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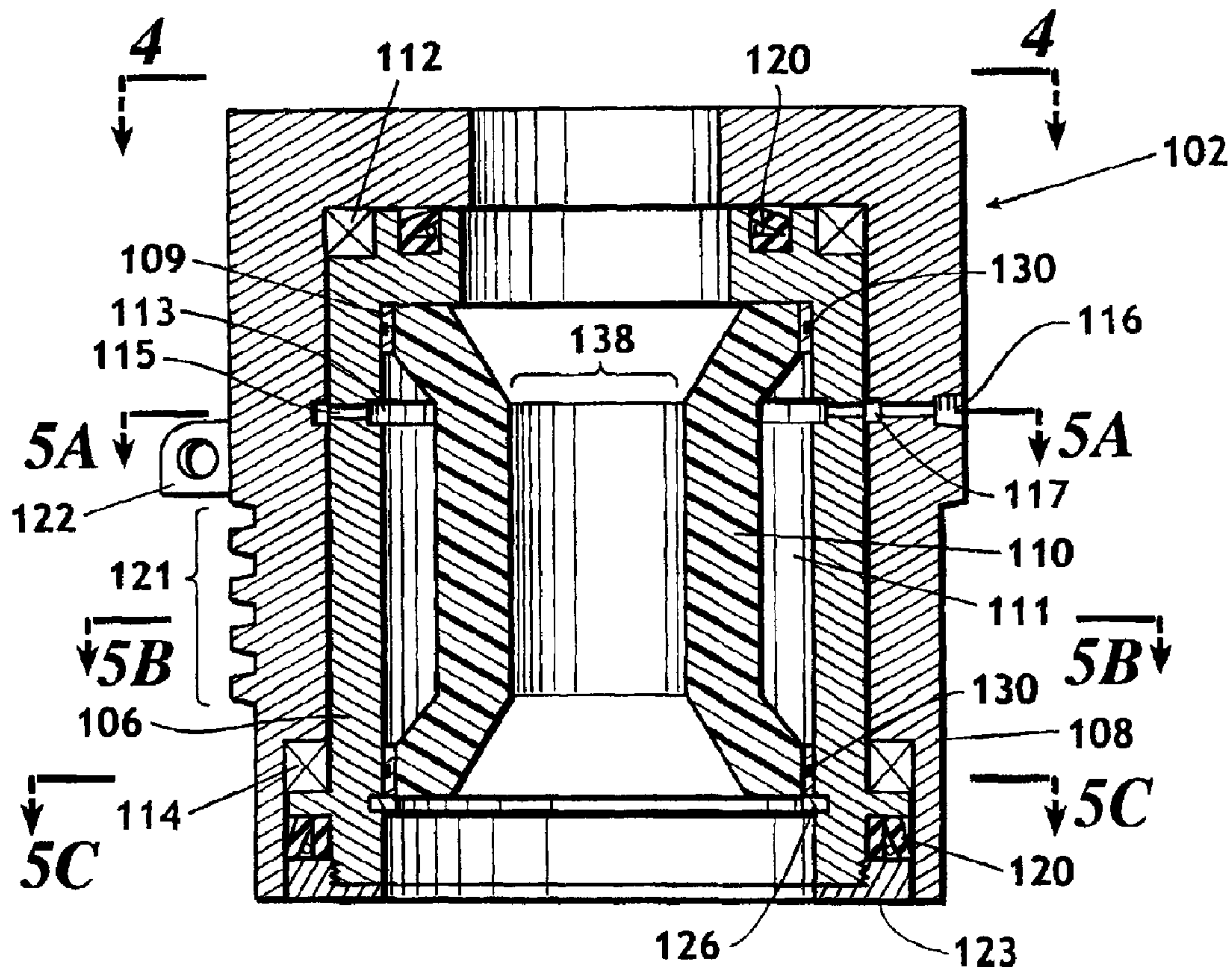
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(57) Abrégé/Abstract:

A Rotating Pressure Control Head (RPCH) with a rapid engagement mechanism is disclosed. The RPCH comprises an upper body and a lower body. The rapid engagement mechanism allows the upper body to be quickly disengaged from the lower body



(57) **Abrégé(suite)/Abstract(continued):**

and replaced with a new upper body. The upper body comprises a sealing element and an inner housing that rotates with respect to an outer housing. The sealing element contains a plurality of internal cavities. The plurality of cavities control the constriction of the sealing element around the drill pipe.

ABSTRACT OF THE DISCLOSURE

A Rotating Pressure Control Head (RPCH) with a rapid engagement mechanism is disclosed. The RPCH comprises an upper body and a lower body. The rapid engagement mechanism allows the upper body to be quickly
5 disengaged from the lower body and replaced with a new upper body. The upper body comprises a sealing element and an inner housing that rotates with respect to an outer housing. The sealing element contains a plurality of internal cavities. The plurality of cavities control the constriction of the sealing element around the drill pipe.

ROTATING PRESSURE CONTROL HEAD

FIELD OF THE INVENTION

The present invention is directed generally at controlling well head blow
5 outs, and specifically to a rotating pressure control head having a rapid
engagement mechanism and a replaceable and predictably deformable sealing
element.

BACKGROUND OF THE INVENTION

10 When the hydrostatic weight of the column of mud in a well bore is less
than the formation pressure, the potential for a blowout exists. A blowout occurs
when the formation expels hydrocarbons into the well bore. The expulsion of
hydrocarbons into the well bore dramatically increases the pressure within a
section of the well bore. The increase in pressure sends a pressure wave up the
15 well bore to the surface. The pressure wave can damage the equipment that
maintains the pressure within the well bore. In addition to the pressure wave, the
hydrocarbons travel up the well bore because the hydrocarbons are less dense
than the mud. If the hydrocarbons reach the surface and exit the well bore
through the damaged surface equipment, there is a high probability that the
20 hydrocarbons will be ignited by the drilling or production equipment operating at
the surface. The ignition of the hydrocarbons produces an explosion and/or fire
that is dangerous for the drilling operators. In order to minimize the risk of
blowouts, drilling rigs are required to employ a plurality of different blowout
preventers (BOPs), such as a rotating BOP, an annular BOP, a pipe ram, and a
25 blind ram. Persons of ordinary skill in the art are aware of other types of BOPs.

The various BOPs are positioned on top of one another, along with any other necessary surface connections such as nitrogen injection. The stack of BOPs and surface connections is called the BOP stack. A typical BOP stack is illustrated in FIG. 1.

5 One of the devices in the BOP stack is a rotating BOP. The rotating BOP is located at the top of the BOP stack and is part of the pressure boundary between the well bore pressure and atmospheric pressure. The rotating BOP creates the pressure boundary by employing a ring-shaped rubber or urethane sealing element that squeezes against the drill pipe, tubing, casing, or other
10 cylindrical members (hereinafter, drill pipe). The sealing element allows the drill pipe to be inserted into and removed from the well bore while maintaining the pressure differential between the well bore pressure and atmospheric pressure. The sealing element may be shaped such that the sealing element uses the well bore pressure to squeeze the drill pipe or other cylindrical member. However,
15 most rotating BOPs utilize some type of mechanism, typically hydraulic fluid, to apply additional pressure to the outside of the sealing element. The additional pressure on the sealing element allows the rotating BOP to be used for higher well bore pressures.

 Prior art rotating BOPs have several drawbacks. One of the drawbacks is
20 that the rotation of the drill pipe wears out the sealing element. The passage of pipe joints, down hole tools, and drill bits through the rotating BOP causes the sealing element to expand and contract repeatedly, which also causes the sealing element to become worn. When the sealing element becomes sufficiently worn, it must be replaced. Replacement of the sealing element can only occur when the

drilling operations are stopped. Repeated stoppages in the drilling operations lower productivity because the well takes longer to drill. Increased longevity of the sealing element would result in fewer replacements and, thus, less down time and increased productivity. Therefore, a need exists for a rotating BOP with a sealing
5 element having increased longevity.

United States Patent 6,129,152 (the '152 patent) to Hosie, entitled "Rotating BOP and Method" discloses the use of bearings to allow the sealing element to rotate with the drill pipe. The bearings are subject to wear due to rotation. Thus, a need exists in the art for a rotating BOP design in which the
10 lifetime of the bearings for the rotating sealing element is increased.

Some prior art rotating BOP's use a large number of ball bearings to reduce wear. But a rotating BOP using ball bearings requires that the rotating BOP be removed from the drilling site in order to replace the ball bearings. Thus, the prior art replacement method is time consuming and results in additional down
15 time at the drilling site. If the rotating BOP could be "swapped out" with another unit, the reduction in downtime would mean greater productivity. Therefore, a need exists for a rotating BOP that is interchangeable and that may be engaged and disengaged rapidly.

An additional problem encountered with prior art rotating BOPs, including
20 the '152 patent rotating BOP, is that the vertical height of the sealing element is increased to allow the sealing element to withstand higher pressures. API standards require an annular BOP to be used in the BOP stack below the rotating BOP. In extreme cases, the BOP stack can reach thirty feet in height. Drilling engineers are constantly seeking ways to decrease the height of the BOP stack.

Decreasing the height of the sealing element for a given pressure rating would decrease the height of the rotating BOP, and thus decrease the height of the BOP stack. Consequently, a need exists for a sealing element that is shorter than prior art sealing elements while maintaining the same pressure differential as the prior art sealing elements.

SUMMARY OF THE INVENTION

The present invention, which meets the needs stated above, is a Rotating Pressure Control Head (RPCH) with a rapid engagement mechanism. The rapid engagement mechanism allows the upper body to be quickly disengaged from the lower body and replaced with a new upper body. The RPCH comprises an upper body and a lower body. The upper body comprises a sealing element and an inner housing that rotate with respect to an outer housing. The sealing element includes a plurality of internal cavities. The plurality of cavities in the sealing element control the constriction of the sealing element around the drill pipe. By controlling the constriction of the sealing element around the drill pipe, the sealing element is able to withstand higher well bore pressure than similarly sized sealing elements. Moreover, for a given well bore pressure, the sealing element of the present invention is shorter than the prior art sealing element designs. The combination of the shorter sealing element and the rapid engagement mechanism allows the RPCH to be significantly shorter than prior art rotating BOPs. Consequently, a BOP stack utilizing the RPCH is shorter than a BOP stack utilizing prior art rotating BOPs.

In the preferred embodiment, the sealing element rotates within the upper body. The preferred embodiment utilizes a plurality of bearings located at the uppermost and lowermost ends of the upper body. One set of bearings is configured to support the vertical load placed upon the upper body. A second set
5 of bearings is configured to support the horizontal load placed upon the upper body. The position and division of workload between the first set of bearings and the second set of bearings decrease the harmonic vibrations at the extreme ends caused by the rotating drill pipe, thus increasing the service life of the bearings.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by
5 reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a prior art blowout control stack, including a rotating blowout preventer, a pipe ram, blind ram, and gas injection;

FIG. 2 is a blowout control stack with a Rotating Pressure Control Head, an
10 annular ram, a blind ram, and gas injection;

FIG. 3 is a cross-sectional elevation view of the upper body;

FIG. 4 is a plan view of the upper body taken along line 4-4 in FIG. 3;

FIG. 5A is a cross-sectional plan view of the upper body taken along line
5A-5A in FIG. 3;

15 FIG. 5B is a cross-sectional plan view of the upper body taken along line
5B-5B in FIG. 3;

FIG. 5C is a cross-sectional plan view of the upper body taken along line
5C-5C in FIG. 3;

FIG. 6 is a plan view of the lower body;

20 FIG. 7 is a cross-sectional elevation view of the lower body taken along line
7-7 in FIG. 6;

FIG. 8 is an elevation view of the alignment of the upper body and the
lower body;

FIG. 9 is an elevation view of the insertion of the upper body into the lower body;

FIG. 10 is an elevation view of the securement of the upper body to the lower body;

5 FIG. 11 is a cross-sectional plan view of the insertion of the upper body into the lower body taken along line 11-11 in FIG. 9;

FIG. 12 is a cross-sectional plan view of the securement of the upper body to the lower body taken along line 12-12 in FIG. 10;

10 FIG. 13 is a cross-sectional elevation view of the insertion of the upper body into the lower body taken along line 13-13 in FIG. 11;

FIG. 14 is a cross-sectional elevation view of the securement of the upper body to the lower body taken along line 14-14 in FIG. 12;

FIGS. 15A and B are an exploded view of the present invention;

15 FIG. 16 is a cross sectional view of the present invention with the sealing element in a relaxed position;

FIG. 17 is a cross sectional view of the present invention with the sealing element in a contracted position;

FIG. 18 is a cross sectional view of the present invention with the sealing element in an expanded position;

20 FIG. 19 is a blowout control stack with the Modified Rotating Pressure Control Head, an annular ram, a blind ram, and gas injection;

FIG. 20 is a plan view of the modified lower body; and

FIG. 21 is a cross sectional view of the modified lower body taken along line 21-21 in FIG. 20.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 2 is an illustration of a blowout control stack employing the present invention, the Rotating Pressure Control Head (RPCH) **100**, in place of the prior art rotating BOP shown in FIG.1. RPCH **100** is affixed to a stack including a prior art annular ram, a prior art blind ram, a prior art pipe ram, and prior art gas injection. Persons of ordinary skill in the art will also appreciate the fact that RPCH **100** may replace not only the prior art rotating BOP, but the annular ram, the blind ram, and optionally the pipe ram when the well bore pressure does not exceed 1,500 psi. Utilization of the present invention to replace the prior art rotating BOP, the annular ram, the blind ram, and the pipe ram significantly reduces the height of the BOP stack. RPCH **100** has upper body **102** and lower body **104**. Moreover, as discussed further below (see FIG. 19 through FIG. 21), lower body **104** may be modified to include outlet **103** for connection to a separation vessel.

FIG. 3 is a cross-sectional elevation view of upper body **102**. Upper body **102** comprises outer housing **108**, inner housing **106**, sleeve **109**, sealing element **110**, and retaining ring **126**. A plurality of upper rapid engagement threads **121** are located on the lowermost portion of the exterior of outer housing **108**. The upper rapid engagement threads **121** mate up with a plurality of lower rapid engagement threads **118** on lower body **104** (not shown in FIG. 3). Outer housing **108** also contains locking tab **122**, which mates up with locking tab **122** on lower body **104**. Port **116** is an aperture located in outer housing **108**.

