



(22) Date de dépôt/Filing Date: 2000/05/15

(41) Mise à la disp. pub./Open to Public Insp.: 2000/11/19

(45) Date de délivrance/Issue Date: 2004/08/10

(30) Priorité/Priority: 1999/05/19 (09/315,218) US

(51) Cl.Int.⁷/Int.Cl.⁷ E21B 21/06

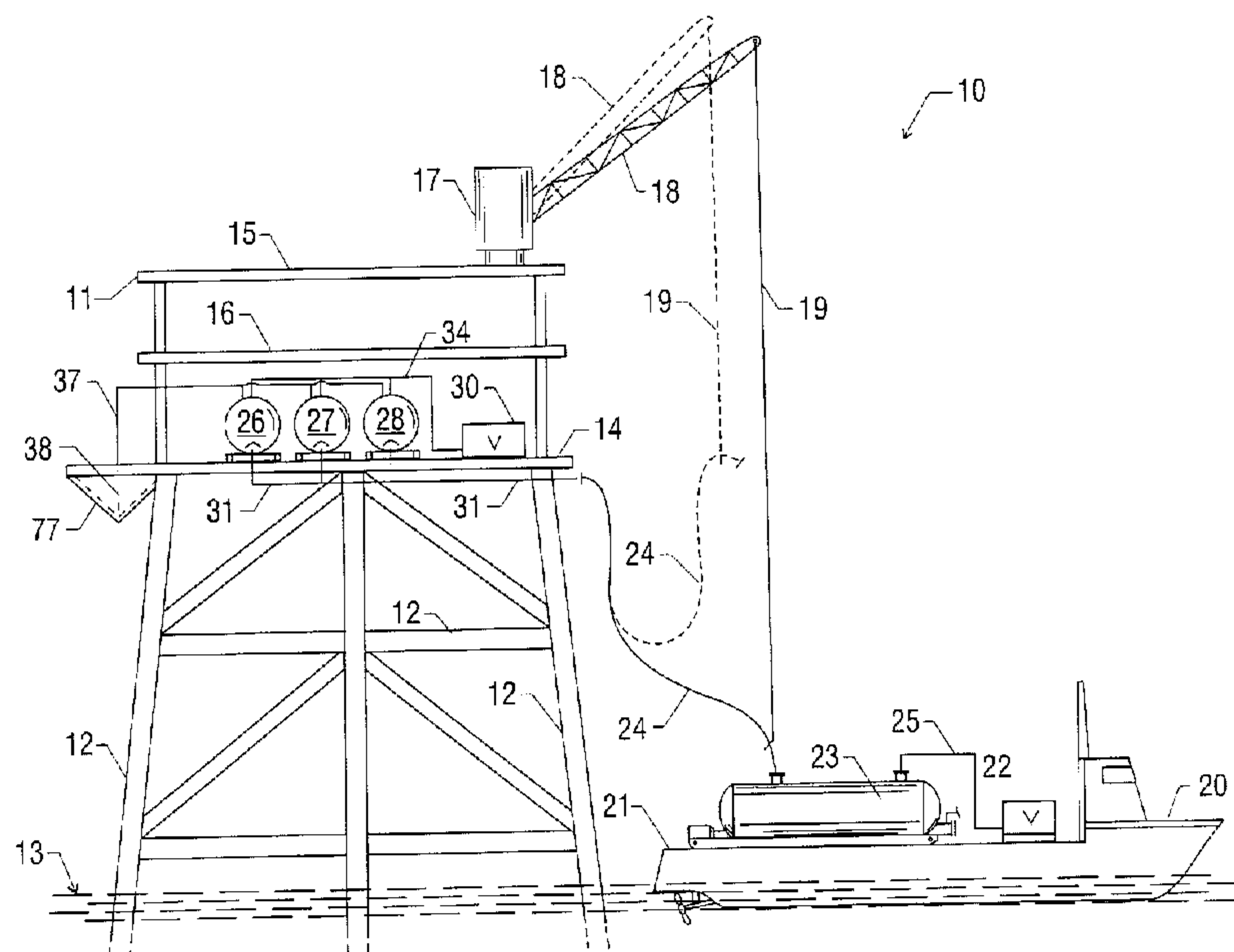
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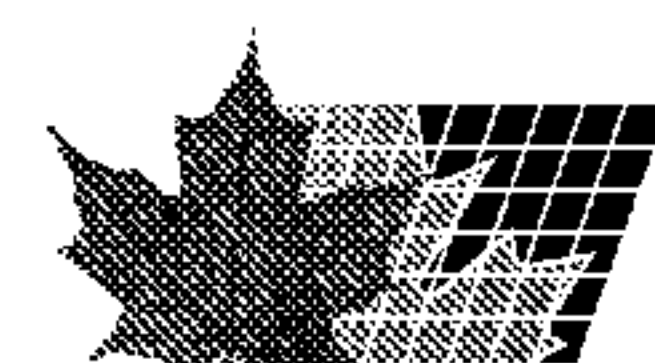
(54) Titre : METHODE ET APPAREIL POUR LA MANUTENTION ET L'EVACUATION DE DEBRIS DE FORAGE DE
PUITS DE PETROLE ET DE GAZ

(54) Title: METHOD AND APPARATUS FOR HANDLING AND DISPOSAL OF OIL AND GAS WELL DRILL CUTTINGS



(57) Abrégé/Abstract:

A method and apparatus for removing drill cuttings from an oil and gas well drilling platform provides for the separation of drill cuttings from at least a volume of the well drilling fluid (i.e. drilling mud) on the drilling platform so that the drilling fluids can be recycled into the well bore. The cuttings are then transferred to a cuttings collection receptacle (eg. trough) on the platform. The separated drill cuttings are then suctioned with a first suction line having an intake portion. The suctioned drill cuttings are transmitted to a processing tank (or multiple such tanks) on the platform, each having a tank interior. A vacuum is formed within the processing tank interior with a blower that is in fluid communication with the tank interior via a second vacuum line. The tank is connected to a floating work boat with a discharge flow line. Cuttings are processed within the tank, being chopped or cut into smaller size particles with a pump that is preferably contained within the processing tank. Cuttings are slurrified or liquefied in the processing tank, then transmitted from the tank to the work boat via the flow line. Multiple holding tanks can be positioned on the drilling platform for storage of cuttings until a work boat arrives. The work boat can be provided with one or more high capacity work boat holding tanks (for example 100-1000 barrels) for receiving cuttings from the multiple holding tanks on the drilling platform when disposal is desired.



**METHOD AND APPARATUS FOR HANDLING AND DISPOSAL OF
OIL AND GAS WELL DRILL CUTTINGS**

ABSTRACT OF THE DISCLOSURE

5 A method and apparatus for removing drill cuttings from an oil and gas well drilling platform provides for the separation of drill cuttings from at least a volume of the well drilling fluid (i.e. drilling mud) on the drilling platform so that the drilling fluids can be recycled into the well bore. The cuttings are then
10 transferred to a cuttings collection receptacle (eg. trough) on the platform. The separated drill cuttings are then suctioned with a first suction line having an intake portion. The suctioned drill cuttings are transmitted to a processing tank (or multiple such tanks) on the platform, each having a tank interior. A vacuum is
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20 preferably contained within the processing tank. Cuttings are slurried or liquified in the processing tank, then transmitted from the tank to the work boat via the flow line. Multiple holding tanks can be positioned on the drilling platform for storage of cuttings until a work boat arrives. The work boat can be provided
25 with one or more high capacity work boat holding tanks (for example 100-1000 barrels) for receiving cuttings from the multiple holding tanks on the drilling platform when disposal is desired.

TITLE OF THE INVENTION

"METHOD AND APPARATUS FOR HANDLING AND DISPOSAL OF
OIL AND GAS WELL DRILL CUTTINGS"

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

10 The present invention relates to oil and
gas well drilling and more particularly to the
handling of cuttings that are generated during
oil and gas well drilling activity. Even more
particularly, the present invention relates to an
improved method and apparatus for handling cuttings
that are generated during oil and gas well

drilling and in oil and gas exploration. Tanks are provided on an oil and gas well drilling platform and on a work boat positioned next to the platform. Both the platform and work boat have vacuum units that help transfer cuttings from the platform to the work boat. Processing units can be used to slurrify or liquify the cuttings, either on the platform or on the boat. The liquified or slurried cuttings can be treated to obtain a desired particle size and/or viscosity.

2. General Background of the Invention

10 In the drilling of oil and gas wells, a drill bit is used to dig many thousands of feet into the earth's crust. Oil rigs typically employ a derrick that extends above the well drilling platform and which can support joint after joint of drill pipe connected end to end during the drilling operation. As the drill bit is pushed farther and farther into the earth, additional pipe joints are added to the ever lengthening "string" or "drill string". The drill pipe or drill string thus comprises a plurality of joints of pipe, each of which has an internal, longitudinally extending bore for carrying fluid drilling mud from the well drilling platform through the drill string and to a drill bit supported at the lower or distal end of the drill string.

Drilling mud lubricates the drill bit and carries away well cuttings generated by the drill bit as it digs deeper. The cuttings are carried in a return flow stream of drilling mud through the well annulus and back to the well drilling platform at the earth's surface. When the drilling mud reaches the surface, it is contaminated with small pieces of shale and rock which are known in the industry as well cuttings or drill cuttings.

Well cuttings have in the past been separated from the reusable drilling mud with commercially available separators that are known as "shale shakers". Other solids separators include mud cleaners and centrifuge. Some shale shakers are designed to filter coarse material from the drilling mud while other shale shakers are designed to remove finer particles from the well drilling mud. After separating well cuttings therefrom, the drilling mud is returned to a mud pit where it can be supplemented and/or treated prior to transmission back into the well bore via the drill string and to the drill bit to repeat the process.

The disposal of the separated shale and cuttings is a complex environmental problem. Drill cuttings contain not only the mud product which would contaminate the surrounding environment, but also can contain oil that is particularly hazardous to the environment, especially when drilling in a marine environment.

In the Gulf of Mexico for example, there are hundreds of drilling platforms that drill for oil and gas by drilling into the subsea floor. These drilling platforms can be in many hundreds of feet of water. In such a marine environment, the water is typically crystal clear and filled with marine life that cannot tolerate the disposal of drill cuttings waste such as that containing a combination of shale, drilling mud, oil, and the like. Therefore, there is a need for a simple, yet workable solution to the problem of disposing of oil and gas well cuttings in an offshore marine environment and in other fragile environments where oil and gas well drilling occurs.

Traditional methods of cuttings disposal have been dumping, bucket transport, cumbersome conveyor belts, screw conveyors, and washing techniques that require large amounts of water. Adding water creates additional problems of added volume and bulk, messiness, and transport problems. Installing conveyors requires major modification to the rig area and involves many installation hours and very high cost.

Patents that relate generally to well cuttings and/or disposal of well cuttings include U.S. patents 4,255,269 issued to Timmer and entitled "Method and Apparatus for Adapting the Composition of a Drilling Fluid for Use in Making a Hole in the Earth by Rotary Drilling". Another patent that relates to drilling and specifically the disposal of drill cuttings is the Dietzen patent 4,878,576 entitled "Method for Accumulating and Containing Borehole Solids and Recovering Drilling Fluids and Water on Drilling Rigs".

The Hansen patent 4,867,877 discloses a waste removal and/or separation system for removing liquid and solid wastes simultaneous from waste holding tanks or vessels.

A drill cuttings disposal method and system is disclosed in the Jackson patent 5,129,469. In the Jackson '469 patent, drill cuttings are disposed of by injecting into a subsurface formation by way of an annular space formed in a wellbore. The cuttings are removed from the drilling fluid, conveyed to a shearing and

grinding system that converts the cuttings into a viscous slurry with the addition of water. The system comprises a receiving tank and a centrifugal pump for recirculating the mixture of cuttings and water (sea water) between the pump and the receiving tank. A
5 discharge conduit is connected to the pump for moving the viscous slurry to an injection pump for high pressure injection into the formation. In the Prestridge et al. patent 5,303,786, drill cuttings a similar earth materials are reduced in particle size, slurried and disposed of from a system which includes a ball mill,
10 a reduced particle receiving tank, a grinder pump and communication with the receiving tank and separator screens for receiving a slurry of particles which have been reduced in size through the ball mill and the grinder pump. The underflow of the separator is suitable for discharge for final disposal, oversized particles are
15 returned to the ball mill and the underflow discharged from the separator is controlled to maintain a certain level in the primary receiving tank. A secondary tank may receive a portion of the underflow to be mixed with viscosifiers and dispersants to maintain a suitable slurry composition for discharge. The system may be
20 mounted on a semi trailer and in weatherproof enclosures with the ball mill, receiving tanks and grinder pump on a first level and the separators on the second level. Receiving hoppers for wet drill cuttings as well as frozen or dried cuttings are provided and water or steam may be mixed with the cuttings and conveyed by a
25 bucket elevator from a first level to a second level of the enclosures.

The Angelle patents 5,662,807 and 5,846,440 disclose an apparatus and method for handling waste. The apparatus includes a container having disposed thereon a rail member. The apparatus
30 also contains a trolley mounted on the rail. The trolley has operatively associated therewith a handling system that has a wiper that extends into the container. The apparatus may also contain an auger, operatively mounted on the container, adapted for removing the waste from the container. A process for handling a
35 discharged waste slurry is also disclosed. The Angelle patents discuss application to oil and gas well drilling and the fact that drilling fluid is an essential component of the drilling process and that the drilling fluid will contain solids which comprise rock and shale cuttings.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a method for disposal of drill cuttings from an oil and gas well drilling platform. The method includes the steps of separating the drill cuttings from substantially all of the well drilling fluid in which the drill cuttings have been conveyed from an area being drilled.

The cuttings are then transferred to a materials collection area on a drilling platform or tower such as a materials collection trough. The drill cuttings are then transported to a holding tank using a vacuum and a first suction line.

