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MOLD LOCKING MECHANISM

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2 Sheets-Sheet 1

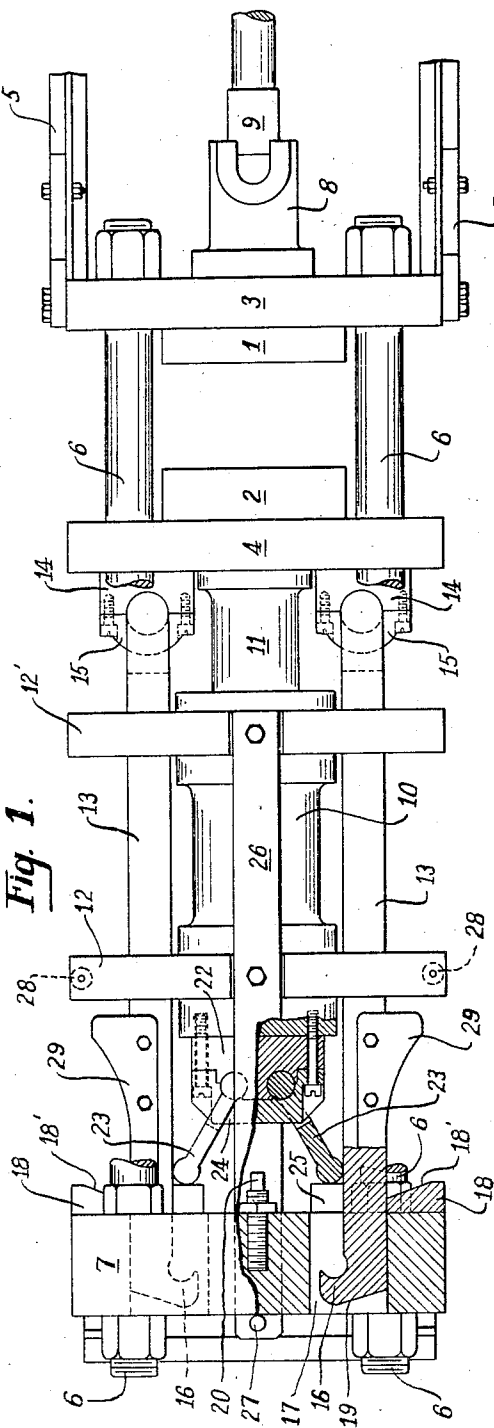


Fig. 1.

