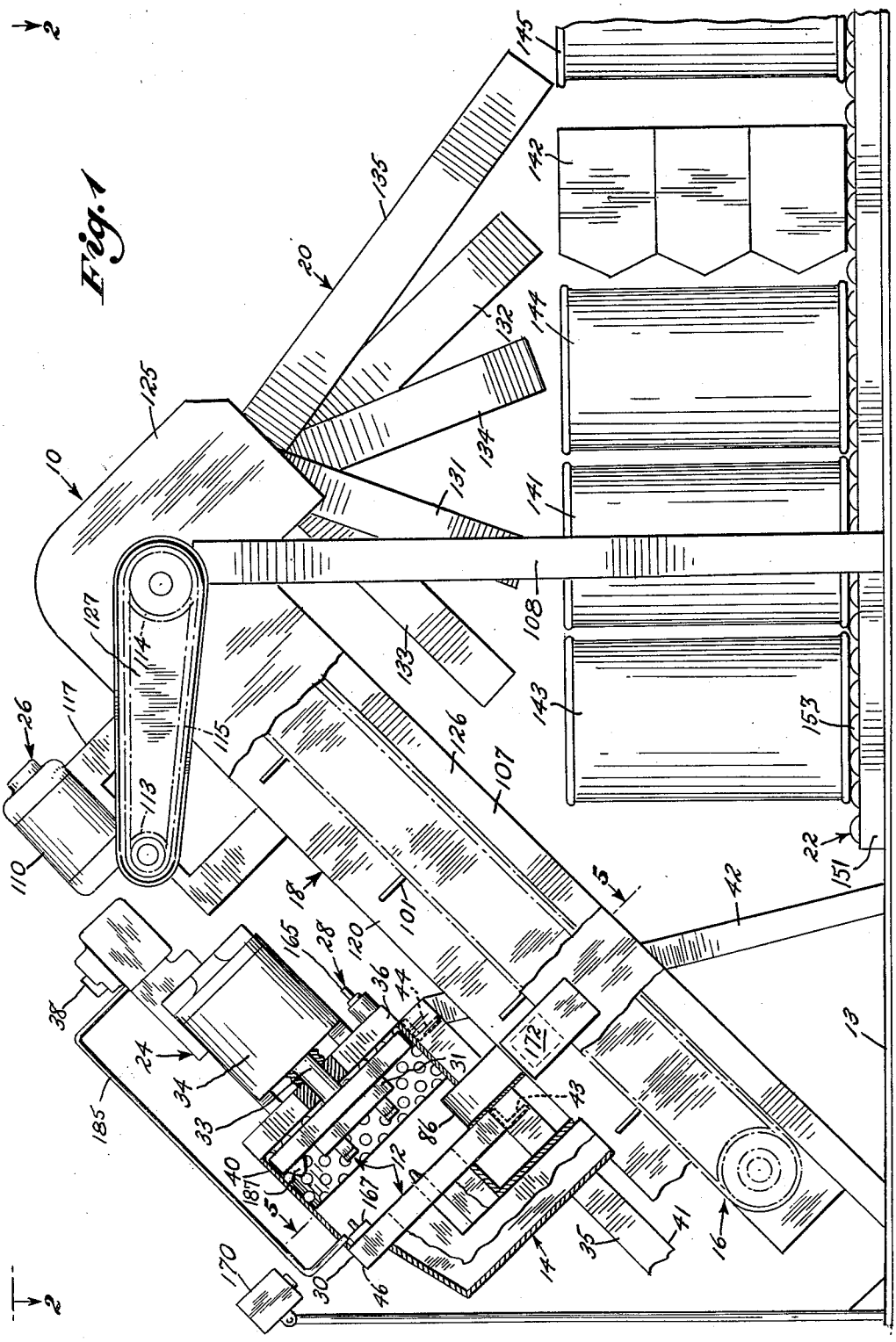
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METHOD FOR TREATING DIE CASTINGS

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Fig. 1



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METHOD FOR TREATING DIE CASTINGS

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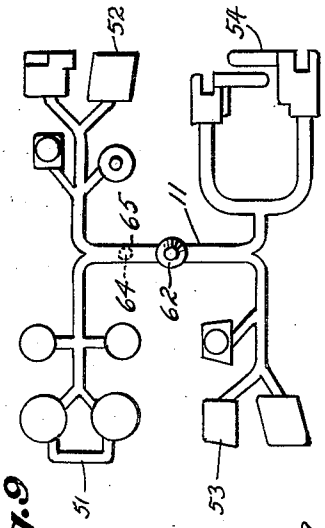


