Feb. 4, 1958 H. E. POUELL 2,821,756

DIE CASTING APPARATUS

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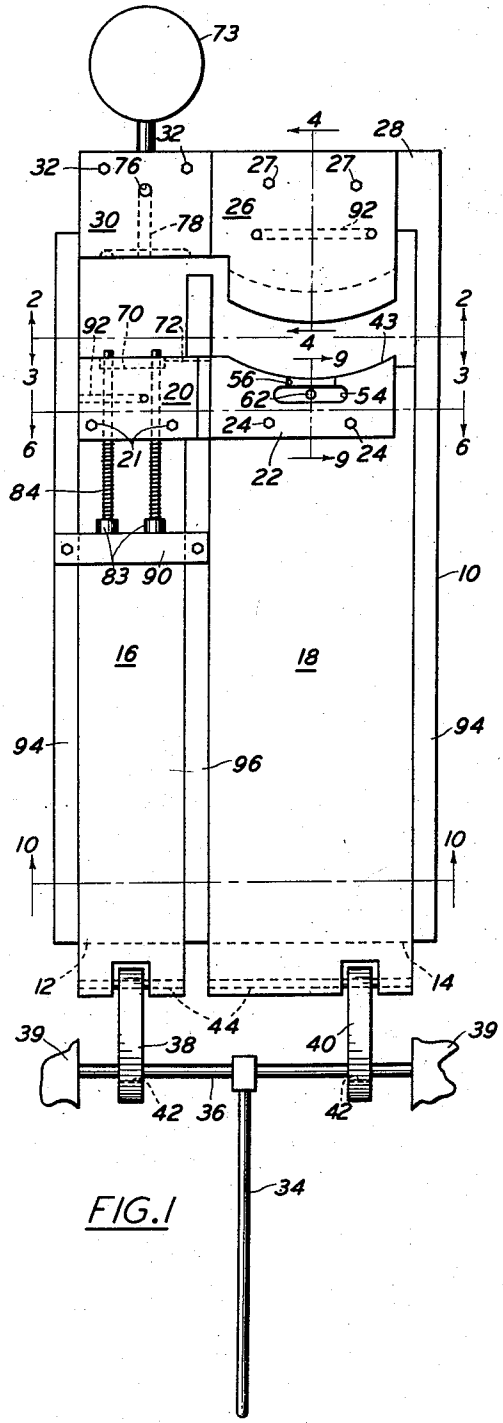


FIG. 1

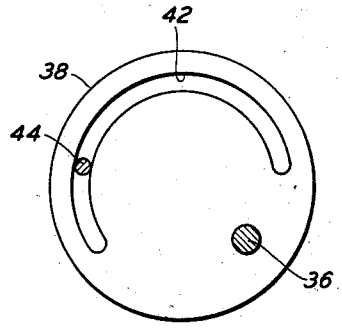


FIG. 1A

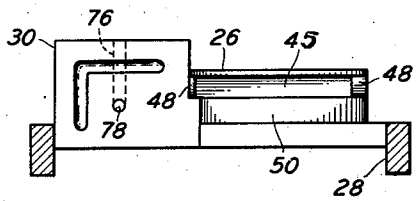


FIG. 2

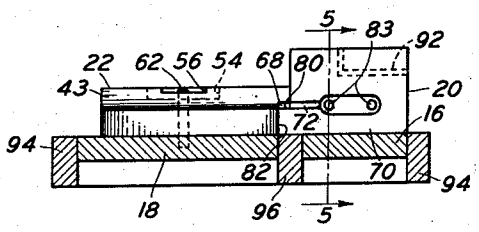


FIG. 3

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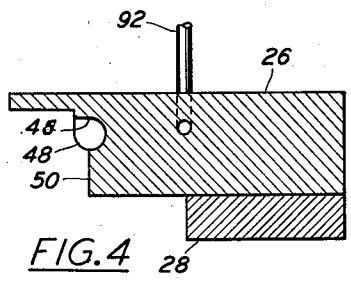


