

July 14, 1942.

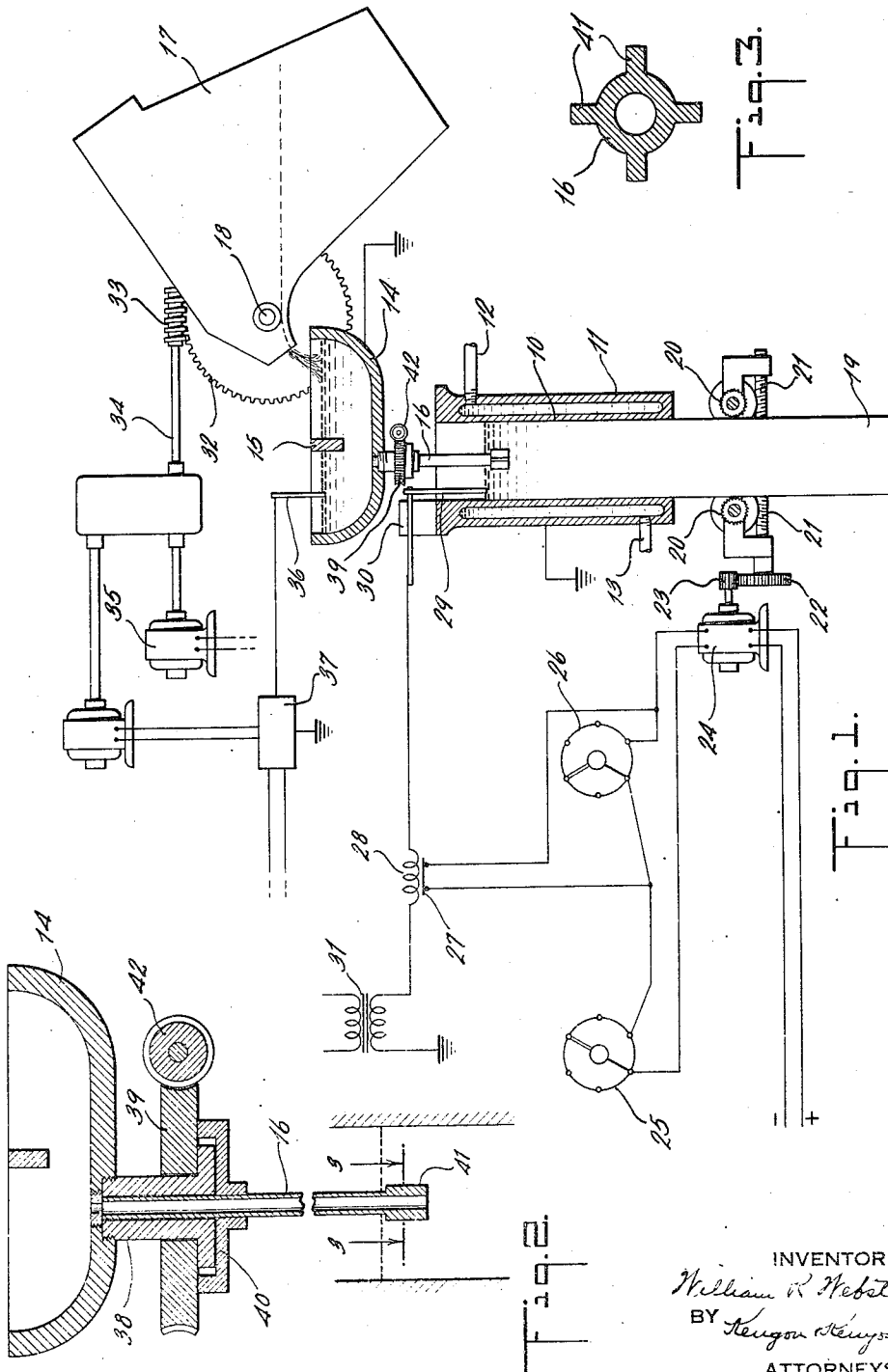
W. R. WEBSTER

2,290,083

CONTINUOUS MOLDING MACHINE

Filed June 4, 1940

2 Sheets-Sheet 1



INVENTOR
William R. Webster
BY *Kearney Kearney*
ATTORNEYS

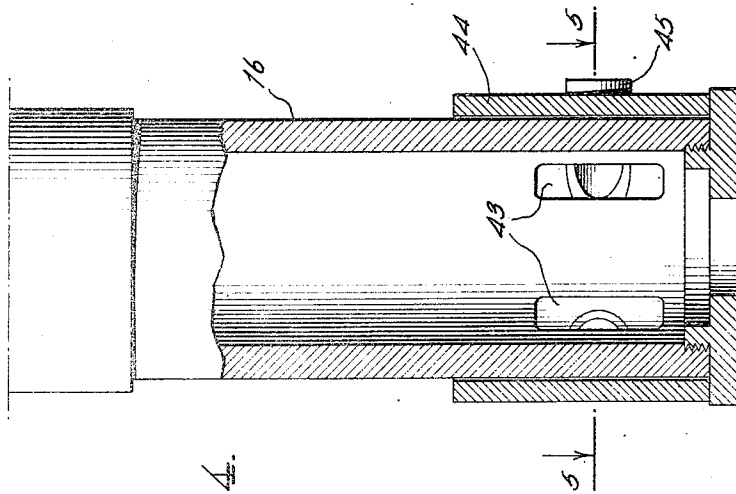
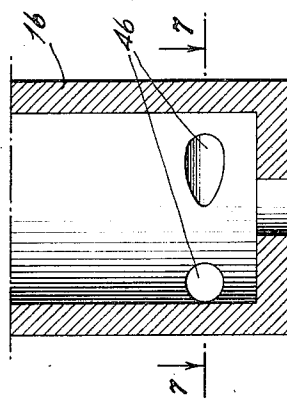
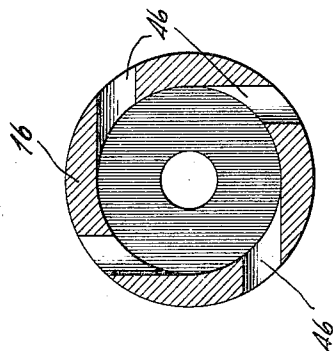
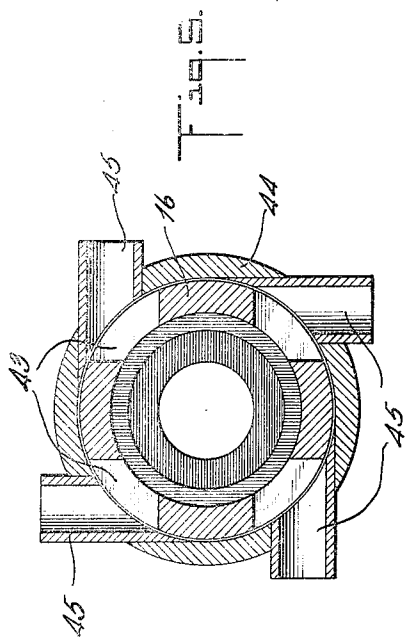
July 14, 1942.

W. R. WEBSTER
CONTINUOUS MOLDING MACHINE

2,290,083

Filed June 4, 1940

2 Sheets-Sheet 2



INVENTOR
William R. Webster
BY *Henry H. Henson*
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,290,083

CONTINUOUS MOLDING MACHINE

William R. Webster, Bridgeport, Conn.

Application June 4, 1940, Serial No. 338,725

2 Claims. (Cl. 22—57.2)

This invention relates to continuous molding machines and more especially to machines for molding bars or rods.

A continuous molding machine of the type to which this invention particularly applies consists essentially of a tubular molding chamber having an inlet and an outlet of which the latter desirably is at a lower elevation than the former. Means are provided to introduce molten metal into the chamber inlet and means are provided for withdrawing the solidified metal in bar form from the outlet while means are provided to promote solidification of the metal in its passage through the molding chamber, such means usually comprising a jacket surrounding the chamber and provided with means for circulating coolant therethrough.

Heretofore continuous molding machines have not been satisfactory due to the lack of uniformity in the molded rods or bars. The lack of uniformity has been due to the absence of means for closely controlling the relation of the feed rate of molten metal to the discharge rate of the molded bar or rod. If the molded rod or bar is discharged at too low a rate, the molten metal overflows the mold and if the discharge rate is too great, then partially solidified metal is discharged instead of fully solidified metal. Also, previous continuous molding machines have been unsatisfactory due to the occurrence in the molten metal of so-called cold shots resulting in surface irregularities and have also been unsatisfactory due to contact of slag and oxides against the mold surface with resulting trapping of the same in the solidifying metal causing surface irregularities.