Inner housing **106** rotates within outer housing **108**. Upper bearing **112** supports the vertical loads placed upon inner housing **106**. Lower bearing **114** supports the horizontal loads placed upon inner housing **106**. If necessary, another bearing may be located on the upper portion of inner housing **106** to
5 further support the horizontal load placed upon inner housing **106**. First seals **120** are located on either side of upper bearing **112** and lower bearing **114**. First seals **120** keep upper bearing **112** and lower bearing **114** sufficiently lubricated to minimize frictional wear on upper bearing **112** and lower bearing **114**. Inner housing **106** also contains first channel **117** that connects port **116** in outer
10 housing **108** to each of cavities **111** in sealing element **110**. Bottom **123** attaches to inner housing **106** by threaded engagement, or by any other suitable means known to persons skilled in the art.

Sealing element **110** is located within sleeve **109**. Sleeve **109** is located within inner housing **106**. Sleeve **109** is held in place by inner housing **106** and
15 retaining ring **126**. Sleeve **109** is bonded to sealing element **110** and is adapted to facilitate the insertion and removal of sealing element **110** from inner housing **106**. Inner housing **106** has second seals **130** between sealing element **110** and inner housing **106**. Sealing element **110** contains a plurality of cavities **111**. Port **116** and first channel **117** are arranged such that hydraulic fluid (not shown) may pass
20 through port **116**, first channel **117**, channel ports **115** (see also FIG. 5A), second channel **113** (see also FIG. 5A) and into cavities **111** in sealing element **110** when sealing element **110** and inner housing **106** are rotating with respect to outer housing **108**. The hydraulic fluid also enters the slight space between outer

housing **102** and inner housing **106** from first channel **117** to provide lubrication for rotating inner housing **106**.

FIG. 4 is a plan view of upper body **102** taken along line 4-4 in FIG. 3. Locking tab **122** can be seen in FIG. 3. As seen in FIG. 3, cylindrical aperture **138** exists along the central axis of outer housing **108**, inner housing **106**, sealing element **110**, and retaining ring **126**. Cylindrical aperture **138** allows the drill pipe to pass through upper body **102**. Under normal operating conditions, the inside diameter of cylindrical aperture **138** in sealing element **110** is less than the inside diameter of the apertures in outer housing **108**. This configuration allows sealing element **110** to form a seal around the drill pipe (not shown) without the drill pipe contacting outer housing **108**. However, sealing element **110** is constructed of a flexible material and may expand until the sealing element **110** inside diameter is the same as the inside diameter of aperture in outer housing **108**. When sealing element **110** expands, a drill bit or a down hole tool may pass completely through upper body **102**.

FIG. 5A is a cross-sectional plan view of upper body **102** taken along line 5A-5A in FIG. 3, FIG. 5B is a cross-sectional plan view of upper body **102** taken along line 5B-5B in FIG. 3, and FIG. 5C is a cross-sectional plan view of upper body **102** taken along line 5C-5C in FIG. 3. FIGS. 5A, 5B, and 5C illustrate the shape and connective details of upper body **102**, particularly sealing element **110**. FIG. 5A illustrates the connection between port **116** in outer body **108**, first channel **117** in inner housing **106**, and cavity **111** in sealing element **110**. Locking tab **122** is also shown in FIG. 5A. FIG. 5B illustrates the shape of cavities **111** in sealing element **110**. FIG. 5B also illustrates inner housing **106**, sleeve **109**,

sealing element **110**, outer housing **108**, and upper rapid engagement threads **121**. FIG. 5C illustrates inner housing **106**, sleeve **109**, sealing element **110**, and outer housing **108**. Sealing element **110** may be formed in any number of ways known to persons skilled in the art. In the preferred embodiment, sealing element
5 **110** is formed by pouring liquid urethane into a cylinder containing a mold, and then removing the mold after the urethane has set in the desired configuration. After removing the top and bottom of the cylinder, and after cutting apertures in the cylinder to expose the internal cavities of the sealing element, the cylinder becomes sleeve **109**. Persons skilled in the art will be aware of other methods of
10 forming sealing element **110**, and that sealing element **110** may be formed from rubber, thermoplastic rubber, plastic, urethane or any other elastomer or elastometric material possessing the required properties.

The introduction of pressurized hydraulic fluid into cavities **111** within sealing element **110** causes sealing element **110** to expand inwardly to form a
15 pressure retaining seal on the drill pipe. Pressurized hydraulic fluid flows through port **116** and into first channel **117**. From first channel **117**, the pressurized hydraulic fluid flows through a plurality of channel apertures **115** into second channel **113** and into cavities **111** (see also FIG. 15A and FIG. 15B). The shape of cavities **111** is such that cavities **111**, inner housing **106**, and sleeve **109** cause
20 sealing element **110** to constrict against the drill pipe in a controlled and predictable manner. Unlike prior art sealing elements that fold, twist, wrinkle, and bend in unpredictable manners as they are forced onto the rotating drill pipe, the inner wall of sealing element **110** twists as sealing element **110** expands inwardly. The twisting action of sealing element **110** results in a pressure seal between the

drill pipe and sealing element **110** that is sufficient for almost any drilling application.

Persons of ordinary skill in the art will appreciate that the pressurization of cavities **111** by a hydraulic fluid may be supplemented or substituted by pressure
5 from the drilling or production fluid. In such an embodiment, cavities **111** may be partially or fully exposed to the drilling or production fluid. For example, in an alternate embodiment, cavities **111** may be open at the bottom so that a cross section taken at the bottom of sealing element **110** may be the same as the cross section of sealing element **110** depicted in FIG. 5B. Alternatively, access to
10 cavities **111** may be through apertures (not shown) in the bottom of sealing element **110**. In such embodiments, as a minimum, port **116** would be closed. Moreover, in such embodiments, inner housing **106** may be manufactured without channel ports **115** and second channel **113** thereby preventing drilling fluid from entering the slight space between inner housing **106** and outer housing **102**.
15 Furthermore, such embodiments permit port **116** to remain open for introduction of hydraulic fluid through port **116** and first channel **117** to lubricate the space between inner housing **106** and outer housing **102**.

The seal between sealing element **110** and the drill pipe is sufficiently strong that the vertical height of sealing element **110** may be less than the height
20 required by prior art sealing elements. As an example, the prior art rotating BOPs require a sealing element that is as much as fifty inches in vertical height. The present invention's sealing element **110** can maintain the same pressure with only fifteen inches of vertical height. The shorter sealing element means that RPCH **100** is shorter, thus reducing the overall height of the stack.

Another advantage of the present invention is that sealing element **110** can completely close off the well bore. When the drill pipe is removed from the center section of sealing element **110**, a pressurized hydraulic fluid can be introduced into cavities **111** to cause the inner wall of sealing element **110** to constrict onto
5 itself, closing off the well bore. In this application, sealing element **110** is able to perform the same function as an annular BOP or blind ram and can withhold well bore pressures of up to 1,500 psi. If the present invention is fitted with a mechanism that positions a plate over the aperture in upper body **102** such that the plate contacts sealing element **110**, then the present invention can withstand
10 almost any pressure encountered in drilling applications.

FIG. 6 is a plan view of lower body **104**. Lower body **104** comprises locking tab **122**, and lower rapid engagement threads **118**. Lower rapid engagement threads **118** on lower body **104** mate up with upper rapid engagement threads **121** on upper body **102**. When lower rapid engagement threads **118** on lower body
15 **104** are engaged with upper rapid engagement threads **121** on upper body **102**, locking tab **122** on lower body **104** mates up with locking tab **122** on upper body **102**. A lock or other device may be placed through locking tabs **122** to prevent accidental disengagement of upper body **102** and lower body **104**. Flange connection **124** connects lower body **104** to the remainder of the stack shown in
20 FIG. 2. FIG. 7 is a cross-sectional elevation view of the lower body **104** taken along line 7-7 in FIG. 6. The orientation of locking tab **122**, lower rapid engagement threads **118**, flange connection **124** and third seal **127** can be clearly seen in FIG. 7.

The present invention is designed such that upper body **102** may be quickly removed and replaced. The rapid engagement mechanism described herein allows a drilling operator to turn an old upper body **102** a small amount, remove the old upper body **102**, align a new upper body **102** with lower body **104**, insert
5 the new upper body **102** into lower body **104**, and secure the new upper body **102** to lower body **104**. FIGS. 8-14 illustrate the aligning, inserting, and securing steps of the present invention. FIG. 8 is an elevation view of the alignment of upper body **102** and lower body **104** (lower body **104** shown in cross-section). The alignment step occurs when a user aligns upper body **102** with lower body **104**.
10 Upper body **102** is properly aligned with lower body **104** when upper rapid engagement threads **121** in upper body **102** align with the spaces between lower rapid engagement threads **118** in lower body **104**, and vice-versa. Rapid engagement and disengagement of upper body **102** is achieved using the same principle of speed and strength used in the design of breech blocks for breech
15 loading artillery.

FIG. 9 is an elevation view of the insertion of upper body **102** into lower body **104** (lower body **104** shown in cross-section). The insertion step occurs when the lower section of upper body **102** is inserted into the upper section of lower body **104**. In the insertion step, upper rapid engagement threads **121** on
20 upper body **102** are aligned with, but have not yet engaged with, lower rapid engagement threads **118** on lower body **104**. FIG. 11 is a cross-sectional plan view of the insertion of upper body **102** into lower body **104** taken along line 11-11 in FIG. 9. FIG. 13 is a cross-sectional elevation view of the insertion of upper body **102** into lower body **104** taken along line 13-13 in FIG. 11 after the rotation

of upper body **102**. Both FIGS. 11 and 13 show movement of upper rapid engagement threads **121** on upper body **102** aligned with, but not engaged with, lower rapid engagement threads **118** on lower body **104**.

FIG. 10 is an elevation view of the securement of upper body **102** to lower
5 body **104** (lower body **104** shown in cross-section). The securement step occurs when upper body **102** is secured to lower body **104**. In the securement step, upper rapid engagement threads **121** on upper body **102** engage lower rapid engagement threads **118** on lower body **104**. Upper body **102** may be rotated as little as twenty degrees or as much as forty-five degrees to sufficiently engage
10 lower body **104**. FIG. 12 is a cross-sectional plan view of the securement of upper body **102** to lower body **104** taken along line 12-12 in FIG. 10. FIG. 14 is a cross-sectional elevation view of the securement of upper body **102** to lower body **104** taken along line 14-14 in FIG. 12. Both FIGS. 12 and 14 show upper rapid engagement threads **121** on upper body **102** engaged with lower rapid
15 engagement threads **118** on lower body **104**.

FIGS. 15A and 15B are an exploded view of the present invention. FIG. 15A illustrates the connection of most of the parts of upper body **102**, including outer housing **108**, upper bearing **112**, first seals **120**, lower bearing **114**, and inner housing **106**. FIG. 15B illustrates the remaining parts of upper body **102**:
20 sealing element **110**, sleeve **109** and retaining ring **126**. FIG. 15B also illustrates lower body **104** including flange connection **124** (see FIG. 7) and the hex nuts used to secure flange connection **124** to the BOP stack (See FIG. 2).

FIGS. 16 through 18 depict Rotating Pressure Control Head **100** connected to switch **132**, hydraulic pump **134** and vacuum pump **136** so that positive or

negative pressure can be applied to sealing element **110** by transmission of positive or negative pressure through port **116**, first channel **117**, channel apertures **115**, and second channel **113** into cavity **111**. Referring to FIG. 16, sealing element **110** is relaxed at atmospheric pressure since switch **132** is in a neutral position and neither positive nor negative pressure is being applied. Referring to FIG. 17, positive pressure is applied when switch **132** engages hydraulic pump **134** to pump fluid into cavities **111** to cause sealing element **110** to form a seal around a drill pipe, or if there is no drill pipe to close entirely. Referring to FIG. 18, negative pressure is applied when switch **132** engages vacuum pump **136** to lower the pressure in cavities **111** causing sealing element to move inwardly and expand cylindrical aperture **138**. Applying negative pressure to expand cylindrical aperture **138** of sealing element **110** facilitates the passage of a drill bit or a down hole tool through upper body **102**. Persons skilled in the art will be aware that the pressure applied to cavities **111** may be regulated by a valve (not shown), and that the valve may be operated manually, automatically in response to a sensor monitoring annular return pressure (not shown), or by a computer connected to the valve and to the sensor (not shown).

FIG. 19 through FIG. 21 depict Modified Rotating Pressure Control Head **101**. Modified Rotating Pressure Control Head has modified lower body **105** and upper body **102** of Rotating Pressure Control Head **100**. Modified lower body **105** has the same features as lower body **104**, but has been enlarged and adapted for receiving outlet **107**. Outlet **107** is adapted for engagement to a valve and pipe connected to a separation vessel. Modified Rotating Pressure Control Head **101** has the advantage that adding outlet **107** for connection to a separation vessel

further decreases the overall height of the stack at the well head. The decrease in height is gained despite the fact that the height of modified lower body **105** is greater than the height of lower body **104** because the addition of outlet **107** to lower body **104** eliminates the need for a set of clamps for a separate outlet **103**
5 (see FIG. 2).

While the preferred embodiment of the present invention utilizes a rotating sealing element **110**, persons of ordinary skill in the art will appreciate that a stationary sealing element **110** may also be used. In the alternative embodiment, sealing element **110** is connected directly to outer housing **108** and the need for
10 inner housing **106**, upper bearing **112**, lower bearing **114**, and first seals **120** are eliminated. The alternative embodiment is simpler and less expensive to construct, but sealing element **110** has a shorter service life. Persons of ordinary skill in the art will know best which embodiment is preferable for individual applications.

With respect to the above description, it is to be realized that the optimum
15 dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function, manner of operation, assembly, and use are deemed readily apparent and obvious to one of ordinary skill in the art. The present invention encompasses all equivalent relationships to those illustrated in the drawings and described in the specification.