FIG.4

FIG.6

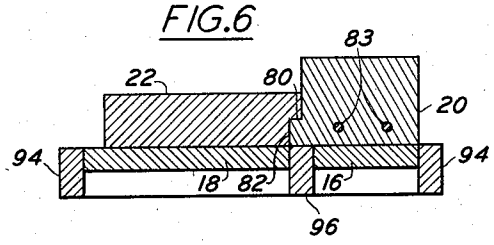


FIG.5

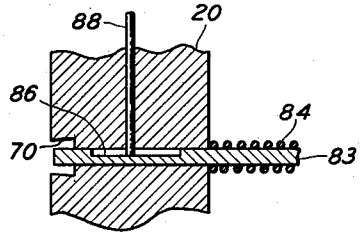


FIG.7

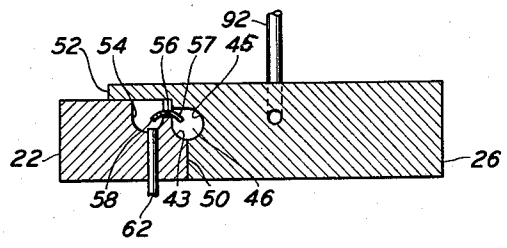


FIG.8

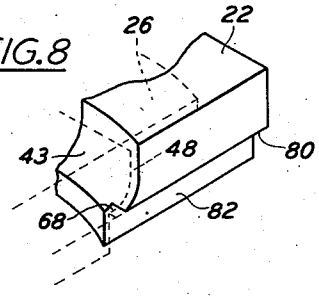


FIG.9

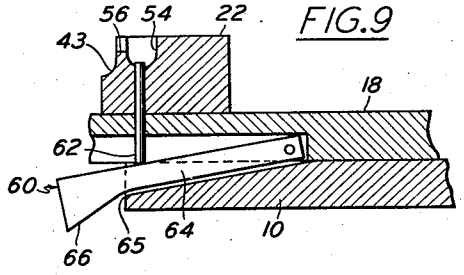
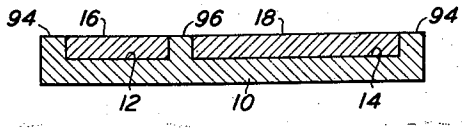


FIG.10



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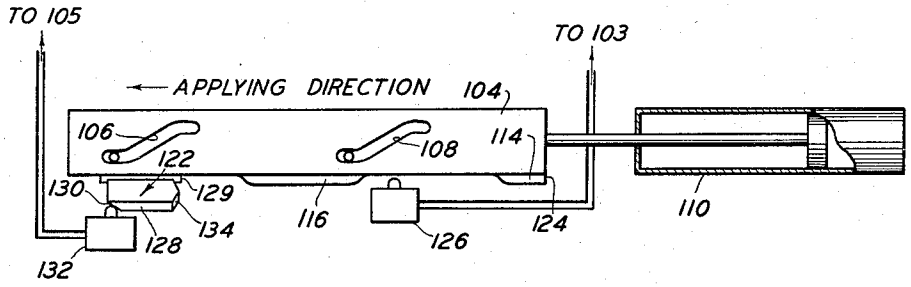


