

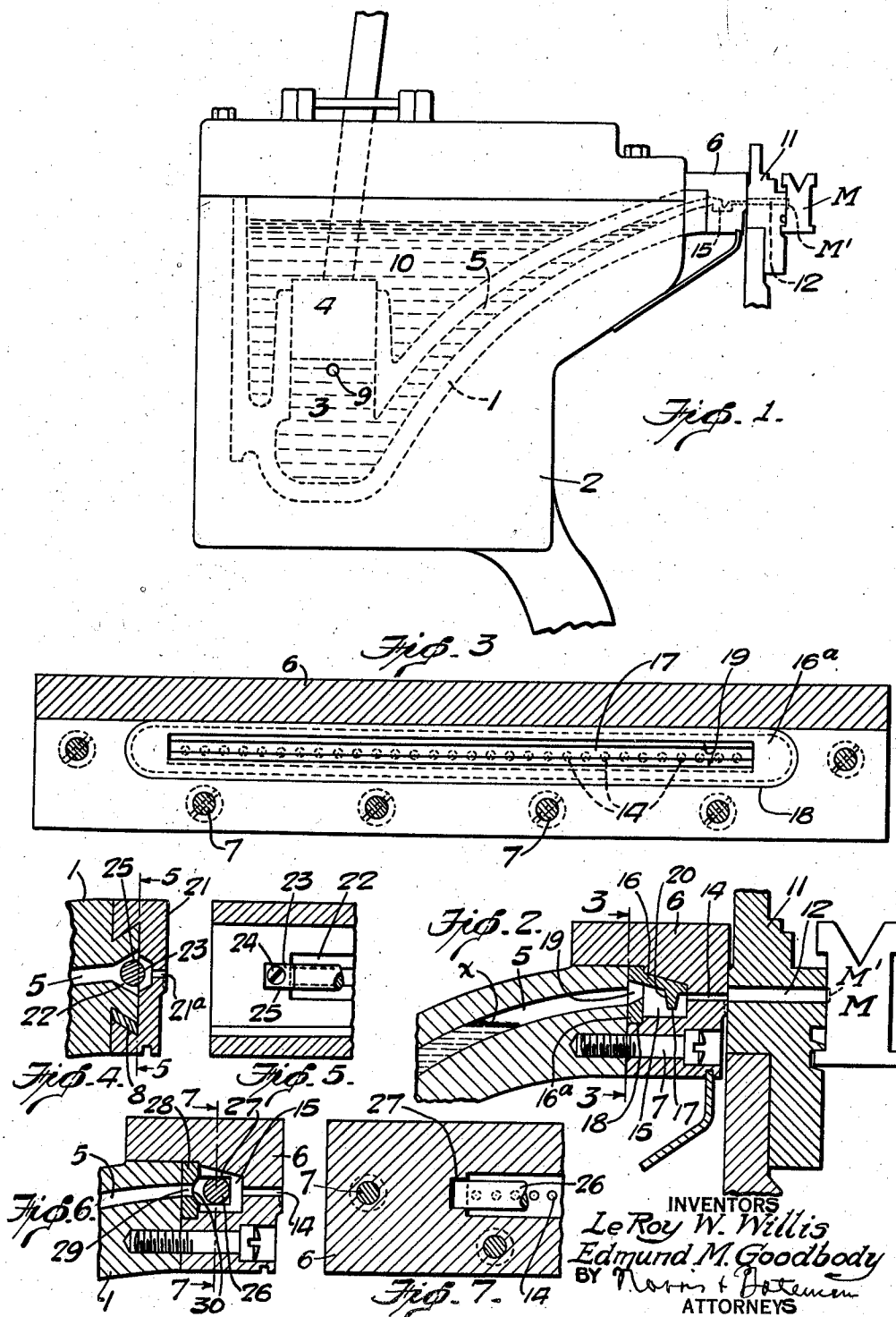
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METAL POT FOR SLUG CASTING MACHINES

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METAL POT FOR SLUG CASTING MACHINES

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1 Claim. (Cl. 22—70)

The present invention relates to improvements in metal pots for slug casting machines of the general class disclosed in U. S. Letters Patent No. 436,532 granted September 16, 1890, wherein composed lines of character bearing matrices are presented edgewise against one face of a slotted mold and a mouthpiece on the metal pot is brought against the opposite mold face in order, through the action of a spring actuated pump plunger within the pot and controlled by a rotary cam, to force molten metal outwardly through the mouthpiece of the pot into the mold slot and against the characters on the matrices aligned along the opposite side of the slot to thereby cast a type bar or slug.