CLAIMS

What is claimed is:

1. A rotating pressure control head comprising:
 - 5 an upper body having an outer housing and an inner housing that rotates with respect to the outer housing;
a sealing element fixed within the inner housing and having a plurality of internal cavities and a plurality of apertures connecting the plurality of internal cavities to a pressurized fluid; and
 - 10 a lower body;
wherein the upper body has a plurality of upper rapid engagement threads and the lower body has a plurality of lower rapid engagement threads, and wherein the upper body engages the lower body by a twisting and interlocking of the upper rapid engagement threads with the lower rapid engagement threads.
- 15 2. The rotating pressure control head of claim 1 wherein inflation of the plurality of internal cavities by the pressurized fluid causes an inner wall of the sealing element to constrict a drill pipe in a predictable manner.

3. The rotating pressure control head of claim 1 or 2 wherein the sealing element further comprises:

a substantially cylindrical outer surface;

5 a substantially cylindrical inner surface concentric with and having a smaller diameter than the outer surface; and

a central aperture defined by the exterior of the inner surface, the central aperture sized to allow passage of a drill pipe;

10 wherein the plurality of inner cavities are disposed within the sealing element between the inner surface and the outer surface, each of the inner cavities having an opening through the outer surface;

wherein upon introduction of the pressurized fluid into the inner cavities through each of the openings, the diameter of the outer surface remains fixed and the diameter of the inner surface decreases; and

15 wherein the inner cavities control the deformation of the inner surface as the diameter of the inner surface decreases.

4. The rotating pressure control head of claim 2 wherein the plurality of internal cavities causes the inner wall of the sealing element to constrict the drill pipe in a twisting action.

20

5. The rotating pressure control head of any one of claims 1 – 4 wherein the lower body has an outlet adapted for connection to a separation vessel.

6. The rotating pressure control head of any one of claims 1 - 5 wherein the inner housing is rotatably engaged with the outer housing by a first bearing configured to support the vertical load placed upon the upper body and by a second bearing configured to support the horizontal load placed upon the upper
5 body.

7. The rotating pressure control head of claim 6 wherein a division of a workload between the first bearing and the second bearing decreases a plurality of harmonic vibrations caused by a rotation of the drill pipe.

10

8. The rotating pressure control head of claim 2 or 4 wherein the inner wall of the sealing element is caused to move away from the drill pipe by reducing the pressure in the internal cavities by means of a vacuum pump attached to a port in the outer housing.

15

9. The rotating pressure control head of claim 2, 4 or 8 wherein the pressurized fluid is a drilling fluid.

10. The rotating pressure control head of claim 2, 4 or 8 wherein the
20 pressurized fluid is a hydraulic fluid.

11. The rotating pressure control head of any one of claims 2 or 4 - 10 wherein the pressurized fluid enters the plurality of internal cavities through a port in the outer housing, a first channel, a plurality of apertures in an inner housing, and a second channel in the inner housing.

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12. The rotating pressure control head of any one of claims 2 or 4 - 10 wherein the pressurized fluid enters the plurality of internal cavities directly through the plurality of apertures in the sealing element.

10 13. The rotating pressure control head of any one of claims 1 - 12 further comprising:

wherein an inflation of the plurality of internal cavities by the pressurized fluid causes an inner wall of the sealing element to constrict a drill pipe in the rotating pressure control head in a twisting action; and

15 wherein the inner housing is rotatably engaged with the outer housing by a first bearing configured to support the vertical load placed upon the upper body and by a second bearing configured to support the horizontal load placed upon the upper body.

20 14. The rotating pressure control head of claim 13 wherein the pressurized fluid enters the plurality of internal cavities through a port in the outer housing, a first channel in the outer housing, a plurality of apertures in an inner housing, and a second channel in the inner housing.

15. The rotating pressure control head of claim 13 wherein the pressurized fluid is a drilling fluid that enters directly into the plurality of internal cavities.
16. The rotating pressure control head of any one of claims 1 – 15 wherein:
5 the upper body rotates between twenty and forty-five degrees with respect to the lower body between a locked position and an unlocked position; and
the upper body is removable from the lower body without any further rotation when the upper body is in the unlocked position.
- 10 17. The rotating pressure control head of any one of claims 1 – 16 wherein the plurality of internal cavities are triangular when viewed in cross-section.
18. A blowout preventer stack containing the rotating pressure control head of
of any one of claims 1 – 17.
- 15 19. A drilling apparatus containing the rotating pressure control head of any
one of claims 1 – 17.

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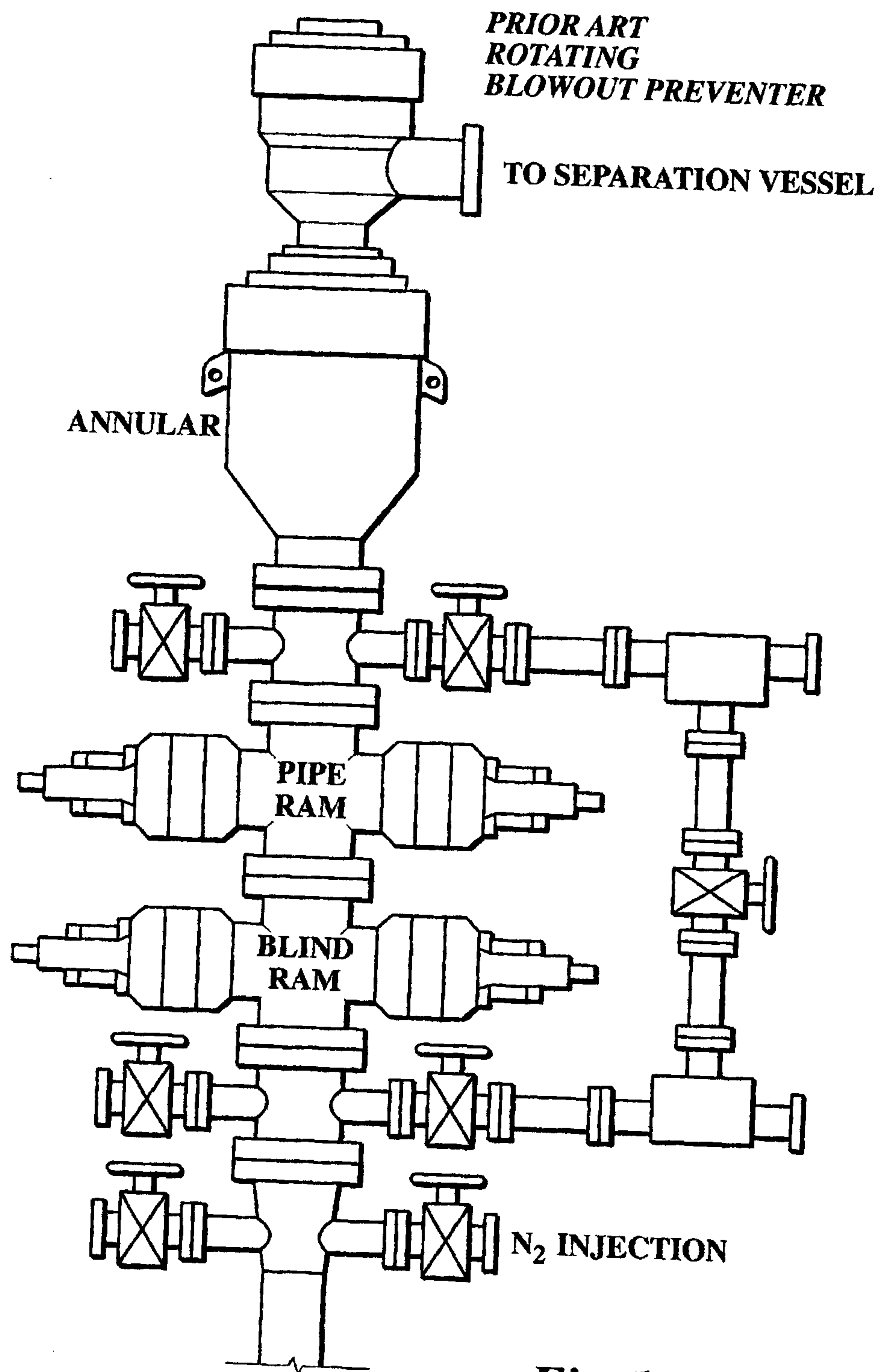
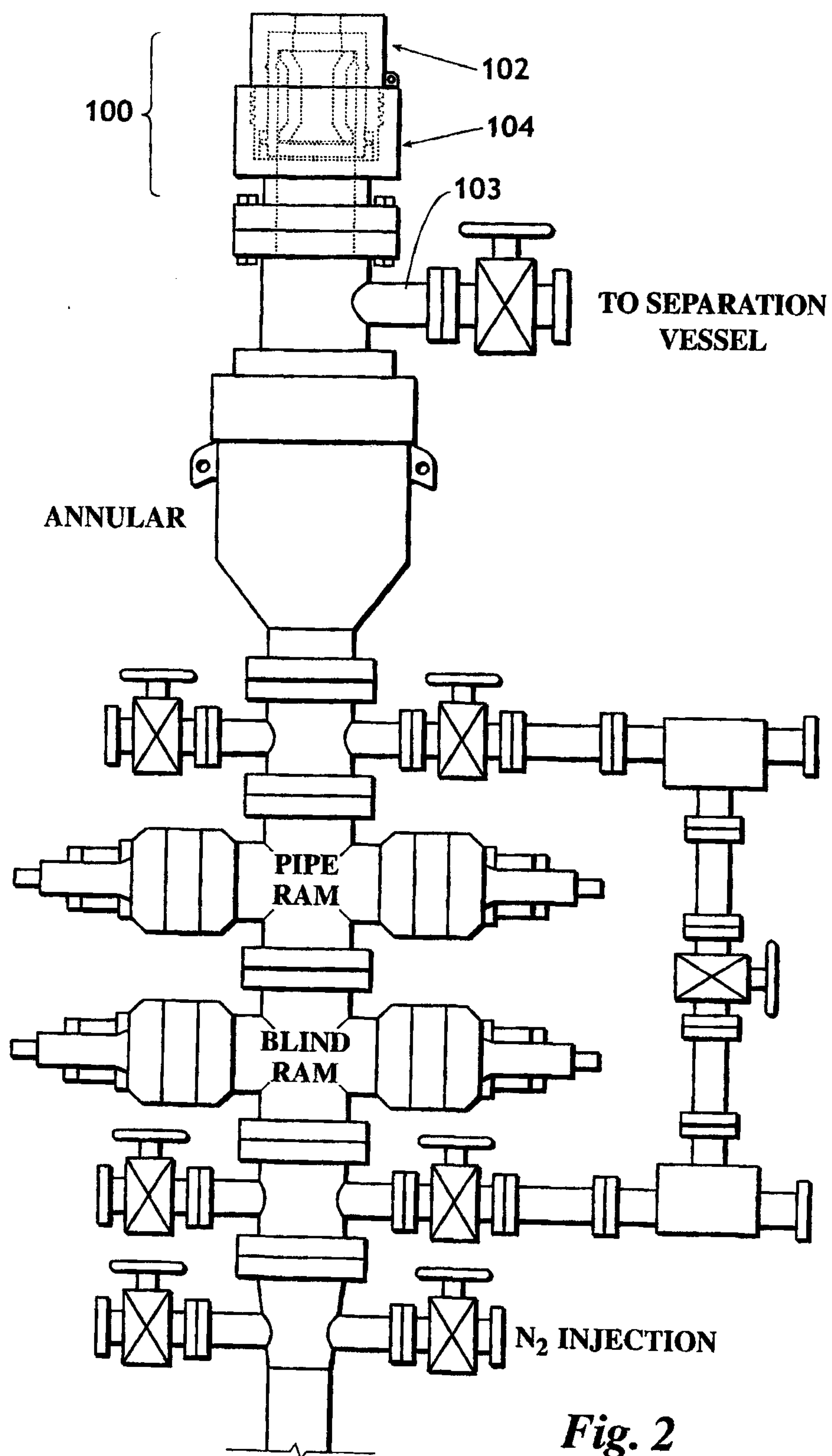
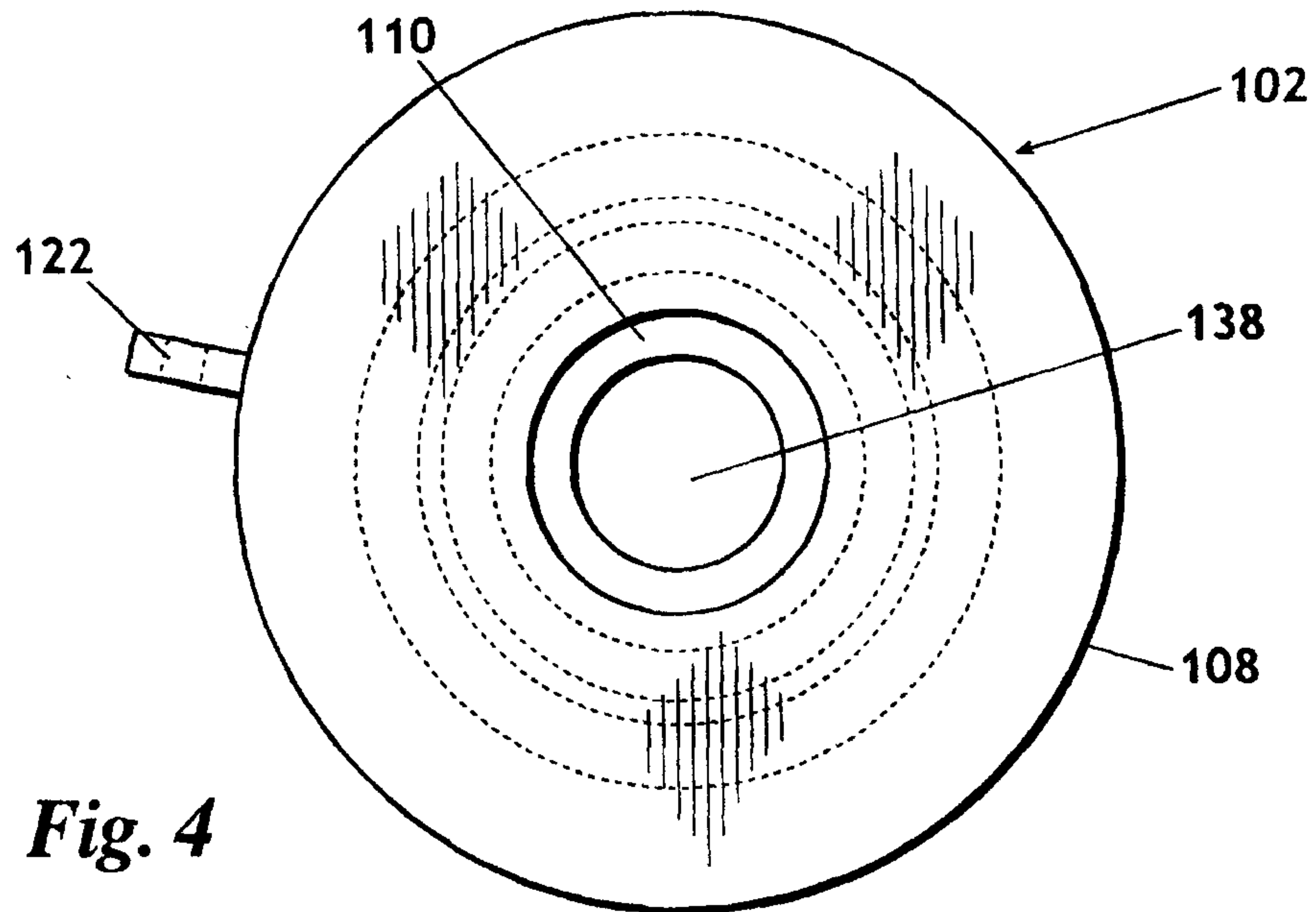
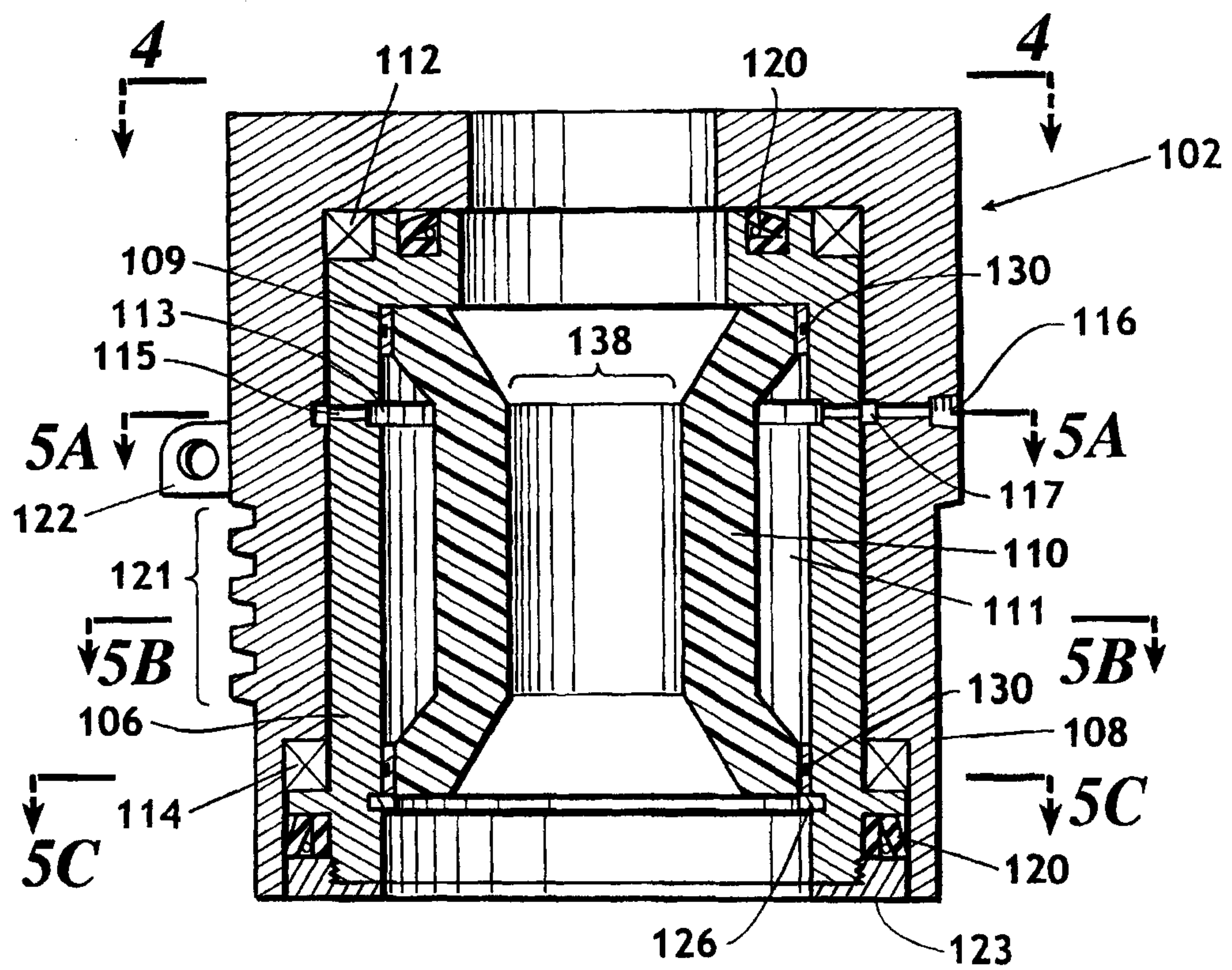


