United States Patent

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[54] LOCKING MECHANISM FOR DIECASTING

4 Claims, 3 Drawing Figs.

[52] U.S. Cl. 164/343, 164/312
[51] Int. Cl. B22d 17/26
[50] Field of Search ..... 164/303, 341, 342, 343, 344, 137, 323, 333, 339, 340, 345; 18/DIG. 5, DIG. 10, DIG. 58, 30 LA, 30 LM, 34 R, 2 RM, 2 RP, 42 P, 30 WM, 30 WC; 249/63—68

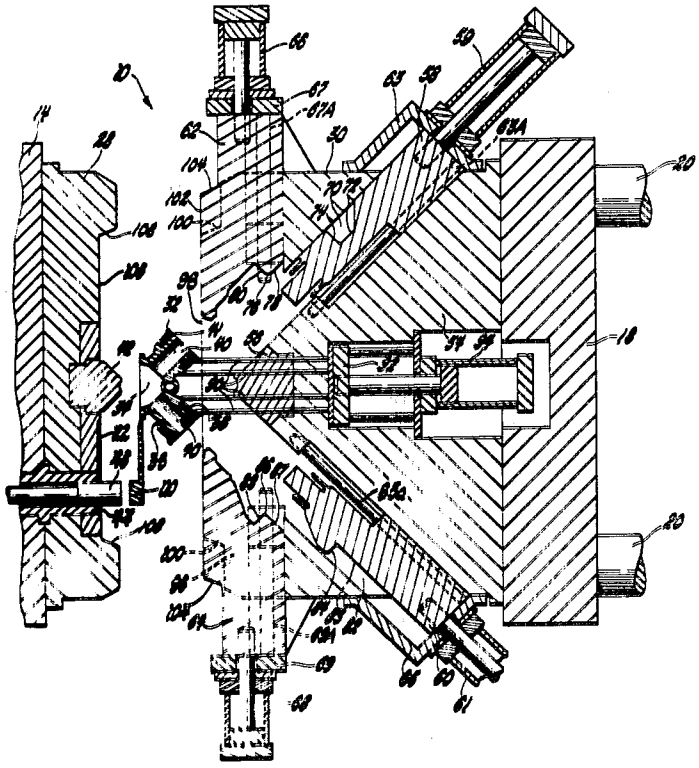
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ABSTRACT: A diecasting machine of the horizontal type including a stationary cover die and an ejector die movable along a longitudinal axis between a mold open and mold closed position. The ejector die comprises a plurality of die elements including die elements movable obliquely to the longitudinal axis of the die assembly and other die elements movable transversely of the longitudinal axis of the die assembly. In accordance with the invention the transversely movable die elements interlock with and hold the obliquely movable die elements in a closed position and the cover die interlocks with and holds the transverse die elements in a closed position when the cover die and ejector die assembly are in a closed position.



