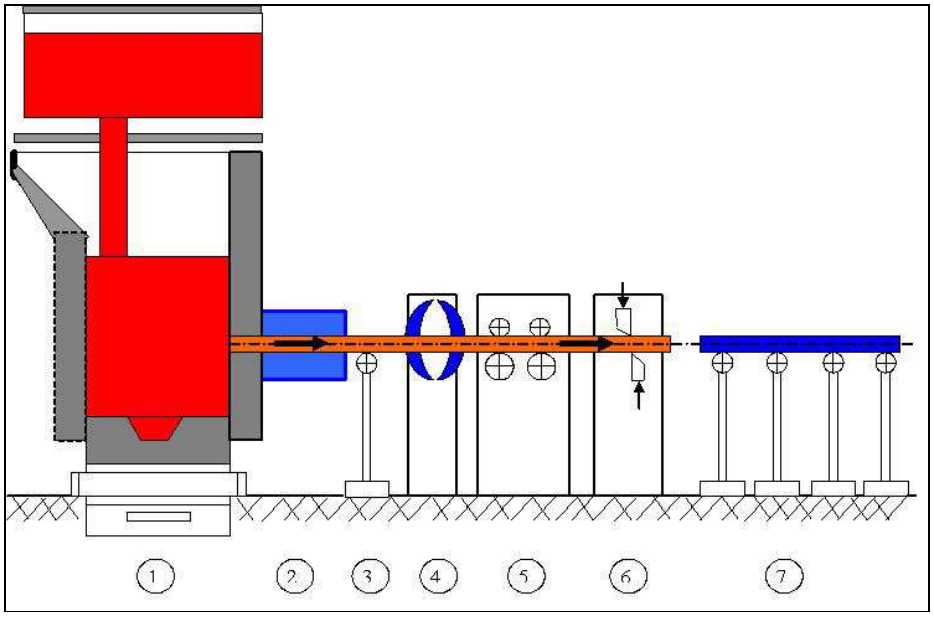

Figure 1. Continuous casting plant equipped with roller

Legend:
1 is tundish, inductive furnace with channel;
2 -crystallized (mold) primary cooling system;
3 -intermediate support;
4 -cooler, secondary cooling system;
5 -withdrawal system with electromechanical operated roller;
6 -cutting system with guillotine, saw or cloth disc;
7 -final support, roller bed for cooling and control.

2. Optimized method for the withdrawal of the profile

The optimized system proposed by the authors for withdrawal profiles, used instead roller withdrawal (which have small areas of contact) adjustable horizontal tanks with flat contact surfaces. This method of withdrawal bars assures the necessary force for withdrawal without creating defects. The importance of intermittent withdrawal of the profile is essential for preventing interruptions in horizontal continuous casting [2].

Continuous withdrawal of profile may lead to disruption at the mold exit. The intermittent withdrawal of the profile provides the formation of solid core out of the mold through the break ring and makes the operation possible. Recently, not only intermittent withdrawal is used, was also adopted a withdrawal followed by a redraw which assure a compression of the profile (Push Back) to facilitate the stability of the withdrawal by solidification of the core profile [3].

With the exception of a developed method by Mannesmann Demag, the withdrawal is generally made by rolls or pinch roll drive systems, which used the action of a DC motor or a hydraulic servo motor. By using the pinch roll may appear considerable deformations on the profiles surface, which may affect the quality of products. The withdrawal unit developed by Mannesmann Demag, which used clamping jaws and offers a much larger area of contact with the profile, and does not cause the serious deformation like in case of withdrawn by rolls. With this machine, the intermittent withdrawal time is precisely controlled to 0.01 s intervals. Nippon Kokand uses a withdrawal by pinch rolls lead by two hydraulic servo motors. In this system, the pinch rolls are driven by two hydraulic servo motors. This drive system controls the cycles of withdrawal and pushing back of the profile, and the whole process is fully automatic. Figure 2 shows typical strand withdrawal patterns [5].

