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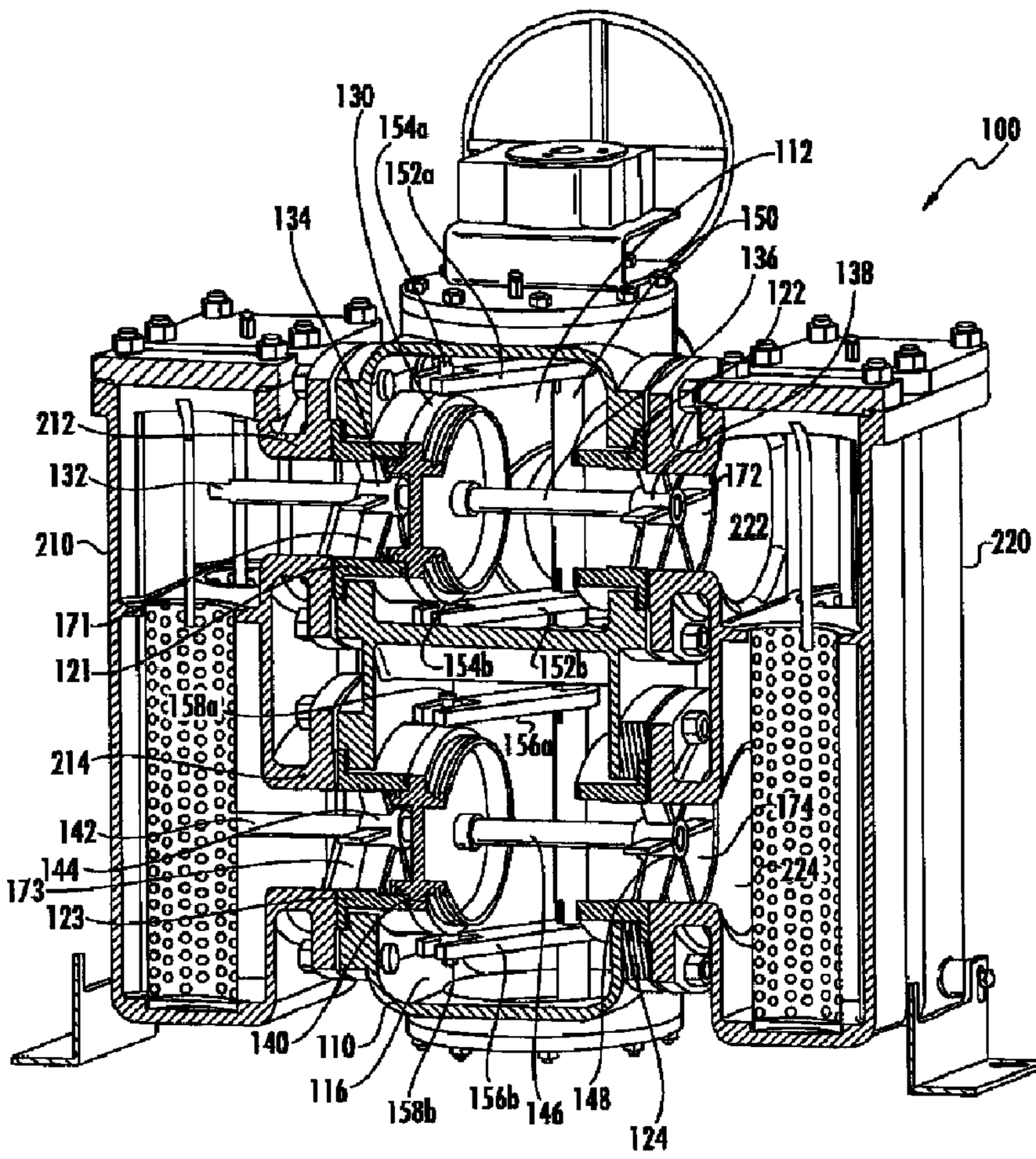


(57) Abrégé/Abstract:
Duplex fluid strainers, systems and methods can include a housing with a first valve chamber defining an inlet port, a first port, and a second port, and a second valve chamber defining a third port, a fourth port, and an outlet port. The first and third ports can be in

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(57) Abrégé(suite)/Abstract(continued):
communication with a first strainer chamber, and the second and fourth ports can be in communication a second strainer. A first seal assembly can include a first disk that is movable within the first valve chamber into sealing engagement against either of the first port or the second port, and a second seal assembly can include a second disk that is movable within the second valve chamber into sealing engagement against either of the third port or the fourth port.

# ABSTRACT OF THE DISCLOSURE

Duplex fluid strainers, systems and methods can include a housing with a first valve chamber defining an inlet port, a first port, and a second port, and a second valve chamber defining a third port, a fourth port, and an outlet port. The first and third ports can be in communication with a first strainer chamber, and the second and fourth ports can be in communication a second strainer. A first seal assembly can include a first disk that is movable within the first valve chamber into sealing engagement against either of the first port or the second port, and a second seal assembly can include a second disk that is movable within the second valve chamber into sealing engagement against either of the third port or the fourth port.

# DESCRIPTION

# DUPLEX STRAINER APPARATUSES, SYSTEMS AND METHODS

## RELATED APPLICATIONS

The presently disclosed subject matter claims the benefit of U.S. Patent Application Serial No. 61/360,620, filed July 1, 2010, the disclosure of which is incorporated herein by reference in its entirety.

## TECHNICAL FIELD

The subject matter disclosed herein relates generally to a fluid strainer for use in a fluid piping system. More particularly, the subject matter disclosed herein relates to duplex strainer apparatuses, systems and methods for providing multiple straining flow paths.

