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(54) IMPROVEMENTS IN AND RELATING TO CONTINUOUS CASTING APPARATUS

(71) We, MANNESHANN AKTIEN-GESELLSCHAFT, a German body corporate, of 4 Dusseldorf 1, Mannosmannufer 2, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to continuous casting apparatus, and in particular to apparatus for regulating the discharge of molten metal in the casting process.

It is known to use a vertically adjustable stopper to regulate the quantity of steel flowing out of a distributing vessel into a continuous casting mould. The stopper adjusting arrangement, is operated by a control unit mounted on the distributing vessel, which control unit receives a signal from an arrangement measuring the degree of fullness of the mould. A closed control circuit of this kind is known from German laid-open specification 24 35 485.

It is also known to make the distributing vessel such that it can be lifted and lowered and also moved laterally or swung out. This is necessary particularly when carrying out consecutive sequence casting, when it is necessary to replace the distributing vessel quickly because of wear, damage or other disturbance. But this requires separating the distributing vessel from the control circuit whether in the mechanical, electrical or hydraulic field. The outlay required increases with the number of moulds supplied from the distributing vessel, since each mould has its own control circuit with the corresponding outlet or stopper of the distributing vessel. But these connection regions are often the cause of disturbances or faults. A hydraulic installation is also subjected to prejudicial effects to a considerable extent in the region of the casting stream from a casting ladle (leaky stopper, splashes of steel).

The invention has as its object to eliminate the aforesaid disadvantages and to provide the possibility of replacing the distributing vessel without special releasing of connections, either within the control circuit or within the operating arrangement for the stopper. Advantageously embodiments of the invention can be arranged to protect the sensitive and easily damaged parts of the control and operating arrangements as far as possible from damage.

Accordingly, the invention provides a continuous casting installation having a casting platform, at least one distributing vessel having a bottom pour outlet and fitted with a stopper and further comprising a first rod vertically disposed in a guide mounted on the distributing vessel so as to allow vertical displacement of the rod in the guide, a cross member connecting the top of the stopper to the top end of the rod, biasing means for biasing the rod vertically downwards to cause the stopper to block the outlet of the distributing vessel, and lifting means supported with respect to the casting platform for engaging the rod via a plug and socket connection to cause displacement of the rod in a vertical direction and thereby control the vertical position of the said stopper. The lifting means preferably comprises a hydraulic cylinder.

In the preferred form of the invention the lower portion of the plug and socket connection is arranged on a transverse support. The transverse support is pivotably connected to a vertically adjustable internally guided holding element. The holding element is connected with the piston rod of a hydraulic cylinder and is adjusted in the vertical direction by the latter. It is advantageous to arrange the hydraulic cylinder on an adjusting cylinder. The adjusting cylinder is used to locate the transverse support such that the plug and socket connection is engaged even when the stopper is in its closed position. For weight relief of the adjusting system, a compressed-air cylinder acts above the hydraulic cylinder with a force directed against the adjusting system.

The invention will now be explained hereinafter by way of example and with reference to the accompanying drawings wherein:

Figure 1 shows a distributing vessel of a continuous casting installation in front view;

Figure 2 shows a fragmentary side view of Figure 1; and

Figure 3 shows a further possible form of the apparatus according to the invention on a distributing vessel.

In Figures 1 and 2 there is shown a part of a distributing vessel 12, as much as is necessary for the understanding of the invention. The outlet 13 is closed with a stopper 14. The stopper 14 is held by a cross-member 1. The cross-member 1 is capable of vertical displacement by a rod 2 which is held to be capable of sliding in a guide 15 secured on the distributing vessel 12. The cross-member 1 is loaded by a spring 3 and holds the stopper 14 in the closed position relatively to the outlet 13. The free lower end of the rod 2 has a tapered bore, forming a part of a plug and socket connection 8, into which engages a conically tapered tip of the piston rod 5 of a hydraulic cylinder 6 situated below the casting platform 7. The hydraulic cylinder 6 is controlled by a measuring device 16 of known type for measuring the degree of fullness of the mould 17. The casting 18 is removed from the mould 17 in a manner known per se.

In Figure 3 in which like parts are designated with like reference numerals to those used in Figures 1 and 2, an advantageous development of the invention is shown. The lower portion of the plug and socket connection 8, that is to say the conically tapered tip, is arranged on a transverse support 9. The transverse support 9 is pivotally connected to a vertically adjustable, internally guided holding element 10 at 11. The internal guiding of the holding element 10 is designated as 19. The piston rod 5 of the hydraulic cylinder 6 regulating the position of the stopper also engages in the holding element. Thus the desired stopper position is brought about indirectly by vertical adjustment of the holding element 10.

