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(54) **FIRE-FIGHTING MONITOR WITH REMOTE CONTROL**


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CPC ............ ***A62C 31/005*** (2013.01); ***A62C 31/24*** (2013.01); ***A62C 37/00*** (2013.01); ***B05B 3/02*** (2013.01); ***B05B 3/025*** (2013.01); ***B05B 3/14*** (2013.01)

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CPC ....... A62C 31/24; A62C 31/02; A62C 31/005; A62C 37/00; B05B 15/066; B05B 15/067;
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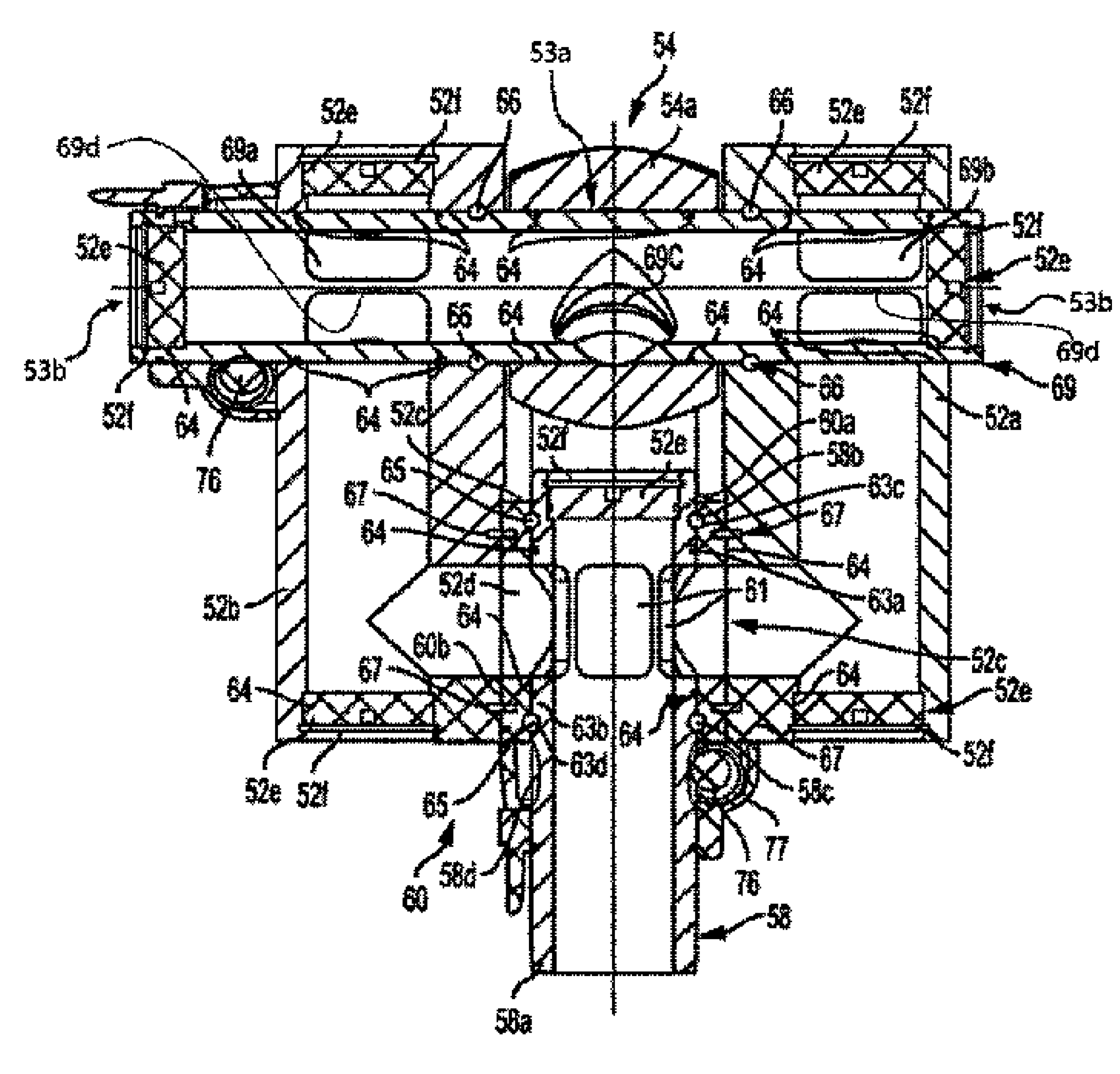
(57) **ABSTRACT**


A high pressure monitor includes an outlet body with a transverse passage, which extends through the body to form two inlets of the outlet body, and a second passage, which is in communication with the transverse passage and extends through the outlet body to form an outlet. The monitor further includes first and second bodies, with the outlet body mounted between the first and second bodies. Each of the first and second bodies has a transverse passage, which are in fluid communication with the inlets of the outlet body. A first swivel joint is provided between the outlet body and the first body. A second swivel joint is provided between the outlet body and the second body. Further, each of the swivel joints comprises a pressure balanced hydraulic fitting with seals and bearings, wherein the seals and bearings are oriented to reduce the axial pressure on the bearings from fluid flowing through the monitor.


**23 Claims, 8 Drawing Sheets**



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**Related U.S. Application Data**

continuation of application No. 11/519,627, filed on Sep. 12, 2006, now abandoned, which is a continuation-in-part of application No. 10/984,047, filed on Nov. 9, 2004, now Pat. No. 7,191,964, and a continuation-in-part of application No. 11/270,952, filed on Nov. 11, 2005, now Pat. No. 7,243,864, said application No. 10/984,047 is a continuation-in-part of application No. 10/405,372, filed on Apr. 2, 2003, now Pat. No. 6,994,282, said application No. 11/270,952 is a continuation of application No. 10/405,372, filed on Apr. 2, 2003, now Pat. No. 6,994,282.

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(58) **Field of Classification Search**
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See application file for complete search history.

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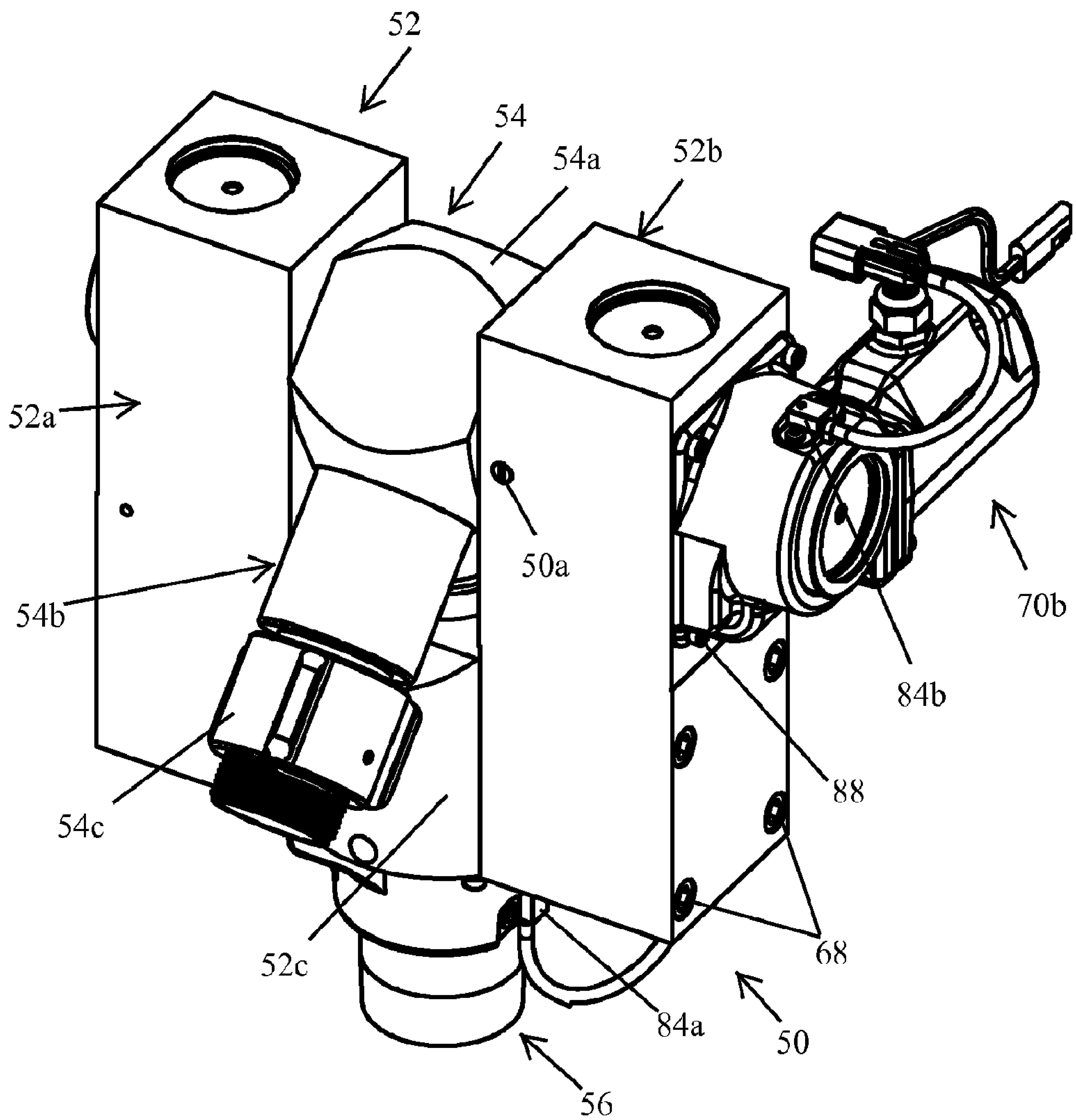