## BACKGROUND

In many fluid flow applications, it is often necessary that the flow from an upstream source be cleaned or strained before use in downstream components. In this regard, strainers are used to protect such downstream equipment by mechanically removing solids from flowing fluids via a straining element, such as a perforated, mesh, or wedge-wire straining element. Although many designs and configurations of strainers exist, duplex strainers provide an added advantage over other straining systems by permitting continuous straining and cleaning of a flow. Specifically, duplex strainers generally include two strainer chambers and some type of mechanism for diverting the flow from one chamber to the other to isolate the flow to a single chamber. This arrangement permits cleaning, servicing, or repairing of one chamber while the other one is in use, thereby enabling the flow through the duplex strainer to remain substantially continuous.

A number of different designs for duplex strainers have been used, with varying valve designs (e.g., scotch yokes, ball valves) for switching the flow between strainers, but each design both has advantages over other options and suffers from one or more problems, such as number and complexity of components, space requirements, effectiveness in flow isolation, and/or ease of operation. Accordingly, an improved duplex strainer is desirable, for example one with a design to effectively control the flow between and among multiple strainer assemblies while minimizing the problems found in prior art designs.

## SUMMARY

In accordance with this disclosure, novel apparatuses, systems and methods are provided for fluid straining for use in a fluid piping system. In one aspect, a fluid strainer is provided. The fluid strainer can comprise a housing comprising a first valve chamber comprising an inlet port, a first port, and a second port, and a second valve chamber comprising a third port, a fourth port, and an outlet port. A first strainer chamber can comprise a first strainer inlet in communication with the first port and a first strainer outlet in communication with the third port, and a second strainer chamber can comprise a second strainer inlet in communication with the second port and a second strainer outlet in communication with the fourth port. Within the first valve chamber, a first seal assembly can comprise a first pivotable member, a first disk, and a first coupler connecting the first pivotable member to the first disk such that the first pivotable member is movable to cause the first disk to move within the first valve chamber into sealing engagement against either of the first port or the second port. Similarly, within the second valve chamber, a second seal

assembly can comprise a second pivotable member, a second disk, and a second coupler connecting the second pivotable member to the second disk such that the second pivotable member is movable to cause the second disk to move within the second valve chamber into sealing engagement against either of the third port or the fourth port.

Although an aspect of the subject matter disclosed herein has been stated hereinabove, and which is achieved in whole or in part by the presently disclosed subject matter, other aspects will become evident as the description proceeds when taken in connection with the accompanying drawings as best described hereinbelow.

## BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present subject matter will be more readily understood from the following detailed description which should be read in conjunction with the accompanying drawings that are given merely by way of explanatory and non-limiting example, and in which:

Figure 1 is a perspective cutaway view of a duplex fluid strainer according to an embodiment of the presently disclosed subject matter;

Figure 2 is a side sectional view of a housing of a duplex fluid strainer according to an embodiment of the presently disclosed subject matter; and

Figures 3A and 3B are top sectional views of a duplex fluid strainer according to two embodiments of the presently disclosed subject matter.

## DETAILED DESCRIPTION

The present subject matter provides devices for fluid straining for use in a fluid piping system. In one aspect, the present subject matter provides a fluid strainer, generally designated **100**. As shown in Figures 1 and 2, fluid strainer

**100** can comprise a housing **110**, which can itself comprise a first valve chamber **112** defining a strainer inlet **114** and a second valve chamber **116** defining a strainer outlet **118**. Fluid strainer **100** can be installed in-line with a fluid piping system such that fluid is received from an upstream piping element at strainer inlet **114** and passed to a downstream piping element out of strainer outlet **118**.

In addition, strainer **100** can further include a first strainer chamber **210** and a second strainer chamber **220**, each in communication with both of first valve chamber **112** and second valve chamber **116**, and each containing a removable strainer basket or filter therein for straining and cleaning the material which flows therethrough. Each of housing **110**, first strainer chamber **210**, and second strainer chamber **220** can be composed of a cast iron material, stainless steel, bronze, or any other material determined to be appropriate for the particular fluid piping system. First strainer chamber **210** and second strainer chamber **220** can each be secured to housing **110** using any of a variety of fasteners, including but not limited to studs, bolts, or clamps. One or both of first strainer chamber **210** or second strainer chamber **220** can be detachable from housing **110**, which can allow easy access for cleaning, repair, or any other maintenance procedure.

In this configuration, fluid received by first valve chamber **112** through strainer inlet **114** can be passed to either or both of first strainer chamber **210** or second strainer chamber **220**, entrained solids or other undesirable materials can be removed from the fluid within first or second strainer chambers **210** or **220**, the fluid can be passed from the strainer chambers to second valve

chamber **116**, and the fluid can be discharged from second valve chamber **116** through strainer outlet **118**.

In particular, in addition to strainer inlet **114**, first valve chamber **112** can further define a first port **121** and a second port **122**. In the configuration shown in Figure 1, for example, first port **121** and second port **122** can be positioned on opposite sides of first valve chamber **112**. Each of first port **121** and second port **122** can serve as fluid pathways out of first valve chamber **112** (e.g., toward first strainer chamber **210** or second strainer chamber **220**, respectively). For instance, first strainer chamber **210** can comprise a first strainer inlet **212** in communication with first port **121**, whereas second strainer chamber **220** can comprise a second strainer inlet **222** in communication with second port **122**. In this arrangement, fluid received by first valve chamber **112** through strainer inlet **114** can be directed through either or both of first port **121** or second port **122** for directing fluid to one or both of first or second strainer chambers **210** or **220**, respectively.

