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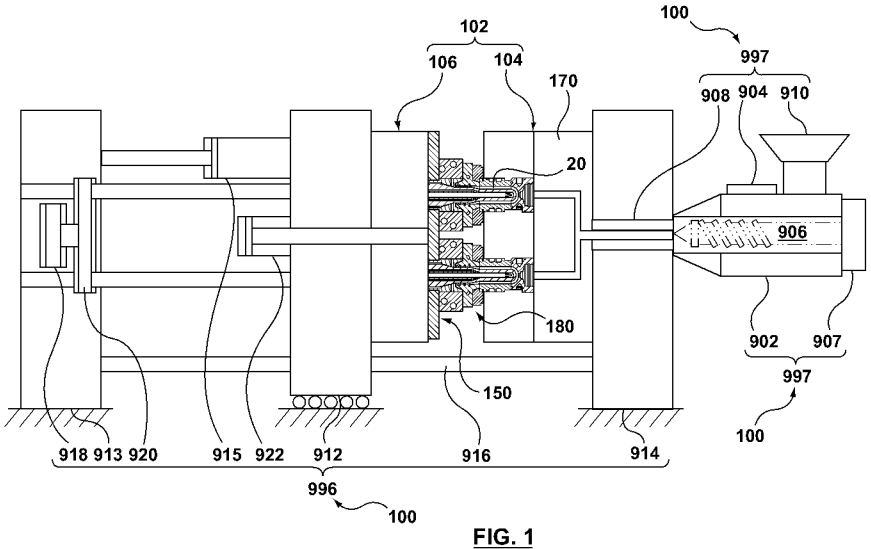



FIG. 1

(57) **Abstract**: According to one aspect, there is provided a latch assembly ( 108, 208, 308, 408, 508) for use in a molding system ( 100) that includes an injection mold ( 102). The latch assembly ( 108, 208, 308, 408, 508) includes a first coupler ( 1 12, 212, 312, 412, 512) that is configured to interact, in use, with a stationary member of the molding system ( 100). The latch assembly ( 108, 208, 308, 408, 508) also includes a second coupler ( 1 14, 214, 314, 414, 514) that is configured to interact, in use, with a movable member of the injection mold ( 102). The first coupler ( 1 12, 212, 312, 412, 512) and the second coupler ( 1 14, 214, 314, 414, 514) are configured to cooperate, in use, to selectively latch, during operation of the molding system ( 100), the stationary member with the movable member, whereby the movable member performs a molding operation with opening of the injection mold ( 102).

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# LATCH ASSEMBLY

## TECHNICAL FIELD

An aspect of the present invention generally relates to, by example, but is not limited to, a latch assembly for use with a stripper assembly of an injection mold.

## BACKGROUND

United States Patent 4,174,939 to BERND, Fenner, published on November 20, 1979 describes a latch for a mold having an inner mold part sandwiched between fixed and movable outer mold parts comprises a pair of bars each mounted on a respective one of outer mold parts and a locking pin mounted on the inner mold part but displaceable thereon in a direction perpendicular to the direction of motion of the mold parts during opening and closing. One of the bars is formed with a seat in which the pin is snugly engageable when the respective outer mold part is snugly engaged with the inner mold part, and the other outer mold part can only move against the inner mold part when this pin is seated in the recess as otherwise it blocks a control surface of the bar of the outer mold part. A bolt provided in the inner part is also slideable to block displacement of the other outer mold part toward the inner mold part until the one outer mold part is relatively closely juxtaposed with the inner mold part and a control surface of the respective bar cams the bolt out of the way of the other part.

United States Patent 4,403,810 to BIENECK, Gunther, published on September 13, 1983 teaches a tripartite mold has a control bar on a fist outer plate and a locking bar parallel thereto on a second outer plate, both of them traversing respective passages in a guide block on an intermediate plate when the mold is closed. A U-shaped detent, sliding transversely to the two bars in a channel of the guide block, straddles the locking bar with clearance and is urged by spring pressure against the control bar which, in the closed position, it contacts with one leg while its other leg engages in a notch on the locking bar so as to latch the intermediate plate to the second outer plate. When the outer plates are driven apart with initial entrainment of the intermediate plate by the second outer plate, a cam on the control bar represses the detent against its spring force and disengages the other leg thereof from the locking bar whereby further separation of the outer plates lets the intermediate plate stay put while the second outer plate moves away.

United States Patent 4,497,624 to BRUN et al., published on February 5, 1985 describes an injection molding machine includes a platen having a plurality of regularly spaced mold element-receiving chambers adapted to receive any of a number of various mold elements substantially wholly within the stationary platen. A hot manifold system is included between the stationary platen and a plastics injector unit, which includes a plurality of blocks independently coupled to the fixed platen, each block having channels through which the plastics material can flow, the channels of adjacent blocks being coupled by a coupling unit. The machine is particularly designed for quick inexpensive mold changes, and has particular utility in laboratory testing of mold designs and small low-capacity production in satellite plants.

United States Patent 4,671,764 to HEHL, Karl, published on June 9, 1987 teaches a device for automatically latching together the two die halves of an injection molding die of a plastics injection molding machine, when the die is removed from the machine, the device comprising a guide sleeve in one die half having a guide portion cooperating with the guide bore of a guide bushing in the other die half, a latching plunger in the guide sleeve having a latching head cooperating with an end face of the guide sleeve to radially expand a split latch ring or a cupped latch disk into engagement with a groove of the guide bushing, when the latching plunger is freed to move from its depressed release position to its latching position, under the action of a preloaded plunger spring. The attachment of the die half to a die carrier member automatically disengages the latching device by depressing the latching plunger.

United States Patent 4,950,152 to BRUN et al., published on August 21, 1990 describes a plurality of injection cores are inserted by a movable platen into corresponding injection cavities defined by mold inserts within a stationary platen, and the cores extend through corresponding split transfer mold cavities. After hollow preforms with threaded neck portions are molded within the cavities, the preforms are removed from the mold cavities, separated from the injection cores, and then shifted transversely by the split transfer molds to cooling or blow cavities defined by blow cavity inserts within the stationary platen on opposite sides of the corresponding injection cavities. The transfer molds return to receive the injection cores, and corresponding blow core units are inserted into the preforms within the blow cavities for pressurizing and expanding the preforms into firm contact with the blow inserts. The preforms are removed from the blow cavities by the blow cores on alternate cycles of press operation and are then released by retraction of the blow cores. The split transfer molds are shifted

transversely in opposite directions and are opened and closed by a cam system which includes cam tracks mounted on the movable platen and incorporating cam track switches

United States Patent 5,314,323 to BOLLES, Gene, published on May 24, 1994 teaches a stripper plate locking device for use with the mold in a molding machine (e.g., injection, compression or transfer) is presented. The mold has openings in each of the plates of the mold for accepting the stripper plate locking device. The device includes a release pin, a body member and a collet member. The pin has a shaft with a head disposed at one end and a first pair of camming surfaces with a shaft portion therebetween disposed at the other end. The body members has a second pair of camming surfaces with a cylindrical portion therebetween disposed at one end thereof and an opening therethrough wherein the shaft of the pin passes. The collet member has a plurality of expandable resilient fingers which define an opening. The collet member includes a third pair of camming surfaces with a first cylindrical section therebetween for expanding the fingers in cooperation with the first camming surface and the shaft portion of the pin. The collet member also has a fourth pair of camming surfaces with a second cylindrical section therebetween. The cylindrical portion is retained at the second cylindrical section when the fingers are in a nonexpanded position and is released when the fingers are expanded.

United States Patent 5,494,435 to VANDENBERG, Leo, published on February 27, 1996 teaches a positive internal latch lock for an injection mold having outer, intermediate, and inner plates movable between open and closed mold positions. The latch lock includes a mechanism for securing the outer and intermediate plates at a predetermined spaced distance when the mold is opened at a first parting line between the outer and intermediate plates. Further, the latch lock provides a mechanism for locking the intermediate and inner plates together until the outer and intermediate plates are secured at the predetermined spaced distance. After the outer and intermediate plates are secured, the intermediate and inner plates are allowed to open at a second parting line.

United States Patent 6,086,355 to ROZEMA et al., published on July 11, 2000 describes an actuator carriage for a multi-level injection molding apparatus having mold core and mold cavity support plates, tie bars supporting a moveable platen and having stripper mechanisms associated with mold cores mounted to the mold core support plates. The stripper mechanisms are displaced relative to the mold cores by lever arms having cam surfaces engaging actuators carried by the actuator carriage. Each actuator carriage includes a support bar extending

generally transversely relative to the tie bars with at least one of the actuators being mounted on the support bar. At least one connector bar is rigidly secured to the support bar and a respective of the mold cavity support plates. The connector bar maintains the support bar at a fixed distance from the mold cavity support plate. The support bar is moveable along at least one of the tie bars and has a lateral restraining device limiting lateral movement of the support bar toward respective of the tie bars.

United States Patent 6,431,852 to VANDENBERG, Leo, published on August 13, 2002 teaches an internal latch for an injection mold that allows opening of the mold at parting lines while selected plates are locked in position and prevented from moving. The system includes an external bushing, an internal bushing that carries cam retainers, and a locking pin. The system may be used in an injection mold having in sequence a stationary plate, a stripper plate and a support plate. The external bushing is secured to the support plate, the internal bushing is secured to the stripper plate, and the locking pin is secured to the stationary plate. The cam retainers selectively engage grooves in the external bushing to lock the stripper plate from moving with respect to the support plate when the locking pin is inserted into the internal bushing beyond the location of the cam retainers. When the locking pin is extracted from the internal bushing, the cam retainers are free to move inwardly thus unlocking the stripper plate from the support plate.

## SUMMARY

According to one aspect, there is provided a latch assembly for use in a molding system that includes an injection mold. The latch assembly includes a first coupler that is configured to interact, in use, with a stationary member of the molding system. The latch assembly also includes a second coupler that is configured to interact, in use, with a movable member of the injection mold. The first coupler and the second coupler are configured to cooperate, in use, to selectively latch, during operation of the molding system, the stationary member with the movable member, whereby the movable member performs a molding operation with opening of the injection mold.

According to another aspect, there is provided an injection molding process that is executable with an injection molding system. The injection molding process begins with a clamping operation that includes operating a clamping assembly to clamp together a first mold portion and a second mold portion of an injection mold arranged therein. The injection molding

process also includes an injection operation that includes operating an injection assembly to inject molding material into the injection mold to form a molded article therein. The injection molding process further includes a latching operation that includes operating a latching assembly to selectively latch a stationary member of a molding system to a movable member of the second mold portion. The injection molding process ends with an opening operation that includes operating the clamping assembly to cause a relative separation of a remainder of the second mold portion with respect to the first mold portion, and thereby cause a relative movement of the remainder of the second mold portion with respect to the movable member which has become stationary with respect to the first mold portion by virtue of having been selectively latched thereto. In so doing, a molding operation is performed with the relative movement of the remainder of the second mold portion with respect to the movable member.

According to a further aspect, there is provided a controller including instructions being embodied in a controller-usable memory of the controller, the instructions including executable instructions for directing the controller to execute the injection molding process.

Other aspects and features of the non-limiting embodiments will now become apparent to those skilled in the art upon review of the following detailed description of the non-limiting embodiments with the accompanying drawings.

## DETAILED DESCRIPTION OF THE DRAWINGS

The non-limiting embodiments will be more fully appreciated by reference to the following detailed description of the non-limiting embodiments when taken in conjunction with the accompanying drawings, in which:

FIG. 1 depicts a schematic representation of an injection molding system 100 having a non-limiting embodiment of an injection mold 102 arranged therein.

FIGS. 2A-2C depict a molded article ejection sequence involving the injection molding system 100 of FIG. 1, wherein a latch assembly 108 that is associated with the injection mold 102 has been latched.

FIGS. 2D-2E depicts another molded article ejection sequence involving the injection molding system 100 of FIG. 1, wherein the latch assembly 108 has been un-latched.

FIG. 2F depicts a schematic representation of the injection molding system 100 of FIG. 1 that includes the molded-article separation assembly.

FIG. 3 depicts perspective view of a non-limiting constructional representation of the injection mold 102 and of the latch assembly 108 associated therewith.

FIGS. 4-12 depict the molded article ejection sequence involving the non-limiting constructional representation of the injection mold 102 and of the latch assembly 108 of FIG. 3.

FIG. 13 depicts a perspective view of a latch assembly according to another non-limiting embodiment.

FIG. 14 depicts a perspective view of a latch assembly according to yet another non-limiting embodiment, wherein the latch assembly is in a coupling position.

FIG. 15 depicts a perspective view of the latch assembly of FIG. 14, wherein the latch assembly is in a decoupling position.

FIG. 16 depicts a perspective view of a latch assembly according to a further non-limiting embodiment.

FIG. 17 depicts a side view of a latch assembly according to another non-limiting embodiment, wherein the latch assembly is in a decoupling position.

FIG. 18 depicts a perspective view of the latch assembly of FIG. 17, wherein the latch assembly is in a coupling position.

FIG. 19 depicts a flow chart of a molding process according to a non-limiting embodiment.

The drawings are not necessarily to scale and may be illustrated by phantom lines, diagrammatic representations and fragmentary views. In certain instances, details not

necessary for an understanding of the embodiments (and/or details that render other details difficult to perceive) may have been omitted.

## DETAILED DESCRIPTION OF THE NON-LIMITING EMBODIMENT(S)

FIG. 1 depicts a schematic representation of an injection molding system 100 having a non-limiting embodiment of an injection mold 102 arranged therein, that is operable, in use, to mold a molded article 30 (FIG. 2A). While the molded article 30 is shown to be a preform of the type that is blow moldable to form a container, no specific limitation on the generality thereof is intended, and as such the molded article 30 may have a different form and/or purpose such as, for example, a container closure.

In the description of the injection molding system 100 and the injection mold 102 that follows many of the components thereof are known to persons skilled in the art, and as such these known components will not be described in detail herein. A detailed description of these known components may be referenced, at least in part, in the following reference books (for example): (i) "Injection Molding Handbook" authored by OSSWALD/TURNG/GRAMANN (ISBN: 3-446-21669-2), (ii) "Injection Molding Handbook" authored by ROSATO AND ROSATO (ISBN: 0-412-10581-3), (iii) "Injection Molding Systems" 3rd Edition authored by JOHANNABER (ISBN 3-446-17733-7) and/or (iv) "Runner and Gating Design Handbook" authored by BEAUMONT (ISBN 1-446-22672-9).

More particularly, the injection molding system 100 shown in FIG. 1 is shown to include, but is not limited to, a clamping assembly 996 and an injection assembly 997.

By way of example, the clamping assembly 996 described hereafter is representative of a typical three-platen variety. However, no specific limitation on the generality of a construction and/or operation of the clamping assembly 996 is intended, and as such the clamping assembly 996 may have a different construction, such as, for example, one having only two-platens. That being said, the clamping assembly 996 may include, amongst other things, a moving platen 912, a stationary platen 914, a clamp block 913, and a tie bar 916. The tie bar 916 links the stationary platen 914 with the clamp block 913, and moreover slidably supports the moving platen 912 thereon. While for the sake of simplicity of depiction only one tie bar 916 is shown, it is typical to provide four such tie bars 916, one extending between each of the four corners of the moving platen 912, the stationary platen 914, and the clamp block 913.

The clamping assembly 996 also includes a platen-moving actuator 915 (such as, for example, a hydraulic actuator, a pneumatic actuator, an electro-mechanical actuator, or the like) that is connected between the moving platen 912 and the clamp block 913. The platen-moving actuator 915 is operable, in use, to move the moving platen 912 with respect to the stationary platen 914 and thus a second mold portion 106 and a first mold portion 104 of the injection mold 102 that are mountable thereto, respectively. The clamping assembly 996 further includes a clamp actuator 918 and a clamp shutter 920 in association with the clamp block 913, wherein the clamp shutter 920 is operable, in use, to selectively connect the clamp actuator 918 with the moving platen 912 for sake of a clamping together of the first mold portion 104 and the second mold portion 106. Lastly, the clamping assembly 996 may also include an ejector actuator 922 (such as, for example, a hydraulic actuator, a pneumatic actuator, an electro-mechanical actuator, or the like) that is associated with the moving platen 912, the ejector actuator 922 being connectable, in use, to a stripper assembly 150 that is associated with the second mold portion 106.

By example, the injection assembly 997 described hereafter is representative of a typical reciprocating screw variety. However, no specific limitation on the generality of a construction and/or operation of the injection assembly 997 is intended, and as such the injection assembly 997 may have a different construction, such as, for example, a two-stage variety having separate plasticizing and injection means. That being said, the injection assembly 997 may include, amongst other things, a barrel assembly 902, a heating assembly 904, a melt-processing structure 906 (such as a screw), a melt-processing actuator 907, a machine nozzle 908, and a hopper 910. The machine nozzle 908 is connectable with a melt distribution apparatus 170 (e.g. hot runner, or the like) that is associated with the first mold portion 104 for delivering, in use, a melt of molding material for distribution to a molding cavity 20 (or cavities) that are defined in the injection mold 102.

The schematic representation of the injection mold 102 shown in FIG. 2A and described hereafter is representative of a typical two-part mold wherein the first mold portion 104 is a stationary half and the second mold portion 106 is a movable half that are associated, in use, with the stationary platen 914 and the moving platen 912 of the clamping assembly 996, respectively. However, no specific limitation on the generality of a construction and/or operation of the injection mold 102 is intended, and as such the injection mold 102 may have a different construction, such as, for example, one having a plurality of movable and/or stationary mold portions.

The first mold portion 104 and the second mold portion 106 are movable relative to one another, in use, along a mold-stroke axis, between a molding position (FIG. 1) and an ejection position (FIG. 2C). The first mold portion 104 and the second mold portion 106 each include shoe portions (i.e. one or more mold plates) within which are arranged portions of mold stacks 180 that define the molding cavities 20. Included in this is the stripper assembly 150 that is associated with the second mold portion 106 with which to move one or more members of the mold stack (e.g. split mold inserts 184 and the like) for sake of ejecting the molded article 30 therefrom.

The stripper assembly 150 may include a stripper plate 152 upon which slide pair members 154 are slidably arranged for positioning of split mold inserts 184 of the mold stack 180 that are connected thereto. In operation, the stripper assembly 150 is selectively movable by the ejector actuator 922, along the mold-stroke axis 901, between a retracted position (FIG. 2A) and an extended position (FIG. 2C) relative to a core assembly 140 of the second mold portion 106. The sliding movements of the slide pair members 154, generally perpendicular to the mold-stroke axis 901, are driven by a cam (not shown), wherein the movement of the slide pair members 154 is linked with the movement of the stripper assembly 150. That being said, the person of ordinary skill in the art will appreciate that other means for driving the movement of the slide pair members 154 are known, including, for example, a servo-actuator like that described in United States Patent Application Publication No. 2007/005939 to Serniuck et al, published on March 15, 2007.

Also with reference to FIG. 2A, a latch assembly 108 is shown in association with the injection mold 102. The latch assembly 108 is a structure that is operable to selectively latch the stripper assembly 150 of the second mold portion 106 to the first mold portion 104. A technical effect of latch assembly 108, wherein the stripper assembly 150 is selectively latched with the first mold portion 104, may include providing additional ejection force with which to move the stripper assembly 150 towards the extended position (FIG. 2C) and thereby assist with ejection of the molded articles 30.