An object of this invention is to provide a continuous molding machine equipped with automatic means operative to control the level of the metal in the molding chamber.

A further object of the invention is to equip a continuous molding machine with molten metal feeding means of such nature that circulation of the metal is effected at the top of the mold in such manner as to collect buoyant impurities on the surface of the molten metal in the mold, also effect uniform transition of the metal from its fluid to its solid state and also direct the entering hot metal rapidly against the mold periphery.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is a sectional view partially in elevation of an apparatus embodying the invention, certain of the parts being shown schematically;

Fig. 2 is an enlarged fragmentary section similar to Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is an enlarged fragmentary view of a modified molten metal inlet;

Fig. 5 is a section on the line 5—5 of Fig. 4;

Fig. 6 is a view similar to Fig. 4 of another modification, and

Fig. 7 is a section on the line 7—7 of Fig. 6.

In Figs. 1 and 2, 10 is a vertical molding tube or chamber open at its upper and lower ends and housed within a casing 11 constituting a jacket for circulating cooling liquid around the molding tube. Pipes 12 and 13 are provided for supplying and withdrawing the cooling liquid. A pouring box or dish 14 is supported above the molding tube 11 by any suitable means (not shown) and is provided with a bridge 15. Preferably, a pipe 16 extends from the bottom of the pouring box 14 into the molding tube 10 a predetermined distance below the top of the molding tube but such pipe may be dispensed with in which case the metal will flow in an unconfined stream from the box 14 into the mold. Molten metal to be cast is delivered from an adjustable furnace 17 of the standard induction type supported by a shaft 18. Means, well known in the art, but not disclosed herein are provided for initially forming the ingot blank or stool 19 in the mold, an example of such means being illustrated in the patent to Williams, No. 2,079,644. The ingot 19 is withdrawn from the mold tube by any suitable extracting or withdrawing mechanism such, for example, as toothed rollers 20 which engage the surface of the ingot.

The rollers 20 are operated in synchronism by a driving screw 21 provided at one end with a gear 22 which meshes with a pinion 23 mounted on the armature shaft of a motor 24. In the shunt field circuit of the motor 24, a manually adjustable rheostat 25 is connected in series with a manually adjustable rheostat 26. The armature 27 of a relay 28 is connected in shunt to the rheostat 26. A contact member 29 which may be a small electrical carbon is carried by an insulated support 30 and is part of a circuit including the coil of the relay 28, both ends of such circuit being grounded. Power is supplied to the relay circuit by the transformer 31.

The height of the molten metal in the mold 10 is controlled by controlling the speed of rotation of the rollers 20. The arrangement of the rheostats 25 and 26 is such that when the rheostat 26 is short-circuited by the armature 27 of the relay 28, the motor operates at a slower speed than when the rheostat 26 is not short-circuited. Whenever the level of the molten metal in the chamber 10 is such that the metal engages the contact 29, the relay is energized to operate the armature 27 to open the shunt circuit around the rheostat 26, thereby speeding up the rollers 20 with consequent faster withdrawal of metal from the molding tube and reduction of the height of metal in the tube. Such action continues until

the metal in the molding chamber is disengaged from the contact 29 whereupon the relay circuit is broken with the result that the armature 27 closes the shunt circuit around the rheostat, thereby short-circuiting the same and causing a decrease in the rotational speed of the rollers 20 with consequent slower emergent speed of the bar 19. The rheostats 25 and 26 are manually adjustable so as to normally make the speed of the motor 24 and the rollers 21 such that the rise and fall of the metal level in the mold does not take place with too great frequency or amplitude. Also, the rheostats may be so adjusted as to cause cyclical rise and fall of the metal in the mold over a predetermined distance.

The shaft 18 of the furnace 17 carries a gear 32 which meshes with a worm 33 carried by the shaft 34. The shaft 34 is driven by variable speed means 35 of the type shown in Webster application, Serial No. 221,925. A contact 36 is supported for engagement by the metal in the dish 14 and is electrically connected to control apparatus 37 effective to vary the speed of one of the motors of the variable speed means 35, thereby causing faster or slower rotation of the worm 33. With this arrangement, the level of the molten metal in the dish 14 is maintained substantially constant. Upon decrease of the level of molten metal in the dish 14 sufficient to disengage the metal from the contact 36, the rotational speed of the worm 33 is increased to tilt the furnace 17 to increase the rate of flow of the molten metal into the dish, thereby causing a rise in the level of the molten metal. Upon re-engagement of the molten metal with the contact 36, the reverse procedure is effected with consequent maintenance of approximately constant level of metal in the dish. The control means may alternatively be of the same type as the control means for the rollers 21.