FIG. 13

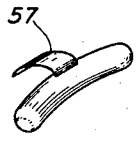


FIG. 11

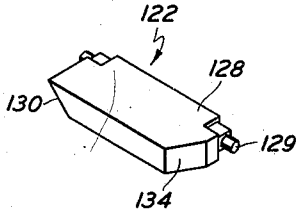


FIG. 14

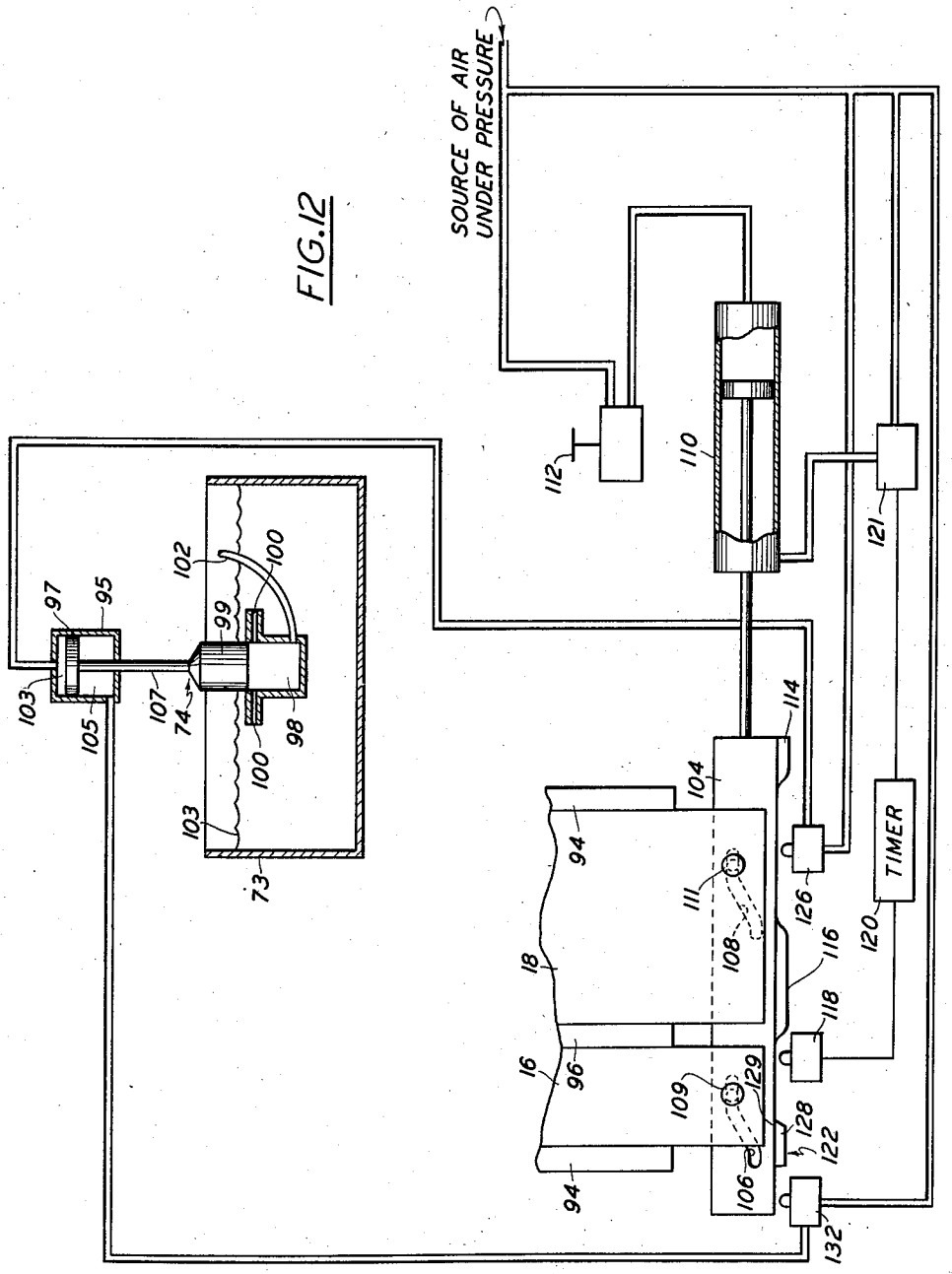
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FIG. 12



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2,821,756

DIE CASTING APPARATUS

Harry E. Pouell, Logansport, Ind.

Application October 14, 1954, Serial No. 462,220

8 Claims. (Cl. 22—58)

This invention relates to a die casting apparatus for manufacturing wheel balance weights or the like.

