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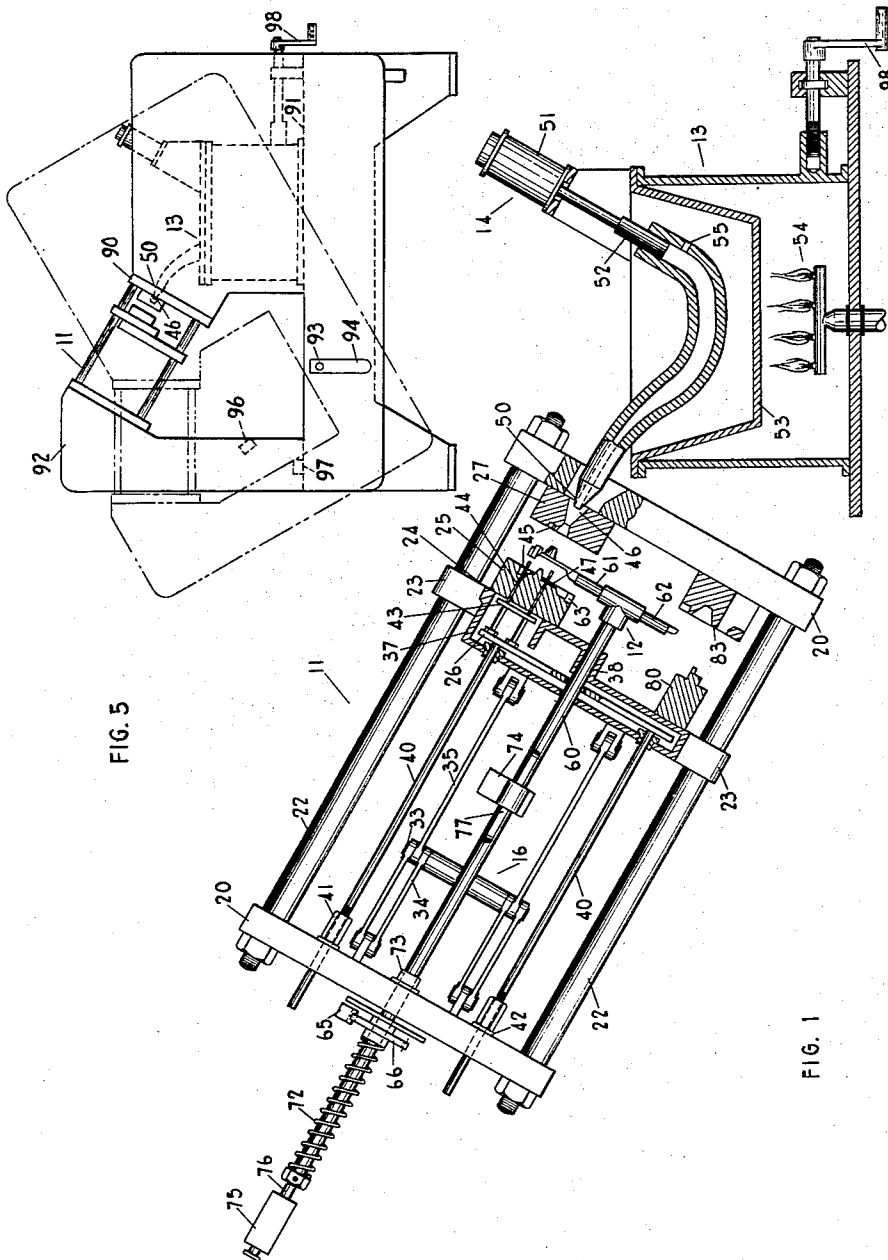
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DIE CASTING AND TRIMMING APPARATUS

