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(54) Title: NECK RING ASSEMBLIES FOR A MOLD

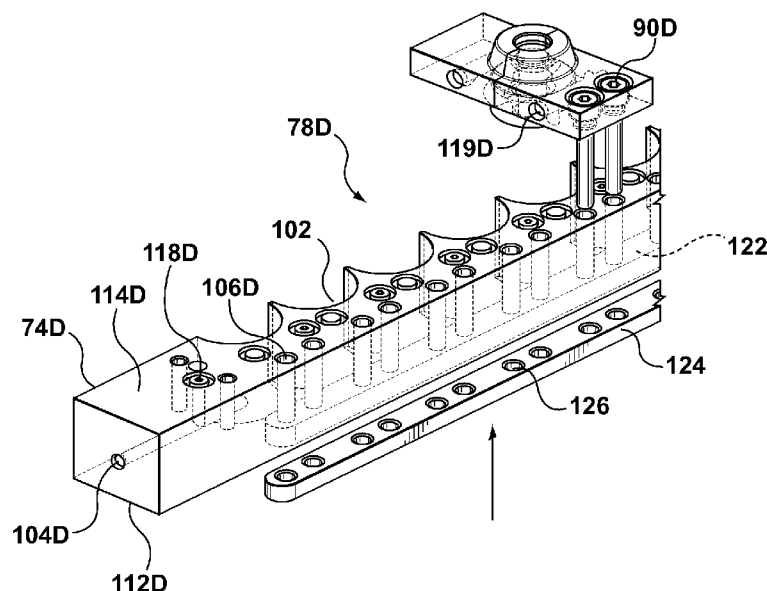


FIG. 6B

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(57) Abstract: A neck ring assembly for a mold is provided. The neck ring assembly comprises a slide; a neck ring half; the neck ring half defining a mounting aperture; a neck ring fastener for mounting the neck ring half to the slide through the mounting aperture; and a mounting structure, the mounting structure adapted to cooperate with the neck ring fastener to mount the neck ring half to the slide, the mounting structure being adapted to reduce, at least in part, distortions in the slide caused by mounting the neck ring half to the slide with the neck ring fastener.

NECK RING ASSEMBLIES FOR A MOLD

TECHNICAL FIELD

5 Embodiments generally relate to (by way of example, but is not limited to) molds. More specifically, embodiments relate to neck ring assemblies for the molds.

BACKGROUND

10 Molding is a process by virtue of which a molded article can be formed from molding material by using a molding system. Various molded articles can be formed by using the molding process, such as an injection molding process. One example of a molded article that can be formed, for example, from polyethylene terephthalate (PET) material is a preform that is capable of being subsequently blown into a beverage container, such as, a bottle and the like.

15 As an illustration, injection molding of PET material involves heating the PET material (or other suitable molding material for that matter) to a homogeneous molten state and injecting, under pressure, the so-melted PET material into a molding cavity defined, at least in part, by a female cavity piece and a male core piece mounted respectively on a cavity plate and a core plate of a mold. The cavity plate and the core plate are urged together and are held together by clamp force, the clamp force being sufficient to keep the cavity and the core pieces together against the pressure of the injected PET material. The molding cavity has a shape that substantially corresponds to a final cold-state shape of the molded article to be molded. The so-injected PET material is then cooled to a temperature sufficient to enable ejection of the so-formed molded article from the molding cavity. When cooled, the molded article shrinks inside of the molding cavity and, as such, when the cavity and core plates are urged apart, the molded article tends to remain associated with the core piece. Accordingly, by urging the core plate away from the cavity plate, the molded article can be subsequently demolded by ejecting it off the core piece. Ejection structures are known to assist in removing the molded articles from the core halves. Examples of the ejection structures include stripper plates, stripper rings and neck rings, ejector pins, etc.

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When dealing with molding a preform that is capable of being subsequently blown into a beverage container, one consideration that needs to be addressed is forming a so-called “neck region”. Typically and as an example, the neck region includes (i) threads (or other suitable structure) for accepting and retaining a closure assembly (ex. a bottle cap), and (ii) an anti-pilferage assembly to cooperate, for example, with the closure assembly to indicate whether the end product (i.e. the beverage container that has been filled with a beverage and shipped to a store) has been tampered with in any way. The neck region may comprise other additional elements used for various purposes, for example, to cooperate with parts of the molding system (ex. a support ledge, etc.). As is appreciated in the art, the neck region can not be easily formed by using the cavity and core halves. Traditionally, split mold inserts (sometimes referred to by those skilled in the art as “neck rings”) have been used to form the neck region.

US patent No. 6,799,962B2 (published 2004-10-05) to Mai et al. teaches a stripper assembly for an injection molding machine comprising at least one slide pair having a first slide and a second slide and actuation means operatively coupled to said first slide for moving the first slide in a first direction. According to an important aspect of the disclosure, the stripper assembly further comprises transmission means operatively coupled to said first slide and said second slide for transforming the movement of the first slide in the first direction in a movement of the second slide in a second direction, the second direction being opposite to the first direction.

US patent No. 5,736,173A (published 1998-04-07) to Wright et al. teaches a preform injection mould including an elongate mould core cooperating with a female mould and a neck ring in a manner to define a mould cavity therebetween. An injection nozzle in the female mould allows molten plastic to be injected into the mould cavity so that a preform molded article may be formed. The neck ring is constituted by a pair of mating halves which can be separated laterally with respect to the longitudinal axis of the mould core. A taper sleeve surrounds the mould core beneath the neck ring. The neck ring halves are secured to diametrically opposed slides to facilitate lateral separation of the neck ring. A pair of slide taper locks contact a respective one of the slides to inhibit lateral movement of the slides and to back up the neck ring when injection mould is in a mould closed position. An annular formation is formed on the upper surface of the neck ring and is accommodated by a complementary recess formed in the bottom of the female mould. The mating inclined surfaces of the female mould and the annular formation constitute an

upper taper lock which is backed up by a cavity plate. An annular formation is provided on the upper surface of the taper sleeve and is accommodated by a complimentary recess formed in the bottom of the neck ring. The mating inclined surfaces of the taper sleeve and neck ring constitute a lower taper lock. Since a portion of the neck ring constitutes the female taper of the lower taper lock, the lower taper lock is backed up by the slide taper locks through the slides allowing the cross-sectional area of the neck ring to be reduced.

SUMMARY

According to one aspect, there is provided a neck ring assembly comprising: a slide; a neck ring half; the neck ring half defining a mounting aperture; a neck ring fastener for mounting the neck ring half to the slide through the mounting aperture; and a mounting structure, the mounting structure adapted to cooperate with the neck ring fastener to mount the neck ring half to the slide, the mounting structure being adapted to reduce, at least in part, distortions in the slide caused by mounting the neck ring half to the slide with the at least one neck ring fastener.

According to another aspect, there is provided a slide for a neck ring assembly, the slide being adapted to receive a neck ring fastener for mounting a neck ring half to the slide; the slide including a mounting structure, the mounting structure adapted to cooperate with the neck ring fastener to mount the neck ring half to the slide, the mounting structure being adapted to reduce, at least in part, distortions in the slide caused by mounting the neck ring half to the slide with the neck ring fastener.

These and other aspects and features of 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.

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 is a perspective view of a mold in a closed position;

Fig 2 is a cross-sectional view of a mold stack in the mold shown in Fig. 1;

Fig. 3A is a combined perspective view and top plan view of a slide adapted for the mold of Fig. 1, according to one embodiment;

5 Fig. 3B is a cross sectional view of a neck ring assembly including the slide of Fig. 3A;

Fig. 3C is a top-plan view of a portion of the slide shown in Fig. 3A;

Figs. 4A and 4B are a perspective view and a top plan view, respectively, of a slide adapted for the mold of Fig. 1, according to another embodiment;

10 Figs. 5A and 5B are a perspective view and a top plan view, respectively, of a slide adapted for the mold of Fig. 1, according to another embodiment;

Figs. 5C and 5D are a perspective view and a top plan view, respectively, of a slide adapted for the mold of Fig. 1, according to another embodiment;

Figs. 5E and 5F are a perspective view and a top plan view, respectively, of a slide adapted for the mold of Fig. 1, according to another embodiment;

15 Fig. 6A and 6B are a perspective view and an exploded view, respectively, of a neck ring assembly adapted for the mold of Fig. 1, according to another embodiment;

Fig. 7A and 7B are a perspective view and an exploded view, respectively, of a neck ring assembly adapted for the mold of Fig. 1, according to another embodiment;

20 Fig. 8A and 8B are a perspective view and an exploded view, respectively, of a neck ring assembly adapted for the mold of Fig. 1, according to another embodiment;

Fig. 9A and 9B are a perspective view and an exploded view, respectively, of a neck ring assembly adapted for the mold of Fig. 1, according to another embodiment;

Fig. 10A is a perspective view of a neck ring assembly adapted for the mold of Fig. 1, according to another embodiment;

25 Fig. 10B is a perspective view of slide for the neck ring assembly of Fig. 10A;

Fig. 10C is a perspective view of a pair of neck rings for the neck ring assembly of Fig. 10A;

Fig. 10D is a perspective view of a clamping unit for the neck ring assembly of Fig. 10A;

30 Fig. 11A is a perspective view of a neck ring assembly adapted for the mold of Fig. 1, according to another embodiment;

Fig. 11B is a perspective view of slide for the neck ring assembly of Fig. 11A;

Fig. 11C is a perspective view of a pair of neck rings and the slide for the neck ring assembly of Fig. 11A;

Fig. 11D is a perspective view of a clamping unit for the neck ring assembly of Fig. 11A;

Fig. 11E is a perspective view of a fluid coupler for the neck ring assembly of Fig. 11A;

5 Fig. 12A is a perspective view of a neck ring assembly adapted for the mold of Fig. 1, according to another embodiment;

Fig. 12B is a perspective view of slide for the neck ring assembly of Fig. 12A;

Fig. 12C is a perspective view of a pair of neck rings for the neck ring assembly of Fig. 12A;

10 Fig. 12D is a perspective view of a mounting bar for the neck ring assembly of Fig. 12A;

Fig. 13A is a perspective view of a neck ring assembly adapted for the mold of Fig. 1, according to another embodiment;

Fig. 13B is a perspective view of a mounting bar for the neck ring assembly of Fig. 13A; and

15 Figs. 14A and 14B are perspective views of a neck ring assembly adapted for the mold of Fig. 1, according to another 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)

25 Referring now to Fig. 1, a mold is shown generally at 20. Mold 20 defines at least one mold stack 22, each mold stack 22 (described in greater detail below) being adapted to produce, in use, a molded article (not shown). In the presently-illustrated embodiment, the molded article(s) produced are PET preforms. Other possible types of molded articles produced by mold 20 will occur to those of skill in the art. The mold stacks 22 are mounted to, or are otherwise retained by,

30 a plurality of mold plates 24. Mold plates 24 include a cavity plate 26 and a core plate 28. Those of skill in the art will recognize that this list of mold plates 24 is not exhaustive nor exclusive,

and that mold 20 may include other mold plates 24. Alternatively, some or all of the mold plates 24 could be subdivided into multiple sub-plates.

