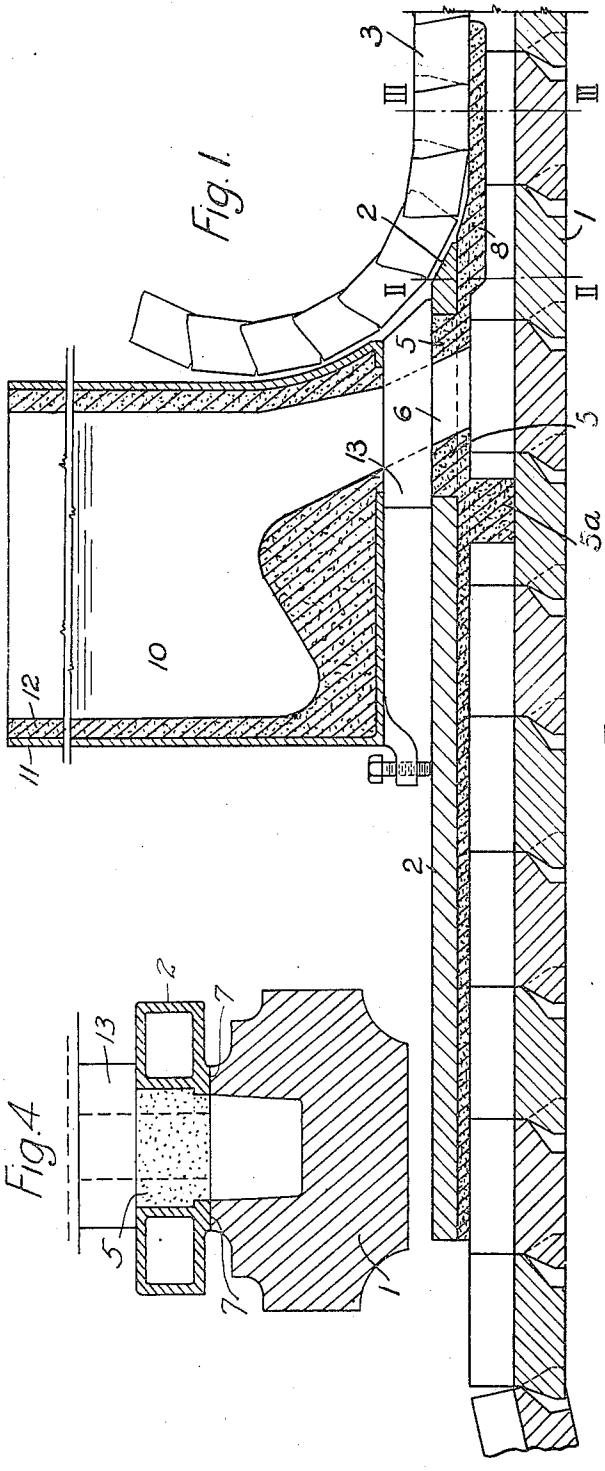
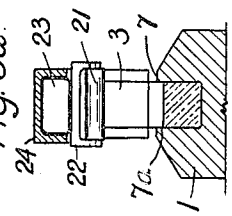
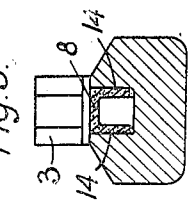
July 11, 1939. F. W. HARBORD ET AL 2,166,006

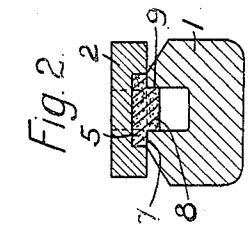
APPARATUS FOR CASTING METAL

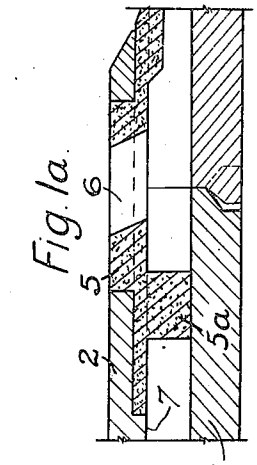
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APPARATUS FOR CASTING METAL

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5 Claims. (Cl. 22—57.3)

This invention relates to apparatus for the direct and continuous casting from molten metal of billets, slabs, bars and the like of the kind in which the molten metal is arranged to be introduced into a mould or cavity which is continuously formed adjacent to the pouring point by the cooperation of moving mould members constituted, for instance, by articulated segments.

According to the principal feature of the invention a moving bottom member cooperates with a stationary top member, through which the molten metal flows into the mould cavity, to close this cavity at a predetermined point, the moving bottom member, at a predetermined distance ahead of the pouring point, cooperating with another top member which preferably moves at the same speed as the bottom member. The stationary top member may be arranged by an inset to close the end of the mould cavity at a predetermined point ahead of the pouring point, or also to cooperate with the moving bottom member to form the initial portion of the mould cavity which beyond this point is continued by the cooperation of the moving top and bottom members.