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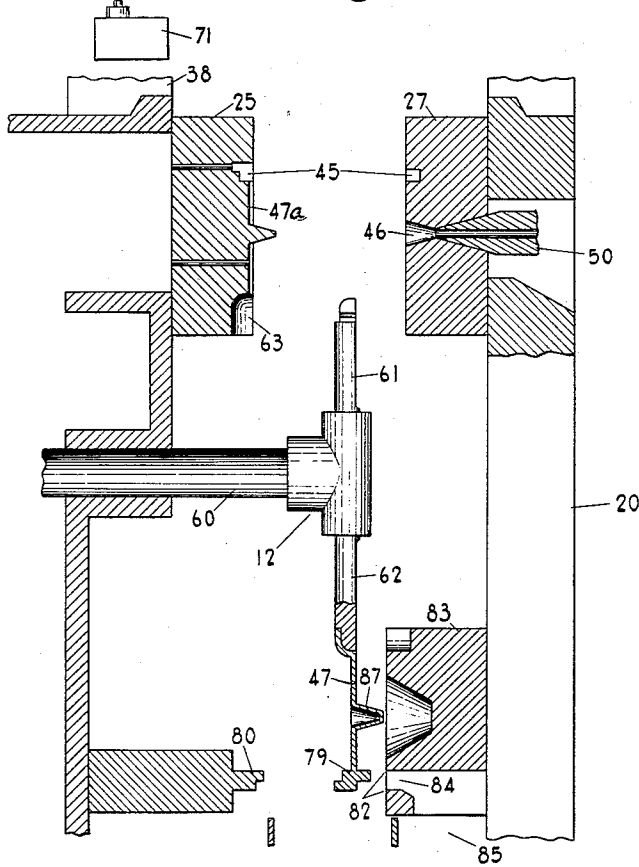
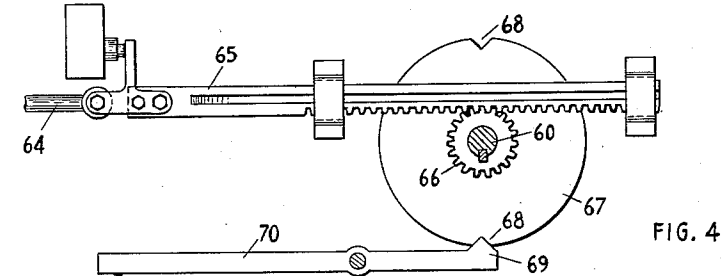
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DIE CASTING AND TRIMMING APPARATUS

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10 Claims. (Cl. 22—68)

This invention pertains to the art of die casting. More specifically the invention is related to a die casting machine in which a uniquely applied, oscillatable carrier transfers a casting from one position to another between relatively movable supports for separable die halves, the carrier being movable by one of the die supports to enable the simultaneous formation and trimming of separate die castings during each cycle of the machine.

Though machines combining the functions of casting and trimming have appeared to be a universally desirable and logical step toward shortening the end product cycle, available mechanisms have not attained the anticipated acceptance by the industry. In conventionally applied, automatic casting and trimming devices, a casting carrier is alternately positioned between dies for forming a casting thereupon, and is then picked up by separate mechanisms for transfer to a position completely out of the line of die movement for trimming. This normally requires stoppage of die movement with consequent loss of time. It also necessitates the use of separate driving members for the casting apparatus and for the casting transfer and trimming mechanisms. Synchronization of the necessarily complicated movements of such structures consequently is difficult and calls for extraordinary precision in the machining of the separate parts to insure exact location of the casting carrier with respect to the dies, if breakage and accidents are to be avoided. Attempts to build the casting transfer apparatus as an integral part of the casting machine have not been successful. Transfer of a casting in a direction out of the line of normal die movement for subsequent removal and trimming is inefficient and uneconomical. Breakdown of either of the separate mechanisms results in complete shutdown.

Inadequacies of prior art casting and trimming devices have been largely obviated in the apparatus of the present invention wherein the motions of a casting transfer mechanism have been uniquely coordinated and synchronized with conventional die casting apparatus for the simultaneous performance of both casting and trimming operations during each cycle of the machine. The movement of the casting carrier is directly in line with normal die movement. To assure continuity of performance, the casting transfer mechanism is interchangeable. Its removal for any cause, therefore will not interfere with normal die casting.

Accordingly, it is an object of the invention to provide apparatus adapted to the performance of casting and trimming operations during a single cycle of machine operation.

It is another object of the invention to provide an interchangeable casting carrier assembly adapted to movement by an ejector die support to enable performance of casting and trimming operations during a single machine cycle and alternately to provide a machine adaptable to conventional casting operations when the casting carrier assembly is not used.

It is a further object of the invention to provide a

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casting carrier and a support therefor which, at all stages of a casting and trimming cycle, is positioned through a bore in an ejector die support and adapted to movement thereby and therethrough with respect to a stationary cover die.

It is a still further object of the invention to provide a detachable casting carrier assembly for a casting and trimming machine wherein a die casting is formed upon one end of the carrier and another casting is removed and trimmed from an opposite end of the carrier during each cycle of the machine.

