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Farrell

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[54] **BREECH MECHANISM INCLUDING SELF-ALIGNING BREECH BLOCKS**

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[52] **U.S. Cl.** **425/450,** 74/527, 425/242, 164/341

[51] **Int. Cl.** **B29f 1/00,** G05g 5/06

[58] **Field of Search** 425/149, 150, 242, 450; 74/527; 164/341

[56] **References Cited**

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2,862,238	12/1958	Cuzzi	425/450
3,465,387	9/1969	Allard et al.	425/149
3,505,708	4/1970	Moslo	425/242 X
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FOREIGN PATENTS OR APPLICATIONS

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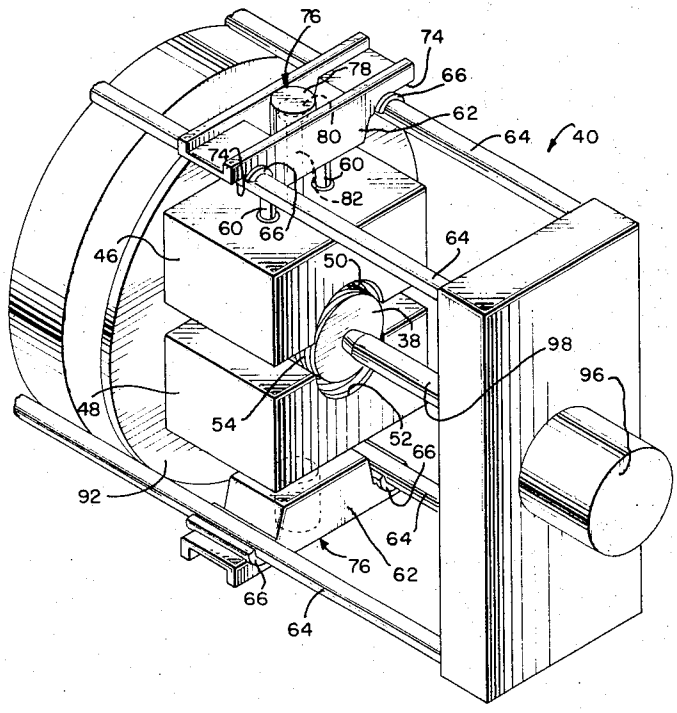
Primary Examiner—R. Spencer Annear

Attorney, Agent, or Firm—Robert R. Paquin; David W. Tibbott

[57] **ABSTRACT**

A molding machine of the type comprising tie rods mounted to one platen which are received by breech mechanisms associated with a second platen. Each breech mechanism comprises a plurality of cooperative breech blocks driven towards-and-away from one another by individual cylinder-and-piston actuators which exert equal, oppositely directed moving forces on the breech blocks. The breech blocks are mounted for lateral and longitudinal movement relative to their respective tie rods, thereby enabling the breech blocks to be self-aligning with the tie rods and accommodating tie rod stretch.

