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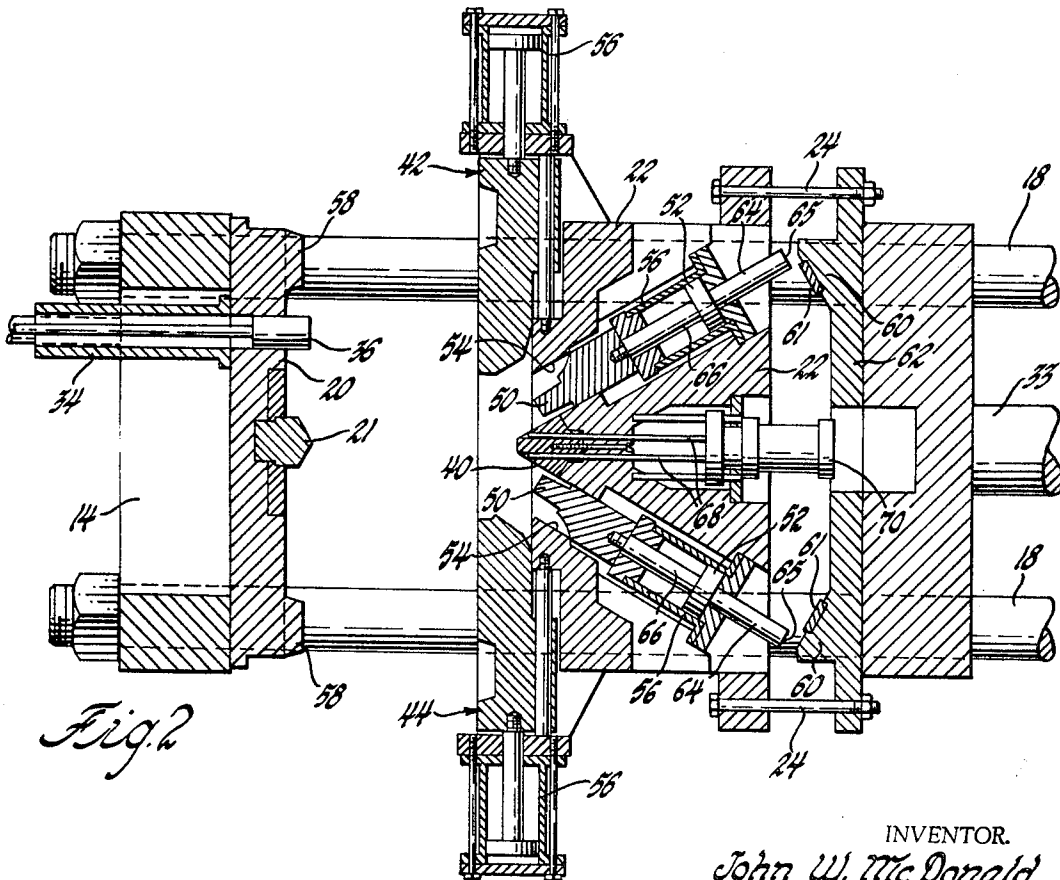
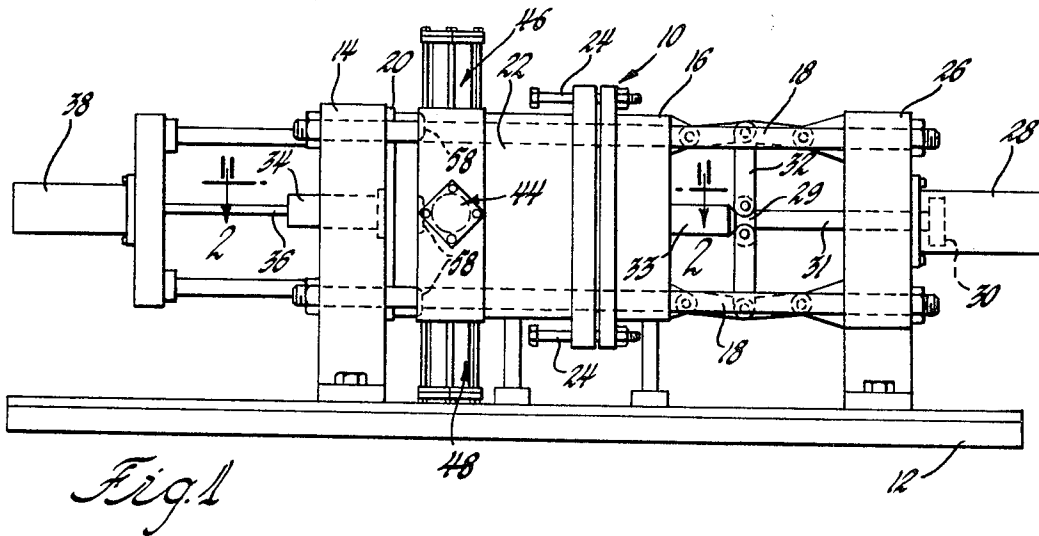
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3,433,292