Another object of the invention is the provision in a casting and trimming machine of a casting carrier and a support therefor, capable of movement to die closure position between opposed die halves by a support for a movable ejector die, and being capable of movement in a direction opposite to and during the movement of an ejector die to open position.

It is likewise an object of the invention to provide in a casting and trimming machine, separable supports for die casting apparatus and for molten metal heating and injecting apparatus which are utilized for movement of the die casting and casting transfer apparatus away from the heating and injection means to render the latter inoperable and to render the casting apparatus safely accessible.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, while its scope will be pointed out in the appended claims:

Referring now to the drawings:

Fig. 1 is a side view of a complete casting and trimming machine including casting mechanism, molten metal furnace, kettle and injector apparatus, with dies in open position.

Fig. 2 is a top view of the casting and trimming mechanism including the piston drive and toggle link actuating means showing an arm of a casting carrier positioned between the dies in closure position and ready for casting.

Fig. 3 is a view in enlarged detail showing the dies and the die supports, the casting carrier and its rotatable support, and including alternate stop means for the precise positioning of the carrier with respect to the die cavities; apparatus for trimming another casting concomitantly with die closure also is shown.

Fig. 4 is a rear view of the casting and trimming mechanism in enlarged detail showing the actuator and connections for oscillating the casting carrier support to transfer a casting from forming to trimming position between the die supports.

Fig. 5 depicts separable base members having individual supporting frames for the die casting and casting transfer apparatus and for the molten metal heating and injector apparatus.

Referring now to Fig. 1 of the drawings, there is represented an automatic die casting and trimming machine comprising separately supported casting apparatus generally designated 11, detachable casting transfer mechanism 12, molten metal heating means 13, including pot and furnace, molten metal injector means 14, pressure driving means including the usual motor, not shown, and conventional fluid pressure apparatus 16, Fig. 4. It will be understood that the apparatus may also include suitable devices for timing the sequence of operations necessary to produce completely trimmed die castings.

The casting mechanism shown in Fig. 1, with the dies in open position, is angularly positioned with respect to the heating apparatus in a rigid U-frame 20, mounted upon a tiltable base support, which in turn may be pivotably fixed to the bed plate of the machine. Bolted

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or otherwise rigidly secured between the extended arms of the U-frame are standards or guide rods 22, along which supporting sleeve members 23, of the die actuators are slideably guided to achieve the essential straight line movement of ejector die 25, ejector plate 26, toward and away from stationary cover die 27, in a manner well understood in the art. The apparatus for moving the dies from the open position of Fig. 1, to closed, casting position shown in Fig. 2, may be identified by study of both figures. A fluid pressure cylinder 30, and piston 31, in communication with a suitable source of pressure, for example air, is connected to drive rod 32, in turn connected to toggle link arrangement 33, including short link 34, bolted to lugs 36, on the frame, and long link 35, suitably secured to drive platen 37, in communication with ejector die carriage 38, upon which is mounted the ejector die for movement toward and away from the cover die. The position of the oscillatable driving cylinder at the extreme limits of the die opening and closure strokes is indicated. Positioning rods 40, projecting slideably through the upper arm of the U-frame and through drive plate 37, are bolted or otherwise fixed to ejector plate 26, for limiting the movement thereof with respect to the drive plate via adjustable stops 41, which at a properly timed instant of the drive plate movement, contact bumpers 42, to hold the ejector plate stationary while the drive plate completes its withdrawal movement. Fixed to the underside of the ejector plate and projecting into an opening in the die carriage or support and movable therewith, is a spacer plate 43, upon which are maintained ejector pins 44, slidably projectable through openings in the ejector die when the ejector plate is immobilized by stops previously described, to contact and expel a casting from the cavities of the ejector die in a manner and for a purpose well understood by anyone skilled in the art.

Bolted and clamped to the lower arc of the U-frame is stationary cover die 27, in precise alignment with the movable ejector die so that mating cavities 45, of the separable die halves, including gate 46, runner 47, vents (not shown,) and other essential die appurtenances, may be properly positioned when the dies are forced together for casting. It will be understood that the opposed die halves must be in exact register when the dies are closed. This may be effectively accomplished by the use of suitable dowel pins mounted on the stationary or cover die and in alignment with suitable receptors in the ejector die.