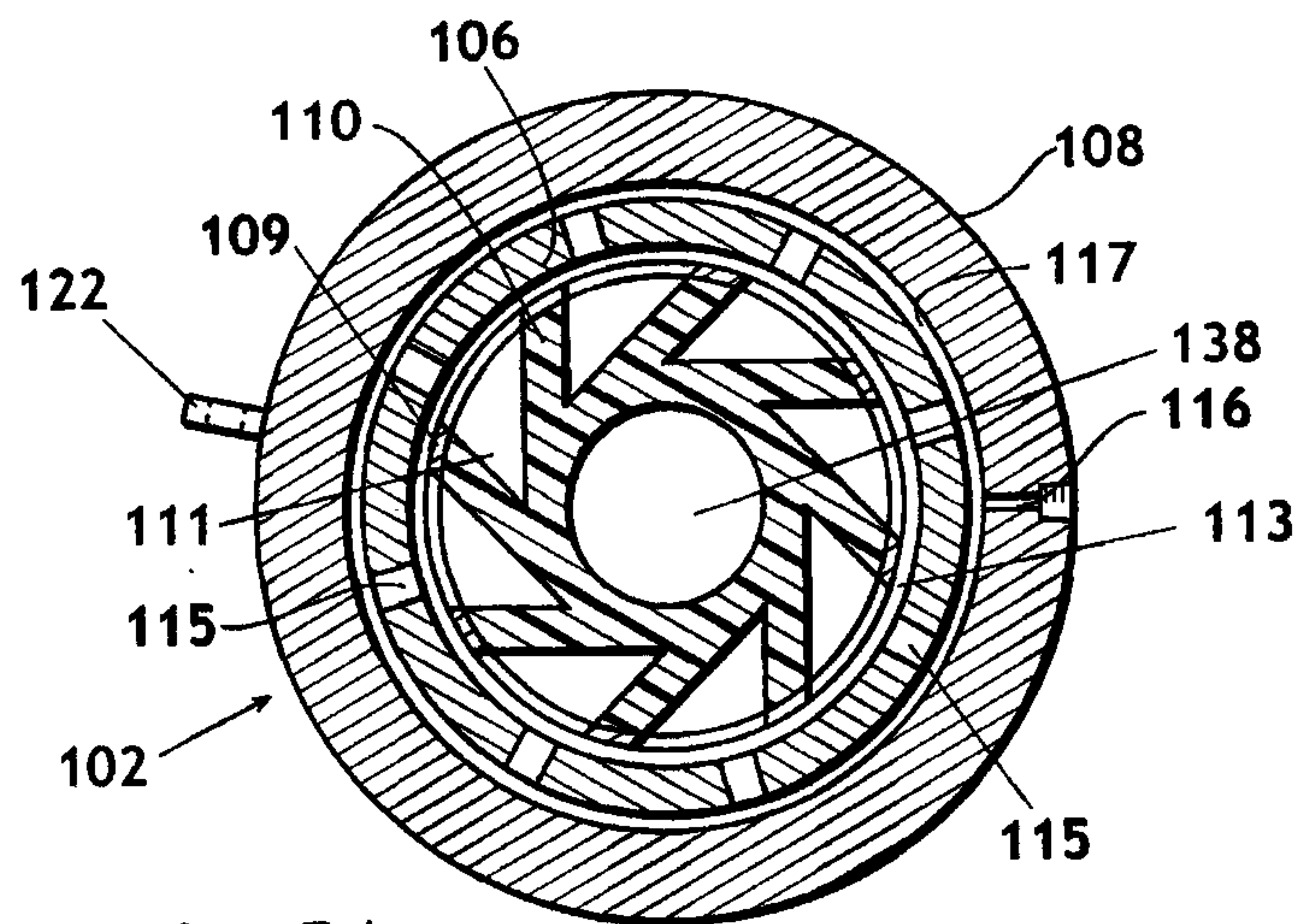
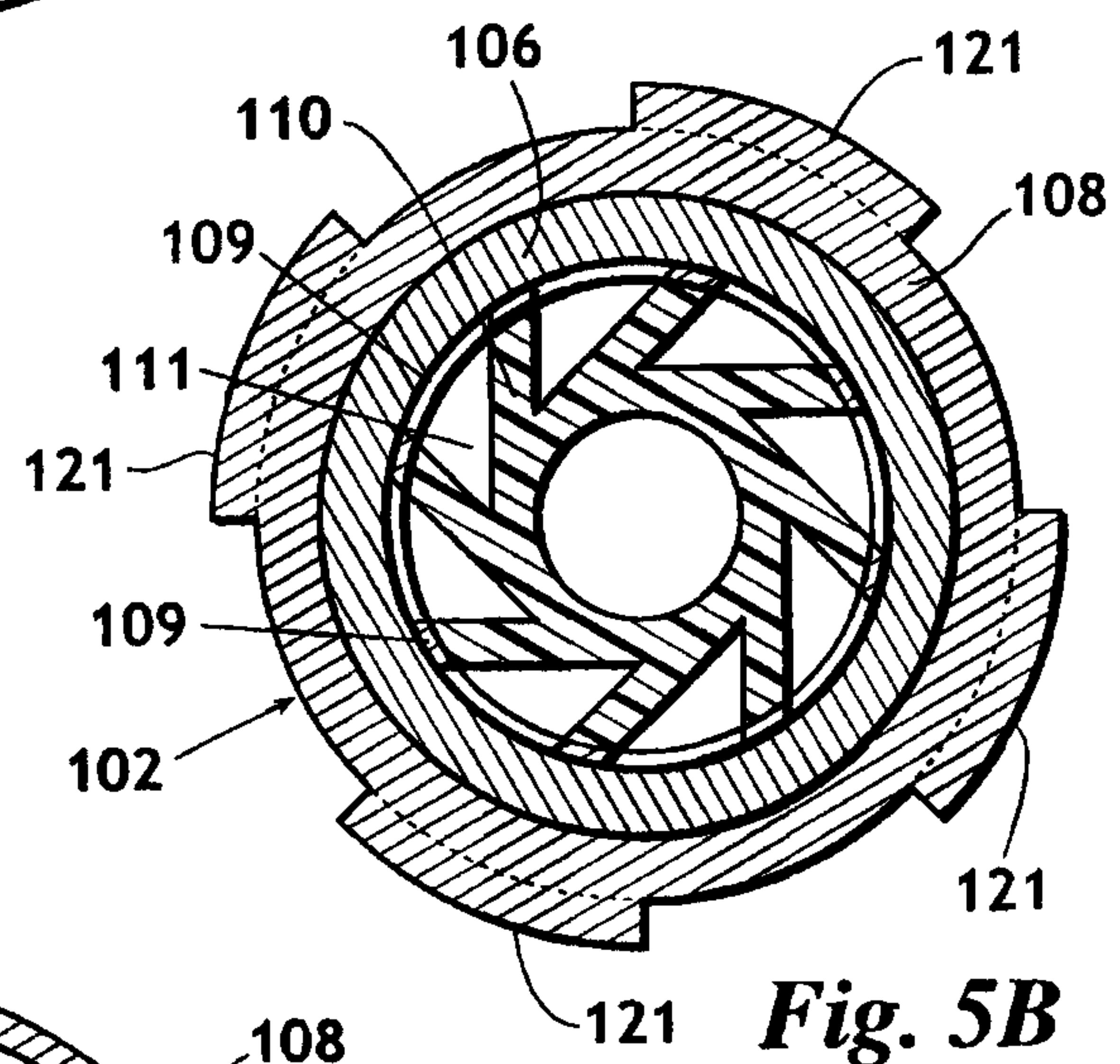
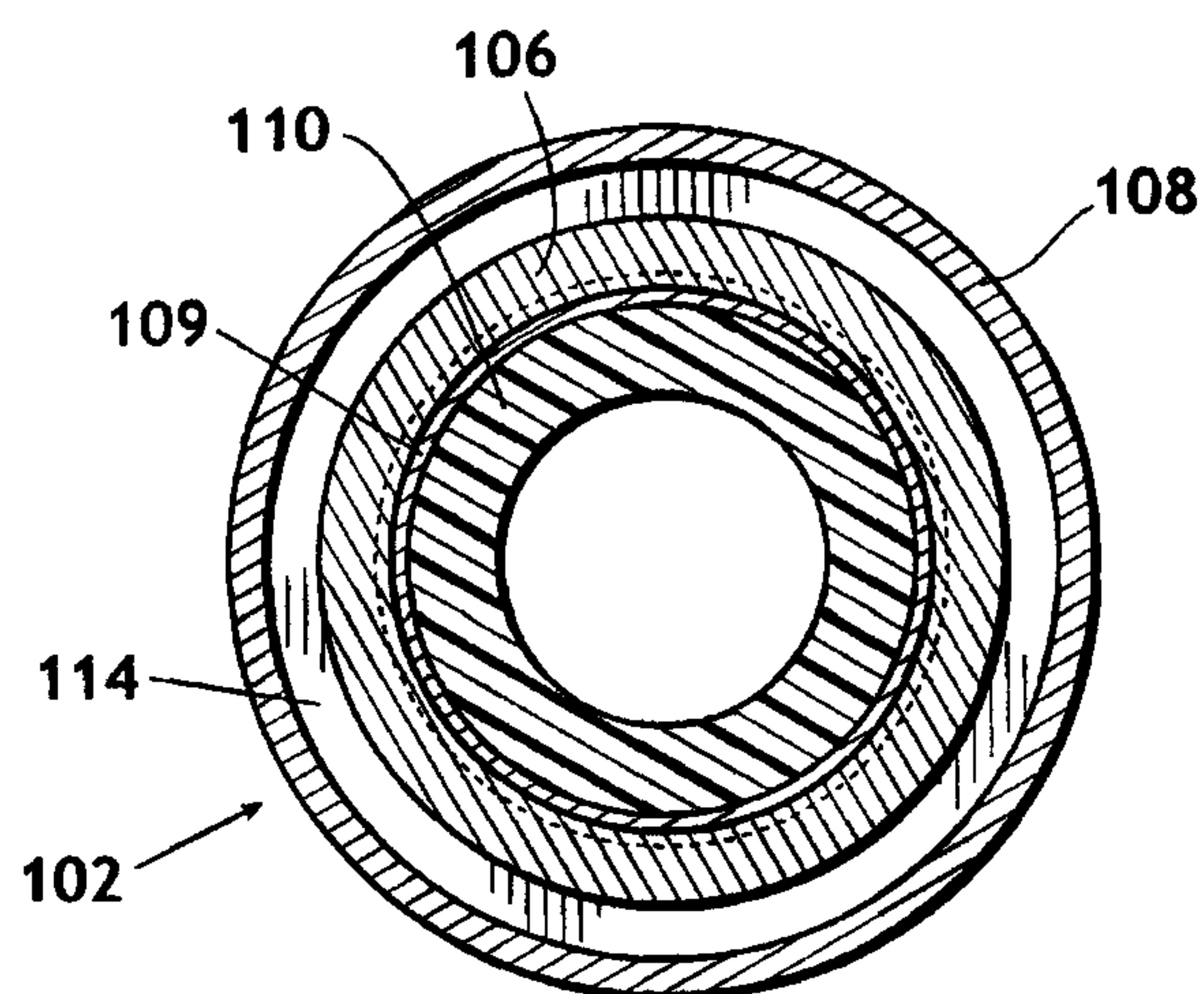
Fig. 1
(PRIOR ART)