LOCKING MECHANISM FOR DIECASTING

Filed May 25, 1966

Sheet 1 of 2



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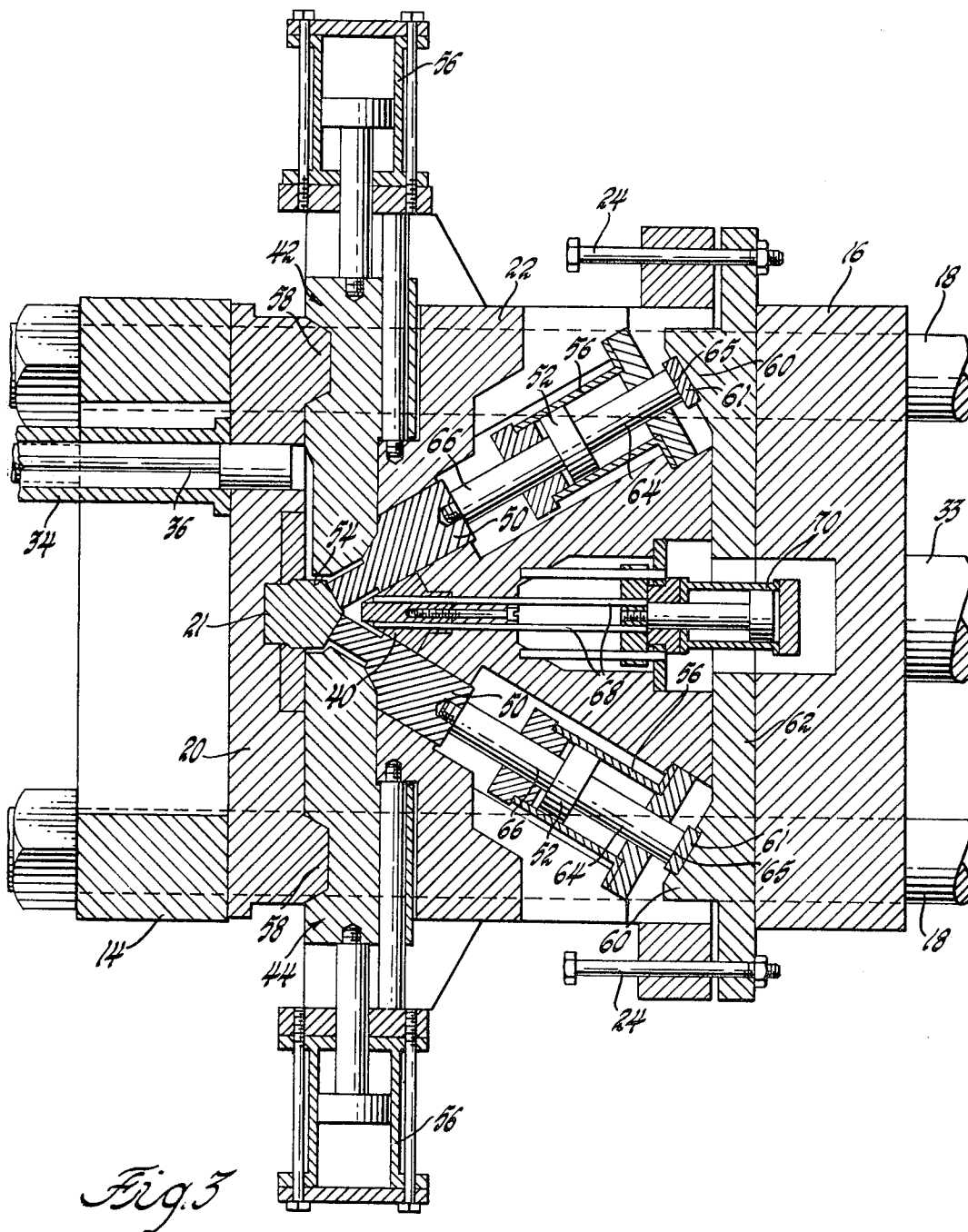
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LOCKING MECHANISM FOR DIECASTING

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7 Claims

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ABSTRACT OF THE DISCLOSURE

A locking mechanism is disclosed for diecasting machines employing a die member in the ejector die assembly which member is movable obliquely with respect to the axis of movement of the ejector die. In a preferred embodiment a backup plate is connected to the ejector die assembly by means of a lost motion connection. The backup plate locks the die member in the machine closed position and is moved away from the ejector die in the machine open position to permit withdrawal of the die member from the die cavity.