Projecting through the U-frame and into the gate 46, of the cover die is nozzle 50, of molten metal injector means comprising pressure cylinder 51, and piston 52, and port 55, in communication with a supply of molten metal in pot 53. Beneath the pot is furnace 54, for maintaining the metal at temperature conducive to fluidity with due regard for special considerations which may arise in connection with the desired speed of "shot" and the cooling and melting points of the particular types of alloys used for casting. It will be appreciated that the heating and injector means illustrated are merely representative and may be subjected to various modifications in style or type as called for by the speed and timing of injection, amount of pressure, ganging machine requirements etc., without departing from the spirit of the invention.

The die casting, metal heating and injector apparatus so far described is well known and may be applied to the production of die castings in a conventional manner either by applying an ejector die specially adapted to the purpose or by inserting suitable plugs within opening 63, of the ejector die, normally left clear for the intrusion of one of the formed arms of casting carrier 61, when the machine is to be used in the manner of the invention, for combined casting and trimming operations. The casting transfer mechanism will be described hereafter in connection with the novel casting and trimming aspects

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of the invention but plays no part in the operation of the machine for standard die casting. The following description, therefore, is included here merely to emphasize the complete flexibility of the apparatus which may be applied with comparatively minor set up changes to either of the specified operations. When used for conventional die casting, the operation may begin with the dies in open position as shown in Fig. 1. Upon actuation of suitable controls, the ejector die is moved toward closure position by actuation of piston 31 in fluid pressure cylinder 30, to move drive rod 32, toggle links 33, and drive plate 37, to bring the ejector die into tight conformation with cover die 27, as shown in Fig. 2. At an appropriately timed instant, a shot of molten metal from pot 53, is delivered under high pressure from nozzle 50, through gate 46, into the cavities between the closed die members. After a suitable cooling and hardening interval, the ejector die is withdrawn from the cover die upon the retractable stroke of driving rod 32, effecting reverse movement of the toggle links and drive plate. The retraction of the die and its carriage support 37, moves the ejector plate 26, until stops 41, contact bumpers on the frame, whereupon the ejector plate is held stationary while the retraction of the drive plate and the die carriage continues causing the ejector die to move along the ejector pins which emerge from the die to lift the casting contactually out of the die cavity while the die and its associated mechanisms return to the former open position. This mode of operation, of course, calls for removal of the casting from the ejector pins and for transport of same to separate trimming and finishing devices. The separate operations are time consuming and naturally do not contribute to shortening the casting cycle.

For combining the die casting operations just described with completely automatic trimming operations performed continuously and to all intents and purposes simultaneously, during each machine cycle, the unique, interchangeable casting carrier and transfer mechanisms shown in Figs. 1, 3 and 4, may be utilized. In accordance with the invention, means for receiving, translating and disposing of a casting maintained between relatively movable die members comprises a carrier support or shaft 60, firmly sustained for rotational and longitudinal movement through apertures in U-frame 20, drive plate 37, ejector plate 26, and ejector die support 24. Upon the free end of the shaft and movable therewith is die casting carrier having opposed arms 61, and 62.

From die open position shown in Fig. 1, the shaft supported carrier may be moved longitudinally to die closure position of Fig. 2, by contact between drive plate 37, and a suitable collar or projection rigidly fixed to the carrier shaft. This movement occurs concomitantly with the normal closure movement of the ejector die and carriage. Upon contact between the drive plate and the collar of the carrier, one arm 61, of the carrier is precisely positioned within open cavity 63, of the ejector die and is thus brought into casting position between the tightly closed die halves. Fluid metal is injected through gate 46, as previously described, and a suitable cooling and hardening period is permitted to elapse during which a casting is formed and hardened upon the carrier arm 61, where it is maintained pending further stages of the operation.

The shaft and the carrier are positioned also for rotary or oscillatory motion. As shown in Fig. 4, drive rod 64, in communication with a suitable cylinder and piston drive arrangement, moves rack 65, causing rotation of pinion gear 66, fixedly keyed to carrier shaft 60, causing the latter to rotate. Detent plate 67, also keyed to the shaft, has notches 68, spaced exactly 180 degrees apart into which detent 69, on the end of lever 70, will fall closing micro switch 71, at an appropriate instant. The switch controlled plunger action maintains the detent in

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the notch until reactivation is necessary during the next casting cycle when the detent is withdrawn by action of the plunger upon the lever to permit rotation of the carrier in the opposite direction. The detent thus limits the oscillatory movement of the shaft and carrier, depending upon the direction of movement of drive member 64, to provide a safety factor in conjunction with other stop means directly on the shaft, to be described presently, for precisely locating the casting carrier with respect to the casting dies and trimming members. The shaft and the carrier thus are alternately oscillated between two critically established positions exactly 180 degrees apart. In one position, as in Fig. 1, the arm 61 of the carrier is between the dies, and in the other position, the arm 62, of the carrier is die enclosed.