A vacuum is generated within the holding tank using a blower so that drill cuttings are transported from the trough or collections area to the tank via a suction line.

Cuttings are then transferred from the holding tank to a work boat via a flow line. Further treatment such as recycling of drilling mud can be performed on the boat.

The drill cuttings are typically transported directly to a holding tank via a first suction line.

The vacuum is generated by a vacuum generating means or blower that is in fluid communication with the holding tank via a second suction line.

The work boat preferably provides its own holding tank of very large volume such as 100-1000 barrels. The holding tank on the work boat is likewise provided with a blower that pulls a vacuum on the tank to aid in transfer of cuttings from the holding tanks on the platform to the holding tank on the work boat.

In one embodiment, the boat is equipped with treatment units that process the cuttings. The cuttings can be slurried on one deck of the boat and then pumped for storage to another deck area on the boat. In yet another embodiment, the boat is equipped with treatment apparatus that separates and recycles drilling fluids such as more expensive synthetics. In a second embodiment, the work boat collects cuttings transferred to it from the drilling platform. The platform or tower has processing equipment that can slurrify or liquify cuttings to produce a desired particle size or viscosity.

BRIEF DESCRIPTION OF THE DRAWINGS

For a further understanding of the nature, objects, and advantages of the present invention, reference should be had to the following detailed description, read in conjunction with the following drawings, wherein like reference numerals denote like elements and wherein:

Figures 1-1A are elevational views of the preferred embodiment of the apparatus of the present invention;

Figure 2 is a partial elevational view of the preferred embodiment of the apparatus of the present invention;

Figure 3 is a sectional view taken along lines 3-3 of Figure 2;

Figure 3A is a sectional view illustrating an alternate construction for the tank shown in Figures 2 and 3;

Figure 4 is a fragmentary elevational view of the preferred embodiment of the apparatus of the present invention illustrating the boat, vacuum unit and tank situated on the deck of the boat;

Figure 5 is an elevational view of the preferred embodiment of the apparatus of the present invention showing an alternate arrangement of storage tanks on the work boat portion thereof;

Figure 6 is a plan view of the preferred embodiment of the apparatus of the present invention showing the work boat configuration of Figure 5;

Figure 7 is an elevational view of the preferred embodiment of the apparatus of the present invention showing an alternate arrangement of storage tanks on the work boat portion thereof;

Figure 8 is a top, plan view of the work boat of Figure 7;

Figure 9 is an elevational view of the preferred embodiment of the apparatus of the present invention showing another alternate arrangement of storage tanks on the work boat portion thereof;

Figure 10 is a top, plan view of the work boat of Figure 9;

Figure 11 is a schematic diagram showing the preferred embodiment of the apparatus of the present invention and utilizing the work boat of Figures 7 and 8;

Figure 12 is a schematic diagram of the preferred embodiment of the apparatus of the present invention and utilizing the work

boat of Figures 9 and 10;

Figure 13 is a sectional view taken along lines 13-13 of Figure 5;

Figures 14 and 15 are fragmentary perspective views of the preferred embodiment of the apparatus of the present invention showing the hose used to off load cuttings from rig to boat;

Figure 16 is an elevational view of an underwater storage tank for use with the method of the present invention and showing an alternate apparatus of the present invention;

Figure 17 is an end view of the underwater storage tank of Figure 7;

Figure 18 is a perspective view of the storage tank of Figures 7 and 8 while in tow; and

Figure 19 is a schematic view of the alternate embodiment of the apparatus of the present invention and showing the alternate method of the present invention using an underwater storage tank.

Figure 20 is a fragmentary perspective view of a second embodiment of the apparatus of the present invention;

Figure 21 is a sectional view taken along lines 21-21 of Figure 20;

Figure 22 is a sectional view taken along lines 22-22 of Figure 20;

Figure 23 is a fragmentary elevational view of the processing tank portion of the second embodiment of the apparatus of the present invention;

Figure 24 is a schematic elevational view of the second embodiment of the apparatus of the present invention;

Figure 25 is a schematic view of the second embodiment of the apparatus of the present invention;

Figure 26 is a side elevational view of the processing tank portion of the second embodiment of the apparatus of the present invention.

For a further understanding of the nature, objects, and advantages of the present invention, reference should be had to the following detailed description, read in conjunction with the following drawings, wherein like reference numerals denote like

elements and wherein:

DETAILED DESCRIPTION OF THE INVENTION

Figures 1-1A and 11-12 show generally the preferred embodiment
5 of the apparatus of the present invention and the method of the
present invention, designated generally by the numeral 10 in
Figures 1, 1A and by the numerals 10A, 10B in Figures 11, 12
respectively. In Figure 1, a jack-up rig type drilling vessel is
shown for use with the method and apparatus of the present
10 invention. In Figure 1A, a fixed drilling platform is shown.
Cuttings disposal apparatus 10 is shown in Figures 1-1A in an
offshore marine environment that includes an offshore oil and gas
well drilling platform 11. The platform 11 (Figure 1A) can include
a lower support structure or jacket 12 that extends to the ocean
15 floor and a short distance above the water surface 13. The
platform 11 can also be a jack-up rig (Fig. 1) or a semi-
submersible. A superstructure is mounted upon the jacket 12 or
upon jack-up rig legs 12A, the superstructure including a number
of spaced apart decks including lower deck 14, upper deck 15 and
20 in Figure 1A an intermediate deck 16. Such a platform 11 typically
includes a lifting device such as crane 17 having boom 18 and
lifting line 19. In general, the concept of an offshore oil and
gas well drilling platform is well known in the art.

In Figures 1A and 4-10, a work boat 20 is shown moored next
25 to platform 11 for use in practicing the method of the present
invention. Work boat 20 has deck 21 that supports vacuum unit 22,
vacuum lines 25, and one or more storage tanks 23. In Figures 5-
10, multiple tanks are provided, designated respectively by the
numerals 23A-23E in Figures 5-6 and designated respectively of the
30 numerals 101, 103 in Figures 7-10.

The drilling platform or drilling rig 11 supports one or more
tanks for holding cuttings that have been removed from the well
bore during drilling, such as the plurality of rig tanks 26, 27,
28 in Figure 1A and tanks 26, 27, 28, 29 in Figure 1.

35 The tanks 23 and 23A-23E on boat 20 are preferably very large
tanks, each having a volume of between for example between 100 and

1000 barrels. The tanks 26-29 on platform 11 can be, for example, between about 50 and 1000 barrels in volume each. A suction line 24, 24A, 24B can be used to form a removable connection between the plurality of rig vacuum tanks 26, 27, 28, 29 and the boat storage tanks 23 or 23A-23E. The suction line 24 can be attached for example to a discharge manifold 31 (see Figures 1, 1A and 2). In another embodiment, (see Figures 7-10), the suction line 24 can be used to transmit cuttings from tanks 26, 27, 28, 29 to an underwater storage tank, as will be described more fully hereinafter. In Figures 14, 15, a connection arrangement is shown for joining line 24 between platform 11 and boat 20.

During oil and gas well drilling operations, a receptacle on rig 11 such as trough 77 receives drill cuttings that are removed from the well bore and preferably after those drill cuttings have been subjected to solids control, such as the removal of drilling fluids (e.g. drilling mud) therefrom.

Cuttings in trough 77 are moved from the trough 77 to one or more of the storage tanks 26, 27, 28, 29 using a vacuum unit 30. Vacuum unit 30 is connected to suction manifold 34 as shown in Figures 1A and 2. Arrow 39 in Figure 2 shows the direction of air flow in header 34. The suction manifold 34 communicates between vacuum unit 30 and each of the rig vacuum tanks 26, 27, 28, 29 via a spool piece or suction line 35. The suction line 35 includes valve 36 for valving the flow of air from each tank 26, 27, 28, 29 to vacuum unit 30 via suction manifold 34. An additional suction manifold 37 communicates with each of the tanks 26, 27, 28, 29 and with trough 77 via suction intake 38. In this fashion, valving enables cuttings to be transmitted to any selected tank 26, 27, 28, 29.

Valves 36 control flow of cuttings between each tank 26, 27, 28, 29 and manifold 37. Pressurized air from supply header 45 can be injected into discharge line 32 downstream of valve 33 to assist the flow of cuttings. Valves 48 can be used to valve such air flow. Once vacuum unit 30 is activated, drill cuttings in trough 77 are suctioned from trough 29 using the intake 38 end of header 37. The intake end 28 of suction header 37 can be in the form of

a 3"-8" flexible hose, for example. Cuttings can then be transmitted via header 37 to the desired tank 26, 27, 28 or 29.

Figures 2, 3, 3A and 13 show the construction of one of the rig vacuum tanks 26, 27, 28, 29 more particularly. In Figure 3, 3A, the tank 28 is shown as a pressure vessel capable of holding a desired vacuum or pressure valve and having an interior 40 surrounded by cylindrically shaped side wall 41 and two dished end portions 42, 43. At the lower end of tank 28 interior 40, an auger or augers 44 can be used to transfer cuttings that settle in tank 28 to discharge line 32. The well drill cuttings can then enter manifold 31. A valve 33 can be positioned in between each tank 26, 27, 28 and discharge line 32 for valving the flow of cuttings from the tank interior 40 to discharge manifold 31. Auger 44 can be operated by motor drive 46, having a geared transmission as an interface between motor drive 46 and auger 44.

The tank 28 in Figure 3A has some features that are optional and additional to the tank 28 of Figure 3. Tank 28 in Figure 3A has a cylindrically shaped side wall 41 and dished end portions 42, 43. Augers 44 can be used to transfer cuttings that settle in tank 28 to discharge 32. Drilling fluid to be recycled can be suctioned from interior 40 of tank 28 using suction line 78 that is adjustable up and down as shown by arrow 91 in Figure 3A. The suction line 78 can be used to recycle drilling fluid after solids within the interior 40 of tank 28 have settled, leaving the drilling fluid as the upper portion of the material contained within interior 40 of tank 28. Suction line 79 fits through sleeve 80 that can be fitted with a set screw, pin, taper lock fitting or similar fitting to grasp suction line 78 at the desired elevational position.

In Figures 14 and 15, a connection is shown that can be used to join the hose 24 that transmits cuttings from the rig 11 to the boat 20. In Figures 14 and 15, the hose 24 can be in two sections, 24A, 24B that are joined together using fittings 99A-99B. Crane lift line 19 attaches with its lower end portion to fitting 96 using a hook, for example, and an eyelet on the fitting 96 as shown in Figure 14. The fitting 96 can include a pair of spaced apart

transversely extending pins 97, 98 that fit recesses 94, 95 respectively on respective saddle plates 92, 93 that are welded to the rig 11 as shown in Figure 14. In this fashion, the rig operator can raise the lower portion 24B of hose 24 upwardly until
5 the pins 97, 98 engage the recesses 94, 95 as shown in Figure 15. With the hose lower end portion 94B so supported by the saddle plates 92, 93, the pins 97, 98 rest in the recesses 94, 95. A rig operator then connects the coupling member 99A to the coupling member 99B as shown in Figures 14 and 15. The upper end portion
10 24A of hose 24 can be connected to header 31 as shown in Figure 1.

Figures 7-8 and 11 shown an alternate arrangement of the apparatus of the present invention that incorporates optional treatment features on the boat 20. In of Figures 7, 8 and 11, the
boat 20 is shown outfitted with storage tanks 103 in addition to
15 optional processing equipment that further processes the mixture of cuttings and drilling fluids that are transmitted to the boat 20 via flow line 24.

In Figures 7 and 8, the vessel 20 has an upper deck 100 with a plurality of tanks 101 stored under the deck 100 in hold 102, and
20 a second plurality of tanks 103 above deck 100 as shown in Figures 7 and 8. Vacuum system 22 on the boat 20 can pull a vacuum on any selected one of the tanks 26-29. Each rig tank 26-29 in Figure 11 provides a discharge that communicates with discharge header 31. The tanks 26-29 are constructed in accordance with the tank 28 of
25 Figure 3 or 3A.

In Figures 7-8 and 11, the boat 20 is provided with optional equipment to further treat the cuttings that are collected in the plurality of tanks 103 after the cuttings or a mixture of cuttings and drilling fluid has been transferred via flow line 24 to the
30 boat 20.

The cuttings received in the plurality of tanks 103 on the upper deck 100 of vessel 20 are further treated to slurrify the combination of cuttings and drilling fluid in order to obtain a desired particle size and a desired viscosity. This enables this
35 further treated mixture of cuttings and fluid to be pumped into tanks 101 that are under deck 100. In this fashion, storage can

be maximized by slurrifying, and storing the cuttings/drilling fluid mixture in the tanks 101 that are under deck 100 in hold 102.

In Figures 7, 8 and 11, the flow line 24 transmits cuttings to header 104 that is valved with valves V so that incoming
5 cuttings can be routed to any particular of the tanks 103 as desired. Vacuum unit 22 on boat 20 can pull a vacuum through header 105 on any selected tank 103. This is because each of the tanks 103 is valved with valves V between the tank 103 and header 105. A walkway 106 accessible by ladder 107 enables an operator
10 to move between the various valves V and headers 104, 105 when it is desired to open a valve V or close a valve V that communicates fluid between a header 104 or 105 and a tank 103.

By closing all of the valves V that are positioned in between a tank 103 and the vacuum header 105, the vacuum can be used to
15 pull a vacuum on cuttings grinder unit 108 via flow line 109 (see Figure 11). A discharge header 110 is used to communicate discharged fluid that leaves a tank 103 to cuttings grinder unit 108. Valves V are used to control the flow of fluid between each tank 103 and header 110 as shown in Figure 11. Pump 111 enables
20 material to be transferred from cuttings grinder unit 108 via flow line 112 to shaker 113 and holding tank 114. Material that is too large to be properly slurried is removed by shaker 113 and deposited in cuttings collection box 115 for later disposal. Material that passes through shaker 113 into holding tank 114 is
25 slurried by recirculation from tank 114 to pump 116 and back to tank 114. When a desired particle size and viscosity are obtained, the slurry is pumped with pump 116 to one of the tanks 101. Each of the tanks 101 is valved between discharge header 119 and tanks 101 as shown in Figure 11.