2 Sheets-Sheet 1

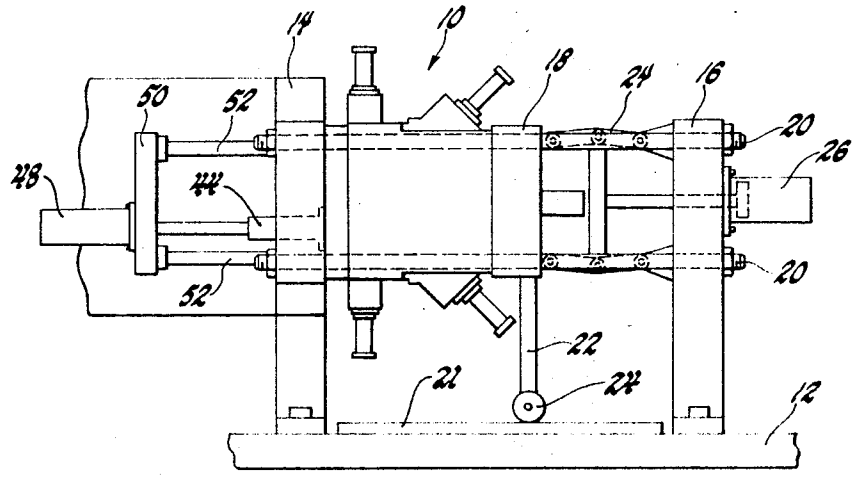


Fig. 1

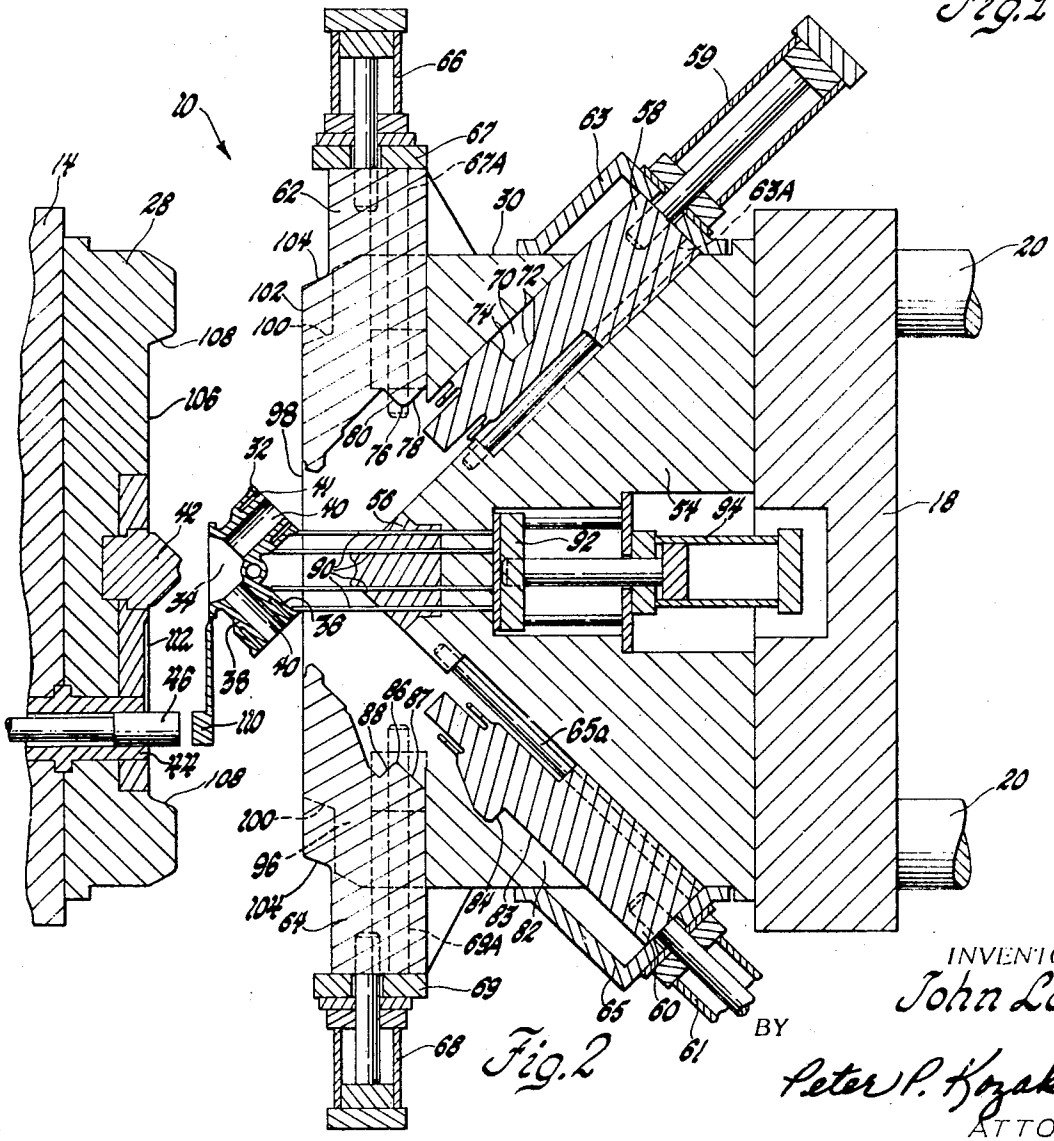


Fig. 2

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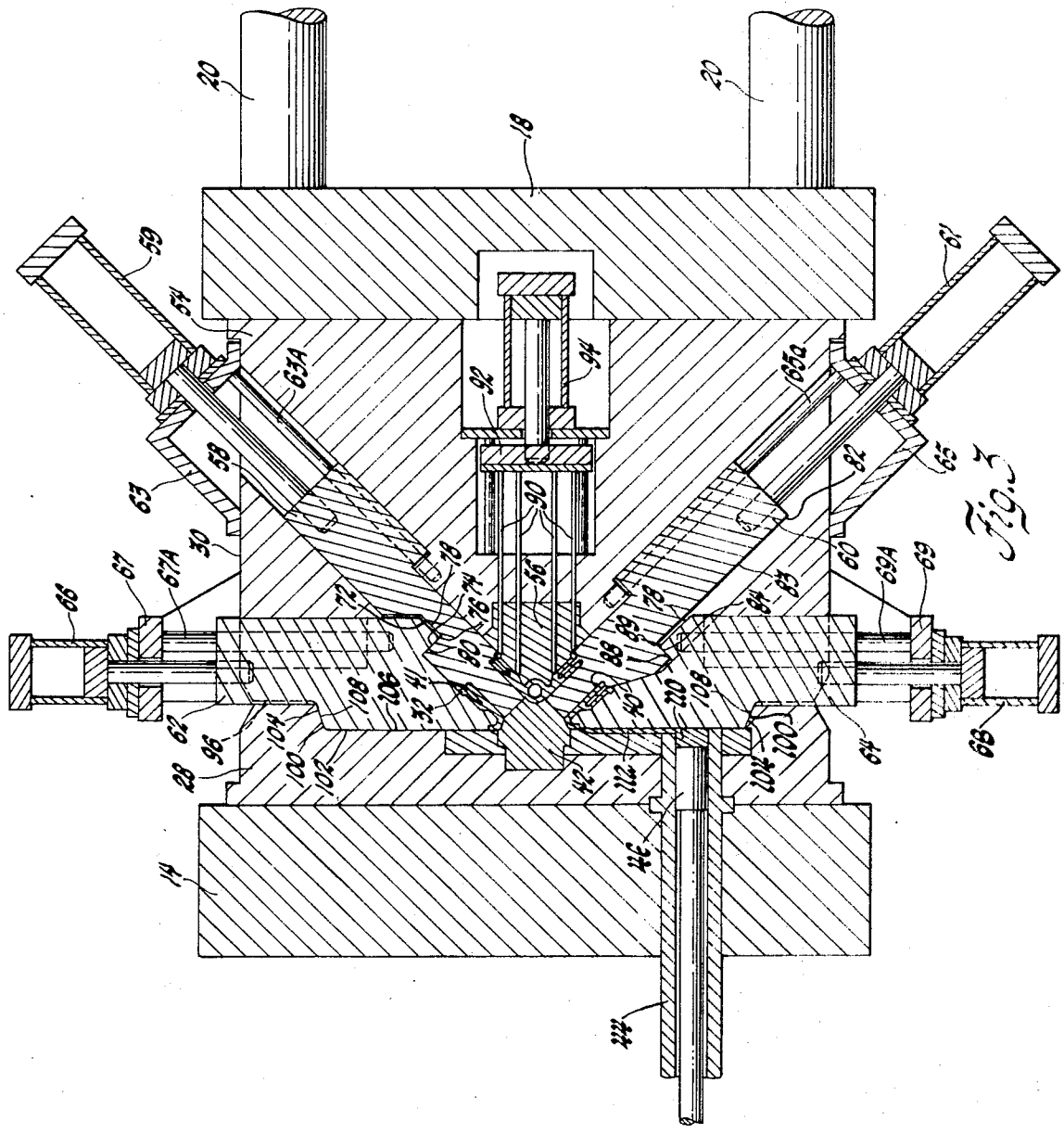


FIG. 2

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LOCKING MECHANISM FOR DIECASTING

This invention relates to die-casting machines having a plurality of relatively movable die members forming the movable ejector die assembly and more particularly to a means of interlocking the die members in a die-closed position during the molten metal injection step of the die-casting process.