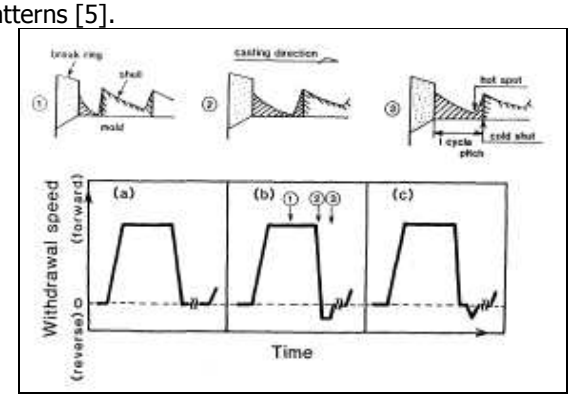

Figure 2. Examples of withdrawal pattern

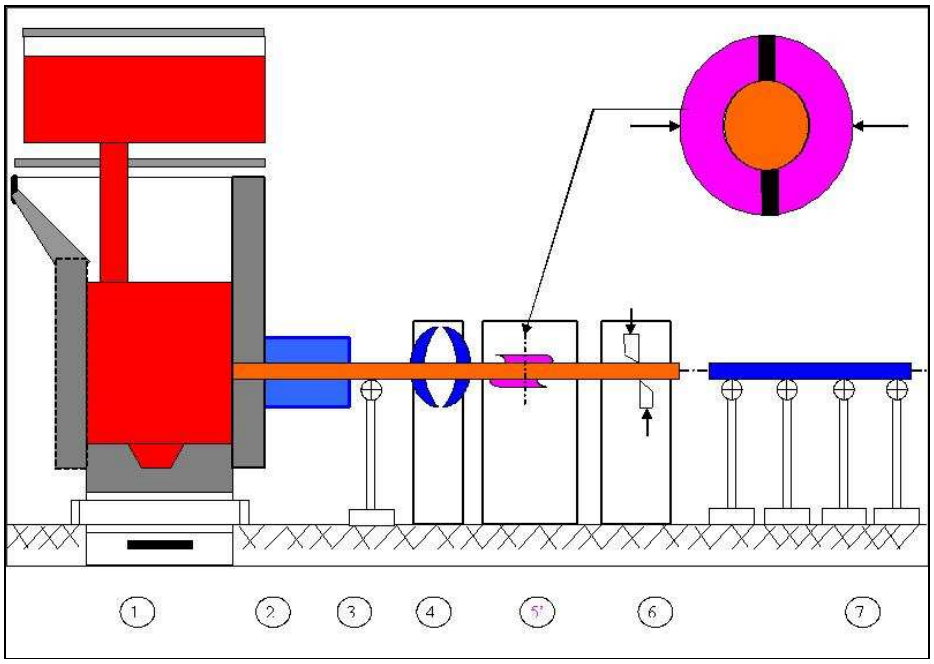

Figure 3. Continuous casting plant equipped with tanks and proportional cylinders
Legend:
1 is tundish, inductive furnace with channel;
2 -mold, primary cooling system;
3 -intermediate support;
4 -cooler, secondary cooling system;
5 -optimized withdrawal system with tanks acted by proportional hydraulic cylinders;
6 -cutting system with guillotine, saw or cloth disc;
7 -final support, roller bed for cooling and control.

3. Controlling system for operation of horizontal continuous casting.

Control system proposed for the horizontal continuous casting equipped with tanks to hold the profile is an automatic system. This control system is equipped with automatic programmable logic controller (PLC) from GE Fanuc company model Micro 90 Series with 16-channel digital I / O and 8-channel analog I/O (see Figure 4) [1]. With the PLC, the withdrawal can function automatically. To do this,

are used sensors and transducers that provide information from process, information are analyzed and processed, and the results are sent to process like sizes to lead the process of withdrawal a profile. For programming of PLC is used a PC with GE Fanuc software company [5].