Fig. 9

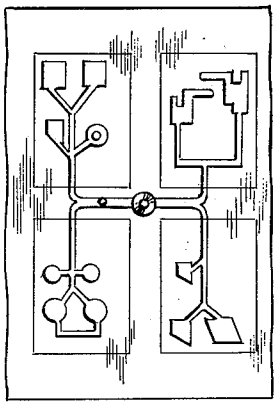


Fig. 1A

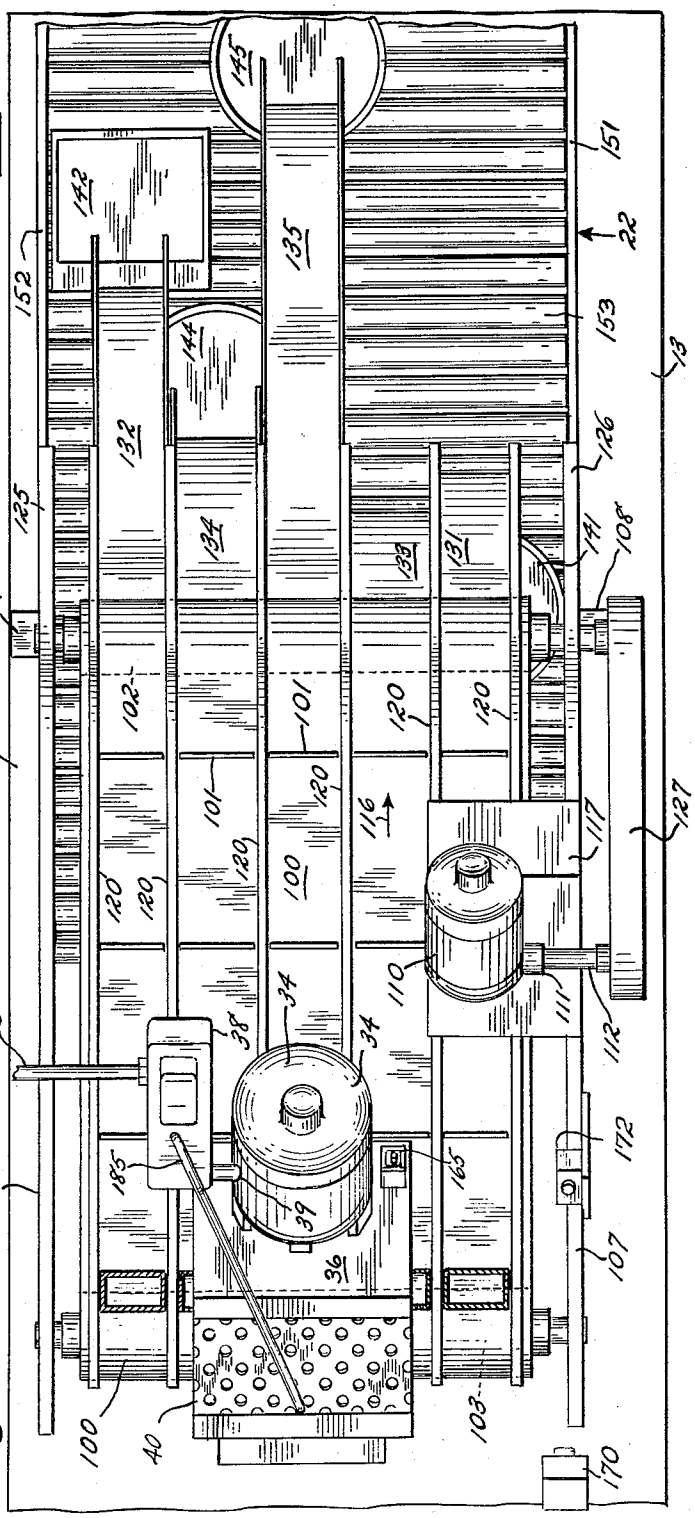


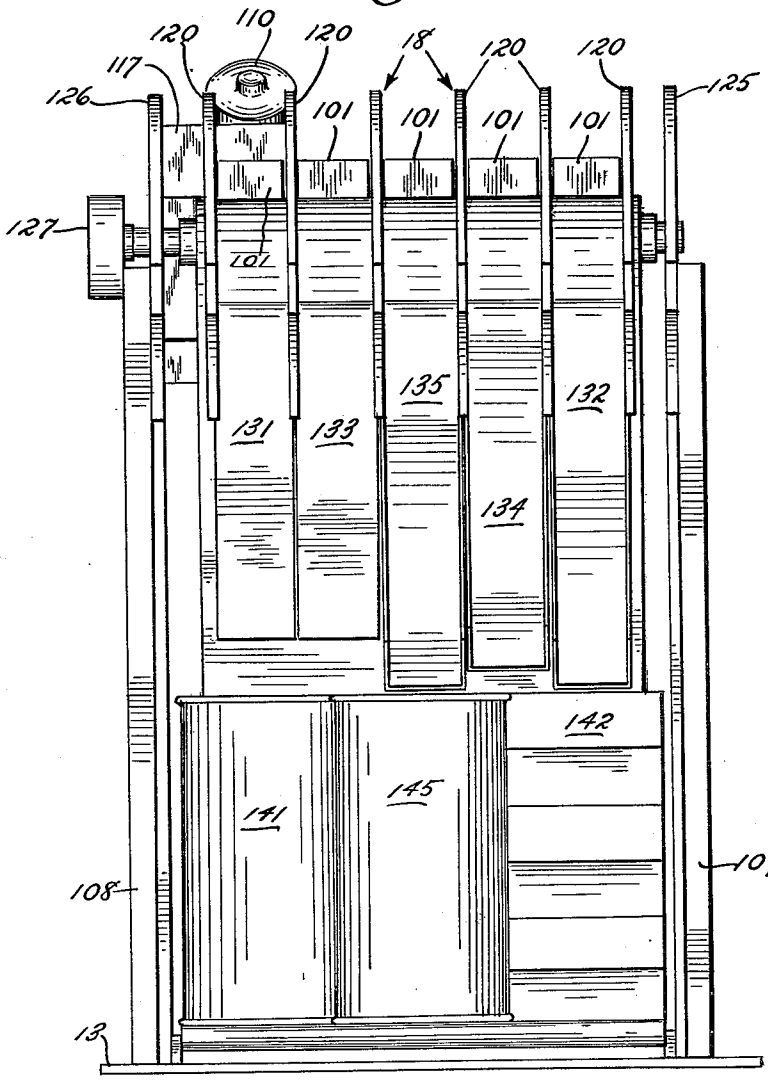
Fig. 2

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Fig. 3