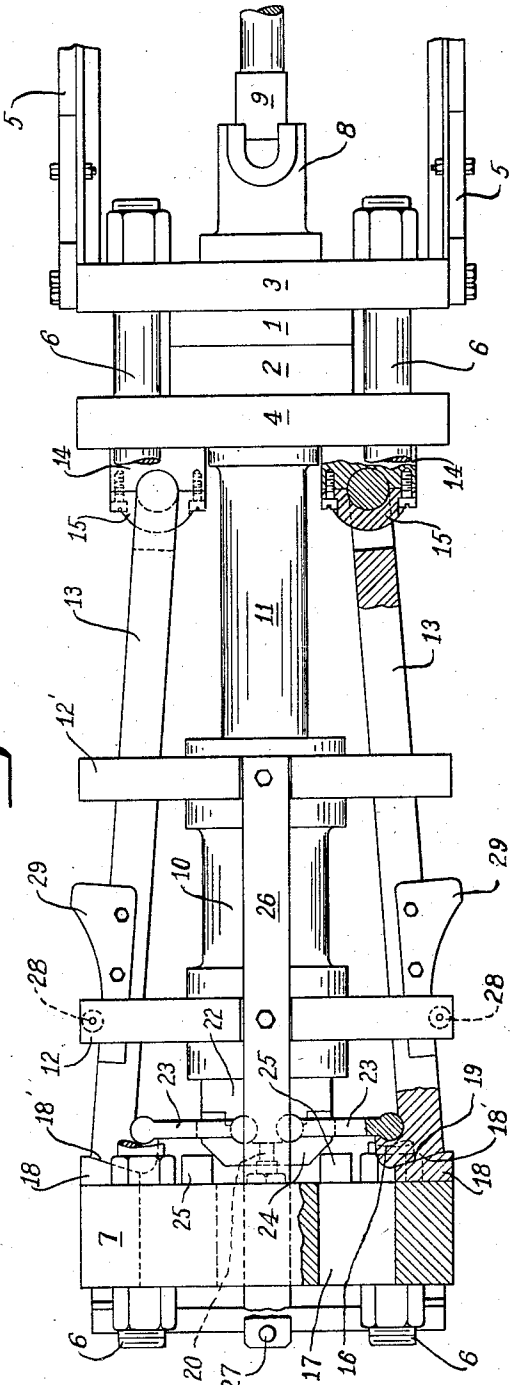


Fig. 2.

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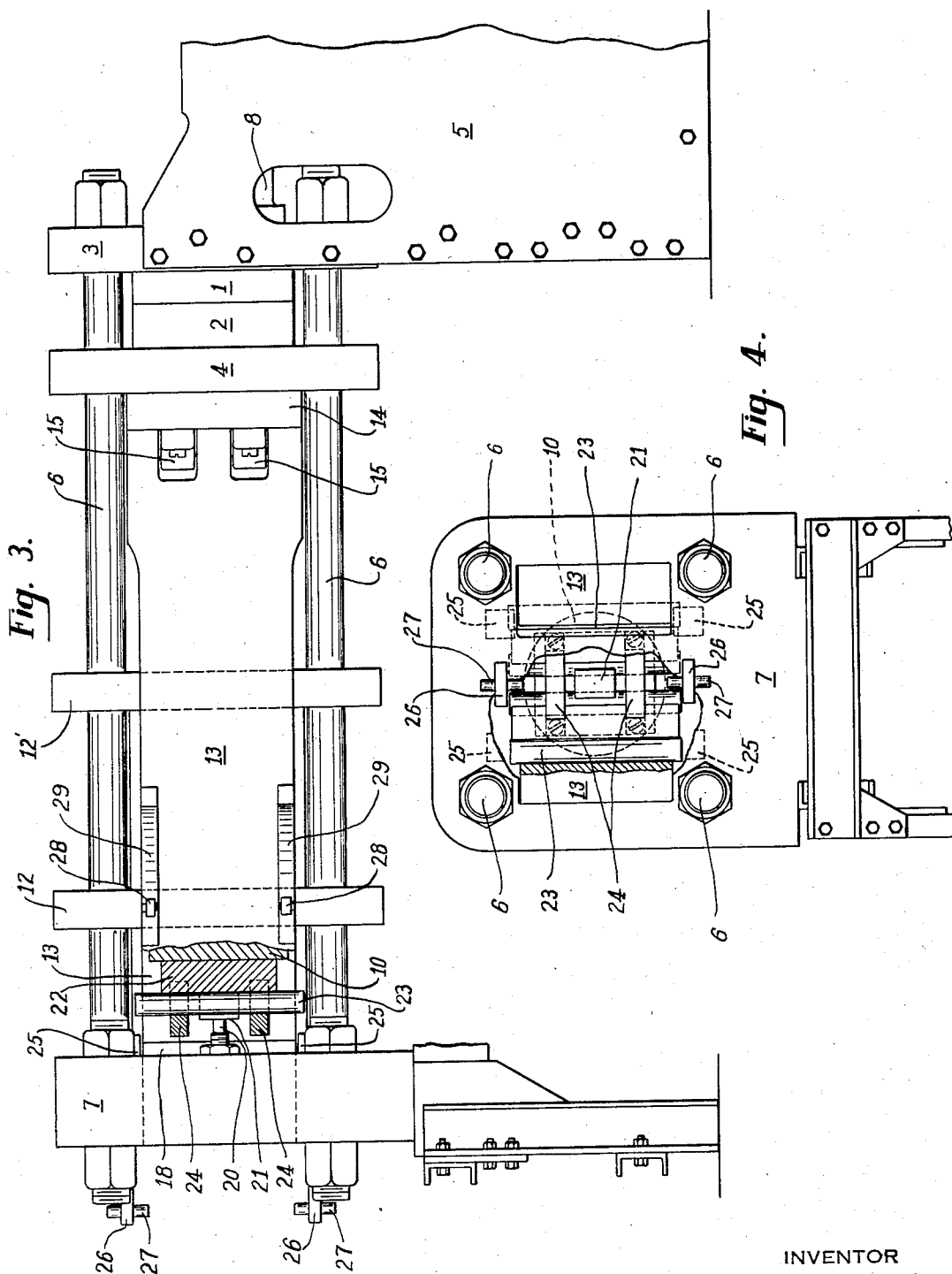
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MOLD LOCKING MECHANISM