FIG. 1

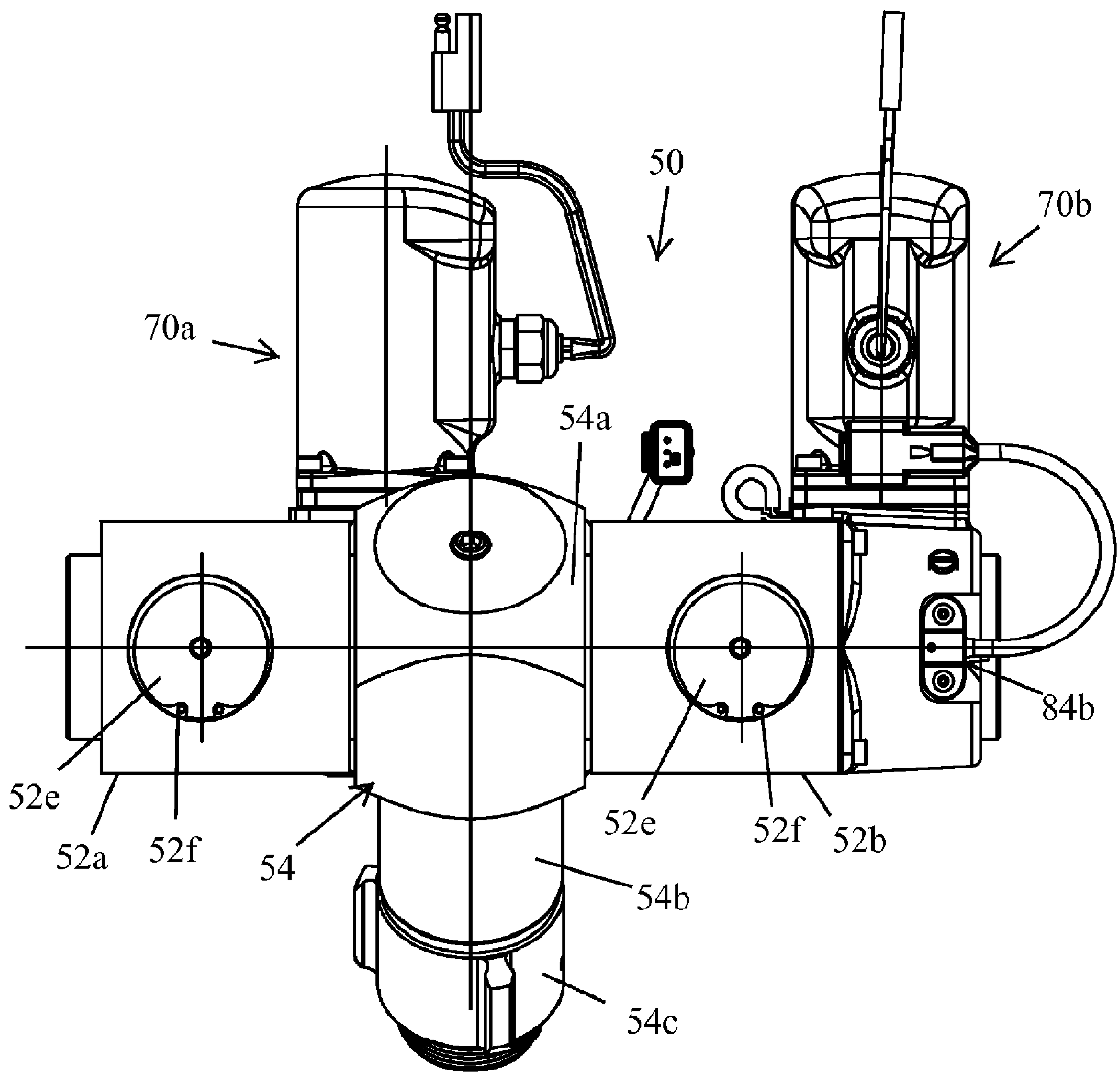


FIG. 2

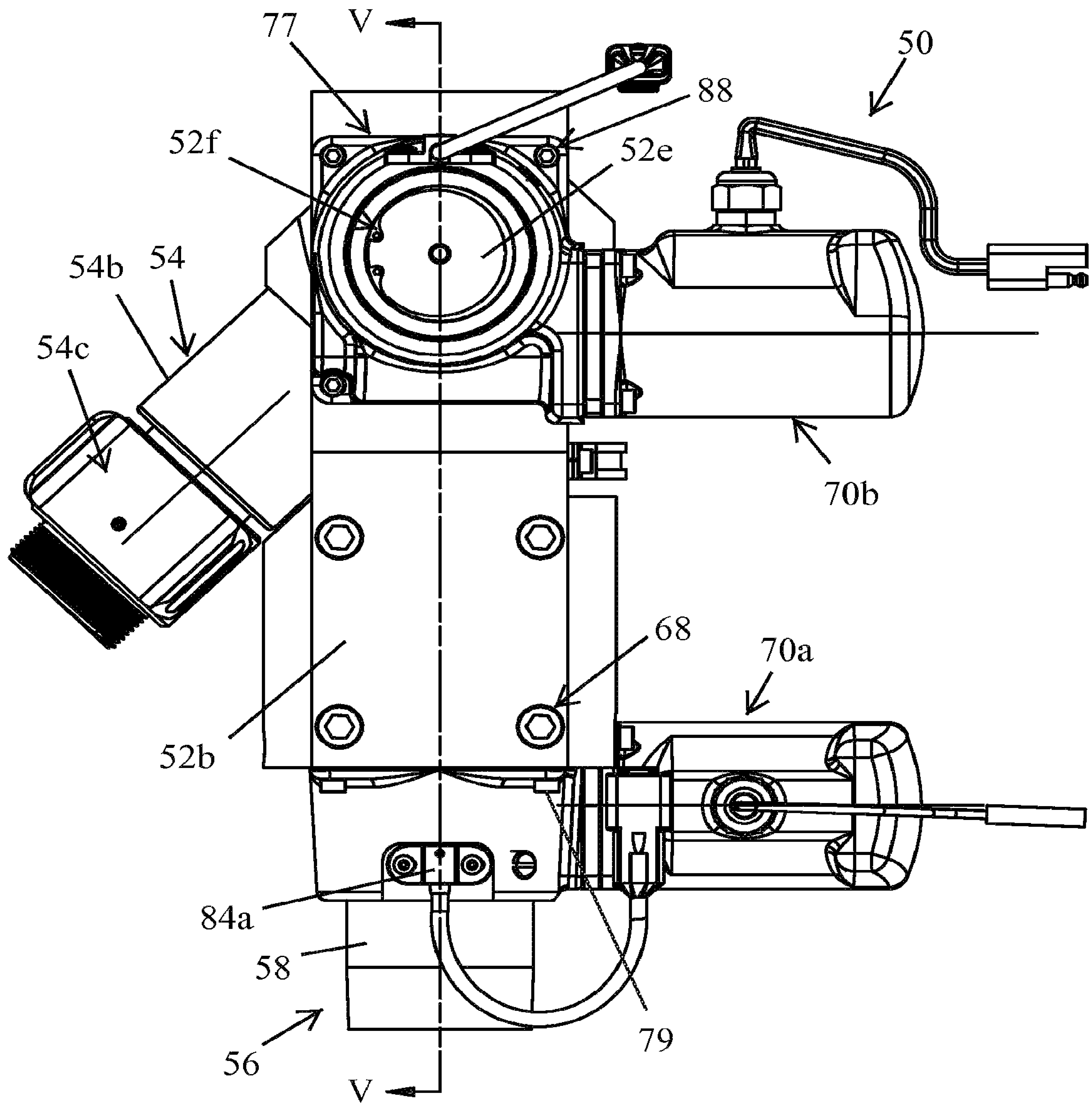


FIG. 3

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