Likewise, second valve chamber **116** can define a third port **123** and a fourth port **124**, which can be positioned on opposing sides of second valve chamber **116** and can each serve to admit fluid into second valve chamber **116** (e.g., from first strainer chamber **210** or second strainer chamber **220**, respectively). For instance, first strainer chamber **210** can comprise a first strainer outlet **214** in communication with third port **123**, and second strainer chamber **220** can comprise a second strainer outlet **224** in communication with fourth port **124**. In this arrangement, fluid from either or both of first or second strainer chambers **210** or **220** can be directed to second valve chamber **116**

through third and fourth ports **123** or **124**, respectively, for directing fluid to second valve chamber **116** and out of fluid strainer **100** through strainer outlet **118**.

Regarding the particular design of fluid strainer **100**, Figure 1 shows a cutaway front view of fluid strainer **100**. As shown in Figure 1, fluid strainer **100** can comprise a movable flow control system within housing **110** to selectively control the flow of fluid to either or both of first or second strainer chambers **210** or **220**. Specifically, for example, the flow control system can comprise a first disk **130** movable within first valve chamber **112** into sealing engagement against either of first port **121** or second port **122**. First disk **130** can be sufficiently sized so that it is capable of closing off flow when moved against either of first port **121** or second port **122**. In this regard, first disk **130** can include sealing elements, such as O-rings formed from an elastomeric material (e.g., rubber), which can help first disk **130** to form a fluid-tight seal with first port **121** or second port **122**.

To help guide the movement of first disk **130** within first valve chamber **112**, first disk **130** can be connected to a first disk stem **132** that extends away from one side of first disk **130** towards first port **121**. First disk stem **132** can be received by a first disk guide **134** positioned within first port **121**. Similarly, first disk **130** can be further connected to a second disk stem **136** that extends away from the other side of first disk **130** towards second port **122**. Second disk stem **136** can be received by a second disk guide **138** positioned within second port **122**. In this arrangement, first disk **130** can be slideably supported for reciprocal lateral movement in first valve chamber **112**.

Similarly, a second disk **140** can be movable within second valve chamber **116** into sealing engagement against either of third port **123** or fourth port **124**. Again, second disk **140** can be sized to substantially block flow to either of third port **123** or fourth port **124**, and second disk **140** can further include sealing elements (e.g., O-rings) for helping to establish a fluid-tight seal. Second disk **140** can be connected to a third disk stem **142** and a fourth disk stem **146** extending away from opposing sides of second disk **140** towards a third disk guide **144** positioned in third port **123** and a fourth disk guide **148** positioned in fourth port **124**, respectively. In this arrangement, second disk **140** can be slideably supported for reciprocal lateral movement in second valve chamber **116**.

Movement of first disk **130** and second disk **140** can be controlled by a single pivotable coupling rod **150** that can, for example and without limitation, extend through both of first valve chamber **112** and second valve chamber **116**. Specifically, within first valve chamber **112**, at least one first coupler can be mounted to coupling rod **150** and can extend toward first disk **130**. In the configuration shown in Figures 1, 2, 3A, and 3B, for example, the at least one first coupler can comprise a top first coupler **152a** and a bottom first coupler **152b**, which can each comprise a Scotch yoke extending from coupling rod **150** towards an exterior edge of first disk **130**. Referring to Figure 2, top first coupler **152a** can extend from coupling rod **150** towards a first pin **154a** connected at a top edge of first disk **130**, and bottom first coupler **152b** can extend from coupling rod **150** towards a second pin **154b** connected at a bottom edge of first disk **130**. Each of top first coupler **152a** and bottom first

coupler **152b** can define a substantially forked end that is adapted to capture first pin **154a** and second pin **154b**, respectively.

Likewise, within second valve chamber **116**, at least one second coupler can be mounted to coupling rod **150** and can extend toward second disk **140**. For example, the at least one second coupler can comprise a top second coupler **156a** and a bottom first coupler **156b**, which can each comprise a Scotch yoke extending from coupling rod **150** towards second disk **140**. Specifically, top second coupler **156a** can extend towards a third pin **158a** connected at a top edge of second disk **140**, and bottom second coupler **156b** can extend from coupling rod **150** towards a fourth pin **158b** connected at a bottom edge of second disk **140**.

In this arrangement, when coupling rod **150** is rotated, the rotation can be transferred by first couplers **152a** and **152b** and second couplers **156a** and **156b** into linear sliding displacement of both first disk **130** and second disk **140**. For example, coupling rod **150** can be rotated to a first sealing position in which first disk **130** is moved into sealing engagement against first port **121** of first strainer chamber **112**, and second disk **140** is moved into sealing engagement against third port **123** of second strainer chamber **116**. This arrangement is shown generally in Figure 3A. As shown in Figure 3A, in this first sealing position, fluid entering first valve chamber **112** through strainer inlet **114** can be routed through second port **122**into second strainer chamber **220**, from which it can be further routed through fourth port **124** into second valve chamber **116**, where it can be discharged from strainer outlet **118**. Similarly, Figure 3B shows first disk **130** moving towards this position in a version of fluid strainer **100**

having two strainer baskets in each of first strainer chamber **210** and second strainer chamber **220**. Regardless of the specific configuration of fluid strainer **100**, however, the movement of first disk **130** and second disk **140** can be substantially the same.

Alternatively, coupling rod **150** can be rotated to move to a second sealing position in which first disk **130** is in sealing engagement against second port **122** at the same time that second disk **140** is in sealing engagement against fourth port **124**. In this arrangement, fluid entering first valve chamber **112** through strainer inlet **114** can be routed through first port **121**, first strainer chamber **210**, and third angled member **123** into second valve chamber **116**, where it can be discharged from strainer outlet **118**.