As ordinarily constructed, the metal pot used in machines of this class comprises a reservoir portion containing a supply of molten metal, a pump well within the reservoir having a port for admitting metal into the well from the reservoir, and an upwardly and forwardly extending passage or throat leading from the bottom of the well, the upper end of the throat being provided with a mouthpiece, which by a forward rocking movement of the pot to casting position, engages at its outer side with the back of the mold. Normally, the pump plunger is held in raised or retracted position by a controlling cam, and once during each cycle of operation of the machine, rotation of the cam brings a depression therein to a position which permits the plunger to descend under the influence of a powerful actuating spring and thus force the molten metal below the plunger and in the throat ahead of the plunger through one or more rows of exit holes in the mouthpiece and into the mold slot, the path of flow of the metal according to the usual previous practice, being kept as direct and free from obstructions as possible so as not to unduly resist the force with which the metal stream enters the mold.

Since the maximum level of the metal in the pot reservoir must always be maintained somewhat below the level of the exit or outlet holes in the mouthpiece in order to avoid spilling of the molten metal as the pot rocks to and from casting position, it follows that there is always a volume of air in the throat of the pot above the normal metal level therein, even when the mouthpiece is advanced and engaged with the mold prior to the casting operation. Moreover, it is well known that, due to exposure to the atmosphere, the molten type metal rapidly chills and oxidizes on its surface resulting in the accumulation of a surface film of dross (lead oxides, antimony and other impurities) which varies

in quantity according to the temperature at which the metal is being run and the length of time it may stand idle and which film amounts in effect to a chilled layer separated or floating, so to speak, on the top of the hotter metal beneath.

It has been found from experience that the air in the throat of the pot above the surface of the molten metal therein and in the mold slot, together with the dross accumulation on the surface of the molten metal in the throat have a direct and detrimental effect on the solidity of the type slugs and on the quality of the type face cast thereon against the punched characters on the matrices aligned at the front of the mold slot, it being understood that the size of the mold slot and of the type face varies according to the class of printed matter to be produced from the slugs.

While it is practically impossible to say precisely just how and to what extent the air and the dross respectively contribute to producing a detrimental effect on the slugs, the results of long experimentation point to this explanation; that the dross on the surface of the metal in the pot throat dominates the constituency of the first charge of metal which enters the mold and casts against the cold matrices and that the natural cooling effect of the air and the sudden chilling of the impure metal produces on the type face imperfections commonly known as frost spots and shrinks or wrinkles which directly impair the quality of print which it is possible to obtain from the slugs. Moreover, the sudden action of the pump plunger when it is released drives the metal and the air in the throat above the metal forwardly into the mold with such force that the air produces a strong buffing action and is trapped, except for such small quantity of air as may escape through small vents which are usually provided, and the air so trapped often forms slight depressions or hollows on the type face and also pockets beneath the type face and throughout the body of the slug. Such air pockets, especially those near the surface of the type face, frequently cause the characters cast on the slug to cave in, especially when subjected to the pressure applied in impressing the characters on the slugs in stereotype paper matrices so widely used in modern printing processes.

Various expedients have been resorted to in attempting to correct the foregoing defects and thereby produce solid slugs with a smooth and perfect type face comparable with that of individual type. Among these expedients are arrangements to enable the air in the mold and pot

throat to be vented therefrom more adequately, the provision of more perfectly smooth walls and an uninterrupted path of flow for the molten metal, and the application of a more sudden action and greater pressure to the pump plunger to throw the metal directly into the mold and against the matrices with greater force. These expedients however have, at best, been unsuccessful, they resulting in only a small degree of improvement in solidity of the slugs or the quality of the type faces thereon under certain working conditions and frequently, whatever improvement has been effected in one of these conditions has only been possible at the sacrifice of the other.

The primary object of the present invention is to effectively overcome the aforesaid defects under all working conditions, that is, for different speeds of casting and for all sizes of molds and type faces. To this end, the invention provides means which are believed to be contrary to the principles heretofore considered essential to the casting of type slugs in machines of this class. Thus, instead of permitting the type metal to have a direct and unobstructed path of flow, the present invention provides a deliberate interference in the form of walls or baffle means so located as to divert the path of flow of the metal stream yet not unduly reduce the force with which the stream passes out of the mouthpiece and into the mold. It has been found that the violent churning action produced when the metal stream impinges against the baffles and flows around them under the continued action of the pump plunger causes the dross accumulation to be instantaneously broken up and thoroughly mixed with the hot and pure molten metal beneath its surface before the metal passes into the mold. Thus, the dross particles no longer predominate in the portion of the metal stream which first strikes the matrix characters, and although the baffles act as a deliberate obstruction to the direct flow of the stream of metal they are so formed and located as to allow the metal to flow around them under the full force of the pumping action. Moreover, the pressure or quantity of unvented air left in the mold is not so great nor so likely to be trapped as heretofore in undesirable hollows or pockets, the momentary hesitation in the flow of the metal stream by the action of the baffle means, although such hesitation is so slight as not to retard the casting operation, permitting the air to be more completely vented before the metal enters the mold.