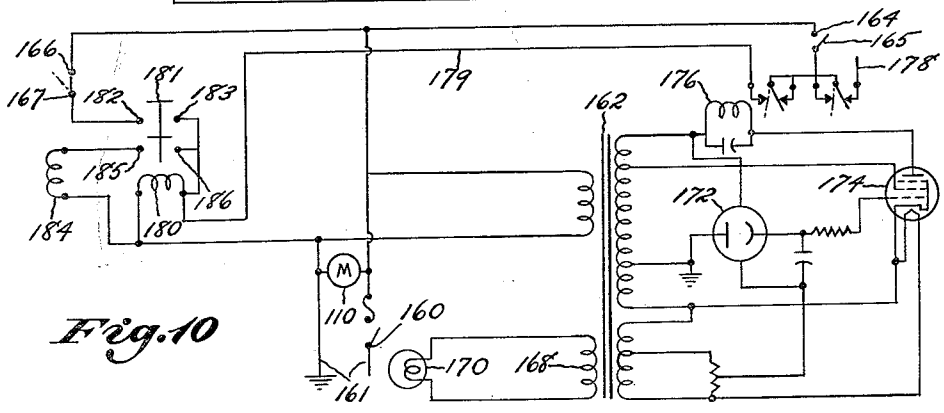


Fig. 10

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Fig. 6

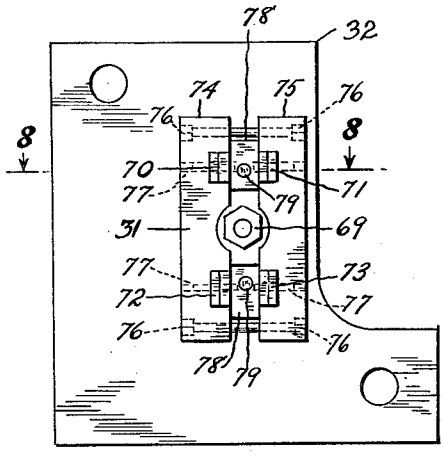
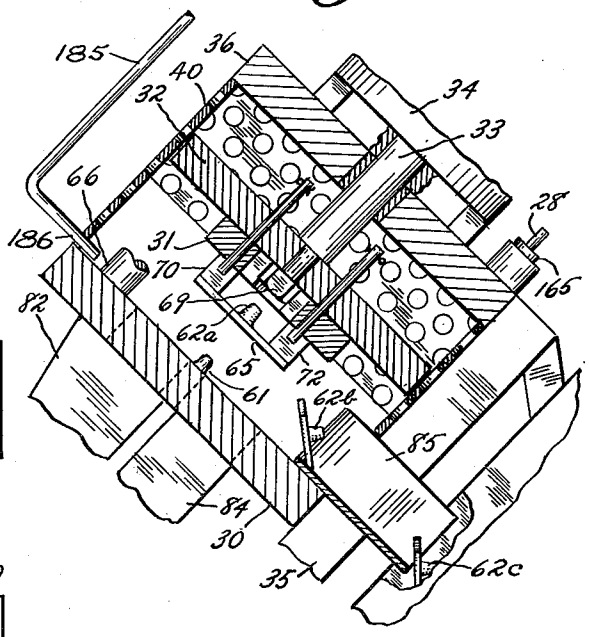