30 When the boat 20 reaches a desired disposal facility, pump 118 receives fluid from discharge header 119 for transmission via line 120 to a desired disposal site such as a barge, on land disposal facility or the like.

In Figures 9-10 and 12, the apparatus of the present invention
35 is shown fitted with optional treatment features, designated generally by the numeral 10B in Figure 12. In the embodiment of

Figures 9, 10 and 12, processing is used to remove desirable drilling fluid from cuttings that are transferred to boat 20 via line 24. In Figures 9, 10 and 12, the rig 11 has a plurality of tanks 26-29, and inlet header 37, a vacuum system 30, a vacuum header 34, and pumps 90 to remove desirable drilling fluid at the rig or platform 11 for recycling. However, in Figures 9-10 and 12, recycling of drilling fluid also occurs on boat 20. Thus, the equipment located on rig 11 is the same in the embodiment of Figures 11 and 12. The equipment on boat 20 differs in the embodiment of Figures 9-10 and 12. The boat 20 in Figures 9-10 and 12 includes a plurality of tanks 103 that discharge cuttings to a first conveyor such as auger 121. Auger 121 directs cuttings that are discharged by tanks 103 to a conveyor such as screw conveyor 122. Screw conveyor 122 deposits cuttings in separator 123. In separator 123, some drilling fluids are removed and transmitted via flow line 124 to recycled liquid holding tank 125. The separator 123 is preferably a hopper with a vibrating centrifuge, spinning basket driven by a motor. Such separators 123 are commercially available.

After drilling fluid has been separated at separator 123, dry cuttings are transmitted to cuttings dryer unit 126 using screw conveyor 127. The cuttings dryer unit 126 further dries the cuttings so that they can be transferred to a vessel, barge, etc. or dumped overboard via discharge pipe 130. Any fluid that is removed from the cuttings at cuttings dryer unit 126 can be recycled through pump 128 and flow line 129 to liquid holding tank 125 and then to the platform 11 via flow line 131.

Figures 16-19 show an underwater tank assembly 51 that can be used to replace or supplement the tank 23 of Figure 1 or the plurality of tanks 23A-23E in Figures 5 and 6. In Figures 16-19, underwater tank assembly 51 can be stored on the sea bed 74 so that it does not occupy rig space or space on the deck 21 of vessel 20. Rather, the underwater tank assembly 51 can receive cuttings that are discharged from tanks 26, 27, 28 on rig 11 by discharging the cuttings from the selected tank 26, 27, 28 via header 31 and into cuttings flow line 60. The cuttings flow line 60 can be attached

to header 31 in a similar fashion to the attachment of flow line 24 shown in Figure 1.

5 The flowline 21 transmits cuttings from header 31 to tank 23 on boat 20 or to a plurality of tanks 23A-23E on boat 20. The cuttings flow line 60 would be of sufficient length to extend from the discharge flowline 31 to the sea bed 74 and specifically to inlet fitting 59 on main tank 52 of underwater tank assembly 51, as shown in Figure 7. In this fashion, cuttings can be discharged from the rig 11 tanks 26, 27, 28 to underwater tank assembly 51 in
10 the direction of arrow 61. As with the embodiment of Figures 1-6, a vacuum unit such as vacuum unit 22 on vessel 20 or a vacuum unit such as vacuum unit 30 on rig 11 can be used to pull a vacuum on main tank 52.

In Figure 16, main tank 52 provides a vacuum fitting 56 to
15 which vacuum line 57 is attached. A vacuum unit 22 or 30 can pull a vacuum on tank 52 with air flowing in the direction of arrow 58. This flow enhances the flow of cuttings from the tanks 26, 27, 28 on rig 11 into main tank 52 in the direction arrow 61.

The main tank 51 has ballasting in the form of a plurality of
20 ballast tanks 53, 54. The combination of tanks 52, 53, 54 are connected by a welded construction for example using a plurality of connecting plates 74.

Ballast piping 62 communicates with fittings 63, 64 that are positioned respectively on the ballast tanks 53, 54 as shown on
25 Figure 8. Control valve 65 can be used to transmit pressurized air in the direction of arrow 66 into the ballast tanks 53, 54 such as when the underwater tank assembly 51 is to be raised to the surface, as shown in Figure 10, the upward movement indicated by arrows 75.

30 Arrow 67 in Figure 16 indicates the discharge of air from ballast tanks 53, 54 using control valve 55 when the underwater tank assembly 51 is to be lowered to the sea bed 76. In Figure 19, arrows 68 indicate the discharge of water from tanks 53, 54 when the underwater tank assembly is to be elevated. Outlet fittings 69,
35 70 enable water to be discharged from ballast tanks 53, 54.

Support frame 55 can be in the form of a truss or a plurality

of feet for engaging the sea bed 76 when the underwater tank assembly 51 is lowered to the sea bed prior to being filled with drill cuttings during use.

When main tank 52 has been filled with well drill cuttings and the tank assembly 51 has been raised to the water surface 13, the tank assembly 51 can be towed to a disposal sight using tow line 72, tug boat 73 and tow eyelet 71 on tank 52.

It should be understood that the underwater tank assembly 51 can be used to supplement tanks 23, 23A-23E as described in the preferred embodiment of Figure 1-6. Alternatively, the underwater tank assembly 51 can be used for storage instead of the boat mounted tanks 23, 23A-23E.

Figures 20-26 show a second embodiment of the apparatus of the present invention designated generally by the numeral 150. In Figures 24 and 25, the second embodiment of the apparatus of the present invention includes a number of components that are placed on an oil and gas well drilling platform or tower 11 as with the embodiment of Figures 1-19. In the embodiment of Figures 21-26, the various components as shown in Figures 24 and 25 can be placed on a deck of platform 11 such as lower deck 14, upper deck 15, or intermediate deck 16, as the lower deck 14 in Figures 24 and 25. As with the embodiment of Figures 1-19, drill cuttings that are collected from a cuttings trough 77 on platform 11 are transferred to storage tanks 190 on a work boat 20.

In Figures 24-25, a suction line 151 has an intake end portion 152 that communicates with trough 77. The cuttings 152 are transferred in the direction of arrow 153 to processing tank 154 (see Figures 20-23 and 26). A vacuum unit 155 draws a vacuum on the tank 154. A suction line 156 communicates with drop tank 157. An additional suction line 158 extends between drop tank 157 and manway 159 at the upper end portion of tank 154.

Arrows 160 in Figure 24 indicate the flow path of air in line 158 when a vacuum is being drawn on tank 154. Similarly, arrow 161 in Figure 24 indicates the flow of air from drop tank 157 to vacuum unit 155. Arrow 162 shows the discharge of air from the vacuum unit. Vacuum unit 155, drop tank 157, and processing tank 154 can

each be skid mounted for ease of transport to the platform or tower 11 and upon the deck 14 of the platform or tower 11. Hydraulic control unit 163 can be used to control the hydraulic functions of pump apparatus 164 using control lines 201, 202, 206-208. Pump 164 is contained within the interior 165 of processing tank 154 (see Figures 20-23).

The details of construction of pump 164 can be seen in Figures 20-23. The pump 164 is placed at the lower end of tank 154. It can be placed against the lower end of the tank wall 186 as shown in Figure 23. Pump 164 is mounted upon a base that can include ring 187 and a plurality of legs 188. The plurality of legs 188 support housing 190. Impeller 189 is placed within housing 190. The housing 190 has a lower inlet opening 192 through which fluid can travel during recirculation of cuttings and fluid. A plurality of pulverizing/cutting blades 191 can be mounted on a shaft that is common with pump impeller 189 and driven by motor 195 as shown in Figure 23. In this fashion, cuttings that have been blended with a liquid waste stream (eg. washwater, rainwater, etc.) and slurrified or liquified flow downwardly within the interior 165 of tank 154 as shown by arrows 193 in Figure 23. Arrows 194 indicate the travel of blended, slurrified, or liquified cuttings into housing 190 through opening 192. Impeller 189 and blades 191 are powered with rotary hydraulic motor 195. Motor 195 is provided with hydraulic flow lines 206, 207 that communicate with a suitable hydraulic control unit 163. Motor 195 can be lubricated using lubrication flow line 208. Motor 195, housing 190, impeller 189 and hydraulic control unit 163 can be obtained commercially from Alco Pump Company of Beaumont, Texas.

A discharge header 196 receives blended and slurrified material that is discharged from pump housing 190. A diverter valve member 197 can be used to open or close side discharge 211 of header 196. When the diverter valve member 197 is in a closed position as shown in hard lines in Figure 23, blended, slurrified cuttings or liquified cuttings enter header 196 and flow out of tank 154 through discharge flow line 166 in the direction of arrow 169.

Prior to the present invention, liquid waste streams were

typically collected on oil and gas well drilling platforms as a liquid only waste stream. This would include rain water and wash down, for example. Such liquid wastes were typically pumped to a boat. Cuttings have heretofore been primarily disposed of by
5 either injection into a downhole disposal well as discussed in U.S. Patent No. 5,129,469 or transmitted to a box for later disposal on shore such as shown and described in the Dietzen patent 4,878,576. With the present invention, the liquid waste stream (for example rain water and wash water) can be combined with the drill cuttings
10 and blended for disposal by transfer to a boat. When diverter valve member 197 is opened to the position shown in phantom lines in Figure 23, material contained within tank 154 is continuously recirculated so that the drill cuttings can be blended and homogenized and slurried. Wash water and other liquid waste can
15 be added to the cuttings by transmitting those cuttings to the processing tank 154. By combining the liquid waste stream that necessarily must be disposed of (for example wash water, rain water, contaminated mud, waste drilling fluid or other liquids, etc.) with the drill cuttings and blending and homogenizing that
20 mix, a pumpable slurry can be obtained. Fluid injection line 203 can be used to add fluid (for example liquid waste streams) to the material contained within tank 154 in order to change the consistency of the slurry to obtain a desired pumpable slurry. In this fashion, separate waste streams that contain some components
25 that can be pumped can be combined with waste streams that cannot be pumped (for example drill cuttings) to provide a homogenized, pumpable waste stream.

Diverter valve member 197 can be pivotally mounted to manifold 196 at pivot 198. Push rod 199 moves upwardly and downwardly in
30 order to open or close the diverter valve member 197. Push rod 199 is reciprocally moved by hydraulic cylinder 200 that is controlled by a pair of hydraulic fluid flow lines 201, 202. Hydraulic cylinder 200 can be mounted to manifold 196 at supports 204, 205. The attachment 205 can function as the pivotal connection 198
35 between diverter valve member 198 and header 196. In this fashion, one end of push rod 199 pivotally attaches to diverter valve member

197 in order to support one end of the assembly of hydraulic cylinder 200 and pushrod 199.

Tank 154 can be provided with clean outs such as larger diameter clean out opening 209 and smaller diameter clean out opening 210 which can be in the nature of a drain fitting positioned at the very bottom of tank wall 186 as shown in Figure 23.

In figures 24, 25, discharge flow line 166 extends from processing tank 154 to a pair of holding tanks 167, 168. Slurrified, blended, or liquified drill cuttings can be discharged from processing tank 154 to holding tanks 167, 168 in the direction of arrow 169 in Figure 24 and 25. Valves 170, 171 control the flow of liquified, blended or slurrified drill cuttings into either tank 167 or 168 as selected. It should be understood that any number of holding tanks 167, 168 could be provided on deck 14 of platform 11.

Pump 172 can be provided on platform 11 for recirculating material within tank 167, 168 to prevent settling. Pump 172 can also be used as a discharge pump to pump material contained in tanks 167 or 168 to boat 20. When recirculating material within tanks 167, 168, valve 173 is opened as are valves 174 and 175. The pump 172 can intake material from tanks 167 and 168 through flow lines 176, 177 flowing in the direction of arrows 178. Flow line 179 communicates with flow lines 176 and 177 to intake material at the suction side of pump 172. Valve 185 is opened and valve 173 is closed when material is to be discharged from tanks 167, 168 via flow line 180.

Discharge flow line 180 can be provided with a quick connect quick disconnect fitting 181 for communicating with hose 182 that can be connected to header 183 on boat 20 at fitting 184. The boat 20 can be a large work boat (eg. 70-180' in length) and contain a number of storage tanks 190 that each receive material from header 183. The boat 20 is preferably sized to contain a large number of tanks 190 so that a huge volume of processed drill cuttings can be disposed of by transferring blended drill cuttings material and liquid waste to the boat 20.

The following table lists the parts numbers and parts descriptions as used herein and in the drawings attached hereto.