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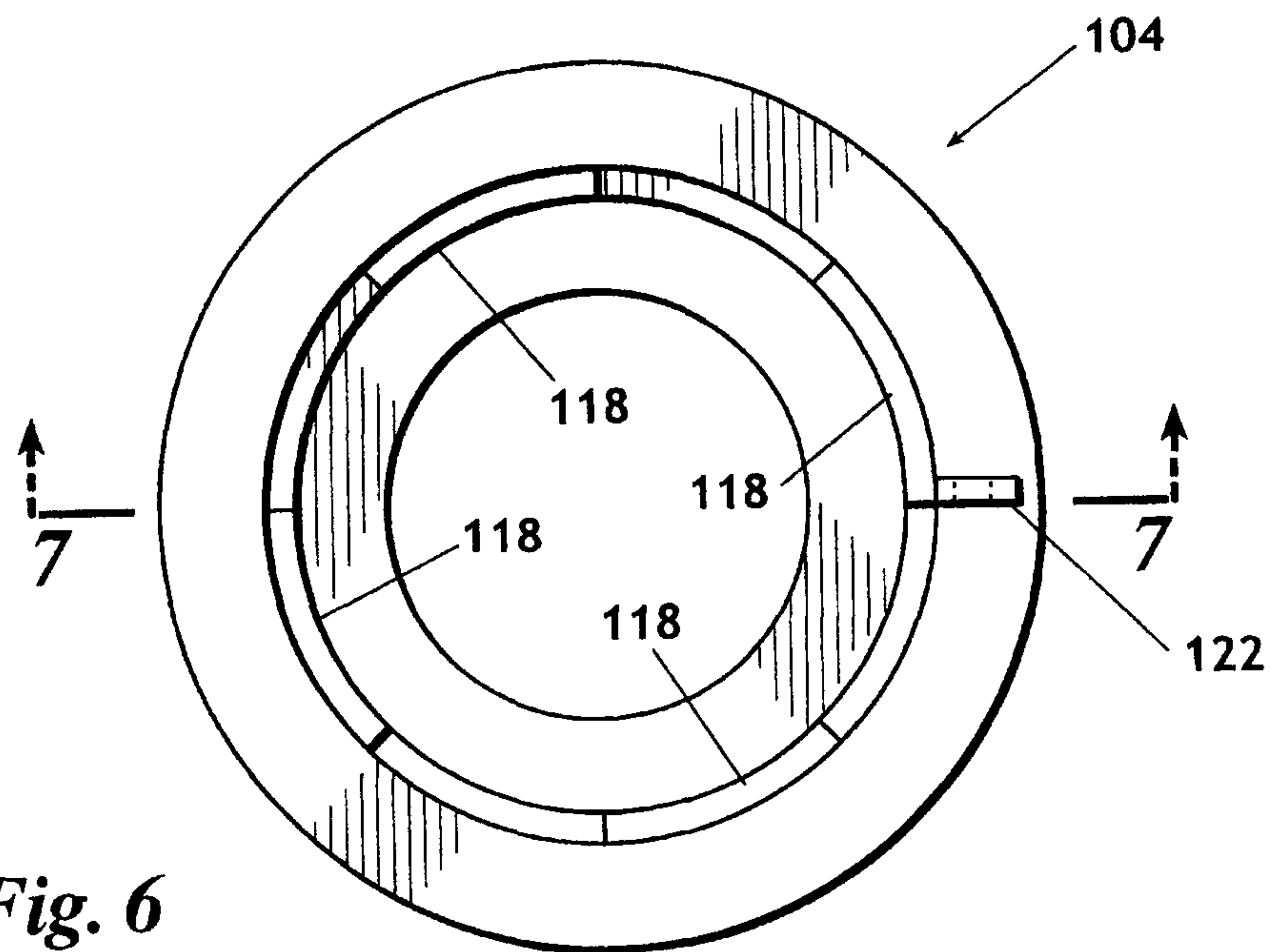
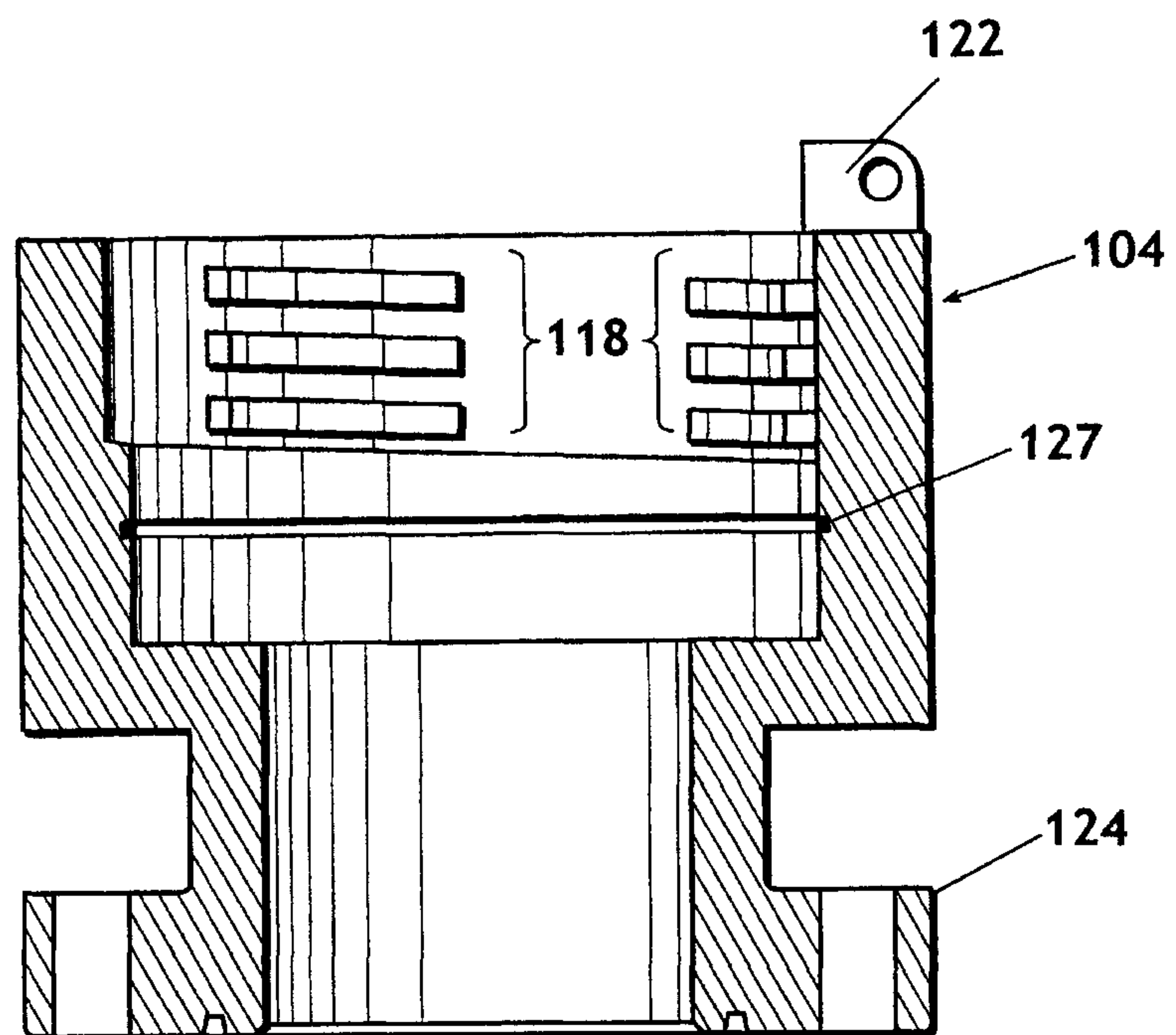
*Fig. 2*

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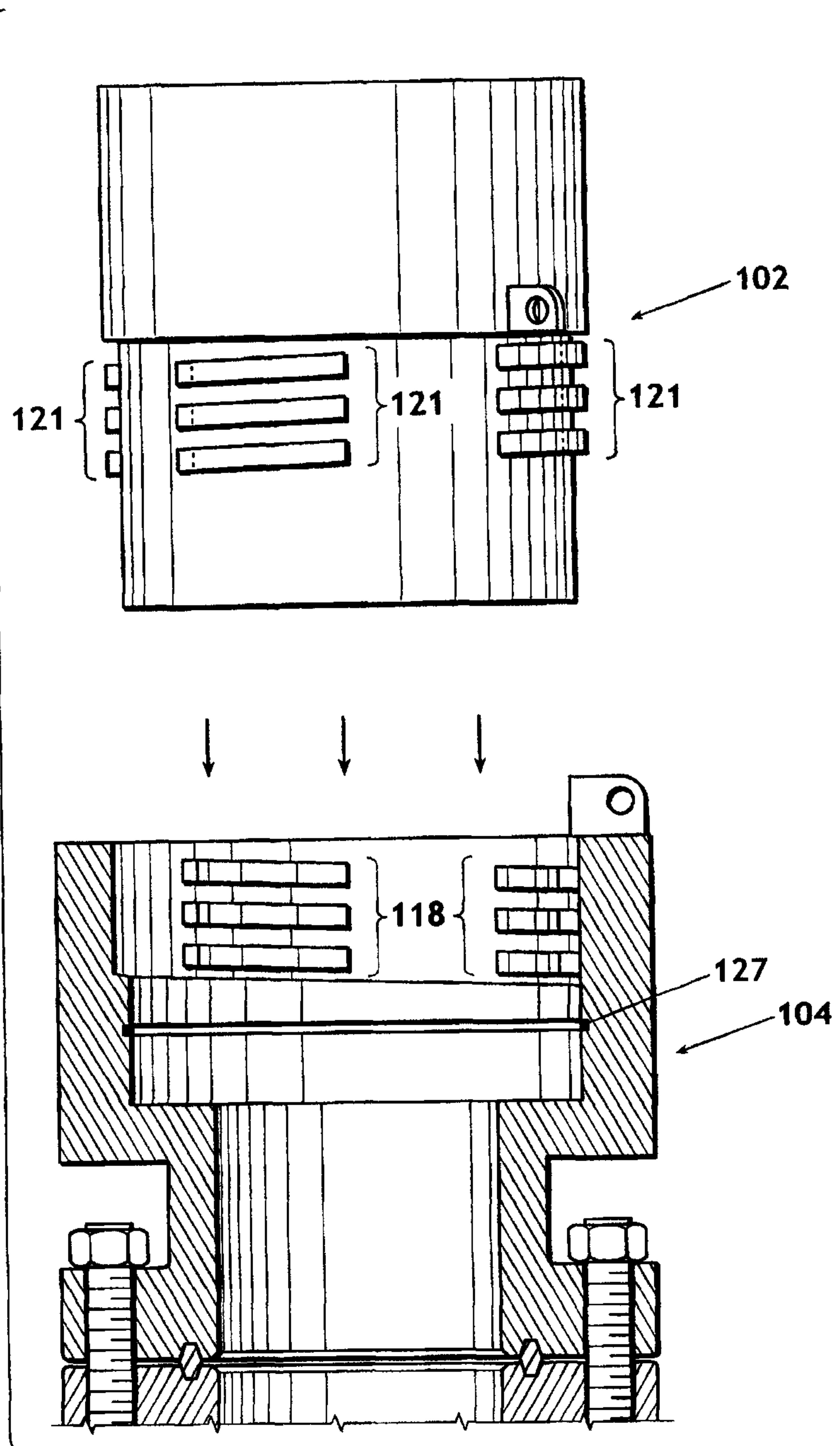
*Fig. 4**Fig. 3*