As will be apparent from the following description, the apparatus is not limited to manufacture of only a single product; describing the invention in connection with a wheel balance weight is only for purposes of illustration. It will be understood that numerous other articles may be made by applying the principles of the invention hereafter described.

It is an object of this invention to provide a die cast apparatus which so operates that the article as ejected from the apparatus requires no further finishing. This object is highly significant when it is considered that most die castings have flash or sprue residue which must be removed before the article is finished. Contained within the above object is my aim to eliminate these finishing operations which are an added source of manufacturing cost.

A further object of the invention is to obtain automatic operation for a device of the class described. Through automatic operation, it is my aim to provide low-cost die castings, which are ejected as finished articles from the die cast apparatus. As a result of automatic operation, I intend to eliminate variables which are incident to manual working of the mechanism.

The above and further objects and features of the invention will become apparent from a consideration of the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a top view of a manually operated die casting apparatus;

Fig. 1A is a side view of the cam members;

Figs. 2, 3 and 4 are section views taken respectively on the lines 2—2, 3—3 and 4—4 of Fig. 1;

Fig. 5 is a section view taken on the line 5—5 of Fig. 3;

Fig. 6 is a section view taken through a movable part of the apparatus on the line 6—6 of Fig. 1;

Fig. 7 is a section view taken through the dies when they are closed for a die cast;

Fig. 8 is a side view of the dies shown in a closed position, viewed from the left-hand side of Fig. 1;

Fig. 9 shows the die-ejecting mechanism in a sectional view taken on the line 9—9 of Fig. 1;

Fig. 10 is a sectional view of the bed and carrier members taken on line 10—10 of Fig. 1;

Fig. 11 shows a die casting which can be made by the illustrated apparatus;

Fig. 12 is a schematic view showing the metal-injecting device and means whereby the die-casting apparatus can be made to operate automatically; and

Figs. 13 and 14 are detail views of the control devices which regulate operation of the metal-injecting device shown in Fig. 12.

The die-casting apparatus, shown generally in Fig. 1, includes a bed 10 having two flat, spaced-apart parallel ways on tables 12 and 14. A feeder-block carrier 16 and a die-block carrier 18 are carried by ways or tables 12 and 14, respectively, for reciprocation.

A feeder block 20 is fastened by bolts 21 to the one end of the carrier 16, and is movable therewith during operation of the apparatus. A movable die-block 22 is fastened by bolts 24 to one end of the die-block carrier 18, and is movable therewith.

A stationary die-block 26 is attached by means of bolts 27 to an upright end 28 of the bed 10. Also attached to the upright end 28 is a companion feeder-block 30 which may be fastened in some suitable manner as, for example, by bolts 32.

The die-casting apparatus is actuated by manually turning a handle 34 fastened to a rock shaft or the like 36, which is journalled in stationary frame members 39 at opposite ends thereof. Two cam members 38 and 40 are fixedly carried by the rock shaft 36. The cams 38 and 40 are provided with cam slots 42 (see Fig. 1A). Cam followers 44 are mounted in carriers 16 and 18, and are engaged with the cam slots 42 in the two circular members 38 and 40. The cam slots 42 are so related in contour that relative movement is produced between the two carriers as the shaft 36 is rocked. The significance of this relative movement will become more apparent later in this description.

The front face of the movable die-block 22 is formed with a curved recess 43. This recess 43 along with a companion recess 45 in the juxtaposed face of the stationary die-block 26 defines a die-cavity 46 (Fig. 7). The opposite ends of recesses 43 and 45 are formed with mating radii curvatures 48 (best seen in Figs. 2, 4 and 8) to close the ends of the die cavity 46. Referring to Fig. 7, the underside of the die cavity 46 is sealed by engagement of vertical sides 50 of the die-blocks 22 and 26. The stationary die-block 26 has a lip or plate 52 which overlies the movable die-block when the dies are in a closed position as illustrated. The projection 52 contacts the upper surface of the movable die block and thus serves to pilot the latter and completely seal the die cavity 46.

