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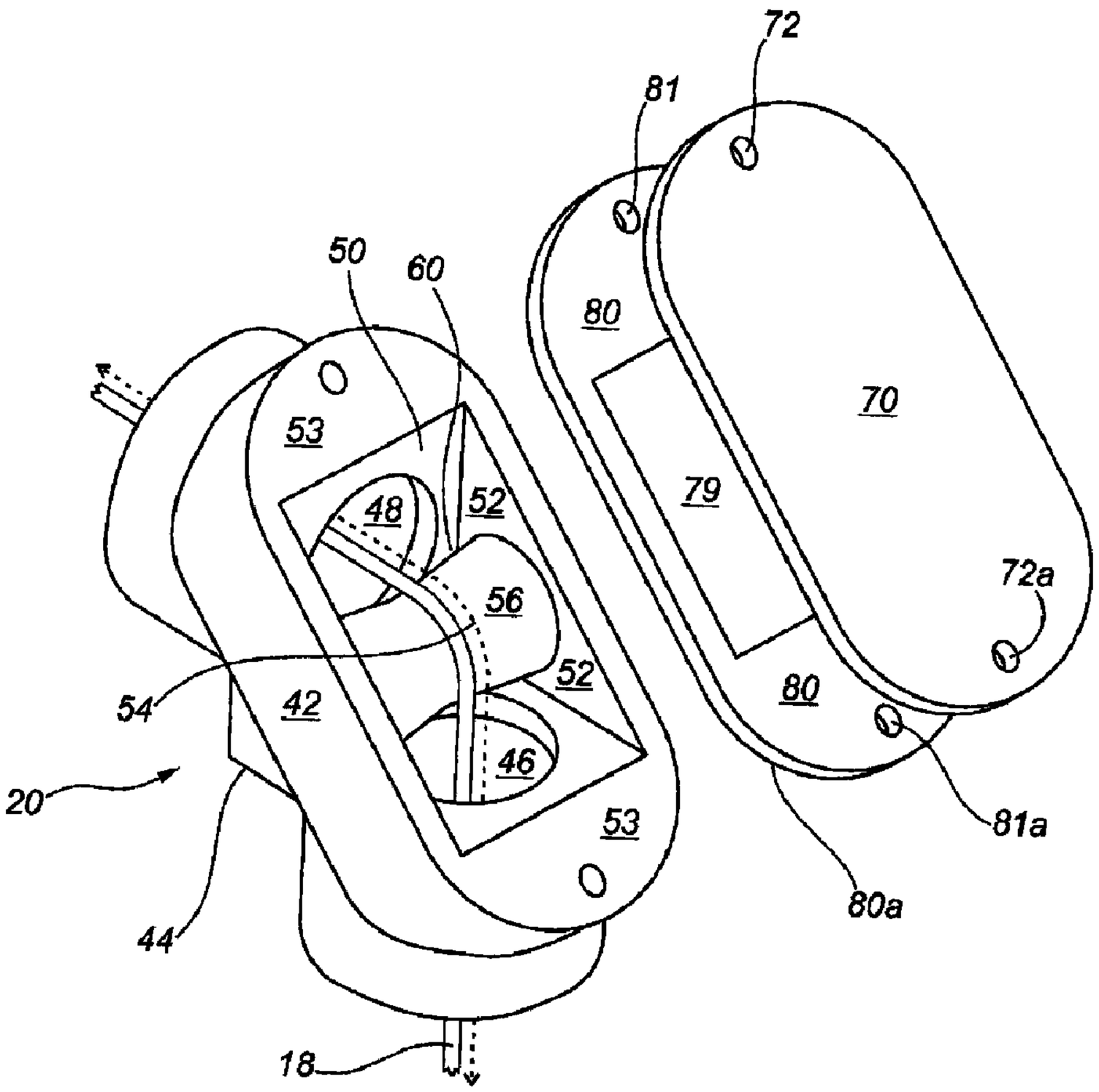
(54) Title: CABLE GUIDE SUPPORT FOR CABLE-GUIDED TANK GAUGE



(57) Abrégé/Abstract:
A tank gauge system is provided comprising a float, a cable, an indicator and at least one cable guide support. The float is in a tank containing liquid and moves with it. The cable connects the float to the indicator on the outside through the cable support for

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communicating the liquid level in the tank. The cable support comprises a body having two side openings merging into a cavity formed on a top portion of the body. A roller is positioned in the cavity, between the two openings and is rotatable about an axis transverse to the direction of cable movement. The roller has a predetermined axial length that is substantially wider than each of the openings so that the cable moving through the openings is urged to maintain contact with the roller. This prevents the cable from coming off the roller and minimizes jamming.

ABSTRACT

A tank gauge system is provided comprising a float, a cable, an indicator and at least one cable guide support. The float is in a tank containing liquid and moves with it. The cable connects the float to the indicator on the outside through the cable support for communicating the liquid level in the tank. The cable support comprises a body having two side openings merging into a cavity formed on a top portion of the body. A roller is positioned in the cavity, between the two openings and is rotatable about an axis transverse to the direction of cable movement. The roller has a predetermined axial length that is substantially wider than each of the openings so that the cable moving through the openings is urged to maintain contact with the roller. This prevents the cable from coming off the roller and minimizes jamming.