Referring now to Fig. 2, one of the mold stacks 22, and proximate portions of the mold plates 24 are shown in greater detail. Cavity plate 26 and its attached mold stack components can be generally referred to as a cavity half assembly 30. In use, the cavity half assembly 30 is mounted to a runner system (not depicted) for the delivery of a molten material and stationary platen (none shown). Core plate 28 and its attached components can be generally referred to as a core half assembly 32. In use, the core half assembly 32 is mounted to a movable platen (not shown), and is operable to be translated towards or away from the cavity half assembly 30.

In Fig. 2, the cavity half assembly 30 and the core half assembly 32 are abutted together or, in other words, are depicted in a mold-closed configuration. For each mold stack 22, core plate 28 defines a core bore 34. Mounted within core bore 34 is a core insert 38. In the presently-illustrated embodiment, core insert 38 is hollow and may be fitted with a cooling tube (not shown). Mounted to core plate 28 around the core insert 38 is a lock ring 40. The lock ring 40 includes a flange 46 that is adjacent to core plate 28. Lock ring 40 is securely mounted to core plate 28 using fasteners (not shown) located in flange 46.

For each mold stack 22, cavity plate 26 defines a cavity bore 54. Located within the cavity bore 54 on the side furthest from the core half assembly 32 is a gate insert 56, adapted in use to receive the nozzle of a runner system (not shown). Also located within the cavity bore 54 is a cavity insert 58. Cavity insert 58 further defines cooling channels 60 for the circulation of a cooling fluid (not shown). The cavity insert 58, in cooperation with the gate insert 56 defines, in use, at least some of an exterior surface of the molded article. Although the presently-illustrated embodiment shows the cavity insert 58 and the gate insert 56 formed as separate inserts, those of skill in the art will recognize that the two inserts can also be integrally formed together as a single component.

Cavity insert 58 is retained within cavity bore 54 by a cavity flange 62. Cavity flange fastener (not shown) are provided to securely mount the cavity flange 62 to the cavity plate 26. In the presently-illustrated embodiment, cavity flange 62 further defines a tapered surface 70 to assist in

the alignment of the mold stack 22 upon closure of the core half assembly 32 with the cavity half assembly 30. Even though the cavity flange 62 and the cavity insert 508 are depicted as being separately made components, in alternative embodiments of the present invention, they can be made as a single structure.

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Within each mold stack 22, between the cavity flange 62 and lock ring 40 is an opposing pair of neck ring assemblies 78. Each neck ring assembly 78 includes a neck ring half 80 that is mounted to a slide 74. In mold 20, each slide 74 mounts a plurality of neck ring halves 80. The opposing pair of neck ring assemblies 78 defines, in use, the neck finish portion of the molded article (i.e., each pair of opposing neck ring halves 80 defines a complete neck ring). Each neck ring half 80 includes a lock ring tapered surface 82 that assists in the alignment of mold stack 22 with an opposing mated tapered surface 81 on the end of lock ring 40. Each neck ring half 80 further includes a wear taper surface 84 that assists in the alignment of mold stack 22 with the opposing mated tapered surface 70 on cavity flange 62.

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Neck ring halves 80 abut each other when the mold half assemblies are closed together to cooperate and form the molded article. When the molded article is to be removed from mold 20, the neck ring halves 80 are translated apart from each other by the pair of slides 74 which are operable to slide or otherwise move away from core insert 38 (movement not depicted). Those of skill in the art will recognize that wear plates or other such structures may be present between slides 74 and the core plate 28 (none depicted). Each neck ring half 80 includes at least one mounting aperture 86 (seen in Fig. 3B), and typically includes a pair of mounting apertures 86. Each slide 74 includes at least one slide aperture 88 (seen in Fig. 3A) for each neck ring half 80 (i.e., one slide aperture 88 for each mounting aperture 86). In the presently-illustrated embodiment, a pair of slide apertures 88 are provided for each neck ring half 80. At least one neck ring fastener 90 is provided to mount the neck ring half 80 to its respective slide 74, with one neck ring fastener 90 being provided for each pair of mounting aperture 86 and slide aperture 88. In the presently-illustrated embodiment, a pair of neck ring fasteners 90 is used to mount each neck ring half 80 to its respective slide 74, each of the neck ring fasteners 90 being a threaded bolt.

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It can clearly be seen in Fig. 2, when mold 20 is in the closed position, a mold cavity 92 for the molded article is cooperatively defined by the core insert 38, the cavity insert 58, gate insert 56, and the neck ring assembly 78. Those of skill in the art will appreciate that proper alignment of these aforementioned components is required to ensure consistency between molded articles over repeated molding cycles.

Referring now to Figs. 3A-3C, a slide 74A for a neck ring assembly 78A that is suitable for mounting within mold 20 is shown in greater detail. Fig. 3A is a combined perspective view and top plan view of slide 74A. Fig. 3B is a cross sectional view of the neck ring assembly 78A, including the slide 74A. Fig. 3C is a top-plan view of a portion of the slide 74A. Slide 74A is a generally rectangular bar having a plurality of scalloped walls 102. When opposing slides 74A from a pair of opposing neck ring assemblies 78 are abutted together, the scalloped walls 102 cooperatively define a circular cut-out around the lock ring 40 (Fig. 2).

Slide 74A defines one or more cooling channels 104 that extend longitudinally through the slide 74A, and are adapted for circulating a cooling fluid. Slide 74A is adapted to include a stress-isolating feature to reduce stress in the slide 74A caused by mounting the neck ring halves 80 to the slide 74A. Specifically, each slide aperture 88 on slide 74A is defined by a bore 106 adapted for receiving one of the neck ring fasteners 90 in order to mount the neck ring half 80 to slide 74A. As illustrated in Fig. 3C by the dashed line 'M', each of pair of slide apertures 88 is located in the "middle" of slide 74A, that is to say, being located substantially equidistant from both a scalloped wall 102 and a sidewall 110 of slide 74A. Within embodiments of the present invention, the middle of slide 74A represents a so-called "neutral zone". Needless to say that in alternative embodiments of the present invention, the implementation of the "neutral zone" does not need to be exactly at the mid-line of the slide 74A.

Each slide aperture 88 further includes a counterbore 108 (best seen in Fig. 3B) which is located coaxially around bore 106. Counterbore 108 extends inwards from a cavity-facing surface 114 towards the middle of slide 74A (relative to an opposing core-facing surface 112). Each bore 106 further includes a threaded portion 116 which starts beyond counterbore 108, substantially in the middle of slide 74A relative to the core-facing surface 112 and the cavity-facing surface 114. Neck ring fastener 90 includes a threaded portion 117 that is mated to threaded portion 116 on

bore 106. Thus, the interface between mated threaded portions 116 and 117 occurs substantially in the middle of slide 74A relative to the distance between the core-facing surface 112 and the cavity-facing surface 114. The interface between mated threaded portions 116 and 117 also occurs substantially in the middle of slide 74A relative to scalloped walls 102 and sidewall 110 (distance 'M'). Bending of slide 74A by the interaction of the mated threaded portions 116 and 117 during the fastening of neck ring half 80 to slide 74A is reduced.

Referring now to Figs. 4A and 4B, another embodiment of a slide for a neck ring assembly for use with mold 20 is shown at 74B. Figs. 4A and 4B are a perspective view and a top plan view, respectively, of slide 74B. Slide 74B is similar in shape to slide 74A, and includes the plurality of scalloped walls 102. In addition, one or more cooling channels 104B extend longitudinally through the slide 74B for circulating a cooling fluid through slide 74B. In addition, cooling channels 104B include branching channels 118B for circulating the cooling fluid into complementary cooling channels on the neck ring halves 80 (not depicted in Figs. 4A and 4B).

Each slide 74B further includes a pair of slide apertures 88B adapted for receiving neck fasteners 90 to mount each neck ring half 80. As with the previously-described embodiment, each slide aperture 88B includes a bore 106 and a counterbore 108. In the presently-illustrated embodiment, the threaded portion 116B of each tap is located proximate the cavity-facing surface 114. Also in the presently-illustrated embodiment, each slide aperture 88B of pair of slide apertures 88B includes as a stress-isolating feature, a stress relief groove 120B located concentrically around the slide aperture 88B. The stress relief groove 120B localizes, at least partially, deformation in the slide 74B (i.e., bowing and/or bending of slide 74B) to the region of slide 74B between slide aperture 88B and stress relief groove 120.

Referring now to Figs. 5A and 5B, another embodiment of a slide for a neck ring assembly adapted for mold 20 is shown generally at 74C. Figs. 5A and 5B are a perspective view and a top plan view, respectively, of the slide 74C. Slide 74C is similar in shape to slide 74B, and includes the plurality of scalloped walls 102. Slide 74C further includes one or more cooling channels 104C extending longitudinally through the slide 74C as well as branching channels 118C for circulating the cooling fluid into complementary channels on the neck ring halves 80.

Each slide 74C further includes a pair of slide apertures 88C that are adapted for receiving neck fastener 90 to mount each neck ring half 80 to slide 74C, the slide apertures 88C being similar to slide apertures 88 as described above. As a stress-isolating feature, a stress relief groove 120C is located between each slide aperture 88C, each stress relief groove 120C running generally perpendicular to the longitudinal axis (not separately numbered) of slide 74C. The stress relief groove 120C localizes, at least partially, deformation in the slide 74C (i.e., bending or bowing of slide 74C) to the region of slide 74C between parallel stress relief grooves 120C so that deformation caused by the mounting of neck ring fastener 90 in one slide aperture 88 is not transmitted to an adjacent slide aperture 88 on slide 74C.

Figs. 5C and 5D show a variant embodiment of slide 74C, namely slide 74C'. Figs. 5C and 5D are a perspective view and a top plan view, respectively, of the slide 74C'. In the variant slide 74C', a stress grooves 120C' splits the two slide apertures 88C of each pair of slide apertures 88C, isolating the one slide aperture 88C from the other. Each stress relief groove 120C' runs generally perpendicular to the longitudinal axis (not separately numbered) of slide 74C'. The stress relief groove 120C' localizes, at least partially, deformation in the slide 74C' (i.e., bending or bowing of slide 74C') to the region of slide 74C' between parallel stress relief grooves 120C'. Deformation caused by the mounting of neck ring fastener 90 in one slide aperture 88 of a pair of slide apertures 88 is not transmitted to the other slide aperture 88 of the pair of slide apertures 88.

Figs 5E and 5F show another variant embodiment of slide 74C, namely slide 74C''. Figs. 5E and 5F are a perspective view and a top plan view, respectively, of the slide 74C''. In the variant slide 74C'', a stress grooves 120C'' is located between each pair of slide apertures 88C, isolated each pair of slide apertures 88 from their adjacent pairs of slide apertures 88. Each stress relief groove 120C'' runs generally perpendicular to the longitudinal axis (not separately numbered) of slide 74C''. The stress relief groove 120C'' localizes, at least partially, deformation in the slide 74C'' (i.e., bending or bowing of slide 74C'') to the region of slide 74C'' between parallel stress relief grooves 120C''. Deformation caused by the mounting of neck ring fastener 90 in one slide aperture 88 of a pair of slide apertures 88 is not transmitted to adjacent pairs of slide aperture 88.