In die-casting articles of complex shape such as an engine block, a plurality of movable die members are used which are registered in a die-closed position to form the die cavity and which are subsequently retracted to permit removal of the casting from the die. These die sections must be held in a die-closed position against high molten metal injection pressures in the vicinity of 10,000 pounds per square inch. In die casting an engine block, the die apparatus may consist of a cover die which defines the crank case portion of the block and an ejector die assembly which defined the top, the sidewalls and the cylinders of the block. The ejector die assembly may consist of a main portion which defines the top of the block, a pair of obliquely movable die portions or slides which form the barrel cores for forming the cylinders and a pair of opposed die portions or slides movable relative to the ejector die assembly transversely thereof which forms the sidewalls of the engine block.

It is an object of this invention to provide means for utilizing the locking force of the normal die-casting machine, i.e. the mechanical advantage obtained in the opening and closing mechanism to secure or lock all of the die members against movement when the dies are moved to a die-closed position.

It is a more specific object of this invention to provide recesses in the oblique dies or slides which are engaged by projections in the transverse dies in the die-closed position and further to provide projections on the transverse dies which engage a recess in the cover die whereby the transverse dies lock the oblique dies and the cover die locks the transverse dies in a die-closed position and whereby all the dies are maintained in the die-closed position by the normal locking force of the machine.

Other objectives and advantages of my invention will appear more clear from the following detailed description wherein reference is made to the accompanying drawings in which:

FIG. 1 is an elevation view of a die-casting machine embodying the invention with the dies of the machine being a closed and locked position;

FIG. 2 is an enlarged fragmentary sectional view of FIG. 1 except that the dies are shown in an open position;

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

Referring to the drawings and particularly to FIG. 1, a die-casting machine generally indicated at 10 includes a platform 12 which supports the stationary platen 14 and the vertical support 16.

The movable platen 18 is slidably supported on the tie rods 20 which in turn are supported by the stationary platen 14 and the support 16 in a well known manner. The movable platen is also supported by a pillar 22 attached to the movable platen and supported by the rollers 24 disposed in rolling engagement with the rails 21. The stationary support 16 and the movable platen 18 are interconnected by the toggle mechanism 24 whereby the movable platen 18 is movable reciprocably between a die-open position and a die-closed position by the hydraulic cylinder 26 in a well known manner.

The stationary platen 14 also supports a shot sleeve 44, a shot plunger 46 reciprocable therein and a hydraulic cylinder 48 connected to the shot plunger 46 and supported by the platen 50 attached to the stationary platen 14 by the rods 52 fixed to the platen 50 and the stationary platen 14.

The above described mechanism is of standard construction common to toggle-operated horizontal die-casting machines and the details thereof will be obvious to those familiar with the art.

Referring to FIG. 2, the stationary platen 14 carries the cover die 28 and the movable platen 18 carries the ejector die 30. In the preferred embodiment of this invention, the cover and ejector dies cooperate in a die-closed position to form a die cavity in the form of a V-type engine block. A typical casting 32 is shown in FIG. 2 including the crankcase cavity 34, the top surfaces 36, the sidewalls 38 and the cylinder bores 40.

The cover die 28 includes the die member 42 which defines the crankcase cavity 34 of the engine block. The stationary platen 14 and the cover die 28 contain and support the shot sleeve 44 and the shot plunger 46 as previously described.

The ejector die includes a main portion 54 mounted rigidly on the movable platen 18, a die portion 56 which defines the top portion 36 of the casting, the obliquely opposed barrel core members or die members 58 and 60 positioned at oblique angles to the longitudinal axis of the apparatus and movable relative to the main die member 54 between a die-open and a die-closed position. These oblique die members 58 and 60 are usually positioned at an angle of about 45° to the longitudinal axis of the ejector die and define the cylinder barrels 40 and the cooling passage 41 when in a die-closed position. The ejector die assembly also includes a pair of opposed die members 62 and 64 movable transversely of or perpendicularly to the longitudinal axis of the die-casting apparatus. The die members 62 and 64 define the sidewalls or bulkheads 38 of the engine block 32 when they are in a die-closed position.