This invention relates to diecasting machines having relatively movable die members associated with a movable ejector die assembly.

More particularly it relates to a means of locking such members in a die-closed position during the injection step of the diecasting process.

In the diecasting of articles of complex shape, such as engine blocks, a plurality of movable die sections are used which can be registered in a die-closed position to form a die cavity and subsequently retracted to permit removal of the cast part from the die. These die sections must be held in place in a closed position against extremely high molten metal injection forces, sometimes up to 500,000 to 1,000,000 pounds. Those die parts which are movable in a direction coinciding with the principal or longitudinal direction of movement of the diecasting machine are locked in place by the normal opening and closing mechanism of the machine itself. Those die parts which move in a direction parallel to the parting plane, which is perpendicular to the principal axis of the machine, are locked in place during injection step by wedges or the like protruding from the cover die. Even though substantial force builds up during the metal injection step in diecasting, the movable die members can be satisfactorily locked in a die-closed position when they move only in these two directions. However, with die members disposed at an acute angle with respect to the longitudinal axis of the diecasting machine, a wedge extending from the stationary cover die has been recognized as inadequate as such a die member has appreciable mechanical advantage against the wedge. Moreover, the hydraulic cylinders which are generally used to impart the necessary reciprocating motion to the core or die members are inadequate to lock the members in a die-closed position. Hence, it has been the practice to hold movable angularly disposed members in the ejector die assembly by additional mechanisms not a part of the machine.

It is an object of this invention to provide means of utilizing the locking force of the normal diecasting machine itself, i.e. the mechanical advantage obtained in the opening and closing mechanism, to secure a die or core member whose axis of movement forms an angle with the principle direction of the diecasting machine which is less than a right angle.

It is a more specific object of this invention to provide in a diecasting machine a movable die assembly associated with a backup plate utilizing the backup plate to secure relatively movable members of the die assembly in place when the machine is in the die-closed position.

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It is a further object of this invention to provide in a diecasting machine a movable die assembly connected to a backup plate by a lost motion connection so that the plate may be retracted from its lockup position permitting withdrawal of the movable die member from the casting.

In accordance with my invention these and other objects are accomplished, generally speaking, by providing in a normal diecasting machine a stationary die, an ejector die assembly comprising a plurality of die members at least one of which is movable relative to the assembly along an axis angularly displaced to the longitudinal axis of the machine, and a backup plate attached to the back side of the ejector die assembly by a lost motion connection. When the machine is in the closed position the stationary die and the die members of the ejector die assembly, including the relatively movable member, register in the die-closed position to define a cavity therebetween. In this position, the backup plate is held against the opposite (rear) side of the ejector die assembly and the movable die member by the closing mechanism of the machine. The integrity of the cavity in the die-closed position is thus maintained. The machine is opened by first withdrawing the backup plate to the limit of the lost motion connection. Coincidentally the movable die member is retracted. Further withdrawal of the backup plate moves the ejector die assembly to the full die-open position.

Other objects and advantages of my invention will be apparent from the complete description which follows wherein reference being had to the enclosed drawings in which:

FIGURE 1 is a somewhat schematic elevational view of a diecasting machine embodying the principles of the invention, the dies of the machine being in the closed and locked position ready to receive a shot of molten metal;

FIGURE 2 is a detailed, fragmentary view taken along line 2—2 of FIGURE 1, except that the dies are shown in the open position;

FIGURE 3 is a view similar to FIGURE 2 except that the dies are shown in the closed position.