14 Claims, 5 Drawing Figures



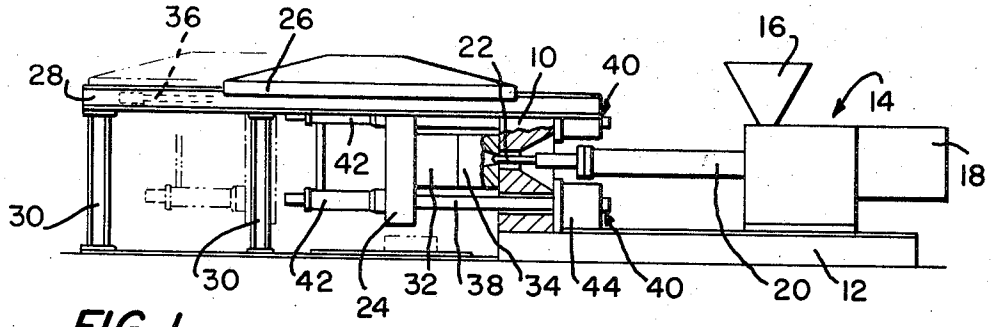


FIG. 1

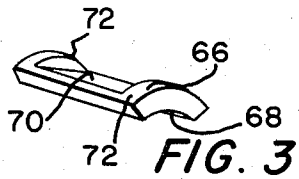


FIG. 3

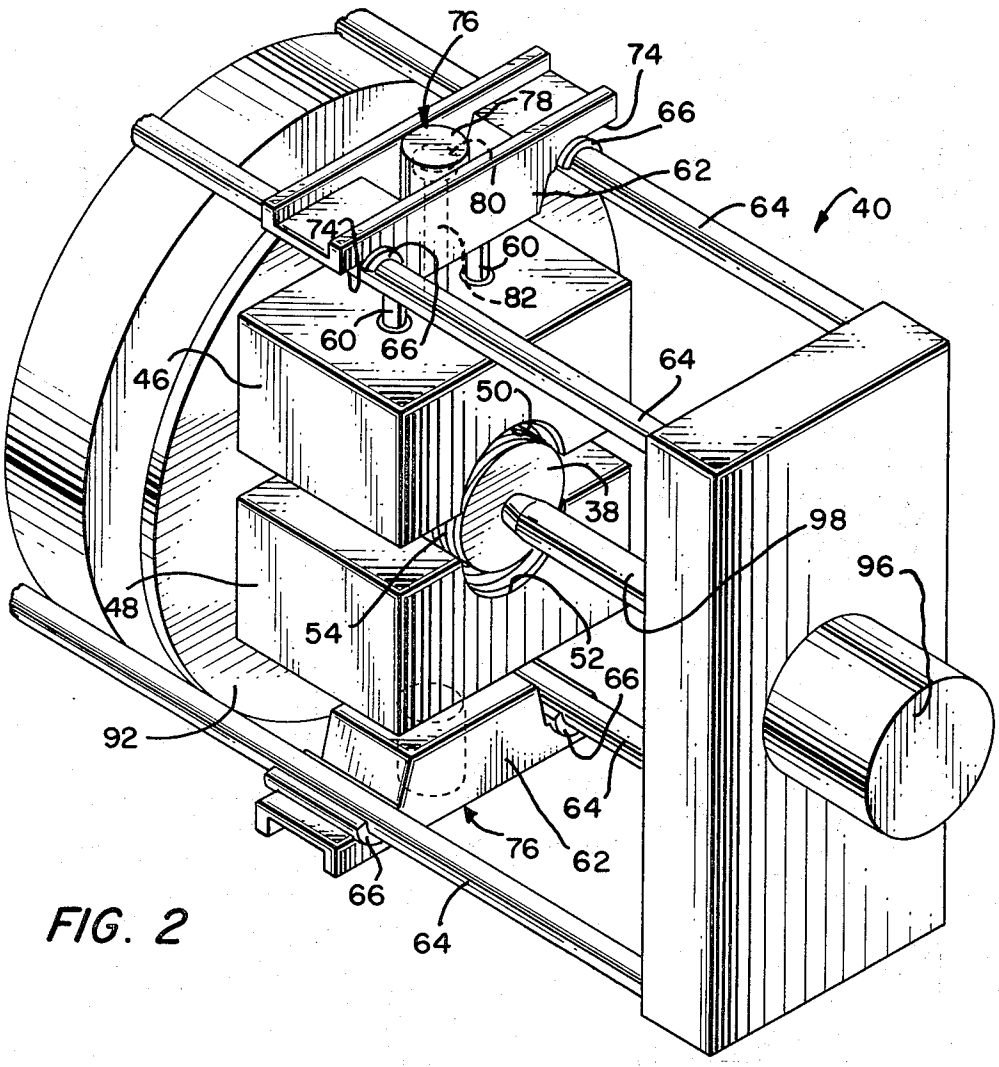


FIG. 2

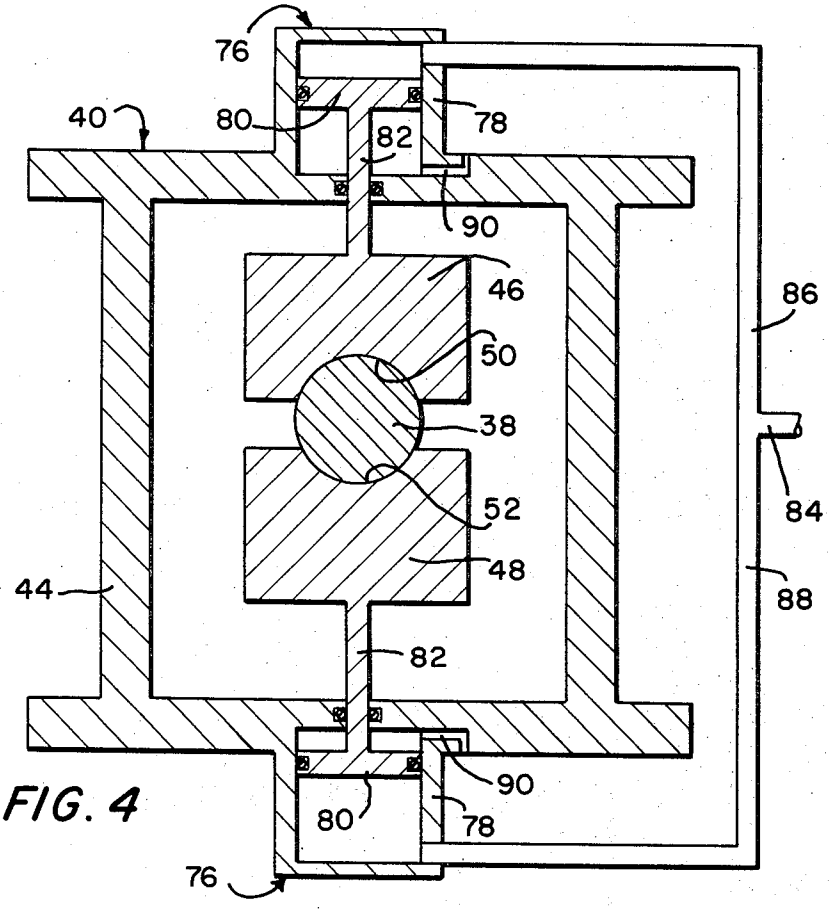

76
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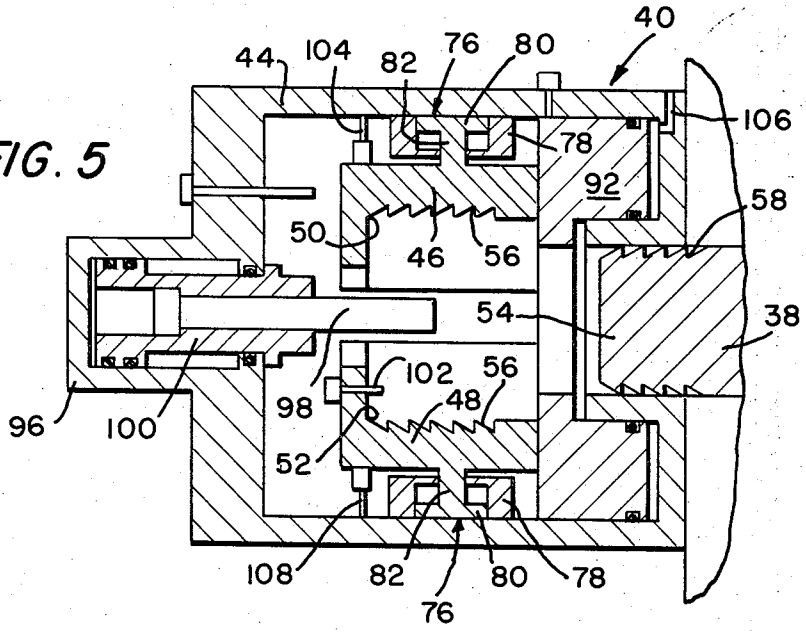
FIG. 4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106
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FIG. 5

BREECH MECHANISM INCLUDING SELF-ALIGNING BREECH BLOCKS

The present invention relates to molding machines including tie rods gripped by breech mechanisms during the machine operation and more particularly to the provision of a new and improved breech mechanism for a molding machine of this type.

Conventionally, a breech mechanism of such a molding machine generally has included a plurality of breech blocks, cooperative to grip a therebetween tie rod, which are driven towards-and-away from one another by actuating means in the form of a single cylinder-and-piston actuator or other similar driving means producing unbalanced reaction forces when the breech blocks engage a tie rod. Conventionally, also, the breech blocks frequently have not been both self-alignable with the received tie rod and capable of accommodating tie rod stretch.