The movable die-block 22 is provided with a second recess 54 and an indentation 56 between the recess 54 and the face of the movable die-block.

A U-shaped clip or mounting member 58 for the cast article is positioned with one leg in the recess 54 and the other leg in die cavity 46. The shank of the mounting member is fitted into the indentation 56 (Figs. 1 and 7) to avoid interference with the overlying projection 52 as the movable die-block slides into position for the casting operation.

An ejecting mechanism 60 (Fig. 9) is used to eject the cast article from the apparatus when the movable die-block 22 retracts from the stationary die-block 26. The ejecting mechanism comprises a pin 62 (Figs. 1, 3, 7 and 9) which extends into the recess 54 and is engageable with a leg of U-shaped clip 57 which is fitted into the recess. This clip is an element of the finished product. The pin 62 is forced upwardly by a lever 64 (Fig. 9) which is pivotally mounted in a groove in the underside of die-carrier 18. The lever 64 has a cam surface 66 which is engageable with the front edge 65 of the bed 10, so that when the die-carrier 60 is retracted (moved to the right in Fig. 9), the lever is cammed upwardly to contact pin 62 which engages clip 57 (Figs. 7 and 11) to eject the clip 57 from the recess 54.

When the stationary and movable dies are closed, the die cavity 46 is completely sealed except for a gate opening 68 (Figs. 3 and 8) which permits molten metal entry into the cavity. This is best seen in Fig. 8.

The feeder block 20 has a feeder chamber 70 which is closed when the feeder block is in engagement with the stationary companion feeder block 30. Molten metal, originating in heated container or melting pot 73 (Fig. 12) is fed through a vertical inlet 76 (Fig. 1) in block 30, and horizontal passage 78 into the chamber 70. The

molten metal then passes from the chamber 70 through the channel 72 and gate opening 68 into the die cavity 46.

The movable die-block 22 and feeder-block 20 are slidably interfitted with a stepped connection 80 (Figs. 1, 3 and 6) therebetween. The lateral edge 82 of the block 20 adjacent to the gate opening 68 provides a shearing edge which cuts the cast metal at gate 68, thus separating the casting in the die cavity 46 from the sprue material in the feeder chamber 70. This shearing of the metal at gate 68 takes place when retractile relative movement is produced between the die-block 22 and feeder block 20. The operating cams 42 are so contoured that the die-block 22 is retracted before the feeder block 20 after the casting "dwell."

The sprue material which is formed in the feeder chamber 70 is dislodged therefrom by two knock-out pins 83 having helically wound springs 84 (Fig. 1) normally holding the pins 83 so that the pin ends do not extend into the feeder or sprue chamber 70. Movement of the knock-out pins is limited by engagement of the sides of a recess 86 (Fig. 5) in the pin with a fixed stop 88 which is carried in the feeder-block. This is best seen in Fig. 5 which shows the knock-out pins extending into the feeder chamber to dislodge the sprue therefrom.

When the feeder-block carrier 16 is retracted, the ends of the knock-out pins engage an abutment 90 fixed to the stationary bed 10, so that continued retractile movement of the carrier 16 forces the ends of the pins through the feeder chamber 70 to dislodge the sprue material therefrom.

Both the feeder-block and the stationary die are cooled by passing water through passages 92. The molten metal is then quickly cooled to the solid state, and the time for a "dwell" can be very greatly reduced.

The reciprocable sliding movement of the feeder block and die-block is guided by two side rails 94 and an intermediate rail 96 which separates tables 12 and 14.

There remains to be considered the manner in which actuation of the molten metal-injecting device 74 (Fig. 12) is coordinated with the operation of the balance of the apparatus.

The injecting device 74 consists of a double acting air-power cylinder 95, a piston 97, a molten metal-pressurizing chamber 98, inlets 100 from the heater 73, and a delivery passage 102 connecting with inlet 76 (Fig. 1) in the stationary companion feeder block 30.

