METHOD FOR TREATING DIE CASTINGS

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1 Claim. (Cl. 83—27)

This application is a continuation-in-part of application Serial No. 818,078 filed June 4, 1959, now abandoned.

This invention relates generally to die casting, and more particularly to the treatment and handling of such castings. Originally dies were used which made only one casting per shot. It was soon realized that it was more economical, particularly when small castings were made, to make several of them in a single shot. This was because a casting machine has a high overhead cost per hour and it is not being fully utilized if only one small casting is made at a time. Therefore, the art soon developed to the point where several castings of the same type were being made in a single shot.

The next stage was the development of the combination mold. In cases where there was being produced a set of parts which ultimately went into the same assembly, so that each of the die cast parts was required in a fixed ratio to the others, it was possible to put them all into a single mold, called a combination mold. This combination mold had the economy of the multi-cavity mold previously described in that it utilized the machine more fully and also saved tooling expense since only one mold could produce a variety of parts.

However, such combination molds had the disadvantage that they could only be used when the various parts were required in a definite ratio. In an effort to overcome this disadvantage, the concept of the unit die originated. The unit die is a kind of combination die in which various castings may be made by replacing portions of the die. The complete die, or "frame," is constructed so that standard interchangeable inserts or units may easily be seated in it. In a good construction, the frame is made so that if there are four locations for example, any units may be placed in any location, giving greater flexibility.

However, after the shot of castings is removed from the unit die, certain problems arise which tend to offset the economy of the unit die system.

Suppose that each of the individual castings is to be broken off at the gate (which is deliberately made to be the weakest portion of the runner so that the casting will break there most easily) and then the parting lines of the various castings are to be hand cleaned or tumbled to remove flash, etc. This method of separating entails certain disadvantages. There is considerable expense of hand labor with the operator (or "gate breaker") facing a number of containers, breaking off the castings at the gate and throwing them into the various boxes. There is considerable possibility of error from throwing the parts into the wrong box; the possibility of damage from throwing the castings a distance.

Another possibility is to break off the parts as above described and then individually die trim the parts so as to clean up the parting lines of each particular casting. This method has the same disadvantages as just previously described, and some additional ones. The additional ones are these: that each individual part must then be individually die trimmed, a very expensive method since only one part is trimmed at a time. In our method, if trimming is desired, it may be done on a unit shot, an entire quarter of a complete shot (with a four-unit mold). It is more economical to trim a quarter of a complete shot at a time (which may mean four or five or six separate castings) than it would be to train every individual casting.

It may be proposed that an entire shot be trimmed at a single time. Disadvantages are: first, it may be unnecessary to incur the tooling cost for trimming every individual piece since some parts may need only tumbling. There is no such method in actual size—a special type of unit trim die would have to be created which would have to correspond fully with the unit casting mold with replaceable inserts corresponding to the units in the mold. Furthermore, such proposed method could not be used easily because of the large number of pieces in the average unit die. This method is used in combination dies which have a relatively smaller number of different pieces but in a unit die there tends to be more variety. There would be a very considerable problem in keeping these castings separate since they cannot just be dropped down. Instead you would have to shute away twenty-four parts at a time, and they do not shute easily—therefore, it tends to hind and jam, because of the low shute angle necessitated by the wide distribution required. Required, a separate set of shutes would be required for each unit die suited to the variety of its particular castings. Also, there are problems with the containers to receive the dropped castings; finding room in the restraining room under and near the trim press for all the containers and arranging them so that a material handler can take away the ones which fill up most rapidly, and so on.

A variation on the above method would be to trim one quarter (in the case of a four-unit mold) of a complete shot at a time. Although the number of castings required through the trim die would be more manageable since the number would be less, there would be other very serious disadvantages. Since a large shot would be manipulated for that one-quarter which was to be trimmed, there would be a possibility of injury due to the free end of the shot whipping around during trimming. This would be a very slow operation since the complete shot is so clumsy. Complete shots would tangle with one another and would be hard to disentangle. Some of the castings would tend to break off at the gate (and get lost) before trimming, because complete shots would have to be handled (and disentangled) four times to trim them completely. This method would still not solve the problem of certain castings which could be tumbled rather than trimmed, saving tooling costs.