Referring now to Figs. 6A-6B, another embodiment of a neck ring assembly for mold 20 is shown generally at 78D. Fig. 6A and 6B are a perspective view and a partially-exploded view,

respectively, of the neck ring assembly 78D. Neck ring assembly 78D includes a slide 74D which is similar in shape to slide 74B, and includes the plurality of scalloped walls 102. In addition, one or more cooling channels 104D extend longitudinally through the slide 74D as well as branching channels 118D for circulating the cooling fluid into complementary cooling channels 119D on the neck ring halves 80. In alternative embodiments of the present invention, the one or more cooling channels 118D can be implemented differently. For example, rather than extending longitudinally, the one or more cooling channels 104D can be implemented at an angle to allow for the flow of the cooling channel from one instance of the neck ring assembly 78D to a next instance of the neck ring assembly.

Slide 74D further includes a plurality of sets of slide apertures 88D, one set of slide apertures 88D for each scalloped wall 102. Each slide aperture 88D extends fully through slide 74D from a cavity facing surface 114D to at least one mounting trench 122 located along a core-facing surface 112D. In the presently-illustrated embodiment, the at least one mounting trench 122 is a single mounting trench 122 that extends between all of the slide apertures 88D.

Neck ring assembly 78D uses at least one mounting structure to minimize deformation in the slide 74D caused by the neck ring fasteners 90D. The mounting structure, namely at least one mounting bar 124, is located within mounting trench 122. In the presently-illustrated embodiment, mounting trench 122 receives a single mounting bar 124. Mounting bar 124 is implemented as a rod that is sized to securely fit within with mounting trench 122, and which is inserted from the opening along the core-facing surface 112D (as indicated by the arrow in Fig. 6B). Mounting bar 124 further includes threaded apertures 126 that are coaxially aligned with the slide apertures 88D when the mounting bar is fully extended into mounting trench 122. The threads on threaded apertures 126 are mate-able with complementary threads (not shown) on a neck ring fastener 90D. Each neck ring fastener 90D extends through one of the neck ring halves 80, through slide aperture 88D and into threaded apertures 126. Deformation of mounting bar 124 during the mounting of neck ring halves 80 is distributed through slide 74D, minimizing the deformation (i.e., bending or bowing) of slide 74D.

Figs. 7A and 7B illustrate a variation on this embodiment, generally at 78E. Neck ring assembly 78E includes a slide 74E where the mounting structure, namely a mounting trench 122E is located

between the cavity facing surface 114E and the core-facing surface 112E. A mounting bar 124E is inserted into mounting trench 122E through an opening in a sidewall 110E of slide 74E.

Referring now to Figs. 8A-8B, another embodiment of a slide for mold 20, namely slide 74F, is shown. Fig. 8A shows a neck ring assembly 78F mounted to slide 74F. Fig. 8B is an exploded view of the neck ring assembly 78F and slide 74F. Slide 74F is similar in many respects to slide 74D. However, instead of a single mounting bar being mounted within a single mounting trench, slide 74F includes a plurality of mounting trenches 122F and a plurality of mounting bars 124F. Each mounting trench 122F is positioned so that a pair of apertures 126F on mounting bar 124F are coaxially aligned with the pair of slide apertures 88F for each neck ring half 80.

Alternatively, although not depicted, the mounting trenches 122F could be positioned so that the pair of apertures 126F on mounting bar 124F are coaxially aligned with slide apertures 88F on adjacent pairs of slide apertures 88F (i.e., the mounting bars 124F are arranged to be offset from the neck ring halves 80). This is depicted in more detail with reference to Figs. 9A and 9B that illustrate a variation of this embodiment, generally at 78G. Neck ring assembly 78G includes a slide 74G, where mounting trenches 122G are located between the cavity facing surface 114G and the core-facing surface 112G. Mounting bars 124G are inserted into the mounting trenches 122G through openings in a sidewall 110G of slide 74G.

Referring now to Figs. 10A-10D, another embodiment of a neck ring assembly is shown generally at 78H. Neck ring assembly 78H includes a neck ring half 80H mounted to a slide 74H. Fig. 10B shows slide 74H with the neck ring half 80H removed. Fig. 10C shows the neck ring half 80H, removed from slide 74H. Fig. 10D shows another mounting structure, namely clamp unit 128H, the clamp unit 128H being used to mount the neck ring half 80H to the slide 74H. Clamp unit 128H is substantially I-shaped, having parallel flange portions 130 spaced apart by a perpendicular bar 132.

Slide 74H includes a complementary aperture 136 that is generally "T-shaped" and sized to fit a flanged portion 130 and a portion of perpendicular bar 132. Neck ring half 80H includes another complementary aperture 134 that is generally "T-shaped" and which is sized to fit another flanged portion 130 and a portion of perpendicular bar 132. Clamp unit 128H is inserted into the

complementary apertures 134 and 136 through an opening along their sidewalls 110H. The length of perpendicular bar 132 forces the ring portion 82H to abut in a fixed position against slide 74H. When clamp unit 128H is fully inserted into apertures 134 and 136, cooling channels 104H on slide 74H and branching channels 118H on neck ring halves 80H are coaxially aligned, providing fluid communication therebetween. An O-ring (not depicted) is located around the mated cooling channels 104H and branching channels 118H to reduce leakage of the cooling fluid. Bores 106H on neck ring half 80H and slide 74H are further aligned so that positioning dowels or precision bars (neither shown) can be inserted therethrough.

Referring now to Figs. 11A-11E, another embodiment of a neck ring assembly is shown generally at 78I. Fig. 11A shows a neck ring half 80I mounted to a slide 74I. This embodiment is similar to the one depicted above in Figs 10A-10D; however, in the embodiment depicted in Figs. 11A-11E, the neck ring half 80I is held in a fixed position by the mounting structure, namely clamp unit 128I, which causes the neck ring half 80I to “float” slightly over slide 74I creating a gap therebetween, rather than directly abutting against each other.

Fig. 11B shows slide 74I with the neck ring half 80I removed. Fig 11C shows the neck ring half 80I, removed from slide 74I. Fig. 11D shows a clamp unit 128I, the clamp unit 128I being sized to mount the neck ring half 80I to the slide 74I. Clamp unit 128I is substantially I-shaped, having two sets of parallel flange portions 130 spaced apart by a perpendicular bar 132. Fig. 11E shows fluid connector, specifically an O-ring dowel unit 140 which provides communication between cooling channels 104I and branching channels 118I. When the neck ring half 80I is mounted to slide 74I, O-ring dowel unit 140 is compressed and provides a tight seal between itself and cooling channel 104I and branching channel 118I.

Referring now to Figs. 12A-12D, another embodiment of a neck ring assembly is shown generally at 78J. Fig. 12A shows a neck ring half 80J mounted to a slide 74J. Fig. 12B shows slide 74J with the neck ring half 80J removed. Fig 12C shows the neck ring half 80J, removed from slide 74J. Fig. 12D shows a mounting bar 124J.

Like the embodiment shown in Figs. 8A-8B, slide 74J includes a plurality of mounting trenches 122J. A mounting bar 124J is provided for each mounting trench 122J. A neck ring fastener 90

extends through each slide aperture 88J and includes threads for interfacing with complementary threads within mounting bar 124J. Like the embodiment depicted in Figs. 11A-11E, the neck ring half 80J “floats” over slide 74J rather than directly abutting against it. A fluid connector, namely an O-ring dowel 140J interconnects cooling channels 104J and 118J. While the embodiment depicted in Figs. 12A-12D shows the mounting bar 124J being inserted from the core-facing surface 112J, slide 74J could be adapted to receive the mounting bars 124J through openings located along its sidewall 110J (not shown) in a manner similar to that depicted in Figs. 9A-9B.

Fig. 13A and 13B show an embodiment of a neck ring assembly 78K, similar to the embodiment illustrated in Figs. 12A-12D. Like the embodiment shown in Figs. 12A-12D, in this embodiment shown in Figs. 13A-13B, mounting bars 124K are used as mounting structures to mount the neck ring halves 80K to slide 74K. However, in this embodiment, each neck ring half 80K has a single mounting aperture 86K adapted to receive a single neck ring fastener 90. Each neck ring fastener 90 extends through an slide aperture 88K in slide 74K into a mounting bar 124K located within a mounting trench 122K. Thus, each mounting bar 124K mounts only a single neck ring fastener 90K.

Referring now to Fig. 14A, another embodiment of a neck ring assembly is shown generally at 78L. Neck ring assembly 78L includes a slide 74L having a plurality of slide apertures 88L. Each slide aperture 88L includes a counterbore 142 proximate the cavity-facing side 114 of slide 74L. Seated within the counterbore 142 is a spring 144. Each neck ring fastener 90L includes a land 146 located along the shaft of the neck ring fastener 90L so that it abuts against spring 144 when the neck ring fastener 90L is fully mounted within its mounting bar (not separately numbered). The spring 144 thus acts against the neck ring fastener 90L, urging the neck ring halves 80L away from slide 74L.

Referring now to Fig. 14B, another embodiment of a neck ring assembly is shown generally at 78M. Neck ring assembly 78M includes a slide 74M having a plurality of slide apertures 88M. Each slide aperture 88M includes a counterbore 142M proximate the mounting trench 122M. Seated within the counterbore 142M is a spring 144. Each neck ring fastener 90M includes a land 146M located along the shaft of the neck ring fastener 90M so that it abuts against spring 144 when the neck ring fastener 90M is fully mounted within its mounting bar (not separately

numbered). The spring 144 thus acts on neck ring fastener 90M, urging the neck ring halves 80M towards slide 74M.

Referring now to Fig. 15, another embodiment of a neck ring assembly is shown generally at 100M. Neck ring assembly 100M includes a slide 102M having a plurality of slide apertures 108M. Each slide aperture 108M includes a counterbore 110M located on an opposite end of the slide 102M vis-à-vis the slide aperture 108M. The slide aperture 108M is configured to received a fastener, such as a bolt 1112. It is noted that for the sake of simplicity of illustration, Fig. 15 does not depict neck rings, but rather depicts so-called “neck ring dummies” used during certain portions of the assembly procedure. Seated within the counterbore 110M is a blind bolt 1114. It is noted that the blind bolt 1114 is selected to have the same diameter and is applied with the same torque as the associated bolt 1112. Even though this needs not be so in every embodiment of the present invention, the depicted blind bolt 1114 has the same length as the associated bolt 1112. It is noted that the blind bolt 1114 is another non-limiting example for implementation of the stress-isolating feature. In other words, within these embodiments of the present invention, the stress-isolating feature includes the counterbore 110M and further includes the blind bolt 1114. This specific implementation can also be thought of as a stress-equilibrium feature.

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 neck ring assembly , comprising:
 - a slide;
 - a neck ring half; the neck ring half defining a mounting aperture;
 - a neck ring fastener for mounting the neck ring half to the slide through the mounting aperture;and
 - a mounting structure , the mounting structure adapted to cooperate with the neck ring fastener to mount the neck ring half to the slide , the mounting structure being adapted to reduce, at least in part, distortions in the slide caused by mounting the neck ring half to the slide with the neck ring fastener.
2. The neck ring assembly of claim 1, wherein the slide defines a slide aperture for receiving the neck ring fastener.
3. The neck ring assembly of claim 1, wherein the mounting structure is located, at lest partially, within a mounting trench formed in the slide.
4. The neck ring assembly of claim 1, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar.
5. The neck ring assembly of claim 1, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar, the at least one mounting trench being open to a surface of the slide opposite a side where a scalloped wall is defined.
6. The neck ring assembly of claim 1, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar, the at least one mounting trench being open to a sidewall of the slide relative to the a side where a scalloped wall is defined.