Finally, a number of additional features can further improve the operation of fluid strainer **100**. First, a pressure equalization line generally designated **160** can be connected between first strainer chamber **210** and second strainer chamber **220** for improving service life of seals within fluid strainer **100** and minimizing operating torque. Specifically, for instance, when coupling rod **150** is moved to the first sealing position (i.e., positioned for flow through second strainer chamber **220**), fluid pressure in the system can tend to maintain first disk **130** and second disk **140** against first port **121** and third port **123**, respectively, making it difficult to move coupling rod **150** to the first sealing position or to a neutral position in between the first and second sealing positions. To alleviate this problem, pressure equalization line **160** can be operated to reduce or eliminate the pressure differential between the active fluid pathway (e.g., first valve chamber **112**, second strainer chamber **220**, and

second valve chamber **116**) and first strainer chamber **210**, thereby requiring less force to operate coupling rod **150**.

Another feature that can be advantageously included in fluid strainer **100** is a flow-smoothing mechanism to reduce turbulence within the fluid pathways of fluid strainer **100**. Specifically, fluid strainer **100** can comprise a plurality of flow routing vanes at least partially traversing one or more of first port **121**, second port **122**, third port **123**, or fourth port **124**. For example, referring again to Figure 1, first port **121** can comprise a plurality of first flow routing vanes **171** positioned across the opening. First flow routing vanes **171** can be configured to alter incoming turbulent flow between first valve chamber **112** and first strainer chamber **210** to become smoother, thereby reducing pressure drop, noise, erosion, corrosion, vibration, and/or cavitations. Similarly, as shown in Figure 1, one or more of second port **122**, third port **123**, and/or fourth port **124** can likewise comprise a plurality of second flow routing vanes **172**, third flow routing vanes **173**, and/or fourth flow routing vanes **174**, respectively, for smoothing the flow through those ports.

The present subject matter can be embodied in other forms without departure from the spirit and essential characteristics thereof. The embodiments described therefore are to be considered in all respects as illustrative and not restrictive. Although the present subject matter has been described in terms of certain preferred embodiments, other embodiments that are apparent to those of ordinary skill in the art are also within the scope of the present subject matter.

## CLAIMS

What is claimed is:

1. A fluid strainer comprising:

a housing comprising a first valve chamber comprising an inlet port, a first port, and a second port, and a second valve chamber comprising a third port, a fourth port, and an outlet port;

a first strainer chamber comprising a first strainer inlet in communication with the first port and a first strainer outlet in communication with the third port;

a second strainer chamber comprising a second strainer inlet in communication with the second port and a second strainer outlet in communication with the fourth port;

a first seal assembly comprising a first pivotable member, a first disk, and a first coupler connecting the first pivotable member to the first disk such that the first pivotable member is movable to cause the first disk to move within the first valve chamber into sealing engagement against either of the first port or the second port; and

a second seal assembly comprising a second pivotable member, a second disk, and a second coupler connecting the second pivotable member to the second disk such that the second pivotable member is movable to cause the second disk to move within the second valve chamber into sealing engagement against either of the third port or the fourth port.

2. The fluid strainer of claim 1, wherein one or both of the first or second strainer chambers is detachable from the housing.

3. The fluid strainer of claim 1, wherein one or both of the first or second strainer chambers comprises a basket access opening, the basket access opening being configured to engage either a bolted cover or a clamped cover for sealing the basket access opening.

4. The fluid strainer of claim 3, wherein the first or second strainer chambers comprising a basket access opening comprises a clamped cover for sealing the basket access opening, the clamped cover comprising a bleed valve configured to vent pressure within the strainer chamber as soon as a clamp tee bolt is rotated.

5. The fluid strainer of claim 1, wherein one or both of the first or second strainer chambers comprises field adjustable floor mounting legs.

6. The fluid strainer of claim 1, wherein one or both of the first coupler or the second coupler comprises a scotch yoke.

7. The fluid strainer of claim 1, wherein the first seal assembly further comprises a first disk guide positioned within the first port and a second disk guide positioned within the second port; and

wherein the first disk comprises a first disk stem extending from the first disk to the first disk guide and a second disk stem extending

from the first disk to the second disk guide, whereby movement of the first disk into sealing engagement against either of the first port or the second port is constrained by the first disk guide and the second disk guide to be in a predetermined path.

8. The fluid strainer of claim 7, wherein the first disk guide is positioned at a center of the first port, and a plurality of flow routing vanes extend from the first disk guide to an edge of the first port.

9. The fluid strainer of claim 7, wherein the second disk guide is positioned at a center of the second port, and a plurality of flow routing vanes extend from the second disk guide to an edge of the second port.

10. The fluid strainer of claim 7, wherein the predetermined path of the first disk is a substantially linear path.

11. The fluid strainer of claim 1, wherein the second seal assembly further comprises a third disk guide positioned within the third port and a fourth disk guide positioned within the fourth port; and

wherein the second disk comprises a third disk stem extending from the second disk to the third disk guide and a fourth disk stem extending from the second disk to the fourth disk guide, whereby movement of the second disk into sealing engagement against either of the third port or the fourth port is constrained by the third disk guide and the fourth disk guide to be in a predetermined path.

12. The fluid strainer of claim 11, wherein the third disk guide is positioned at a center of the third port, and a plurality of flow routing vanes extend from the third disk guide to an edge of the third port.