Another method would be to take entire shots and put them in a tumbling barrel to break the castings off at the gates by tumbling them. The tumbling would also tend to clean the parting lines. Later, the parts could be screened to separate them or they could be separated by hand. The disadvantages of this method would be great also since you would have so many castings to separate that it would be very confusing—for example, one-fourth separate castings to separate and these two-four changing constantly in groups of 25%. This would require sorting operators of almost superhuman ability. Another problem is that one would then be limited to not being able to run units which required trimming of their contents rather than tumbling, since the castings which require trimming would be damaged by the tumbling action. Another advantage which would be given up would be the possibility of machining several parts simultaneously on their own gate which is sometimes much cheaper than machining them individually.

It is therefore among the objects of the present invention to provide a novel method and means for performing the same which avoids the above described disadvantages. Our method of chopping through the runners at a certain point does not require special tooling of any kind since there is no separating at the gate, the latter being a variable location (the casting may be at various locations in...
any particular unit die). At the same time, there is an automatic separation of the clusters of cast parts from each of the unit dies from the main body of scrap consisting of the sprue with short runner sections.

Our method involves the casting operator placing the complete shot on a “gate chopper.” Precise placement is not required and the rest of the process is automatic. Since the runners are each chopped at a predetermined, constant location, no special tooling of any kind is required, saving tooling expense and setup expense. The unit shots are all separated into large, economically handled containers and the major part of the scrap is also separated for remelting. The unit shots may now be machined economically as a group. Or, the unit may be trimmed as a very manageable group. Or, if they are tumbled, the sorting problem is greatly simplified.

Another advantage herein is precise control of the runner breaking element.

The present machine can be manned by the die casting operator, who, while the die casting machine is cycling, may place the casting in the present machine instead of merely setting it down. Thus, no extra labor is required.

These objects and other incidental ends and advantages will more fully appear in the appended claims and be pointed out in the appended claims.

In the drawings in which similar reference characters designate corresponding parts throughout the several views:

FIGURE 1 is a fragmentary side elevation view, showing a preferred embodiment of the invention.

FIGURE 1a is a fragmentary front elevation view of a unit die set-up with which the present system is operable, slightly reduced with respect to FIG. 9.

FIGURE 2 is a fragmentary plan view as seen from the plane 2—2 on FIGURE 1.

FIGURE 3 is a plan and elevational view as might be seen from the right of FIGURE 1.

FIGURE 4 is an enlarged fragmentary vertical sectional view of a left-hand portion of FIGURE 1.

FIGURE 5 is a fragmentary sectional view as seen from plane 5—5 on FIGURE 1.

FIGURE 6 is a front elevational view of the separating element.

FIGURE 7 is a front elevational view of the female die plate.

FIGURE 8 is a fragmentary sectional view of the structure of FIGURES 6 and 7 in assembled condition as seen from the plane indications on FIGURE 6.

FIGURE 9 is an elevational view of a die cast shot with a number of separate parts thereon.

FIGURE 10 is a schematic electrical diagram.

In accordance with the invention, the machine, generally indicated by reference character 10, comprises broadly: means 12 for severing the runners; conduit means 14; conveyor means 16; guide means 18; chute means 20; container support means 22; power means 24 for the means 12; drive means 26 for the conveyor means 16; and control means 28.

The means 12 includes a female die 30, a male die 31, a ram 32, a piston rod 33, and a cylinder 34. The female die 30 is suitably secured to the support 35 and the piston rod carrier 36 is also connected to the support 35. Disposed between the female die 30 and the piston rod carrier 36 is a guard 40 which prevents the operator placing his hands within a danger area. The cylinder 34 is connected to contain fluid under pressure and is preferably pneumatically operated from a source (not shown) which supplies through the tube 37, the air going by way of the pneumatic control valve 38 and tube 39. Thus, when the machine is operated, air entering the cylinder 34 causes the male die element 31 to move down in the direction of the female die element 30 and to act upon the die casting generally indicated by reference character 11 (FIGURE 9).