The invention also provides baffle means of the kind just described, in the form of a movable baffle member or obstruction in the path of flow of the molten metal, the arrangement of the movable baffle member being such that upon the return stroke of the pump plunger immediately following the casting operation, the baffle member will function as a valve to prevent suction of metal backwardly out of the mold.

To these and other ends, the invention consists in certain improvements and combinations and arrangements of parts, all as will be hereinafter more fully described, the features of novelty being pointed out particularly in the claims at the end of this specification.

In the accompanying drawing:

Figure 1 is a side elevation of a metal pot of the usual form showing one form of baffle according to the present invention applied thereto, the metal pot being shown in casting position

with its mouthpiece engaged with the rear face of a slug casting mold of a form commonly used in machines of this class;

Fig. 2 is a vertical section, on an enlarged scale, taken transversely through the mold and the upper end of the metal pot shown in Fig. 1;

Fig. 3 is a vertical section on the line 3—3 in Fig. 2;

Fig. 4 is a vertical section taken transversely through the mouthpiece portion of a metal pot, showing a modified form of the invention applied thereto;

Fig. 5 is a partial vertical section taken on the line 5—5 in Fig. 4;

Fig. 6 is a vertical section taken transversely through the mouthpiece portion of a metal pot showing another form of the invention applied thereto, and

Fig. 7 is a partial vertical section taken on the line 7—7 in Fig. 6.

Similar parts are designated by the same reference characters in the several figures.

The invention is shown in the present instance for purposes of illustration as applied to a metal pot of the usual form employed in matrix composing and line casting machines of the well known class hereinbefore referred to, but it will be apparent to those skilled in the art that the invention is equally adaptable to other forms of metal pots employed for casting type bars or slugs and that other forms of baffles may be employed, either directly in the metal pot mouthpiece or in the upper end of the metal pot throat above the type metal therein, the invention not being limited in these respects except to the extent that the baffle member shall be so located as to lie in the path of flow of the metal stream and above the normal level of the metal in the metal pot.

As shown in the accompanying drawing, the metal pot 1 shown in dotted lines in Fig. 1 is contained within a housing or jacket 2 and may be provided with a burner or other suitable or well known means for heating it, the metal pot comprising a cylindrical pump well 3 fitted with a pump plunger 4 which is reciprocatory vertically therein, and a passage or throat 5 which communicates with the bottom of the pump well and leads unwardly and forwardly therefrom to a mouthpiece 6 which forms the outlet for the metal pot. The mouthpiece is suitably secured to the upper end of the walls of the throat, as by screws 7 or by a dove tail joint tightened by a wedge-shaped gib 8 as shown in Fig. 4. A side wall of the pump well 3 is provided with a port 9 which permits molten metal in the reservoir portion 10 of the pot to flow into the well and throat portion when the pump plunger is in raised position as shown in Fig. 1. The forward or outer side of the mouthpiece, when in casting position, engages the rear face of the mold 11 having a slot 12 therein in which the type slug is to be cast against the edges of the composed line of matrices M aligned along the opposite or front face of the mold with their character punchings M' aligned at the front of the mold slot. The form of the mold and the arrangement of the metal pot whereby the latter is caused to tilt to and from casting relation with the mold, and also the arrangement of parts for applying spring pressure to the piston 4 and for releasing the same under control of a so-called pump cam while the metal pot is in casting position as shown in Fig. 1 will be understood to be the same as commonly employed in the usual

form of slug casting machines of the class hereinbefore referred to, and it is deemed unnecessary to herein show or explain the details of construction and operation of these parts since they are well known to those skilled in the art and they form no pertinent part of the present invention.