An object of the present invention is to provide a new and improved breech mechanism for a molding machine, which breech mechanism is particularly constructed and arranged to minimize the reaction effects arising when the breech blocks engage a tie rod.

Another object is to provide a new and improved breech mechanism for molding machine, which breech mechanism is particularly constructed and arranged such that equal and opposite moving forces are exerted on the breech blocks.

Another object is to provide a new and improved breech mechanism for a molding machine, which breech mechanism is particularly constructed and arranged to enable the breech blocks to be both readily self-alignable with the received tie rod and also capable of accommodating tie rod stretch.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein, as will be understood, the preferred form of the invention has been given by way of illustration only.

In accordance with the invention, a molding machine may comprise a first platen, a second platen movable towards-and-away from the first platen, at least one tie rod mounted to one of the platens longitudinally projecting from such platen towards the other thereof, a breech mechanism associated with said other platen for gripping the tie rod, the breech mechanism including a plurality of breech blocks cooperative to grip a therebetween tie rod and moveable towards-and-away from one another, actuating means for moving each of the breech blocks towards-and-away from the other, and such actuating means comprising an individual pressure fluid operative cylinder-and-piston actuator for each of the breech blocks. Also, in accordance with the invention, each breech block may be mounted for movement both laterally and longitudinally of the tie rod by a mounting means comprising support means, shoe means movably on the support means, and carriage means connected to the breech block and movably mounted on the support means by the shoe means.

Referring to the drawings:

FIG. 1 is an elevational view, partially broken away and in section, of an injection molding machine including a plurality of breech mechanisms constructed in accordance with one embodiment of the invention;

FIG. 2 is an enlarged, perspective view illustrating one of the breech mechanisms of the injection molding machine shown in FIG. 1;

FIG. 3 is a perspective view illustrating one of the shoes supporting the breech blocks of the breech mechanism shown in FIG. 2;

FIG. 4 is a view schematically illustrating the supply of pressure fluid to the cylinder-and-piston actuators for the breech blocks of such breech mechanism; and

FIG. 5 is a view schematically illustrating the breech mechanism shown in FIG. 2.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, FIG. 1 illustrates the breech mechanism of the invention as applied to a molding machine of the type described in U.S. Pat. No. 3,590,418, issued July 6, 1971 and assigned to the assignee of the present invention. It will be understood, however, that the invention has been shown and described as applied to such machine only for the purposes of illustration; and the invention is equally applicable to other forms of molding machines of the beforedescribed general type.

The molding machine illustrated in FIG. 1 comprises a generally vertical first platen **10** mounted upon the upper surface of a ground supported base or base pad **12** which also carries the injection unit of the molding machine, such injection unit being designated generally as **14.** The injection unit **14** may be of any suitable conventional construction and, as shown, includes a receiving hopper **16,** an injection ram device **18,** a plasticizing and feed device **20,** and a discharge nozzle **22** which projects through an opening through the first platen **10.** A generally vertical second platen **24,** oppositely disposed to the first platen **10,** is suspended by a supporting shoe **26** from a generally horizontal guide track **28** which is, in turn, ground mounted by a plurality of supporting posts **30.** The platens **10,24** carry the usual mating mold sections or halves **32,34;** and the second platen **24** is, during the operation of the machine, driven by a cylinder-and-piston motor **36** towards-and-away from the first platen **10** between a mold closed position (shown in solid lines in FIG. 1) and a mold fully open position (shown in broken lines in FIG. 1).

The second platen **24** carries four tie rods **38** which project horizontally from the second platen **24** towards the first platen **10** and, with the second platen **24** in its mold closed position, slidably extend through openings in the first platen **10** into individual breech mechanisms, each designated generally as **40,** associated with the latter. The tie rods **38,** as illustrated, extend through the second platen **24** into individual retraction tubes **42** mounted on the second platen **24** and are in the manner described in U.S. Pat. No. 3,465,387, issued Sept. 9, 1969 and assigned to the assignee of the present invention, adjustable by drive means (not shown) on the second platen **24** to vary the portions of their lengths projecting from the second platen **24** towards the first platen **10.** Such portions of the lengths of the tie rods **38,** as will be understood, are advantageously maintained sufficiently short to permit the tie rods **38** to be entirely removed from their openings in the first platen **10** during the movement of the second platen **24** away from the latter thereby facilitating the

discharge of a formed part from between the mold halves **32,34.**

Further details of the construction and operation of a molding machine of this general type, if desired, can be obtained from the beforementioned U. S. Pat. No. 3,590,418; and it will be understood that, as disclosed in such patent, the tie rods **38** alternatively could be mounted to the first platen **10** in which event the breech mechanisms **40** would be associated with the second platen **24** for movement therewith.