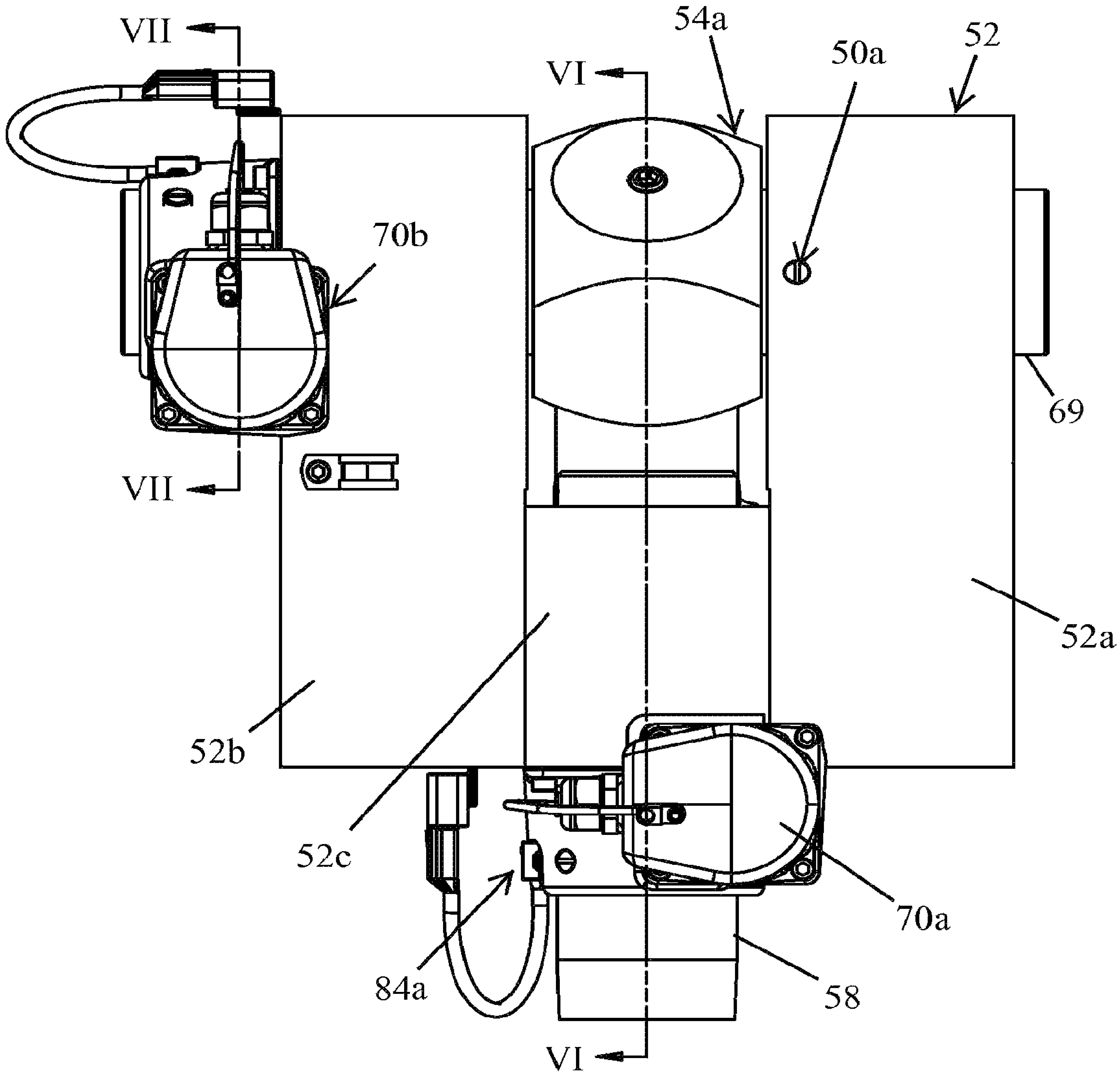


FIG. 4

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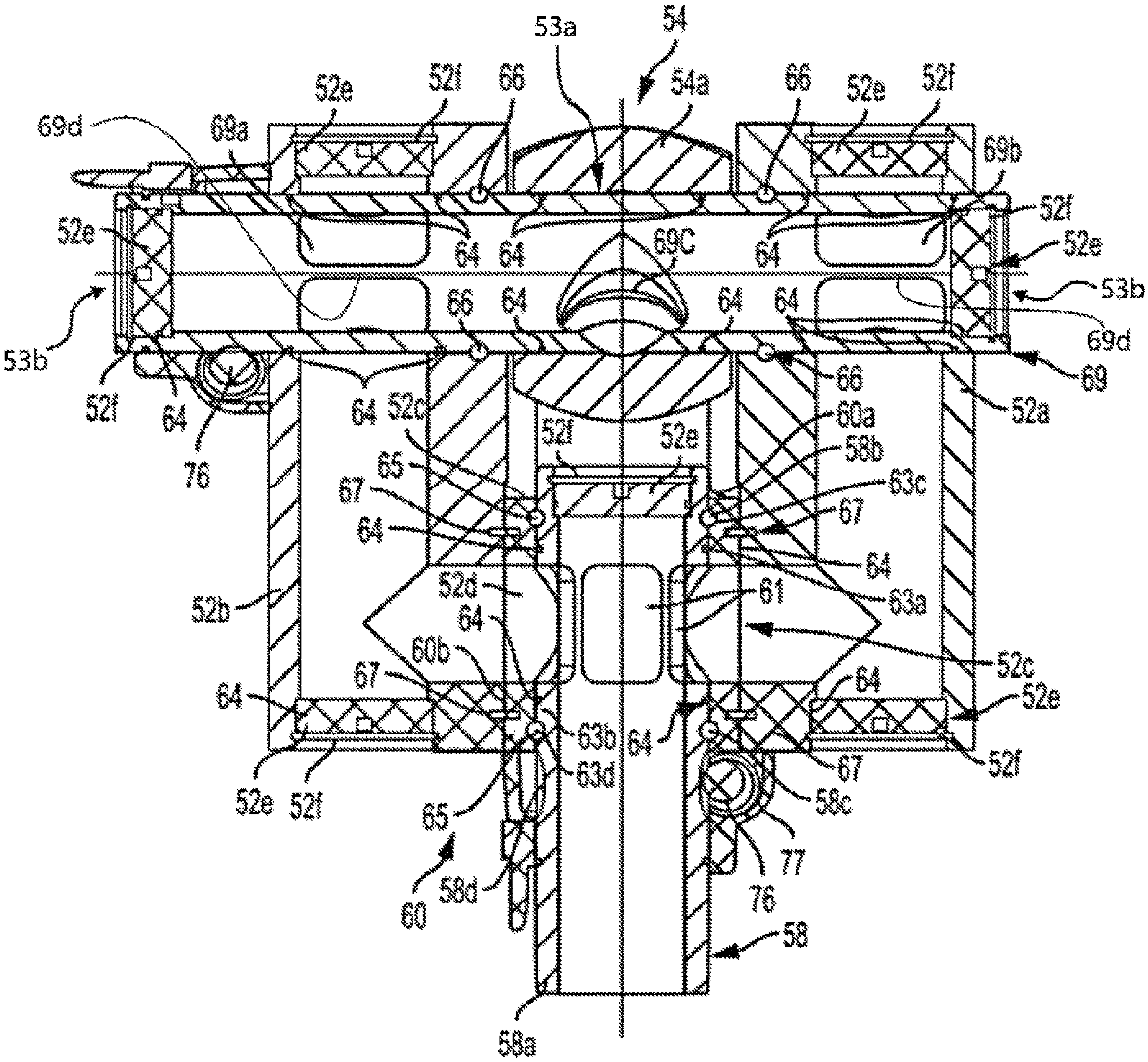