Heretofore, it has been considered essential to have the walls of the metal passage or throat 5 as smooth as possible and to avoid obstructions in the path of flow of the molten metal when the pump plunger is released, in order to allow the stream of molten type metal to flow as freely as possible and with maximum velocity under the influence of the pumping action into the mold and against the edges of the matrices alined in front of the casting slot. However, it has been found that this principle of free flow of the metal stream permits the layer x on the surface of the molten metal in the throat and consisting of an accumulation of oxidized metal or dross and impurities to dominate the content of the first portion of type metal pumped into the mold and impinging against the character punchings on the matrices. Moreover, the portion of the passage or throat 5 above the normal level of the molten metal, the average normal level being represented in Fig. 2, contains a body of air, and the casting slot in the mold also contains a quantity of air which varies according to the size of the casting slot. Consequently, when the pump plunger 4 is released, not only will the accumulation of dross and impurities on the surface of the type metal in the throat pass in more or less concentrated form directly to the matrices but the unobstructed flow of the metal together with the suddenness of the pumping action will allow very little of the air ahead of the metal to escape. The result therefore has been that some of the air ahead of the metal stream becomes trapped in the cavities formed by the character punchings in the matrices and, to a much greater extent, forms air holes or pockets beneath the type face and throughout the body of the cast slug. Since the matrices are cold when the cast is made against them, the dross accumulation together with the hot metal immediately following it and to some extent mixed with it, suddenly chills when it strikes the cold matrices and forms frost spots and wrinkles on the face of the type characters so that the cast characters do not present a sufficiently smooth and perfect surface to properly take ink for printing purposes, the imperfections being particularly evident when the slugs are used for direct printing therefrom on hard or glossy paper.

According to the present invention, the principle of free and direct flow of the molten type metal into the mold and against the matrices is supplanted by a principle contrary thereto and which every effort heretofore has been made to avoid in constructing metal pots of this class and in attempting to improve the quality of the cast slugs.

One embodiment of the present invention is shown in Figs. 1 to 3 inclusive wherein the metal pot mouthpiece 6 contains the usual row of exit or outlet orifices 14, the mouthpiece being provided, immediately in rear of the exit orifices, with an enlarged chamber 15 which extends longitudinally of the mouthpiece or transversely of the throat. A baffle member 16 is mounted in the chamber 15 and extends along the upper wall thereof, this baffle member having a continuous rib 17 which projects downwardly therefrom into

proximity with the lower wall of the chamber 15 and across the path of flow of the metal stream from the throat of the metal pot to the exit orifices of the mouthpiece. The baffle member 16 is preferably constructed with a longitudinal flange portion 16^a which is fitted into a recess 18 formed by an enlarged portion of the chamber 15, this recess extending longitudinally along the rear portion of the mouthpiece 6, and the flange portion 16^a is provided with a slot 19 which extends longitudinally thereof but terminates short of the ends of the flange portion 16^a, this slot permitting free passage of metal from the throat 5 into the chamber 15. The upper and lower walls of the slot 19 are tapered or bevelled in opposite directions so that the width of the slot opening through which the metal enters the chamber 15 is somewhat less than its width on the side toward the throat 5, and the narrow side of the slot is located at such a height that metal discharging from the throat through this slot will impinge against the face 20 of the rib 17 which is opposite to the slot 19. It will thus be seen that the rib 17 is positioned so that it will effectively obstruct the direct flow of metal from the throat 5 of the metal pot to the mold slot 12 and that it thereby constitutes a baffle against which the metal stream is compelled to impinge and around or beneath which the metal must flow before it passes through the exit orifices 14 in the mouthpiece in order to enter the mold slot.

In the form of the invention shown in Figs. 4 and 5, the mouthpiece 21 shown is substantially the same as the one commonly employed at present on commercial slug casting machines of the class referred to. According to this form of the invention however, the upper and lower walls of the throat 5 immediately behind the mouthpiece are oppositely bevelled to provide a flared or widened chamber 22 between the upper end of the throat 5 and the exit orifices 21^a of the mouthpiece, and a rod 23, which may be secured at its ends to the metal pot by screws 24, extends across the flared or widened chamber 22, each end of this rod being seated in a recess 25 at each end of the chamber 22. The rod 23 lies directly in the path of flow of molten type metal when the latter is pumped upwardly in the throat 5 and it serves the same purpose as the flange 17 previously described in connection with the baffle member 16, the baffle in the form of the rod 23, however, permitting the molten type metal to pass around both sides thereof.