The breech mechanisms **40** are all of identical construction and arrangement and hence, although only one thereof has been illustrated in FIGS. **2** through **5** and hereinafter specifically described, it will be understood that all of the other breech mechanisms **40** are the same as that so illustrated and described. The breech mechanisms **40** each include a breech housing or casing **44** containing aligned, upper and lower breech blocks **46,48,** respectively, which are vertically movable towards-and-away from one another and provided with semi-circular recesses **50,52** cooperative to grip the end **54** of a tie rod **38** between the breech blocks **46,48.** The semi-circular recesses **50,52** and the tie rod end **54,** as illustrated, are preferably provided with cooperative grooves **56,58,** respectively, facilitating the gripping of the rod end **54** by the breech blocks **46,48.**

As illustrated in FIG. **2,** the breech blocks **46,48** are mounted in a manner permitting their longitudinal and lateral movement relative to a therebetween tie rod end **54,** thus accommodating tie rod stretch and enabling the breech blocks **46,48** to be self-aligning with the tie rod end **54.** More particularly, the breech blocks **46,48** are slidably mounted for their beforedescribed vertical movement on a pair of vertical slide rods **60** which at opposite ends are affixed to carriage frames or carriages **62.** The carriages **62,** in turn, are each slidably mounted on a pair of horizontal slide rods **64,** extending parallel to the tie rod **38,** by separate supporting or bearing shoes **66** located intermediate the carriage **62** and each of the horizontal slide rods **64.** The bearing shoes **66** each include an arcuate bearing surface **68** slidably engaging the arcuate periphery of their respective horizontal slide rod **64** and an opposite flat keying surface **70,** bounded adjacent the ends of the bearing shoe **66** by arcuate retaining positions **72** thereof, which engages a corresponding flat surface **74** on a carriage **62** to key the latter to the bearing shoe **66.** Hence, the carriages **62** are resultantly slidable both longitudinally along and laterally of the horizontal tie rods **62;** and the breech blocks **46,48,** being carried by the carriages **62** through the vertical slide rods **60,** are enabled to both move longitudinally of the tie rod **38** to accommodate tie rod expansion and horizontally laterally of the tie rod **38** to readily self-align therewith.

The breech blocks **46,48** are vertically driven towards-and-away from each other by individual cylinder-and-piston actuators **76** carried by the carriages **62** whereby the actuators **76** for the breech blocks **46,48** are on opposite sides of the latter. The actuators **76** are of identical construction and size and each include a cylinder **78** fixedly mounted on a carriage **62** and a piston **80** which is slidably in the cylinder **78** and connected to a breech block **46** or **48** by an extension rod **82.** Both of the actuators **76** of each breech mechanism **40** are connected to a common source of pressure fluid whereby the fluid at such common pressure is supplied to their cylinders **78** to drive the breech blocks **46,48** towards one another. More specifically, as schematically depicted in FIG. **4,** the pressure fluid is supplied through a singly supply conduit **84,** communicating with a source (not shown) of the pressure fluid, and branch conduits **86,88** connecting the head ends of the cylinders **78** of both actuators **76** to such supply conduit **84.** As a result of the before-described construction and arrangement, the reaction forces produced in each breech mechanism **40** upon engagement of the breech blocks **46,48** with a therebetween tie rod end **54** are equal and opposite. Hence, these reaction forces cancel each other within the assembly formed by the carriages **62** and the breech blocks **46,48;** and the reaction forces produced between such assembly and the horizontal slide rods **64** is only equal to the weight of the assembly. Also, as the head ends of the cylinders **78** of the actuators **76** are connected to receive pressure fluid from a common supply conduit **84,** full gripping pressure on the tie rod end **54** can only occur after both breech blocks **46,48** engage the end **54;** and, as the gripping forces of the breech blocks **46,48** on the tie rod end **54** are equal and opposite, such gripping does not in any manner tend to move the tie rod **38** or to cause an undesirable net reaction therein.