In order to allow the controlling hydraulic cylinder 6 to be operated sensitively, in this case weight relief is provided for the entire adjusting system by means of a compressed-air cylinder 20. Furthermore, there is provided below the hydraulic cylinder 6, in line therewith, an adjusting cylinder 21 which locates the holding element 10 with the transverse support 9 and the hydraulic cylinder 6 in the closed position of the stopper 14 against the spring-loaded rod 2. Thus it is possible to control the stopper with a very small hydraulic cylinder.

The apparatus operates in the following way:

The distributing vessel is first of all arranged in known manner for a casting process and preheated. The plug 14 is pressed against the outlet 13 by the force of the springs 3. The distributing vessel can now be moved into the casting position over the

said tapered end of the piston rod, and said first rod and said piston rod are arranged coaxially.

5. An installation according to claim 3 wherein the plug of said plug and socket mould on the casting platform. By operating the hydraulic cylinder 6 as shown in Figures 1 and 2, or the adjusting cylinder 21 shown in Figure 3, the lower portion of the plug and socket connection 8 is moved into contact with the rod 2. Thus the distributing vessel is ready for casting. After filling the distributing vessel, the stopper is moved upwards by operation of the hydraulic cylinder 6, and during further travel receives its control signal from the device 16 which measures the degree of fullness. When the casting process is ended, the stopper is lowered into the closed position and held in this position again by the springs 3.

If it is necessary to replace the distributing vessel, it can be removed from the installation by simply lifting and moving the distributing vessel aside (Figure 1 and Figure 2). In the solution shown in Figure 3, the plug and socket connection can be released by further lowering of the adjusting cylinder 21. In this case a simple displacement of the distributing vessel is sufficient for removal from the continuous casting installation.

#### WHAT WE CLAIM IS:—

1. A continuous casting installation having a casting platform, at least one distributing vessel having a bottom pour outlet and fitted with a stopper and further comprising a first rod vertically disposed in a guide mounted on the distributing vessel so as to allow vertical displacement of the rod in the guide, a cross member connecting the top of the stopper to the top end of the rod, biasing means for biasing the rod vertically downwards to cause the stopper to block the outlet of the distributing vessel, and lifting means supported with respect to the casting platform for engaging the rod via a plug and socket connection to cause displacement of the rod in a vertical direction and thereby control the vertical position of the said stopper.

2. An installation according to claim 1 wherein the biasing means comprises at least one spring.

3. An installation according to claim 1 or claim 2 wherein the lifting means comprises a hydraulic cylinder.

4. An installation according to claim 3 wherein the piston rod of the hydraulic cylinder has a tapered free end forming the plug of the said plug and socket connection and the said first rod has a tapered bore at its bottom end which releasably receives the connection is mounted on a support which is pivotally attached to the piston rod of the hydraulic cylinder so as to pivot about a vertical axis.

6. An installation according to claim 5 described with reference to the accompanying 10  
wherein the hydraulic cylinder is mounted drawings.  
on a vertical height adjusting means whereby  
the said plug can be disconnected from the  
5 socket when removing the distributing vessel.
7. An installation according to claim 6  
wherein the adjusting means comprises a  
further hydraulic cylinder.
8. An installation substantially as herein

For the Applicants:  
LLOYD WISE, BOULY & HAIG,  
Chartered Patent Agents,  
Norman House,  
105—109 Strand,  
London, WC2R 0AE.

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Fig.2

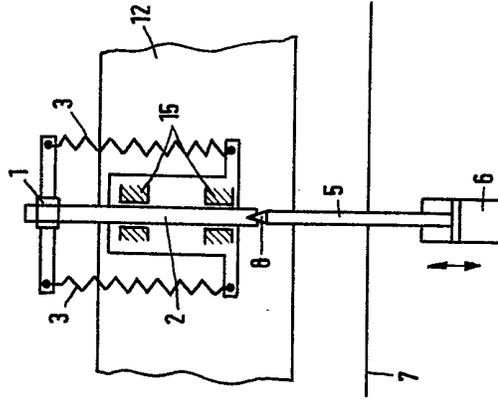


Fig.1