7. The neck ring assembly of claim 1, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar, wherein each of the at least one mounting bar and the at least one mounting trench comprises, respectively, a plurality of mounting bars and a plurality of mounting trenches.
8. The neck ring assembly of claim 1, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar, wherein each of the at least one mounting bar and the at least one mounting trench comprise a plurality of mounting bars and a plurality of mounting trenches, and at least some of the plurality of mounting bars are operable to receive the neck ring fastener from a plurality of neck ring halves.
9. The neck ring assembly of claim 1, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide.
10. The neck ring assembly of claim 1, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the clamp unit including a flanged portion which is adapted to be slotted into a complementary aperture on the neck ring half.
11. The neck ring assembly of claim 1, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the clamp unit including a flanged portion which is adapted to be slotted into a complementary aperture on the slide.
12. The neck ring assembly of claim 1, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the clamp unit including a flanged portion which is adapted to be slotted into a complementary aperture on the neck ring half and another flanged portion which is adapted to be slotted into another complementary aperture on the slide.
13. The neck ring assembly of claim 1, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the fixed position forcing the neck ring half to abut against the slide.

14. The neck ring assembly of claim 1, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the fixed position providing a gap between the neck ring half and the slide.
15. The neck ring assembly of claim 1, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the fixed position providing a gap between the neck ring half and the slide, the neck ring assembly further comprising a fluid connector between a cooling channel on the slide and a branching channel on the neck ring half.
16. The neck ring assembly of claim 1, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the fixed position providing a gap between the neck ring half and the slide, the neck ring assembly further comprising a fluid connector between a cooling channel defined on the slide and a branching channel defined on the neck ring half, the fluid connector being an O-ring dowel.
17. The neck ring assembly of claim 1, wherein the neck ring fastener is a threaded bolt.
18. The neck ring assembly of claim 2, wherein the slide aperture is defined by a bore, the bore including a threaded portion, and a counterbore defined coaxially around the bore.
19. The neck ring assembly of claim 1, further comprising:
a spring, the spring being located between the neck ring half and the slide, the spring urging the neck ring half away from the slide.
20. The neck ring assembly of claim 1, further comprising:
a spring, the spring being located between the slide and the mounting structure, the spring urging the neck ring half towards the slide.
21. The neck ring assembly of claim 1, wherein
the slide defines a pair of slide apertures for each neck ring half to be mounted;
the neck ring defines a pair of mounting apertures; and

the neck ring is mounted to the slide by a neck ring fasteners extending through each of the pair of mounting apertures and the pair of slide apertures.

22. A slide for a neck ring assembly, the slide being adapted to receive a neck ring fastener for mounting a neck ring half to the slide; the slide including:

a mounting structure, the mounting structure adapted to cooperate with the neck ring fastener to mount the neck ring half to the slide, the mounting structure being adapted to reduce, at least in part, distortions in the slide caused by mounting the neck ring half to the slide with the neck ring fastener.

23. The slide of claim 22, wherein the slide defines a slide aperture for receiving the neck ring fastener.

24. The slide of claim 22, wherein the mounting structure is located, at least partially, within a mounting trench formed in the slide.

25. The slide of claim 22, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar.

26. The slide of claim 22, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar, the at least one mounting trench being open to a surface of the slide opposite a side where a scalloped wall is defined.

27. The slide of claim 22, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar, the at least one mounting trench being open to a sidewall of the slide relative to the a side where a scalloped wall is defined.

28. The slide of claim 22, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar, wherein each of the at least one mounting bar and the at least one mounting trench comprises, respectively, a plurality of mounting bars and a plurality of mounting trenches.

29. The slide of claim 22, wherein the mounting structure includes at least one mounting bar and the slide defines at least one mounting trench for receiving the at least one mounting bar, wherein each of the at least one mounting bar and the at least one mounting trench comprise a plurality of mounting bars and a plurality of mounting trenches, and at least some of the plurality of mounting bars are operable to receive the neck ring fastener from a plurality of neck ring halves.

30. The slide of claim 22, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide.

31. The slide of claim 22, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the clamp unit including a flanged portion which is adapted to be slotted into a complementary aperture on the neck ring half.

32. The slide of claim 22, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the clamp unit including a flanged portion which is adapted to be slotted into a complementary aperture on the slide.

33. The slide of claim 22, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the clamp unit including a flanged portion which is adapted to be slotted into a complementary aperture on the neck ring half and another flanged portion which is adapted to be slotted into another complementary aperture on the slide.

34. The slide of claim 20, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the fixed position forcing the neck ring half to abut against the slide.

35. The slide of claim 22, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the fixed position providing a gap between the neck ring half and the slide.

36. The slide of claim 22, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the fixed position providing a gap between the

neck ring half and the slide, the neck ring assembly further comprising a fluid connector between a cooling channel on the slide and a branching channel on the neck ring half.

37. The slide of claim 22, wherein the mounting structure includes a clamp unit operable to retain the neck ring half at a fixed position relative to the slide, the fixed position providing a gap between the neck ring half and the slide, the neck ring assembly further comprising a fluid connector between a cooling channel defined on the slide and a branching channel defined on the neck ring half, the fluid connector being an O-ring dowel.

38. The slide of claim 22, further comprising:

a spring, the spring being located between the neck ring half and the slide, the spring urging the neck ring half away from the slide.

39. The slide of claim 22, further comprising:

a spring, the spring being located between the slide and the mounting structure, the spring urging the neck ring half towards the slide.

40. The slide of claim 22, wherein

the slide defines a pair of slide apertures for each neck ring half to be mounted;

the neck ring defines a pair of mounting apertures; and

the neck ring is mounted to the slide by a pair of neck ring fasteners extending through the pair of mounting apertures and the pair of slide apertures.

41. The slide of claim 23, wherein the slide aperture is adapted to receive a threaded bolt.

42. The slide of claim 23, wherein the slide aperture is defined by a bore, the bore including a threaded portion, and a counterbore defined coaxially around the bore.