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2 Sheets-Sheet 2



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MOLD LOCKING MECHANISM

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11 Claims. (Cl. 22—68)

This invention relates to molding machines, such as die casting machines, and relates particularly to mechanism for locking the dies of such machines in a closed position.

Machines of the type in which material to be cast is forced into molds under pressure commonly employ a pair of cooperating dies to form the mold cavity. At least one of the dies is movable toward and from the other in order to permit opening and closing of the mold, there being suitable power mechanism, such as a hydraulic cylinder or mechanically operated toggle arms, for actuating the movable mold. When material to be cast or molded is forced into the mold cavity, the dies tend to be forced apart, particularly when high pressures are applied in injecting the material into the dies, and for that reason various types of devices have been proposed for locking the dies together so that the castings produced have the desired dimensions and metal being cast does not escape between the dies.

It is an object of this invention to provide an improved locking mechanism for holding the dies of such machines in a closed position against the pressure exerted during the injection into them of material being cast. It is a further object of this invention to provide apparatus for closing the dies of such machines, which apparatus includes mechanism for locking one die securely against the other and holding the dies together during the casting operation. A further object of this invention is the provision of a die casting machine for producing castings from molten metal, the machine being equipped with improved mechanism which affords a rigid, unyielding lock which holds the dies in closed position during the casting operation. Other objects of the invention will be apparent from the following specification and claims, and from the accompanying drawings of a machine embodying the invention.

Referring to the drawings:

Fig. 1 is a plan view, partly in section, of a portion of a die casting machine constructed in accordance with the invention, showing the mold in open position;

Fig. 2 is a plan view similar to Fig. 1, but with the mold closed and locked by the mold locking mechanism;

Fig. 3 is a side elevation, partly broken away, of the machine of Fig. 1 with the mold locked;

Fig. 4 is an end view, partly broken away, of the machine of Fig. 1.

The die casting machine of the drawings com-

prises a stationary die 1 and a movable die 2 mounted on the fixed platen 3 and the movable platen 4 respectively. The fixed platen 3 is mounted on the base 5 of the machine, and supports four tie bars 6 (shown partly broken away in Figs. 1 and 2) which are fixedly attached thereto and to the crosshead 7. The movable platen 4 is slidably mounted on the tie bars 6 for movement toward and from the fixed platen. An injection chamber 8, from which fluid or pasty metal to be cast is forced into the mold cavity formed by the dies when the dies are closed, is attached to the fixed platen and is provided with the plunger 9 reciprocable in the bore thereof, the plunger serving to force molten material in the chamber 8 into the mold cavity which communicates with the bore of the chamber 8 through a sprue (not shown) extending through the fixed platen 3 and the mold 1. Other types of injection mechanism are well-known in the art and can likewise be employed in place of the chamber 8 and plunger 9.