Fig. 4



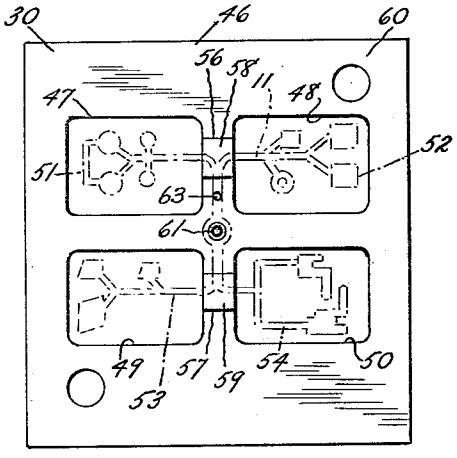


Fig. 7

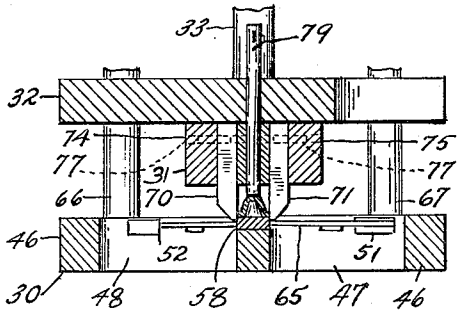


Fig. 8

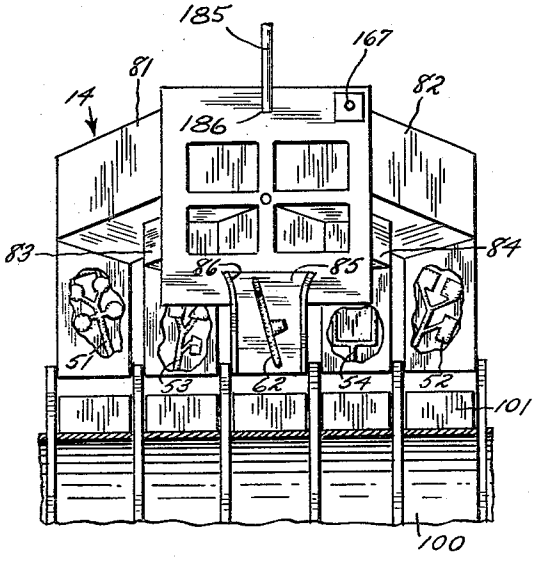


Fig. 5

United States Patent Office 3,103,841 Patented Sept. 17, 1963

3,103,841

METHOD FOR TREATING DIE CASTINGS

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Filed Oct. 1, 1962, Ser. No. 227,501
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 given 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 a single mold could produce a variety of parts.

However, such combination molds had the disadvantage that they could be used only 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 chute away, say twenty-four parts at a time, and they do not chute easily—they tend to bind and jam, because of the low chute angle necessitated by the wide distribution required. Further, a separate set of chutes 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 restricted 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 dropping 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, twenty-four separate castings to separate and these twenty-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 progress of this disclosure 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 elevational view, showing a preferred embodiment of the invention.

FIGURE 1*a* is a fragmentary front elevational 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 rear end elevational view as might be seen from the right of FIGURE 1.

FIGURE 4 is an enlarged fragmentary vertical sectional view of a lefthand portion of FIGURE 1.

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

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

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

FIGURE 8 is a fragmentary sectional view of the structures 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 adapted 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 clusters **51**, **52**, **53** and **54** on the 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 the sprue **62** of the casting **11**, the latter being provided with a correspondingly shaped, upwardly extending recess (FIGURE 8). Thus by placing the casting **11** with seated recess engaging the pin **61** the casting **11** is maintained in position to be acted upon by the female die **30**. In operation, the operator places the casting **11** in the same orientation, 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 shiftable 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 drawn toward each other by bolts **76** while the members **70–73** are held in position by dowel pins **77**. The pins **77** also engage slideably 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 knock-out pins **79** 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 **62***a*, **62***b*, and **62***c*. To prevent the part **62** from becoming entangled on the pin **61** or missing the entrance to 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 **14**, preferably 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 said 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 journalled 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 journalled 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 **168** supplies energy to the light source **170** casting 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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