"CABLE GUIDE SUPPORT FOR CABLE-GUIDED TANK GAUGE"

INVENTORS: Greg McGillis, Dan Theriault and Bob Winterford

FIELD OF THE INVENTION

The present invention relates to the field of cable guide supports. More particularly, the present invention relates to the field of cable-guide supports for use in cable-guided mechanical tank gauge systems.

BACKGROUND OF THE INVENTION

A storage vessel in the form of a tank is commonly used, particularly in the oil and gas industry, for containing liquids and gases. The tank may be equipped with a measuring instrument for determining the amount of liquid in the tank.

The measuring instrument often employed for determining liquid levels in the tank is a mechanical tank gauge. A float is contained in the tank and floats on the liquid. The float is attached to one end of a cable, which is guided by a pulley to the outside of the tank where the other end of the cable is connected to an indicator. Changes in the level of liquid cause the float to move up or down in the tank, which translates to movement of the cable and the indicator to show the new liquid level.

U.S. Patent 5,050,432 issued to Barritt discloses a tank gauge having two pulleys. One of the pulleys is in a sealed housing, while the other pulley is exposed to the outside, on the exterior of the tank. The pulleys are of the conventional grooved-type variety.

There have been problems with this type of design of the pulley for guiding the cable. In particular, the cable has a tendency to rub against the sides of the pulley causing increased wear and slack in the cable over time. This can result in the cable losing contact or slipping off of the pulley. In addition, the configuration of the pulley requires that the cable be aligned centrally in the groove between the two sides for reliable operation. Accordingly, having a two pulley system requires that the pulleys be perfectly aligned with each other and the cable, otherwise the cable will not be centered on the pulley. This can cause unreliable operation of the tank gauge since the cable can impinge on the sides of the pulley, or even get

jammed between the pulley and the pulley support. Furthermore, one of the pulleys is exposed to outside environmental conditions that can affect the performance of the tank gauge. Dirt, debris, snow or ice on the cable, as a result of being exposed to the environment, can cause jamming or impair operability of the tank gauge.

Canadian Patent 1,321,892, issued to Grimes discloses a tank gauge with a pulley rotatable on a shaft. The cable lies in a groove and contacts side flanges of the pulley. The design of the pulley for the tank gauge of this patent is similar to that of Barritt and therefore suffers from the same drawbacks as mentioned above. In particular, the tank gauge provided by Grimes necessitates the use of a tensioner as reduced tension in the cable greatly increases risk of the cable losing contact or disengaging from the pulley. Also, the pulley is not enclosed and is exposed to the outside, which is a concern since the tank gauge is needed to operate year round.

Accordingly, there is a need for an improved tank gauge system that overcomes certain disadvantages of the prior arts.

It is the purpose of the present invention to provide such a tank gauge system and a cable guide support to be used in the system.

SUMMARY OF THE INVENTION

The present invention relates to a cable guide support for a tank gauge. The guide support comprises a body having a top portion, a first side opening at one end and a second side opening at the other end of the body. The top portion has an interior cavity enclosed within the body, which is located between the two openings. The openings extend into the cavity to define a pathway configured to accommodate a cable moving through the pathway.

A cable-engaging element is operatively positioned within the cavity between the first and second openings and in communication therewith for guiding the cable. The cable-engaging element is rotatable about an axis transverse to the direction of cable movement and has a predetermined axial length that is substantially wider than each of the openings so that the cable moving through the openings is urged to maintain contact with the cable-engaging element.

In one embodiment, the present invention provides that the cable-engaging element includes a roller narrowing in diameter towards its approximate center, which is in alignment with the pathway of the cable moving through the openings.

In another embodiment, the cavity containing the cable-engaging element is enclosed and the side openings provide entrance of the cable onto the cable-engaging element.

In another embodiment, the present invention provides a liquid level tank gauge system comprising a float member, a cable, an indicator mechanism, and at least one cable guide support. The float member is positioned within a tank containing liquid and operable to move with the liquid. The cable has a first end and a second end, the first end being associated with the float member. The second end of the cable is associated with the indicator mechanism, which cooperates with the float member movement to measure the liquid level in the tank. The cable guide support is operatively associated with a portion of the tank, between the float member and the indicator mechanism, for guiding the cable. The cable guide support comprises a body having a top portion, a first side opening at one end and a second side opening at the other end thereof. The top portion forms an interior cavity located between the openings that extend into the cavity to define a pathway configured to allow passage of the cable therethrough. A cable-engaging element is operatively positioned within the pathway for guiding the cable. The cable-engaging element being rotatable about an axis transverse to the direction of cable movement and having a predetermined axial length that is substantially wider than each of the openings so that the cable moving through the openings is urged to maintain contact with the cable-engaging element.