Reciprocation of the movable die 2 toward and from the fixed die 1 is effected by means of fluid pressure supplied to each end of the pressure cylinder 10 through ports in the ends of the pressure cylinder which communicate with a source of pressure fluid through piping (not shown), the flow of pressure fluid to and from either end of the pressure cylinder being controlled by suitable valves. The pressure fluid operates a piston within the cylinder 10 and attached to the ram 11, which is connected at the opposite end to the movable platen 4. The pressure cylinder 10 is supported on the tie bars 6 by means of the supporting plates 12 and 12' attached thereto, which are slidably mounted on the tie bars, permitting movement of the pressure cylinder and the supporting plates toward and from the movable platen 4. A pair of locking arms 13 are pivotally mounted at one end in the bearing blocks 14 attached to the rear of the movable platen, whereby the locking arms are free to swing on a vertical axis. The caps 15 extend through openings in the locking arms and serve to hold the locking arms in place in the bearing blocks 14.

The sides of the plates 12 and 12' are recessed to accommodate the locking arms 13, which have a sliding fit therein. Thus, the plates 12 and 12', and the locking arms 13, aid in preventing misalignment of the movable platen under the weight of the movable die 2 and associated parts which it sometimes carries,

such as hydraulic cylinders for operating parts of the die.

Each locking arm 13 is provided with a detent 16 adjacent the free end thereof. The crosshead 7 is provided with a pair of passages 17 in which the free ends of the locking arms slide during the greater portion of the movement of the movable platen toward and from the fixed mold 1, and also carries abutments 18 located besides each of the passages 17 and having beveled faces 18' which are complementary to cam surfaces 19 at the free end of the adjacent locking arms 13. The crosshead 7 also carries the adjustable stop 20 in alignment with the cooperating stop face 21 of the plate 22 attached to the rear of the pressure cylinder 10.

Transversely movable toggle arms 23 are pivotally mounted in bearing recesses in the plate 22, and are held in the bearing recesses by straps 24 bolted to the rear of the pressure cylinder, the toggle arms each being slotted to permit the straps 24 to extend through them. The toggle arms 23 press against the locking arms 13 and, during the greater portion of the mold closing operation, also press at each end against the bearing plates 25 carried by the crosshead 7 above and below the passages 17. The larger portion of the free end of each toggle arm is in alignment with one of the detents 16, with the result that it is engaged by the detent as the locking arms advance in the closing of the mold; the upper and lower portions of the free end of each toggle arm are adapted to be intercepted by the bearing plates 25 in the course of the operation of the machine, as is explained hereinafter.

The plates 12 and 12' carry a pair of bars 26 which extend through openings in the crosshead 7 and are provided at their free end with the stops 27. The plate 12 is also provided with two pairs of cam followers 28 extending from the bearing surfaces of the recesses in the sides of the plate which accommodate the locking arms, the cam followers being in alignment with, and adapted to cooperate with, the cams 29 mounted in recesses in the locking arms.

In the operation of the machine, starting with the molds in the fully open position, as shown in Fig. 1, pressure fluid entering the rear of the pressure cylinder 10 moves the ram 11 and movable die 2 toward the fixed die 1. During that time the toggle arms 23 press against the locking arms 13 and the bearing plates 25, and transmit the thrust of the cylinder 10 thereto, the toggle arms 23 being prevented from moving outwardly by the locking arms 13 and the side wall of the passages 17 until just before the mold parts meet. Thus, the cylinder 10 is prevented from moving toward the cross head 7 during that stage of the mold closing operation. However, the locking arms are of such length that shortly before the dies meet, and just as the detents 16 engage the toggle arms 23, the outer edge of the cam surface 19 of each locking arm moves past the inner edge of the beveled face 18' of the adjoining abutment 18, whereupon the locking arms and toggle arms are free to move outwardly, and the cylinder 10 is free to move toward the crosshead 7. By this time the outermost portion of the cams 29 has advanced past the cam followers 28.

As the cylinder 10 moves toward the crosshead 7, it forces the free ends of the toggle arms 23 outwardly, and as a result, presses the locking arms 13 outwardly, forcing the cam surfaces 19

of the ends thereof against the beveled faces 18' and causing the movable die 2 to be advanced into contact with the fixed die 1, at which time the stop face 21 strikes the adjustable stop 20, and the toggle arms are in substantially a straight-line position.