The outlet from the dish 14 is on the opposite side of the bridge 15 from that into which the molten metal is introduced so that the bridge skins off any dross or foreign matter which may be introduced into the dish from the furnace. As shown in Fig. 2, a flanged bushing 38 is screwed into the lower portion of the pouring dish 14 and a worm gear 39 is rotatably supported by said bushing. A bracket 40 attached to the under face of the worm gear 39 is rigidly attached to and supports the tube 16, at the lower end of which are provided a plurality of radial vanes 41. A worm 42 meshes with the worm gear 39 and is driven by any suitable means (not shown). The tube 16 extends sufficiently below the level of the molten metal that the ribs 41 are completely immersed in such metal. The tube 16 is caused to rotate during the introduction of molten metal into the tube, thereby causing horizontal rotary circulation of the molten metal near the upper level thereof.

In the modification shown in Figs. 4 and 5, the tube 16 has its upper end rigidly connected to the pouring dish 14 and at its bottom end is provided with a plurality of radial apertures 43 and a collar 44 is rotatably supported by the tube in overlying relationship to the ports 43. The collar is equipped with a plurality of nozzles 45 substantially tangential to the surface of the tube 16. Molten metal escapes from the tube 16 partly through the bottom outlet and partly through the nozzles 45, causing rotation of the collar 44 with consequent distribution of the incoming metal over the entire mold tube area. The flow of molten metal from the nozzles 45 causes rotary

horizontal circulation in the upper portion of the molten metal.

In Figs. 6 and 7 is disclosed a modification in which the tube 16 is provided with tangential horizontally directed orifices 46 adjacent the bottom of the tube. The flow of molten metal through the orifices causes horizontal rotary circulation of the metal in the mold tube.

The horizontal rotary circulation of the upper portion of the molten metal in the mold tube distributes the incoming metal uniformly over the surface of the mold tube and causes the light particles of dross and oxide floating on the top surface of the metal to approach the center of the surface of the body of metal. Segregation of such particles at the center of the metal surface permits the removal thereof by any suitable means, and also prevents such particles from becoming incorporated in the surface of the metal bar. Also, the horizontal rotating circulation of the top portion of the body of molten metal prevents occurrence of so-called cold shots and similar surface irregularities as well as effects uniform transition of the metal from its liquid to its solid state.

The mold tube 10 may be composed of brass and in a machine for casting brass, a lining of chromium tungsten or the like is preferably provided for the tube 10. The use of such a lining obviates all tendency for zinc oxide to adhere to the surface of the mold tube, thereby avoiding malfunction of the apparatus due to zinc oxide sticking to the inside of the mold as has been the case where the inner surface of the mold was brass.

I claim:

1. A continuous molding apparatus comprising a vertical molding chamber having a top inlet and a bottom outlet, a pipe leading into said chamber, means rotatably supporting said pipe at its upper end, means for supplying molten metal to the upper end of said pipe, means for promoting solidification of the molten metal in said chamber, means for withdrawing solidified metal from said chamber through said outlet, a driving motor for said withdrawing means, a contact in the upper portion of said chamber engageable by molten metal therein, an electric circuit closed by engagement of the metal with said contact, means controlled by the amount of current flow in said circuit for regulating the motor speed, means for effecting rotation of said pipe and agitating means carried by the lower end of said pipe.

2. A continuous molding apparatus comprising a vertical molding chamber having a top inlet and a bottom outlet, a pipe leading into the upper end of said chamber, means rotatably supporting said pipe at its upper end, means for supplying molten metal to the upper end of said pipe, means for effecting rotation of said pipe, agitating means carried by the lower end of said pipe, for effecting horizontal circulation of the upper portion of the metal in said chamber, means for withdrawing solidified metal from said chamber through said outlet, and means responsive to the height increase of the molten metal in said chamber to decrease the ratio of the molten metal flow rate to the linear longitudinal speed of the metal discharged from said chamber and responsive to height decrease of molten metal in said chamber to increase the ratio of the molten metal flow rate to the linear emergent speed of the solidified metal.

WILLIAM R. WEBSTER.