PARTS LIST

	Part Number	Description
5	10	cuttings disposal apparatus
	11	platform
	12	jacket
	13	water surface
10	14	lower deck
	15	upper deck
	16	intermediate deck
	17	crane
	18	boom
15	19	lifting line
	20	work boat
	21	aft deck
	22	vacuum unit
	23	storage tank
20	23A	storage tank
	23B	storage tank
	23C	storage tank
	23D	storage tank
	23E	storage tank
25	24	first suction line
	25	second suction line
	26	rig vacuum tank
	27	rig vacuum tank
	28	rig vacuum tank
30	29	rig vacuum tank
	30	vacuum unit
	31	discharge manifold
	32	discharge line
	33	outlet valve
35	34	suction manifold
	35	suction line

	36	valve
	37	manifold
	38	suction intake
	39	arrow
5	40	interior
	41	wall
	42	end
	43	end
	44	auger
10	45	supply header
	46	motor drive
	47	valve
	48	valve
	49	walkway
15	50	header
	51	underwater tank assembly
	52	main tank
	53	ballast tank
	54	ballast tank
20	55	support frame
	56	vacuum fitting
	57	vacuum line
	58	arrow
	59	inlet fitting
25	60	cuttings flow line
	61	arrow
	62	ballast piping
	63	ballast fitting
	64	ballast fitting
30	65	control valve
	66	arrow
	67	arrow
	68	arrow
	69	outlet
35	70	outlet
	71	towing eyelet

	72	tow line
	73	tugboat
	74	connecting plate
	75	arrow
5	76	seabed
	77	trough
	78	suction line
	79	screen
	80	sleeve
10	90	pump
	91	arrow
	92	plate
	93	plate
	94	recess
15	95	recess
	96	fitting
	97	pin
	98	pin
	99A	coupling member
20	99B	coupling member
	100	deck
	101	tank
	102	hold
	103	tank
25	104	header
	105	header
	106	walkway
	107	ladder
	108	cuttings grinder unit
30	109	flow line
	110	header
	111	pump
	112	flow line
	113	shaker
35	114	holding tank
	115	collection box

	116	pump
	117	header
	118	pump
	119	header
5	120	flow line
	121	auger
	122	screw conveyor
	123	separator
	124	flow line
10	125	tank
	126	cuttings dryer unit
	127	conveyor
	128	pump
	129	flow line
15	130	discharge pipe
	131	flow line
	150	cuttings disposal apparatus
	151	suction line
	152	intake
20	153	arrow
	154	processing tank
	155	vacuum unit
	156	suction line
	157	drop tank
25	158	suction line
	159	manway
	160	arrow
	161	arrow
	162	arrow
30	163	hydraulic control unit
	164	pump
	165	tank interior
	166	discharge flow line
	167	holding tank
35	168	holding tank
	169	arrow

	170	valve
	171	valve
	172	pump
	173	pump
5	174	pump
	175	pump
	176	flow line
	177	flow line
	178	arrow
10	179	flow line
	180	flow line
	181	fitting
	182	hose
	183	header
15	184	fitting
	185	valve
	186	tank wall
	187	base ring
	188	leg
20	189	impeller
	190	housing
	191	cutting blade
	192	inlet opening
	193	arrow
25	194	arrow
	195	motor
	196	discharge header
	197	diverter valve member
	198	pivot
30	199	push rod
	200	hydraulic cylinder
	201	hydraulic fluid flow line
	202	hydraulic fluid flow line
	203	fluid injection line
35	204	support
	205	support

	206	hydraulic fluid flow line
	207	hydraulic fluid flow line
	208	lubrication flow line
	209	clean out
5	210	drain fitting
	211	side discharge
	V	valve

10 The foregoing embodiments are presented by way of example only; the scope of the present invention is to be limited only by the following claims.

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

1. A method for disposing of drill cuttings from an oil and/or gas well drilling platform, comprising:
 - a) transporting said drill cuttings to a cuttings collection area on the platform;
 - b) transporting said drill cuttings from said cuttings collection area to a processing tank via a first suction line by generating a vacuum within said processing tank, said processing tank further including a pump therein;
 - c) adding liquid to the cuttings in the processing tank;
 - d) blending the cuttings and the liquid in the processing tank; and
 - e) transferring the blended drill cuttings from the processing tank to a work boat via a flow line using said pump.
2. The method as claimed in claim 1, wherein said drill cuttings are transported directly to said processing tank via the first suction line.
3. The method as claimed in claim 1 or 2, wherein the vacuum is generated by vacuum-generating means that is in fluid communication with the processing tank via a second suction line.
4. The method as claimed in claim 1, 2 or 3 wherein the liquid added is a waste stream.
5. The method as claimed in claim 3, wherein any waste liquids or solids entering said second suction line is removed from the second suction line at a separator that is positioned in fluid communication with the second suction line upstream of the vacuum-generating means.
6. The method as claimed in claim 3, wherein the vacuum generated is in the range of about 16 to 29 inches of mercury.

7. The method as claimed in claim 3, wherein the vacuum-generating means generates a fluid flow in the first and second suction lines in the range of about 300 to 3200 cubic feet per minute.

8. The method as claimed in claim 1, wherein said drill cuttings are transported to said work boat at least in part through gravity flow.

9. The method as claimed in claim 1, wherein the flow velocity in the first suction line is in the range of about 100 to 600 feet per second.

10. Apparatus for use in disposing of drill cuttings from an oil and/or gas well drilling marine platform, comprising:

- a) a processing tank to which said drill cuttings are transported;
- b) a blending device that can break up drill cuttings to reduce their size, said blending device being positioned in a flow path that communicates with the tank;
- c) a work boat floating next to the platform; and
- d) a flow line for transferring cuttings from the processing tank to the work boat;
- e) vacuum-generating means for generating a vacuum within the processing tank so that said drill cuttings are transported to said processing tank via a first suction line; and
- f) the processing tank includes a pump therein, said pump discharging said drill cuttings from said processing tank.

11. The apparatus as claimed in claim 10, wherein said vacuum-generating means is in fluid communication with the processing via a second suction line.

12. Apparatus as claimed in claim 11, further comprising a separator that is positioned in fluid communication with the second suction line upstream of the vacuum-generating means for removing any liquids and solids which enter the second suction

line from said second suction line.

13. A method for removing drill cuttings from an oil and gas well drilling platform that uses a drill bit supported with a drill string and a well drilling fluid during a digging of a well bore, comprising the steps of:

a) transmitting the cuttings and well drilling fluid to a cuttings receptacle on the platform;

b) generating a vacuum within a processing tank and suctioning the cuttings via a first suction line having an intake end portion that is positioned at the cutting receptacle;

c) transporting the drill cuttings via the first suction line to the processing tank that has at least one access opening for communicating with a tank interior, said processing tank having a recirculating pump therein, the vacuum within the processing tank interior being formed by a blower that is in fluid communication with the processing tank interior via a second vacuum line;

d) transferring the cuttings from the processing tank using the recirculating pump to a holding tank on the platform using a first flow line; and

e) transferring the cuttings from the holding tank to a boat using a second flow line.

14. The method of claim 13 wherein there are a plurality of holding tanks on the platform.

15. The method of claim 13 wherein the flow velocity in the first suction line is about 100 - 600' per second.

16. The method of claim 14 further comprising the step of connecting the holding tanks with a manifold.

17. The method of claim 13 wherein in step "f," the cuttings are pumped from the holding tank.

18. The method of claim 13 wherein liquids and solids are

separated from the second suction line.

19. The method of claim 13 wherein in step "c", the blower generates fluid flow in the second vacuum line of between about 300 and 3200 cubic feet per minute.

20. The method of claim 13 wherein the vacuum formed within the processing tank is between about 54200 and 84700 Nm⁻² (sixteen and twenty-five inches of mercury).

21. A method of removing drilling cuttings from an oil and gas well drilling platform that uses a drill bit supported with a drill string and a well drilling fluid during a digging of a well bore, comprising the steps of:

- a) separating drill cuttings from at least a volume of the well drilling fluid on the drilling platform so that a volume of the drilling fluids can be recycled into the well bore during drilling operations;

- b) transmitting the separated drill cuttings to a collection area on the platform;

- c) generating a vacuum within a processing tank and suctioning the separated drill cuttings via a first suction line having an intake end portion;

- d) transmitting the drill cuttings via the first suction line to the processing tank that has at least one opening for communicating with the tank interior, said processing tank having a recirculating pump therein;

- e) the vacuum within the processing tank being formed by a blower that is in fluid communication with the processing tank interior via a second vacuum line;

- f) connecting the processing tank to a floating work boat with a discharge flow line; and

- g) transmitting cuttings from the processing tank to the work boat via the discharge flow line using the recirculating pump.

22. A method for disposing of drill cuttings from an oil

and/or gas well drilling platform, comprising:

- a) transporting said drill cuttings to a materials collection receptacle;
- b) generating a vacuum within a processing tank and transporting said drill cuttings from said receptacle via a first suction line to the processing tank using said vacuum, said tank having a pump therein;
- c) blending the drill cuttings and a liquid in a flow path that communicates with the processing tank; and
- d) transferring the drill cuttings and liquid from the processing tank to a work boat via a flow line using the pump in the processing tank.

23. A method as claimed in claim 22, wherein said drill cuttings are transported directly to said processing tank via the first suction line.

24. The method as claimed in claim 22, wherein said vacuum is generated by vacuum-generating means that is in fluid communication with the processing tank via a second suction line.

25. The method as claimed in claim 24, wherein any liquid waste and solid waste entering said second suction line is removed therefrom at a separator that is positioned in fluid communication with the second suction line upstream of the vacuum-generating means.

26. The method as claimed in claim 22 wherein the vacuum generated is in the range of about 54200 to 84700 Nm^{-2} (16 to 25 inches of mercury).

27. The method as claimed in claim 22, wherein the vacuum-generating means generates a fluid flow in the first and second suction lines in the range of about 8.5 to 42.5 m^3 (300 to 1500 cubic feet) per minute.

28. The method as claimed in claim 22, wherein said drill

cuttings are transported to said processing tank in part through gravity flow.

29. The method as claimed in claim 22, wherein said drill cuttings are transported via said first suction line from a bottom of said cuttings receptacle.

30. A method for disposing of drill cuttings from an oil and/or gas well drilling platform, comprising:

- a) separating said drill cuttings from substantially all of a well drilling fluid in which said drill cuttings have been conveyed from an area being drilled;
- b) transporting said drill cuttings to a materials collection receptacle;
- c) generating a vacuum within said processing tank and transporting said drill cuttings from said receptacle via a first suction line to said processing tank using the vacuum, said processing tank having a pump therein;
- d) blending the cuttings and a liquid inside the processing tank; and
- e) transferring the cuttings to a work boat via a flow line using said pump.

31. The method of claim 30, wherein the transportation of drill cuttings to the processing tank occurs substantially continuously over time as a well is drilled.

32. Apparatus for use in disposing of drill cuttings from an oil and/or gas well drilling platform, comprising;

- a) means for separating said drill cuttings from substantially all of a well drilling fluid in which said drill cuttings are carried from the area being drilled;
- b) a materials collection receptacle to which said drill cuttings are transported;
- c) a processing tank for receiving said drill cuttings;
- d) a suction line for transporting said drill cuttings

from said collection receptacle to said processing tank via a vacuum; and

e) a chopping device that enables cuttings particle size to be reduced inside the processing tank.

33. The apparatus of claim 32, wherein the transportation of drill cuttings to the processing tank occurs substantially continuously over time as a well is drilled.

The Commissioner of Patents,
Hull, Quebec.



A/M/J.....Y/M/D

2004/01/29

030 - 04

D000108340

Sir:

(E21B - 21/06 - Examiner: John Hurkmans)

Re: File No.: 2,308,528
Applicant: M-I L.L.C.
Title: "Method and Apparatus for Handling and
Disposal of Oil and Gas Well Drill
Cuttings"
Filed: May 15, 2000

AMENDMENT

In response to the Examiner's action dated July 31, 2003, applicant wishes to amend this application as follows:

DISCLOSURE

Page 1, lines 1 and 2, delete.

Lines 6 - 30, withdraw without prejudice.

A new disclosure page 1 is enclosed.

CLAIMS

Claims 1 - 48, withdraw without prejudice and insert new claims 1 -

33.

New claim pages containing claims 1 to 33 are enclosed.

_R_E_M_A_R_K_S_

Applicant acknowledges with appreciation the thorough review of the application by the Examiner.

The disclosure has been amended to address the Rule 81(1) and 81(2) issues.

With reference to the Rule 29 requisition, a copy of a related U.S.

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patent No. 6,345,672 B1 granted February 12, 2002 is enclosed, the front cover and first page of which lists the prior art cited during its prosecution.

Also enclosed is a copy of the EPO search report on the related European case which is still pending.

With reference to the claims, the Examiner has cited the U.K. patent to Bailey, No. 3,330,600 and U.S. patent No. 5,842,529 to Dietzen which is well known to applicant as it has a common inventor with the present application and is related in that under U.S. practice, the U.S. patent noted above is a "continuation-in-part", it yet somewhat removed from the cited U.S. patent.

As applicant understands the application of the prior art, the various claims are rejected as summarized, namely:

- (i) claims 1, 5, 12, 14, 15 and 32 are rejected as anticipated by Bailey;
- (ii) claims 2, 3, 4, 9, 10, 11, 13, 16, 17, 19, 33, 34, 35 and 41 to 44 are rejected as obvious having regard to Bailey in light of Dietzen; and
- (iii) claims 22 to 29, 30, 31 and 41 to 46 are rejected as obvious having regard to Dietzen in light of Bailey.

Based on the above, claims 6, 7, 8, 18, 20, 21, 36 - 40, 47 and 48 were not rejected on the prior art.

Applicant presents amended claims, wherein new independent claim 1 includes the limitations of claims 5 and 6.

New independent claim 10 is previous claim 14 but includes limitations similar to those in claims 5 and 6.

- 3 -

New independent claim 13 is previous claim 22 but includes the limitations of claims 16 and 18.

New independent claim 21 is previous claim 30 but includes the limitations similar to those in claims 5 and 6.

New independent claim 22 is previous claim 32 but includes the limitation of claims 36 and 37.

New independent claim 30 is previous claim 45 but includes limitations similar to those in claims 5 and 6.

New independent claim 21 is previous claim 47.

New dependent claims have been formulated for these new independent claims from the previous dependent claims.

As each of the new independent claims include limitations which are from or parallel limitations in non-rejected claims, favourable reconsideration of the claims as presented are believed to be in order.

Under the circumstances of the claim amendments being directed to rewriting claims to incorporate limitations from or paralleling non-rejected claims, no detailed discussion of the cited prior art references is believed necessary at this time.