The term “selectively latch” means that the latch assembly 108 is configurable to latch (when needed) the stripper assembly 150 with the first mold portion 104, and unlatch (when no longer needed) the stripper assembly 150 from the first mold portion 104. When latched, the latch assembly 108 may limit relative movement between the stripper assembly 150 and the

first mold portion 104 in at least one of a separating direction (i.e. moving further apart) and a converging direction (i.e. moving closer together) along the mold-stroke axis 901.

In accordance with a non-limiting embodiment, the latch assembly 108 includes (but is not limited to) a first coupler 112 that is configured to interact, in use, with a stationary member of the molding system 100 and a second coupler 114 that is configured to interact, in use, with a movable member of the injection mold 102. The first coupler 112 and the second coupler 114 are configured to cooperate, in use, to selectively latch, during operation of the molding system 100, the stationary member with the movable member, whereby the movable member performs a molding operation (e.g. such as, for example, ejecting/stripping of a molded article from the mold, and/or operating an in-mold article handling system to remove the molded article from the mold) with opening of the injection mold 102.

The latch assembly 108 also includes a latch member 110 having the first coupler 112 and the second coupler 114 associated therewith. In this embodiment, the first coupler 112 and the second coupler 114 are structured to couple, in use, with the first mold portion 104 (i.e. stationary member) and the stripper assembly 150 of the second mold portion 106 (i.e. movable member), respectively, wherein the first coupler 112 is operable to selectively couple with the first mold portion 104, whereby the stripper assembly 150 may be selectively latched to the first mold portion 104. As such, in this non-limiting embodiment the molding operation is ejecting (i.e. stripping) a molded article 30 (FIG. 2A) from the second mold portion 106.

It will be appreciated that the latch assembly 108 may be provided integrally with the injection mold 102 or otherwise provided as a retrofit thereto (i.e. mated to an existing injection mold 102 having a stripper assembly).

A non-limiting molded article ejection sequence will now be described with reference to FIGS 2A-2C. With a partial opening (FIG. 2A) of the injection mold 102 from the molding position (FIG. 1), which involves moving the second mold portion 106, and with it the stripper assembly 150, relative to the first mold portion 104 in the separating direction along the mold-stroke axis 901, by means of operation of the platen-moving actuator 915, the latch assembly 108 may be configured to selectively latch, as shown, the stripper assembly 150 to the first mold portion 104. By so doing, further relative movement between the stripper assembly 150 and the first mold portion 104 is prevented upon reaching a predefined distance 'L' therebetween. The predefined distance 'L' may be selected dependent on the particularities of

the operation of the injection mold 102, particularly those having to do with operation of the stripper assembly 150 for sake of ejection of the molded articles 30. Thereafter, with a further opening (FIG. 2B) of the injection mold 102 towards the ejection position, which involves moving the core assembly 140 of the second mold portion 106 relative to the first mold portion 104 and the stripper assembly 150 in the separating direction along the mold-stroke axis 901, by means of operation of the platen-moving actuator 915, the stripper assembly 150 is arranged further towards the extended position (FIG. 2C). With the relative movement between the core assembly 140 and the stripper assembly 150, along the mold-stroke axis 901, the cam (not shown) is operable to drive relative motion between the slide pair members 154, generally perpendicular to the mold-stroke axis 901, to re-position the split mold inserts 184 and in so doing eject (i.e. strip) the molded articles 30 from mold cores 182 of the mold stacks 180 around which they were formed. The mold cores 182 are shown as being associated with the core assembly 140. Thus, a mold opening force that is provided by the platen-moving actuator 915 that is otherwise provided to open the injection mold 102 may be further harnessed to augment (i.e. boost) an ejection force that is provided through operation of the ejector actuator 922 with which to move the stripper assembly 150 relative to the core assembly 140.

Augmentation of the ejection force with latching of the latch assembly 108 may be particularly helpful in situations where there is otherwise insufficient force available with which to dislodge molded articles 30 from the mold stacks 180. Such a problem may arise from time to time through various causes. Most often the cause relates to the molded articles 30 having become seized around their respective mold cores 182 due to excessive shrinkage. The foregoing scenario may arise, for example, with excessive cooling of the molded articles 30 due to an extended residence on their respective mold cores 182 such as may arise with manual operation of the injection molding system 100 during start up and the like.

With continued operation of the injection molding system 100 (i.e. steady-state operation) the augmentation of the ejection force may no longer be required. Accordingly, another non-limiting molded article ejection sequence of the injection molding system 100 will now be described with reference to FIGS 2D-2E. With a partial opening (FIG. 2E) of the injection mold 102 from the molding position (FIG. 1), which involves moving the second mold portion 106, and with it the stripper assembly 150, relative to the first mold portion 104 in the separating direction along the mold-stroke axis 901, by means of operation of the platen-moving actuator 915, the latch assembly 108 may be selectively un-latched, as shown, to

unlatch the stripper assembly 150 from the first mold portion 104, whereby further relative movement between the stripper assembly 150 and the first mold portion 104 is not prevented thereby. Thereafter, with a further opening of the injection mold 102 towards the ejection position (FIG. 2E) the ejector actuator 922 is operable, albeit without assistance from the platen-moving actuator 915, to move the stripper assembly 150 towards the extended position (FIG. 2C) relative to the core assembly 140. As before, with the relative movement between the core assembly 140 and the stripper assembly 150, along the mold-stroke axis 901, the cam (not shown) is operable to drive the relative motion between the slide pair members 154, generally perpendicular to the mold-stroke axis 901, to re-position the split mold inserts 184 and in so doing eject (i.e. strip) the molded articles 30 from mold cores 182 of the mold stacks 180 around which they were formed.

The operation of the latch assembly 108 to selectively latch the stripper assembly 150 with the first mold portion 104 need not be reserved for temporary (i.e. intermittent) use, but may also be latched during regular operation (i.e. steady-state operation) of the injection molding system 100.

In yet another non-limiting embodiment (not shown) it may be further possible to omit the ejector actuator 922 altogether, wherein the ejection force may be entirely provided by the platen-moving actuator 915 acting via the latch assembly 108.

With reference to FIG. 2F there is depicted an alternative non-limiting embodiment of the injection molding system 100 for sake of illustrating that the latch assembly 108 may be incorporated with a different arrangement of the injection mold 202. More particularly, the injection mold 202 is shown as including a first mold portion 204 and a second mold portion 206 that are associated, in use, with the stationary platen 914 and the moving platen 912, respectively. With such an arrangement an ejector actuator (not shown) may be incorporated into the first mold portion 204 for sake of moving, in use, the stripper assembly 150 relative thereto.

A more detailed description of the injection mold 102 will now be provided with reference a non-limiting constructional representation (i.e. detailed construction) thereof that is depicted with reference to FIG. 3. It is worth noting that not all members of the injection mold 102 are depicted – same for FIGS. 4-12 that follow. For example, the stripper assembly 150 has been depicted without the split mold inserts 184 (like those in FIG. 2A) and without connecting

bars with which the slide pair members 154 may be linked together. This has been done merely for sake of revealing the underlying structures of the injection mold 102 that may have otherwise have been obscured from view. That being said, the person of ordinary skill in the art will appreciate the structure, integration, and operation of the missing members of injection mold 102 as these are well known in the art.

The injection mold 102 is shown to include the first mold portion 104, the construction and operation of which is well known to those of ordinary skill in the art and as such will not be described in detail herein. Briefly, the first mold portion 104 is shown to include the melt distribution apparatus 170 (e.g. hot runner or the like) with a cavity assembly 160 fastened thereto. The melt distribution apparatus 170 includes a front plate 172, a manifold plate 174, and a backing plate 176 that cooperate in arranging melt distribution components such as, for example, manifolds, injection nozzles, and a sprue (none of which are shown) therein. Likewise, the cavity assembly 160 includes a cavity plate within which cavity members (not shown) of the mold stacks may be arranged, and wherein the cavity members therein are arranged in fluid communication with the injection nozzles (not shown) of the melt distribution apparatus 170.

The injection mold 102 is also shown to include the second mold portion 106, the construction and operation of which is well known to those of ordinary skill in the art and as such will not be described in detail herein. Briefly, the second mold portion 106 is shown to include the core assembly 140 and the stripper assembly 150 that is slidably linked thereto to accommodate relative movement therebetween along the mold-stroke axis 901. The core assembly 140 includes a core plate to which the mold cores (not shown) are mountable. The stripper assembly 150 includes the stripper plate 152 with the slide pair members 154 slidably connected to a face thereof. The split mold inserts (not shown) are mountable, in use, to the slide pair members 154 for sake of a relative repositioning thereof (i.e. opening and closing thereof) with corresponding relative movements (i.e. diverging and converging) of the slide pair members 154 in a direction that is generally perpendicular to the mold-stroke axis 901. The relative movement of the slide pair members 154 is driven, in use, in cooperation with a cam 128 that is fixedly connected to the core assembly 140 responsive to the relative movement between the core assembly 140 and the stripper assembly 150 along the mold-stroke axis 901. Of note, a pair of cylindrical spacers 136 are disposed between the cam 128 and the core assembly 140 for reasons that follow.

As explained previously, the latch assembly 108 broadly includes the latch member 110 having the first coupler 112 and the second coupler 114 associated therewith.

The first coupler 112 may broadly include, as shown, a lock assembly 116 and a lock engager 118. The lock assembly 116 is associated with the first mold portion 104, whereas the lock engager 118 is associated with the latch member 110. The purpose of the lock assembly 116 is to provide a means with which to selectively couple the latch member 110 with the first mold portion 104, and more particularly, for example, to the front plate 172 of the melt distribution apparatus 170 and thus limit travel or sliding movement of the latch member 110 along the mold-stroke axis 901.

More particularly, the lock assembly 116 is associated with a top face of the front plate 172 of the melt distribution apparatus 170. The lock assembly 116 includes a lock actuator 122, a lock body 124, a lock block 126, and a lock receiver 111. The lock assembly 116 is engagable with the lock engager 118 defined by the latch member 110. The lock engager 118 is formed in the latch member 110 as an elongated passageway that stretches, at least in part, along a portion of a bar-like body of the latch member 110 in the direction of the mold-stroke axis 901. The elongated passageway of the lock engager 118 provides for a limited relative movement between the first mold portion 104 and the stripper assembly 150 of the second mold portion 106, for sake of permitting the injection mold 102 to be opened, from the molding position towards the ejection position, with the latch assembly 108 being selectively latched (i.e. with the lock assembly 116 being engaged with the lock engager 118), whereafter an end portion 119 of the elongated passageway is interactable, in use, with the lock body 124 to arrest the first mold portion 104 and the stripper assembly 150 of the second mold portion 106 at a predefined distance 'L' (FIG. 5) therebetween. The first coupler 112 may be selectively coupled with the first mold portion 104, and in so doing selectively latch or un-latch the lock assembly 116, with controlled operation of the lock actuator 122 to slidably move the lock body 124 through the passageway defining the lock engager 118 and into or out of the lock receiver 111 defined in the front plate 172. The lock block 126 is structured to mount the lock actuator 122 to the top face of the front plate 172, and to otherwise house and retain, in use, the lock body 124 when the lock body 124 is not received in the lock receiver 111.

The second coupler 114 broadly includes, as shown, a guide assembly 113, a guide engager 115, a catch 129, and an end-link 117. The guide assembly 113 is associated with the cam

128, and the guide engager 115 is associated with the latch member 110. The guide assembly 113 and the guide engager 115 cooperate, in use, to guide movement of the latch member 110 along the mold-stroke axis 901. The catch 129 is also associated with the cam 128, and the end-link 117 is associated with the latch member 110. The catch 129 and the end-link 117 cooperate, in use, to limit relative motion between the core assembly 140 and the stripper assembly 150. The end-link 117 being further structured to couple, in use, with the stripper assembly 150, and thereby couple the latch member 110 thereto.

More particularly, the guide assembly 113 includes a guide block 130, and a pair of bolts 132. The bolts 132 fixedly attach the guide block 130 with the cam 128. The guide block 130 defines a groove in cooperation with a face of the cam 128, the groove being aligned along the mold-stroke axis 901. The guide engager 115 is defined by the latch member 110 as an elongated channel that stretches along the direction of the mold-stroke axis 901. The guide engager 115 slidably engages, in use, within the groove defined between the guide block 130 and the cam 128. As such, the guide engager 115 and the guide block 130 are configured to constrain the sliding movement of the latch member 110 along the mold-stroke axis 901.

The end-link 117 is provided as a hook-shaped portion that is disposed at an end of the latch member 110, wherein a front face of the end-link 117 is contactable, in use, with a back face of the stripper plate 152 and thus couple therewith (in the sense that a force is transferrable therebetween).

The catch 129 is provided by a bottom face of the cam 128, and as such the cylindrical spacers 136 that support the cam 128 are slidably arranged through the end-link 117, wherein the front face of the end-link 117 is catchable, in use, by the catch 129 as the core assembly 140 and the stripper assembly 150 are made to separate along the mold-stroke axis 901, whereby further relative motion therebetween (i.e. away from one another) is prevented. As such, the end-link 117 and the catch 129 cooperate to provide a forward limit for the latch member 110 relative to the core assembly 140 along the mold-stroke axis 901.

The latch assembly 108 may further include a latch-reset assembly 120. The latch-reset assembly 120 is structured to reset, in use, a position of the latch member 110 towards a rear limit of travel. The rear limit is provided through the cooperation, in use, of a rear face of the end-link 117 and a pocket face that is defined in the core plate of the core assembly 140. The latch-reset assembly 120 includes a spring member 134 and a spring guide that is provided by an outer surface of the cylindrical spacers 136 upon which the cam 128 is supported. The

spring member 134 is positioned between the cam 128 and the latch member 110. During normal molding operation, the latch-reset assembly 120 is used to urge the latch member 110 towards the rear limit of travel.

Whereas the foregoing non-limiting embodiment of the latch assembly 108 has been depicted and described as being associated with a top side of the injection mold 102, no such limitation on the generality on the number and placement thereof is intended. For example, according to another implementation (not shown), the latch assembly 108 may be mounted to a bottom side of the injection mold 102. In another example, a pair of the latch assemblies 108 may be provided that are mounted to the top and to the bottom, respectively, of the injection mold 102, a technical effect of which may include a reduced possibility of inadvertent cocking of the stripper assembly 150.

What follows is the molded article ejection sequence involving the non-limiting constructional representation of the injection mold 102 and of the latch assembly 108 of FIG. 3.

FIG. 3 depicts a configuration of the injection mold 102 during a step of molding of the molded articles, and as such is arranged in the molding position (i.e. mold is closed). In this configuration, the first coupler 112 is not coupled to the first mold portion 104, wherein the lock body 124 is not yet engaged with the lock receiver 111. However, in another non-limiting embodiment, not shown, the lock body 124 may remain engaged with the lock receiver 111 during the step of molding.

FIG. 4 depicts a configuration of the injection mold 102 during a step of selectively coupling of the first coupler 112 (i.e. selectively latching of the latch assembly 108), wherein the injection mold 102 remains in the molding position and the lock assembly 116 is in the process of being actuated to move the lock body 124 into the lock receiver 111, whereby the latch member 110 is being selectively coupled to the first mold portion 104.

FIG. 5 depicts a configuration of the injection mold 102 during a step of opening of the injection mold 102 after having selectively coupled the latch member 110 with the first mold portion 104. As such, the second mold portion 106 is shown as it is undergoing movement away from the first mold portion 104 (i.e. in the separating direction along the mold-stroke axis 901), wherein the stripper assembly 150 having thus far moved in unison with the core

assembly 140 is arranged at a predefined distance 'L' from the first mold portion 104. The second mold portion 106 may be moved by using the platen-moving actuator 915 depicted in FIG. 1, as previously described, and in the manner known to those skilled in the art. In this manner, the second mold portion 106 becomes separated from the first mold portion 104 while the lock body 124 moves or slides relative to the lock engager 118 (along the elongated slot). It is worthwhile noting that at this point the latch assembly 108 prevents further movement of the stripper assembly 150 in the separating direction along the mold-stroke axis 901. That is, the latch member 110 is no longer able to move in unison with the second mold half 106 by virtue of the latch member 110 having reached its limit of travel with respect to the first mold portion 104, wherein the end portion 119 of the elongated passageway in the lock engager 118 has contacted the lock body 124. Furthermore, the stripper assembly 150 is no longer able to move in unison with the core assembly 140 (i.e. in the separating direction) by virtue of the latch member 110 being at its limit of travel with respect to the stripper plate 152, wherein the front face of the end-link 117 is in contact with a back face of the stripper plate 152.

FIG. 6 depicts a configuration of the injection mold 102 during a step of cracking of the molded article (not shown) from the mold core 182 on which it is arranged, and possibly seized. This step requires, as discussed previously, a relative movement (away) between the core assembly 140 and the stripper assembly 150, and wherein the ejection force required to do so is augmented (i.e. boosted) by the platen-moving actuator 915 (FIG. 1) in concert with the ejector actuator 922 (FIG. 1) of the clamping assembly 996 (FIG. 1). As such, with the stripper assembly 150 being held at the predefined distance 'L' relative to the first mold portion 104 by the latch member 110, as discussed previously, further movement of the core assembly 140 in the separating direction relative to the stripper assembly 150 is driven by the platen-moving actuator 915 (FIG. 1), which in effect provides a separating force that boosts the ejection force that is being otherwise provided by the ejector actuator 922 for sake of separating of the two (i.e. force the core assembly 140 away from the stripper assembly 150). It should be noted however that in another non-limiting process, the ejector actuator 922 may be omitted or left inactive during this step. As explained previously, the separating movement of the core assembly 140 relative to the stripper assembly 150 has the technical effect of stripping of the molded articles (not shown) from their mold cores 182, including those that may have been seized thereon. This step may be useful during start up of the injection molding system 100, and may further be useful during steady-state operation thereof. It is worthwhile noting that during this step, that the spring member 134 is compressed between

the stripper assembly and the cam 128 for sake of storing of energy with which to reset the latch member 110 into contact with the core assembly 140. Also, it may now be appreciated that the end-link 117 and the catch 129 cooperate to provide a forward limit of motion of the latch member 110 relative to the core assembly 140.

FIG. 7 depicts a configuration of the injection mold 102 during a step of re-arranging of the injection mold 102 towards an un-latching position after having cracked the molded articles (not shown) from their mold cores 182. More particularly, with the molded articles (not shown) remaining on the mold cores 182, the injection mold 102 is moved part way towards the molding position, as shown, whereupon core assembly 140 is returned into contacting relation with respect to the stripper assembly 150, and wherein the latch member 110 is assisted in its return into contact with the core assembly 140 with release of the energy in the spring members 134 (i.e. return towards a decompressed state).

FIG. 8 depicts a configuration of the injection mold 102 after having reached the un-latching position after having cracked the molded articles (not shown) from their mold cores 182. In this configuration, a gap is provided between the end portion 119 of the lock engager 118 and the lock body 124, whereby the lock body 124 may be retracted into the lock body 124 without frictional binding therebetween (i.e. the lock body 124 is free to move).

