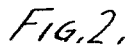
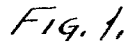


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3,208,113

DIE CASTING MACHINE

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Filed Dec. 14, 1962, Ser. No. 244,638

1 Claim. (Cl. 22—68)

This invention relates generally to die casting machines of the cold chamber type wherein a cylinder forms a shot chamber which receives the molten material such as aluminum for example, that is then forcibly ejected by a plunger through a substantially horizontal die gate and into the die cavity. More particularly, the present invention relates to the arrangement and relative positioning of the shot chamber relative to the die cavity and to the die gate.

In die casting equipment of the type to which the present invention relates, it is essential that a minimum amount of time elapses from the time the molten material is poured into the shot chamber until the material is forcibly driven into the die cavity. While the filling of the shot chamber and the injection of the material into the die cavity must occur in very rapid succession to prevent premature chilling of the molten material, it is also necessary to prevent premature entry of the material by gravity into the die cavity, that is, before the plunger begins its injection stroke. In other words, for the production of castings with sound center sections and minimum porosity, it is essential to have practically simultaneously filling of the entire die cavity.

Accordingly, the present invention is directed to improved die casting equipment in which the above desirable characteristics are obtained and the objectionable features have been eliminated.

A more specific aspect of the present invention relates to equipment of the above type in which the shot chamber formed by the cylinder is inclined at an angle to the horizontal, that is, it extends upwardly toward the die gate. As a result, the rear end of the cylinder, in respect to the direction of movement of its plunger in a cavity charging direction, is located beneath the die gate and acts as a retaining reservoir for the supply of molten material and prevents the material from prematurely flowing through the die gate. Immediately upon filling this reservoir to a predetermined level, the material is then almost simultaneously forcibly injected by the plunger through the die gate.

Some prior art devices prevent premature draining of the molten charge through the gate by locating the gate in the upper portion of the end of the horizontal charging cylinder. However, it is also sometimes necessary to insure proper filling of the die cavity to be able to utilize various types of gates and perhaps more than one into a die cavity. This often means a gate opening must be located in the lower half of the charging cylinder end or adjacent the bottom of the cylinder.

Accordingly, the present invention permits the use of various types of gates, either of the large or pin-point gate type, and also permits unrestricted location and arrangement of these gates relative to the height of the charging cylinder discharge end.

These and other objects and advantages of the present invention will appear hereinafter as this disclosure progresses, reference being had to the accompanying drawings, in which;

FIGURE 1 is a side elevational view of a die casting machine utilizing the present invention, certain parts being shown in section, broken away or removed for clarity, and illustrating the position of the various movable parts when the molten material has been dumped in the shot

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chamber and immediately prior to injection into the die cavity;

FIGURE 2 is a view which is generally similar to FIGURE 1 but showing the position of the various parts after the injection has been made, the movable die platen and plate removed and just prior to removal of the biscuit from the end of the plunger.

Referring in greater detail to the drawings, a stationary platen 1 rests securely on a suitable support, such as the machine base 2. A plurality of generally horizontally disposed guide rods 3 extending through the platens 1 and 6 are rigidly secured thereto by conventional means, such as nuts 5. These parallel rods are smoothly finished and act as guideways for the movable platen 6 which is slidably mounted thereon for movement between the casting position shown in FIGURE 1 and the product ejecting position as illustrated in FIGURE 2. Any conventional means may be utilized for effecting such reciprocation of this movable platen, such as for example, the conventional hydraulic ram 7, or conventional toggle mechanism.

A die plate 9 is removably secured by bolts 10 to the fixed platen 1 and its front surface 9a is smoothly and accurately finished.

An injection cylinder 12 extends through both the platen 1 and the plate 9 and its front end 12a is ground flush with the smooth surface 9a of the die plate. This cylinder is held securely in position by a collar 13 which may be formed integrally therewith and a tapered retaining ring 14, both of which fit snugly in the counterbore 16 formed in the rear side 9b of the plate 9.

The rear end of the cylinder 12 extends from the platen 1 and has a charging opening 18 in its top side through which the predetermined amount of molten material is introduced into the bore of the cylinder.

A piston plunger 20 reciprocates within the cylinder bore and has a piston rod 21 extending rearwardly therefrom for reciprocation by any suitable means, such as a conventional double-acting hydraulic cylinder (not shown).

The supply opening 18 in the upper side of the cylinder is located immediately in front of the plunger 20 when the latter is in the retracted position shown by the full lines in FIGURE 1.

In accordance with the present invention, the cylinder is inclined in respect to the horizontal, that is to say, it extends axially in a downward and rearward direction away from die gates 32, 33 and the front edge of its inner surface substantially registers at its lowest point with the lowest gate 32, that is, with the bottom portion of the gate as shown in FIG. 1 and as will be more fully explained hereinbelow. In this manner, the supply charge of molten material introduced through opening 18 collects in a reservoir formed at the rear end of the cylinder and by the plunger, the pool of molten material accumulating in the reservoir being of sufficient quantity for producing a cast and being stored within the cylinder at a sufficiently low level so that none of the metal from the pool will prematurely flow by gravity into the gate 32. The predetermined amount of material and inclination of the cylinder are such that the material does not enter the die gates, to be presently referred to, until the plunger begins to move forcibly and instantaneously driving the material through the gate.