FIG. 5

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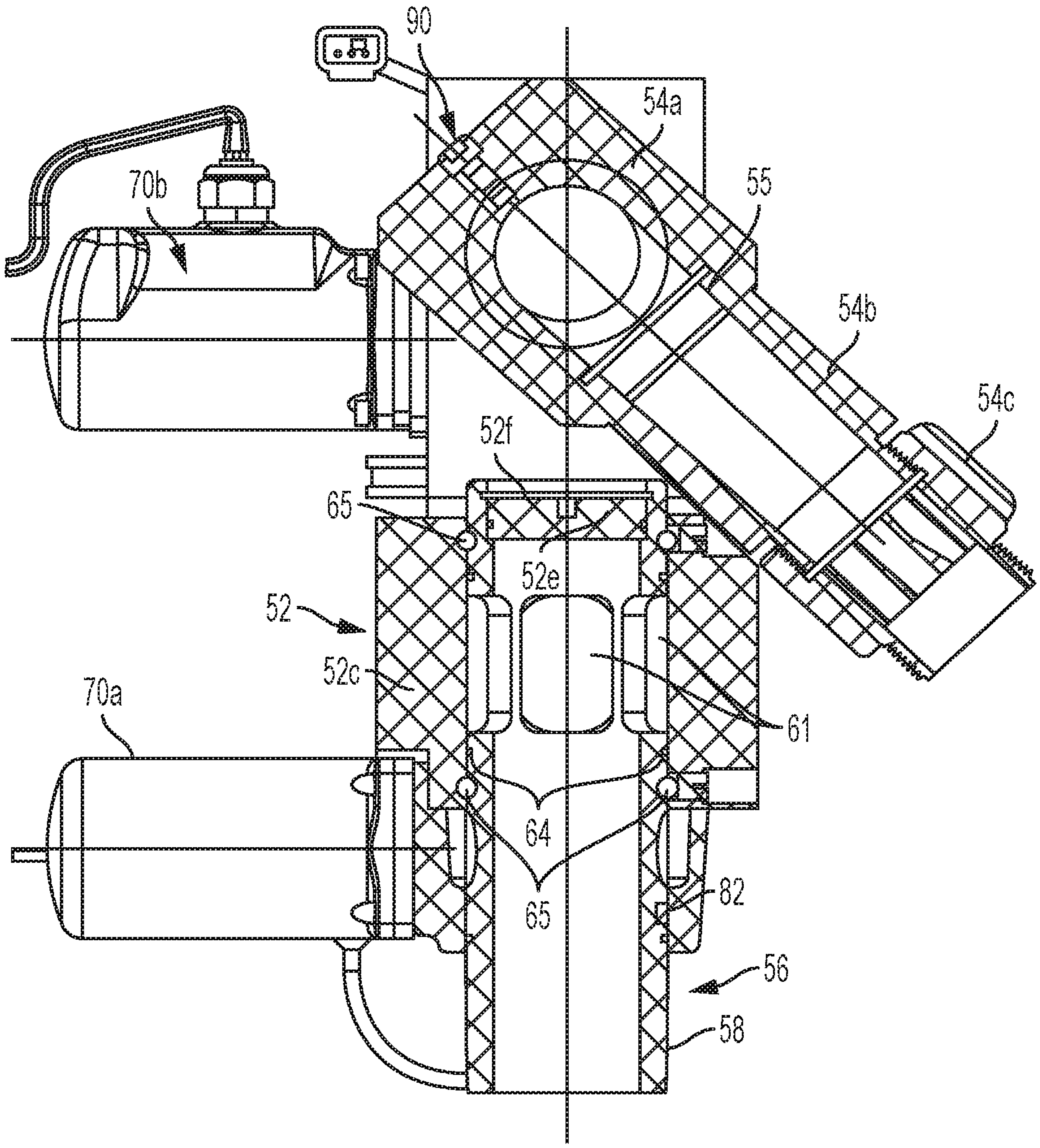


FIG. 6

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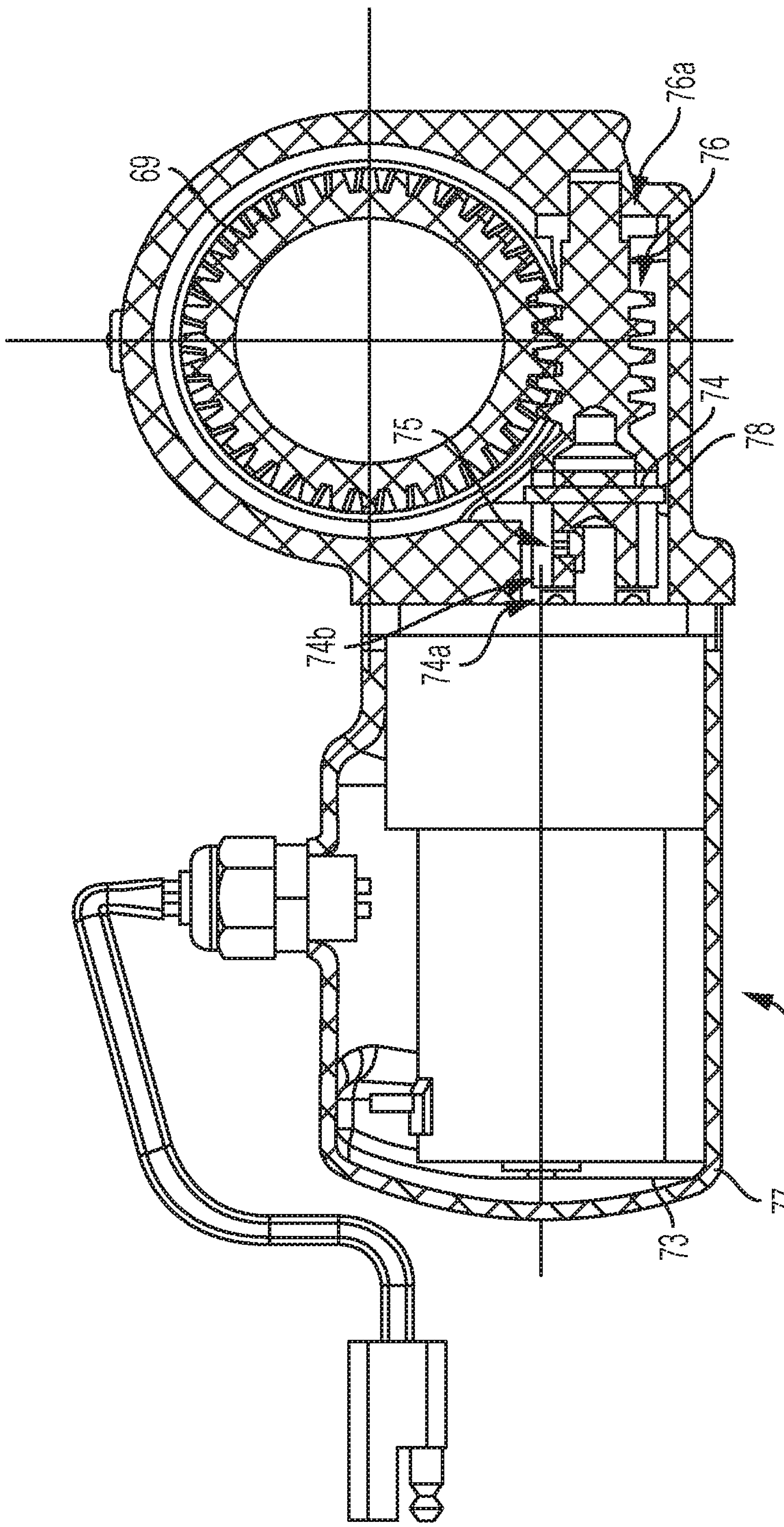