FIG. 9 depicts a configuration of the injection mold 102, in the un-latching position, during a step of selectively decoupling of the first coupler 112 (i.e. selectively un-latching of the latch assembly 108), wherein the lock body 124 is depicted as undergoing disengagement from the lock engager 118, whereby the latch member 110 is being selectively decoupled from the first mold portion 104.

FIG. 10 depicts a configuration of the injection mold 102 during a step of opening of the injection mold 102 towards the ejection position after having selectively un-latched the latch assembly 108.

FIG. 11 depicts a configuration of the injection mold 102, in the ejection position, during a step of ejecting of the molded articles wherein the stripper assembly 150 is depicted as undergoing movement away from the core assembly 140 along the mold-stroke axis 901, by the ejector actuator 922 (FIG. 1), for sake of operating the stripper assembly 150 to eject the molded articles (not shown) that have thus far been associated therewith.

With reference to FIG. 12, the injection mold 102 is shown to be in the ejection position, wherein the stripper assembly 150 is in a state of undergoing movement towards the core assembly 140 (not shown), by the ejector actuator 922 (FIG. 1), for sake of returning the second mold portion 106 to a state required for molding once again. In another non-limiting process, this step may be conducted concurrently with the closing of the injection mold 102 (i.e. movement of the second mold portion 106 towards the first mold portion through actuation of the platen-moving actuator 915).

In addition, FIG. 12 also depicts that the injection molding system 100 may further include (but is not limited to) a controller 930. The controller 930 includes (but is not limited to) a controller-usable memory 932, such as short-term memory, such as random access memory (RAM), etc, and/or long-term memory, such as ROM (read-only memory), etc. The controller-usable memory 932 embodies instructions 934. The instructions 934 are executable by the controller 930. The instructions 934 may have been complied from a software compiler by those skilled in the art. High-level computer programmed code was written, using a computer programming language, such as C++, and the compiler is used to convert the programmed code into the instructions 934. The instructions 934 include (but is not limited to) executable instructions for directing the controller 930 to execute the molded article ejection sequence. The latch assembly 108 is operatively connectable (via the lock actuator 122) with the controller 930.

Turning now to FIG. 13, there is depicted another non-limiting embodiment of a latch assembly 208. Similar to the latch assembly 108, the latch assembly 208 includes a first coupler 212 that is configured to interact, in use, with a stationary member of the molding system 100 and a second coupler 214 that is configured to interact, in use, with a movable member of the injection mold 102. The first coupler 212 and the second coupler 214 are configured to cooperate, in use, to selectively latch, during operation of the molding system 100, the stationary member with the movable member, whereby the movable member performs a molding operation with opening of the injection mold 102.

In contrast with the first coupler 112 of the latch assembly 108 that is configured to interact with the first mold portion 104, the first coupler 212 is configured to interact with a stationary member of the clamping assembly 996 (FIG. 1). More particularly, the first coupler 212 is configured to clamp onto the tie bar 916 of the clamping assembly 996. As such, the first

coupler 212 has a split construction that includes a first jaw 210 and a second jaw 211 that may be fastened together to clamp the tie bar 916 therebetween.

Like the second coupler 114 of the latch assembly 108, the second coupler 214 may be configured to interact with, for example, the stripper assembly 150 (i.e. movable member) of the second mold portion 106, wherein the molding operation is stripping, in use, a molded article 30 (FIG. 2A) from the mold core 182 that is associated with the second mold portion 106.

The second coupler 214 is movably (i.e. slidably) connected to the first coupler 212 to provide for selective relative repositioning thereof, in use, between a coupling position, as shown, and decoupling position (not shown). The bi-directional movement of the second coupler 214 relative to the first coupler 212 is along the arrows shown.

The second coupler 214 includes an actuator interface 216, such as a threaded bore, for connection to an actuator (not shown). In operation, the actuator provides for movement of the second coupler 214 relative to the first coupler 212 between the coupling position and the decoupling position. To govern control of the actuator, it may be operatively connected to a controller 930 (FIG. 12) in the same manner as the lock actuator 122 of the latch assembly 108, as described previously. Alternatively, the second coupler 214 may be manually repositioned relative to the first coupler 212, in use, by an operator of the molding system 100. That is, where there is insufficient force to strip the molded article 30 from the mold core 182, such as, for example, at start up of the molding system 100, the operator may manually slide the second coupler 214 into the coupling position, as shown, whereafter the required extra force is provided by the platen-moving actuator 915 (FIG. 1) with opening of the injection mold 100. Subsequent to the stripping of the molded article 30, the operator could then move the second coupler 214 back to the decoupling position for sake of normal operation of the molding system 100.

For sake of interacting with the stripper assembly 150, the second coupler 214 is provided with a catch 215, which in the present non-limiting embodiment is provided by a finger-like projection that extends from an end of a block body of the second coupler 214. The catch 215 is configured to capture, or hook, in use, a back face of the stripper plate 152 (or some other portion of the stripper assembly 150) when in the coupling position, and with separation of a first mold portion 104 of the injection mold 102 and the second mold portion 106 (i.e.

opening of the injection mold 102) to a predefined distance therebetween. Put another way, during a first stage of opening of the injection mold 102, driven by means of the platen-moving actuator 915 (FIG. 1), the stripper assembly 150 is moved away from the first mold portion 104, along with the rest of the second mold portion 104, until it comes into contact with the catch of second coupler 214, in other words entering the coupling position. Thereafter, during a second stage of opening of the injection mold 102, the position of the stripper assembly 150 is kept stationary by virtue of being latched to the stationary member. In this way, during the second stage of opening of the injection mold 102 a remainder of the second mold portion 106 is moved relative to the stripper assembly 150 to perform stripping of the molded article 30 (FIG. 2A) from the more core 184 that is associated with the second mold portion 106, or at least an initial step thereof (i.e. cracking of the molded article 30 from the mold core – as described previously).

In operation, the second coupler 214 is to be positioned into the coupling position prior to completion of the relative separation of the second mold portion 106 with respect to the first mold portion 104 (e.g. such as when the injection mold 102 is still in a closed configuration).

Turning now to FIG. 14, there is depicted yet another non-limiting embodiment of a latch assembly 308. Similar to the latch assembly 208, the latch assembly 308 includes a first coupler 312 that is configured to interact, in use, with a stationary member of the molding system 100 and a second coupler 314 that is configured to interact, in use, with a movable member of the injection mold 102. The first coupler 312 and the second coupler 314 are configured to cooperate, in use, to selectively latch, during operation of the molding system 100, the stationary member with the movable member, whereby the movable member performs a molding operation with opening of the injection mold 102.

Similar to the first coupler 212 of the latch assembly 208, the first coupler 312 is configured to clamp onto the tie bar 916 of the clamping assembly 996. Likewise, the second coupler 314 is configured to interact the stripper assembly 150 (i.e. movable member) of the second mold portion 106, wherein the molding operation is stripping, in use, a molded article 30 (FIG. 2A) from the second mold portion 106.

In contrast to the sliding connection between the first coupler 212 and the second coupler 214 of the latch assembly 208, the second coupler 314 is rotationally connected to a first jaw 311 of the first coupler 312 to provide for selective relative repositioning thereof, in use, between

a coupling position, as shown, and decoupling position as shown with reference to FIG. 15. The bi-directional rotational movement of the second coupler 314 relative to the first coupler 312 is along the arrows shown.

The second coupler 314 includes an actuator interface 316 for connection to an actuator (not shown). In operation, the actuator provides for movement of the second coupler 314 relative to the first coupler 312.

For sake of interacting with the stripper assembly 150, the second coupler 314 is provided with a catch 315, which in the present non-limiting embodiment is provided by a finger-like projection that extends from an end of a block body of the second coupler 314. The catch 315 is configured to capture, or hook, in use, a back face of the stripper plate 152 (or some other portion of the stripper assembly 150) when in the coupling position, and with separation of a first mold portion 104 of the injection mold 102 and the second mold portion 106 (i.e. opening of the injection mold 102) to a predefined distance therebetween. As best shown with reference to FIG. 15, the block body of the second coupler 314 also includes a tapered relief 318 along a back side thereof at an opposite end from the catch 315. The tapered relief 318 provides for clearance between the second coupler 314 and the stripper assembly 150 when the second coupler 314 is arranged in the decoupling position.

Turning now to FIG. 16, there is depicted yet another non-limiting embodiment of a latch assembly 408. Similar to the latch assembly 208, the latch assembly 408 includes a first coupler 412 that is configured to interact, in use, with a stationary member of the molding system 100 and a second coupler 414 that is configured to interact, in use, with a movable member of the injection mold 102. The first coupler 412 and the second coupler 414 are configured to cooperate, in use, to selectively latch, during operation of the molding system 100, the stationary member with the movable member, whereby the movable member performs a molding operation with opening of the injection mold 102.

Similar to the first coupler 412 of the latch assembly 208, the first coupler 412 is configured to clamp onto the tie bar 916 of the clamping assembly 996. Likewise, the second coupler 414 is configured to interact the stripper assembly 150 (i.e. movable member) of the second mold portion 106, wherein the molding operation is stripping, in use, a molded article 30 (FIG. 2A) from the second mold portion 106.

Like the latch assembly 208, the latch assembly 408 also makes use of a sliding connection between the first coupler 412 and the second coupler 414. One notable difference however is that the second coupler 414 has the form of a pin, which in this non-limiting embodiment has a cylindrical shape, in contrast with the block body of the second coupler 214 (FIG. 13). The second coupler 414 is slidably arranged through a vertical flange that projects outwardly from a first jaw 411 of the first coupler 412. A forward portion of the second coupler 412 provides a catch 415 with which to interact, when positioned into the coupling position, with a catch receiver 426 that is provided by a bore (shown in outline) that is defined in the stripper plate 152. The bi-directional sliding movement of the second coupler 414 relative to the first coupler 412 is along the arrows shown.

The second coupler 414 includes an actuator interface 416 for connection to an actuator (not shown). In operation, the actuator provides for movement of the second coupler 414 relative to the first coupler 412.

The operation of this non-limiting embodiment is distinct from the foregoing in that the catch 415 must first be aligned with the catch receiver 426 before being moved into the coupling position. The foregoing requirement is the result of the fact that the bore of the catch receiver 426 is enclosed feature of the stripper plate 152. Alternatively, the catch receiver 426 may be provided as an enclosed slot (i.e. wider than the catch 415), which would ease the required accuracy of positioning between the catch 415 and the catch receiver 426 prior to prior to movement of the second coupler 412 into the coupling position. As further alternative, the catch receiver 426 may be provided as a slot that extends through a rear face of the stripper plate 152 such that the second coupler 412 may be positioned into the coupling position before the injection mold 102 is opened.

Turning now to FIG. 17, there is depicted another non-limiting embodiment of a latch assembly 508. Similar to the latch assembly 408, the latch assembly 508 includes a first coupler 512 that is configured to interact, in use, with a stationary member of the molding system 100 and a second coupler 514 that is configured to interact, in use, with a movable member of the injection mold 102. The first coupler 512 and the second coupler 514 are configured to cooperate, in use, to selectively latch, during operation of the molding system 100, the stationary member with the movable member, whereby the movable member performs a molding operation with opening of the injection mold 102.

Similar to the first coupler 412 of the latch assembly 408, the first coupler 512 is configured to interact with a stationary member of the clamping assembly 996 (FIG. 1). One notable difference however is that the first coupler 512 is configured to interact (i.e. mount) to the stationary platen 914 instead of the tie bar 916. That being said, in yet another alternative embodiment, not shown, the first coupler 512 may be mounted to the first mold portion 104 (i.e. stationary by virtue of being mounted the stationary platen 914).

Like the second coupler 414 of the latch assembly 408, the second coupler 514 is configured to interact the stripper assembly 150 (i.e. movable member) of the second mold portion 106, wherein the molding operation is stripping, in use, a molded article 30 (FIG. 2A) from the second mold portion 106.

The second coupler 514 is pivotally connected to the first coupler 512 to provide for selective relative repositioning thereof, in use, between an uncoupling position, as shown, and decoupling position (FIG. 18).

The latch assembly 508 also includes an actuator 522 that links the first coupler 512 with the second coupler 514 to provide for movement, in use, of the second coupler 514 relative to the first coupler 512.

For sake of interacting with the stripper assembly 150, the second coupler 514 is provided with a catch 515, which in the present non-limiting embodiment is provided by a hook that extends from an end thereof. The catch 515 is configured to hook, in use, a catch receiver 526 that is defined by a catch bar 524 that is connected to the stripper plate 152 of the stripper assembly 150. The catch receiver 526 is provided by an elongate opening that is defined by the catch bar 524. The elongate opening of the catch receiver 526 is configured to allow for insertion of the catch 515 therein when the injection mold 102 is in a molding configuration (i.e. closed) and yet allow for the injection mold 102 to be opened a predefined distance before the hook of the catch 515 interacts with an end portion of the elongate opening of the catch bar 524. In this way, there is disengagement of the second mold portion 106 from the first mold portion 104 prior to the latch assembly 108 interacting with the stationary and movable members to arrest further movement of the stripper assembly 150. Put in another way, the catch receiver 526 is configured to receive the catch 515 with the first mold portion 104 and the second mold portion 106 being in the molding configuration and to interact

therewith only once the first mold portion 104 and the second mold portion 106 have been separated to the predefined distance therebetween.

The latch assembly 508 may also include, as shown, a third coupler 528 that is configured to interact, in use, with the stripper assembly 150 of the injection mold 102. Like the second coupler 514, the third coupler 528 is also pivotally connected to the first coupler 512 to provide for selective relative repositioning thereof, in use, between an uncoupling position, as shown, and decoupling position (FIG. 18). In this way the stripper plate 150 may be latched in several places to the stationary platen 914 to provide for a more balanced distribution of applied forces during the molding operation of stripping of the molded article 30 (FIG. 2A). As such, the second coupler 514 and the third coupler 528 have been arranged near a top and a bottom, respectively, of the stripper assembly 150.

The latch assembly 508 also includes a link 520 with which to connect the third coupler 528 with the second coupler 514. More particularly, the second coupler 514, the third coupler 528, and the link 520 are configured to cooperate to provide for linked movement of the second coupler 514 and the third coupler 528. The link 520 is also configured to link both of the second coupler 514 and the third coupler 528 with the actuator 520.

To further balance the applied forces during stripping of the molded article 30, the injection molding system 100 may further include another latch assembly (not shown), similar to the latch assembly 508, on the opposite side of the injection mold 102, and in this way provide for latching symmetry that will work to avoid a force imbalance that may lead to cocking of the stripper assembly 150.

With reference to FIG. 19, there is depicted a flow chart that lists the steps of a non-limiting injection molding process 600 involving the foregoing non-limiting embodiments of the latch assembly.

The injection molding process 600 begins with a clamping operation 610 that includes operating the clamping assembly 996 (FIG. 1) to clamp together the first mold portion 104 and a second mold portion 106 of an injection mold 102 arranged therein. The foregoing step is well understood in the art and thus will not be described any further herein.

Next, the injection molding process 600 includes an injection operation 620 that includes operating an injection assembly 997 to inject molding material into the injection mold 102 to form a molded article 30 therein. Again, the foregoing step is well understood in the art and thus will not be described any further herein.

Next, the injection molding process 600 includes a latching operation 630 that includes operating the latching assembly 108 (FIG. 3), 208 (FIG. 13), 308 (FIG. 14), 408 (FIG. 16), 508 (FIG. 17) to selectively latch the stationary member of the molding system 100 (e.g. one of the first mold portion 104 or a member of the clamping assembly 996, such as the tie bar 916 or the stationary platen 914) to the movable member (e.g. stripper assembly) of the second mold portion 104. With latching of the latch assembly 108, 208, 308, and 508 (i.e. the first coupler 112, or the second coupler 214, 314, 514 is moved to the coupling position), the movable member of the second mold portion 106 remains movable relative to the first mold portion 104, through a predefined distance with opening of the injection mold 102, after which point further separating movement thereof is arrested. In contrast, with latching of the latching assembly 408, the movable member of the second mold portion 106 becomes fixed relative to the first mold portion 104 until such time as the latch assembly 408 is deactivated.

The injection molding process 600 ends with an opening operation 640 that includes operating the clamping assembly 996 to cause a relative separation of the second mold portion 106 with respect to the first mold portion 104, and thereby cause a relative movement of the remainder of the second mold portion 106 with respect to the movable member which is stationary with respect to the first mold portion 104 by virtue of having been selectively latched thereto. In so doing, a molding operation is performed (e.g. stripping of the molded article 30 from the second mold portion 106) with the relative movement of the remainder of the second mold portion 106 with respect to the movable member.

It is noted that the foregoing has outlined some of the more pertinent non-limiting embodiments. Thus, although the description is made for particular arrangements and methods, the intent and concept of the aspects is suitable and applicable to other arrangements and applications. It will be clear to those skilled in the art that modifications to the disclosed embodiments can be effected without departing from the scope the independent claims. It is understood that the described embodiments are merely illustrative of the independent claims.

**WHAT IS CLAIMED IS:**

1. A latch assembly (108, 208, 308, 408, 508) for use in a molding system (100) that includes an injection mold (102), the latch assembly (108, 208, 308, 408, 508) comprising:

a first coupler (112, 212, 312, 412, 512) that is configured to interact, in use, with a stationary member of the molding system (100); and

a second coupler (114, 214, 314, 414, 514) that is configured to interact, in use, with a movable member of the injection mold (102);

the first coupler (112, 212, 312, 412, 512) and the second coupler (114, 214, 314, 414, 514) being configured to cooperate, in use, to selectively latch, during operation of the molding system (100), the stationary member with the movable member, whereby the movable member performs a molding operation with opening of the injection mold (102).

2. The latch assembly (108, 208, 308, 408, 508) of claim 1, wherein:

the stationary member of the molding system (100) is a first mold portion (104) of the injection mold (102), the first coupler (112) being configured to interact therewith.

3. The latch assembly (108, 208, 308, 408, 508) of claim 2, wherein:

the movable member of the molding system (100) is a stripper assembly (150) of a second mold portion (106) of the injection mold (102), the second coupler (114) being configured to interact therewith, and wherein the molding operation is ejecting, in use, a molded article (30) from the second mold portion (106).

4. The latch assembly (108) of claim 3, further comprising:

a latch member (110), the first coupler (112) and the second coupler (114) being associated therewith;

the first coupler (112) and the second coupler (114) being structured to couple, in use, with the first mold portion (104) and the stripper assembly (150), respectively, wherein at least one of the first coupler (112) and the second coupler (114) is operable to selectively couple therewith, whereby the stripper assembly (150) may be selectively latched to the first mold portion (104).

5. The latch assembly (108) of claim 4, wherein:

the latch member (110), the first coupler (112) and the second coupler (114) are configured to cooperate to accommodate, in use, relative separation of the second mold

portion (106), including the movable member that is associated therewith, a predefined distance ('L') with respect to the first mold portion (104) prior to a completion of the relative separation of the second mold portion (106) with respect to the first mold portion (104).

6. The latch assembly (108) of claim 5, wherein:

the first coupler (112) includes a lock assembly (116) and a lock engager (118), the lock assembly (116) being associated with the first mold portion (104), the lock engager (118) being associated with the latch member (110), wherein the lock assembly (116) is operable, in use, to selectively couple the latch member (110) with the first mold portion (104) through engagement of the lock assembly (116) and the lock engager (118).