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*Fig. 6**Fig. 7*

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Fig. 8

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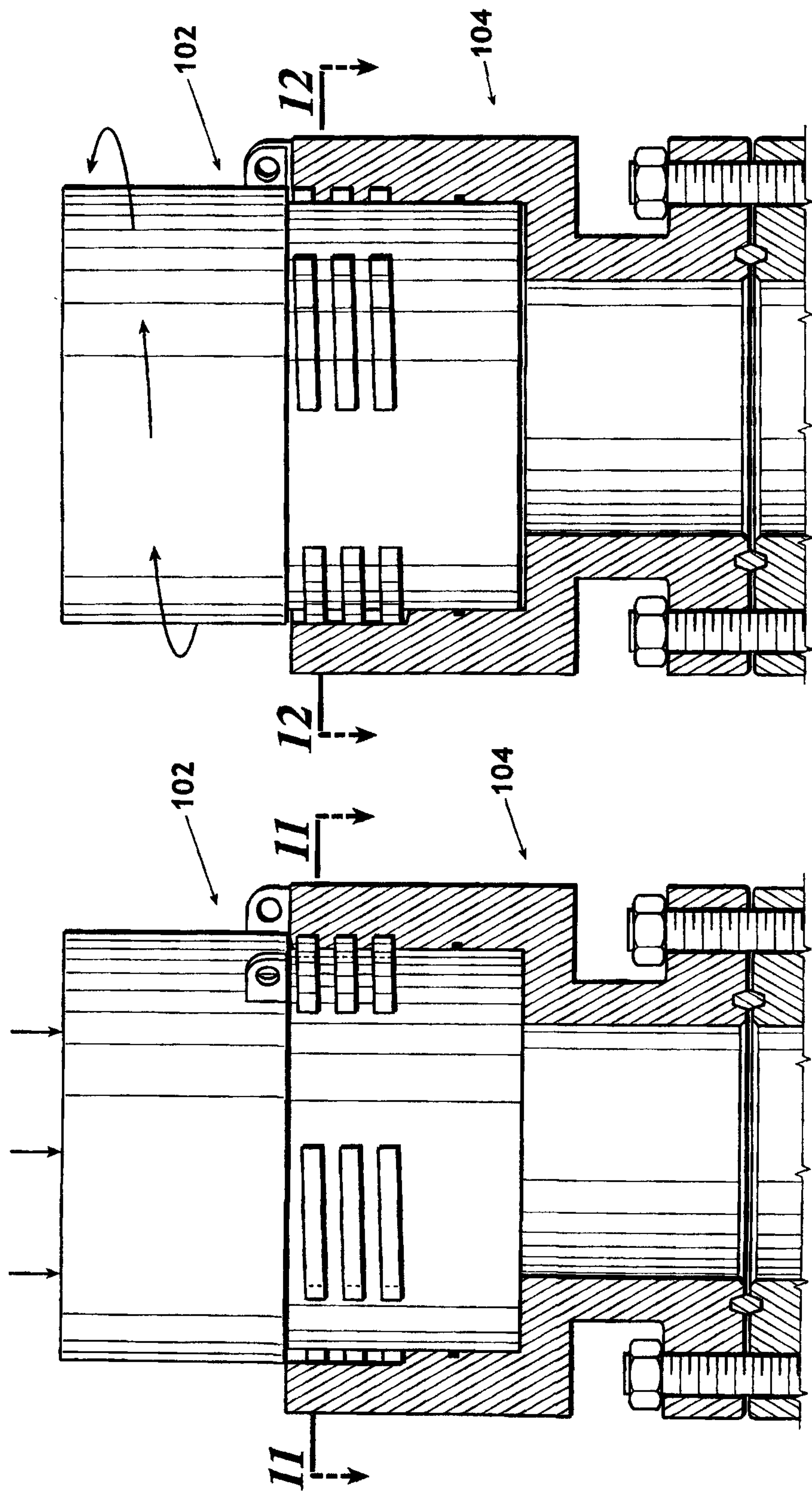


Fig. 9

Fig. 10

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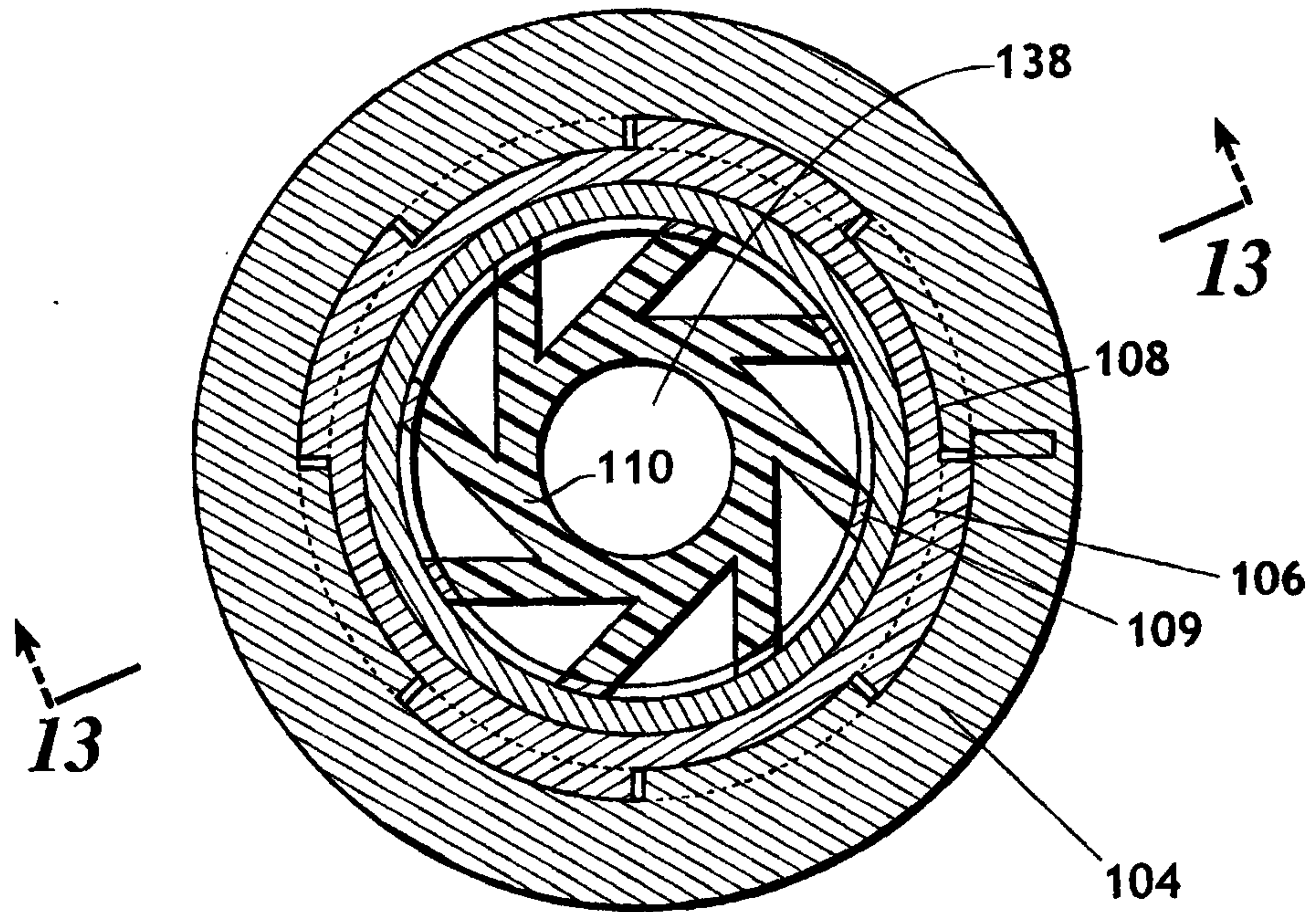


Fig. 11

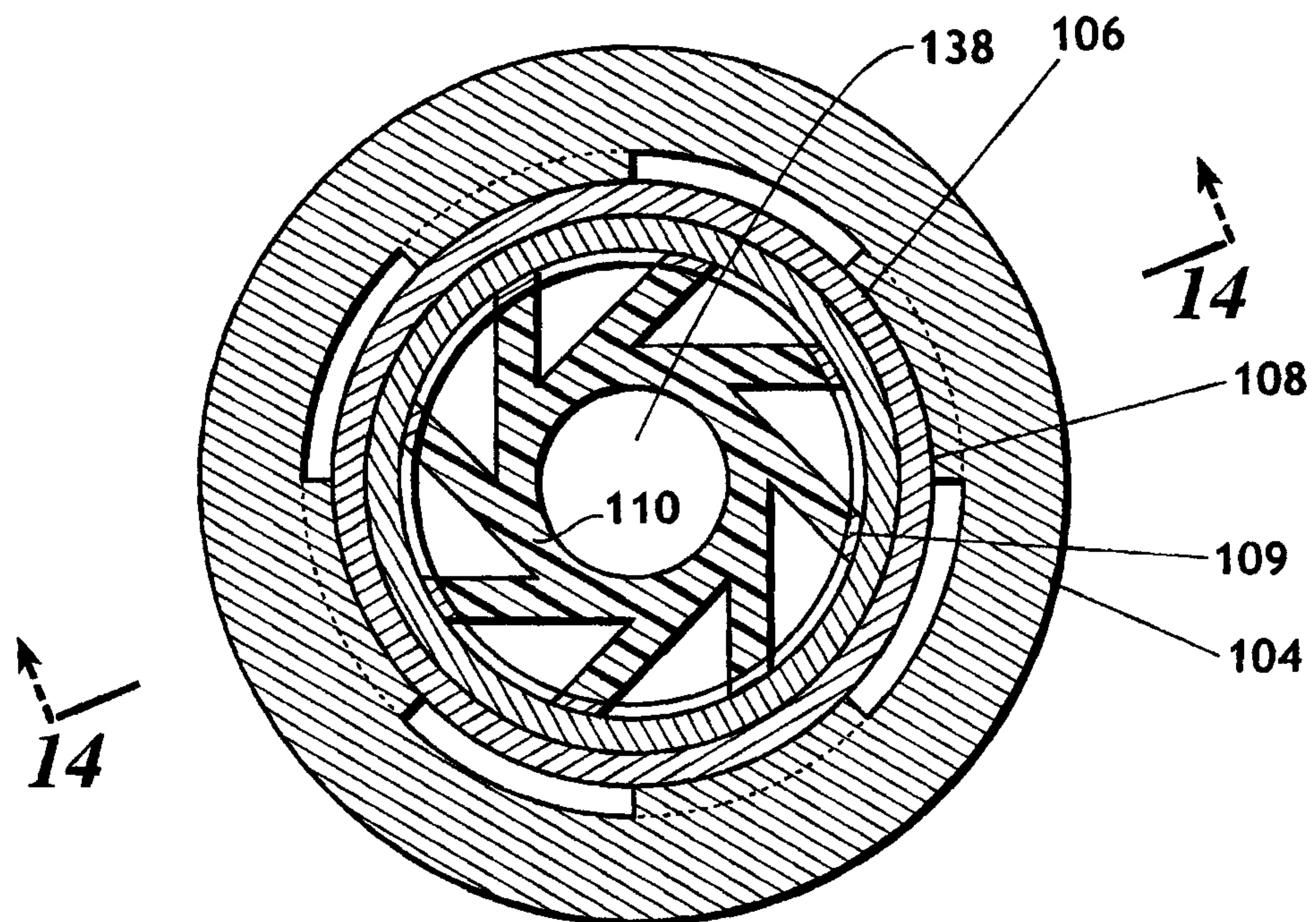


Fig. 12

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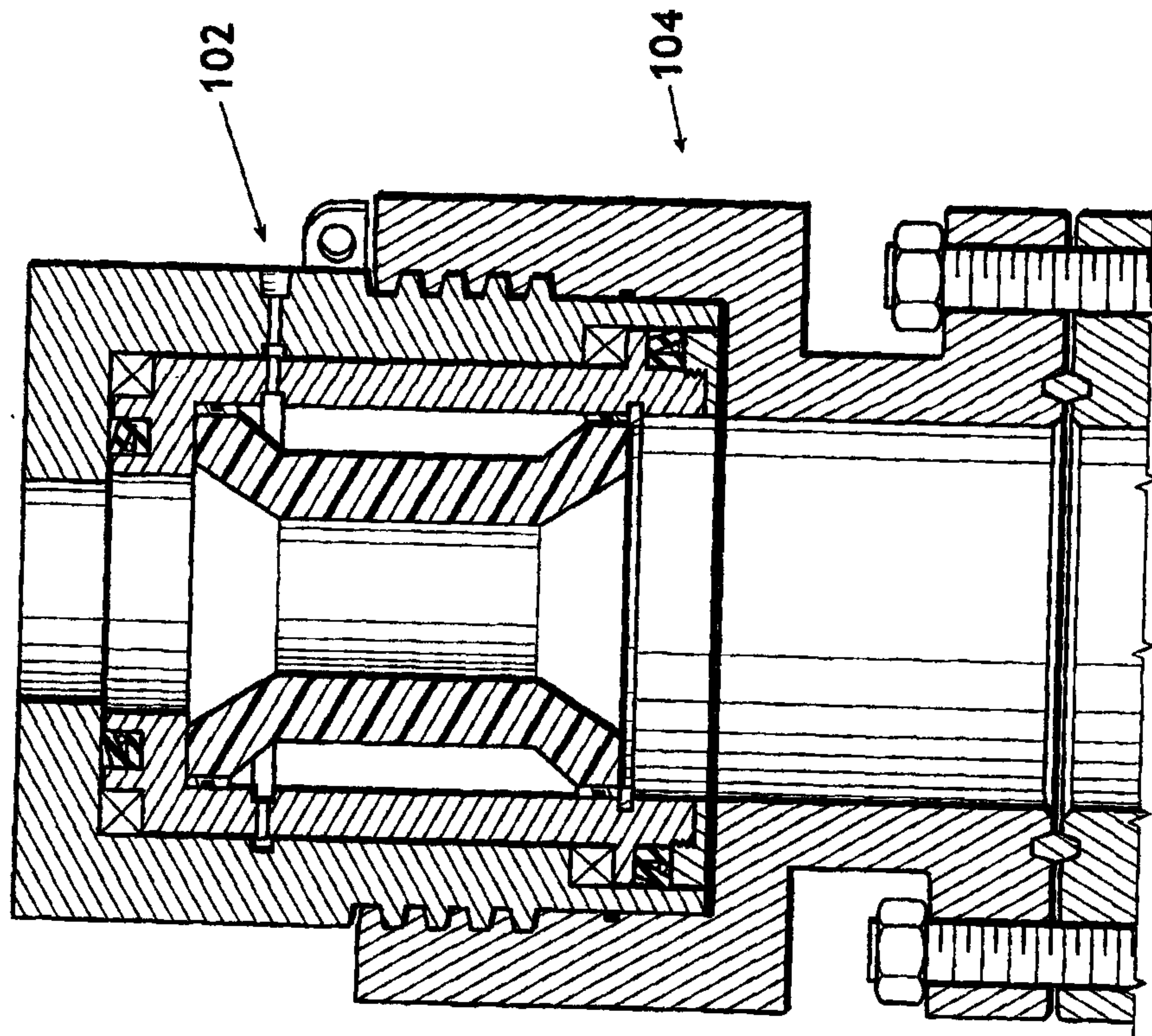