The precise positioning of the arms and consequently of the casting 79, supported thereupon, is an essential feature of the invention. Each arm must be exactly placed with respect to the moving parts which function to produce a casting thereupon or to remove and trim a casting therefrom. Thus, as shown more clearly in Fig. 3, arm 61, must be exactly located with respect to die aperture 63, if damage to the arm or to the die is to be avoided as the dies come together. Arm 62, likewise must be exactly located with respect to moving punch 80, and to trimming dies 82, if mutilation of the casting 79, is to be avoided as the trimming members are brought together. Supplementing the function of the notched detent plate described in connection with Fig. 4, is "flipper" stop 74, shown in Fig. 1, rigidly keyed to shaft 60, in longitudinally extended slot 77. The stop is rigidly fixed to prevent radial movement so that upon each oscillation of the carrier it will come into contact with a suitable bumper (not shown), preferably formed integrally of the frame to limit the rotation of the shaft to precisely 180 degrees. The combined action of the stop and the detent plate mentioned in connection with Fig. 4, thus provide an extra safety factor for the necessarily precise location of the carrier arms. At the instant that the "flipper" stop makes contact with the frame, detent 69, is moved into notch 68, to prevent bounce and possible mislocation of the carrier arms. The stop cannot be permanently fixed longitudinally of the shaft due to the necessity for adjustment therealong in accordance with the spacing of the forming and trimming dies in closure position as dictated by the size and shape of the castings in process. The combined stop and detent action, however, assures the necessarily precise positioning of the carrier arms for the dual purpose casting and trimming.

The movements just described are sequentially related to die opening as well as to closing. After the usual cooling and hardening interval following the injection of metal during which the casting is formed upon the carrier arm, the ejector die is moved away from the closure die by the timed reversal of piston 31, and drive plate 37, as described previously. As the dies part, pressure at the injector nozzle supplemented by tension upon spring 72, is sufficient to maintain the carrier supported casting in the cavities of the moving ejector die. The joint movement of ejector die, casting and casting carrier continues until stops 73, on the carrier support and stop 41, on the ejector plate take over, whereupon the die moves relatively to the ejector pins. At this instant the coil of solenoid 75, previously referred to, is energized by actuation of a conventionally applied micro switch, causing the solenoid plunger 76, to apply thrust upon the rear end of the carrier support to advance the support and the carrier borne casting an incremental distance sufficient to clear the casting from contact with the ejector pins. In the mean time, the ejector die has attained fully open position and for an instant remains stationary. The casting carrier is then rotated 180 degrees as previously described, to position the other carrier arm between the dies and to bring the arm bearing the casting between members effectively applicable to re-

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moval and trimming of the casting concomitantly with the next die closure stroke.

As shown in Fig. 3, all of the apparatus for removal and trimming of castings may be formed integrally of the die supports. A punch 80 conforming to the shape and size of an individual casting 79, projects from ejector die support 38, to contact the casting at the same time that member 83, integrally formed in the cover die support comes into contact with the runner portion 47, by which the casting is supported upon the arm 62, of the carrier. Cooperation of the punch and the member 83, during the closure movement of ejector die 25, consequently, effectively separates the casting from the runner and the runner from the carrier, and forces the casting through the trimming die aperture 84, the sharp edges 82, thereby trimming away all objectionable flash and causing the completely trimmed casting to fall into chute 85, whence it is delivered to a suitable receptacle. The trimmed material, including the runners, sprue and flash, falls via another chute on the opposite side of the trimming die into a separate receptacle from which it is available for remelting and subsequent casting operations.

To a considerable degree the efficiency of the trimming apparatus herein disclosed depends upon techniques applied in the design of the cast parts. The parting line of the dies must be more precisely determined than in conventional die casting. Parts should be designed so that sprues, flash and runners extend outwardly from the die parting line in a direction as nearly as possible normal to the line of combined action of trimming punch and die. This will assure positive shearing away of all superfluous material to produce a cleanly trimmed casting. Similarly, careful designing may provide runner locations best adapted to the conformation of the carrier arm and at the same time insure that runner connections are sufficiently thin and brittle to break away cleanly from the support and from the casting upon actuation of the trimming members.