The present invention disclosed herein is characterized by certain advantages, in particular:

- the openings merge into the cavity containing the cable-engaging element to provide a pathway for guiding the cable;
- the cable-engaging element is substantially wider than the openings to prevent the cable from coming off the cable-engaging element and minimizes jamming;
- the cable-engaging element narrows in diameter so as to center the cable on it; and

- the cable-engaging element is enclosed to reduce debris and foreign materials from interfering with performance of the cable guide support.

Broadly stated, one aspect of the present invention is a cable guide support, comprising: a body having a top portion, a first side opening at one end and a second side opening at the other end thereof, the top portion forming an interior cavity located between the openings which extend into the cavity to form a pathway configured to accommodate a cable moving therethrough; and a cable-engaging element operatively positioned within the cavity between the first and second openings and in communication therewith for guiding the cable, the cable-engaging element being rotatable about an axis transverse to the direction of cable movement and having a predetermined axial length that is substantially wider than each of the openings so that the cable moving through the openings is urged to maintain contact with the cable-engaging element.

Broadly stated, another aspect of the present invention is a liquid level tank gauge system, comprising: a float member positioned within a tank containing liquid and operable to move with the liquid; a cable having a first end and a second end, the first end being associated with the float member; an indicator mechanism associated with the second end of the cable and cooperating with the float member movement to measure the liquid level in the tank; and at least one cable guide support operatively associated with a portion of the tank, between the float member and the indicator mechanism, for guiding the cable, the guide support comprising a body having a top portion, a first side opening at one end and a second side opening at the other end thereof, the top portion forming an interior cavity located between the openings which extend into the cavity to form a pathway configured to allow passage of the cable therethrough, and a cable-engaging element operatively positioned within the pathway for guiding the cable, the cable-engaging element being rotatable about an axis transverse to the direction of cable movement and having a predetermined axial length that is substantially wider than each of the openings so that the cable moving through the openings is urged to maintain contact with the cable-engaging element.

Other objects, features and advantages of the present invention will become clear from the following detailed description, when read in association with the drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described by way of examples with reference to the following figures wherein:

Figure 1 is a schematic side view of a tank gauge system in accordance with an embodiment of the present invention;

Figure 2 is a front view of an indicator mechanism in accordance with an embodiment of the present invention;

Figure 3 is a perspective view of a cable guide support in accordance with an embodiment of the present invention;

Figure 4 is a top plan view of a cable guide support in accordance with an embodiment of the present invention; and

Figure 5 is a side elevational view of a cable guide support in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

Figure 1 illustrates tank gauge system **10** mounted on tank **12** that contains liquid **14**, such as oil, drilling mud, petroleum, water, chemicals or the like. Tank gauge system **10** comprises a float member **16**, a cable **18**, a cable guide support **20** and an indicator mechanism **22**. Float member **16** has a predetermined weight and buoyancy so as to float in liquid **14**. Float member **16** follows the change in the level of liquid **14** in tank **12**. Design, configuration and material used in construction of float member **16** are known to those skilled in the art. Materials such as corrosive resistant plastics, PVC and metals having particular desirable properties that are resistant to the nature of the liquid **14** may be used.

In a representative embodiment, float member **16** is connected to cable **18**, which can be made of stainless steel, through clip **24** that enables float member **16** to be detached, when desired. Other types of connectors, known to those skilled in the art, for connecting float member **16** to cable **18** may be used such as a swivel (not shown). Cable **18** extends from

float member **16** up tank **12**, through an adaptor **26** and nut **28** in a top part **30** of tank **12**. Cable guide conduit **25** is located on top part **30** of tank **12** allows communication between float member **16** and indicator mechanism **22** located exterior of tank **12**. Cable guide conduit **25** consists of conduit sections **29a**, **29b**, and **29c**, in combination with cable guide supports **20** and **20a** to from an inverted U-shaped cable conduit system.

Each guide supports **20, 20a** is positioned along top part **30** of tank **12** at a predetermined distance from each other. Each of cable guide supports **20, 20a** is mutually aligned with conduit sections **29a**, **29b**, and **29c**. Section **29a** has one end mounted to adaptor **26** and section **29c** has one end mounted to a clamping block **31** to secure to indicator mechanism **22.** This enables free movement of cable **18** between float member **16** and indicator mechanism **22** through cable guide supports **20, 20a**.

Indicator mechanism **22** includes a gauge board **32** and an indicator bar **34**. Their design and construction is well known to those skilled in the art. While different configurations of gauge board **32** may be fabricated depending on the application, gauge board **32** is generally made to correspond with tank **12** height. In the embodiment shown in Figure 1, gauge board **32** is made from aluminum having a mounting bracket **36** to secure gauge board **32** to a side portion **37** of tank **12**. Mounting bracket **36** can be secured to tank **12** using welds, adhesive, magnets or any other means as known by those skilled in the art.