The position of the various parts of the mechanism at this point is shown in Fig. 2. Metal may then be forced into the mold cavity from the chamber 8 by the plunger 9, and allowed to solidify.

In opening the mold, pressure fluid is introduced into the pressure cylinder 10 between the piston therein which forms one end of the ram 11, and the front end of the pressure cylinder. The locking arms 13 and the abutments 18 prevent the movable platen 4 from moving toward the crosshead 7; hence, the cylinder 10 advances toward the platen 4, unlocking the toggle arms 23. As the cylinder 10 and the plates 12 and 12' move forward, the cams 29 press against the cam followers 28 and thus the locking arms 13 are forced inwardly until they are in alignment with the passages 17. At the same time the free ends of the toggle arms 23 are returned to a position against the bearing plates 25. At this point the stops 27 strike the crosshead 7, preventing further advance of the pressure cylinder. As the locking arms swing toward each other, they no longer prevent movement of the movable platen 4. Consequently, retraction of the movable platen by movement of the piston in the pressure cylinder begins, separating the dies. Upon alignment of the free ends of the locking arms with the passages 17, the abutments 18 cease to restrain retraction of the movable platen, whereupon the continuing flow of pressure fluid into the cylinder returns the movable die 2 and the locking arms to the fully retracted position shown in Fig. 1. The casting formed in the mold may then be removed and the cycle repeated.

Although the invention has been particularly described with reference to a machine for die casting metal, it will be understood that it can also be employed in other machines in which material to be cast or molded is injected into a mold under pressure. Also, if desired, separate pressure cylinders may be employed for effecting the mold closing and the mold opening operations, rather than the double acting cylinder shown and described, the cylinder or cylinders used for opening the mold being mounted for simultaneous reciprocation with the cylinder which closes the mold. Various other modifications can be made in the machine without departing from the invention and the appended claims.

I claim:

1. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means carried by said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, and means for moving said movable platen toward said other platen and having a member adapted to remain stationary initially, and subsequently to move in a direction opposite to the die closing movement of said movable platen, during said die closing movement of said movable platen, said member being adapted to force said locking means into locking position against said abutment upon movement of said member in a direc-

tion opposite to the die-closing movement of said movable platen.

2. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means carried by said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said other platen, said platen-moving means having a member movable in a direction opposite to the die-closing movement of said movable platen during said die-closing movement, and being adapted to force said locking means into locking position against said abutment upon such movement of said member away from said movable platen, means for initially restraining such movement of said member away from said movable platen during the die-closing movement of said movable platen toward said other platen, said restraining means being adapted to permit subsequent movement of said member away from said movable platen.

3. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means carried by said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said other platen, said platen-moving means having a member movable in a direction opposite to the die-closing movement of said movable platen during said die-closing movement, means operable by such movement of said member away from said movable platen for causing transverse movement of said locking means into locking position against said abutment, means for initially restraining such movement of said member away from said movable platen during the die-closing movement of said movable platen toward said other platen, said restraining means being adapted to permit subsequent movement of said member away from said movable platen.

4. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means carried by said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said other platen and having a member movable in a direction opposite to the die closing movement of said movable platen during said die closing movement, said member being adapted to force said locking means into locking position against said abutment upon movement of said member in a direction opposite to the die closing movement of said movable platen, and having a lost-motion connection with said locking means, whereby said member and said locking means are free to move independently of each other to a limited extent, and means for restraining movement of said member in a direction opposite to the die-closing movement of said movable platen during the die-closing movement of said platen until the lost-motion effect of said connection is overcome.