When the die-block 22 and feeder block 30 are closed, molten metal 103 is forced from the injecting device 74 into the feeder block 30 by the double acting piston 97. A control means (not shown) including some suitable valve arrangement, etc. is operated responsively to actuation of the apparatus so that when the dies are completely closed, pressure is communicated to the upper chamber 103 of the cylinder 95, forcing the molten metal in chamber 98 under piston 96 to the feeder chamber 70 and die cavity 46.

When the "dwell" or period for casting has expired, the molten metal in the die cavity and sprue chamber 70 is completely solidified and cooled. Carrier movement is now reversed, whereupon a second control means (not shown) causes pressure to be developed in the lower cylinder chamber 105 forcing the piston 97 upwardly and terminating metal delivery by the injecting device 74. The first-mentioned operating means immediately terminates communication of pressure to the upper cylinder chamber 103 when carrier block movement is reversed.

The apparatus can be constructed for automatic operation as shown in Figs. 12, 13 and 14. The movement of the die carrier 18 and feed-block carrier 16 is controlled by reciprocation of an actuating block 104 having S-shaped cam slots 106 and 108 which are contoured to produce the desirable relative movement between the movable die-block and the feeder block. The cam slots receive cam followers 109 and 111 which are connected to the rear of carriers 16 and 18 respectively. The actuating block 104 is reciprocated by a double-acting power cylinder 110 which is initially operated by depressing a hand-operated air valve 112. This initial operation of the valve 112 moves the actuating block 104 toward the left, closing the die and feeder blocks. When the actuating block has moved as far to the left as possible, signifying that the apparatus is now in position for a "cast," a control 114 (indicated schematically in Figs. 12 and 13) starts operation of the injecting device 74 in the matter before described.

As the actuating block 104 moves leftwardly, a cam 116 on the actuating block operates an electrical switch 118, and thus energizes a conventional electric timer 120 which, after a predetermined time, actuates an air valve 121 which reverses the power cylinder 110 and moves the actuating block 104 toward the right. Immediately, the control means 114 is affected and responds by relieving pressure developed in the upper chamber 103 of the injecting device. A second control means 122 (indicated schematically in Fig. 12) immediately responds to movement of the actuating block toward the right, by causing pressure build-up in the lower chamber 105 of the double acting cylinder. The plunger 107 and piston 97 are thus moved upwardly.

Figs. 13 and 14 show the controls 122 and 114 in greater detail. When the actuating block 104 completes its leftward die-closing movement, a wedge 124 on the side of block 114 contacts and operates an air valve 126 which energizes the metal injection device 74.

While the actuating block is moving leftwardly, the valve-operating member 128 carried on the side of block 104 is swung upwardly on hinge 129 by reason of the sloping corner surface 130 which rides up and over the valve 132. The member 128 does not operate the valve 132 because it rides up and over the valve 132. When the actuating block has moved to its extreme leftward position, the valve operating member 128 drops down to its original level, bringing the wedge-shaped surface 134 into position for operating the valve 132 so that any right-hand movement of the block 104 thereafter immediately operates the valve and deactuates the metal-injecting device 74.

A brief summary of the invention will next be given by considering the steps of a complete die-casting operation accomplished manually and automatically. A metallic U-shaped clip 57 is placed in the recess 54 so that the shank thereof lies over the indentation 56. The lever 34 is rotated, moving the die carrier 18 and feeder block carrier 16 forwardly. When the dies are completely closed, molten metal is injected into the feeder chamber 70 and die cavity 46. The dies are allowed to "dwell" until the metal has solidified and cooled sufficiently. The lever is returned to its original position and the carriers are moved rearwardly. The cams 42 are so contoured that die block 22 is moved rearwardly ahead of the feeder block 20. This relative movement shears the sprue from the end of the cast article and the ejecting mechanism 60 expels a complete casting which requires no further processing, such as trimming, removing flashing, etc.