Referring to the drawings and particularly to FIGURE 1, a diecasting machine indicated generally at 10 includes rails 12 on which the stationary platen 14 is supported. A movable platen 16 is slidably supported on the rails 12 as is a rear stationary platen 26. Tie bars 18 connect the respective platens and serve as a guide for the movable platen 16. Attached to the front fixed platen 14 and supported thereby is the cover die holding block 20 on which is mounted a cover die or stationary die 21 best shown in FIGURES 2 and 3. In this embodiment the various die members comprising the ejector die assembly are associated with and supported by an ejector die holding block 22. The ejector die holding block 22 is slidably supported by the rails 12 and attached to the movable platen 16 by means of a lost motion connection represented in this embodiment by the stripper bolts 24 in FIGURE 1. Movement and lock up of the movable platen 16 and the ejector die holding block 22 are effected by means anchored to the fixed rear platen 26. In the hydraulic closing cylinder 28 fluid pressure is exerted against a piston 30 in response to actuating means (not shown). Piston 30 transmits the force through a rod 31, cross-head 29, toggle linkage 32 and stop 33 to the movable platen 16.

At the other end of the machine 10 as seen in FIGURE 1, molten metal is injected into the cavity formed by the closed dies through a shot sleeve 34 extending through the front platen 14, by a shot plunger 36. The shot plunger 36 is actuated by fluid pressure in a hydraulic shot cylinder 38.

The movable ejector die holding block 22 and the various die members are better shown in FIGURES 2 and 3.

The ejector die holding block 22 supports the ejector die 40 and the slidable die members 42, 44, 46 and 48. It is seen that these slidable die portions (42, 44, 46, 48) have an axis of movement which is perpendicular to the principal axis of the machine and parallel to the parting plane. The ejector die holding block 22 also supports two core members 50 movable relative to the rest of the ejector die assembly whose axis of movement forms an acute angle with the principal axis of the machine and opening in the direction of the movable platen 16.

When the machine is in the die-closed position as shown in FIGURE 3, the various die and core members are fully inserted and register to form a die cavity 54, which could assume any desired shape, but which as shown is suitable for the casting of a V-type motor block. In this case it can be seen that the movable core slides 50 are used to form the two cylinder banks of the engine block. The various sliding die sections and cores are supported by the ejector die holding block 22 and hydraulic cylinder means indicated in each case as 56 are used to advance and withdraw the die and core sections. The die members which move in a direction perpendicular to the axis of the machine are suitably locked into die-closed position during the molten metal injection by a cover die wedge device 58 protruding from the surface of the cover die holding block 20. However, other means must be provided to satisfactorily lock up the sliding core sections 50 as there is no mechanical advantage in using a cover die wedge means in this situation.

In accordance with my invention, this is provided by permitting relative motion, preferably limited relative motion, between the movable platen 16 and the movable ejector die holding block 22. This is particularly advantageous in that the core members 50 may be positioned in the ejector die holding block 22 such that when the machine is closed the cores are supported and locked by the movable platen 16. Yet because the ejector die holding block 22 is not rigidly attached to the movable platen 16 there is suitable space when the machine is opened, for the cores 50 to be completely withdrawn from the die cavity 54. These advantages will become more apparent as the mechanism is more fully explained.

When the machine is in the die-open position, as shown in FIGURE 2, the movable platen 16 and the ejector die holding block 22 are separated by a distance determined by the length of the stripper bolts 24 so that the cores 50 may be withdrawn from the die cavity 54 thus permitting removal of the casting. This lost motion connection (stripper bolts) permits the ejector die holding block 22 and the movable platen 16 to be separated while still utilizing the moving force transmitted by the hydraulic cylinder 28 through the toggle linkage 32. Of course, it is realized that no connection between the movable platen 16 and the ejector die holding block 22 would be required in accordance with my invention if separate means were provided for moving the holding block 22 between the open and closed positions of the machine.

Referring now to FIGURE 3, in the closed position of the machine the cores 50 are inserted into the die cavity 54. Attached to the core member 50 is a piston rod 66 which in turn is connected with a piston head 52 which together form a piston reciprocally operable as a part of the hydraulic cylinder means 56 to move the core member into and out of the die cavity 54. When molten metal is charged to the die cavity 54 the hydraulic pressure within the cylinder 56 is not sufficient to maintain the core member in the cavity. To prevent the core member 50 from being blown out of the cavity additional supporting means must be provided. As shown in FIGURE 3 this is accomplished by a column member 64 abutting the piston head 52. As shown, column member 64 has a planar bearing surface 65 which is perpendicular to the axis of movement of the core member 50. The column member 64 extends along the axis of movement of the

core member 50. In the die-closed position of the machine the bearing surface 65 of the column member 64 bears against a planar bearing surface 61 of a wedge-shaped protrusion 60 from backup plate 62 to lock the core member 50 in die-closed position during the injection step of the diecasting process. Bearing surface 61 of the protrusion 60 is also perpendicular to the axis of movement of core member 50. Backup plate 62 is supported by the movable platen 16. Preferably the supporting wedge 60 is part of a separate member, as shown, so that it can be varied in shape and location depending upon the article to be cast and thus can be changed from job to job without requiring alteration of the movable platen 16 itself. However, it is to be understood that the projection 60 could be integrally formed with the movable platen 16 and the movable platen used as the backup plate.