The rod ends of the cylinders **78** of the actuators **76** are provided with individual fluid connections **90** which communicate with the source (not shown) of the pressure fluid in a conventional manner; and suitable conventional valving means (not shown) interconnect the fluid connections **90** and the supply conduit **84** whereby, in the conventional manner, pressure fluid may be selectively supplied through each thereof to one end of each of the cylinders **76** while fluid is exhausted through the other thereof from the other end of each cylinder **76.**

Each breech mechanism is provided with the usual load cell **92** which, after the tie rod ends **54** have been gripped by the breech blocks **46,48** of all of the breech mechanisms **40,** is the usual manner fluid actuated to exert clamping force on the second platen **24** through the respective adjacent breech blocks **46,48** and their gripped tie rod **38.** In addition, as illustrated, each breech mechanism **40** is provided with a cylinder **96,** aligned with its respective tie rod **38,** which slidably contains both a cushioning piston **98** and a there-surrounding break-away or push-back piston **100.** The cushioning piston **98,** as will be understood, is fluid biased to engage the tie rod end **54** during axial movement of the tie rod **38** into the breech mechanism **40,** thereby cushioning or absorbing the shock of such tie rod movement. The push-back piston **100** is fluid actuated to, in cooperation with the cushioning piston **98,** assist in initiating axial movement of the tie rod **38** out of the breech mechanism **40** after opening of the breech blocks **46,48** by their movement from one another. Load cells and cushioning and push-back cylinder-and-piston arrangements of this general type are, of course, per se well known in the art. For example, the beforementioned U.S. Pat. No. 3,465,387 described generally similar apparatus for these purposes.

The operation of the before described molding machine is believed to be apparent from the preceeding description. However, in order to insure understanding of the breech mechanisms **40,** a brief description of their operation is hereinafter given.

During the driven movement of the second platen **24** towards its mold closed position, the tie rod ends **54** are moved intermediate the open breech blocks **46,48** of their respective breech mechanisms **40,** while low pressure fluid in the cylinders **96** causes the cushioning cylinders **98** to cushion the tie rod movement. Each tie rod end **54** during its said movement trips the usual limit switch **102** whereupon, after all such limit switches **102** have been so tripped indicating that the tie rod ends **54** are all in position for gripping by their respective breech blocks **46,48,** pressure fluid is caused to flow from the source (not shown) through the supply conduits **84** and branch conduits **86,88** to the head ends of the cylinders **78.** Simultaneously, pressure fluid is exhausted from the rod ends of the cylinders **78;** and, hence, the breech blocks **46,48** of each breech mechanism **40** are vertically driven towards one another to closed positions wherein they cooperate to grip the therebetween tie rod end **54** and then apply full clamping force to the latter. The breech blocks **46,48** during their said driven movement, automatically move laterally as necessary for their self-alignment with the tie rod ends **54** and also longitudinally of the tie rods **38** as necessary to compensate for tie rod stretch.

During the movement of the breech blocks **46,48** to their closed positions, the limit switch **104** is resultantly tripped, thereby causing pressure fluid to be supplied through the passage **106** to the load cell **92.** This pressure fluid in the conventional manner causes the load cell **92** to apply clamping force on the second platen **24** through the breech blocks **46,48** and the tie rods **38;** and during the application of such clamping force, plasticized material is injected between the mold halves **32,34.** Then, after a predetermined time period preset into the usual timer, the passage **106** is connected to exhaust, thereby releasing the clamping pressure; and pressure fluid is supplied to the rod ends of the actuator cylinders **78,** while fluid is exhausted from the head ends thereof, thereby driving the breech blocks **46,48** one from the other to their open positions. Thereupon, the limit switch **108** is tripped causing the pistons **98,100** to be fluid driven to initiate movement of the tie rods **38** out of the breech mechanisms **40** and the second platen **24** is driven away from the first platen **10** preparatory to commencing another operating cycle of the machine.