In the form of the invention shown in Figs. 6 and 7, the mouthpiece 6 which is like that shown in Figs. 1 to 3 inclusive, is provided with a baffle in the form of a rod 26 which extends longitudinally across the chamber 15 in the mouthpiece, but the baffle in this instance is movable instead of stationary. Instead of securing the baffle to the upper end of the pot throat or to the mouthpiece, the mouthpiece is provided with a recess 27 at each end beyond the chamber 15 in which the respective ends of the baffle rod 26 are fitted movably, these recesses being so located as to retain the baffle 26 always in direct line with the path of flow of the molten type metal passing from the throat 5 into the mold, but these recesses are of sufficient depth in the mouthpiece to permit the baffle to move horizontally toward and from the upper end of the throat 5. A plate 28, corresponding substantially to the flange portion 16^a of the baffle member 16 and provided with a slot 29 terminating short of the ends thereof and communicating with the

throat, serves to retain the baffle rod 26 within the recesses 27 in the mouthpiece, and the forward side of the plate 28 is provided with a seat 30 into which the baffle rod 26 is adapted to fit when in its rear position. The plate 28 is merely seated loosely in an enlarged recess portion of the chamber 15, as in the case of the baffle member 16, as clearly shown in Fig. 3, it being unnecessary to secure the baffle member 16 or the plate 28 rigidly in place, it being convenient not to do so since they may then be easily removed for inspection or cleaning, by mere removal of the mouthpiece from the metal pot.

The movable baffle 26 shown in Figs. 6 and 7 functions not only as a baffle as described but it also functions to overcome back suction of molten type metal from the mold when the pump plunger is retracted or raised after the casting operation. Various schemes have been previously proposed for controlling the back suction of metal from the mold, as for example the arrangement of a valve immersed within the metal and directly controlled by the pump plunger, as in U. S. Letters Patent No. 1,732,075 granted October 15, 1929. The arrangement according to the present invention however, has the distinct advantage that by locating the valve above the metal level in the throat and as close as possible to the mold, greater efficiency is obtained since the valve responds more quickly, and instantly upon the start of the rise or retraction of the pump plunger, it cuts off the back flow of metal due to the partial vacuum created in the pot throat. The baffle 26 in the present instance has only sufficient horizontal movement to present openings above and below it for the passage of the molten type metal when the metal is pumped upwardly through the throat 5, the force of the metal stream impinging against the baffle driving it forwardly in the recesses 27 in which it is free to move, and the suction due to the partial vacuum created in the throat 5 upon the return stroke of the plunger causes the baffle to instantly return to its seat 30 in the plate 28 and thereby interrupt the action of the vacuum which would otherwise draw unsolidified type metal backwardly out of the mold through the orifices 14 in the mouthpiece.

The desirability and advantage of the valve action just described will be apparent to those skilled in the art, it being well known that continuous casting in one mold over long periods causes the mold to become so hot that the slugs do not solidify sufficiently before the return stroke of the pump plunger to prevent some of the metal at the base of the slugs from being drawn back out of the mold, and such undesirable withdrawal of unsolidified metal from the mold is avoided by the movable baffle functioning as a valve as hereinbefore described.

In each embodiment of the invention shown,

a baffle is provided which is located within a chamber which is between the normal level of the molten metal in the throat or passage leading from the pump well and the orificed mouthpiece or outlet through which the molten metal is injected into the mold, and the baffle is elongated and extends across the width of said chamber, the latter being preferably of a width conforming with the usual laterally widened or horizontally flared form of the throat, and the baffle projects partially across the height of said chamber so that it will be directly in the path of flow of the molten metal stream discharging from the throat and passing through this chamber on its way to the outlet and the mold when the pump plunger descends to make a cast. In consequence, the stream of molten metal will be violently churned when it strikes the baffle and this churning action will be augmented by the deflection of the flowing metal by the baffle against the walls of the chamber as the metal flows around the baffle on its way through the chamber, thereby causing whatever dross may lie on the surface of the metal to be instantly dispersed and thoroughly mixed with the hotter and pure metal under the surface, and such churning action provides a momentary interval which allows the air which is forced forwardly ahead of the metal stream to be more completely vented from the mold. The resultant slugs produced in accordance with the present invention show a marked improvement in solidity throughout and in quality, particularly with respect to perfection of the surface of the type characters thereon, frost spots, hollows and wrinkles being eliminated to such extent that the slugs are suitable for direct printing on hard or glossy paper, and even in cases where the letters are of the larger sizes, practically all objectionable imperfections are eliminated.

We claim as our invention:—

A metal pot for slug casting machines having a metal reservoir to contain a body of molten metal, a well to receive metal from the reservoir and having means for forcing metal therefrom, a throat extending upwardly from the well to a level above that of the metal in the reservoir and to a horizontally elongated outlet of substantially the same width as the portion of the throat adjacent thereto for injecting metal discharged from the throat into a slug casting mold, a transverse chamber substantially as wide as the outlet and located between the normal level of metal in the throat and the outlet for the flow of metal there-through, and a solid baffle extending horizontally across said chamber in parallel relation to the outlet and disposed for the flow of metal around and beyond it in at least one unbroken stream before reaching the outlet.

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