The specific design of the core member 50 and column member 64 depends upon the means used to move the core. In some cases the column member could be abutting the core member and in others simply an extension of the core member. However, when hydraulic cylinder core moving means are used, it is convenient to have the column member abutting or integrally formed with the piston as shown in FIGURE 3. Moreover, if the core member in a specific die design is quite large and massive more than one column member may be used in cooperation with the core member. In this case a plurality of load bearing column members would bear against the backup plate to hold the core member in the die-closed position during the injection of molten metal. Thus, this invention permits a core member, angularly disposed to the principal axis of a diecasting machine to be locked in the die cavity without using additional mechanisms, not a part of the machine. This means that the diecasting operation may be performed more economically and with greater safety.

A normal cycle of the machine is as follows. Starting in the die-closed position, molten metal is injected into the die cavity 54 by the shot plunger 36 through the shot cylinder 34. Upon solidification of the metal, the lockup pressure is released by the hydraulic closing cylinder 30 and the movable platen 16 begins to move in the opening direction in response to the pulling force transmitted through the toggle mechanism 32. The injection piston 36 follows through for a few inches forcing the ejector die holding block 22 to remain against the movable platen 16 and the backup plate 62. However, as the movable platen 16 is further moved toward its die-open position the entire ejector die holding block section 22 will separate from the backup plate 62 the distance permitted by the length of the stripper bolts 24. As this separation occurs, fluid pressure within the hydraulic cylinders 56 attached to the core slides 50 concomitantly acts upon pistons 52 to retract the slides 50 out of the casting. Similar hydraulic cylinders 56 operate to withdraw the die sections 42, 44, 46 and 48 from the casting and the die is now in the die-open position as shown in FIGURE 2. The casting, which remains adhering to the ejector die 40, is now removed. The removal is facilitated by the use of suitable ejector pins 68 which are actuated by means of a hydraulic ejector cylinder 70, as is known in the art. After removal of the casting the movable die sections 42, 44, 46 and 48 and the sliding cores 50 are returned to the casting position by operation of their respective cylinders 56. Coincidentally the movable platen 16 is pushed toward closing position by a force generated within the hydraulic closing cylinder 30 and transmitted through the toggle linkage 32. The wedge bearing surfaces 61 of the backup plate 62 seat on the bearing surface ends 65 of the core slides 50 or their backup columns 64. The movable platen 16 is moved against the movable ejector die holding block assembly 22 and sequentially pushes it into die-closed position against the cover die 20. The machine is now ready for the next injection.

Various modifications of the above-described embodi-

ment will be apparent to those skilled in the art for accomplishing the same object. It is to be understood that such modifications can be made without departing from the scope of the invention which should be considered limited only by the following claims.

I claim:

1. In a diecasting machine the combination comprising a stationary cover die and an ejector die assembly movable along the longitudinal axis of said machine between a die open and a die closed position cooperatively defining a cavity therebetween in said closed position, said ejector die assembly comprising a plurality of die portions including at least a first die portion movable between said die open and said die closed positions along said longitudinal axis and at least a second die portion disposed at an angle less than a right angle with respect to said longitudinal axis and movable between a second die open and a second die closed position, an independently movable backup plate disposed at the back side of said ejector die assembly attached thereto by a lost motion connection, said backup plate being movable along said longitudinal axis in a die closure direction to effect movement of said ejector die assembly to said die closed position and to lock said first die portion and second die portion in a die closed position and being operative on movement in the die opening direction to move into a spaced-apart relation from said die portion as permitted by said lost motion connection to permit movement of said second die to said second die open position and sequentially to move said first die portion to said die open position.