FIG. 7

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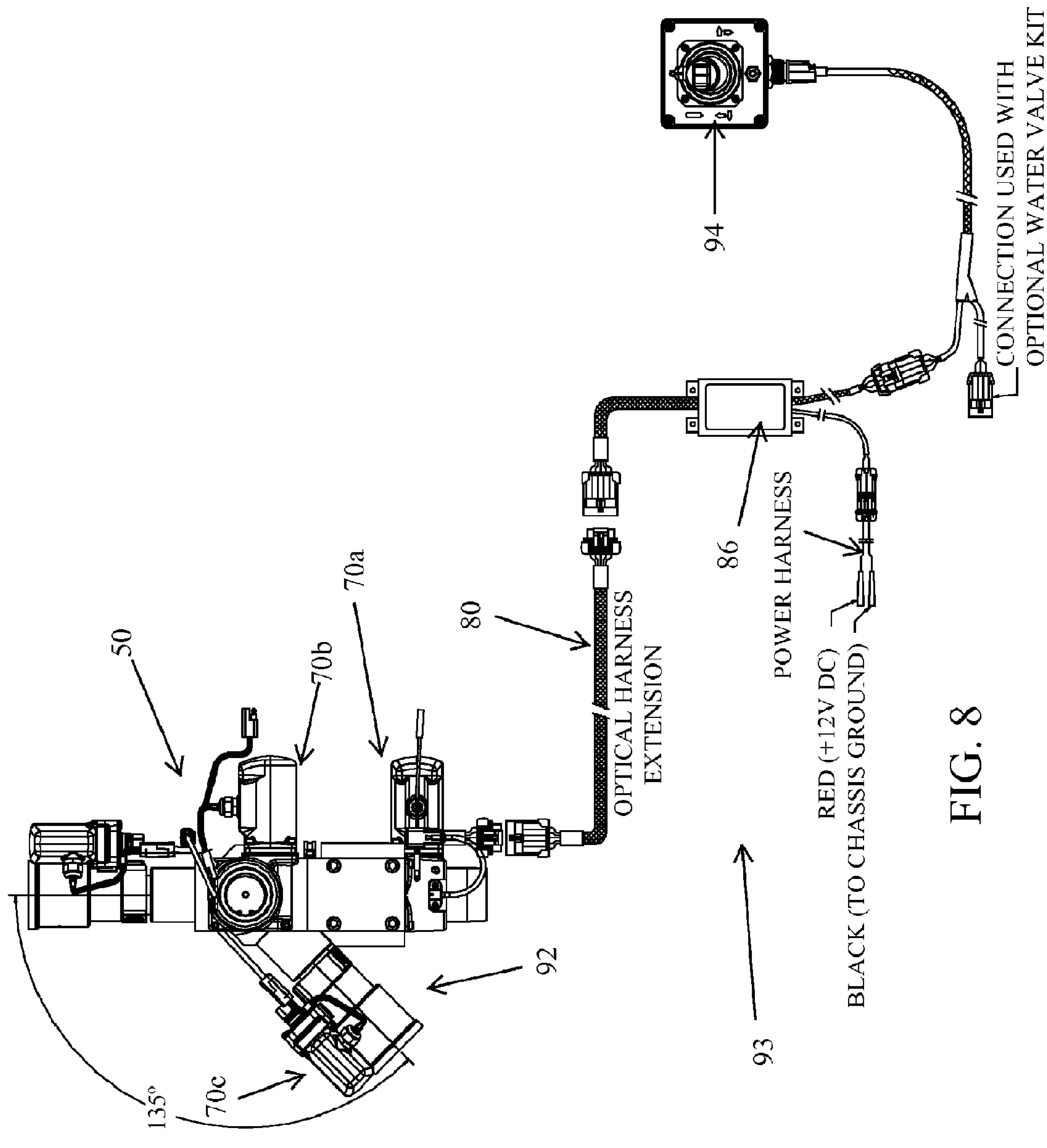

50
70b
70a
80
OPTICAL HARNESS EXTENSION
86
POWER HARNESS
RED (+12V DC)
BLACK (TO CHASSIS GROUND)
94
CONNECTION USED WITH OPTIONAL WATER VALVE KIT
92
93
70c
135°


FIG. 8

# FIRE-FIGHTING MONITOR WITH REMOTE CONTROL

**Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.**

## CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Continuation of U.S. patent application entitled FIRE-FIGHTING MONITOR WITH REMOTE CONTROL, Ser. No. 12/474,227, filed May 28, 2009, which is a Continuation of U.S. patent application entitled HIGH PRESSURE MONITOR, Ser. No. 11/519,627, filed on Sep. 12, 2006 (now abandoned)[, which is a non-provisional patent application based on U.S. Provisional Application Ser. No. 60/715,627 filed Sep. 9, 2005 entitled HIGH PRESSURE MONITOR]; and

U.S. patent application Ser. No. 11/519,627 is a Continuation-in-Part of U.S. patent application entitled FIRE-FIGHTING MONITOR WITH REMOTE CONTROL, Ser. No. 10/984,047, filed Nov. 9, 2004, granted Mar. 20, 2007 as U.S. Pat. No. 7,191,964; and

U.S. patent application Ser. No. 11/519,627 is also a Continuation-in-Part of U.S. patent application entitled RADIO CONTROLLED LIQUID MONITOR, Ser. No. 11/270,952, filed Nov. 11, 2005, granted Jul. 17, 2007 as U.S. Pat. No. 7,243,864; and

U.S. patent application Ser. No. 10/984,047 is a Continuation-in-Part of U.S. patent application entitled RADIO CONTROLLED LIQUID MONITOR, Ser. No. 10/405,372, filed Apr. 2, 2003, granted Feb. 7, 2006 as U.S. Pat. No. 6,994,282; and

Application Ser. No. 11/270,952 is a Continuation of U.S. patent application entitled RADIO CONTROLLED LIQUID MONITOR, Ser. No. 10/405,372, filed Apr. 2, 2003, granted [Jul. 17, 2007] *Feb. 7, 2006* as U.S. Pat. No. 6,994,282, the entire disclosures of all of the patents and patent applications referenced in this Cross [Section] *Reference* to Related Applications are hereby explicitly incorporated by reference herein.

## TECHNICAL FIELD AND BACKGROUND OF THE INVENTION

The present invention generally relates to a high pressure monitor and, more specifically, for a high pressure monitor for use in a high pressure foam system.

## SUMMARY

The present invention provides a monitor that is suitable for high pressure applications.

In one form of the invention, a high pressure monitor includes an outlet body and first and second bodies, with the outlet body mounted between the first and second bodies. The outlet body has a transverse passage, which extends through the body to form two inlets, and a second passage in communication with the transverse passage, which extends through the outlet body to form an outlet. Each of the first and second bodies has a transverse passage, which are in fluid communication with the inlets of the outlet body.



First and second swivel joints are provided between the outlet body and the first body and between the outlet body and the second body, respectively. Each of the swivel joints comprises a pressure balanced hydraulic fitting with seals and bearings, wherein the seals and bearing are oriented to reduce the axial pressure on the bearings from fluid flowing through the monitor.

In one aspect, the outlet body comprises a transverse tubular member mounted between the first and second bodies. The transverse tubular member has a passage, which forms the transverse passage of the outlet body and is in communication with the second passage of the outlet body. Further, the transverse tubular member is mounted in the first and second bodies by the first and second swivel joints.

In a further aspect, the high pressure monitor further includes an intermediate body with an inlet and a transverse passage, which is in communication with the inlet of the intermediate body. The transverse passage of the intermediate body is in fluid communication with the transverse passages of the first and second bodies.

According to a further aspect, the high pressure monitor also includes an inlet body. The inlet body has a transverse passage, which is in fluid communication with the transverse passages of the first and second bodies and forms the inlet of the monitor. The inlet body also has a swivel joint between the inlet body and the intermediate body wherein the inlet body is rotatable within the intermediate body. For example, the swivel joint at the inlet body and the intermediate body may comprise pressure balanced hydraulic fittings, such as seals and bearings.

In yet another aspect, the transverse passages of the first and second bodies are configured to provide an expanded volume for fluid flowing into the monitor wherein the pressure at the swivel joint between the inlet body and the intermediate body is reduced from the pressure at the inlet of inlet body.

In another aspect, the transverse passages in the first and second bodies and the intermediate body are configured to balance the pressure at the swivel joint between the inlet body and the intermediate body.

According to a further aspect, the traverse passages of the first and second bodies and the transverse member are configured to maintain the reduced pressure of the fluid flowing through the monitor wherein the pressure at the swivel joints between the outlet body and the first and second bodies is reduced from the outlet pressure of the fluid flowing from the outlet of the monitor.

In addition, the transverse passages of the first and second bodies and of the transverse member are configured and arranged to balance the pressure at the swivel joints between the outlet body and the first and second bodies.

In yet other aspects, the monitor further optionally includes a driver for pivoting the outlet body. Similarly, the monitor may include a driver for rotating the intermediate body about the inlet body.

According to another form of the invention, a high pressure monitor includes an outlet body, first and second bodies, with the outlet body rotatably mounted between the first and second bodies, an intermediate body, and an inlet body. Each of the first and second bodies has a transverse passage, which are in fluid communication with the inlets of the outlet body. The inlet body has a transverse passage that is in fluid communication with the transverse passages of the first and second bodies through the intermediate body and forms the inlet of the monitor. The inlet body also has a swivel joint between the inlet body and the intermediate body wherein the intermediate body is rotatable about the inlet body. In addition, the inlet body and the intermediate body include openings to provide fluid communication between the inlet body and the passages of the first and second bodies, which are arranged to direct the flow of fluid radially outward from the inlet body in a direction perpendicular to the inlet flow of fluid into the inlet body.

In one aspect, the high pressure monitor includes a first swivel joint between the outlet body and the first body and a second swivel joint between the outlet body and the second body.