7. The latch assembly (108) of claim 6, wherein:

the latch member (110) includes a bar-like body, the lock engager (118) being defined as an elongated passageway that stretches along a portion of the latch member (110) in a direction of a mold-stroke axis (901), the elongated passageway having an end portion (119) that is interactable, in use, with a lock body (124) to arrest the first mold portion (104) and the stripper assembly (150) at the predefined distance ('L') therebetween.

8. The latch assembly (108) of claim 7 wherein:

the lock assembly (116) includes a lock actuator (122), the lock body (124), and a lock receiver (111), the lock actuator (122) being operable to slidably move the lock body (124) through the lock engager (118) and into or out of the lock receiver (111) that is defined in the first mold portion (104).

9. The latch assembly (108) of claim 5, wherein:

the second coupler (114) includes an end-link (117) that is associated with the latch member (110) with which to couple, in use, with the stripper assembly (150).

10. The latch assembly (108) of claim 9, wherein:

the latch member (110) includes a bar-like body, the end-link (117) is provided as a hook-shaped portion that is disposed at an end of the latch member (110), wherein a front face of the end-link (117) is contactable, in use, with a back face of a stripper plate (152) of the stripper assembly (150) to couple therewith.

11. The latch assembly (208, 308, 408, 508) of claim 1, wherein:

the stationary member of the molding system (100) is associated with a clamping assembly (996) thereof.

12. The latch assembly (208, 308, 408, 508) of claim 11, wherein:
the stationary member of the molding system (100) is one of a tie bar (916) or a stationary platen (914) of the clamping assembly (996).

13. The latch assembly (208, 308, 408, 508) of claim 12, wherein:
the first coupler (212, 312, 412) is configured to clamp onto the tie bar (916).

14. The latch assembly (508) of claim 12, wherein:
the first coupler (512) is configured to mount to the stationary platen (914).

15. The latch assembly (208, 308, 408, 508) of claim 1, wherein:
the second coupler (214, 314, 414, 514) is movably connected to the first coupler (212, 312, 412, 512) to provide for selective relative repositioning thereof, in use, between a coupling position and decoupling position.

16. The latch assembly (208, 308, 408, 508) of claim 15, wherein:
the second coupler (214, 314, 414) is one of slidably, rotationally, or pivotally connected to the first coupler (212, 312, 412) to provide for selective relative repositioning thereof, in use, between the coupling position and the decoupling position.

17. The latch assembly (208, 308, 408, 508) of claim 15, further comprising:
an actuator (522) that is operatively connected to the second coupler (214, 314, 414, 514) with which to position the second coupler (214, 314, 414, 514), in use, relative to the first coupler (212, 312, 412, 512).

18. The latch assembly (208, 308, 408, 508) of claim 15, wherein:
the movable member of the molding system (100) is a stripper assembly (150) of a second mold portion (106) of the injection mold (102), the second coupler (214, 314, 414) being configured to interact therewith.

19. The latch assembly (208, 308, 408, 508) of claim 18, wherein:

the second coupler (214, 314, 414, 514) includes a catch (215, 315, 415, 515) with which to capture, in use, the stripper assembly (150) with the second coupler (214, 314, 414, 514) being positioned in the coupling position and with separation of a first mold portion (104) of the injection mold (102) and the second mold portion (106) to a predefined distance ('L') therebetween.

20. The latch assembly (208, 308) of claim 19, wherein:

the catch (215, 315) is configured to interact with a back face of a stripper plate (152) of the stripper assembly (150).

21. The latch assembly (408, 508) of claim 19, wherein:

the catch (415, 515) is configured to interact with a catch receiver (426, 526) that is associated with a stripper plate (152) of the stripper assembly (150).

22. The latch assembly (408) of claim 21, wherein:

the catch receiver (426) is defined the stripper plate (152).

23. The latch assembly (508) of claim 21, wherein:

the catch receiver (526) is defined by a catch bar (524) that is connected to the stripper plate (152).

24. The latch assembly (508) of claim 21, wherein:

the catch receiver (526) is configured to receive the catch (515) with the first mold portion (104) and the second mold portion (106) being in a molding configuration and to interact therewith once the first mold portion (104) and the second mold portion (106) have been separated to the predefined distance ('L') therebetween.

25. The latch assembly (508) of claim 21, further comprising:

a third coupler (528) that is movably connected to the first coupler (512) for selective relative repositioning thereof, in use, between the coupling position and the decoupling position.

26. The latch assembly (508) of claim 25, further comprising:

a link (520), wherein the second coupler (514), the third coupler (528), and the link (520) are configured to cooperate to provide for linked movement of the second coupler (514) and the third coupler (528).

27. An injection molding process (600) that is executable with an injection molding system (100), the injection molding process (600) comprising:

a clamping operation (610) that includes operating a clamping assembly (996) to clamp together a first mold portion (104) and a second mold portion (106) of an injection mold (102) arranged therein;

an injection operation (620) that includes operating an injection assembly (997) to inject molding material into the injection mold (102) to form a molded article (30) therein;

a latching operation (630) that includes operating a latching assembly (108, 208, 308, 408, 508) to selectively latch a stationary member of a molding system (100) to a movable member of the second mold portion (106); and

an opening operation (640) that includes operating the clamping assembly (996) to cause a relative separation of a remainder of the second mold portion (106) with respect to the first mold portion (104), and thereby cause a relative movement of the remainder of the second mold portion (106) with respect to the movable member which has become stationary with respect to the first mold portion (104) by virtue of having been selectively latched thereto; and

wherein, a molding operation is performed with the relative movement of the remainder of the second mold portion (106) with respect to the movable member.

28. The injection molding process (600) of claim 27, wherein:

the movable member of the molding system (100) is a stripper assembly (150), and wherein the molding operation is stripping of the molded article (30) from a mold core (182) that is associated with the remainder of the second mold portion (106).

29. The injection molding process (600) of claim 27, wherein:

the latching assembly (108, 208, 308, 408, 508) includes a first coupler (112, 212, 312, 412, 512) and a second coupler (114, 214, 314, 414, 514) that are configured to cooperate, in use, to selectively latch the stationary member with the movable member, and wherein the latching operation (630) includes selectively coupling at least one of: i) the first coupler (112, 212, 312, 412, 512) to the stationary member; and ii) the second coupler (114, 214, 314, 414, 514) to the movable member of the injection molding system (100).

30. The injection molding process (600) of claim 29, wherein:

the latching operation (630) includes repositioning the second coupler (214, 314, 414, 514) relative to the first coupler (112, 212, 312, 412, 512) between a decoupling position and a coupling position.

31. The injection molding process (600) of claim 30, wherein:

the second coupler (214, 314, 514) is positioned into the coupling position prior to a completion of the relative separation of the second mold portion (106) with respect to the first mold portion (104).

32. The injection molding process (600) of claim 30, wherein:

the second coupler (414) is positioned into the coupling position only once the second mold portion (106) has been separated from the first mold portion (104) by a predefined distance.

33. The injection molding process (600) of claim 27, wherein:

the opening operation (640) involves a first stage opening of the injection mold (102).

34. A controller (930) including instructions (934) being embodied in a controller-usable memory (932) of the controller (930), the instructions (934) including executable instructions for directing the controller (930) to execute the injection molding process (600) of any one of claims 27 to 33.