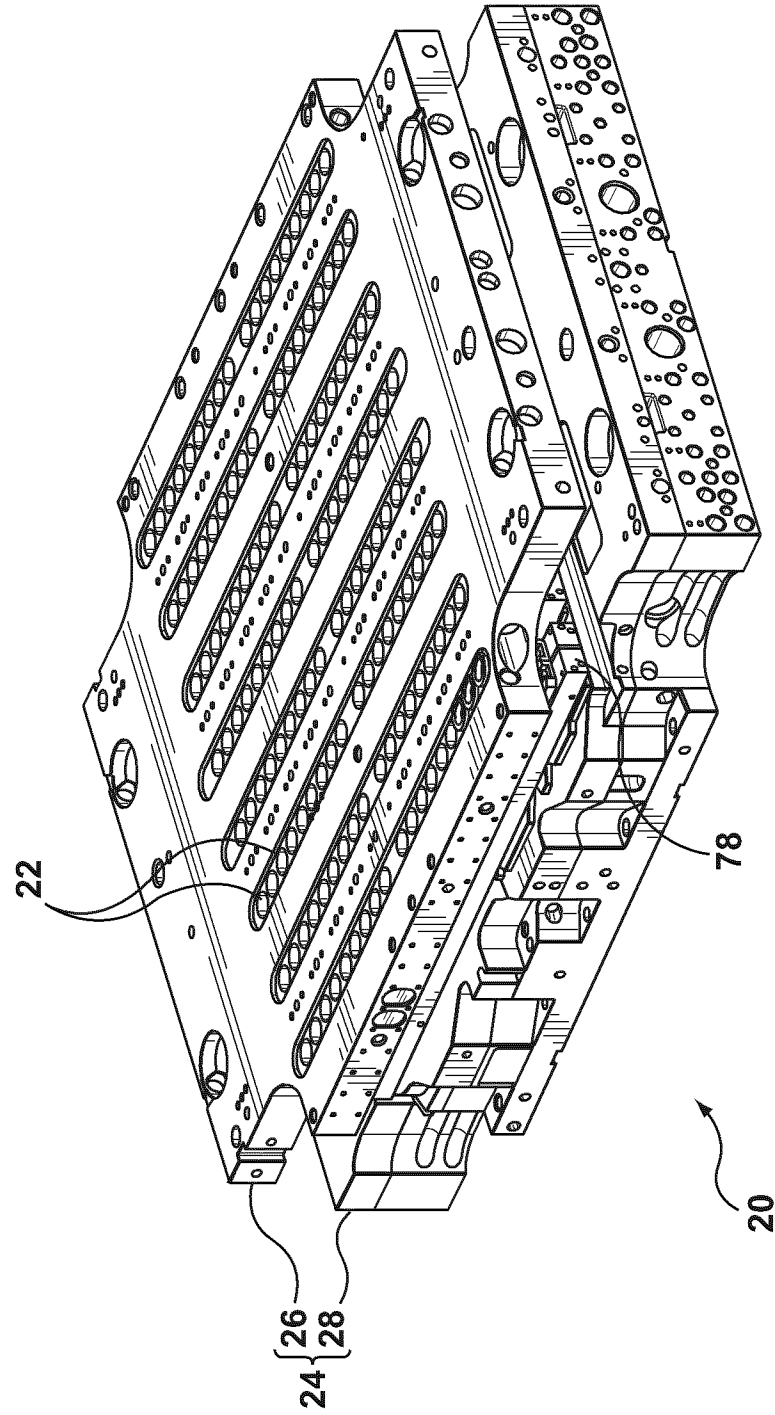


FIG. 1

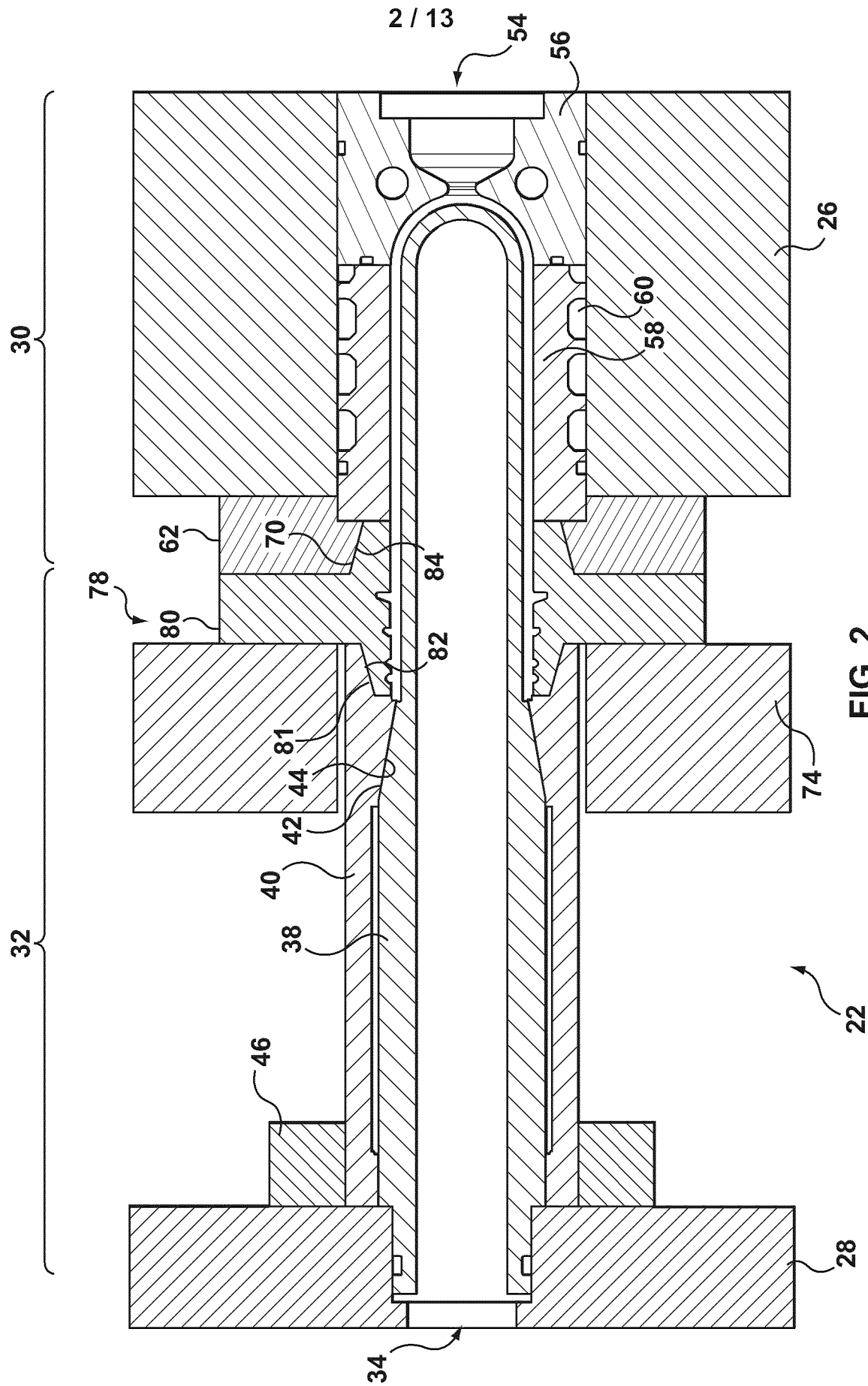
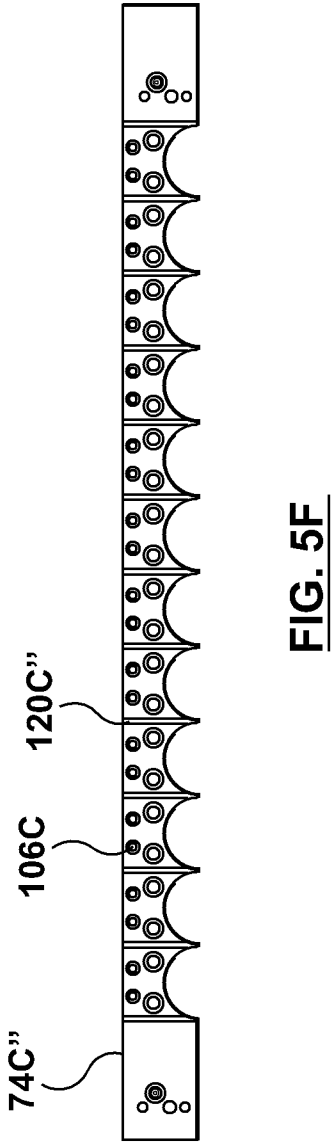
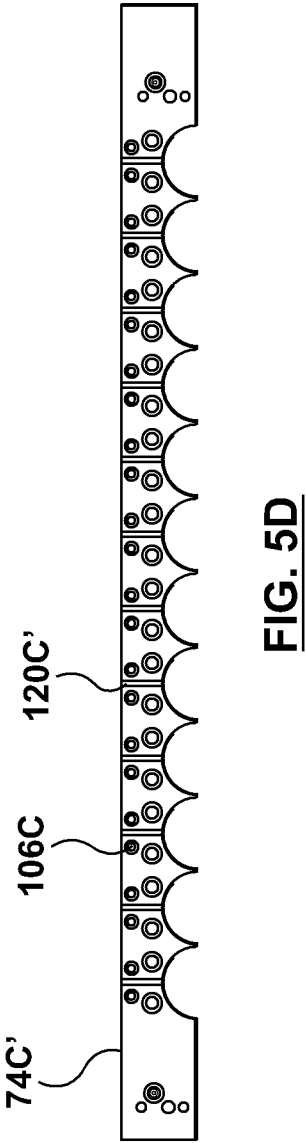
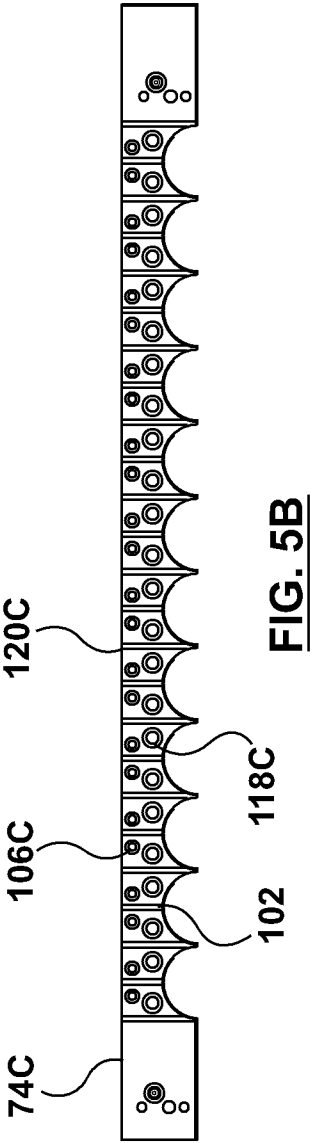
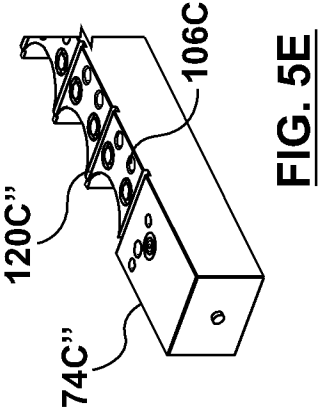
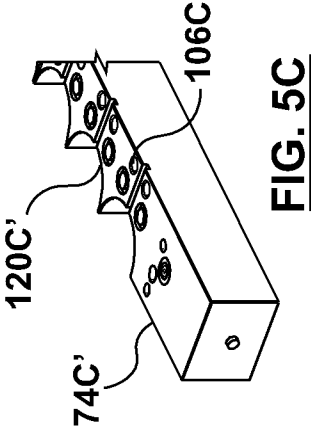
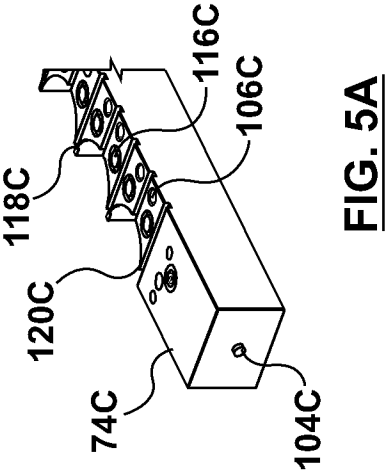