Safety of the operator as well as of the apparatus must be prime consideration in the design of any die casting machine. Though not specifically shown or claimed in the instant application, it will be understood that solenoid or other interlocks and pushbutton controls may be incorporated in a known manner in the electrical circuitry for automatic resetting or opening of the machine at any stage in a casting cycle. Such safety provisions are too well standardized in all modern casting machines to require detailed description. On the other hand, segregation of the separate machine functions, as of casting, casting transfer, trimming and metal heating, as exhibited herein, is believed to contribute uniquely to safeguarding the apparatus and the operator. In Fig. 5, for example, the casting apparatus 11, and the heating-injector apparatus 13, are maintained respectively upon separable supports 90, and 91. With the machine operably positioned as shown, the center of mass of the casting apparatus, including side plate 92, is to the right of fulcrum bar 93, which contributes to the stability of the casting members in operation. The apparatus may be locked in this position by turn of handle 94. If, for any reason such as breakage of an essential driving connection or a sprue sticking in the gate portion of the cover die, proximity of the molten metal heating facility might render access to the break dangerous, the casting apparatus may be moved away from the heating and injecting mechanisms either by manual means or by suitably positioned automatic means to tilt the side frame 92, and the casting apparatus including support 90, about the fulcrum bar. Displacement of the center of mass of the assembly from one side of the fulcrum to the other permits bringing it gently into contact with bumpers 96, 97, on the stationary bed plate 91, in which position the casting apparatus is rendered safely and conveniently accessible for repair or adjustment. Preliminary to tilting the apparatus, it is imperative that nozzle 50, be withdrawn to clear gate

46, if damage either to the gate or to the injection apparatus is to be avoided. Withdrawal of the nozzle may be accomplished by turning crank handle 98, to rotate a suitable worm arrangement causing kettle 13, and the injector apparatus including the nozzle to slide along 5 suitable guideways and away from the casting apparatus. Reverse movement of the crank will return the nozzle to normal operative engagement with the gate after the casting apparatus has been retitled to its initial position.

As mentioned previously, the tilting facility has implications other than safety. For example, all casting operations at one time or another are plagued by the solidification of metal in the gate of cover dies. The problem of gate clearance is doubly intensified in machines intended for combined casting and trimming functions due to the more complicated structures involved and to intermingling of the additional parts and assemblies which, in all previous casting and trimming devices, has necessitated partial or complete disassembly of machine components to provide access. With the casting mechanism including the cover die tilted as indicated in shadow detail in Fig. 5, the accessibility of the gate or other portions of the mechanism are clearly apparent. A prod or scraping tool may be easily inserted through the front of the gate aperture 46, with no danger of hot metal spurting therethrough when the aperture is cleared, and with no disassemblage or adjustment of the device required other than the tilting operations previously described.

As a further contribution to safe operation, it will be obvious that manually or electrically actuated connectors could be applied to the separable base supporting members to shut off completely the flow of molten metal at the injector nozzle whenever tilting of the casting assembly was necessitated. Apparatus for these and other functions deriving incidentally from the invention involves no more than the ordinary skill of a trained mechanic and, for purposes of clarity, has been omitted from the drawings.

The inclusion of a distinctly new casting carrier mechanism located directly in the line of movement of standard die actuating members as specified is believed to constitute an important step in the art of combined casting and trimming mechanisms. Many parts customarily considered essential in comparable prior art devices have been eliminated. Elements essential to the invention described herein have been compactly incorporated with known, basic casting structures in a manner ingeniously directed to the provision of a casting and trimming machine which may be readily adapted either to combination die work or to applications calling for multiple die casting and trimming operations.

Having described the apparatus and the manner in which it may be applied, what is believed to constitute essential novelty is enumerated in the appended claims.

What is claimed is:

1. A casting and trimming machine comprising a frame supported cover die; a movable ejector die and a carriage therefor; metal heating and injecting means; and a support for castings rotatably reversible between said dies by a member extending through said carriage, said member including means for engagement and movement by said carriage to locate said support between said dies in casting receiving position.