5. In a die casting machine, a pair of platens,

each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means carried by said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said other platen, said platen-moving means having a member movable in a direction opposite to the die-closing movement of said movable platen during said die-closing movement, a toggle adapted to be projected by such movement of said member away from said movable platen and operatively connecting said member and said locking means, whereby projection of said toggle effects transverse movement of said locking means into locking position against said abutment, means for initially restraining such movement of said member away from said movable platen during the die-closing movement of said movable platen toward said other platen, said restraining means being adapted to permit subsequent movement of said member away from said movable platen.

6. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means carried by said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said other platen, said platen-moving means having a member movable in a direction opposite to the die-closing movement of said movable platen during said die-closing movement, movable means operable by such movement of said member away from said movable platen for causing transverse movement of said locking means into locking position against said abutment, said movable means having a lost-motion connection with said locking means, whereby said member and said locking means are free to move independently of each other to a limited extent, and means for restraining such movement of said member away from said movable platen during the die-closing movement of said movable platen until the lost-motion effect of said connection is overcome.

7. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means connected to said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said other platen, said last-mentioned means including a pressure cylinder movable in a direction opposite to the die-closing movement of said movable platen during said die-closing movement, means operatively connecting said pressure cylinder and said locking means, said connecting means being adapted to force said locking means into locking position against said abutment upon such movement of said pressure cylinder away from said movable platen, means for initially restraining such movement of said pressure cylinder away from said movable platen during the die-closing movement of said movable platen toward said other platen, said restraining means being adapted to permit subsequent movement of said pressure cylinder away from said movable platen.

8. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means connected to said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said other platen, said last-mentioned means including a pressure cylinder movable in a direction opposite to the die-closing movement of said movable platen during said die-closing movement, toggle arms adapted to be projected by such movement of said pressure cylinder away from said movable platen and operatively connecting said pressure cylinder and said locking means, said toggle arms having a lost-motion connection with said locking means, whereby said pressure cylinder and said locking means are free to move independently of each other to a limited extent, and means for initially restraining such movement of said pressure cylinder away from said movable platen during the die-closing movement of said movable platen toward said other platen, said restraining means being adapted to permit subsequent movement of said pressure cylinder away from said movable platen.

9. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means carried by said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said other platen, said last-mentioned means having a member movable in a direction opposite to the die-closing movement of said movable platen during said die-closing movement, and movable toward said movable platen when said dies are closed, said member being adapted to force said locking means into locking position against said abutment upon such movement of said member away from said movable platen, means for initially restraining such movement of said member away from said movable platen during movement of said movable platen toward said other platen, said restraining means being adapted to permit subsequent movement of said member away from said movable platen, means permitting limited movement of said member toward said movable

platen from its retracted position, and means operable by such movement of said member toward said movable platen for disengaging said locking means from said abutment.

10. In a die casting machine, a pair of platens, each of which carries a die, one of said platens being movable toward and from the other to close and open the mold formed by cooperation of said dies, mold locking means carried by said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, and means for moving said movable platen toward said other platen, said last-mentioned means including a member adapted to remain stationary initially, and subsequently to move in a direction opposite to the die closing movement of said movable platen, during said die closing movement of said movable platen, and to move toward said movable platen when said dies are closed, said member being adapted to force said locking means into locking position against said abutment upon movement of said member in a direction opposite to the die-closing movement of said movable platen, and to disengage said locking means from said abutment upon movement of said member toward said movable platen.

11. In a die casting machine, a pair of oppositely disposed fixed members, a fixed die carried by one of said members, a plurality of tie bars connecting said members, a movable platen carrying a die and reciprocable toward and from said fixed die to close and open the mold formed by cooperation of said dies, mold locking means attached to said movable platen and adapted to move to and from locking position against an abutment transversely of the line of movement of said movable platen, means for moving said movable platen toward said fixed die, said last-mentioned means including a pressure cylinder, a support for said pressure cylinder mounted on said tie bars for reciprocation thereon, said cylinder and said support being movable in a direction opposite to the die-closing movement of said movable platen during said die-closing movement, said locking means having a sliding fit in said support, and means operable by such movement of said pressure cylinder away from said movable platen for causing transverse movement of said locking means into locking position against said abutment.

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