Figure 2 shows a representative gauge board **32** marked with desired units of measurement **33**, depending on the application. Gauge board **32** can be provided in multiple pieces that are joined through board joiners **41** during assembly. Indicator bar **34** is connected to cable **18** and slides along gauge board **32** corresponding to the level of liquid in tank **12**, as indicated by changes in position of float member **16** within tank **12**. Guides **38, 38a** are fitted to an inside portion **40** of indicator bar **34** to enable it to glide smoothly along gauge board **32**. While the construction and configuration of the guides are not essential to the invention, guides **38, 38a** may be made from plastic, or coated with teflon, all known to those skilled in the art. It is preferred that gauge board **32** has a bottom bracket **39** for limiting the movement of indicator bar **34.**

Referring now to Figure 3, showing cable guide support **20** comprising a body **42**. In a representative embodiment, body **42** is constructed from PVC and can be configured to

form an elbow **44** having a first side opening **46** and a second side opening **48**. The two openings **46, 48** lead into cavity **50** having sidewalls **52** that slope downwardly from top portion **53** of body **42** towards its interior. Pathway **54** extends between one side opening **46**, cavity **50** and the other side opening **48**. Openings **46, 48** are mutually aligned along pathway **54** for accepting cable **18**. Pathway **54** is configured to accommodate differently sized cables **18**. Top portion **53** of body **42** is planar with cavity **50** formed generally at the center of body **42** as representatively illustrated in Figure 3, whereby cavity **50** is enclosed within body **42** when lid **70** is attached to body **42**.

As shown in Figure 4, a cable-engaging element is operatively positioned in cavity **50** between openings **46, 48** so as to guide cable **18** moving in pathway **54**. In one embodiment, the cable-engaging element can be roller **56**. Roller **56** can be a cylindrical member, or the like, having bore **55** for receiving axle **58** that extends across lower part **60** of cavity **50**. Roller **56** is freely rotatable on axle **58**. In one embodiment, axle **58** is secured to sidewalls **52** of cavity **50** using locking washer **62**. Other means for securing axle **58** to sidewalls **52** known to those skilled in the art may be used, such adhesive, locking mechanism, or plastic weld.

Roller **56** includes planar end surfaces **64**. The width of roller **56** is selected such that it is slightly narrower than the width of cavity **50**. This allows end surfaces **64** to be in close proximity to opposing sidewalls **52** while not impeding free rotation of the roller **56** on axle **58**. In one embodiment, roller **56** narrows in diameter towards its approximate center **57** that is in alignment with pathway **54**. The axial length of roller **56** is substantially wider than each of openings **46, 48**, when viewed through the openings, so that cable **18** is prevented from slipping between end surfaces **64** and sidewalls **52**.

Referring now to Figure 5, one embodiment of the present invention is shown including lid **70**. Lid **70** includes holes **72, 72a** passing through top surface **74** for fasteners **76** to pass therethrough and secure lid **70** to top portion **53** of body **42**. As shown in Figures 3 and 5, sealing element **78** is provided to provide a seal between lid **70** and top portion **53**. Sealing element **78** can be a rubberized washer or a gasket. Sealing element **78** includes rectangular opening **79,** mating surfaces **80, 80a** and holes **81, 81a**. Sealing element **78** is sandwiched between lid **70** and top portion **53** when fasteners **76** are secured to body **42**. Although lid **70** is provided in this embodiment as a separate element for enclosing cavity **50**,

it should be obvious to one skilled in the art that body **42** may be fabricated as a sealed, one-piece unit having side openings **46, 48** and roller **56** mounted in cavity **50** within body **42**.

Although a few embodiments have been shown and described, it will be appreciated by those skilled in the art that various changes and modifications might be made without departing from the scope of the invention. The terms and expressions used in the preceding specification have been used herein as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims that follow.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A cable guide support, comprising:

a) a body configured to form an elbow, the body having a top portion, a first side opening at one end and a second side opening at the other end thereof, the top portion forming an interior cavity enclosed within the body, the cavity located between the openings which extend into the cavity to form a pathway configured to accommodate a cable moving therethrough; and

b) a cable-engaging element operatively positioned within the cavity between the first and second openings and in communication therewith for guiding the cable, the cable-engaging element being rotatable about an axis transverse to the direction of cable movement and having a predetermined axial length that is substantially wider than each of the openings so that the cable moving through the openings is urged to maintain contact with the cable-engaging element.

2. The cable guide support as set forth in claim 1 wherein the cable-engaging element narrows in diameter towards its approximate centre and is in alignment with the pathway of the cable moving through the openings.

3. The cable guide support as set forth in claim 2 wherein the cable-engaging element comprises a roller having a bore extending therethrough for receiving an axle, the roller being freely rotatable on the axle securely positioned at a lower part of the cavity extending thereacross, from one sidewall to the opposite sidewall, the roller having opposing side surfaces configured to lie sufficiently close against the sidewalls while not impeding rotation of the roller on the axle.

4. The cable guide support as set forth in any one of claims 1 to 3 further comprising a lid associated with the body and being configured to engage with the top portion to enclose the cavity within the body.