In a further aspect, the outlet body includes a transverse tubular member that is mounted between the first and second bodies and has a passage, which forms the transverse passage of the outlet body. The passage of the tubular member is in communication with the second passage of the outlet body. In addition, the transverse tubular member is mounted in the first and second bodies by the first and second swivel joints.

In another aspect, the swivel joint at the inlet body and the intermediate body comprises pressure balanced hydraulic fittings.

According to other aspects, the transverse passages of the first and second bodies are configured to provide an expanded volume for fluid flowing into the monitor wherein the pressure at the swivel joint between the inlet body and the intermediate body is reduced from the pressure at the inlet of inlet body.

In another aspect, the traverse passages of the first and second bodies and the transverse member are configured to maintain the reduced pressure of the fluid flowing through the monitor wherein the pressure at the swivel joints between the outlet body and the first and second bodies is reduced from the outlet pressure of the fluid flowing from the outlet of the monitor.

In yet another aspect, the transverse passages of the first and second bodies and of the transverse member are configured and arranged to balance the pressure at the swivel joints between the outlet body and the first and second bodies.

Accordingly, the present invention provides a monitor that is particularly suitable for high pressure applications.

These and other objects, advantages, purposes, and features of the invention will become more apparent from the study of the following description taken in conjunction with the drawings.

## DETAILED DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the high pressure monitor of the present invention;

FIG. **2** is a top plan view of the high pressure monitor of FIG. **1**;

FIG. **3** is a right side elevation view of the high pressure monitor of FIG. **1**;

FIG. **4** is a rear elevation view of the high pressure monitor of FIG. **1**;

FIG. **5** is a cross-section view taken along line V-V of FIG. **3**;

FIG. **6** is a cross-section view taken along line VI-VI of FIG. **4**;

FIG. **7** is a cross-section view taken along line VII-VII of FIG. **4**; and

FIG. **8** is a schematic drawing of a monitor and nozzle system layout.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, the numeral **50** designates a monitor of the present invention. As will be more fully described below, monitor **50** is configured and arranged so that it can be used as a high pressure monitor and can handle a high flow rate capacity, for example flow rates of up to 300 gal/min at a high pressure, for example at an inlet pressure of up to 1500 lbs/in$^2$. Further, monitor **50** is particularly suitable for use in a high pressure foam system.

As best seen in FIG. **1**, monitor **50** includes a housing **52**, an outlet assembly or body **54**, and an inlet assembly **56**. Housing **52** is formed from two generally block-shaped bodies **52**a, **52**b that form an outer housing and which are interconnected by an intermediate body **52**c, which forms part of the inlet assembly **56**, and by outlet assembly **54**. Housing **52**, outlet assembly **54**, and inlet assembly **56** are optionally formed from wrought aluminum and are further optionally assembled together using fasteners, such as bolts, such that monitor **50** may comprise a bolted modular monitor.

Referring to FIG. **5**, inlet assembly **56** includes an inner inlet body **58** that provides a vertical fluid flow path, as viewed in FIG. **5**, and an inlet connection to an external fluid supply, such as a pipe or tank. Inlet body **58** is rotationally mounted in intermediate body **52**c by a swivel joint **60**, which includes inner and outer halves **60**a, **60**b. Inner [halve] *half* **60**a of joint **60** is located inwardly of housing **52** in the inner or upper portion of intermediate body **52**c. And, outer [halve] *half* **60**b of joint **60** is located in the outer or lower portion of intermediate body **52**c. Body **58** includes a plurality of openings **61** in its side wall **58**a to direct the flow of fluid into the monitor in a radially outward direction from body **58**. Similarly, intermediate body **52**c includes a passage which forms two outlet ports **52**d located 180° apart and oriented at right angles to the swivel joint axis. These ports exit through and are perpendicular to rectangular faces of bodies **52**a, **52**b so that fluid flowing from inlet assembly **56** into housing **52** flows radially outward in a direction perpendicular to the flow of fluid through the [transverse] passage of body **58**. Further, the height of the openings **61** is commensurate with the height of the [passageway] *passageways* in intermediate body **52**c. As a result, the fluid flows in a direction perpendicular to the interface between the intermediate body **52**c and inner and outer halves **60**a, **60**b of swivel joint **60**. Consequently, the configuration is such that swivel joint **60** forms a pressure balanced swivel joint.

Inner half **60**a of swivel joint **60** includes annular grooves **63**a and **63**b formed on body **58** for two O-ring seals **64**, and two annular grooves **63**c and **63**d formed on intermediate body **52**c, which align with annular grooves **58**b, **58**c formed on the outer surface of body **58** to serve as ball bearing races and receive bearings **65**. In this manner, swivel joint **60** allows for left-right rotation of the firefighting monitor about the inlet body **58** and the fluid inlet connection (as seen from FIG. **5**). The annular interface or clearance between inlet body **58** and intermediate body **52**c is therefore sealed by O-ring seals **64**, which are located in the annular grooves formed on their respective facing surfaces. Further, O-ring seals **64** seal against the pressure of the fluid flowing through the monitor. The pressure balance of swivel joint **60** is therefore accomplished by the placement of sealing members **64** relative to the pressure ports such that no net axial force due to static pressure is applied to the ball bearings **65**.

As noted above, intermediate body **52**c includes internal ball bearing races **63**c and **63**d that align with bearing races **58**b and **58**c provided in inlet body **58**. Bodies **58** and **52**c are assembled and rotatably mounted together by the insertion of Torlon® bearing balls **65** into these races (FIG. **5**), which are retained in the races by blocks **52**a and **52**b and a set screw **50**a (FIG. **1**). In addition, the faces of body **52**c that interface with bodies **52**a, **52**b include four tapped mounting holes each, which align with corresponding holes in the two block-shaped bodies **52**a, **52**b of housing **52**. Further, bodies **52**a, **52**b are aligned to the intermediate body **52**c with pins **67** (FIG. **5**), and are clamped to the intermediate body **52**c with bolts **68** (FIG. **3**). The interfaces between intermediate body **52**c and bodies **52**a, **52**b are also sealed with O-rings **64** (FIG. **5**) which are located on grooves formed on their respective facing surfaces.

Bodies **52**a, **52**b each include passageways that are in communication with the passageways in intermediate or outer inlet body **52**c and serve to receive the water discharged horizontally from the discharge ports of the intermediate body **52**c and redirect the flow upward to the outlet assembly **54** through an inner discharge body **69**. Further, the passageways of bodies **52**a, **52**b are optionally larger than the passageways or passages of intermediate body **52**c or inlet body **58** to thereby provide expanded volumes to reduce the pressure at the swivel joint between the inlet assembly **56** and housing **52**. Similarly, as will be described below, bodies **52**a, **52**b and transverse member **69** are configured to maintain the reduced pressure of the fluid flowing through the monitor wherein the pressure at the swivel joints between the outlet body and the first and second bodies is reduced from the outlet pressure of the fluid flowing from the outlet of the monitor.

Inner discharge body **69** is a tubular transverse member *having a middle portion 53a and end portions 53b* with a transverse passage with two sets of inlet ports **69**a and **69**b that align with the vertical passages of bodies **52**a, **52**b. *Each of the sets of inlet ports 69a and 69b may have at least a pair of adjacent ports circumferentially spaced from one another and separated by elements 69d extending from the middle portion 53a to the corresponding end portion 53b. The ports of the sets of inlet ports 69a and 69b may be circumferentially spaced from adjacent ports and separated by the elements 69d to ensure the passages in the bodies 52a and 52b may be fluidly coupled to the passage of the body 69 regardless of the orientation of the outlet assembly 54. More specifically, the elements 69d may be sized to not substantially cover the fluid passages of the bodies 52a and 52b regardless of the orientation of the discharge body 69. Further, in one non-exclusive embodiment there are four ports circumferentially spaced from one another at each of the sets of inlet ports 69a and 69b.* The passages in bodies **52**a and **52**b and in tubular member **69** are generally commensurate in size so as to maintain the reduced pressure of the fluid flowing through the monitor. Body **69** is rotatably supported in bodies **52**a, **52**b by bearings **66** that are located in raceways formed or provided in the outer surface of discharge body **69** and in the side walls of bodies **52**a, **52**b. These ball bearings allow a low friction swivel joint for rotation of body **69** about the horizontal axis as viewed in FIG. **5**. As would be understood, rotation of body **69** about the horizontal axis serves to provide up-down motion of the outer discharge body **54**a (FIG. **6**) and discharge adapter **54**b, which form outlet assembly **54**. *Further, rotation of body 69 causes elements 69d to rotate therewith and may cause elements 69d to extend across vertical passages of bodies 52a and 52b. However, elements 69d are sized so they do not substantially fluidly block the vertical passages from the transverse passage of the body 69 as the elements 69d extend across the vertical passages.* The annular spaces between inner discharge body **69** and bodies **52**a, **52**b are also sealed with seals, such as O-rings **64**. Similar to left-right swivel joint **60**, these O-rings are positioned to accomplish a pressure balance such that no net axial force due to static pressure is applied to the ball bearings.