The knock-out pins 82 dislodge the sprue from the feeder chamber 70. It will be noted from the cross-section of the feeder chamber in Fig. 5 that the walls taper inwardly to lock the sprue within the feeder chamber, thus insuring that the sprue material is carried with the movable feeder block during its retractive stroke.

It will be remembered that the injecting device 74 is immediately deactuated when the "dwell" is completed. This is essential because were the injection device still operating when the carriers were retracted, then molten metal would escape from the companion feeder block 30.

When the apparatus is automatically operated, it is only necessary for the operator to insert a clip 58 in the recess 54 and to depress the hand valve 112. The dies are then closed, molten metal is injected into cavity 46, and

the timer mechanism 120 energized to determine the "dwell" time. The carriers 16 and 18 are next retracted after the injection device is deactuated and the "dwell" is finished. The casting is sheared from the sprue and is ejected as a finished product.

The sprue is expelled from the feeder chamber 70 by the knock-out pins 82 and the apparatus is then ready for re-operation.

It is to be understood that various combinations of feeder block and die blocks are possible without departing from the principles of the invention. For example, a movable and stationary die may be placed on either side of the feeder block and two casting operations can be carried on at the same time. These changes are a few of the many which can be made without departing from the principles of the invention.

I intend to include within the scope of the following claims all equivalent structure and arrangements thereof, by which the same or substantially the same results of the invention may be accomplished.

What is claimed is:

1. A die casting apparatus for making wheel balance weights having mounting clips, said apparatus comprising in combination: a supporting bed, two distinct tables on said bed, a die carrier reciprocable on one of said tables, a feeder block carrier reciprocable on the other of said tables, a plurality of rails for guiding said carriers, a movable die fastened to said die carrier, said movable die being provided with a die face having a recess formed therein, a stationary die provided with a recess in a portion thereof, said stationary and movable dies having engageable surfaces which surround a die cavity formed by the recesses in said fixed and movable dies, a feeder block mounted on said feeder block carrier and being reciprocable against and along the side of the movable die and having a recess formed therein, a stationary companion feeder block which is engageable with said feeder block to define a feeder chamber therebetween, means for injecting molten metal into said feeder chamber, means controlling said metal-injecting means responsively to positioning of said carrier members, a passage between said die cavity and feeder chamber, a stepped connection between said movable die and feeder block, means for cooling the metal in the die cavity and feeder chamber, means for withdrawing the movable die prior to said feeder block whereby solidified metal in the vicinity of said gate is sheared at said stepped connection, means for ejecting the cast article from said movable die, said ejection means including a pin engageable with the mounting clip of the cast article, and a lever carried by said die carrier which is cammed upwardly to force the pin against the clip of the cast article as the die carrier is withdrawn from the stationary die, means for dislodging the sprue from said feeder chamber, said means being inclusive of knock-out pins which are movable relatively to said feeder block while the feeder block is withdrawn from the stationary companion feeder block, and means for reciprocating said carrier members.

2. A die casting apparatus, said apparatus comprising in combination: two elongated tables, two carrier members slidably reciprocable on said tables, a movable and a stationary die, a die cavity formed between said dies when they are in a closed position, said movable die being mounted on one of said carrier members, a movable feeder block, and a stationary companion feeder block, a feeder chamber formed between said blocks when they are in a closed position, said feeder block being mounted on the other of said carrier members, a gate connecting the feeder chamber and die cavity, a slidable fit provided between said feeder block and movable die, means for injecting molten metal into the feeder chamber which services the die cavity through said gate, means for cooling the cast metal, means for retracting the movable die prior to retraction of said feeder block, whereby the casting in said die cavity and the sprue in said feeder chamber are sheared at said slidable fit, a device for ejecting the cast article from said movable die, and means for dislodging the sprue from the feeder chamber during retraction of said feeder block.