5. The cable guide support as set forth in claim 4 further comprising a fastener for removably securing the lid to the top portion of the body.

6. The cable guide support as set forth in claim 4 further comprising a sealing element sealingly positioned between the top portion of the body and the lid.

7. The cable guide support as set forth in claim 6 wherein the sealing element is a rubberized washer or gasket having mating surfaces conforming to the top portion of the body and the lid.

8. The cable guide support as set forth in claim 4 wherein the body and the lid is a one-piece construction.

9. A liquid level tank gauge system, comprising:

a) a float member positioned within a tank containing liquid and operable to move with the liquid;

b) a cable having a first end and a second end, the first end being associated with the float member;

c) an indicator mechanism associated with the second end of the cable and cooperating with the float member movement to measure the liquid level in the tank; and

d) at least one cable guide support operatively associated with a portion of the tank, between the float member and the indicator mechanism, for guiding the cable, the guide support comprising:

i) a body having a top portion, a first side opening at one end and a second side opening at the other end thereof, the top portion forming an interior cavity located between the openings which extend into the cavity to form a pathway configured to allow passage of the cable therethrough, and

ii) a cable-engaging element operatively positioned within the pathway for guiding the cable, the cable-engaging element being rotatable about an axis transverse to the direction of cable movement and having a

predetermined axial length that is substantially wider than each of the openings so that the cable moving through the openings is urged to maintain contact with the cable-engaging element.

10. The liquid level tank gauge system as set forth in claim 9 wherein the indicator mechanism is sufficiently weighted such that the cable is taut and freely moveable on the cable guide support.

11. The liquid level tank gauge system as set forth in claim 10 wherein the indicator mechanism includes a gauge board mounted along a sidewall of the tank and an indicator bar configured to slide along the gauge board.

12. The liquid level tank gauge system as set forth in claim 9 wherein one of the cable guide supports is mounted on a portion of the tank at a predetermined distance from the float member and a second cable guide support is aligned therewith.

13. The liquid level tank gauge system as set forth in claim 11 wherein the gauge board is mounted using a magnetic bracket for releasably coupling the gauge board to the sidewall of the tank.

14. The liquid level tank gauge system as set forth in claim 11 wherein the gauge board is mounted to the tank sidewall with a welded bracket.