2. In a diecasting machine the combination comprising a stationary cover die and an ejector die assembly movable along the longitudinal axis of said machine between die assembly open and die assembly closed positions cooperatively defining a cavity therebetween in said die assembly closed position, said ejector die assembly comprising a plurality of die members including at least one die member movable along an axis at an angle less than a right angle with respect to said longitudinal axis between movable die open and movable die closed positions concomitantly with the movement of said die assembly, said die member having a die cavity end portion and an oppositely extending bearing surface portion, an independently movable backup plate disposed at the back side of said ejector die assembly and attached thereto by a lost motion connection, first power means operatively connected to said backup plate for reciprocal movement along said longitudinal axis, and second power means operatively connected to said movable die member for reciprocally moving said die member between said movable die open and movable die closed positions, said first named means being operative to move said backup plate against said ejector die assembly including the bearing end of said movable die when the latter is in said movable die closed position and to sequentially move said die assembly into said die closed position, said first named means being operative to retract said backup plate from said ejector die assembly within the limit of said lost motion connection permitting said second power means to withdraw said movable die member to said movable die open position said first means moving said die assembly into said die assembly open position.

3. A diecasting machine as in claim 2 wherein said backup plate is supported independently of said ejector die assembly.

4. A diecasting machine as in claim 2 wherein said bearing surface of said movable die member lies in a plane perpendicular to the axis of movement of said die member and wherein said backup plate has a wedge-shaped member protruding therefrom a surface of which lies in a plane perpendicular to the axis of movement of said movable die member, said member being adapted to bear against said bearing surface in said die closed position.

5. A diecasting machine as in claim 2 wherein said lost motion connection comprises at least one stripper bolt of sufficient length to permit the withdrawal of said movable die member to said movable die open position.

6. In a diecasting machine the combination comprising a fixed platen; a stationary cover die associated therewith; an ejector die assembly movable along the longitudinal axis of said machine between die assembly open and die assembly closed positions and adapted to register with said cover die cooperatively defining a cavity therebetween in said die assembly closed position; a movable platen; a backup plate associated with said movable platen, said backup plate being adapted to bear against said ejector die assembly opposite said fixed platen in said die assembly closed position, said movable platen and backup plate being attached to said ejector die assembly by a lost motion connection, said ejector die assembly comprising an ejector die supported by an ejector die supporting means and at least one die member movably supported by said ejector die supporting means movable along an axis disposed at an angle less than a right angle with respect to said longitudinal axis between movable die open and movable die closed positions concomitantly with movement of said ejector die assembly, said die member having a die cavity end portion and an oppositely extending bearing surface portion adapted to bear against said backup plate in said movable die member closed position; first hydraulic power means operatively connected to said movable platen for reciprocal movement along said longitudinal axis; and second hydraulic power means operatively connected to said movable die member for reciprocally moving said die member between said movable die open and movable die closed positions, said first hydraulic means being operative to move said movable platen and said backup plate against said ejector die assembly including said bearing surface of said movable die member when the latter is in said movable die closed position and to sequentially move said ejector die assembly into said die closed position, said first hydraulic means being operative to retract said movable platen from said ejector die assembly within the limit of said lost motion connection permitting said second hydraulic means to withdraw said movable die member to said movable die open position said first means moving said die assembly into said die assembly open position.

7. In a diecasting machine for casting V-type motor blocks, the combination comprising a fixed platen; a stationary cover die associated therewith; an ejector die assembly movable along the longitudinal axis of said machine between die assembly open and die assembly closed positions and adapted to register with said cover die cooperatively defining a cavity therebetween in said die assembly closed position; a movable platen; a backup plate associated with said movable platen, said backup plate being adapted to bear against said ejector die assembly opposite said fixed platen in said die assembly closed position; said movable platen and backup plate being attached to said ejector die assembly by at least one stripper bolt, said ejector die assembly comprising an ejector die supported by an ejector die supporting means and two core members each movably supported by said ejector die supporting means movable along an axis disposed at an angle less than a right angle with respect to said longitudinal axis between core member open and core member closed positions concomitantly with movement of said ejector die assembly, said core members being adapted to form the cylinder banks of said V-shaped engine block, each member having a die cavity end portion and an oppositely extending bearing surface portion adapted to bear against said backup plate in said core member closed position; first hydraulic power means operatively connected to said movable platen for reciprocal movement along said longitudinal axis; and second hydraulic power means opera-

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tively connected to said movable core member for reciprocally moving said core member between said movable core open and movable core closed position, said first hydraulic means being operative to move said movable platen and said backup plate against said ejector die assembly including said bearing surface of said movable core member when the latter is in said movable core closed position and to sequentially move said ejector die assembly into said assembly die closed position, said first hydraulic means being operative to retract said movable platen from said ejector die assembly within the length of said stripper bolt connection permitting said second hydraulic means to withdraw said movable core member to said movable core open position said first means moving said die assembly into said die assembly open position.

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