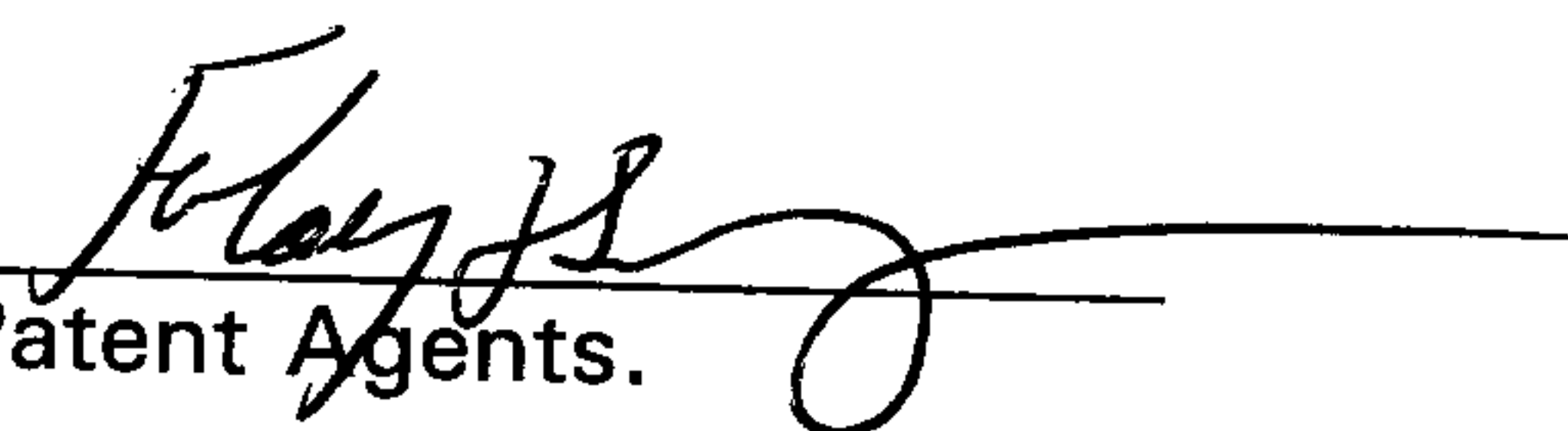
Further, applicant has attempted to address all the Section 27(4) issues raised through revision of the language of the claims or the withdrawal of the particular claim at this time.

Early and favourable reconsideration of this application as amended is

- 4 -

respectfully requested.

Respectfully submitted,
M-I L.L.C.

BY: 
Patent Agents.

January 29, 2004.

70 Gloucester Street,
Ottawa, Ontario,
K2P 0A2.

JCS/dMcK

TITLE OF THE INVENTION

"METHOD AND APPARATUS FOR HANDLING AND DISPOSAL OF
OIL AND GAS WELL DRILL CUTTINGS"

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

10 The present invention relates to oil and
gas well drilling and more particularly to the
handling of cuttings that are generated during
oil and gas well drilling activity. Even more
particularly, the present invention relates to an
improved method and apparatus for handling cuttings
that are generated during oil and gas well

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

1. A method for disposing of drill cuttings from an oil and/or gas well drilling platform, comprising:

a) transporting said drill cuttings to a cuttings collection area on the platform;

b) transporting said drill cuttings from said cuttings collection area to a processing tank via a first suction line by generating a vacuum within said processing tank, said processing tank further including a pump therein;

c) adding liquid to the cuttings in the processing tank;

d) blending the cuttings and the liquid in the processing tank; and

e) transferring the blended drill cuttings from the processing tank to a work boat via a flow line using said pump.

2. The method as claimed in claim 1, wherein said drill cuttings are transported directly to said processing tank via the first suction line.

3. The method as claimed in claim 1 or 2, wherein the vacuum is generated by vacuum-generating means that is in fluid communication with the processing tank via a second suction line.

4. The method as claimed in claim 1, 2 or 3 wherein the liquid added is a waste stream.

5. The method as claimed in claim 3, wherein any waste liquids or solids entering said second suction line is removed from the second suction line at a separator that is positioned in fluid communication with the second suction line upstream of the vacuum-generating means.

6. The method as claimed in claim 3, wherein the vacuum generated is in the range of about 16 to 29 inches of mercury.

7. The method as claimed in claim 3, wherein the vacuum-generating means generates a fluid flow in the first and second suction lines in the range of about 300 to 3200 cubic feet per minute.

8. The method as claimed in claim 1, wherein said drill cuttings are transported to said work boat at least in part through gravity flow.

9. The method as claimed in claim 1, wherein the flow velocity in the first suction line is in the range of about 100 to 600 feet per second.

10. Apparatus for use in disposing of drill cuttings from an oil and/or gas well drilling marine platform, comprising:

a) a processing tank to which said drill cuttings are transported;

b) a blending device that can break up drill cuttings to reduce their size, said blending device being positioned in a flow path that communicates with the tank;

c) a work boat floating next to the platform; and

d) a flow line for transferring cuttings from the processing tank to the work boat;

e) vacuum-generating means for generating a vacuum within the processing tank so that said drill cuttings are transported to said processing tank via a first suction line; and

f) the processing tank includes a pump therein, said pump discharging said drill cuttings from said processing tank.

11. The apparatus as claimed in claim 10, wherein said vacuum-generating means is in fluid communication with the processing via a second suction line.

12. Apparatus as claimed in claim 11, further comprising a separator that is positioned in fluid communication with the second suction line upstream of the vacuum-generating means for removing any liquids and solids which enter the second suction

line from said second suction line.

13. A method for removing drill cuttings from an oil and gas well drilling platform that uses a drill bit supported with a drill string and a well drilling fluid during a digging of a well bore, comprising the steps of:

a) transmitting the cuttings and well drilling fluid to a cuttings receptacle on the platform;

b) generating a vacuum within a processing tank and suctioning the cuttings via a first suction line having an intake end portion that is positioned at the cutting receptacle;

c) transporting the drill cuttings via the first suction line to the processing tank that has at least one access opening for communicating with a tank interior, said processing tank having a recirculating pump therein, the vacuum within the processing tank interior being formed by a blower that is in fluid communication with the processing tank interior via a second vacuum line;

d) transferring the cuttings from the processing tank using the recirculating pump to a holding tank on the platform using a first flow line; and

e) transferring the cuttings from the holding tank to a boat using a second flow line.

14. The method of claim 13 wherein there are a plurality of holding tanks on the platform.

15. The method of claim 213 wherein the flow velocity in the first suction line is about 100 - 600' per second.

16. The method of claim 14 further comprising the step of connecting the holding tanks with a manifold.

17. The method of claim 13 wherein in step "f," the cuttings are pumped from the holding tank.

18. The method of claim 13 wherein liquids and solids are

separated from the second suction line.

19. The method of claim 13 wherein in step "c", the blower generates fluid flow in the second vacuum line of between about 300 and 3200 cubic feet per minute.

20. The method of claim 13 wherein the vacuum formed within the processing tank is between about 54200 and 84700 Nm⁻² (sixteen and twenty-five inches of mercury).

21. A method of removing drilling cuttings from an oil and gas well drilling platform that uses a drill bit supported with a drill string and a well drilling fluid during a digging of a well bore, comprising the steps of:

- a) separating drill cuttings from at least a volume of the well drilling fluid on the drilling platform so that a volume of the drilling fluids can be recycled into the well bore during drilling operations;

- b) transmitting the separated drill cuttings to a collection area on the platform;

- c) generating a vacuum within a processing tank and suctioning the separated drill cuttings via a first suction line having an intake end portion;

- d) transmitting the drill cuttings via the first suction line to the processing tank that has at least one opening for communicating with the tank interior, said processing tank having a recirculating pump therein;

- e) the vacuum within the processing tank being formed by a blower that is in fluid communication with the processing tank interior via a second vacuum line;

- f) connecting the processing tank to a floating work boat with a discharge flow line; and

- g) transmitting cuttings from the processing tank to the work boat via the discharge flow line using the recirculating pump.

22. A method for disposing of drill cuttings from an oil

and/or gas well drilling platform, comprising:

- a) transporting said drill cuttings to a materials collection receptacle;
- b) generating a vacuum within a processing tank and transporting said drill cuttings from said receptacle via a first suction line to the processing tank using said vacuum, said tank having a pump therein;
- c) blending the drill cuttings and a liquid in a flow path that communicates with the processing tank; and
- d) transferring the drill cuttings and liquid from the processing tank to a work boat via a flow line using the pump in the processing tank.

23. A method as claimed in claim 22, wherein said drill cuttings are transported directly to said processing tank via the first suction line.

24. The method as claimed in claim 22, wherein said vacuum is generated by vacuum-generating means that is in fluid communication with the processing tank via a second suction line.

25. The method as claimed in claim 24, wherein any liquid waste and solid waste entering said second suction line is removed therefrom at a separator that is positioned in fluid communication with the second suction line upstream of the vacuum-generating means.

26. The method as claimed in claim 22 wherein the vacuum generated is in the range of about 54200 to 84700 Nm^{-2} (16 to 25 inches of mercury).

27. The method as claimed in claim 22, wherein the vacuum-generating means generates a fluid flow in the first and second suction lines in the range of about 8.5 to 42.5 m^3 (300 to 1500 cubic feet) per minute.

28. The method as claimed in claim 22, wherein said drill

cuttings are transported to said processing tank in part through gravity flow.

29. The method as claimed in claim 22, wherein said drill cuttings are transported via said first suction line from a bottom of said cuttings receptacle.

30. A method for disposing of drill cuttings from an oil and/or gas well drilling platform, comprising:

a) separating said drill cuttings from substantially all of a well drilling fluid in which said drill cuttings have been conveyed from an area being drilled;

b) transporting said drill cuttings to a materials collection receptacle;

c) generating a vacuum within said processing tank and transporting said drill cuttings from said receptacle via a first suction line to said processing tank using the vacuum, said processing tank having a pump therein;

d) blending the cuttings and a liquid inside the processing tank; and

e) transferring the cuttings to a work boat via a flow line using said pump.

31. The method of claim 30, wherein the transportation of drill cuttings to the processing tank occurs substantially continuously over time as a well is drilled.

32. Apparatus for use in disposing of drill cuttings from an oil and/or gas well drilling platform, comprising;

a) means for separating said drill cuttings from substantially all of a well drilling fluid in which said drill cuttings are carried from the area being drilled;

b) a materials collection receptacle to which said drill cuttings are transported;

c) a processing tank for receiving said drill cuttings;

d) a suction line for transporting said drill cuttings

from said collection receptacle to said processing tank via a vacuum; and

e) a chopping device that enables cuttings particle size to be reduced inside the processing tank.

33. The apparatus of claim 32, wherein the transportation of drill cuttings to the processing tank occurs substantially continuously over time as a well is drilled.

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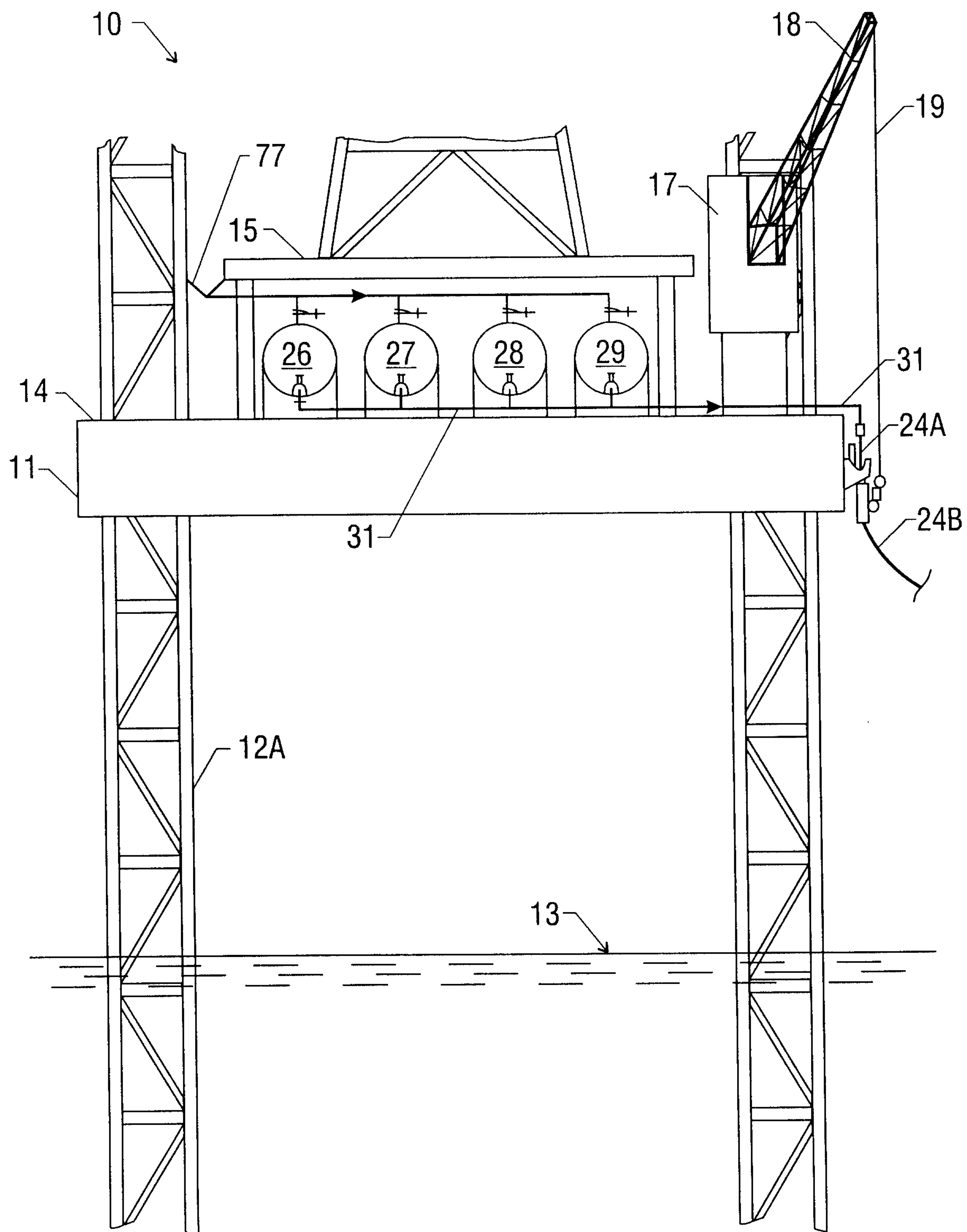