13. The fluid strainer of claim 11, wherein the fourth disk guide is positioned at a center of the fourth port, and a plurality of flow routing vanes extend away the fourth disk guide to an edge of the fourth port.

14. The fluid strainer of claim 11, wherein the predetermined path of the second disk is a substantially linear path.

15. The fluid strainer of claim 1, wherein the first pivotable member and the second pivotable member are coupled such that the first seal assembly and the second seal assembly are movable in unison.

16. The fluid strainer of claim 1, comprising a plurality of flow routing vanes at least partially traversing one or more of the inlet, outlet, first, second, third, or fourth ports.

17. The fluid strainer of claim 16, wherein the plurality of flow routing vanes are configured to alter incoming turbulent flow to become smoother, thereby reducing pressure drop, noise, erosion, corrosion, vibration, and/or cavitations.

18. A method of straining a fluid, comprising:

supplying fluid to a first valve chamber of a strainer housing, the first valve chamber comprising a first port in communication with a first strainer chamber and a second port in communication with a second strainer chamber;

positioning a first disk of a first seal assembly in sealing engagement against either of the first port or the second port to block access to the first strainer chamber of the second strainer chamber, respectively;

directing the fluid from the first valve chamber to the one or the first strainer chamber or the second strainer chamber that is not blocked by the first disk;

directing the fluid from the first strainer chamber or the second strainer chamber to a second valve chamber of the housing; and

directing the fluid out of the second valve chamber.

19. The method of claim 18, wherein the second valve chamber comprises a third port in communication with the first strainer chamber and a fourth port in communication with the second strainer chamber; and

wherein the method comprises positioning a second disk of a second seal assembly in sealing engagement against either of the third port or the fourth port to block access to the first strainer chamber of the second strainer chamber, respectively.

20. The method of claim 19, wherein the first seal assembly and the second seal assembly are coupled for movement together such that positioning the first disk in sealing engagement against the first port or the second port is coordinated with positioning the second disk assembly in sealing engagement against the third port or the fourth port, respectively.

21. A fluid piping system including a fluid strainer, the fluid strainer comprising:

a housing comprising a first valve chamber comprising an inlet port in communication with an upstream piping element, a first port, and a second port, and a second valve chamber comprising a third port, a fourth port, and an outlet port in communication with a downstream piping element;

a first strainer chamber comprising a first strainer inlet in communication with the first port and a first strainer outlet in communication with the third port;

a second strainer chamber comprising a second strainer inlet in communication with the second port and a second strainer outlet in communication with the fourth port;

a first seal assembly comprising a first pivotable member, a first disk, and a first coupler connecting the first pivotable member to the first disk such that the first pivotable member is movable to cause the first disk to move within the first valve chamber into sealing engagement against either of the first port or the second port; and

a second seal assembly comprising a second pivotable member, a second disk, and a second coupler connecting the second pivotable member to the second disk such that the second pivotable member is movable to cause the second disk to move within the second valve chamber into sealing engagement against either of the third port or the fourth port.

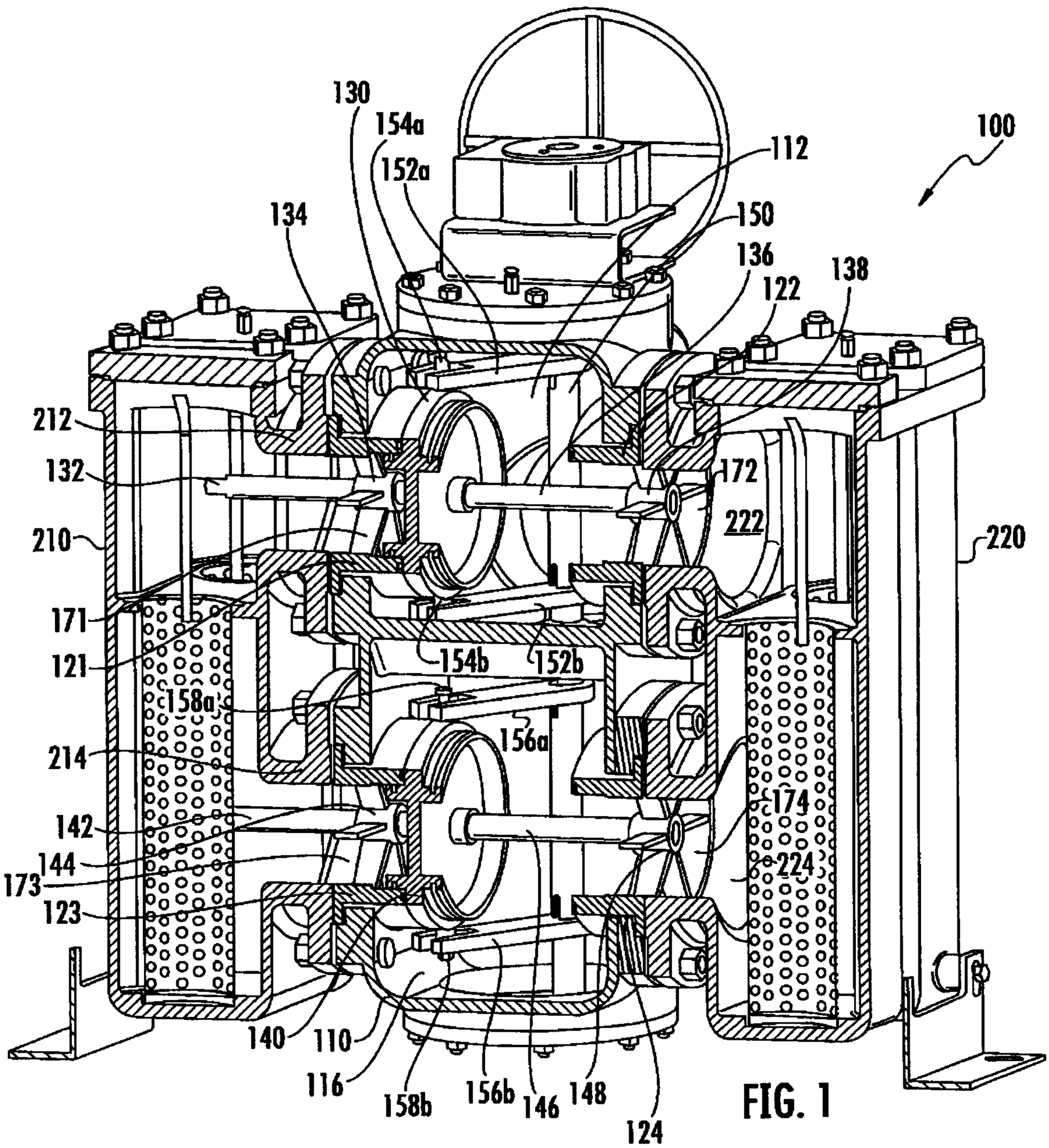
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FIG. 1