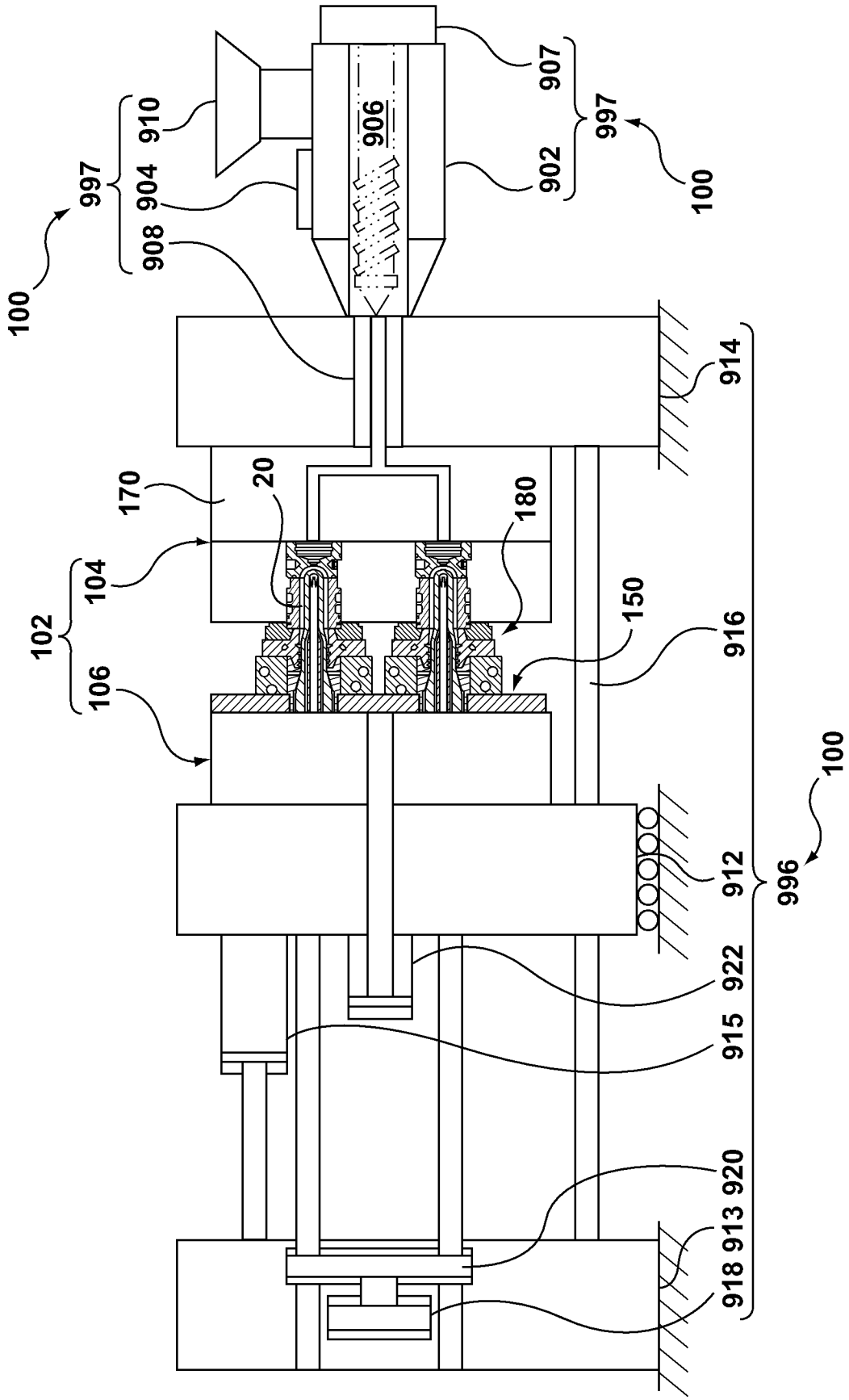

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FIG. 1

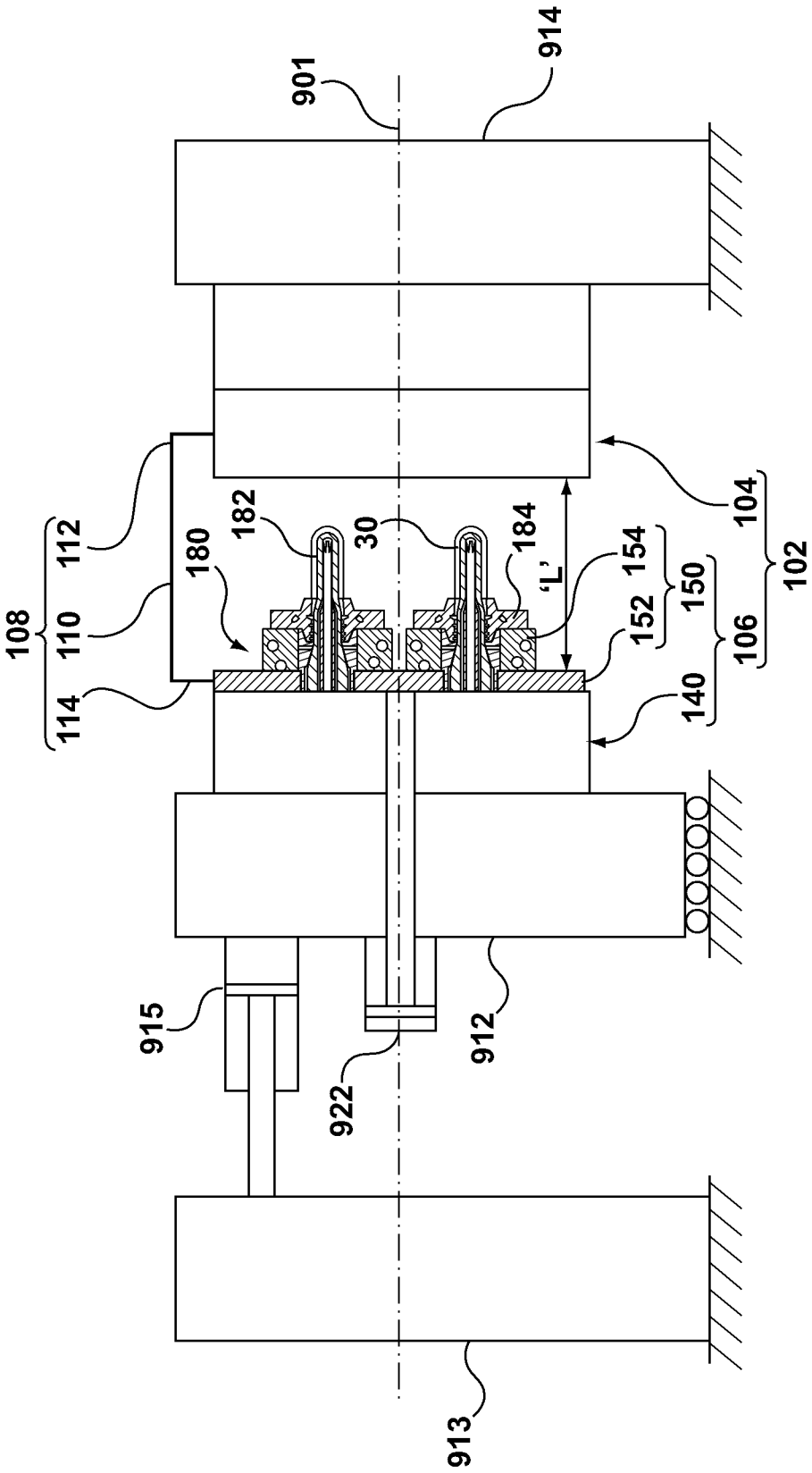

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FIG. 2A

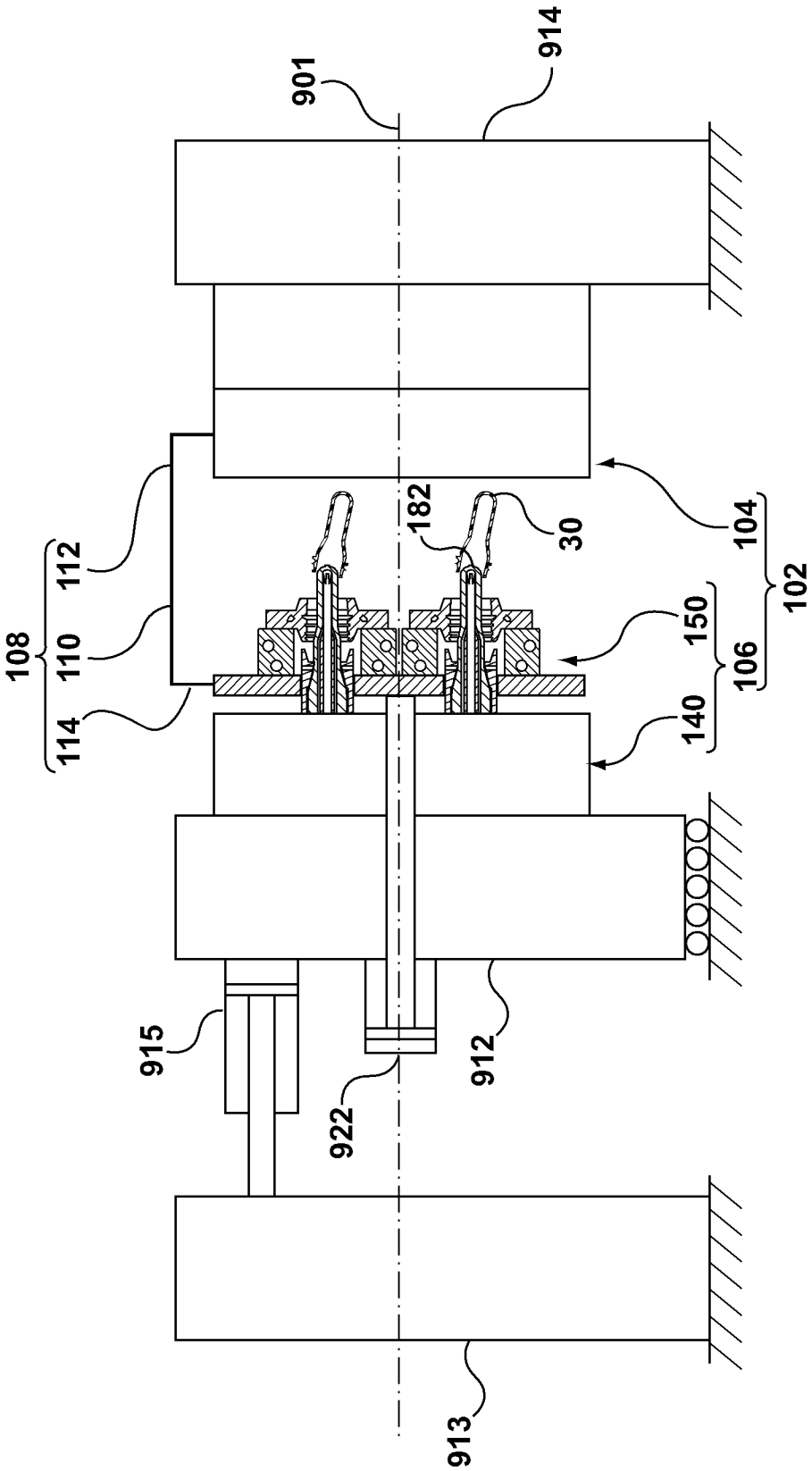

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FIG. 2B

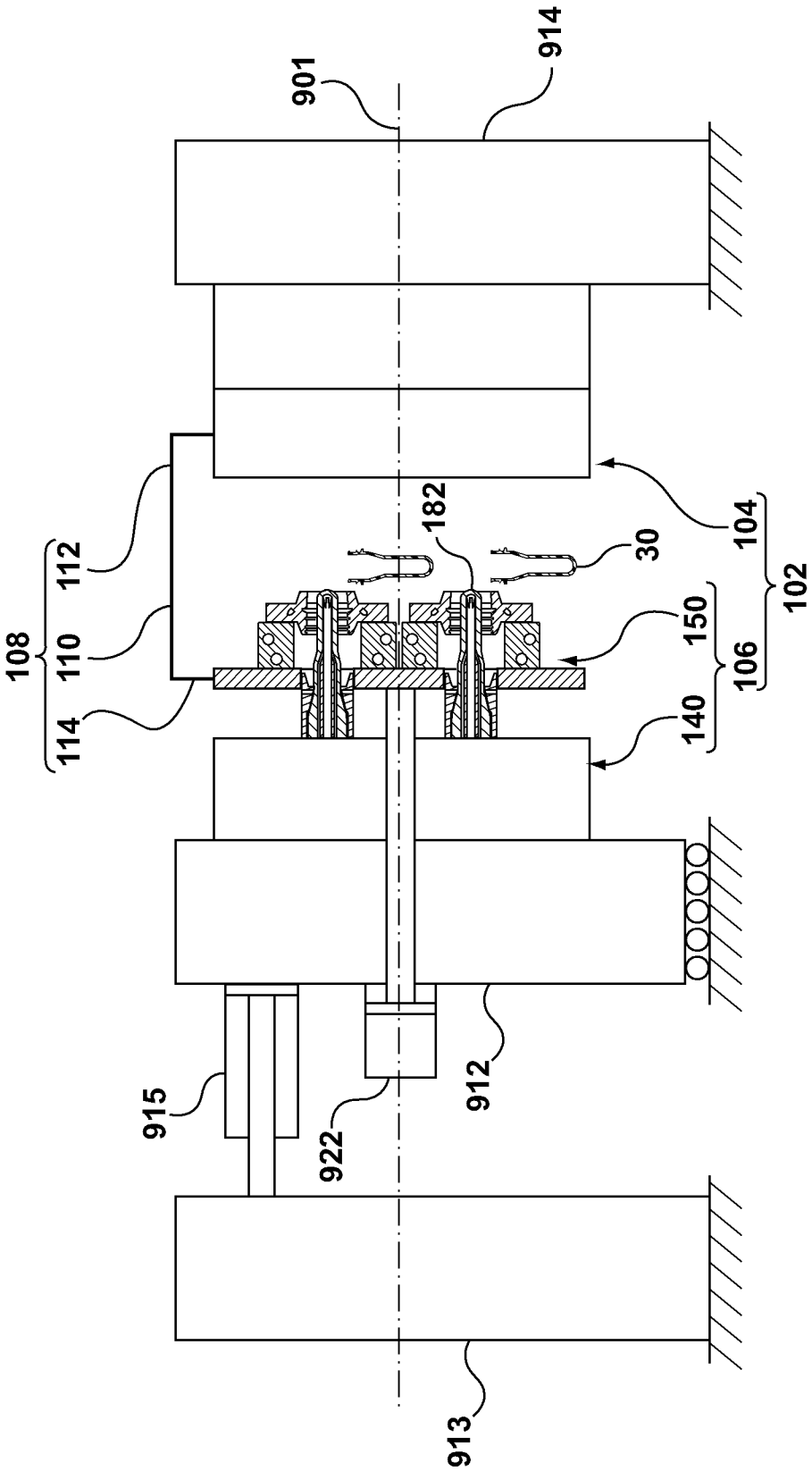

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FIG. 2C

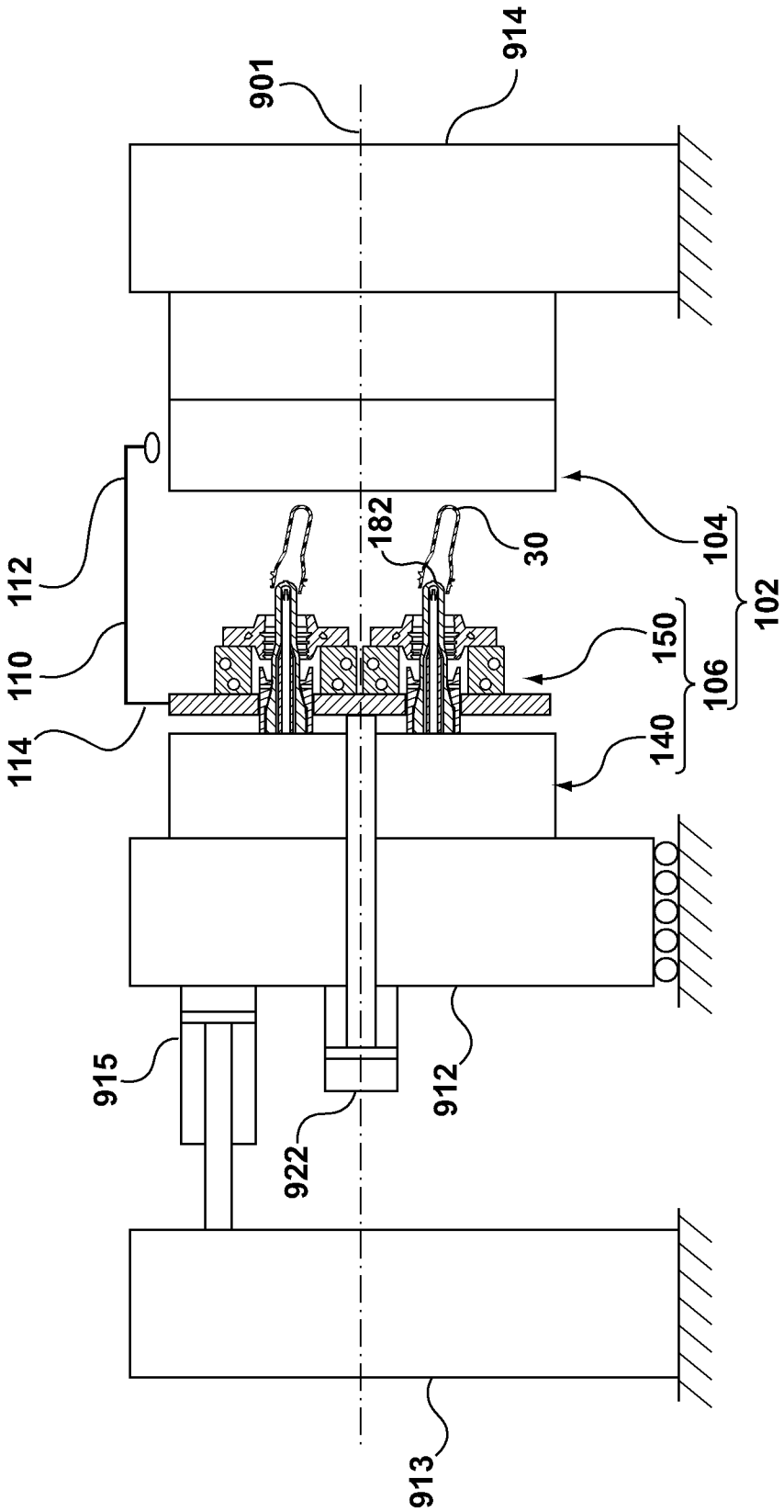



FIG. 2D

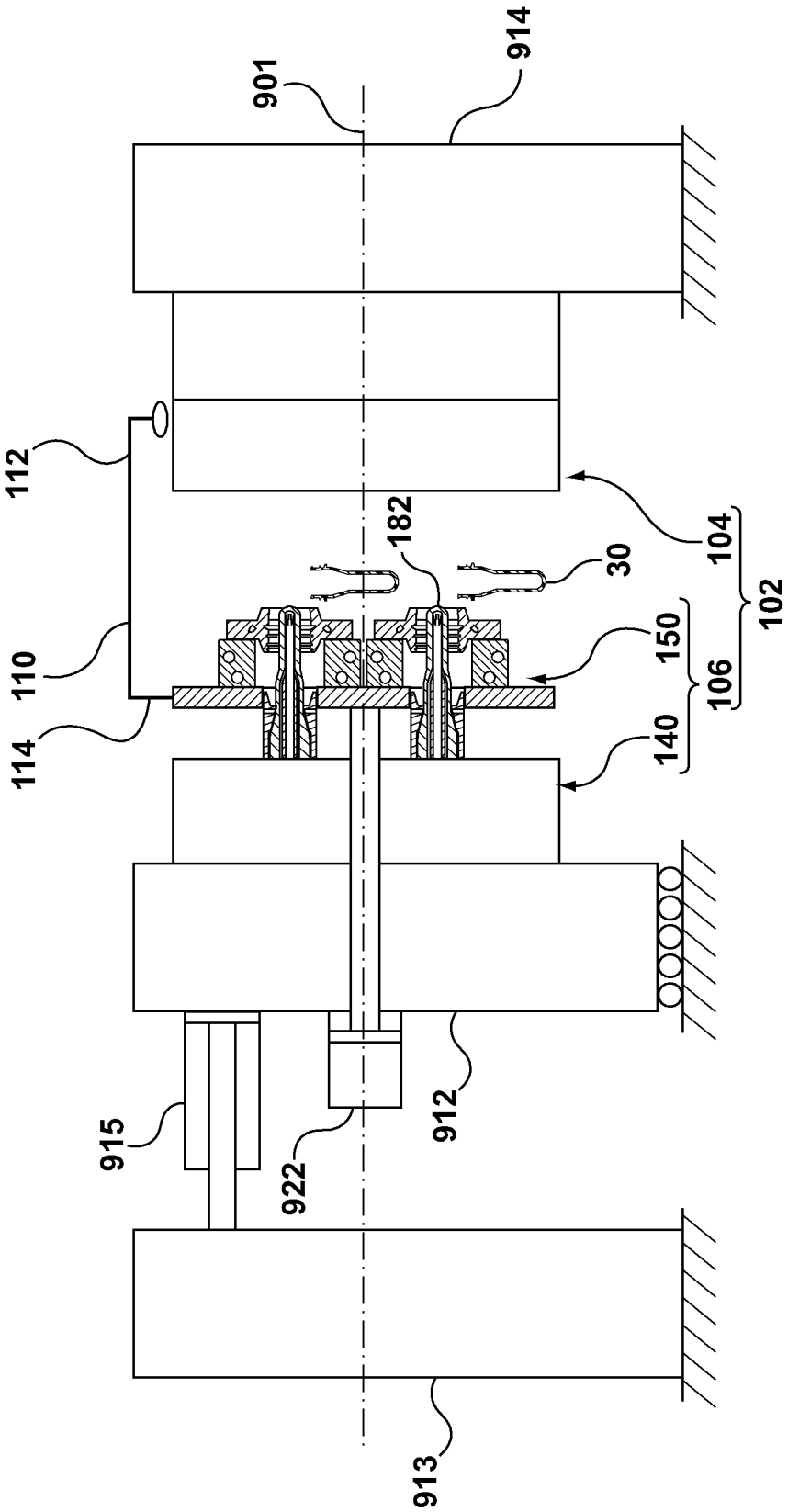



FIG. 2E

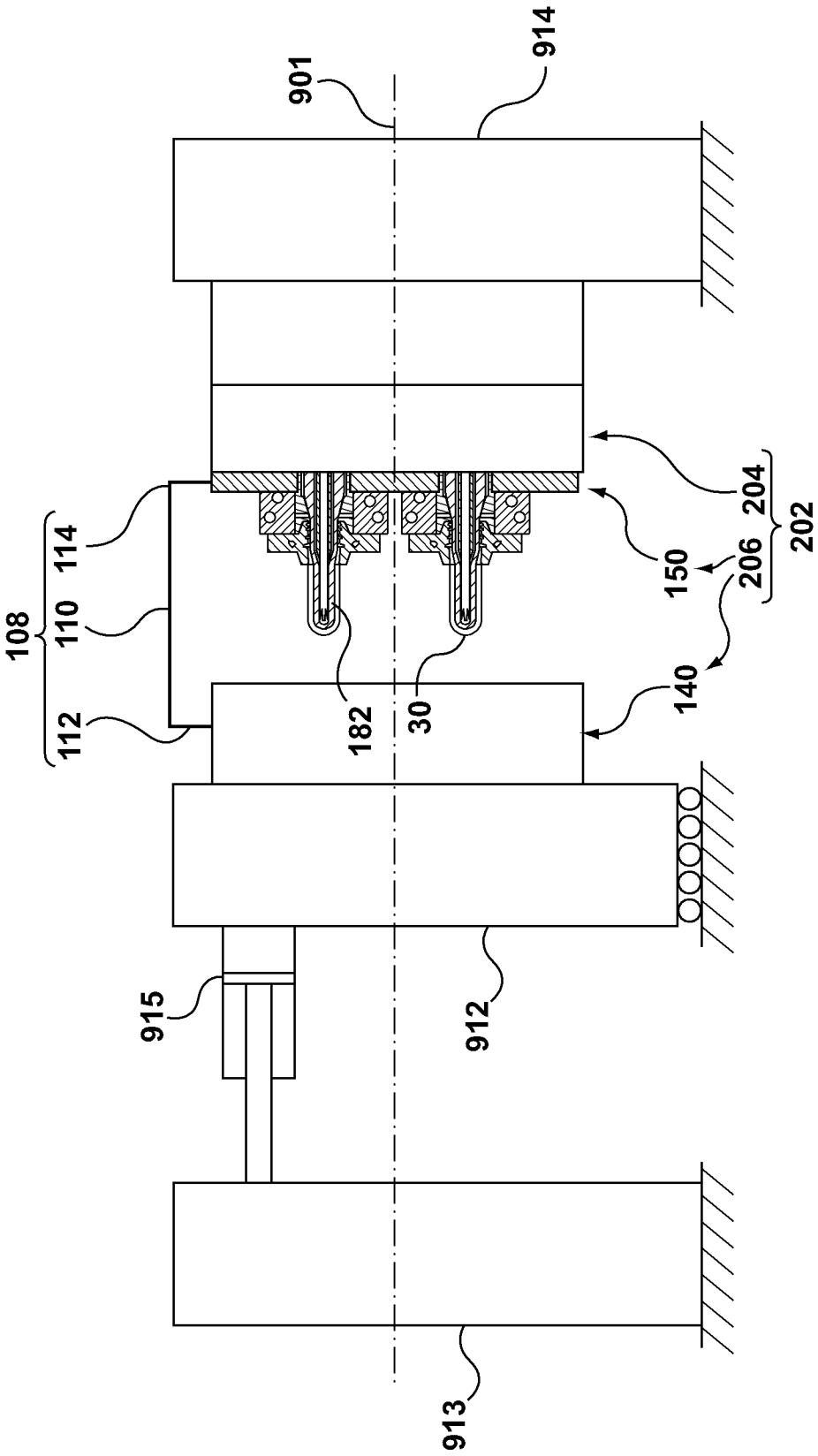



FIG. 2F

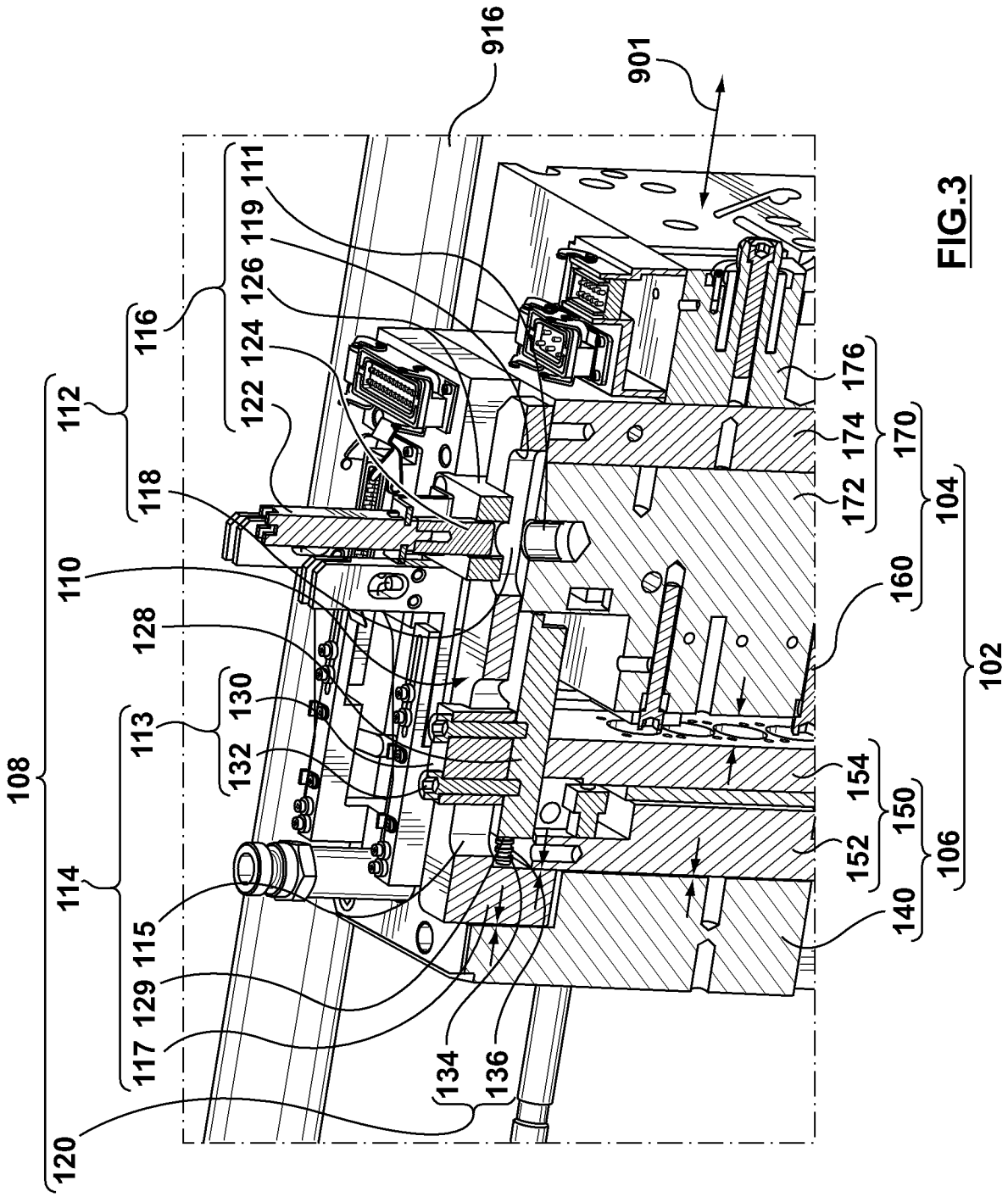

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FIG.3

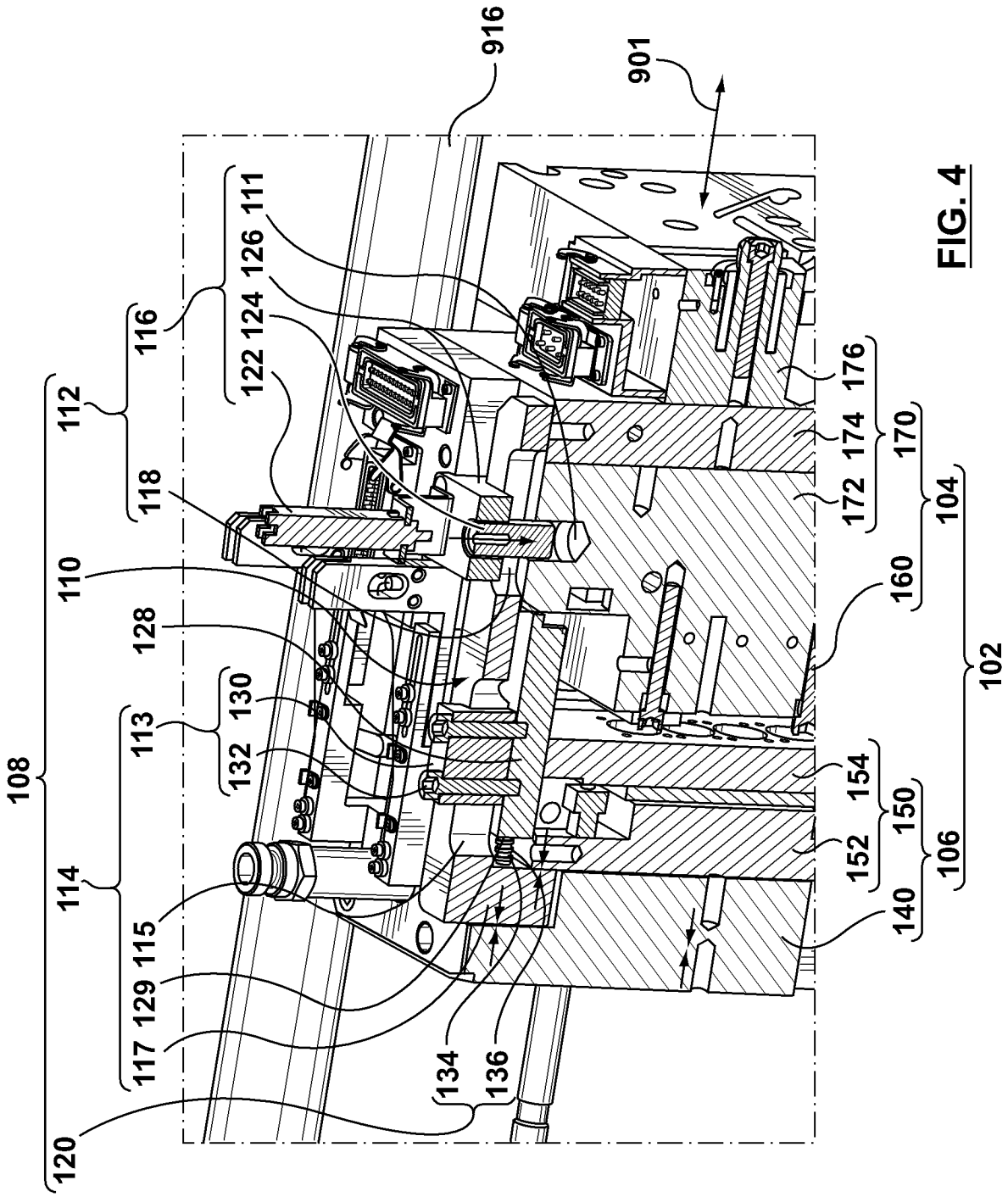

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FIG. 4

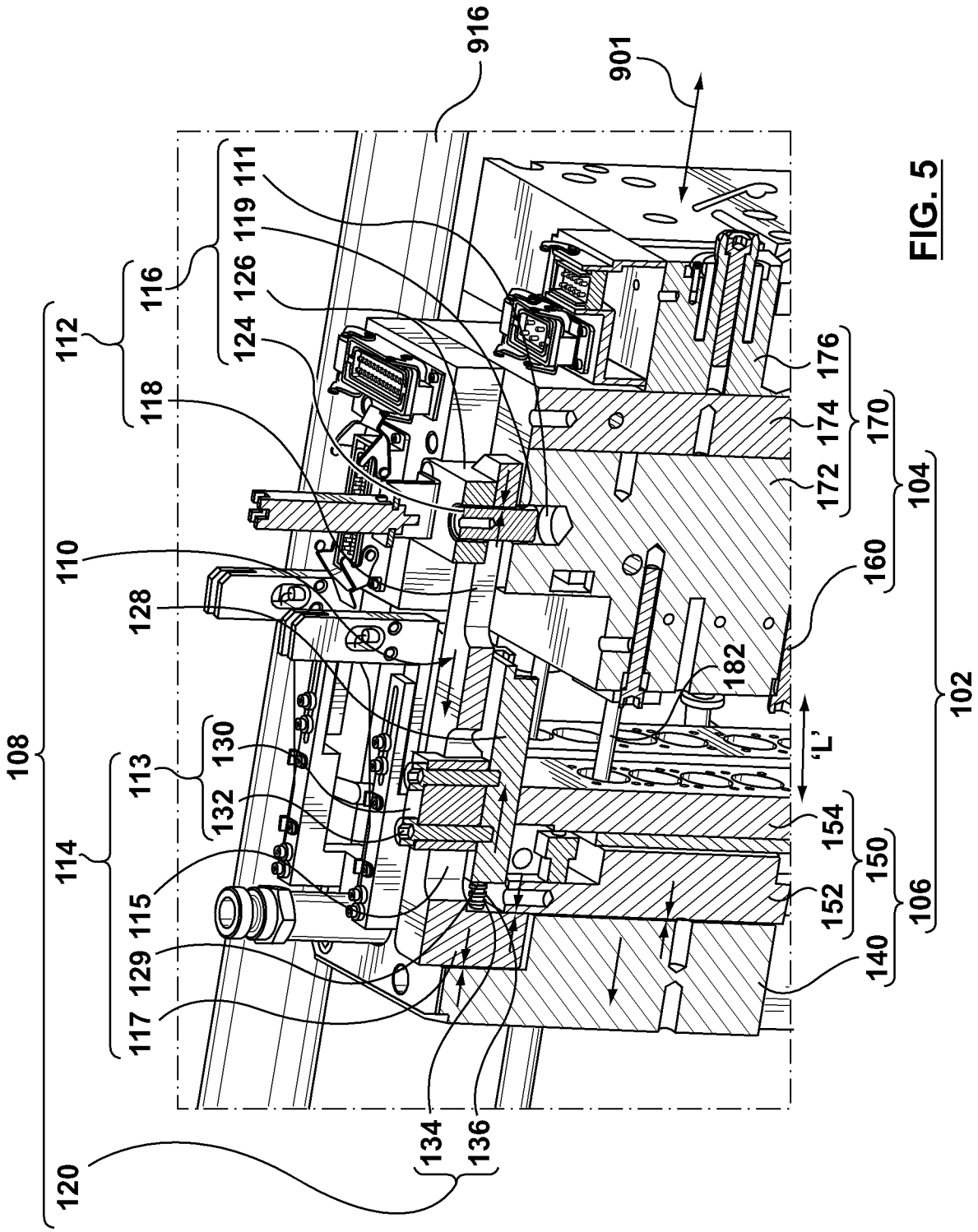

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FIG. 5

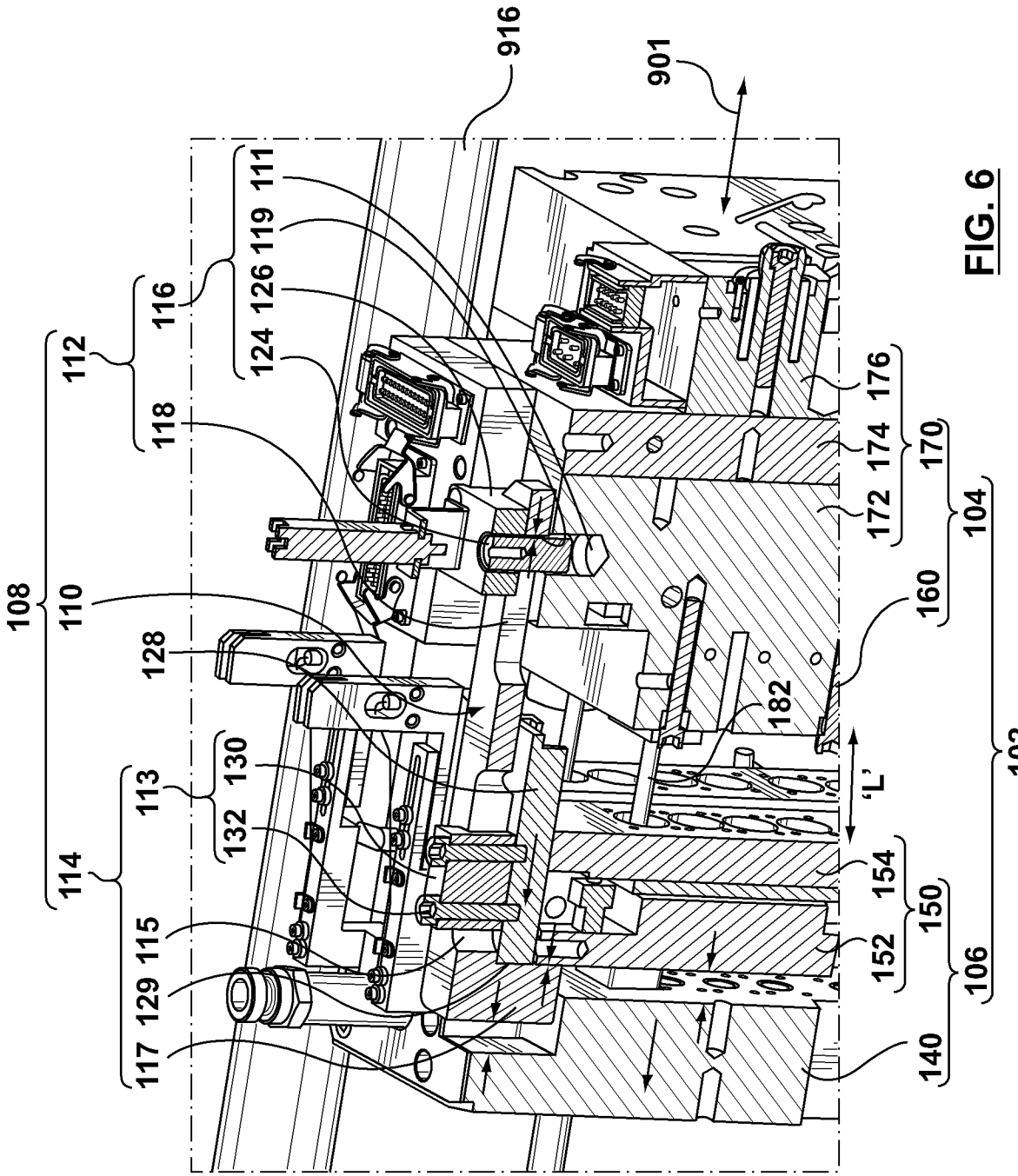

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FIG. 6

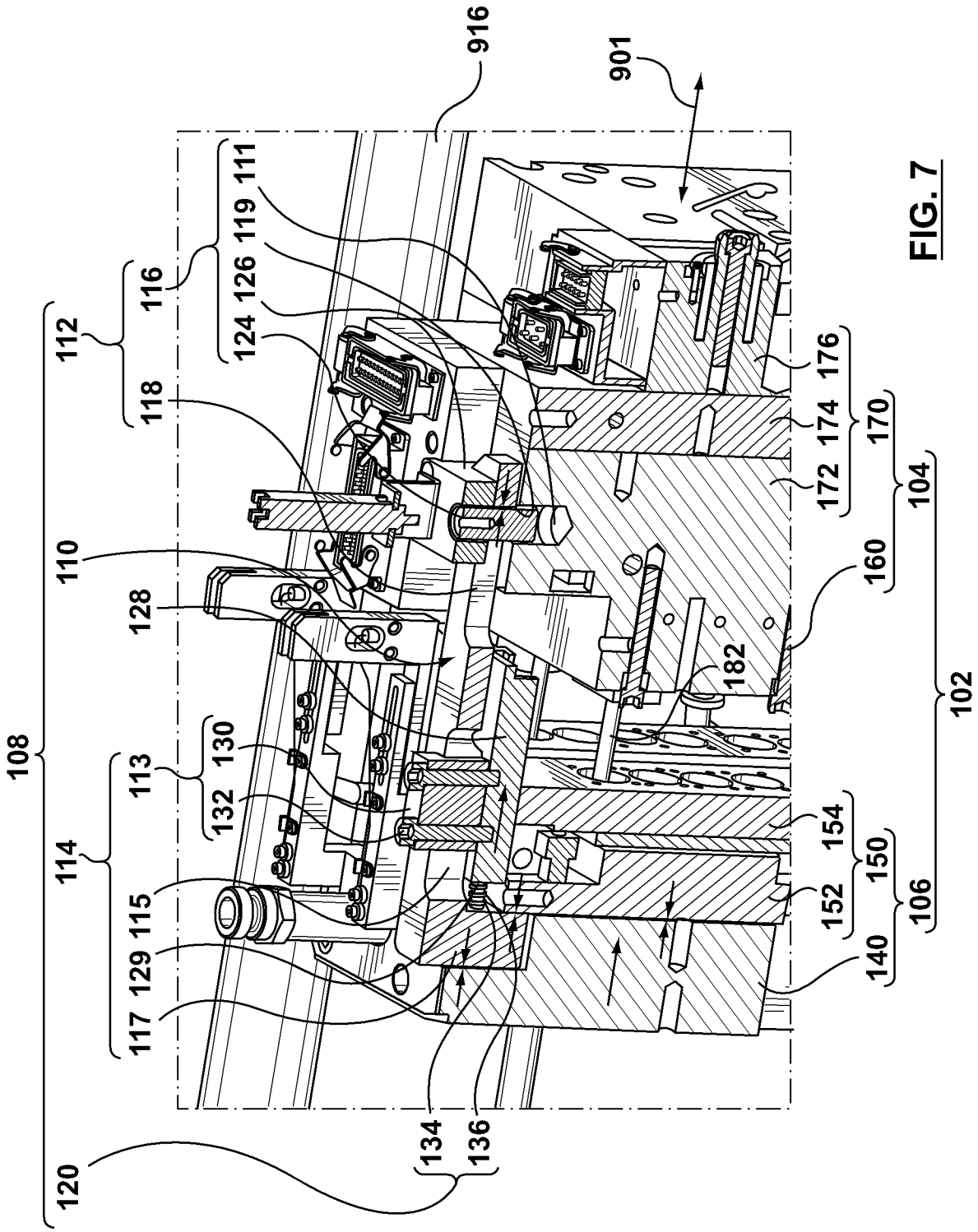