FIG. 1

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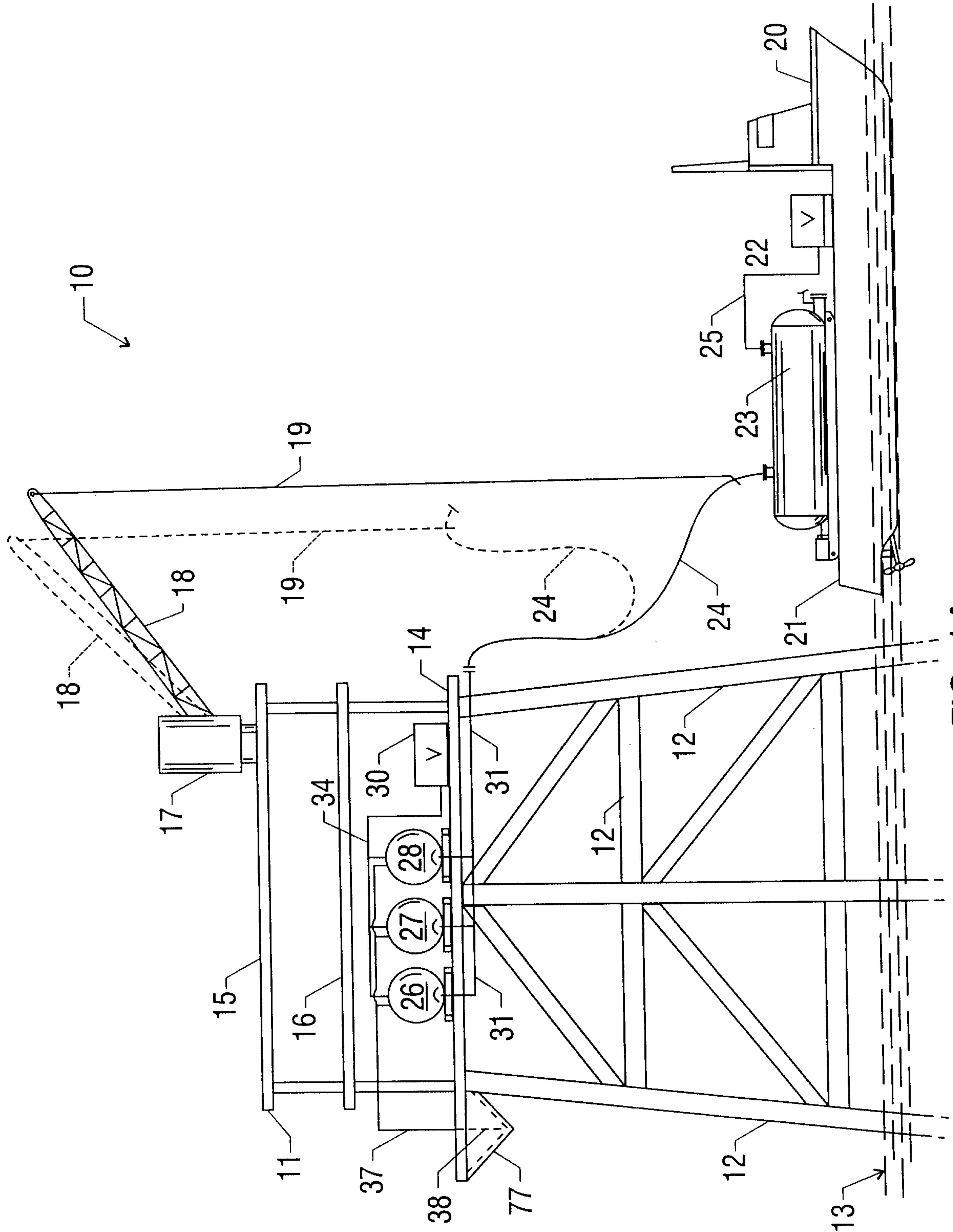


FIG. 1A

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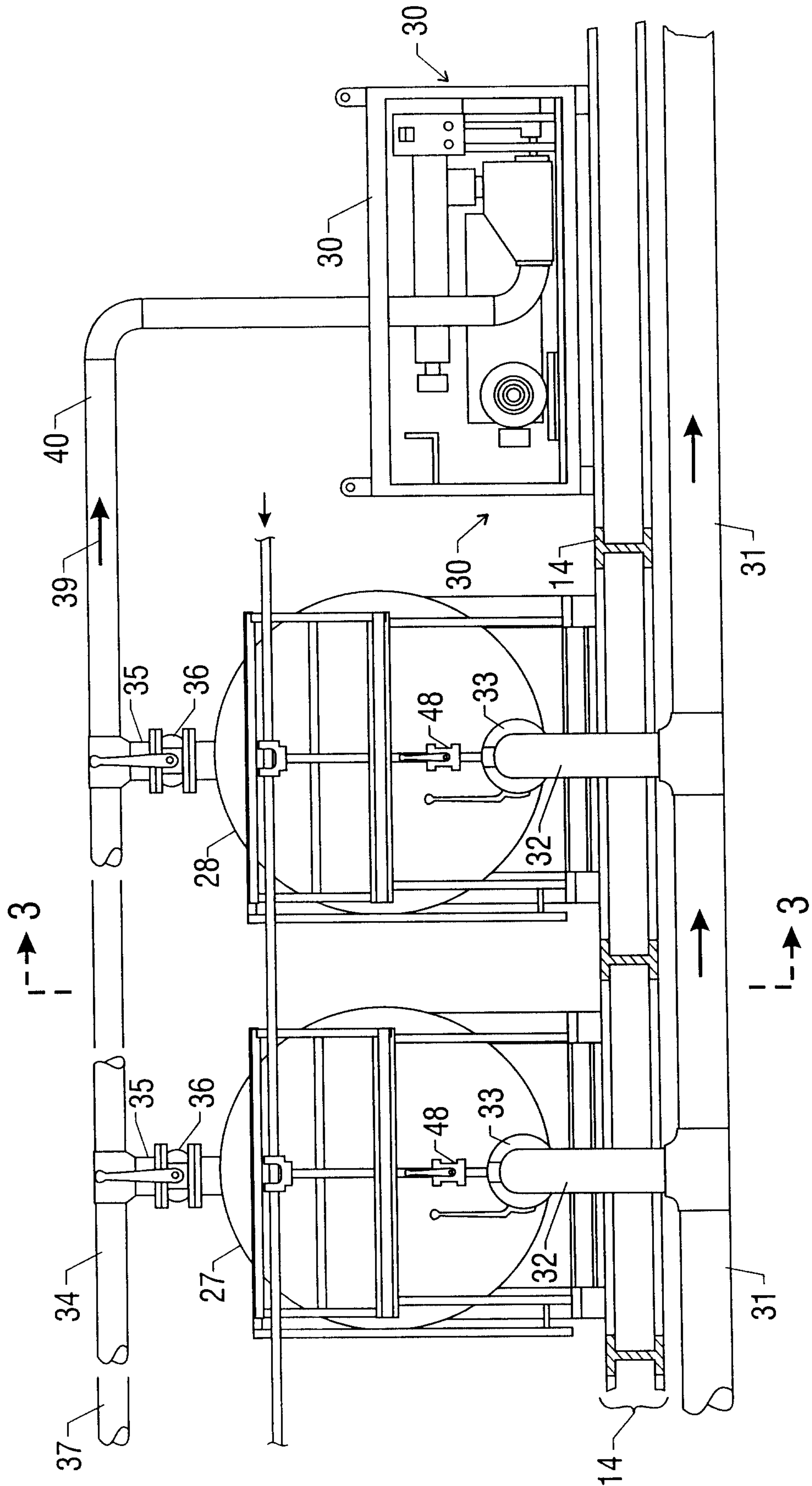


FIG. 2

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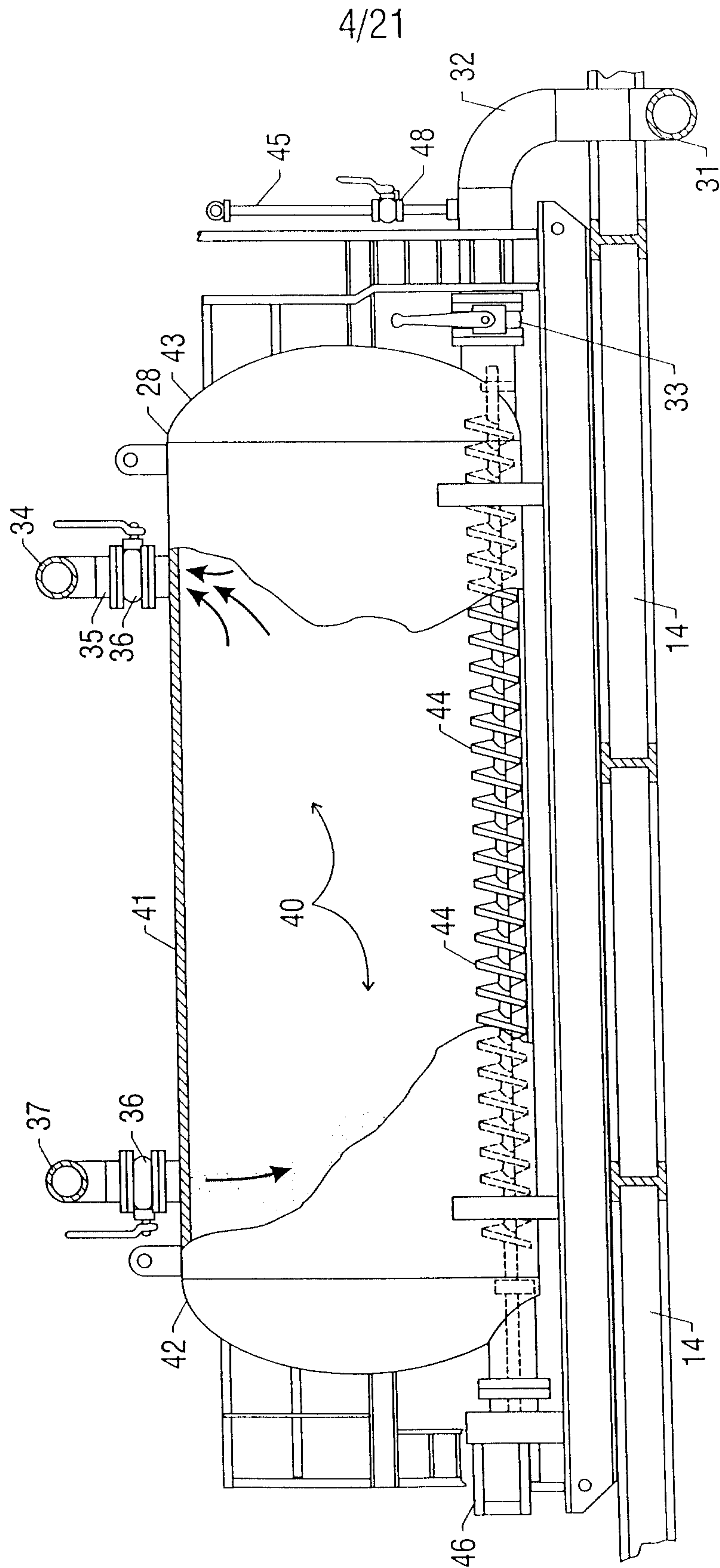


FIG. 3

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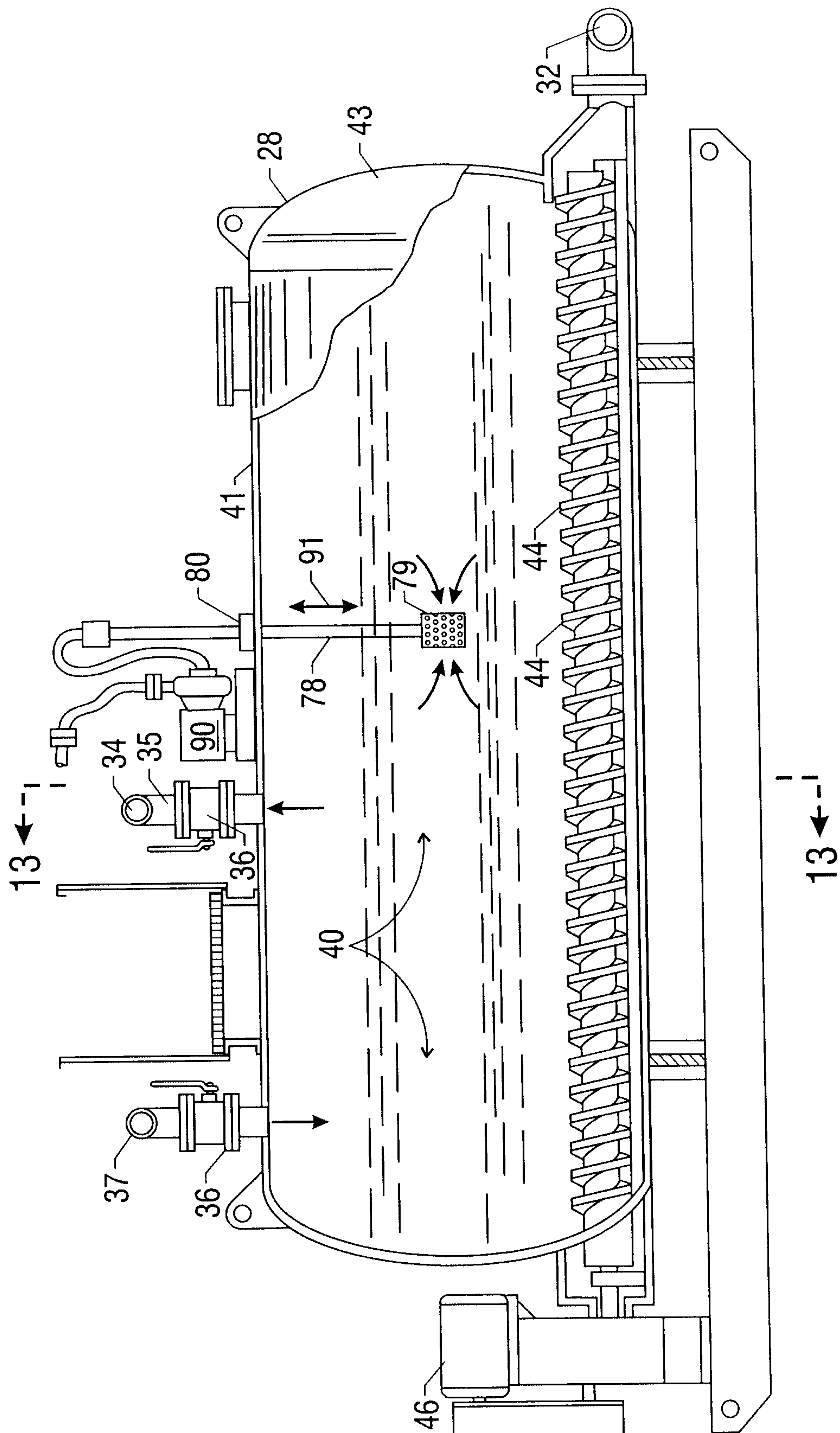