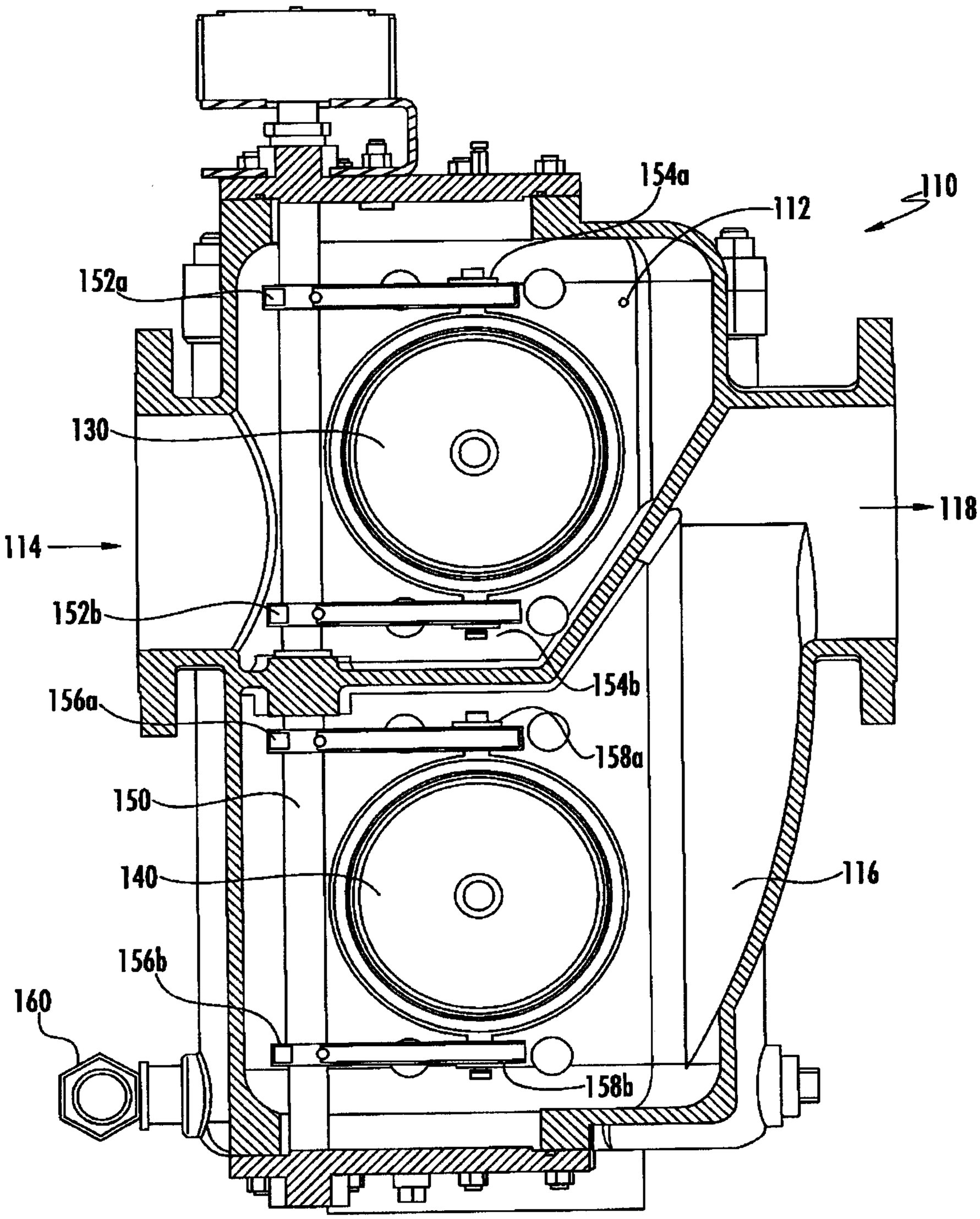
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FIG. 2