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FIG. 7

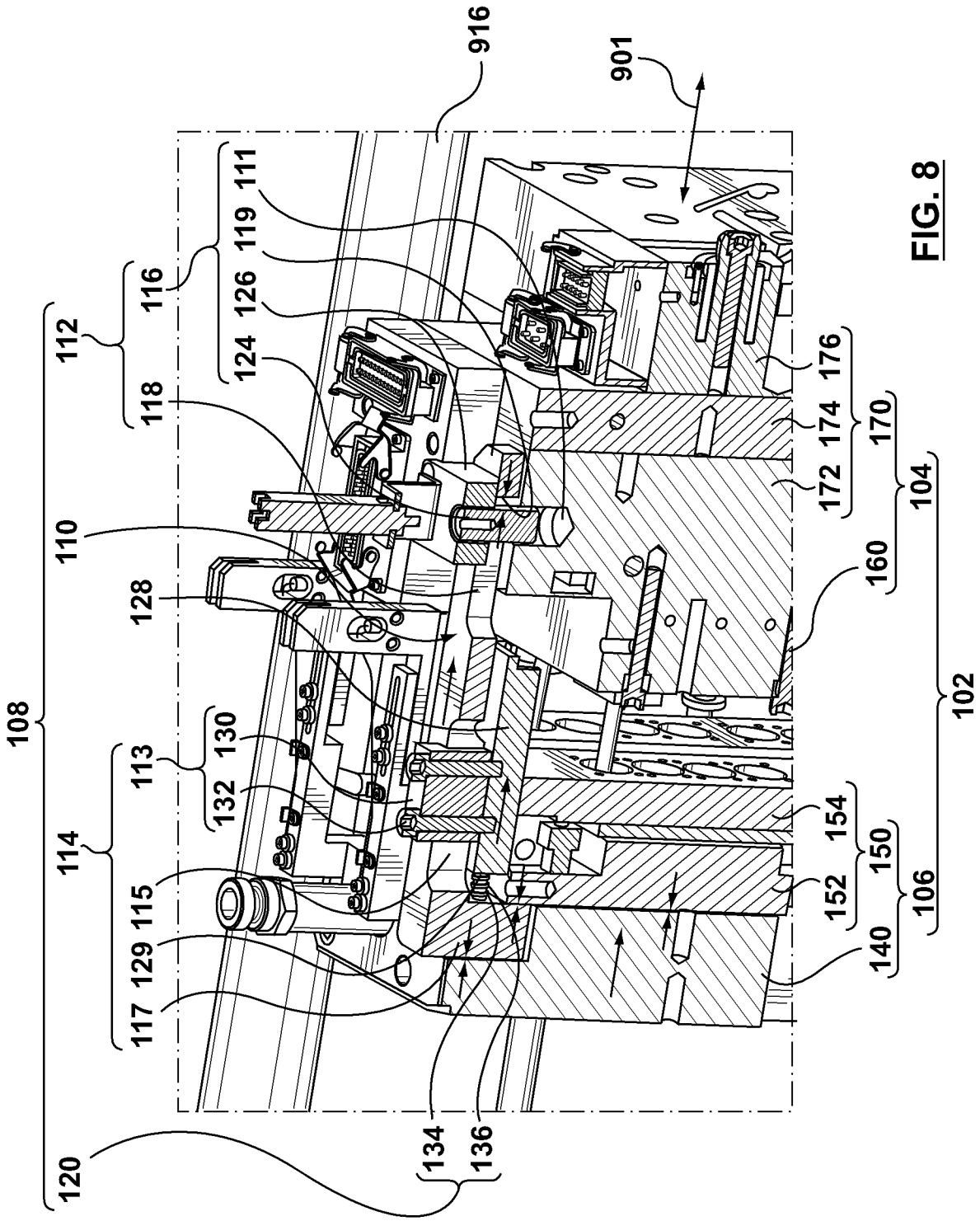

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FIG. 8

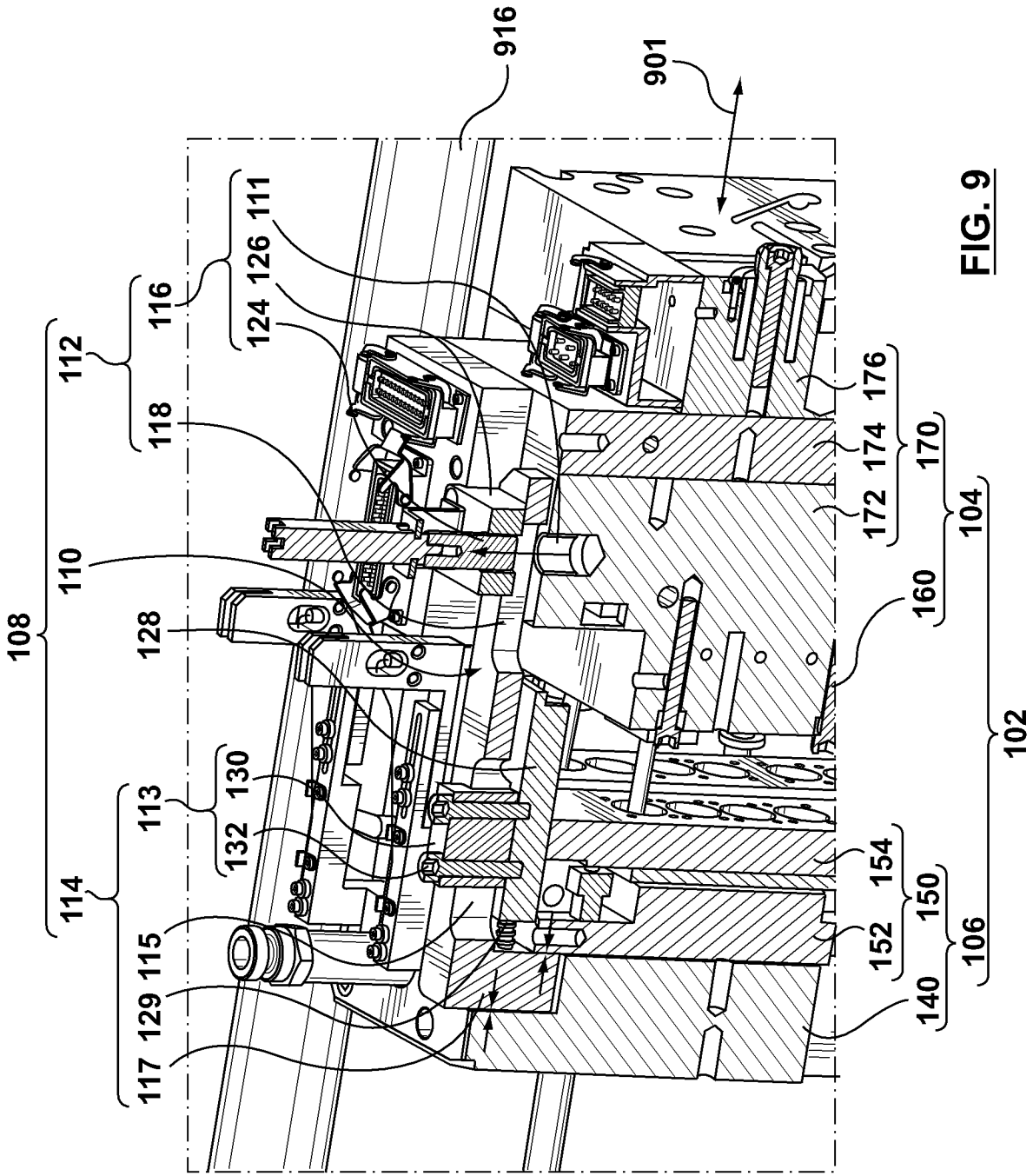

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FIG. 9

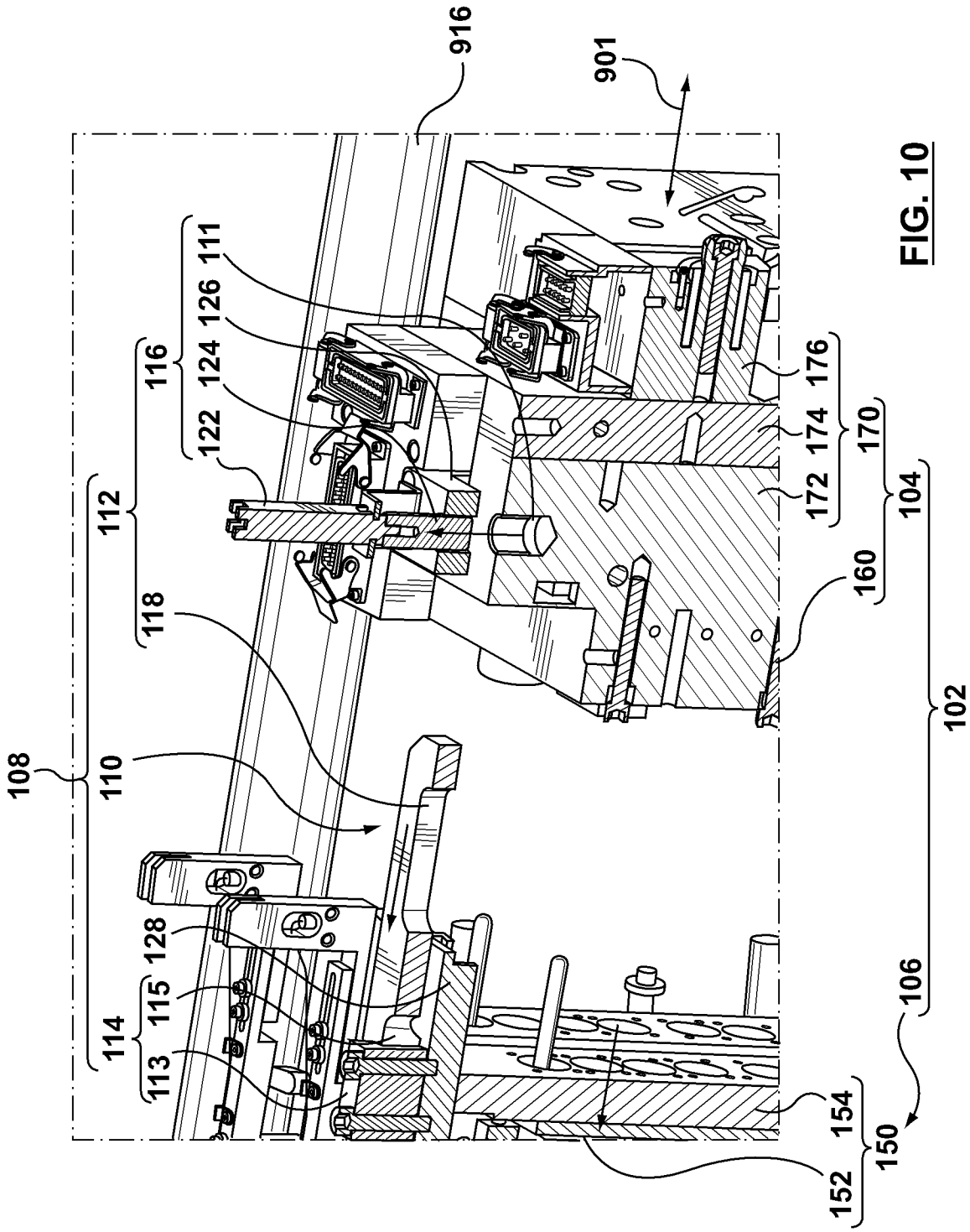

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FIG. 10

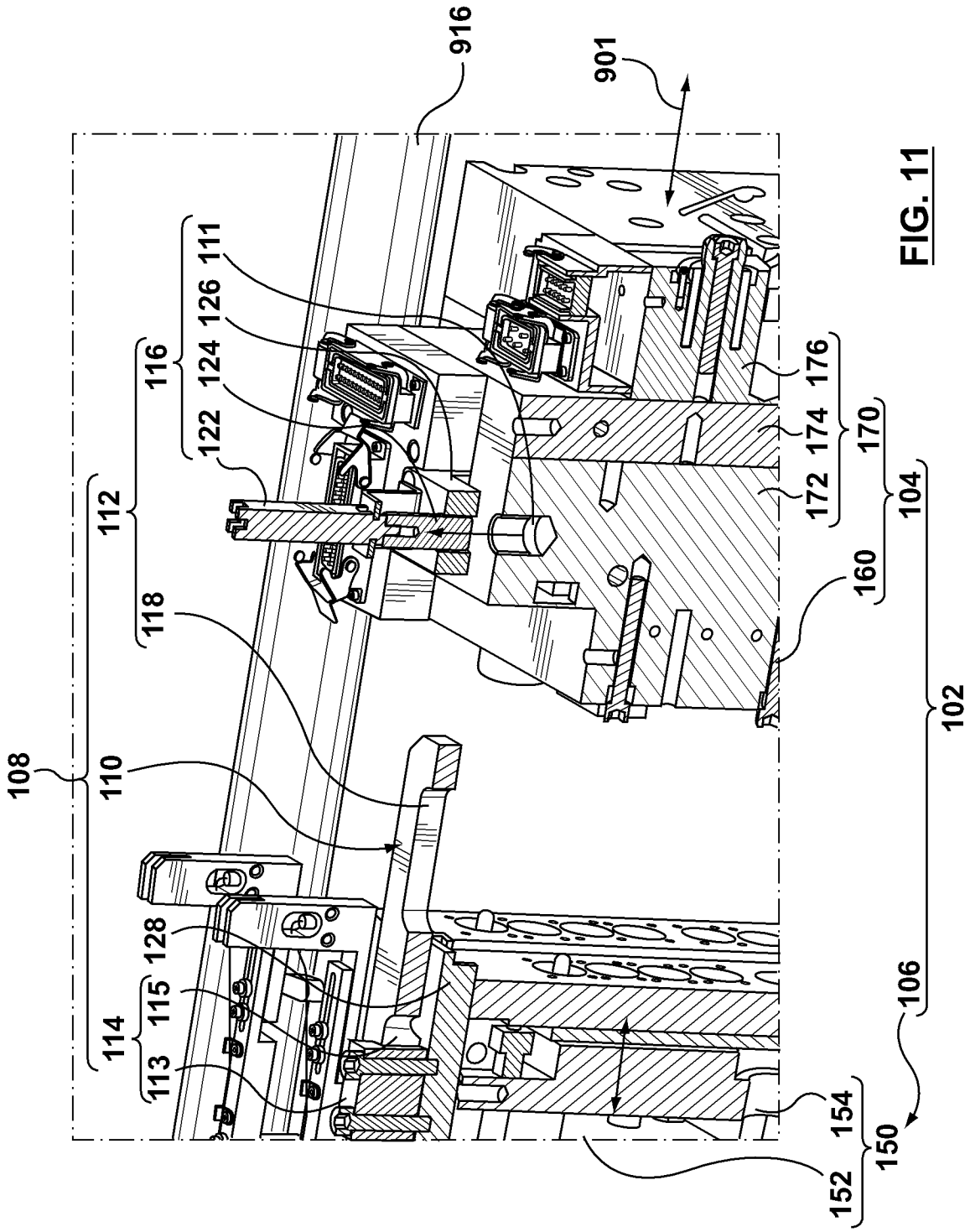

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FIG. 11

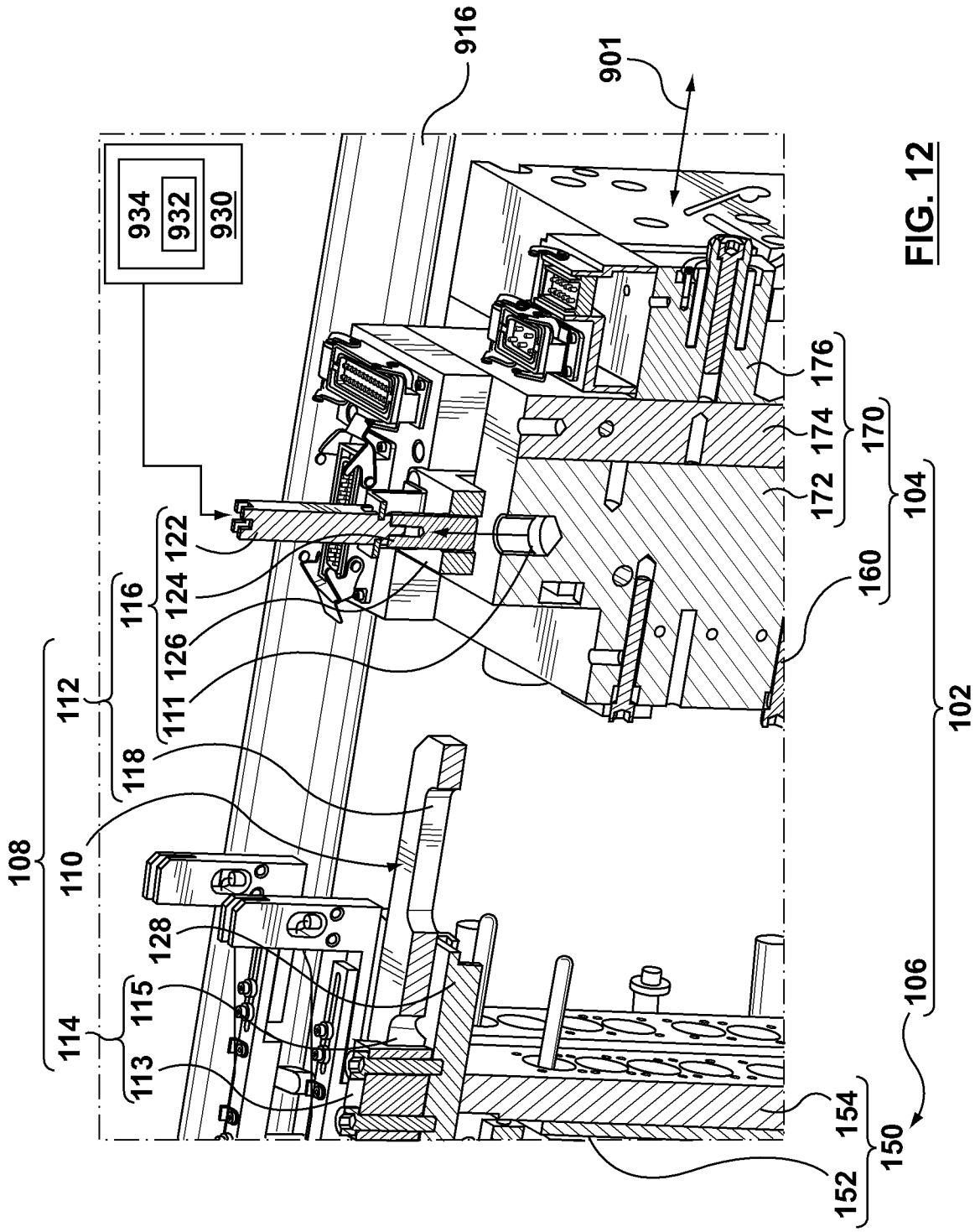

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FIG. 12

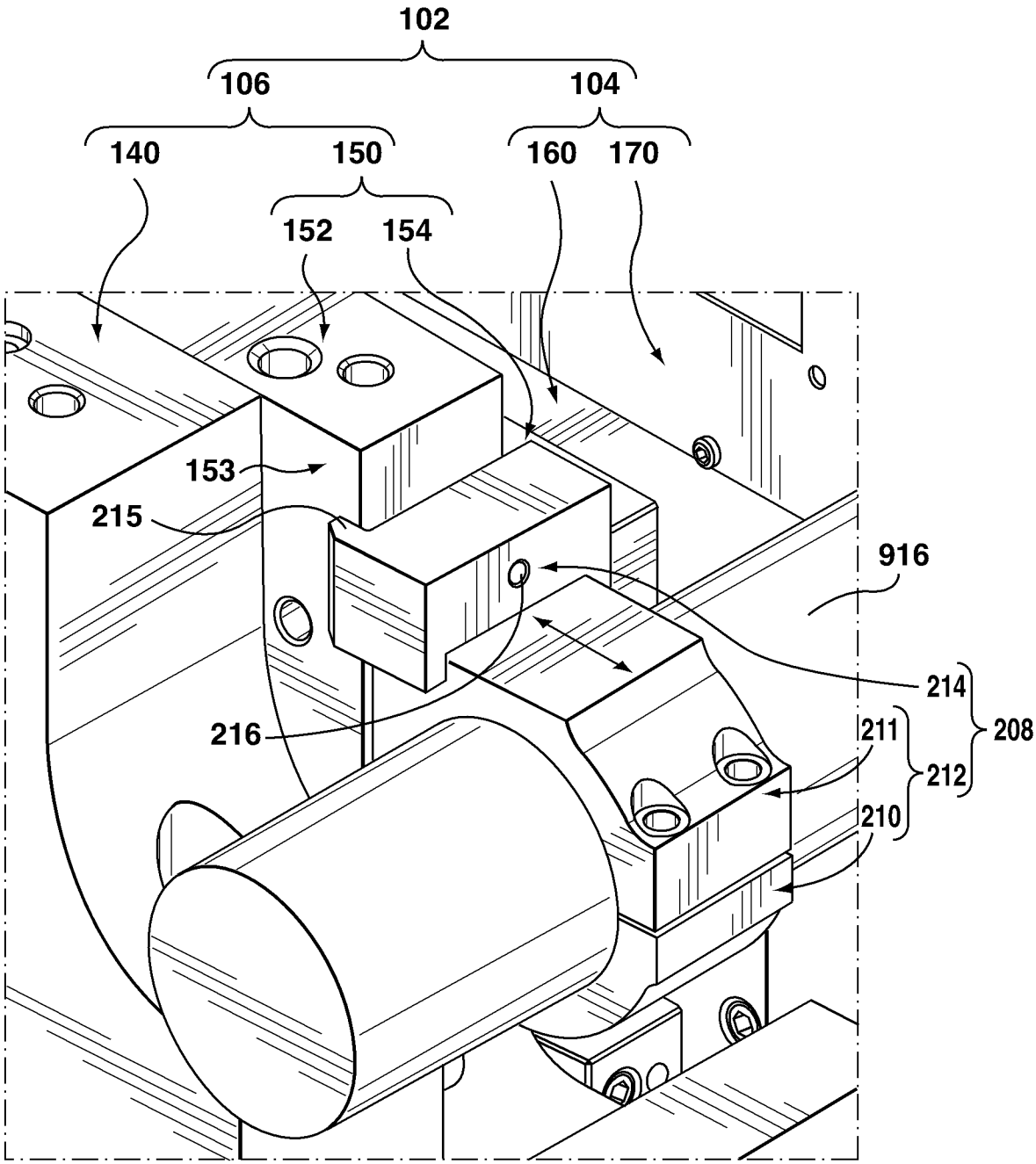

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FIG. 13

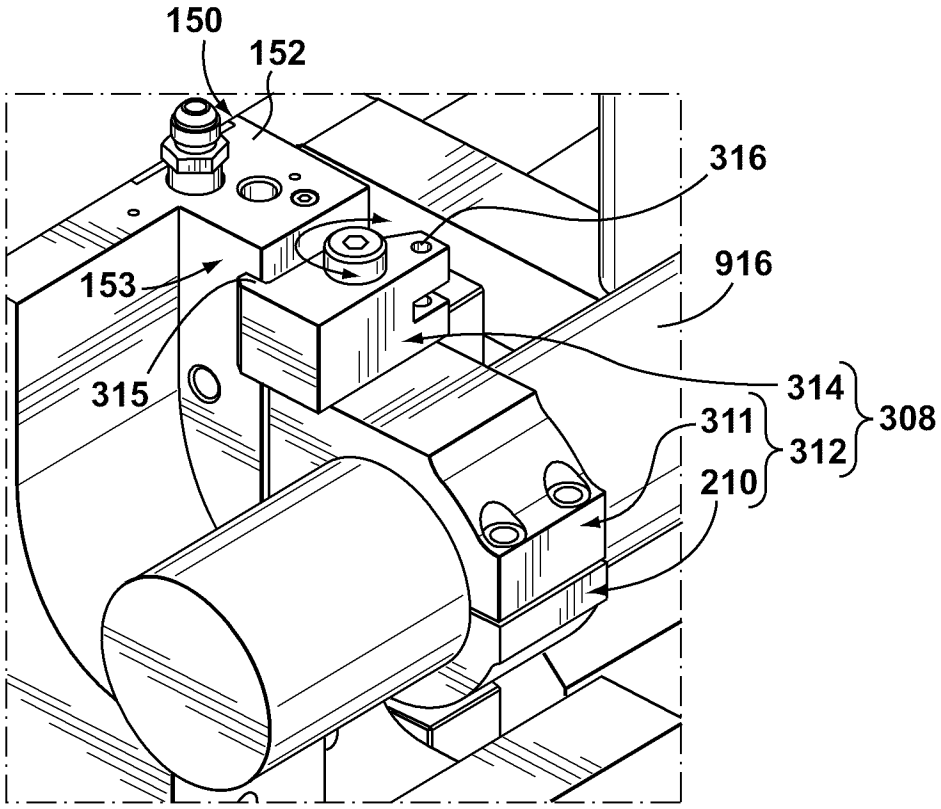

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FIG. 14

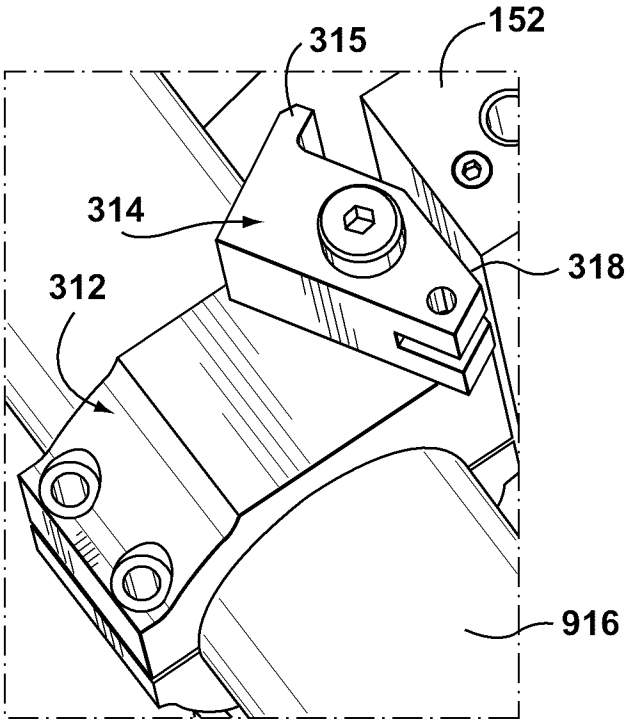

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FIG. 15

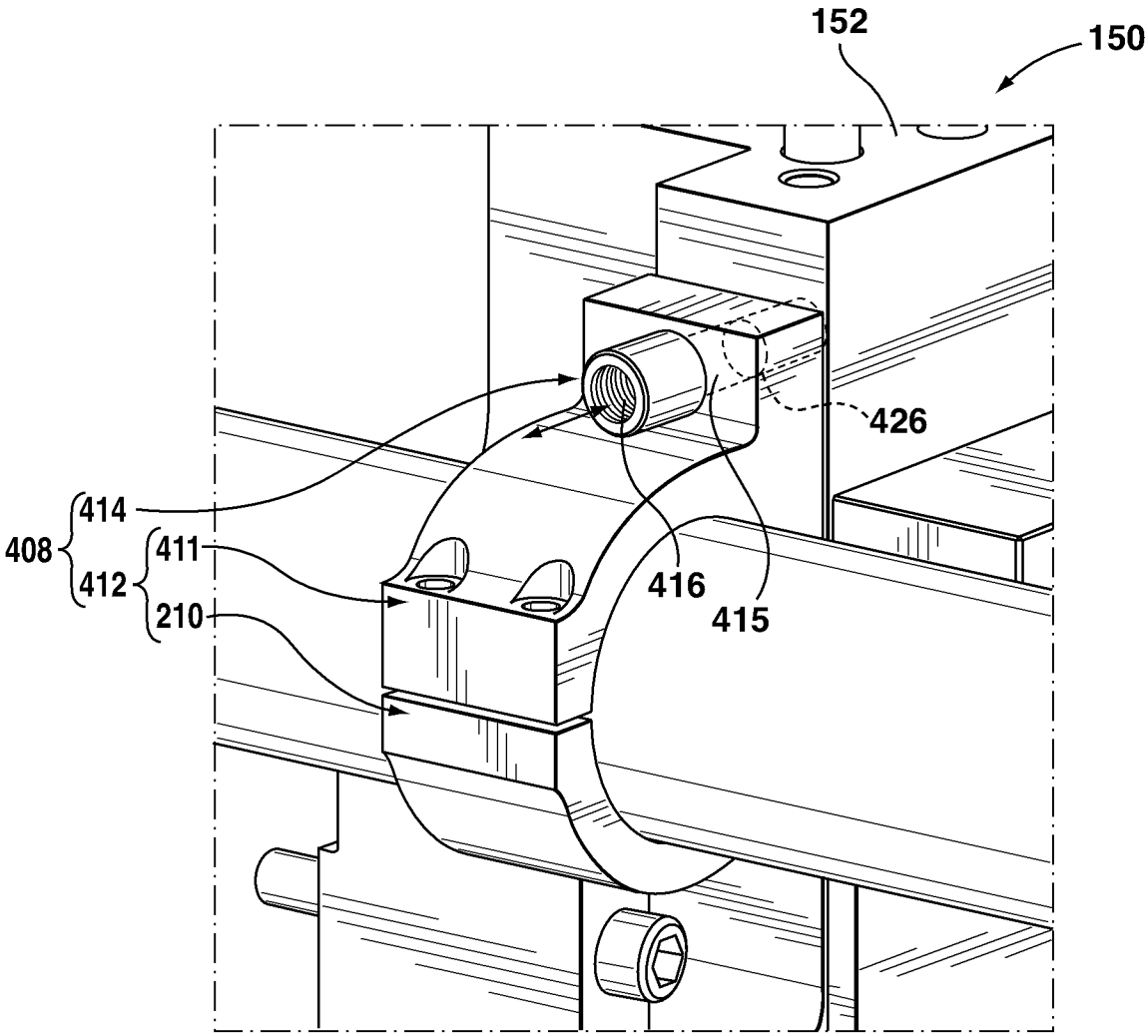



FIG. 16

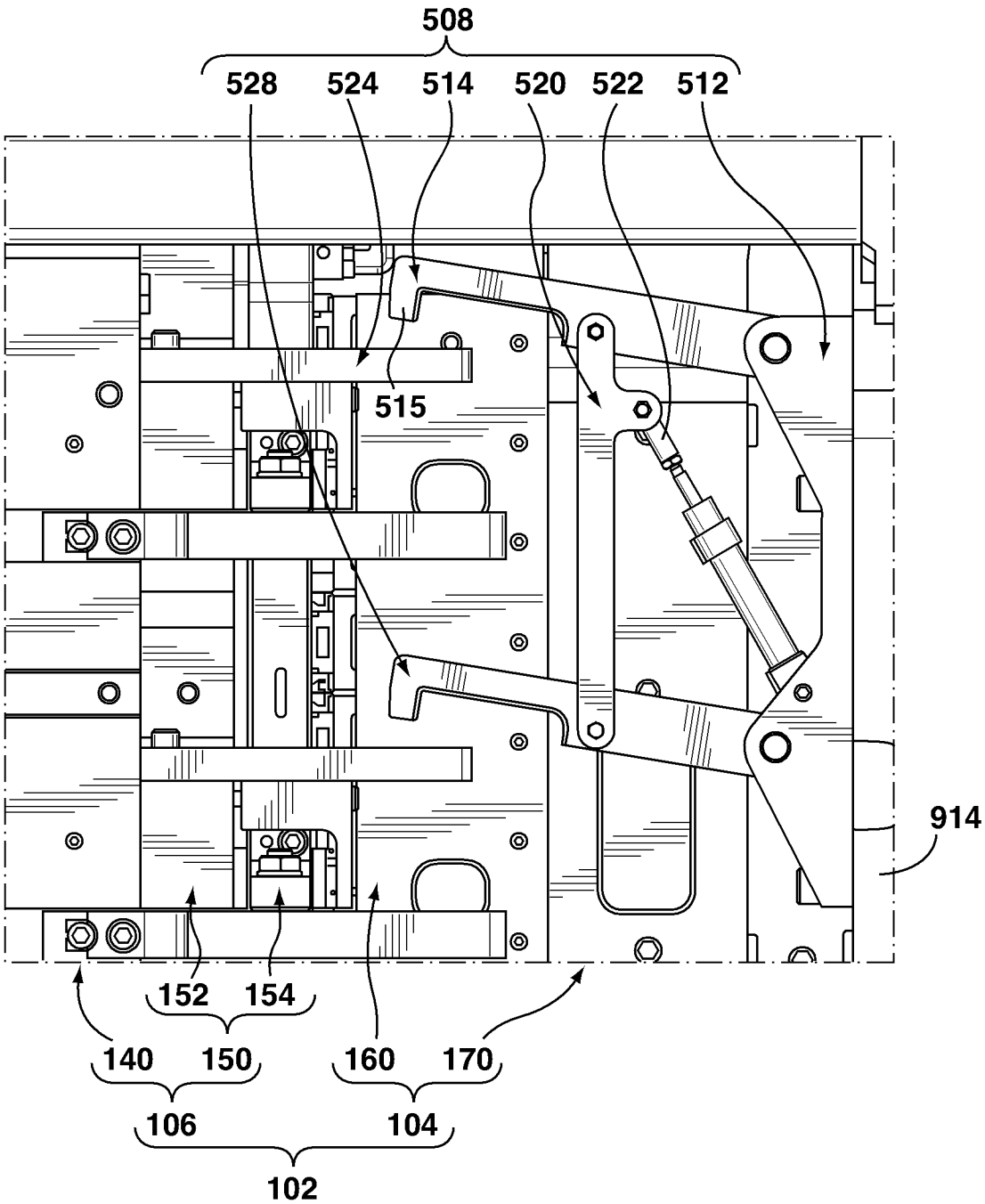

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FIG. 17