The support 35 while shown as broken off at the forward end 41 thereof in FIGURE 1, it will be understood that said support continues in a downward angular direction to join the base 13. Support 35 is maintained in position by the brace 42. The base 13 may be a plate or may be the floor of the location where the machine 10 is installed. The support 35 and the brace 42 are preferably arranged as a spaced pair and are joined by the transverse supports 43 and 44.

The female die 30 is preferably in the form of a rectangular plate 46 and is provided with a plurality of openings 47, 48, 49, and 50. These openings are of a size sufficient to pass the castings and the deposited die casting 11. Disposed between the openings 47 and 48 and the openings 49 and 50, are a pair of depressions 56 and 57 which are adapted to receive the relatively stationary cutting or breaking members 58 and 59. The members 58 and 59 are detachably held in the depressions 56 and 57 in a suitable manner as for example by dowels and screws (not shown). This construction enables removal, sharpening and replacement of the members 58 and 59.

Projecting upwardly from the upper surface 60 of the plate 46 is a conical guide pin 61 upon which may be seated a range of reference characters 62a, 62b, and 62c. The guide pin 61 is maintained in position to be acted upon by the female die 30. In operation, the operator places the casting 11 in the same position, each time, so that automatic sorting takes place. Improper orientation is prevented by providing a depression 63 in the surface 60 within which a corresponding projection 64 extending from the lower surface of the runner 65 nests.

The ram 32 may be the movable plate of a known die set, said plate being rigidly attached along the guide rods 66 and 67. The ram 32 is connected to the lower end of the piston rod 33, having a threaded lower end engaged by a nut 69. A pair of male cutting or breaking members 70, 71, 72 and 73 are held in position by clamping bars 74 and 75. The bars 74 and 75 are suitably driven toward each other by bolts 76 while the members 70-73 are held in position by dowel pins 77. The pins 77 also engage slidably mounted blocks 78 which carry the knock-out pins 79. After the runners have been cut or broken, the sprue 62 and the connected portions of the runners 65 become wedged between the opposed inner faces of the members 70-73. As the piston 33 is retracted upwardly the upper ends of the pins 78 strike against the lower face of the piston rod carrier 36 so that said pins move downwardly with respect to the ram 32 and blocks 78 to push the remaining part of the casting 11 free so that the same may drop. Three such parts are shown in different stages in FIGURE 4, indicated by reference characters 62a, 62b, and 62c. To prevent the part 62 from becoming entangled on the pins 61, provision is made for entry into the conduit 85 the exhaust air from the cylinder 34 is fed through pipe 185 to nozzle 186, which blows the part 62 into the conduit.

The conduit means generally indicated by reference character 84, pr herein comprises a plurality of tubes 81, 82, 83, 84 and a trough 85. Each of the tubes 81—84 inclusive, includes a first portion and a second portion, the first portions being so arranged that their axes are substantially at a right angle with respect to the female die 30. Since the female die 30 is already at substantially an angle of 45° with respect to the horizontal base 13 of the machine 10, the lower inner surfaces of the first portions allow gravity to act on the severed clusters of the die casting, so that they may slide and fall into the second or lower portions of the tubes 81—84, inclusive. Since the lower portions of tubes 81—84 are at substantially right angles with respect to the said first portions, the lower inner surfaces thereof are disposed at an angle of substantially 45°, and the severed die cast-
ing parts continue their downward travel to fall upon the conveyor means 16. The trough 85 is relatively straight, and may have an outward flare 86 at the upper end thereof. The lower ends of the second or lower portions of the tubes 81–84 lie just above the conveyor belt 100 so that the cleats 101 thereof may clear, and the severed die cast clusters may be discharged onto the upper reach of the belt 100.

The conveyor means 16 includes the endless conveyor belt 100, which is preferably of flexible, abrasion and heat-resisting material, and the rollers 102 and 103. The rollers 102 and 103 are suitably journaled on the angularly disposed frame members 106 and 107 which at their lower forward ends are connected to the base 13 and at their upper ends are connected to the vertical supports 108 and 109.