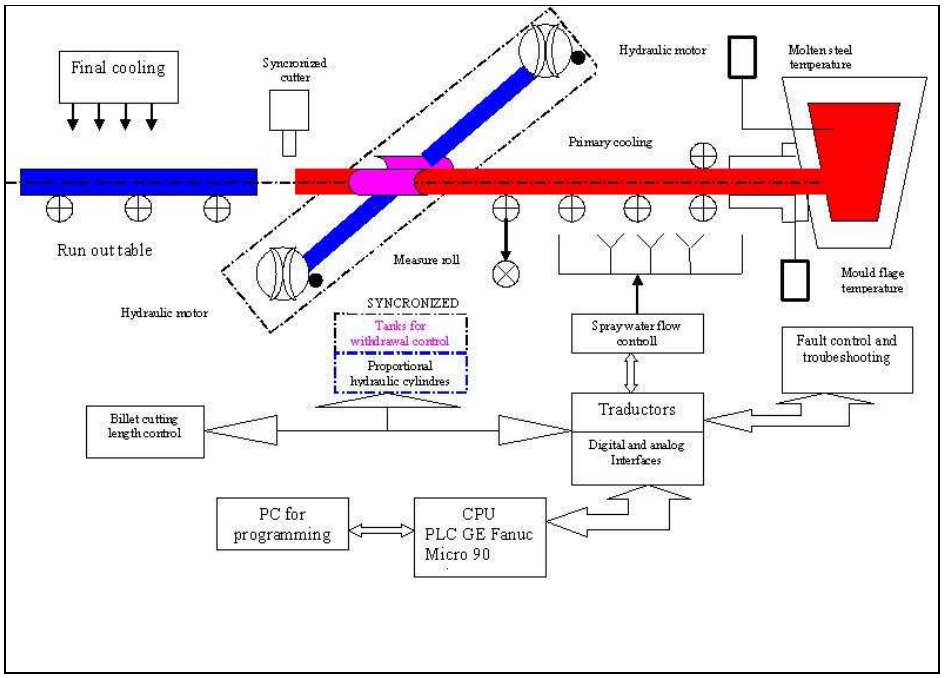

Figure 4. Control system proposed for withdrawal with the tanks at the horizontal continuous casting

Main operation parameters of the withdrawal plant with tanks are:

- running back has values between 0– 50 mm;
- time string values are between 0.1– 9.9 seconds;
- speed of return are the values between 0.5– 9.9 and 10– 20 mm/second;
- time while maintaining the return values are between 0.1– 9.9 seconds;
- motion to withdraw has values between 0- 50mm;
- withdrawal speed values are between 0.5- 9.9 and 10- 20 mm/second;
- during the stationary values are between 0.1- 9.9 seconds;
- release time has values between 0.1- 9.9 seconds.

4. Conclusion.

Making the withdrawal by tanks in horizontal continuous casting brings several advantages over classical withdrawal roller. The main advantage is that after withdrawal does not remain visible traces on the profile caused by the pressure of withdrawal roller. Using the withdrawal profile with tanks assure the necessary force to create withdrawal without defects on the profile. The system is based on proportional cylinders hydraulic action and sequential withdrawal in a wide range of speeds and times of withdrawal.

Other advantages of this method of withdrawal are: adjustable parameters are placed on the serial interface to the PLC the precision and the established parameters prescribed, stable and easy adjustment of parameters of withdrawal according to the type of alloy and principal with the degree of viscosity and thermal conductivity.

References

[1] ***** www.gefanuc.com
[2] Mitchell J.: *Steel Times* (1982), June, 320.
[3] Toothil D.: *Solid Tech Conf.* at Warwich University, Conventry, Sep. 1980, Metal Soc.
[4] Krall H. A. and Huber H.: *MPT-Metal. Plant and Tech.*, Stahleisen, Dusseldorf, (1983), May, 44
[5] Mărgineanu I.: *Automate Programabile*, Editura Albastră, Cluj Napoca, 2005.

Addresses:

- Drd. Eng. Marius Tufoi, "Eftimie Murgu" University of Reşiţa, Piaţa Traian Vuia, nr. 1-4, 320085, Reşiţa, m.tufoi@uem.ro
- Prof. Dr. Eng. Ion Vela, "Eftimie Murgu" University of Reşiţa, Piaţa Traian Vuia, nr. 1-4, 320085, Reşiţa, presedinteuniv@uem.ro
- Conf. Dr. Eng. Constantin Marta, "Eftimie Murgu" University of Reşiţa, Piaţa Traian Vuia, nr. 1-4, 320085, Reşiţa, maco@uem.ro