3. A mechanism for making cast articles comprising a movable and a stationary die block forming a die cavity therebetween, an extending projection on said stationary die block, a recess in said movable die block for receiving a part of a member which is to be cast integrally with the cast article, an ejecting device cooperatively associated with said recess and including a movable element which is actuated responsively to operation of said movable die block, said extending projection overlying the recess in said movable die block when molten metal is injected into the die cavity, a fixed and a movable member defining a molten-metal-receiving chamber therebetween, at least one passage between said chamber and said die cavity for transferring molten metal from said chamber to said cavity, means for shearing the metal in said passage when a "dwell" has expired, and means for moving said movable die block relatively to said movable member to operate said shearing means.

4. An automatic die casting machine comprising a bed, two side-by-side ways on said bed, a carrier slidably reciprocable on each of said ways, a feeder block mounted on one of said carriers, a movable die block mounted on the other of said carriers, a bar reciprocably driven transversely to said carriers, said bar having two camming slots formed therein, a cam follower received in each of said slots and connected to said carriers, a motor operatively controlling the endwise movement of said bars, means for reversing movement of said actuatable means after a predetermined period of time has expired, and means for forcing molten metal under pressure into said die block, said last mentioned means being controlled responsively to movement of said actuatable means.

5. A die casting apparatus comprising in combination: two elongated tables, two carrier members slidably reciprocable on said tables, a movable and a stationary die, a die cavity formed between said dies when they are in a closed position, said movable die being mounted on one of said carrier members, a movable feeder block, and a stationary companion feeder block, a feeder chamber formed between said blocks when they are in a closed position, said feeder block being mounted on the other of said carrier members, a gate connecting the feeder chamber and die cavity, a slidable fit provided between said feeder block and movable die, means for injecting molten metal into the feeder chamber which services the die cavity through said gate, means for retracting the movable die prior to retraction of said feeder block whereby the casting in said die cavity and the sprue in said feeder chamber are sheared at said slidable fit.

6. In a die casting apparatus, a stationary and a movable die, a die cavity formed between said dies when they are abutted, a fixed and a movable feeder block, a sprue chamber formed by said blocks when they are abutted, a slidable interface between said movable die and movable feeder block, a gate connecting the sprue chamber and die cavity, means for injecting molten metal into the sprue chamber which services the die cavity during a casting interval, an actuater for producing non-synchronous uni-directional movement of both said movable die and said movable feeder block at the termination of said casting interval, the resulting relative movement between said movable feeder block and movable die producing a shearing of the sprue from the casting at said slidable interface.

7. A die casting mechanism comprising a fixed and movable die block forming a die cavity therebetween, a fixed and a movable feeder block forming a feeder chamber therebetween, the blocks being disposed in side-by-side positional relation, means for injecting molten metal

into said feeder chamber during a casting interval, a gate connecting the feeder chamber with the die cavity across the interface of the die and feeder blocks to transfer molten metal from the feeder chamber to the die cavity, a slidable interfitting between said movable die and feeder blocks, actuating means for producing parallel movement of both said movable blocks at the termination of said casting interval, the initial movement of one of said movable blocks preceding in time the initial movement of the other of said movable blocks, the resulting relative movement between said movable blocks producing a shearing of the sprue from the casting at said interface of the movable die and feeder blocks, and means for ejecting the sprue and cast article from the feeder chamber and movable die respectively.

8. A die casting apparatus comprising at least two die blocks defining a die cavity when the dies are in abutting relation, a gate at one end of said die cavity immediately adjacent a side face of the die blocks, a fixed and a movable member defining a molten-metal-injection chamber therebetween when said members are in abutting relation and disposed in side-by-side relation to said die blocks, said chamber being connected through said gate to the die cavity, actuating means for producing parallel movement of both the movable die block and the movable member, the initial movement of said movable block preceding in time the initial movement of the movable member, and means for shearing the injected metal located at said gate, said last named means operated by the relative movement of the movable die block and movable member.

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