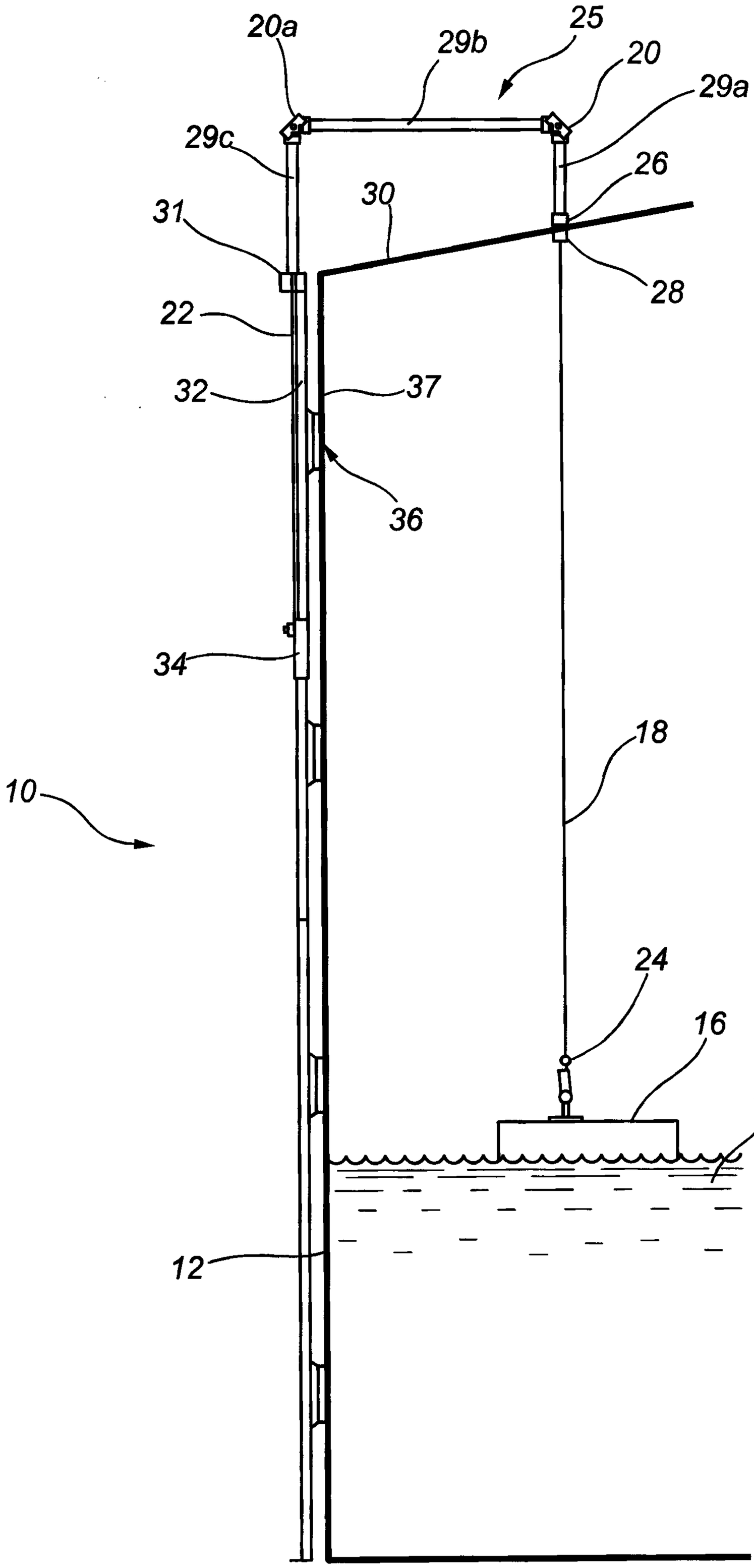

FIG. 1

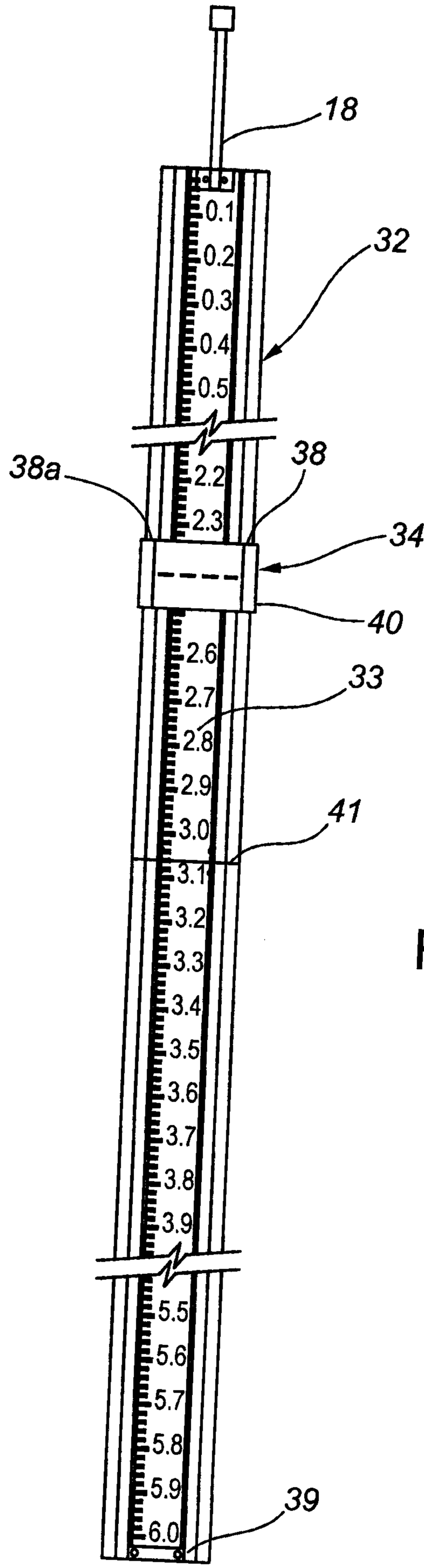
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FIG. 2