FIG. 3A

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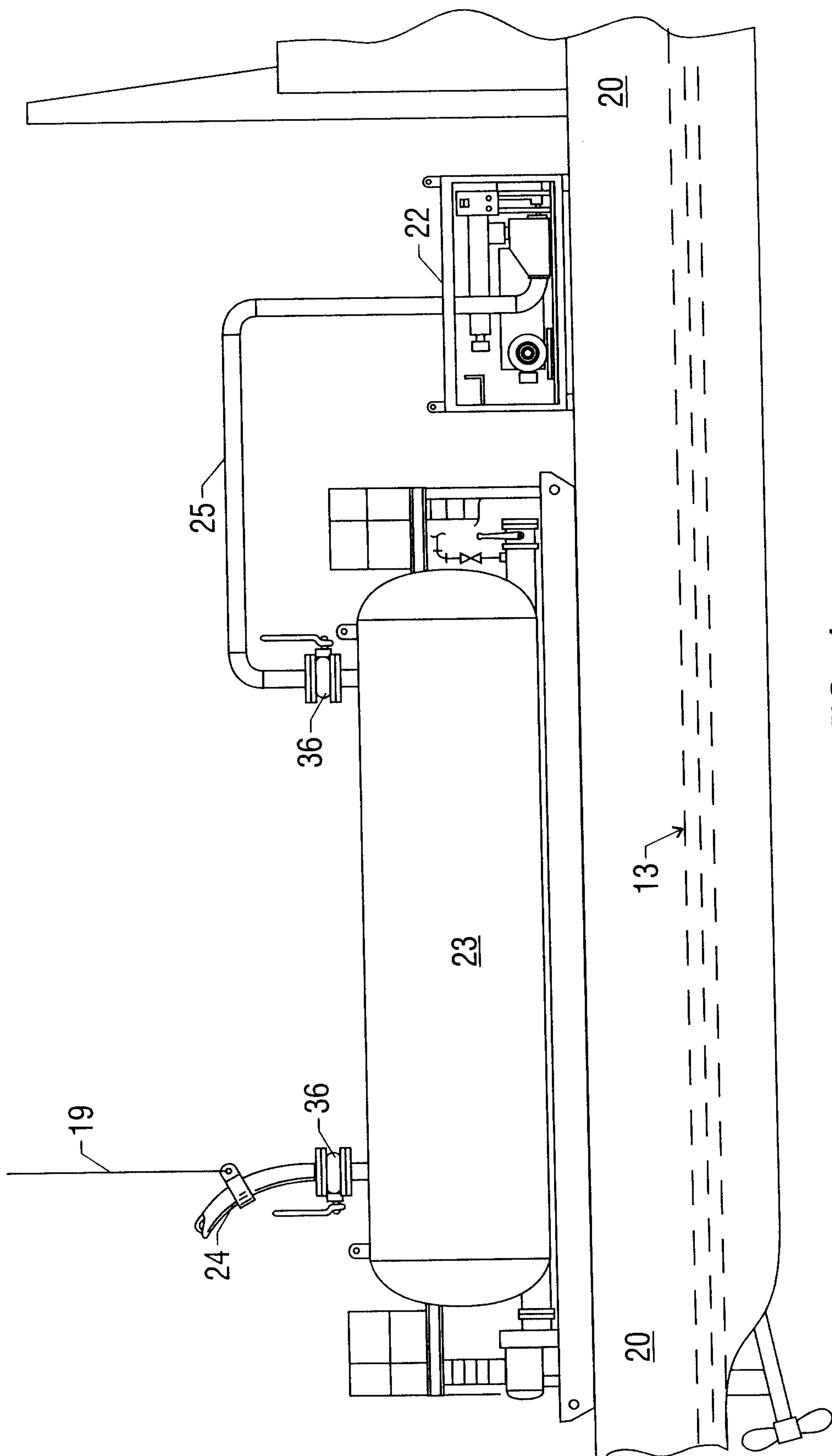
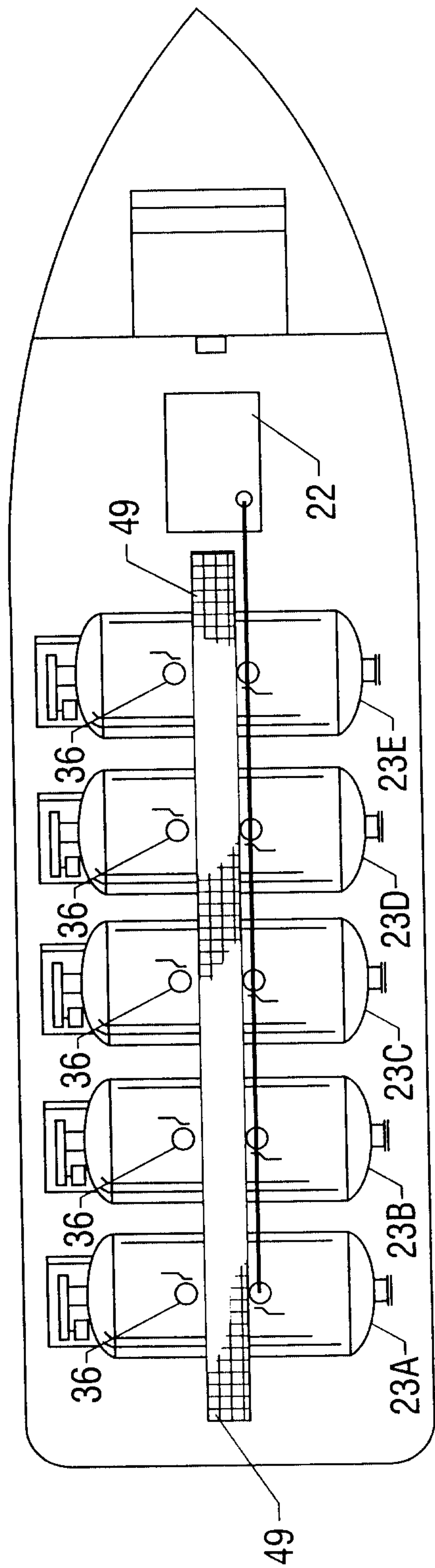
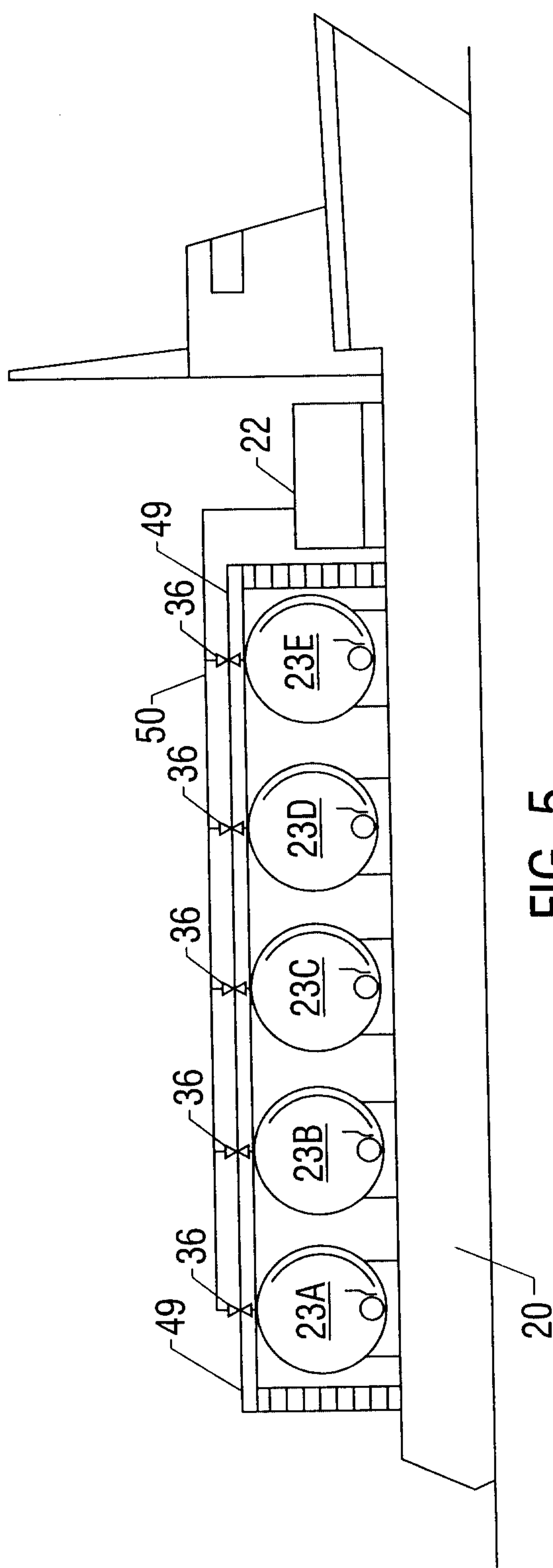


FIG. 4

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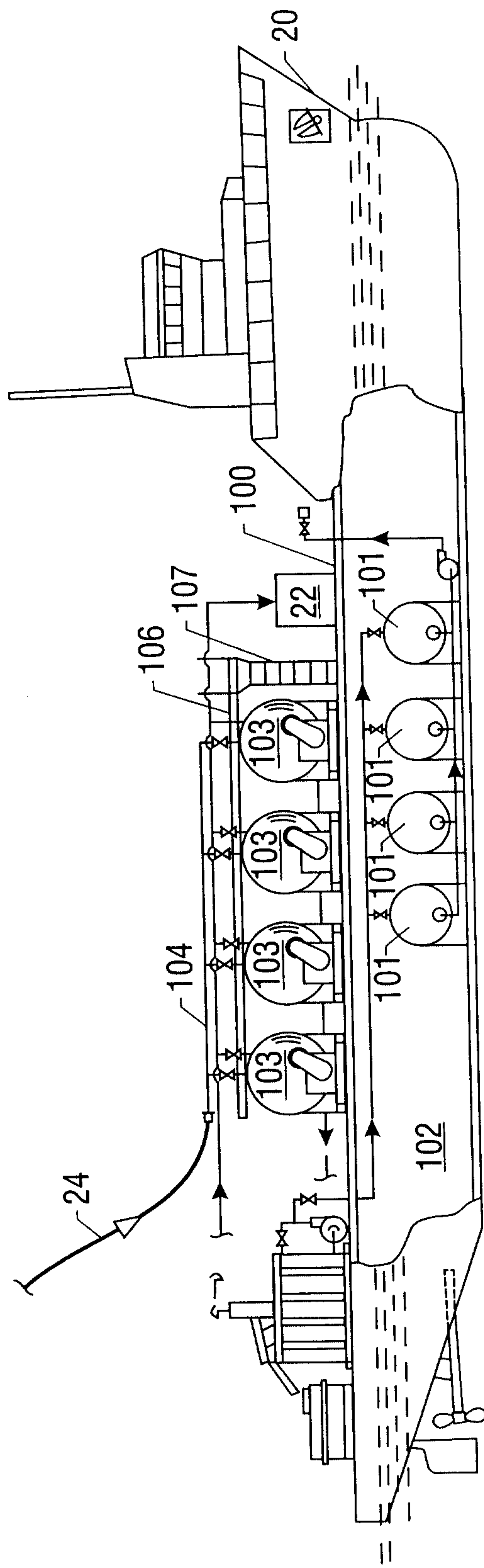