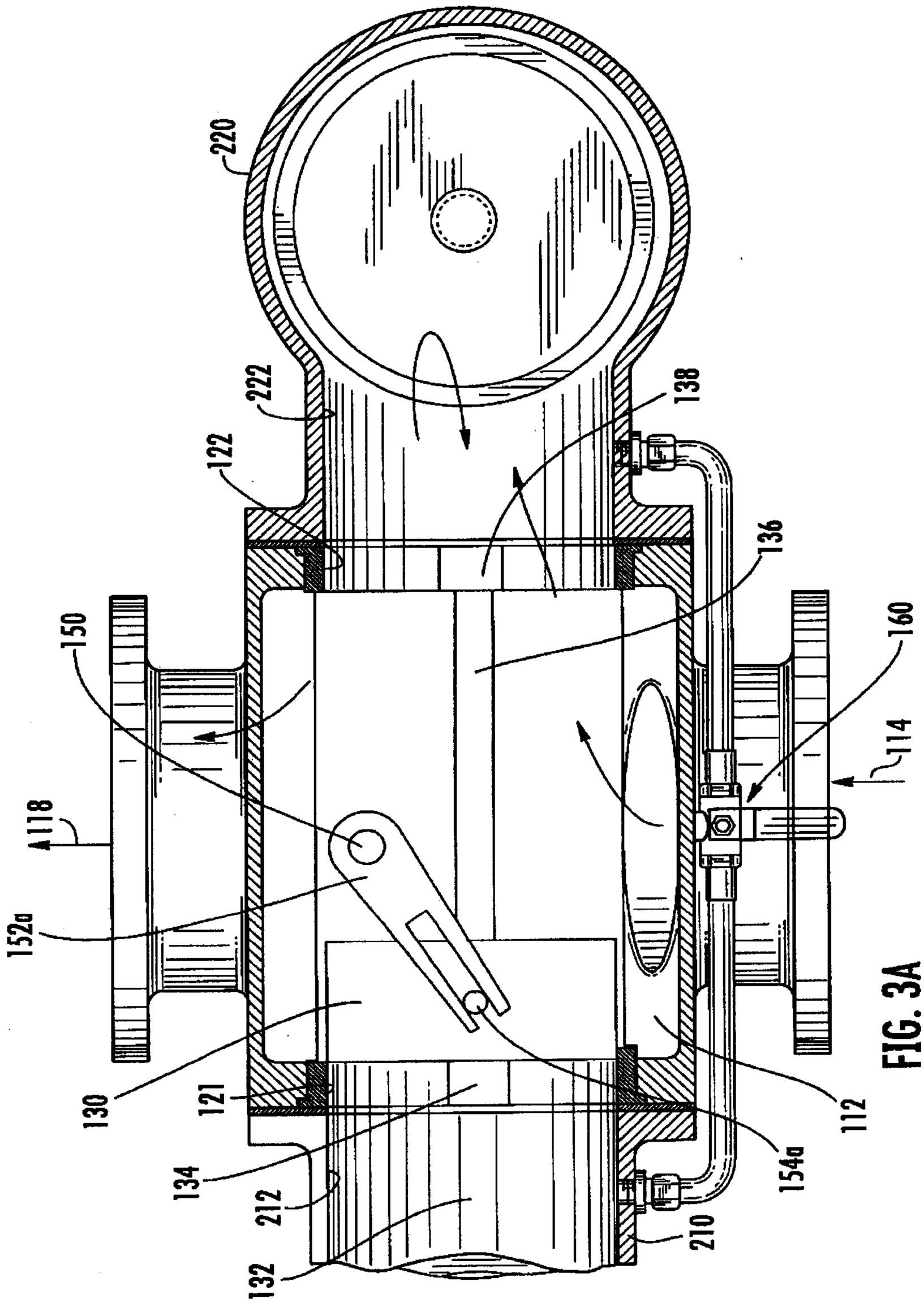
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FIG. 3A