Fig. 14

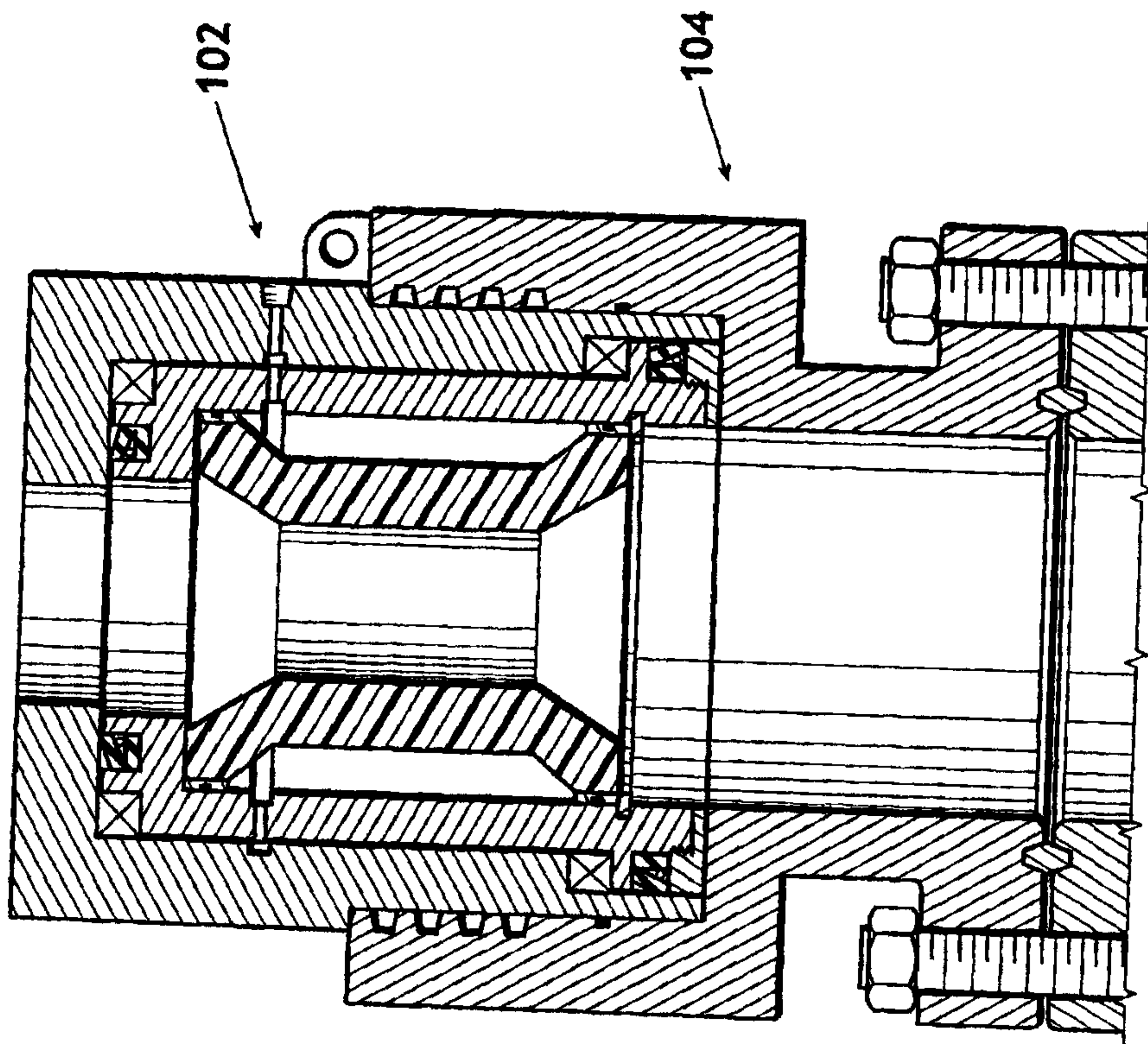
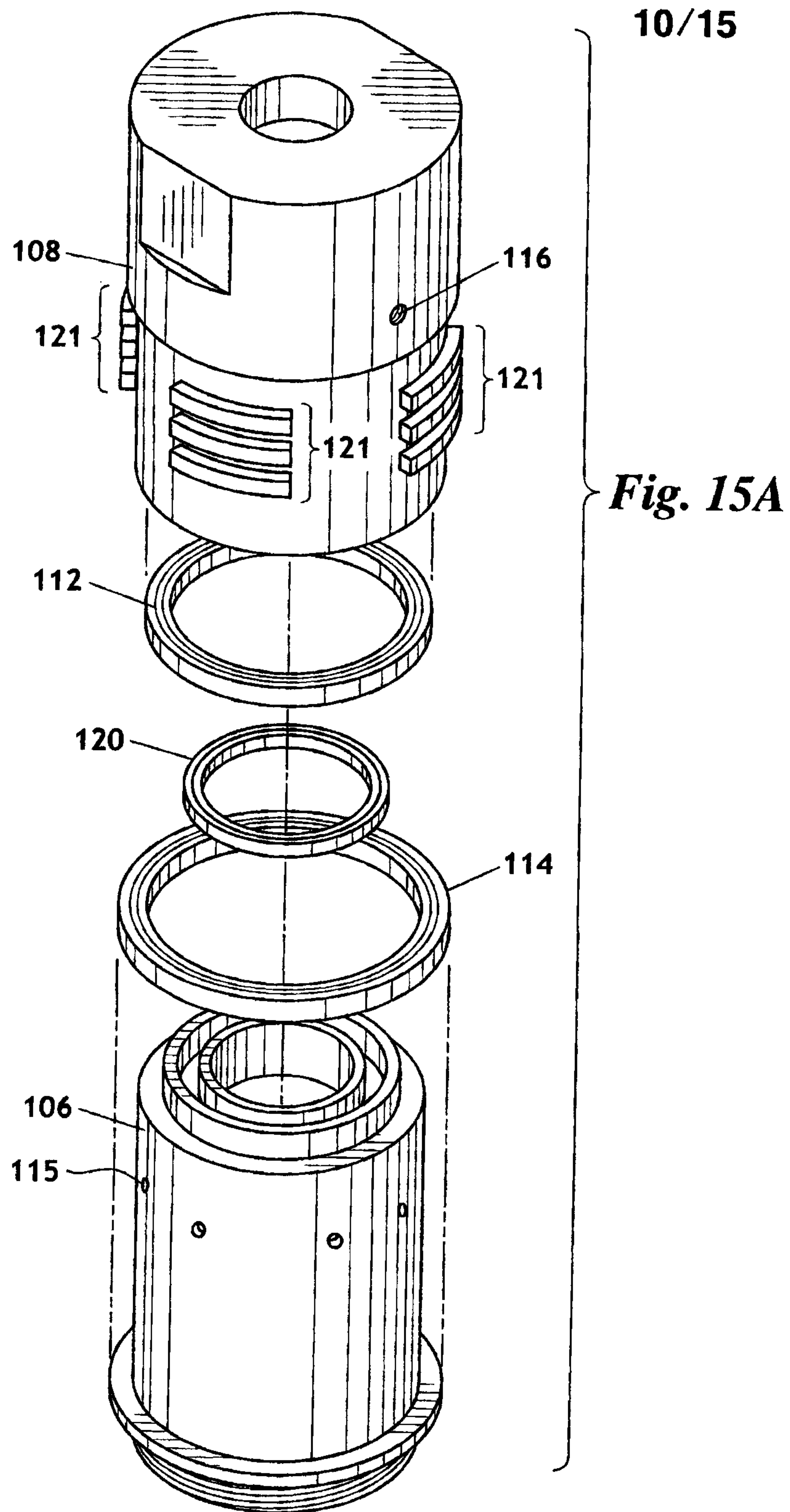