The invention is illustrated by way of example in the accompanying drawing of which Figure 1 is a somewhat diagrammatic view in vertical section, of casting apparatus constructed in accordance with one form of the invention, Figure 1*a* being a similar partial view illustrating a modification. Figures 2 and 3 are sectional views of the bottom member and stationary top member (with inset attached and forming a part of the stationary member) on the lines II—II and III—III of Figure 1, Figure 3 illustrating a detail modfication. Figure 3*a* is a cross sectional view of a modified arrangement of mould mechanism which may be employed. Figure 4 is a sectional view similar to Figure 2 and also illustrating a modified construction.

Referring now first to the construction shown in Figures 1, 2 and 3 it will be seen that the casting apparatus comprises a lower member which contains the mould cavity and consists of a series of moving segments 1 and for a portion of its path cooperates with a stationary upper member 2 and for another portion of its path cooperates with a moving upper member also formed by a series of segments 3 to form a completely enclosed mould cavity, the upper and lower members being kept in substantial contact with each other, until the metal is set.

The lower segments 1, which may be of any desired cross-sectional form, contain the entire mould cavity corresponding to the cross sectional form or shape of the billet desired and are arranged to travel in a straight path while immediately approaching the stationary member 2; at a predetermined point viz. approximately at the section line III—III in Figure 1, the upper segments 3 approach and close the cavity in the lower segments 1 and thereafter travel with these segments at the same speed.

The stationary member 2 consists of a metal member having an inset lining 5 of refractory material provided with an opening 6 forming the pouring point. Attached to, and forming a part of the stationary member 2 is an inset member 8 of graphite or other suitable refractory material adapted to form a metal tight sliding joint at a predetermined distance ahead of the pouring point. The portion 5*a* of the inset lining 5 projects within the mould cavity in the segments 1 as shown in Figure 1 and this portion of the inset 5 is arranged to fit closely to the contour of the mould cavity so as to form a rear closure or stop for this end of the mould cavity. The upper portion of the graphite or refractory material 5, as shown in Figure 2, for the greater part of its length makes intimate contact with the upper edges of the segments 1 on both sides of the mould cavity as show at 7 in Figure 2 so as to prevent lateral leakage of the molten metal. The inset member 8 extends within the mould cavity in the segments 1, the vertical edges of the inset 8 fitting closely against the upper part of the vertical sides of this cavity as shown at 9.

A pouring pot 10 is suitably mounted above the stationary member 2 and comprises a metal casing 11 provided with a lining 12 of fireclay or other suitable refractory material. Interposed between the forward end of the pouring pot 10 and the stationary member 2 is an intermediate member 13 composed of fireclay or the like, the base of the lining 12 of the pouring pot 10 and the member 13 being provided with apertures registering with the opening or pouring point 6 within the stationary member as shown in Figure 1.

It will be seen that the upper segments 3 form an articulated cover or closing member for the mould cavity in the lower segments 1 and the segments 3 are arranged to move downwards continuously so as to contact with the segments 1 for this purpose by passing along a suitably arranged descending track. In the arrangement shown in Figure 1, the chain of segments 3 are shown as arranged to pass around the periphery of a rotating wheel, their descending path being arranged to become tangential to the path of movement of the segments 1 at approximately the

point indicated by the line III—III. Beyond this point, the segments 1 and 3 travel together along parallel straight paths for a suitable distance from the line III—III so as to form a closed mould cavity of sufficient length to ensure the setting of the molten metal in the cavity to form the required continuous billet or bar.

After traversing this distance the chain of upper segments 3 is arranged to rise away from the lower segments 1, so as to pass for instance around the periphery of a second rotating wheel, (not shown) and during its return path to the first wheel the line of segments 3 may be arranged to be cooled in any suitable manner. The lower chain or line of segments 1 may be similarly mounted on supporting wheels so as to traverse a closed path and may be provided with similar cooling arrangements if desired.

In operation the pouring pot 10 is supplied with molten metal from any suitable source in such a manner as to maintain the metal therein at a substantially constant level during the whole period of casting by suitably controlling the rate of teeming of the molten metal from the ladle or other source of supply.

The lines of segments 1 and 3 being set in motion as above described, the molten metal passes from the base opening in the lining 12 of the pouring pot 10 and through the aligned opening in the member 13 and through the opening 6 in the stationary member 2 into the mould cavity. It will be seen that the passage of molten metal towards the rear or left as viewed in Figure 1 is prevented by the stop 5a while lateral leakage from the top of the mould cavity is prevented by substantial contact between the segments 1 and the inset lining 5 along the surfaces 7 (Figure 2). The closure of the mould cavity in the segments 1 is continued towards the right by the inset member 8 from a point slightly to the rear of the end of the stationary member 2 to a point ahead of the line III—III beyond which the contacting upper segments 3 serve to close the mould cavity as above explained.