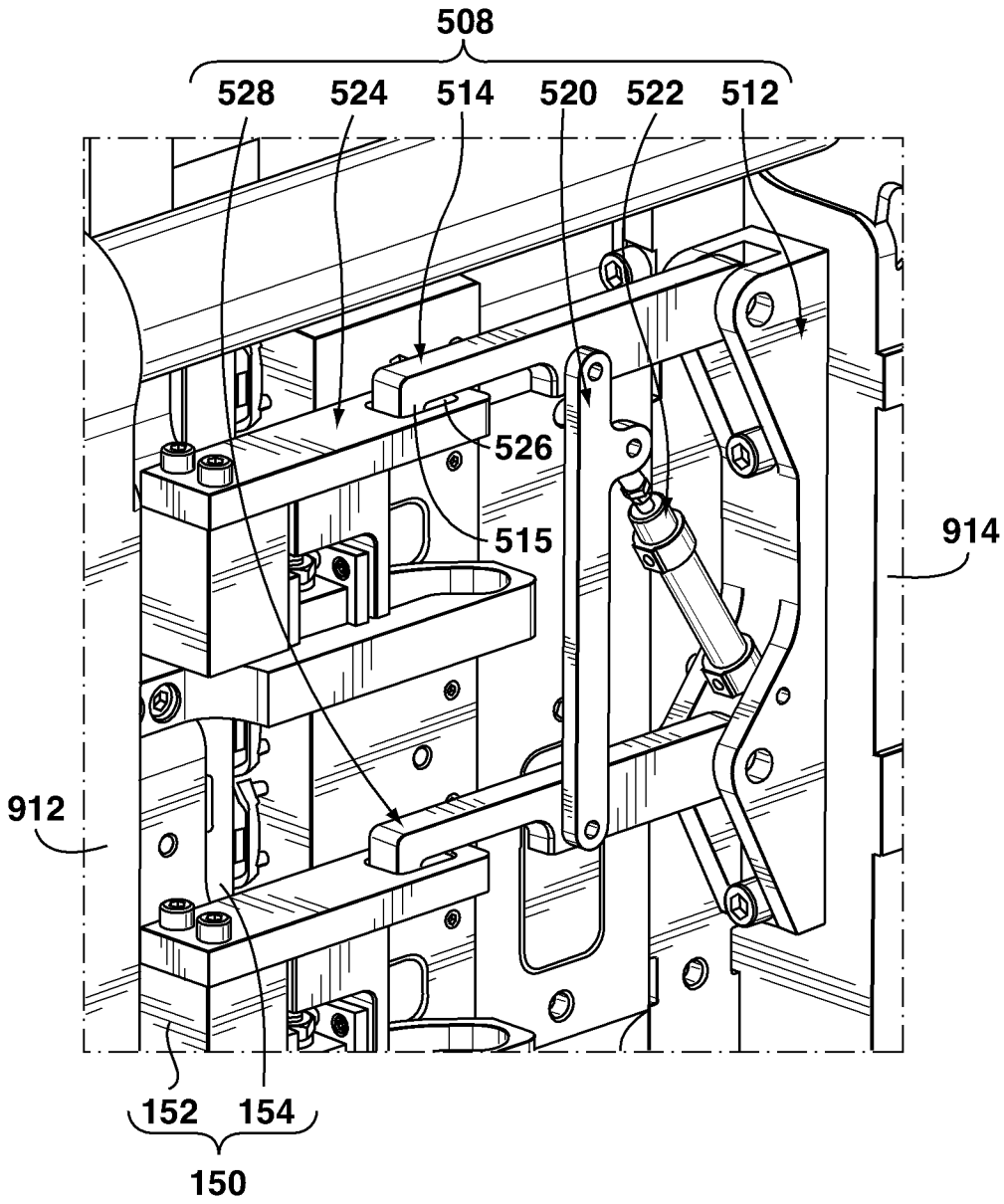



FIG. 18

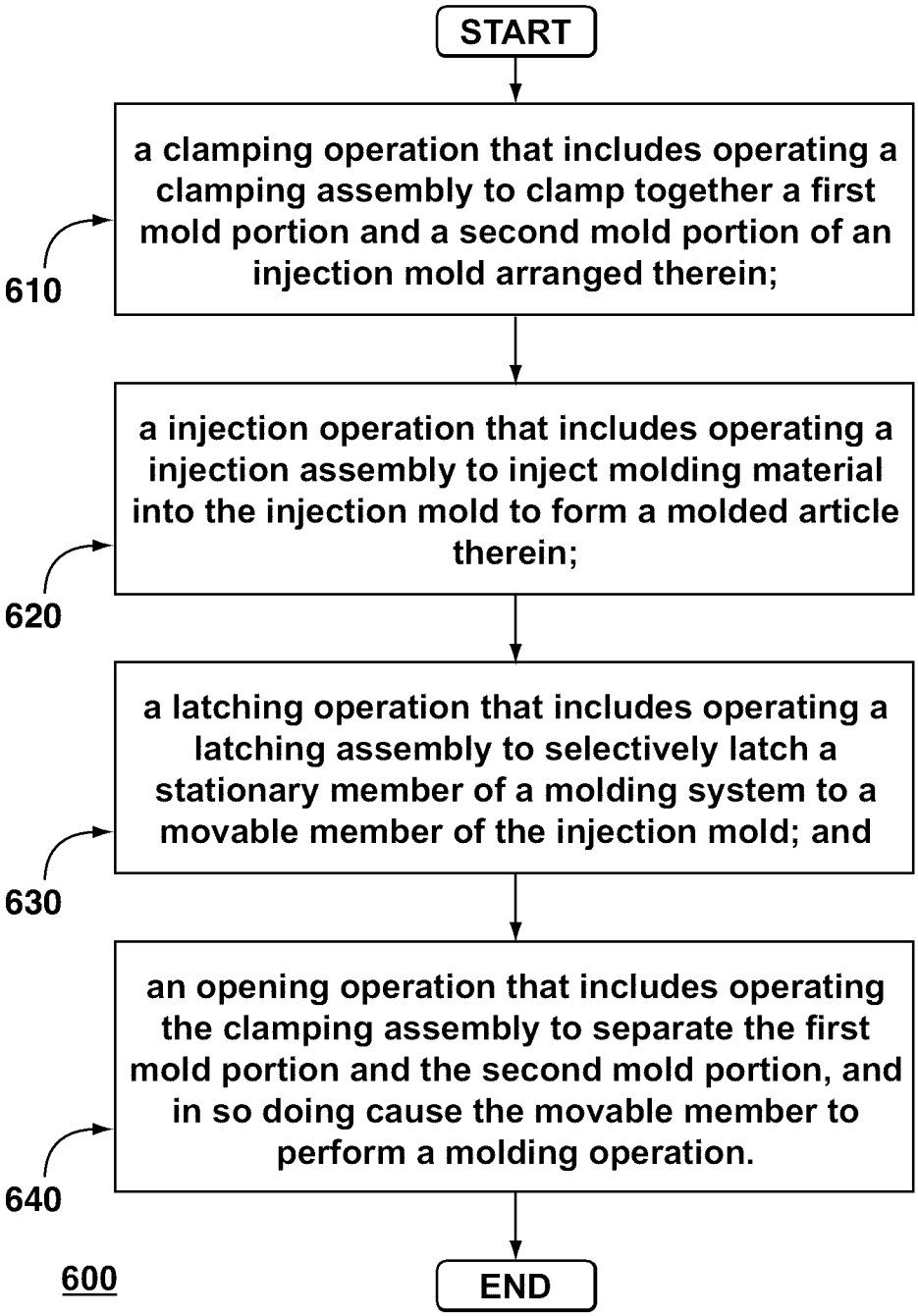

START
a clamping operation that includes operating a clamping assembly to clamp together a first mold portion and a second mold portion of an injection mold arranged therein;
610
a injection operation that includes operating a injection assembly to inject molding material into the injection mold to form a molded article therein;
620
a latching operation that includes operating a latching assembly to selectively latch a stationary member of a molding system to a movable member of the injection mold; and
630
an opening operation that includes operating the clamping assembly to separate the first mold portion and the second mold portion, and in so doing cause the movable member to perform a molding operation.
640
600
END

FIG. 19

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/CA2010/001377

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***B29C 45/64*** (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(2006.01): B29C45/64, B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Google

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Canadian Patent Database, EPOQUE
Keywords: inject+, latch, coupler, stripper, mold, lock, hook, eject, remov+, bar, slide, catch, select+, station, stationar+, control+, opening, clampamping, molding

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>Y | US2002/0106420 A1 (VANDENBERG, L.) 08 August 2002 (08-08-2002)<br>*Figures 1 and 2, abstract, Claim 1* | 1, 2, 3, 11, 12<br>4 to 6 |
| X<br>Y | US5494435 A (VANDENBERG, L.) 27 February 1996 (27-02-1996)<br>*Figures 1 to 4* | 1, 2, 11, 12 |
| X<br>Y | MENGES, G. et al. "How to Make Injection Molds", 1993<br>*pages 420- 422* | 1, 2, 11, 12<br>4 to 6 |
| A | JP61197208 A (KUBOTA, K.) 01 September 1986 (01-09-1986)<br>*Figures 1 to 12* | 1 to 34 |
| A | US4403810 A (BIENECK, G.) 13 September 1983 (13-09-1983)<br>*Figures 1 to 4* | 1 to 34 |

[ ] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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