FIG. 2



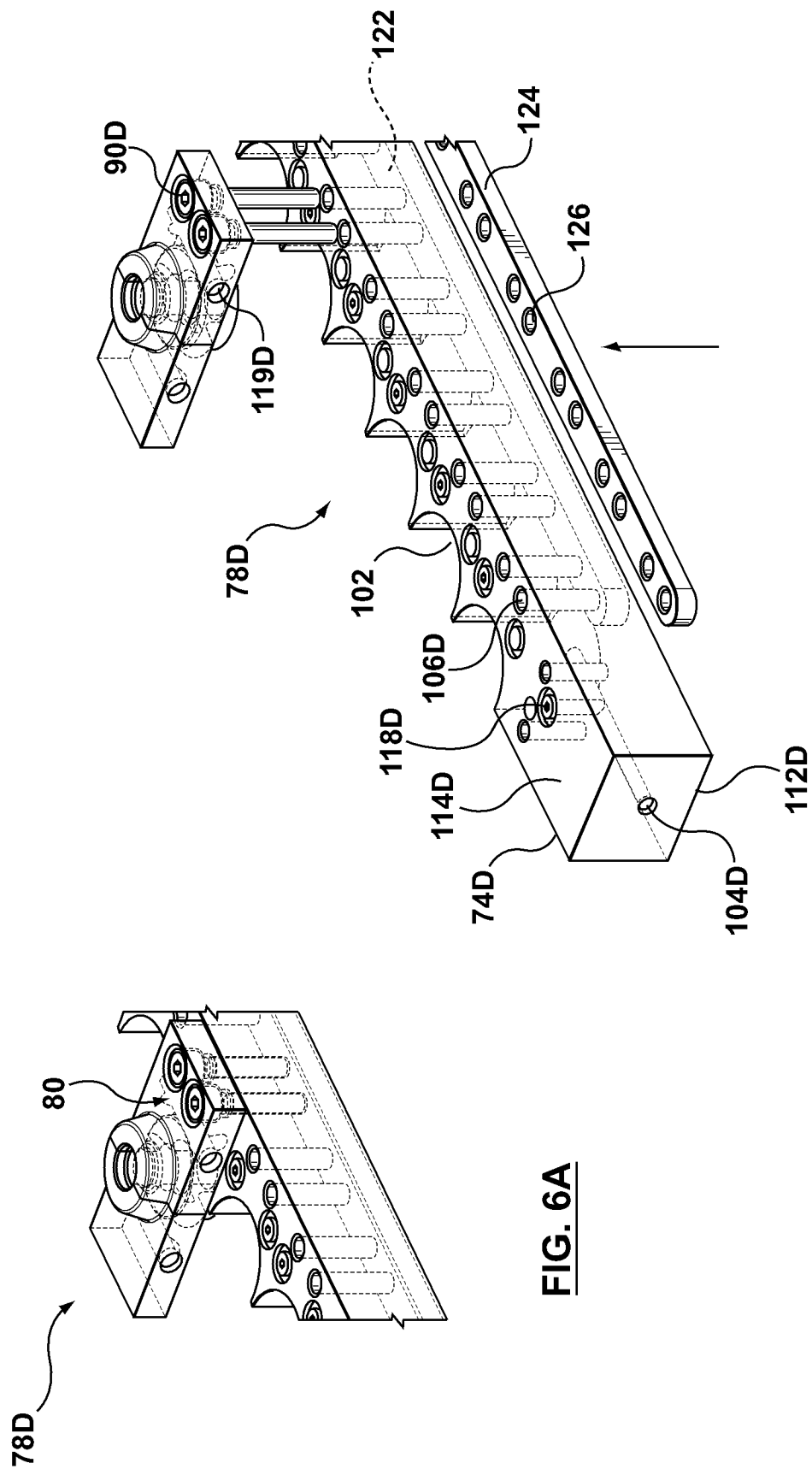


FIG. 6A

FIG. 6B

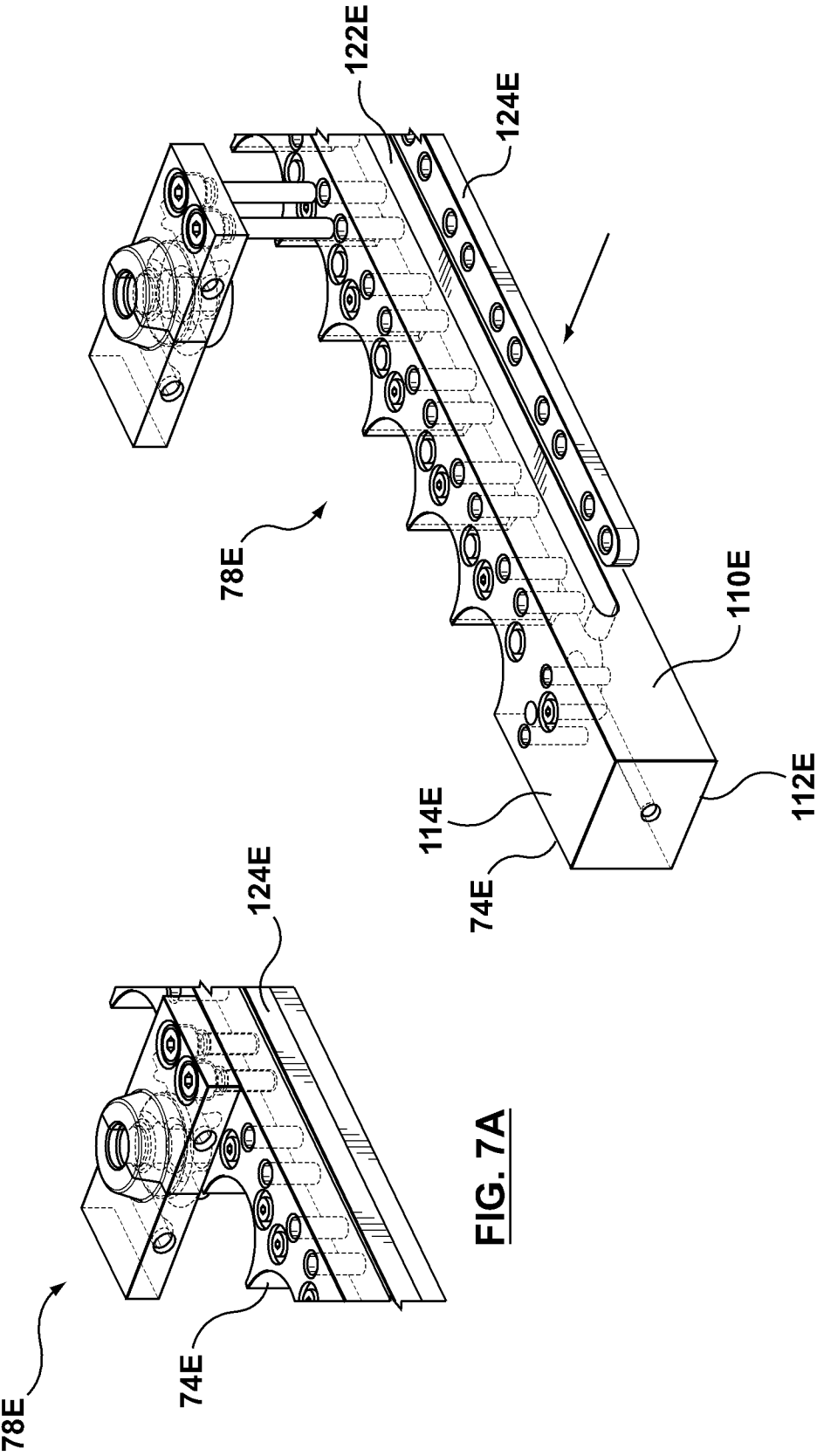


FIG. 7B

FIG. 7A

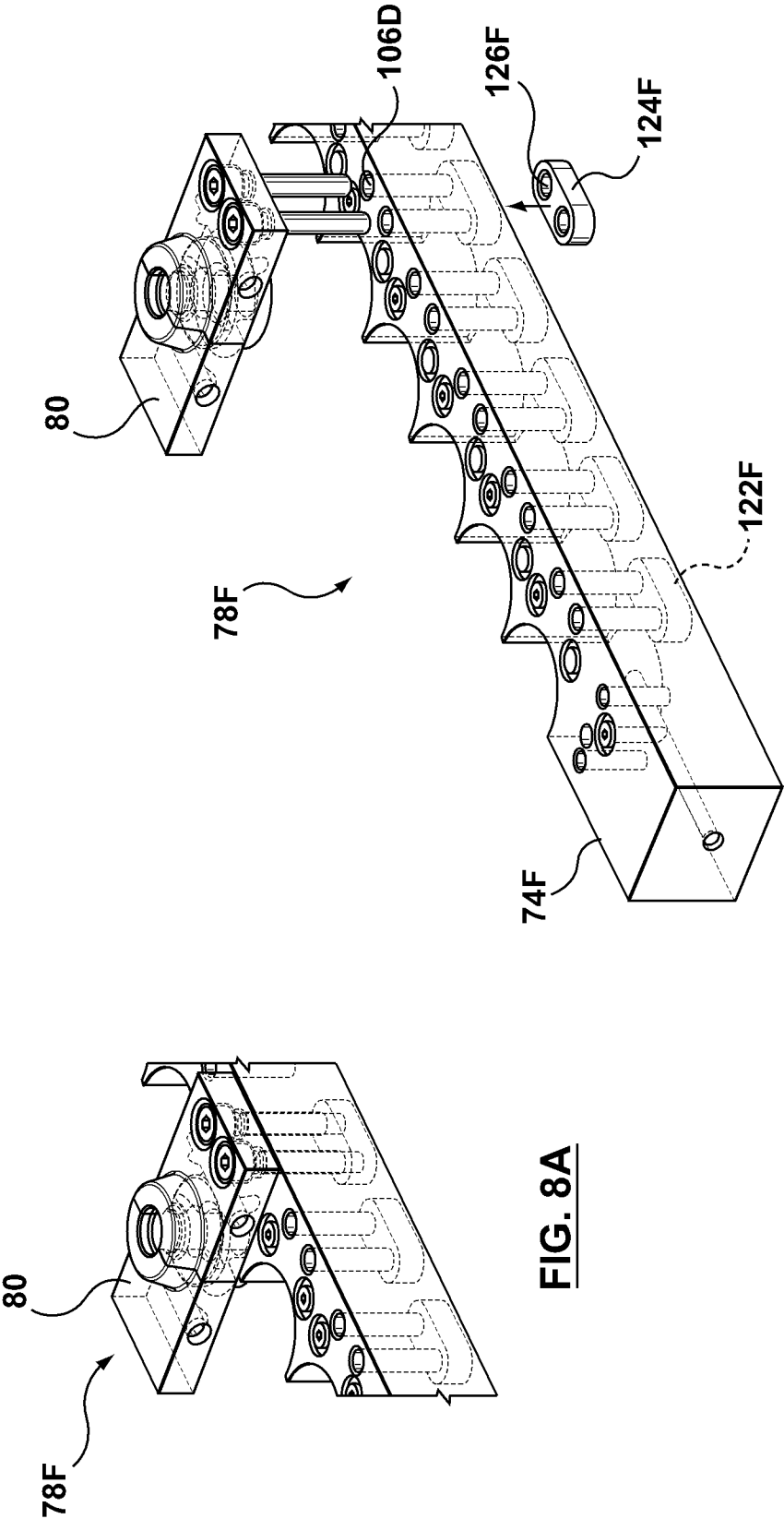


FIG. 8B

FIG. 8A

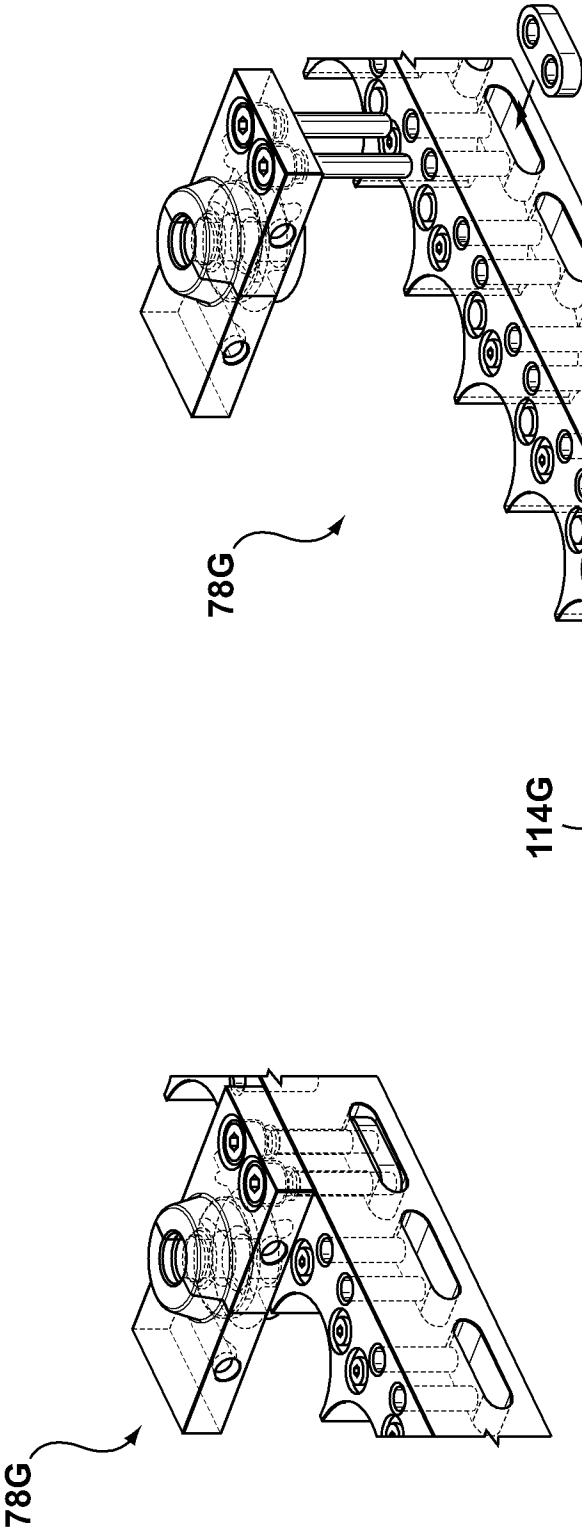


FIG. 9A

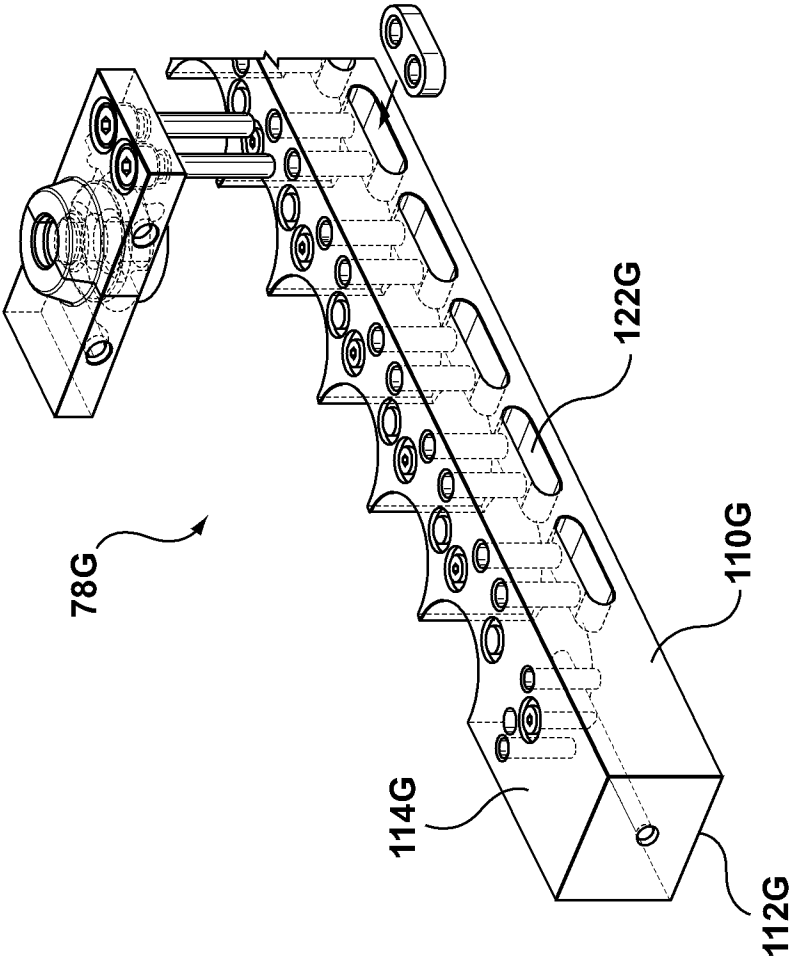


FIG. 9B

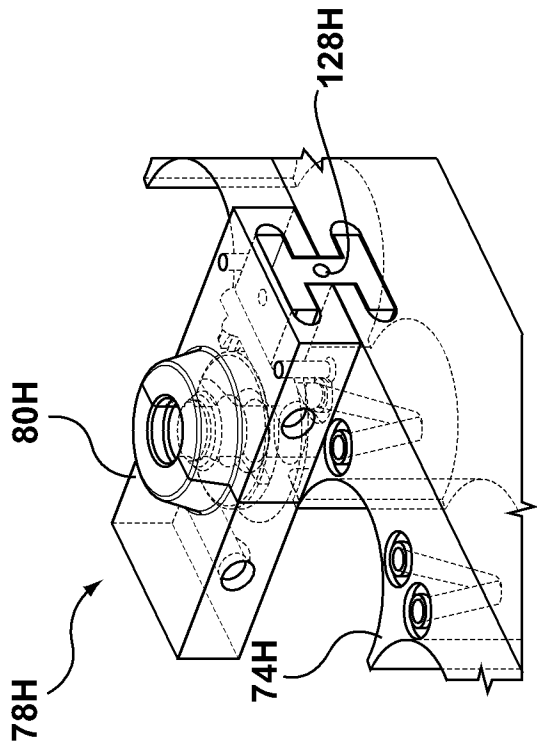


FIG. 10A

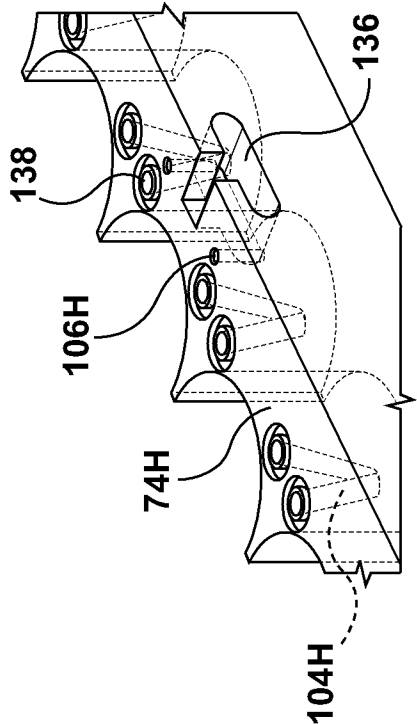


FIG. 10B

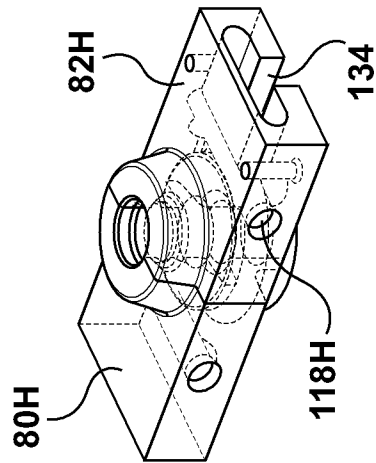


FIG. 10C

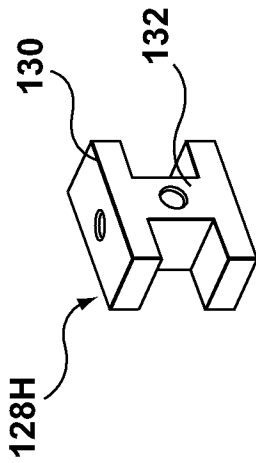


FIG. 10D

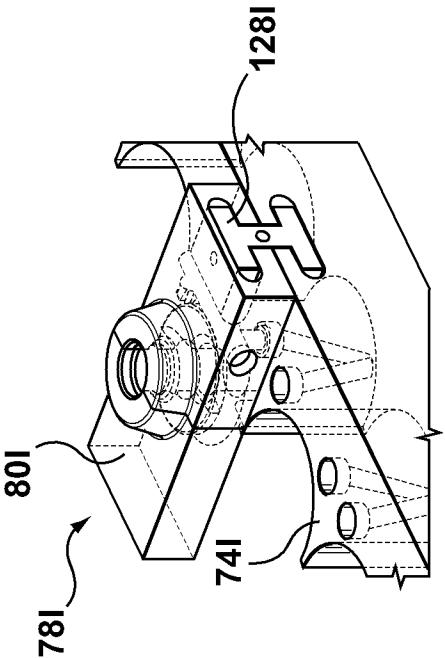


FIG. 11A

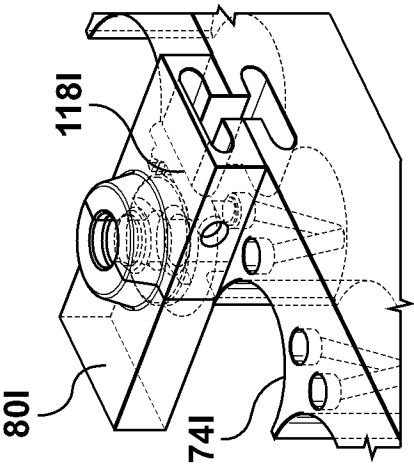


FIG. 11C

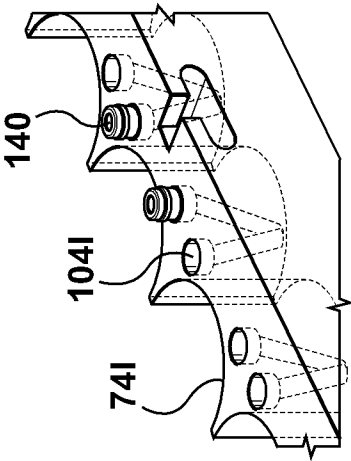


FIG. 11B

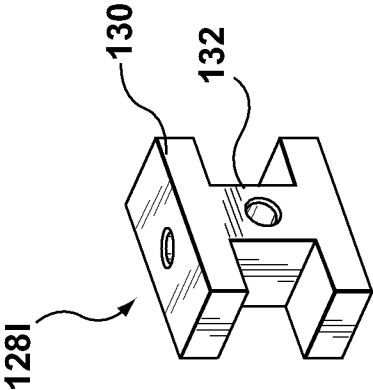


FIG. 11D

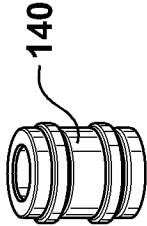


FIG. 11E

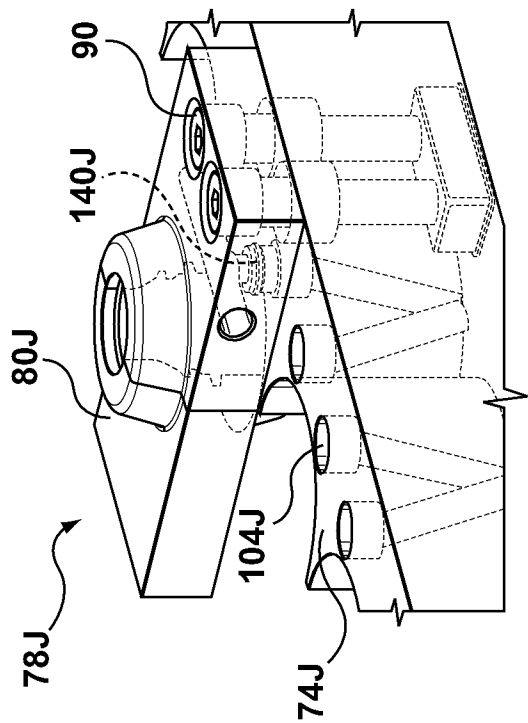


FIG. 12A

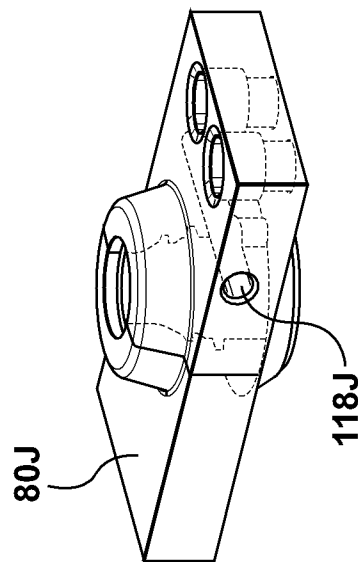


FIG. 12C

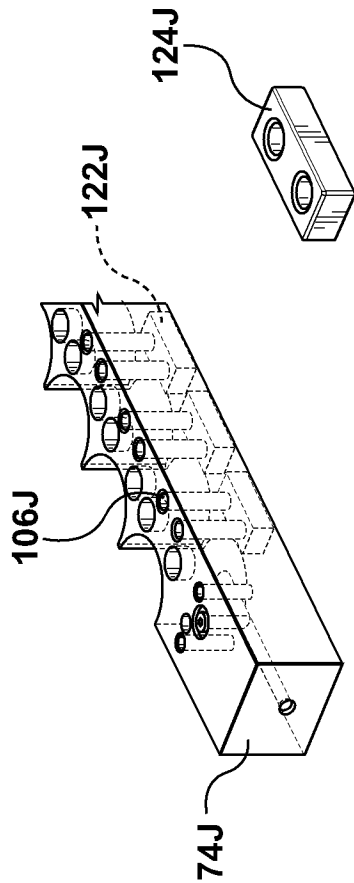


FIG. 12B

FIG. 12D

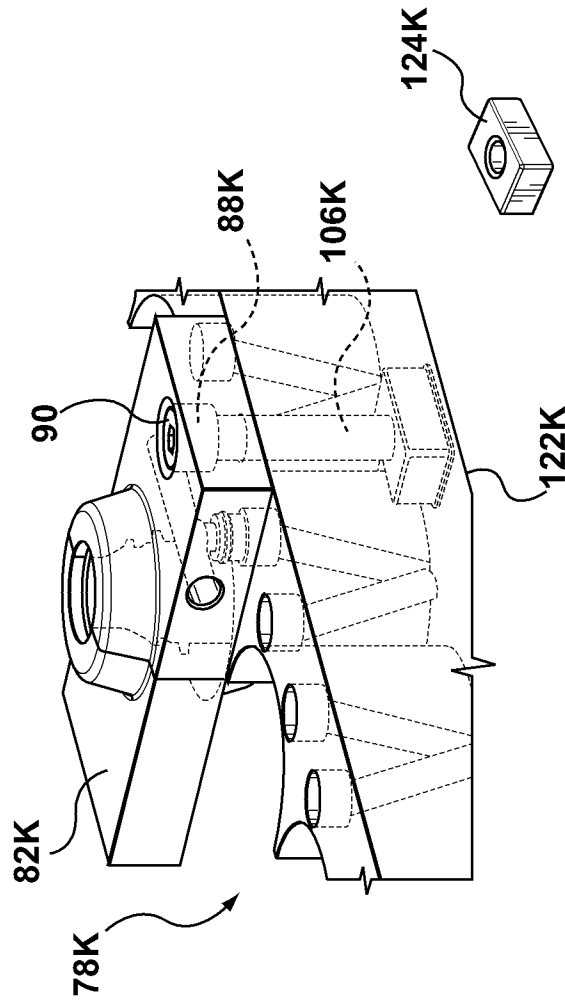


FIG. 13A

FIG. 13B

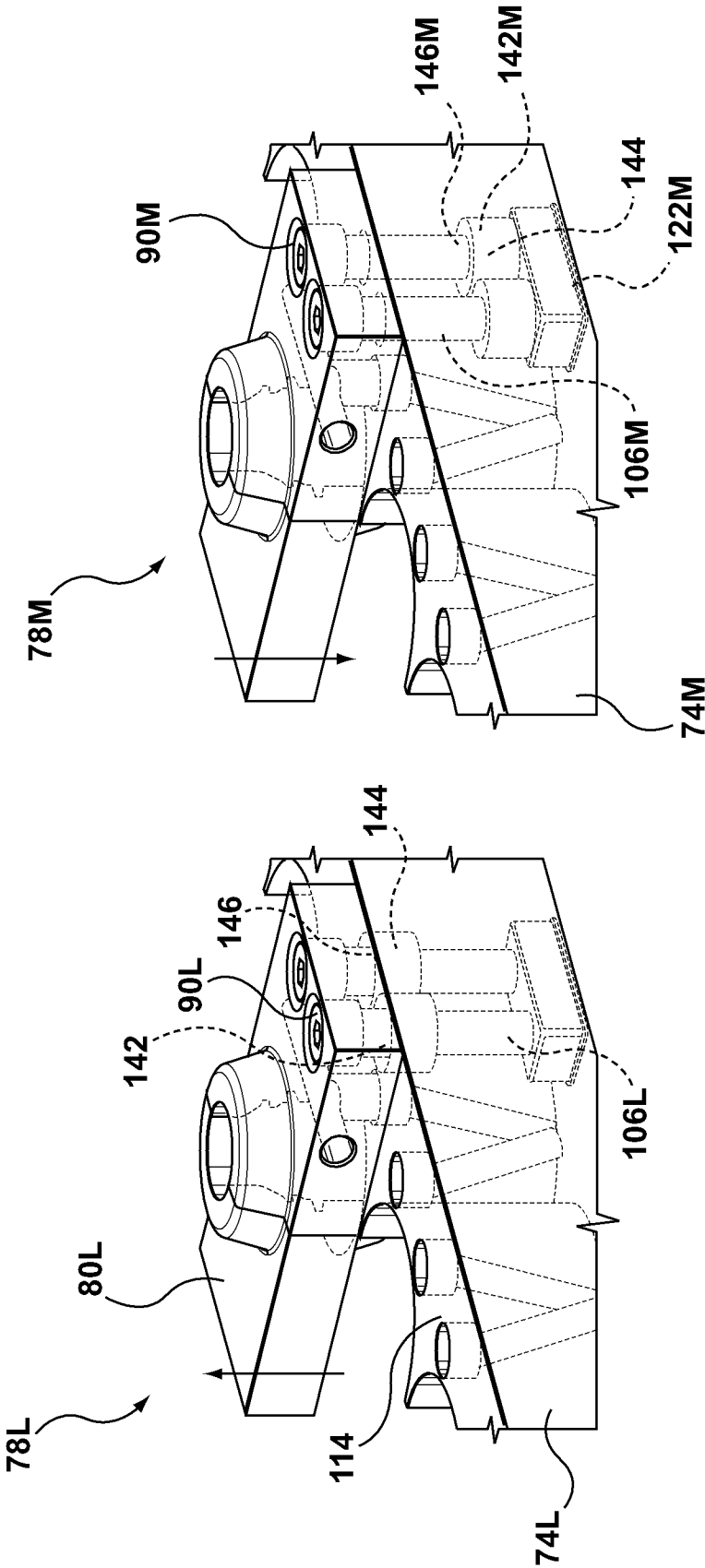


FIG. 14B