In a modified construction of the inset member 8, the latter may be provided with depending flanges or side walls as shown at 14 in Figure 3, thereby increasing the contact surfaces between the inset member 8 and the vertical walls of the mould cavity in the segments 1.

In the modified construction shown in Figure 4, the stationary member 2 is provided with internal passages above the surfaces 7 and arranged to be cooled by means of a water circulation.

In the modification shown in Figure 1a the rear part of the stationary member 2 has a metallic surface bearing on the surfaces 7 of the bottom segments 1 instead of the inset member 5 bearing on these surfaces as shown in Figure 1.

The upper and lower chains of segments may, if desired be constructed and arranged as shown in Figure 3a in which it will be seen that the upper segments 3 have their lower portions adapted to enter the cavity in the lower segments 1, and to close the cavity along the surfaces 7a instead of along the surfaces 7. The upper segments 3 may be arranged, for example, to be pressed down upon the molten metal in the cavity by means of rollers 21 mounted in a housing 22 and loaded by a flexible container or hose 23 carried in an abutment 24 on the frame of the apparatus. The hose 23 is arranged to be expanded by compressed air to a desired extent which can be varied at different parts of the solidifying billet by using separate lengths or sections of hose under different air pressures so that the segments 3 enter the segments 1 and compresses the billet during solidification to an extent dependent upon the shrinkage of the billet.

It will be apparent that the improved apparatus of the invention enables a continuous bar or billet to be cast in the mould cavity from molten metal continuously supplied thereto under any desired pressure or head corresponding to the level of the molten metal in the pouring pot without risk of appreciable leakage. The casting under continuous considerable pressure thus effected ensures the production of a dense homogeneous bar or billet. The cast product is thus usable throughout its entire length except for a short piece at each end and the necessity for cropping is reduced to a minimum.

The continuously produced bar or billet can evidently be led directly to a rolling mill or other apparatus in which the metal is modified as regards its cross-sectional form or area.

The invention is evidently not limited to the particular constructions and arrangements above described and illustrated by way of example which may be varied in many respects without exceeding the scope of the invention.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a continuous casting machine, a travelling bottom mould member constituted by a chain of mould segments and provided with an open mould cavity, a stationary top mould member cooperating with the cavity of said bottom mould member to form a runner channel of closed cross-section on part of said bottom mould member and provided with an admission opening for admitting molten metal into said runner channel, a travelling mould member cooperating with the cavity of said bottom mould member to form a closed mould cavity adjoining said runner channel, said bottom mould member containing the full mould cavity, and an inset attached to the stationary top member and projecting within this cavity, for the purpose specified.

2. In a continuous casting machine, a travelling bottom mould member provided with an open mould cavity, a stationary top mould member cooperating with the cavity of said bottom mould member to form a runner channel of closed cross section on part of said bottom mould member and provided with an admission opening for admitting molten metal into said runner channel, a travelling top mould member cooperating with the cavity of said bottom mould member to form a closed mould cavity adjoining said runner channel, and an inset projecting from the stationary member adjacent to the pouring point, one portion of which immediately adjacent the pouring point is adapted to engage and make close contact with the upper edges of the bottom travelling mould member, another portion adjacent the travelling top mould member being adapted to engage and make close contact with the vertical walls of the mould cavity in the bottom travelling mould member.

3. In a continuous casting machine, a travelling bottom mould member provided with an open mould cavity, a stationary top mould member cooperating with the cavity of said bottom mould member to form a runner channel of closed cross section on part of said bottom mould member and provided with an admission opening for admitting molten metal into said runner

channel, and a travelling top mould member co-operating with the cavity of said bottom mould member to form a closed mould cavity adjoining said runner channel, the position of the stationary top member being arranged to be adjustable relative to the bottom member.

4. In a continuous casting machine, a travelling bottom mould member provided with an open mould cavity, a stationary top mould member cooperating with the cavity of said bottom mould member to form a runner channel of closed cross-section on part of said bottom mould member and provided with an admission opening for admitting molten metal into said runner channel, a travelling top mould member cooperating with the cavity of said bottom mould member to form a closed mould cavity adjoining said runner channel, and an inset supported by said top member comprising a rear stop adapted to close the mould cavity in the bottom mould member, an upper portion adapted to contact closely with the upper surface of the bottom mould member and provided with an aperture through which the molten metal passes, and a front portion adapted to close the mould cavity below the upper surface of the bottom mould member.

5. In a continuous casting machine, a travelling bottom mould member provided with an open mould cavity, a stationary top mould member cooperating with the cavity of said bottom mould member to form a runner channel of closed cross-section on part of said bottom mould member and provided with an admission opening for admitting molten metal into said runner channel, and a travelling top mould member cooperating with the cavity of said bottom mould member to form a closed mould cavity adjoining said runner channel, the stationary top member comprising an inset adapted to cooperate in forming a closed mould cavity with the bottom member and projecting into the closed mould cavity formed by the cooperation of said bottom mould member with said travelling mould member.

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