From the preceding description it will be seen that the invention provides new and improved means for accomplishing all of the aforestated objects and advances. It will be understood, however, that, although only a single embodiment has been illustrated and herein beforedescribed, the invention is not limited merely to this such single embodiment, but rather contemplates other embodiments and variations within the scope of the following claims.

Having thus described my invention, I claim:

1. In a molding machine, a first platen, a second platen movable towards-and-away from said first platen, at least one tie rod mounted to one of said platens longitudinally projecting from said one platen towards the other thereof, a breech mechanism associated with said other platen for gripping said tie rod, said breech mechanism including a purality of breech blocks cooperative to grip a therebetween tie rod and movable towards-and-away from one another, actuating means for moving each of said breech blocks towards-and-away from the other, said actuating means comprising individual pressure fluid operated cylinder-and-piston actuators for each of said breech blocks, means mounting said breech blocks for movement longitudinally of said tie rod and also laterally of said tie rod to permit self-alignment of said breech blocks with a therebetween tie rod during movement of the breech blocks towards one another, said mounting means for each said breech block including rod means on the opposite side of said other platen from said one platen and extending longitudinally of said tie rod, carriage means connected to the breech block, and shoe means mounting said carriage means on said rod means for both longitudinal and lateral movement thereon.

2. A molding machine according to claim **1,** wherein said cylinder-and-piston actuators are constructed to cause equal oppositely directed moving forces to be exerted on said breech blocks.

3. A molding machine according to claim **1,** wherein said cylinder-and-piston actuators are on opposite sides of said breech blocks.

4. A molding machine according to claim **1,** further comprising supply means for supplying pressure fluid at common pressure to said cylinder-and-piston actuators.

5. A molding machine according to claim **4,** wherein said supply means comprises a supply conduit communicating with a source of the pressure fluid, and branch conduits connecting said supply conduit with said cylinder-and-piston actuators.

6. A molding machine according to claim **1,** wherein said cylinder-and-piston actuators are constructed to cause pressure fluid at common pressure to exert equal, oppositely directed forces on said breech blocks during their movement towards one another, and further comprising supply means for supplying fluid at common pressure to said cylinder-and-pressure actuators to so move said breech blocks.

7. A molding machine according to claim **6,** wherein said supply means comprises a supply conduit communicating with a source of pressure fluid and branch conduits connecting said supply conduit with said cylinder-and-piston actuators.

8. A molding machine according to claim **1,** wherein each said shoe means comprises arcuate bearing surface means slidably engaging a said rod means and also keying surface means keying said carriage means to the shoe means.

9. A molding machine according to claim **1,** wherein each said rod means comprises a plurality of horizontal slide rods, each said shoe means comprises a plurality of shoe members each having an arcuate bearing surface slidably on one of said slide rods and also a keying surface keying a said carriage means to the shoe member, and further comprising vertical slide rod means mounting said breech blocks to said carriage means.

10. A molding machine according to claim **9,** wherein the said keying surface of each said shoe member is bounded adjacent opposite ends of the shoe member by retaining portions of the latter.

11. In a molding machine, a first platen, a second platen movable towards-and-away from said first platen, at least one tie rod mounted to one of said platens longitudinally projecting from said one platen towards the other thereof, a breech mechanism associated with said other platen for gripping said tie rod, said breech mechanism including a plurality of breech blocks cooperative to grip a therebetween tie rod and

movable towards-and-away from one another, motor means for moving each said breech block towards-and-away from the other, and means mounting said breech blocks for movement both longitudinally and laterally to said tie rod, said mounting means for each said breech block comprising rod means on the opposite side of said other platen from said one platen and extending longitudinally of said tie rod, and carriage means connected to the breech block and mounted on said rod means for both longitudinal and lateral movement thereon.

12. A molding machine according to claim **11**, wherein each said mounting means further comprises shoe means mounting the carriage means on the rod means for movement thereon.

13. A molding machine according to claim **12**, wherein said shoe means is separate from both said carriage means and said rod means.

14. A molding machine according to claim **13**, wherein each said rod means comprises a plurality of horizontal slide rods, each said shoe means comprises a corresponding plurality of shoe members each having an arcuate bearing surface slidably on one of said slide rods and also a keying surface keying a said carriage means to the shoe member, and further comprising vertical slide rod means mounting said breech blocks to said carriage means.

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