As noted, in the illustrated embodiment, bodies **52**a, **52**b are formed from block-shaped members. Further, each body **52**a, **52**b is formed from a tubular block-shaped member with open ends that are closed and sealed by plugs **52**e and seals, such as O-rings **64**, which forms the vertical flow passages (as viewed in FIG. **5**) of bodies **52**a, **52**b. The plugs **52**e are retained within the bodies **52**a, **52**b by retaining rings **54**f. Body **69** is similarly formed by a tubular member with open ends that are closed and sealed by plugs **52**e and seals **64**, which forms a horizontal flow passage. Plugs **52**e are similarly retained within the inner discharge body **69** by retaining rings **52**f. Inner discharge body **69** also includes a discharge port **[69c]** *69C* that is located midway between the ball bearing races for directing fluid to outer discharge body **54**a.

Discharge outer body **54**a contains a through circular internal passage, which allows it to be slip fitted onto inner discharge body **69**, and a discharge port which is aligned with the discharge port *69C* of inner discharge body **69**. Axial positioning of outer discharge body **54**a to inner discharge body **69**, as well as alignment of discharge ports of these two parts is accomplished by installation of screw **[89]** *90* (FIG. **6**) into a tapped hole in outer discharge body **54**a and into a clearance hole in inner discharge body **69**. The head of screw **[89]** *90* is sealed against leakage by O-ring **[90a]** (*not shown*). The discharge port of outer discharge body **54**a contains threads **55** to allow connection with mating threads of discharge adapter **54**b. This threaded joint is sealed against leakage by O-ring **[55a]** (*not shown*). Similarly, adapter **54**b includes threads for mounting a stream shaper **54**c **[**and**]** *or* nozzle *92* to outlet assembly **54**. As would be understood, the outlet pressure at the outlet body **54**a and adapter **54**b is increased over the pressure in the monitor due to the **[**reduce**]** *reduced* volume of the outlet body and adapter as compared to the volume of the passage of tubular member **69**.

In addition to providing an inlet for monitor **50**, body **58** forms a base about which monitor housing **52** can be rotated to adjust the angular orientation of the outlet of monitor **50** about the vertical axis. Monitor housing **52** is rotated about body **58** by a first driver **70**a (FIG. **3**). As best seen in FIG. **6**, driver **70**a is mounted to housing **52** and drives body **58** to rotate housing **52** about body **58**, which is secured to the inlet connection. In the illustrated embodiment, body **58** includes gears in the form of worm gear teeth **58**d that are machined into the outer cylindrical surface of cylindrical wall **58**a below the lower ball bearing race (**63**d)(FIG. **5**).

To drive the outlet, monitor **50** includes a second driver **70**b (FIGS. **1**, **6**), which has a similar construction to driver **70**a. Driver **70**b engages body **69**, which projects through body **52**b, to thereby rotate discharge body **69** about its longitudinal axis to thereby raise or lower discharge body **54**a and the nozzle that is mounted to discharge body **54**a.

As best seen in FIG. **7**, driver **70**b includes a **[**gear motor assembly**]** *motor* **73**, a drive coupling **74**, which is coupled to the output shaft of **[**gear motor assembly**]** *motor* **73** through a thrust bearing **74**a and thrust washer **74**b using setscrew **75**, and a drive shaft **76**, which is coupled to drive coupling **74**, for driving the body **69** about the horizontal axis as viewed in FIG. **5**. **[**Gear motor assembly**]** *Motor* **73**, drive coupling **74** and drive shaft **76** are all supported by a case **77**, with the positive drive coupling of drive coupling **74** to drive shaft **76** accomplished by a pin **78** which is held in place by a force fit into coupling **74**. And, the end of drive shaft **76** supported and sealed in case **77** by a thrust bearing

76a and *an* O-ring seal [76b] (*not shown*). The outer ends of pin **78** slide into two slots located 180° apart in the coupling end of shaft **76**.

Drive shaft **76** comprises a worm shaft, whose gear teeth mate with the gear teeth provided on body **69**. Body **69** includes worm gear teeth machined into the outer cylindrical surface near the left end of the part as viewed in FIG. **5**. Second driver **70**b is mounted to vertical body **52**b using cap screws **88** and optionally allows for remote control actuation of monitor up-down rotation.

Driver **70**a similarly includes a [gear motor assembly] *motor* **73**, a drive coupling **74**, which is coupled to the output shaft of [gear motor assembly] *motor* **73** using setscrew **75**, and a drive shaft **76**, which is coupled to the drive coupling, for driving the body **58** about the vertical axis as viewed in FIG. **5**. Drive shaft **76** of driver **70**a also comprises a worm shaft, whose gear teeth mate with the gear teeth **58**d on body **58**. Driver **70**a is mounted to housing **52** by worm case **77**, which mounts to the undersides of intermediate body **52**c and bodies **52**a, **52**b using cap screws **79** (FIG. [**4**] *3*) to position shaft **76** to engage the gear teeth on body **58**. For further details of driver **70**a, reference is made to driver **70**b.

Each driver **70**a, **70**b further includes wiring and/or cables for coupling to an external power supply and controls to allow for remote control actuation of monitor left-right or up-down rotation, described below.

Travel limits for the left-right swivel joint *60* are established by the presence of magnets **82** (FIG. **6**), which are mounted to body **58**, and Hall sensor **84**a (FIG. **1**). In the illustrated embodiment, magnets **82** are mounted in recesses or holes within the outer cylindrical surface of inner inlet body **58**. When a magnet [(**82**)] is moved with inlet body **58** to be within sensing range of sensor **84**a, a control signal from sensor **84**a to a microprocessor within control module **86** (FIG. **8**) causes motor **73** to stop and inhibits further rotation of the motor in that direction.

Travel limits for the up-down swivel joint are also established by the presence of magnets [**82**] (*not shown*) provided, for example, in recesses or holes in the outer cylindrical surface of inner discharge body **69**, along with a second Hall sensor **84**b. When a magnet [(**82**)] is moved with inner [outlet] *discharge* body **69** to be within sensing range of second sensor **84**b, a control signal from second sensor **84**b to the microprocessor within control module **86** causes second motor **73** to stop and inhibits further rotation of the motor in that direction.

Referring to FIG. **8**, discharge adapter **54**b serves to provide a discharge flow passage and to properly position nozzle **92** relative to the monitor assembly. The discharge end of discharge adapter **54**b has a male hose thread to mate with the attachment coupling of nozzle **92**. Nozzle **92** optionally comprise a combination straight stream and fog nozzle with electrically controlled actuator **70**c to allow remote adjustment of the stream pattern from wide spray to straight stream, and is calibrated to flow at high flow rates and high pressure, for example 300 gal/min at an inlet pressure of 1500 lbs/in$^2$. Actuator **70**c is a commercial actuator.

As noted above, drivers **70**a, **70**b, and, further, actuator **70**c may all be controlled by a control system **93**. As best seen in FIG. **8**, control system **93** includes a control module **86**. Control module **86** is configured to provide remote control of the positioning of monitor **50** about the vertical axis and over the vertical position of the outlet assembly, as well as control over the stream of fluid from nozzle **92** via actuator **70**c. In the illustrated embodiment, control module **86** is in communication with drivers **70**a, **70**b and actuator **70**c through wiring and cables, which are optionally enclosed in a harness **80**, though it should be understood that RF (*radio frequency*) transmission may be used for transmitting and receiving control signals. In addition, control system **93** may include a user actuatable device, such as a joystick **94**, to provide manual override over control module **86**.

Additional monitor control capability could be achieved by the addition of an optical or magnetic encoder to one or both of the [gear motor assemblies] *motors*. Signal pulses sent from an encoder to a properly programmed control processor could allow for automatic oscillation of the left-right nozzle sweep within a chosen arc. User inputs to initiate monitor and nozzle motion may be accomplished through joystick assembly **94**, which is coupled or in communication with control module **86**. Further, RF control of the monitor may be achieved using a similar RF control system described in [copending applications. The present application is a continuation-in-part of copending application] *commonly owned applications* entitled RADIO CONTROLLED LIQUID MONITOR, Ser. No. 10/405,372, filed Apr. 2, 2003, *now U.S. Pat. No. 6,994,282,* and FIRE-FIGHTING MONITOR WITH REMOTE CONTROL, Ser. No. 10/984,047, filed Nov. 9, 2004, *now U.S. Pat. No. 7,191,964,* which are incorporated herein in their entireties.