FIG. 14A

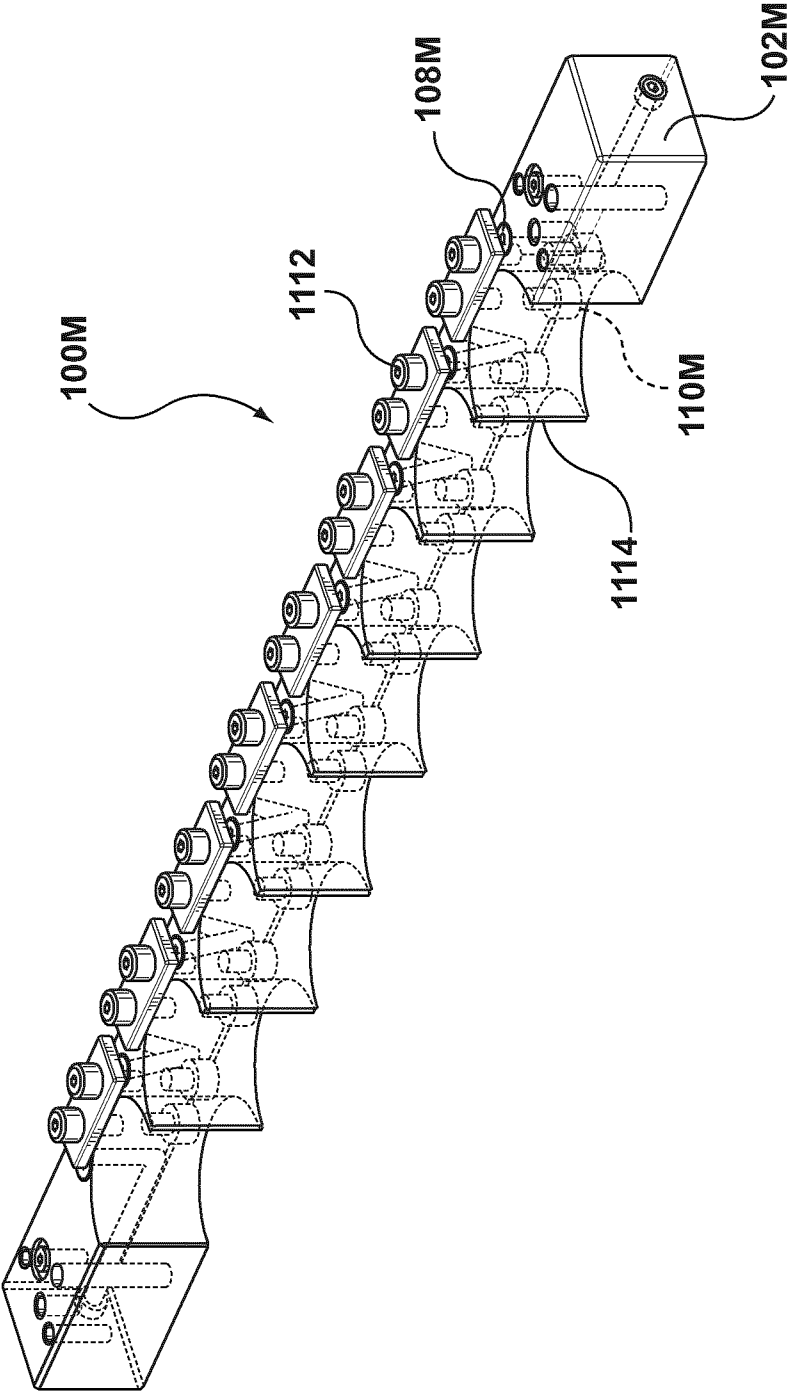


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2011/050560

A. CLASSIFICATION OF SUBJECT MATTER IPC: B29C 49/76 (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: B29C 49/76 (2006.01) USPC: 264/533, 425/525, 425/545 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used) EPODOC, Espacenet keywords: neck, ring, preform, slide		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/000058 A1 (HUSKY INJECTION MOLDING SYSTEMS LTD.) 31 December 2008 (31-12-2008)	1, 2, 17-23, 38-42
Y	see: figures 1, 4, 5 pages 2-3	3, 9-11, 13, 14, 24, 30-32, 34, 35
Y	US 2008/0268086 A1 (HUSKY INJECTION MOLDING SYSTEMS, LTD.) 30 October 2008 (30-10-2008) see: figures 5-7 paragraphs 31-38, 43	3, 9-11, 13, 14, 24, 30-32, 34, 35
A	WO 2010/017622 A1 (HUSKY INJECTION MOLDING SYSTEMS LTD.) 18 February 2010 (18-02-2010) see: figures 3-5 pages 5, 6	1-42
☐ Further documents are listed in the continuation of Box C. ☒ 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 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search 21 December 2011 (21-12-2011)	Date of mailing of the international search report 3 January 2012 (03-01-2012)	
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Authorized officer Julien Daigle (819) 934-4273	

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2011/050560

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
WO2009000058A1	31 December 2008 (31-12-2008)	None	
US2008268086A1	30 October 2008 (30-10-2008)	CA2681011A1 CA2681011C CN101668623A EP2150388A1 EP2150388A4 KR20100007912A US7798804B2 WO2008131515A1	06 November 2008 (06-11-2008) 21 June 2011 (21-06-2011) 10 March 2010 (10-03-2010) 10 February 2010 (10-02-2010) 24 November 2010 (24-11-2010) 22 January 2010 (22-01-2010) 21 September 2010 (21-09-2010) 06 November 2008 (06-11-2008)
WO2010017622A1	18 February 2010 (18-02-2010)	CA2730144A1 CN102112291A EP2323831A1 EP2323831A4 KR20110043751A US2011111079A1	18 February 2010 (18-02-2010) 29 June 2011 (29-06-2011) 25 May 2011 (25-05-2011) 23 November 2011 (23-11-2011) 27 April 2011 (27-04-2011) 12 May 2011 (12-05-2011)