The complete die cavity 24 is defined by the die sections 25 and 26 which are secured, respectively, to the movable platen 6 and to a die plate 27 by means of detachable clamps 28.

The intermediate die plate 27 is also slidable on die guide pins 4 and is urged tightly against the fixed plate 9, as shown in FIGURE 1, by movement of the platen 6 to the casting position shown in that figure. Retracting

tion of die plate 27 to the product ejection position of FIGURE 2 is accomplished in a conventional manner by a pair of hooks 30 carried by the moving platen which pull the plate 27 to the left (in the figures) a predetermined distance at which point a conventional cam (not shown) causes disengagement of the hooks and permits continued movement of only the platen 6 further to the left.

Referring again to the gates for the die casting, for purposes of illustration a plurality of pin-point type gates 32 and 33 have been shown. These are conical in shape so as to permit withdrawal of the solidified material therein along with the rest of the biscuit B, when the die moves to the product ejecting position of FIGURE 2. The end of the plunger is formed as a hook or wedge shape which opens downwardly to thereby provide relief clearance for the biscuit as it is knocked from the end of the plunger in a downward direction. This retaining means on the end of the plunger acts to hold the biscuit on the plunger while the casting C is separated from the biscuit, and then as the sweep ram 40 engages the biscuit the removal of the biscuit in a transverse direction to the plunger is facilitated.

Thus, the biscuit is broken off from the casting at the narrow end of the gates, and the biscuit remains on the end of the plunger until the plunger has fully expelled the biscuit from the cylinder. At that time, the biscuit is knocked off the plunger, permitting withdrawal of the plunger back into the cylinder 12 for the next cycle.

The general cycle of operation is as follows. The ram 7 extends to the right, thereby closing the die sections together and the die plate 27 against the fixed platen 9. The plunger is in the full line position shown in FIGURE 1, and the sweep cylinder or ram 40 is also in the FIGURE 1 position. Immediately upon the supply of molten material being ladled or otherwise poured into the cylinder 12 as shown in FIGURE 1, the plunger drives the charge through the gates and into the cavity. The dotted line position of the plunger as shown in FIGURE 1 indicates the end of the injection stroke of the plunger. In normal operation, there is sufficient molten material to fill the cavity and also the end of the injection cylinder so that the plunger holds the pressure during solidification. The stroke of the plunger may be regulated or predetermined by suitable limit switches or other conventional control devices.

After the material has solidified, ram 7 retracts the platen 6, and the attached die section 25 is pulled to the left in the drawings. Hook mechanism 30 attached between platen 6 also pulls die plate 27 along with the die section 25 so they move together as a unit for a short distance. As this occurs, the plunger 20 follows, pushing the biscuit out of the cylinder. At this time plunger movement is arrested, resulting in the breakage at the pin-point gates of the biscuit from the casting, and the stripping of the die section 26 from the biscuit.

After the die plate 27 has cleared the biscuit, a conventional cam device (not shown) disengages the hook mecha-

nism 30 from plate 27, causing the latter to remain stationary. The die section 25 continues to move to the left to permit the casting to be ejected from the die section 25.

Retraction of the plunger rearwardly (to the right) places it in position to receive the next supply of molten material.

Other forms, numbers, or sizes of gates may be used, for example, a single large type of gate may be placed in any position relative to the horizontal centerline of the die cavity or end of the shot cylinder, depending on the die cavity design or other requirements.

In any event, it will be noted, as in the form of gates illustrated here, gate opening 32 is located adjacent the lower half of the cylinder end.

By inclining the shot cylinder, the molten material supplied to the shot cylinder will not prematurely flow by gravity into any portion of the gate. Such premature entry of the molten material often results in unsound or incompletely filled castings.

With the present invention, however, a simple means has been provided for preventing such undesirable premature flow and which means is usable with any type, size or location of gates. As a result, the injection charge occurs all at once, immediately upon entry of the supply material into the cylinder, and it completely fills the cavity before chilling of the material anywhere therein can occur.

Various modes of carrying out the invention are contemplated as being within the scope of the following claim particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

What is claimed is:

In a die casting machine of the cold chamber type having a die which defines a die cavity and a substantially horizontal gate leading thereto, a molten material injection cylinder having a discharge end in fluid communication with said gate, said gate being located adjacent said discharge end, and a plunger slidable from a retracted loading position in said cylinder toward said gate for thereby injecting molten material through said gate and into said cavity, said cylinder being disposed at an incline from the horizontal so that it extends axially in a downward and rearward direction away from said gate and so that the front edge of its inner surface substantially registers at its lowest point with the bottom portion of said gate whereby the lower end of the cylinder together with said retracted piston forms a reservoir for a pool of molten metal of sufficient quantity for producing a cast in said die cavity and at a sufficiently low level so that none of the metal from said pool will prematurely flow by gravity into said gate.

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