2. A casting and trimming machine comprising a frame; a stationary cover die; a movable ejector die and a carriage therefor; a multiple ended support for a casting rotatably positionable between said dies by a member extending through said carriage for movement by said carriage to casting and trimming positions and for movement jointly therewith during a portion of the movement of said carriage away from said positions; and means for moving said casting support in a direction opposite to the movement of said carriage during another portion of the carriage withdrawal movement.

3. A casting and trimming machine comprising a cover die; an ejector die and a carriage therefor, intermittently and reversibly movable to and from closure position with respect to said cover die; a shaft extending through said carriage for longitudinal movement with respect thereto; a formed bar fixed to one end of said shaft; means alternately positioning opposite ends of said bar in the path of movement of said ejector die; means for casting an object upon said bar subsequently to the movement of said shaft by said carriage; and means cooperatively engageable with the opposite end of said bar for removing and trimming a casting positioned thereon during a proceeding casting cycle and concomitantly with the closure movement of said dies.

4. In a casting and trimming machine having a stationary cover die and a movable ejector die and carriage therefor, the improvement comprising an intermittently oscillatable, double ended carrier on a support extending through a bore in said carriage; means for rotating said carrier; and means including said carriage for moving said carrier and an object cast thereupon axially and concomitantly with the movement of said die.

5. In a die casting and trimming machine including a stationary cover die and a movable ejector die, the improvement comprising a support for a casting carrier extending through a bore in a carriage for said ejector die; means for moving said carriage along said support; means for moving said die and said support concomitantly in one direction; pressure means holding said die and said support stationary and in contact with said cover die; means for moving said ejector die and said support concomitantly in a direction opposite to said first named direction; means reversing the movement of said support during the movement of said ejector die; means for stopping the movement of said support; and means for rotating said support.

6. A die casting and trimming machine comprising molten metal heating and injector means on a stationary support; a stationary cover die and a movable ejector die and carriage therefor on a separate support tiltably replaceable with respect to said stationary support; an interchangeable assembly including an oscillatable support for a casting carrier projecting through said carriage and linearly movable therewith and for receiving thereupon the runner portion of a casting formed between said dies.

7. An attachment for a die casting machine comprising a rotatable shaft; stop means keyed to said shaft to locate a casting carrier on one end of said shaft in the path of closure movement of an ejector die and simultaneously in the path of a moving trimming punch; electrically actuatable means applicable to the other end of said shaft to advance same longitudinally and in the opposite direction to continuing movement of said ejector die; and means limiting the longitudinal movement of said shaft.

8. A die casting and trimming machine comprising a pressure driven die carriage; an ejector die driven thereby; a cover die; means including a nozzle in communication with a gate of said cover die for injecting molten metal under pressure between said dies in closure position to form a casting upon an arm of an oscillatable carrier; means including said ejector die for retracting said casting and said carrier; means actuatable concomitantly with consecutive advances of said ejector die for trimming and removing a casting from said carrier.

9. A casting and trimming machine comprising frame supported cover die and trimming member; a movable ejector die and a movable trimming member having a common carriage; a support for castings rotatably reversible between said dies and said trimming members by a member including means for engagement and movement by said carriage to locate said support between said

dies in closure position and concomitantly between said trimming members; and means including said carriage for reversing the movement of said support and a casting formed thereon.

10. A casting and trimming machine comprising a frame; a stationary cover die; a movable ejector die and a carriage therefor; a multiple ended support for separate castings rotatably positionable between said dies by a member extending through said carriage, said member including means for engagement and movement by said carriage to locate said support between said dies in casting receiving position; and means for reversing the movement of said member and said support with respect to the withdrawal movement of said carriage from die closure position.

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740,733
1,279,249
1,618,223
1,756,602
1,948,992
1,994,824
2,367,303
2,494,777
2,569,083
2,704,388

637,307
641,858

References Cited in the file of this patent

UNITED STATES PATENTS

Bierbaum ----- Oct. 6, 1903
Bungay ----- Sept. 17, 1918
Pierce ----- Feb. 22, 1927
Morris et al. ----- Apr. 29, 1930
Morin ----- Feb. 27, 1934
Kux ----- Mar. 19, 1935
Morin ----- Jan. 16, 1945
Patterson et al. ----- Jan. 17, 1950
Wilhelm ----- Sept. 25, 1951
West et al. ----- Mar. 22, 1955

FOREIGN PATENTS

Great Britain ----- May 17, 1950
Great Britain ----- Aug. 23, 1950