FIG. 3

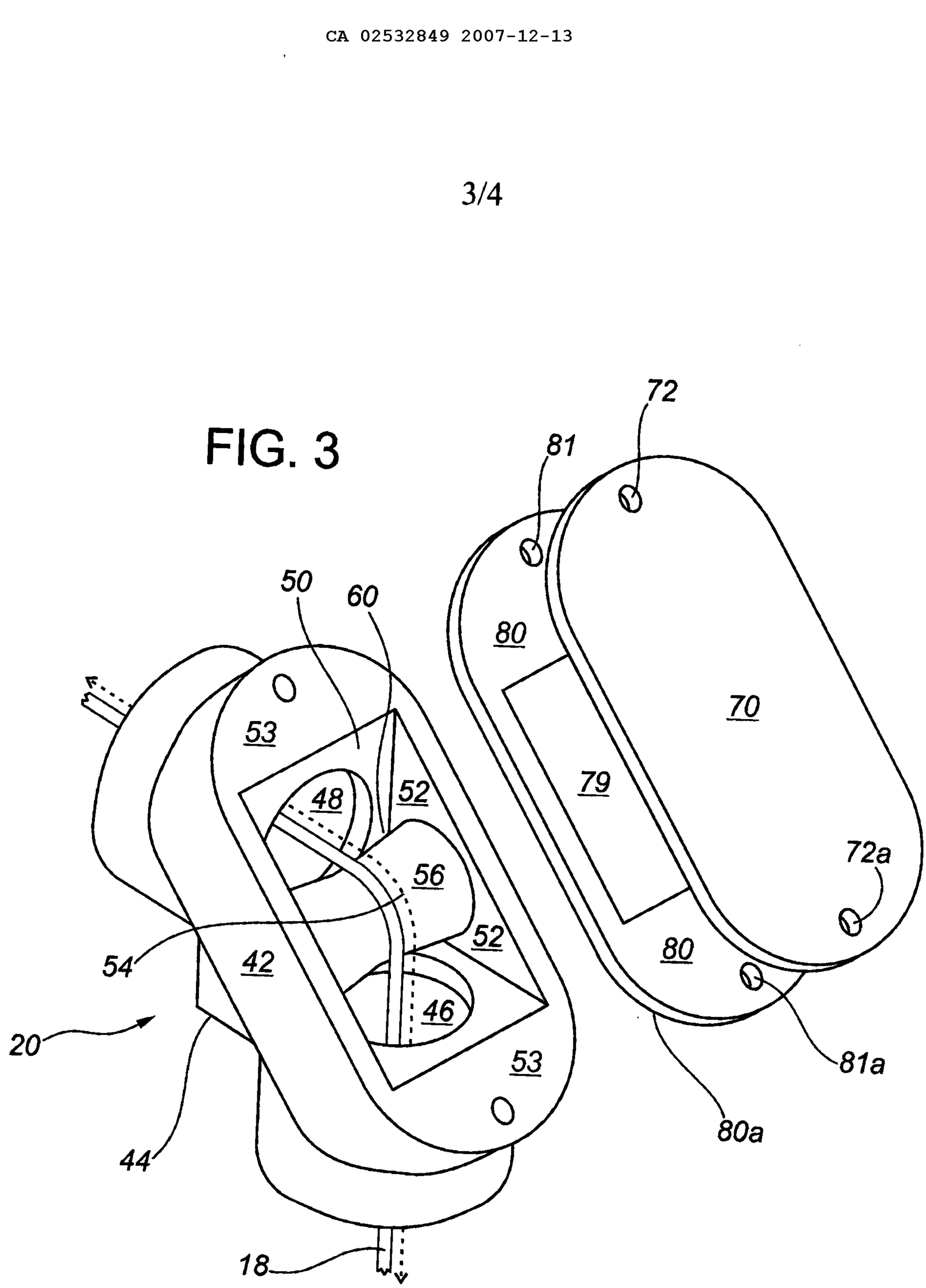

FIG. 4

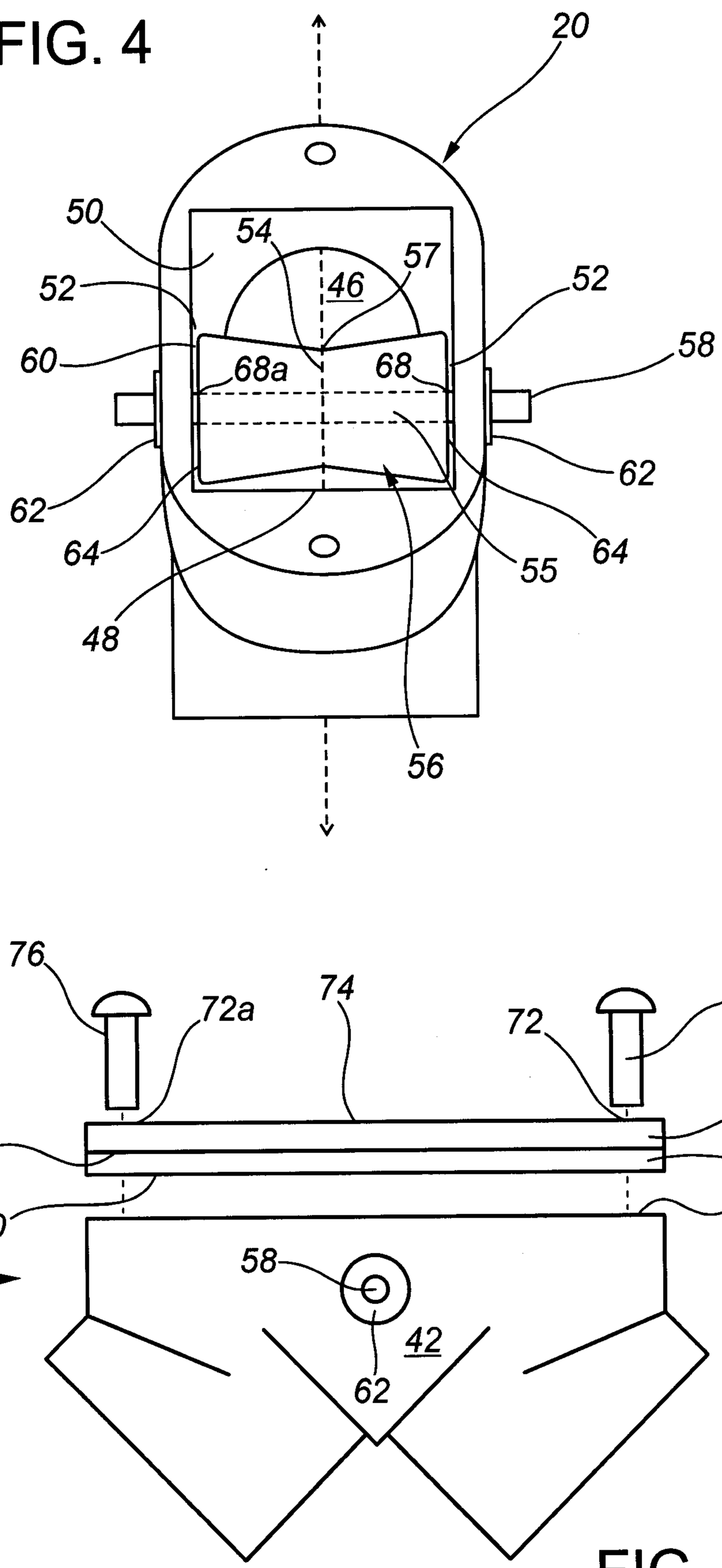
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