While one form of the invention has been shown and described, other forms will now be apparent to those skilled in the art. Therefore, it will be understood that the embodiment shown in the drawings and described above is merely for illustrative purposes, and is not intended to limit the scope of the invention which is defined by the claims which follow as interpreted under the principles of patent law including the doctrine of equivalents.

The embodiments of the invention in which an exclusive property right or privilege is claimed are defined as follows:

**1**. A fire-fighting monitor for directing the flow of fluid from a fluid source, said monitor comprising: a cylindrical pipe section adapted to mount said monitor to a fluid source; a monitor body having an inlet and an outlet, said inlet mounted on and supported by said cylindrical pipe section and for receiving fluid through said pipe section, said outlet in fluid communication with said inlet for discharging fluid from said monitor body; a rotatable connection between said inlet and said pipe section, said rotatable connection permitting said inlet to rotate about a first axis over a range of motion about said pipe section; a drive mechanism mounted to one of said pipe section and said monitor body and drivingly engaging the other of said pipe section and said monitor body for rotating said inlet about said pipe section about said first axis; and a control capable of receiving control signal commands, said control operably connected to said drive mechanism so that said control may provide control signals to said drive mechanism in response to receipt of radio control signal commands to control the rotation of said monitor body about said pipe section, and said control further adapted to cause said monitor body to rotate back and forth in oscillation between predetermined limits established electronically by said control.

**2**. The fire-fighting monitor according to claim **1**, further comprising a remote transmitter apparatus, said remote transmitter apparatus including said transmitter, said remote transmitter apparatus being adapted to allow a user to adjust said predetermined limits.

[**3**. The fire-fighting monitor according to claim **2**, wherein said control further establishes maximum predetermined limits.]

[4. The fire-fighting monitor according to claim 3, wherein said maximum predetermined limits are only adjustable using said control and not by said remote transmitter apparatus.]

[5. The fire-fighting monitor according to claim 2, wherein said rotatable connection permits said inlet to rotate about said first axis over a range of motion extending at least 360 degrees about said pipe section.]

[6. The fire-fighting monitor according to claim 5, wherein said predetermined limits may be adjusted at the control.]

[7. The fire-fighting monitor according to claim 6, wherein said predetermined limits may be adjusted between any two positions in said range of motion.]

[8. The fire-fighting monitor according to claim 1, further comprising a housing mounted to said monitor body, said control being mounted in said housing.]

9. The fire-fighting monitor according to claim 1, wherein said monitor body comprises an inlet pipe Section and an outlet pipe section rotatably mounted relative to said inlet pipe section about a second pivot axis, and said outlet pipe section including said outlet.

10. The fire-fighting monitor according to claim 9, further comprising a second drive mechanism for rotating said outlet pipe section about said second pivot axis.

[11. The fire-fighting monitor according to claim 1, wherein said cylindrical pipe section includes an integral mounting flange extending radially outwardly from said cylindrical pipe section for mounting said monitor to a fire fighting fluid supply.]

*12. The fire-fighting monitor of claim 1, wherein said discharge section comprises a stream shaper.*

*13. The fire-fighting monitor of claim 1, wherein said drive mechanism comprises a worm shaft intermeshing with worm gear teeth.*

*14. The fire-fighting monitor of claim 13, wherein the drive mechanism further comprises a motor drivingly connected to the worm shaft.*

*15. The fire-fighting monitor of claim 1, wherein the plurality of ports are spaced apart to enable fluid flow during rotation of the discharge section with respect to the housing.*

*16. The fire-fighting monitor of claim 1, wherein the rotatable connection between the inlet section and the housing includes a pressure balanced swivel joint.*

*17. The fire-fighting monitor of claim 1, wherein the plurality of ports include four ports.*

*18. The fire-fighting monitor of claim 1, wherein the pair of the plurality of ports are located adjacent to each other.*

*19. The fire-fighting monitor of claim 1, wherein the pair of the plurality of ports are separated by an element of the discharge section, the element being located circumferentially between the pair of the plurality of ports.*

*20. The fire-fighting monitor of claim 19, wherein the element is rotatable to extend across a flow passage in the housing.*

*21. The fire-fighting monitor of claim 19, wherein the element connects the end portion of the discharge section and the middle portion of the discharge section.*

*22. A fire-fighting monitor for directing a flow of fluid from a fluid source, said monitor comprising: an inlet section adapted to mount said monitor to the fluid source; a housing having an inlet and an outlet, said inlet mounted on and supported by said inlet section and for receiving fluid through said inlet section, said outlet in fluid communication with said inlet and a discharge section for discharging fluid from said monitor; a rotatable connection between said housing and said inlet section, said rotatable connection permitting said housing to rotate about a first axis over a range of motion about said inlet section, said discharge section including a plurality of ports configured to rotate relative to the housing and enable fluid flow along a path from the housing to the discharge section, a pair of the plurality of ports being circumferentially spaced in the discharge section; a drive mechanism mounted to the monitor and rotating the housing relative to the inlet section about said first axis; and a control capable of receiving control signal commands, said control operably connected to said drive mechanism in order to provide control signals to said drive mechanism in response to receipt of control signal commands to control a rotation of said housing about said inlet section, and said control further adapted to cause said housing to rotate back and forth in oscillation between predetermined limits.*

*23. The fire-fighting monitor of claim 22, wherein the pair of the plurality of ports are located between a middle portion and an end portion of the discharge section.*

*24. The fire-fighting monitor of claim 22, wherein the discharge section includes an element located circumferentially between the pair of the plurality of ports.*

*25. The fire-fighting monitor of claim 24, wherein the element connects an end portion of the discharge section and a middle portion of the discharge section.*

*26. A fire-fighting monitor for directing a flow of fluid from a fluid source, said monitor comprising: an inlet section adapted to mount said monitor to the fluid source; a housing having an inlet and an outlet, said inlet mounted on and supported by said inlet section and for receiving fluid through said inlet section, said outlet in fluid communication with said inlet and a discharge section for discharging fluid from said monitor; a rotatable connection between said housing and said inlet section, said rotatable connection permitting said housing to rotate about a first axis over a range of motion about said inlet section, said discharge section including a plurality of ports configured to rotate relative to the housing and enable fluid flow along a path from the housing to the discharge section, a pair of the plurality of ports being separated by an element of the discharge section, the element connecting a middle portion of the discharge section and an end portion of the discharge section; a drive mechanism mounted to the monitor and rotating the housing relative to the inlet section about said first axis; and a control capable of receiving control signal commands, said control operably connected to said drive mechanism in order to provide control signals to said drive mechanism in response to receipt of control signal commands to control a rotation of said housing about said inlet section, and said control further adapted to cause said housing to rotate back and forth in oscillation between predetermined limits.*

*27. The fire-fighting monitor of claim 26, wherein the element of the discharge section is rotatable to extend across a flow passage in the housing.*

*28. The fire-fighting monitor of claim 26, wherein the element is located circumferentially between the pair of the plurality of ports.*

*29. A fire-fighting monitor for directing a flow of fluid from a fluid source, said monitor comprising: an inlet section adapted to mount said monitor to the fluid source; a housing having an inlet and an outlet, said inlet mounted on and supported by said inlet section and for receiving fluid through said inlet section, said outlet in fluid communication with said inlet and a discharge section for discharging fluid from said monitor; a rotatable connection between said* *housing and said inlet section, said rotatable connection permitting said housing to rotate about a first axis over a range of motion about said inlet section, said discharge section including a plurality of ports configured to rotate relative to the housing and enable fluid flow along a path from the housing to the discharge section, a pair of the plurality of ports being separated by an element of the discharge section, the element of the discharge section being rotatable to extend across a flow passage in the housing; a drive mechanism mounted to the monitor and rotating the housing relative to the inlet section about said first axis; and a control capable of receiving control signal commands, said control operably connected to said drive mechanism in order to provide control signals to said drive mechanism in response to receipt of control signal commands to control a rotation of said housing about said inlet section, and said control further adapted to cause said housing to rotate back and forth in oscillation between predetermined limits.*

*30. The fire-fighting monitor of claim 29, wherein the pair of the plurality of ports are located between an end portion of the discharge section and a middle portion of the discharge section.*

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