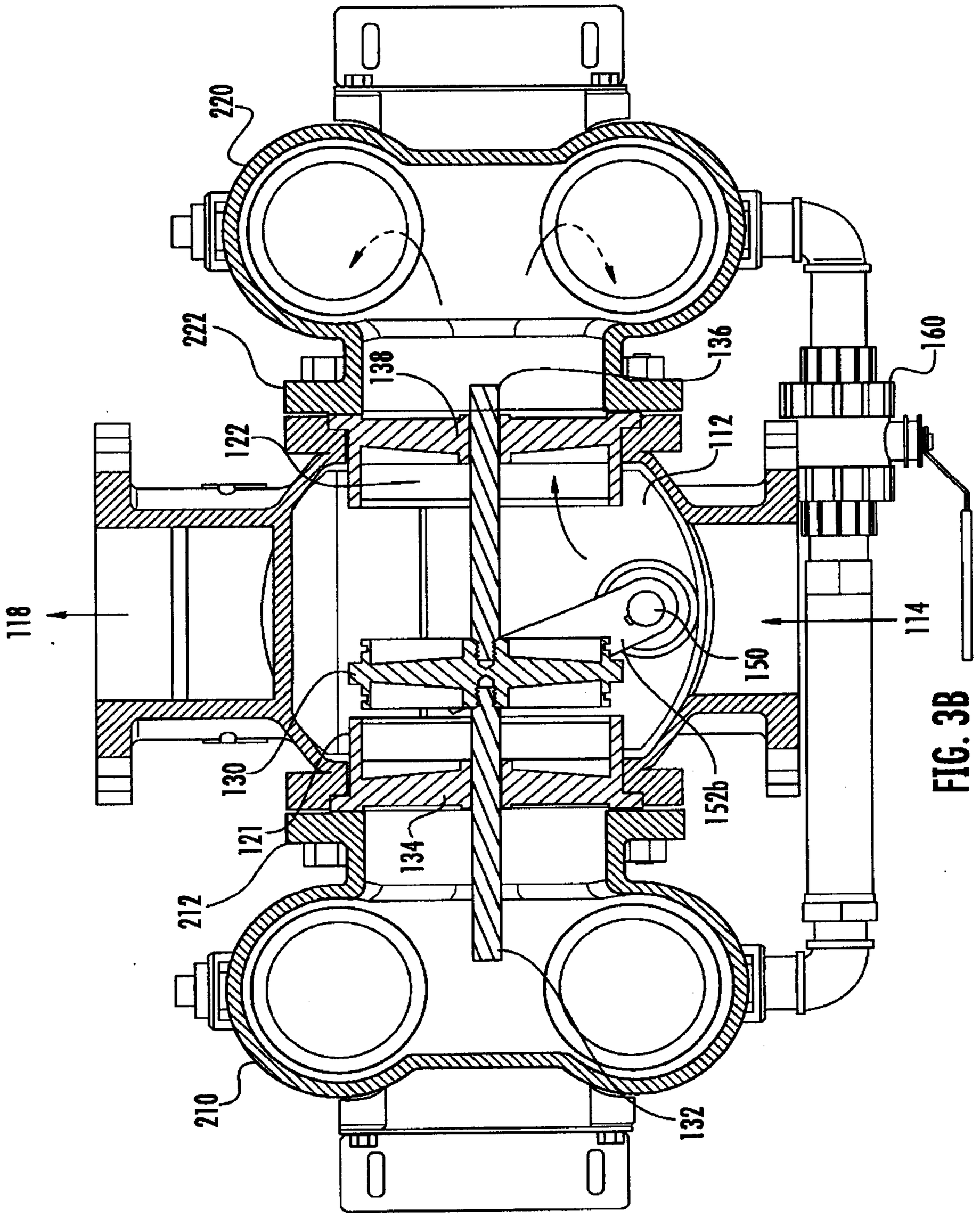
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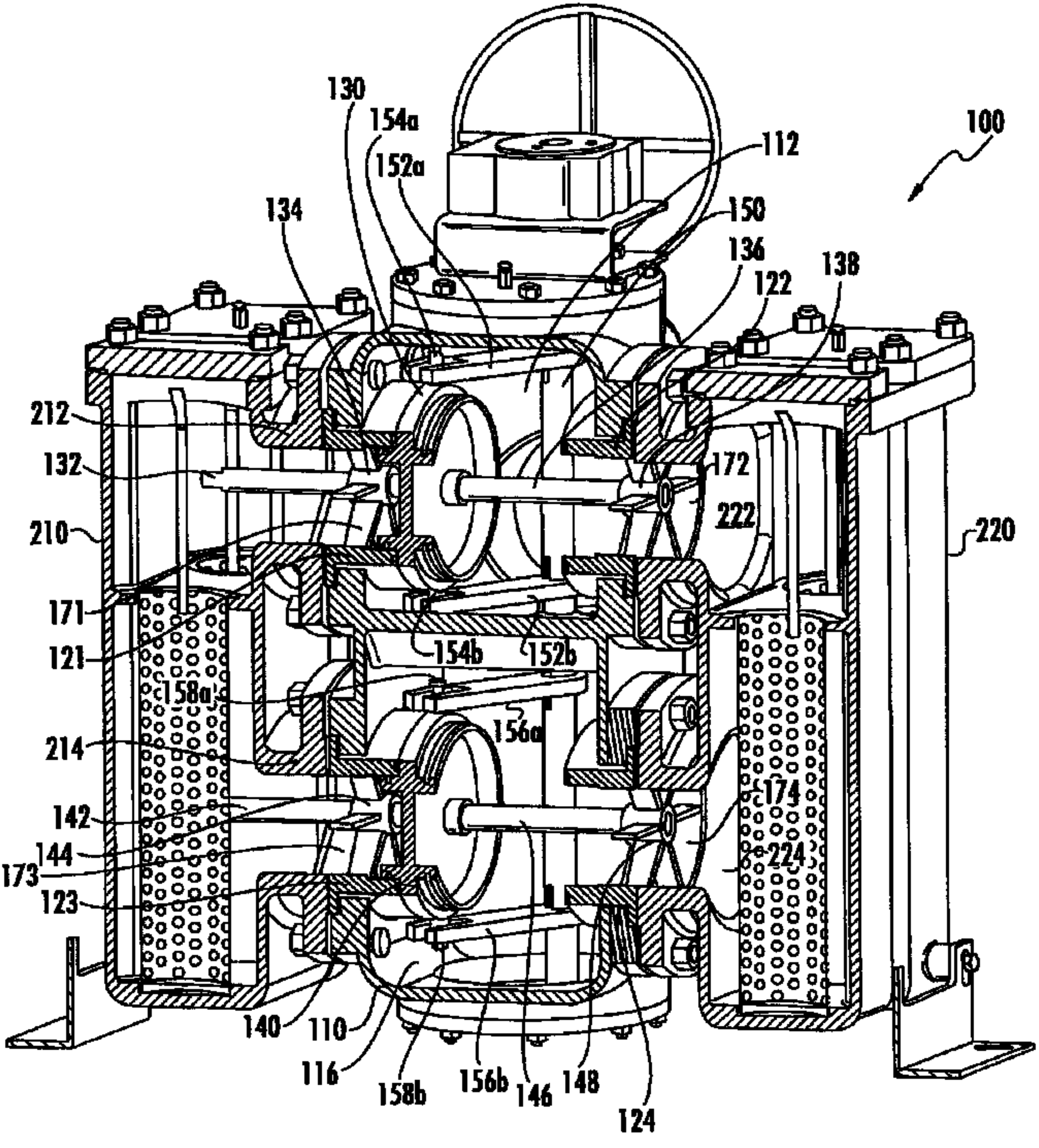
FIG. 3B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