The drive means 26 may include a motor 110 mounted on its support 117 which may have a speed reducer 111, and power is transmitted to the roller 102 by shaft 112, pulleys or sprockets 113 and 114, and belt or chain 115, the pulley or sprocket 114 being fixedly mounted on the drum 102. When energized, the motor 110 drives the belt 100 so that it moves in the direction of the arrow 116 on FIGURE 2.

The operator is protected from contact with the conveyor 100 by the side guard plates 125 and 126 and from the drive means 26 by the guard 127.

The guide means 18 includes a plurality of elongated dividers 120 which preferably extend the length of the upper exposure of the belt 100 and said dividers extend upward sufficient to keep the parts discharged from the separate tubes or troughs 81–85, discrete until said parts are dropped from the belt 100, as it passes around the roller 102, into the chute means 20.

The chute means 20 includes a plurality of chutes 131 to 135 inclusive, preferably equal in number to the number of troughs or tubes 81 to 85 inclusive, and the upper ends of said chutes are disposed below the upper drum 102 so that as the severed die cast parts are dropped from the conveyor belt 100 they slide by gravity down the said chutes to be accumulated in the containers 141 to 145, respectively.

As may be best seen in FIGURE 1, chutes may extend forward and rearward of the position of the drum 102, so that even with a relatively compact machine, large size containers 141–145 may be used, and these may take the form of drums, tote boxes or the like.

The container support means 22 includes a pair of bearing rails 151 and 152 which are mounted on the base 13, and a plurality of spaced and parallel rollers 153 which are journaled in said rails. The rollers 153 permit the containers 141–145 to be easily shifted to receiving positions with respect to the chutes 131–135, and also allow easy removal of filled containers and then replacement with empty containers.

The control means 28 enables safe and rapid operation of the machine 10 correlated to the die casting machine. Closing the main switch 160 sends current from the high side of the line source 161 to the conveyor motor 110 (FIG. 10) to the primary of the power transformer 162, to contact 164 of the normally open start switch 165, and to contact 166 of the normally closed limit switch 167. Secondary winding 170 casts a beam upon the photocell 172 which feeds amplifier 174, the output of which goes to the solenoid 176 of the photoelectric cell operated relay 178. Circuitry of the photocell and amplifier is not described in detail as standard layouts may be used. With solenoid 176 energized, current goes via conductor 179 to solenoid 180 of valve relay 181.

Upon energization of solenoid 180 it closes an auxiliary circuit across contacts 182 and 183 through the limit switch 167. This auxiliary circuit acts as a keeper to hold the valve relay 181 in its closed position after manual pressure on the start switch 165 is released. The power circuit to the solenoid 184 of the pneumatic control valve is closed through contacts 185 and 186. At the end of the power stroke of the piston rod 33 (the runners having been cut) the switch 167 is opened by the contact therewith of the projection 187.

It may thus be seen that we have provided novel and useful means and methods for the economical and efficient production of die castings from unit dies.

We wish it to be understood that we do not desire to be limited to the exact details of construction and methods shown and described, for obvious modifications will occur to a person skilled in the art to which the present invention relates.

The term cluster is used to define a unit slot or the contents of a single unit die including individual die casting or castings and the runners attached thereon.

We claim:

In a method of producing individual die castings, utilizing unit-severing dies in a frame therefor, said frame containing a sprue-forming portion and a runner extending therefrom, the steps of:

(a) providing a shot having a sprue, a plurality of different clusters, and a plurality of runners extending between said sprue and said clusters;

(b) providing separating dies having separate openings therein through which the clusters and the remaining portion of the runners pass subsequent to the severing operation;

(c) separating said runners in the area where the runners are unitary in cross section and leading to the entrance ports of the said unit dies;

(d) providing separate conveying means, each of which is located adjacent the exit end of the respective die openings to receive the severed clusters;

(e) maintaining like clusters separated from the remainder of the clusters while they are in contact with said conveying means; and

(f) collecting like clusters into separate groups upon emergence from said conveying means.

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