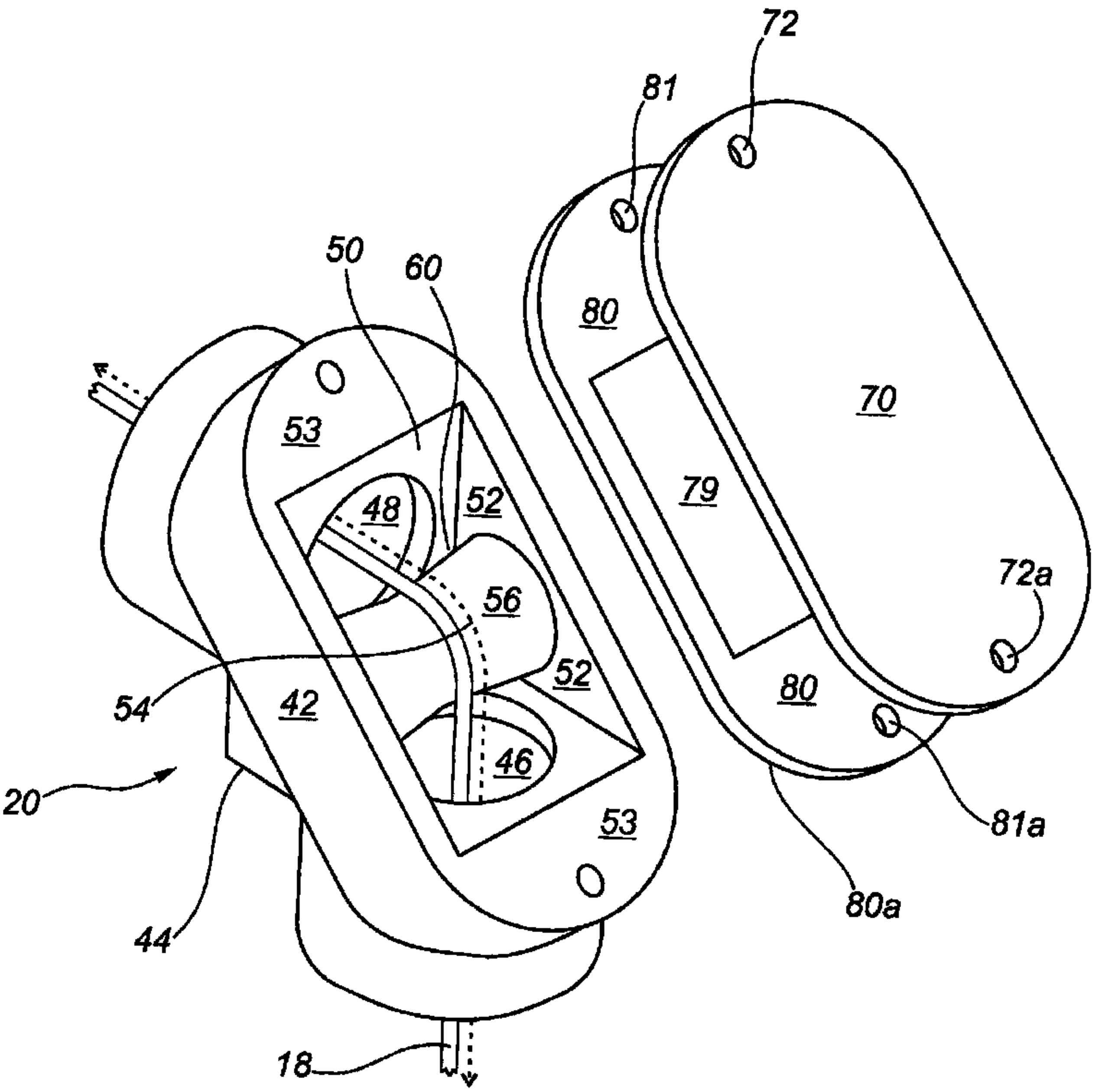
FIG. 5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