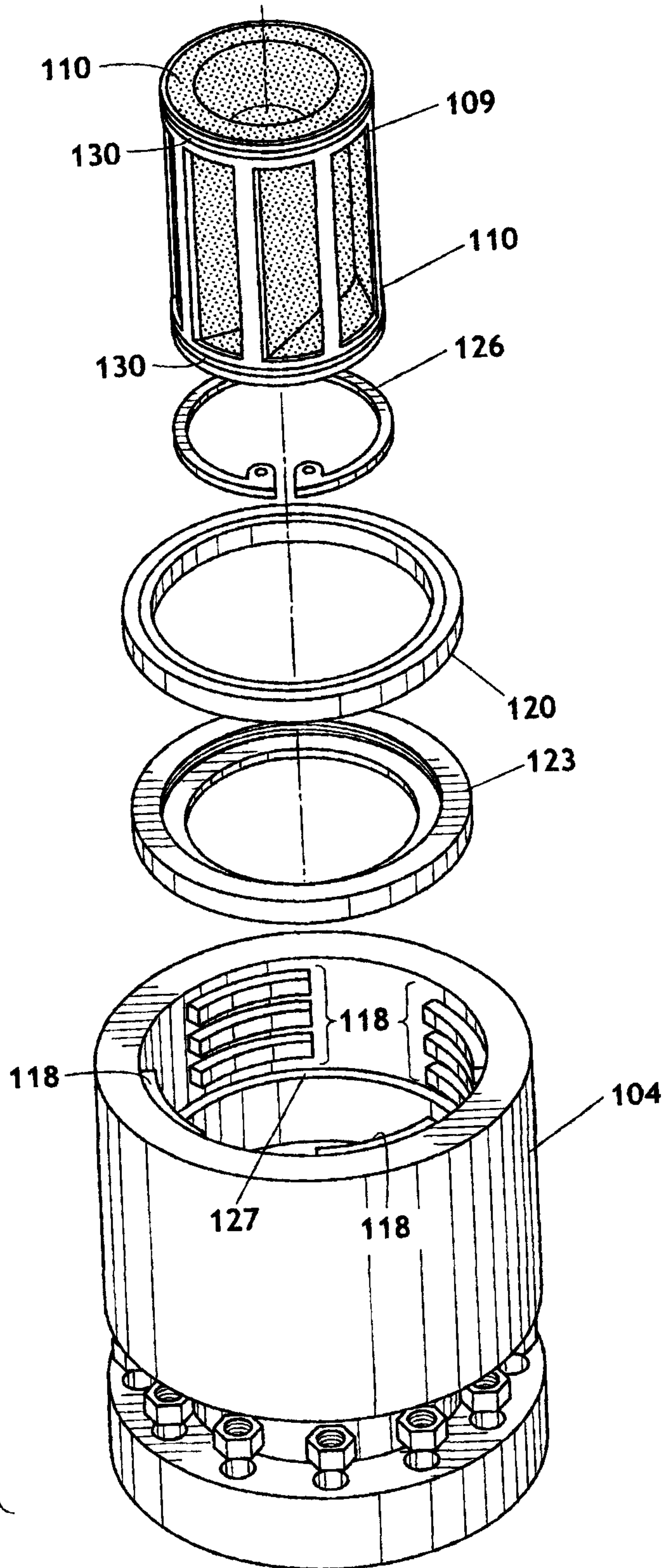
Fig. 13

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Fig. 15B



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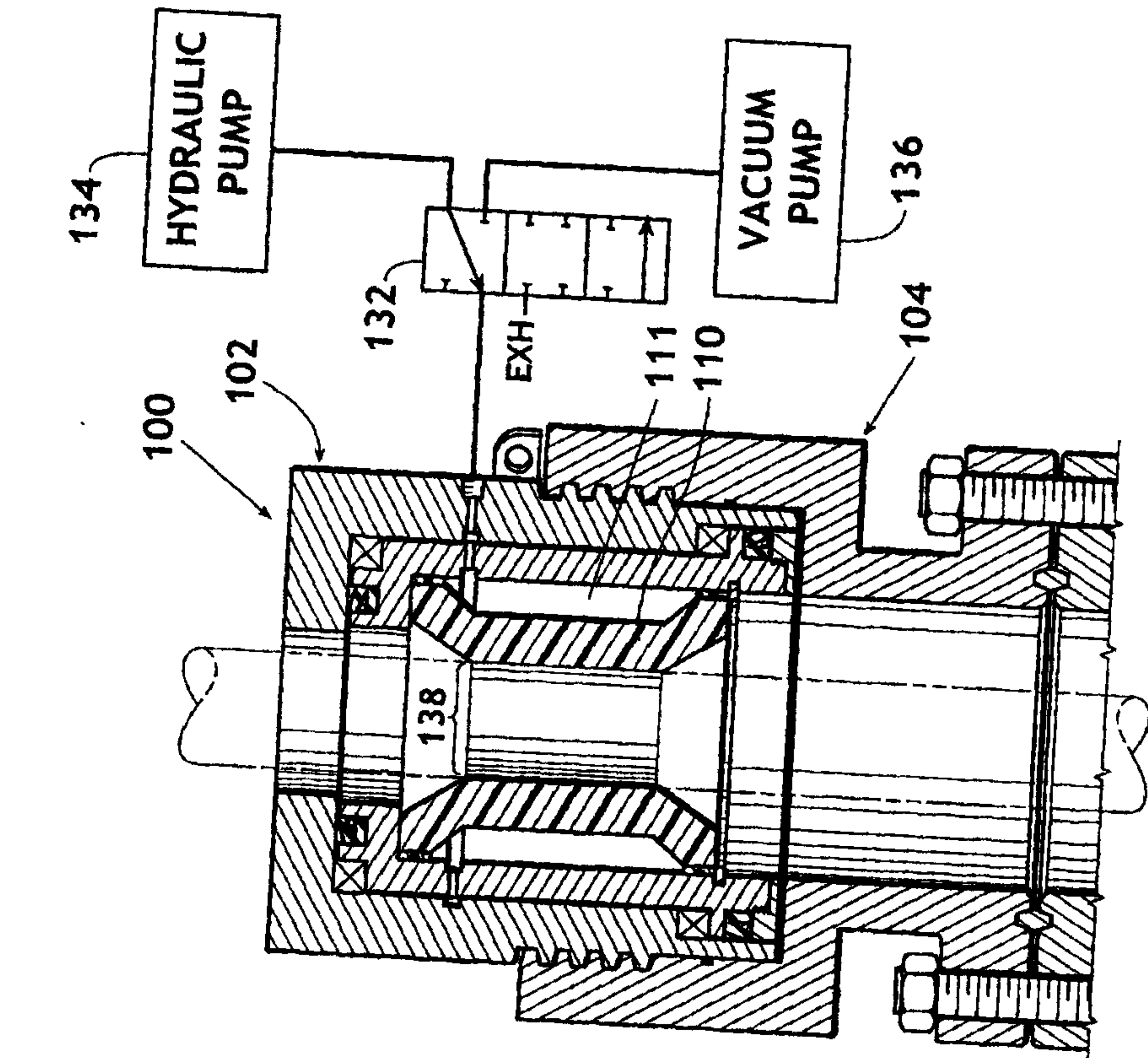


Fig. 17

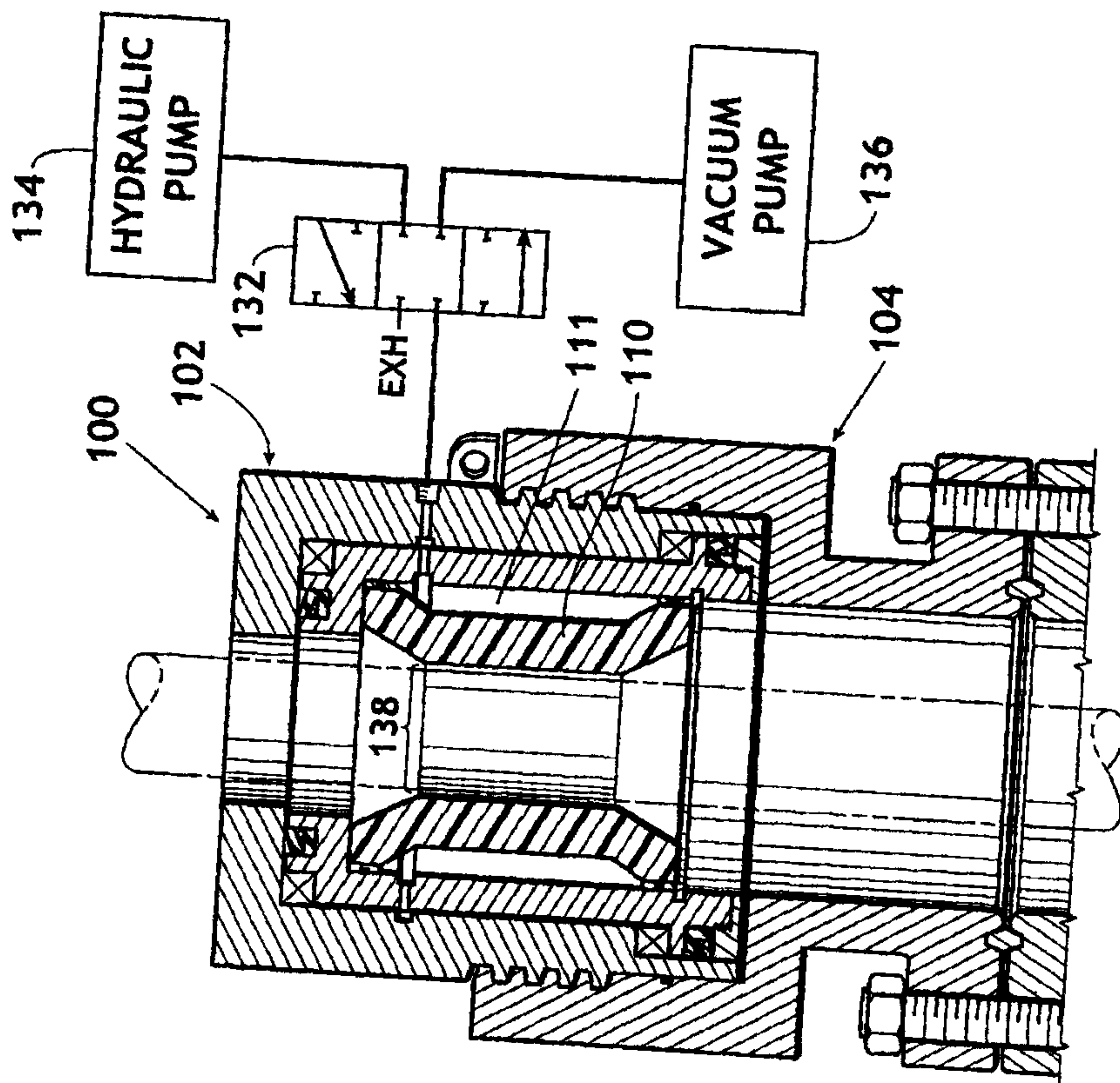
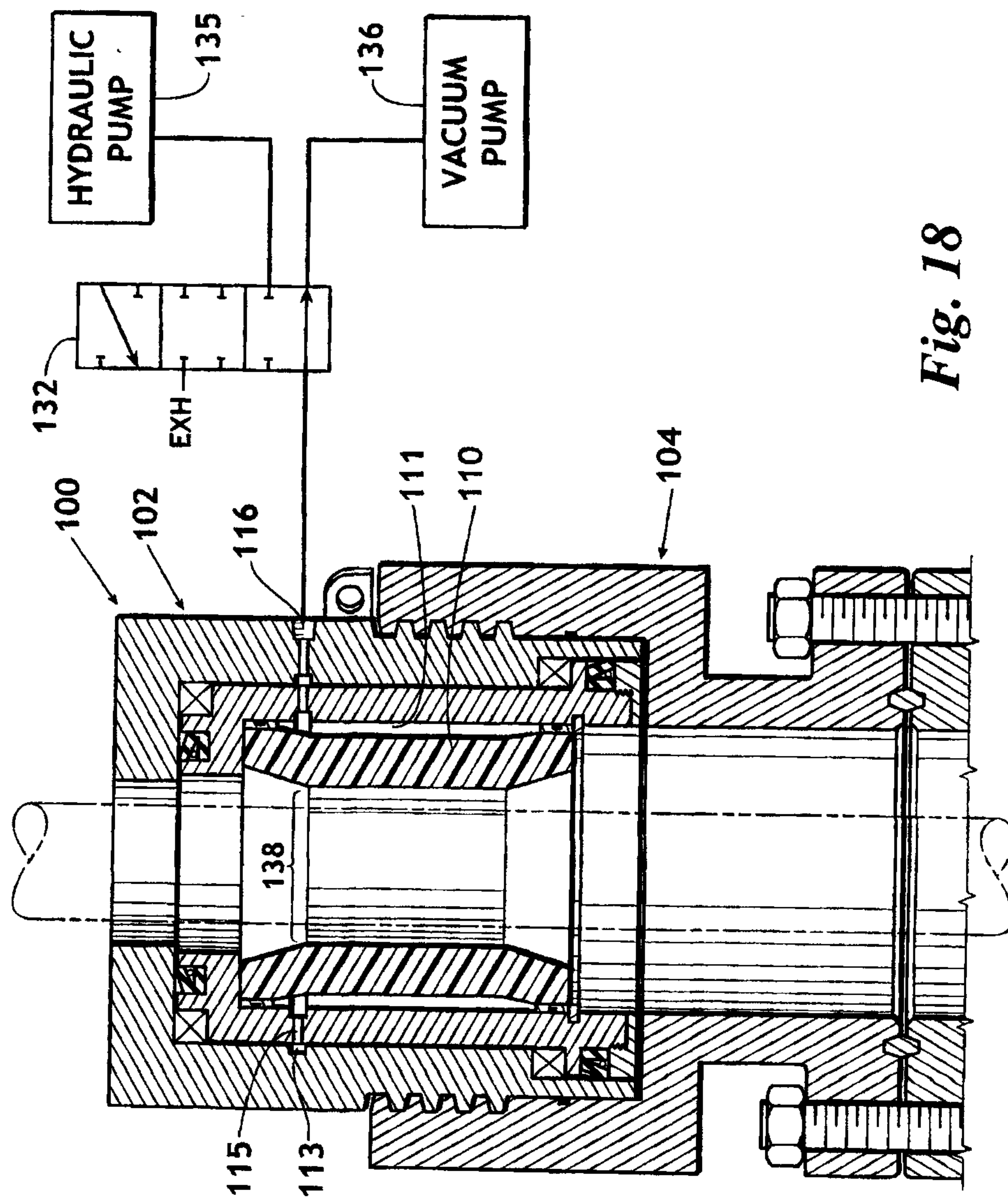
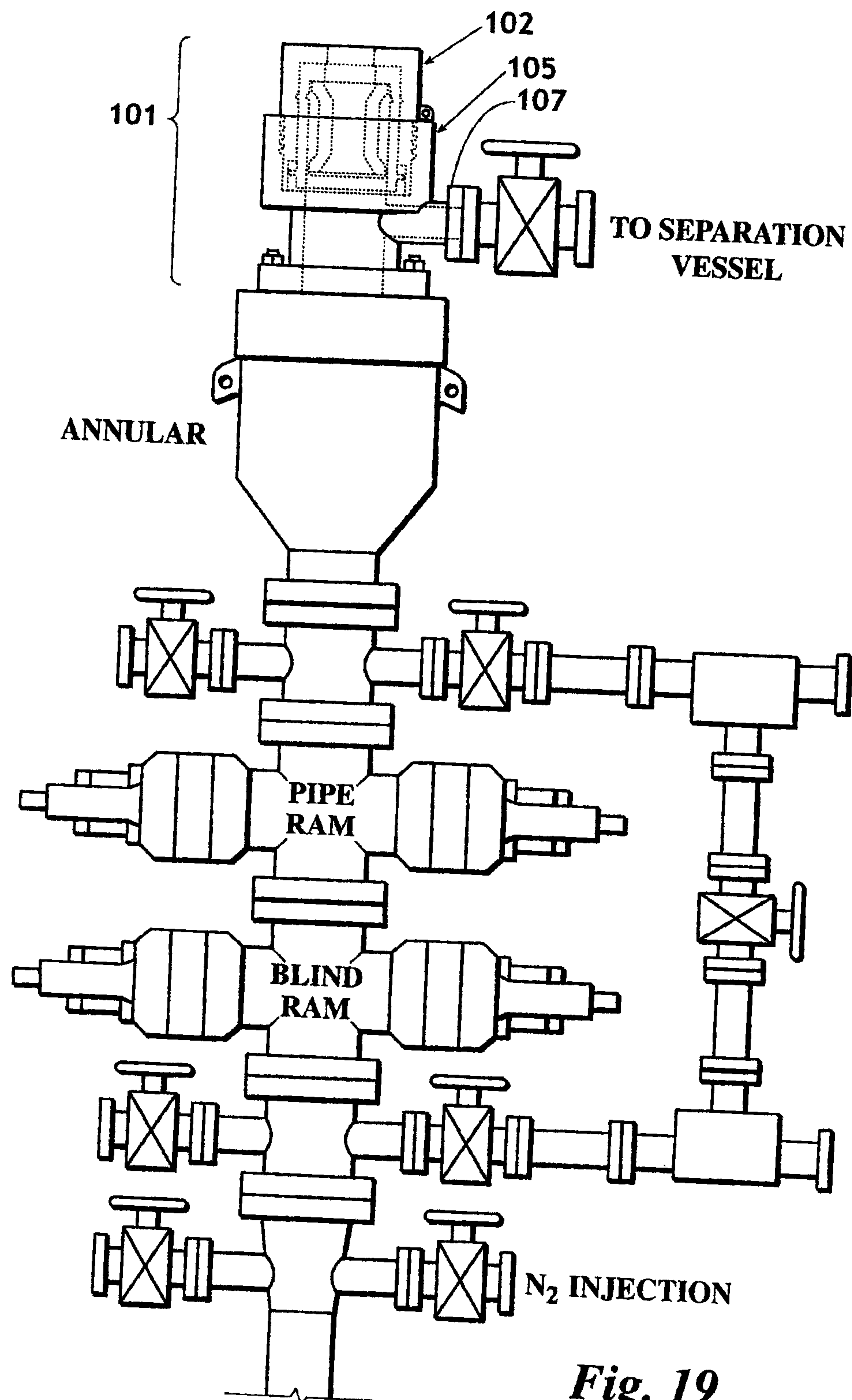


Fig. 16

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*Fig. 18*

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*Fig. 19*

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