The die portions 58 and 60 are reciprocably movable with respect to the main die member 54 by means of the hydraulic cylinders 59 and 61, respectively, supported on the main die portion 54 by means of the brackets 63 and 65 and guided and supported by the tie rods 63A and 65A respectively. The transverse die portions 62 and 64 are movable relative to the main die member 54 by means of hydraulic cylinders 66 and 68, respectively, and are supported on the main die member 54 by means of the brackets 67 and 69, respectively, and are guided and supported by the tie rods 67A and 69A.

In accordance with the principal features of this invention the barrel core or oblique die portion 58 includes a depression 70 therein including a sidewall 72 parallel to the longitudinal axis of the barrel core 58 and a sidewall 74 perpendicular thereto. The transverse die portion 62 includes a projection 76 having a sidewall 78 parallel to the longitudinal axis of the barrel core 58 and a sidewall 80 perpendicular to the longitudinal axis of the barrel core 58. As may be readily seen the side wall 80 of the projection 76 is adapted to engage the sidewall 74 of the recess 70 when the core member 58 and the transverse die portion 62 are in a die-closed position as shown in FIG. 3.

The barrel core 60 similarly has a recess 82 having a sidewall 83 parallel to the longitudinal axis of the barrel core 60 and a sidewall 84 perpendicular to the longitudinal axis of the barrel core 60. The transverse die portion 64 similarly has a projection 86 having a sidewall 87 parallel to the sidewall 83 and a sidewall 88 parallel to the sidewall 84.

The ejector die assembly 30 also includes the conventional ejector pins 90 attached to the ejector plate 92 operated by the hydraulic mechanism 94 in a well known manner.

The face 96 of the ejector die 54 portion facing the cover die is provided with a central protruding portion 98 bounded by the transversely extending angular surface 100. The transverse die portions 62 and 64 are shaped so that the protruding portion 102 thereof bounded by the transverse surface 104 coincide with the surface 108 of the cover die member 28 when the transverse die members are in a die-closed position. The cover die 28 is provided with a recessed surface 106 bounded by the transversely extending surface 108 which form a lock with surfaces 104 of the ejector die assembly when the cover and ejector dies are in a die-closed position.

FIG. 2 shows the apparatus after the engine block has been cast and ejected. In returning the apparatus to a casting position the ejector pins 90 are retracted by the hydraulic cylinder 94 so that the ends thereof are flush with the surface of the die element 56. Next, barrel cores 58 and 60 are moved to a die-closed position as shown in FIG. 3 by means of the hydraulic

cylinders 59 and 61, respectively. Then the transverse die portions 62 and 64 are moved toward each other to a die-closed position as shown in FIG. 3 by means of the hydraulic cylinders 66 and 68, respectively, with the surface 80 of the projection 76 engaging the surface 74 of the recess 70; and with the surface 88 of the projection 86 engaging the surface 84 of the recess 82 whereby the transverse die members 62 and 64 securely lock the barrel cores 58 and 60, respectively, in a die-closed position.

The tip of the plunger 46 is then retracted and the movable platen is moved toward the cover die 28 by means of the hydraulic cylinder 26 and the toggle linkage 24 to a die-closed position whereby the protruding die face 98 of the ejector die engages the recess die face 106 of the cover die and whereby the angular surfaces 108 of the cover die engage the angular surfaces 100 of the ejector die and the angular surfaces 104 of the transverse dies 62 and 64 and whereby the cover die 28 locks the transverse dies 62 and 64 in a die-closed position. The toggle linkage 24 is operative to maintain the cover and ejector dies in a die-closed position against the load of casting pressures, and is operative also to hold the transverse dies 62 and 64 and the barrel cores 58 and 60 in a die-closed position by reason of the interlocking die arrangement described.

The molten metal is then injected into the cavity formed between the die members and permitted to cool. During this time the plunger 46 continues to exert pressure on the solidifying metal bun 110 and on the casting through the runner 112. After the casting has solidified the hydraulic mechanism 26 is operated to move the ejector die to an open position. The pressure of the plunger 46 forces the bun 110 from the shot sleeve and the casting 32 is freed from the cover die and carried by the ejector die. The transverse die portions 62 and 64 are then retracted freeing the barrel cores 58 and 60 which are then retracted. The casting is then readily ejected by means of the ejector pins 90 operated by the hydraulic cylinder 94.

The apparatus and method of operation described herein has substantial advantages of space conservation and simplicity of operation and ease of adjustment in comparison to mechanisms of the prior art. Although the invention has been described in terms of apparatus for making engine blocks it is obvious that the principles involved may be applied to casting other articles within the scope of the invention.

What I claim is:

1. In a die-casting 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 defining a die cavity therebetween in said closed position,

said ejector die assembly comprising a plurality of die portions movable independently of said cover die between an ejector die open-and-closed position including a first main die portion movable between said die-open and die-closed positions along said longitudinal axis, a second die portion carried by said first die portion at less than a right angle to said longitudinal axis and movable between said ejector die open-and-closed positions and a third die portion carried by said first die and movable transversely of said longitudinal axis between said ejector die open-and-closed positions,

said second die portion including depression means and said third die portion including projection means and said depression means being adapted to receive said projection means when said second and third die portions are each in said ejector die-closed position whereby said third die portions lock said second die in said ejector die-closed position,

said third die portion including projection means and said cover die including depression means and said third die portion projection means being adapted to be received in said cover die depression means when said cover die and said ejector die assembly are in said die-closed position whereby said third die portion is locked in said die-closed position and

means for holding said cover die and ejector die assembly in said die-closed position.

2. In a die-casting 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 defining a die cavity therebetween in said closed position,

said ejector die assembly comprising a plurality of die portions movable independently of said cover die between an ejector die open-and-closed position including a first main die portion movable between said die-open and die-closed positions along said longitudinal axis, a pair of opposed second die portions carried by said first die portion at less than a right angle to said longitudinal axis comprising movable between said ejector die open-and-closed positions and a pair of opposed third die portions carried by said first die and movable transversely of said longitudinal axis between said ejector die open-and-closed positions,

each of said second die portions including depression means and each of said third die portions including projection means and each of said depression means being adapted to receive one of said projection means when said second and third die portions are each in said ejector die-closed position whereby said third die portions lock said second die portions in said ejector die-closed position,

said third die portions including projection means and said cover die including depression means and said third die portions projection means being adapted to be received in said cover die depression means when said cover die and said ejector die assembly are in said die-closed position whereby said third die portions are locked in said die-closed position and

means for holding said cover die and said ejector die assembly in said die-closed position.

3. The die-casting machine of claim 1 wherein said second die portion depression means includes a first surface perpendicular to the longitudinal axis of said second die portion and said third die portion projection means includes a second surface perpendicular to the longitudinal axis of second die portions, said first and second surface being adapted to engage one another in said ejector die assembly closed position.

4. In a die-casting machine for casting a V-type engine block including a crankcase cavity, sidewalls, a top side and a plurality of cylinders 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 defining a die cavity therebetween in said closed position, said cover die defining the crankcase cavity and said ejector die assembly defining the said cylinders, sidewalls and top surfaces of said block,

said ejector die assembly comprising a plurality of die portions movable independently of said cover die between an ejector die open-and-closed position including a first main die portion movable between said die-open and die-closed positions along said longitudinal axis, said first die portion defining the top surface of said block, a pair of opposed second die portions carried by said first die portion at less than a right angle to said longitudinal axis and movable between said ejector die open-and-closed positions for defining the said cylinders of said block and a pair of opposed third die portions carried by said first die and movable transversely of said longitudinal axis between said ejector die open-and-closed positions for defining the said sidewalls of said block,

each of said second die portions including depression means and each of said third die portions including projection means and each of said depression means being adapted to receive one of said projection means when said second and third die portions are each in said ejector die-closed position whereby said third die portions lock said second die portions in said ejector die-closed position,

said third die portions including projection means and said cover die including depression means and said third die portion projection means being adapted to be received in said cover die depression means when said cover die and said ejector die assembly are in said die-closed position whereby said third die portions are locked in said die-closed position and

means for holding said cover die and said ejector die assembly in said die-closed position.