FIG. 7

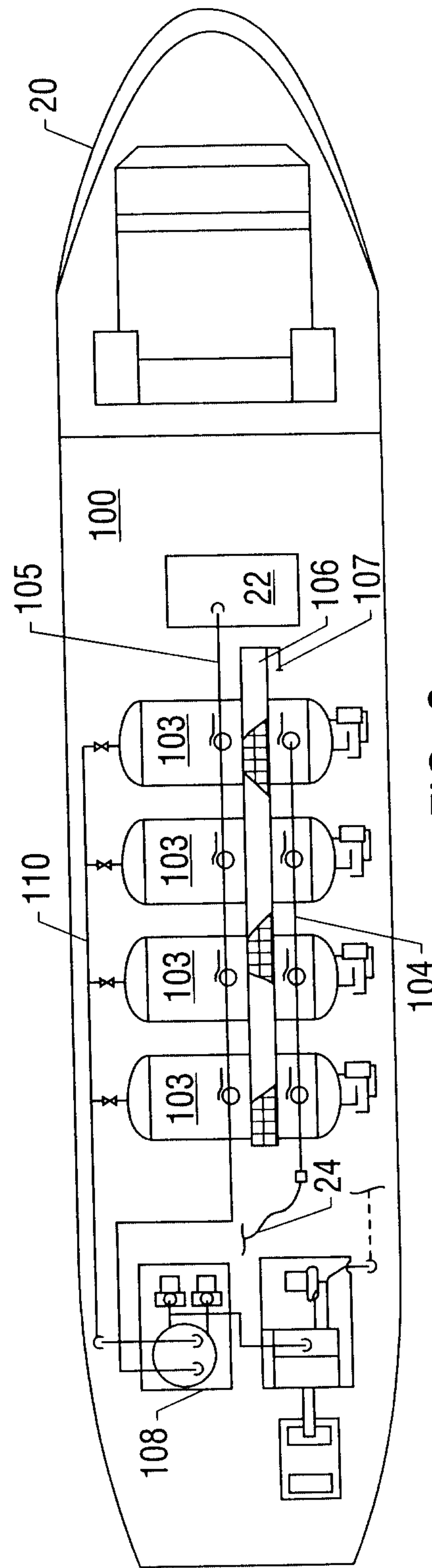


FIG. 8

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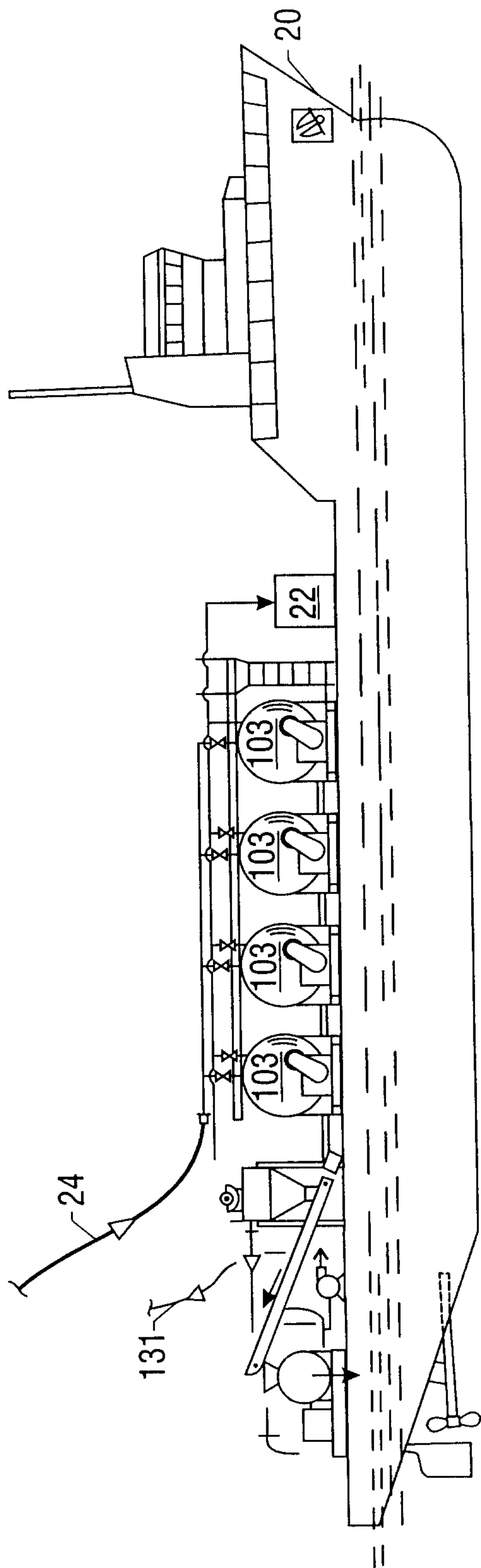


FIG. 9

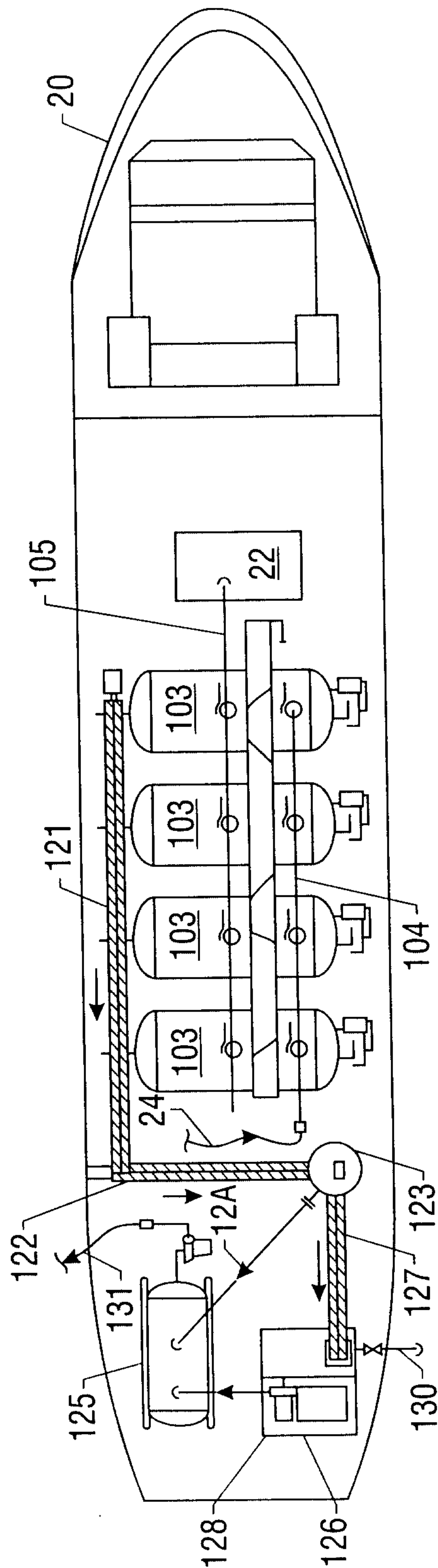


FIG. 10

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10A

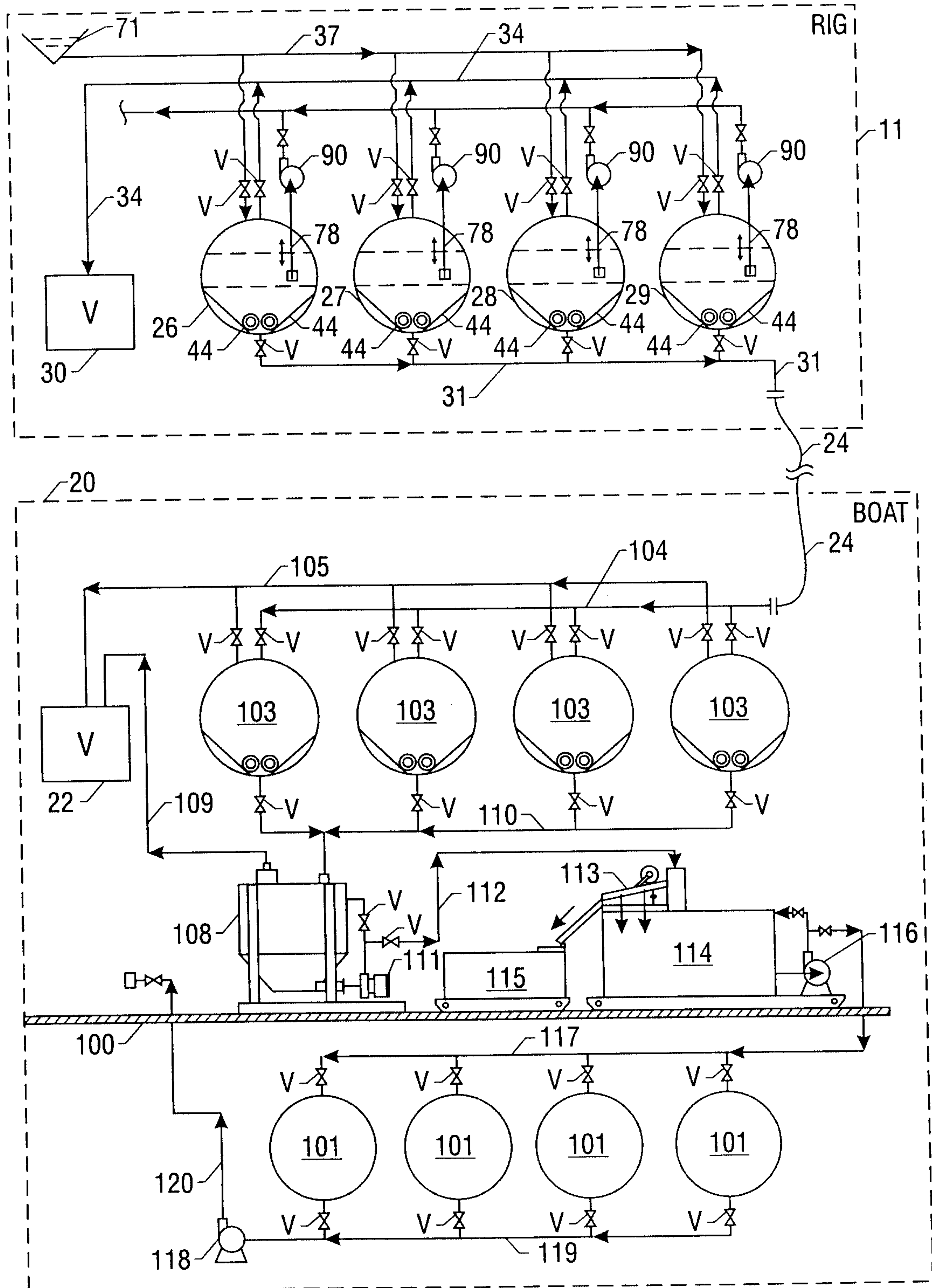


FIG. 11

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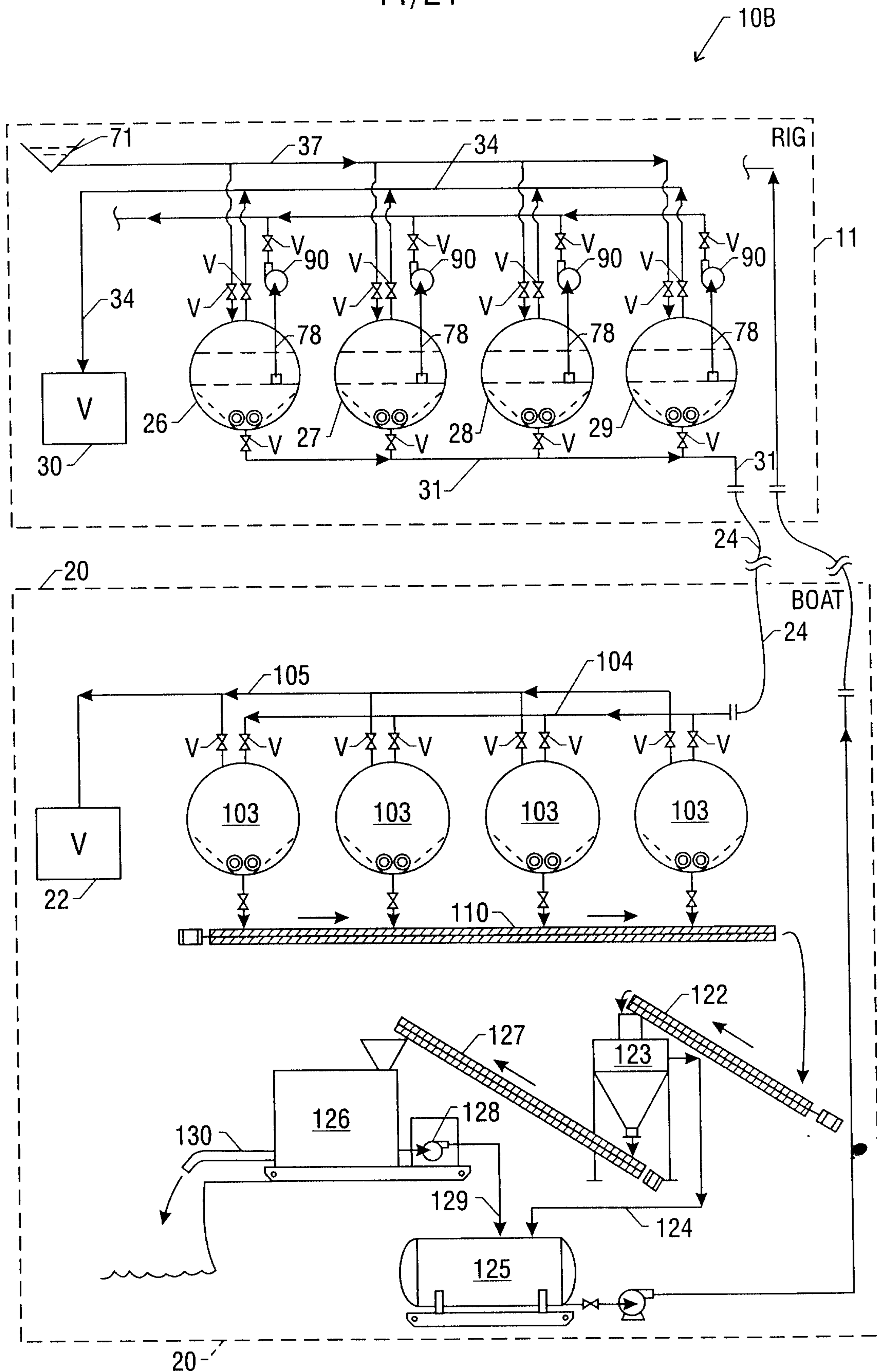


FIG. 12

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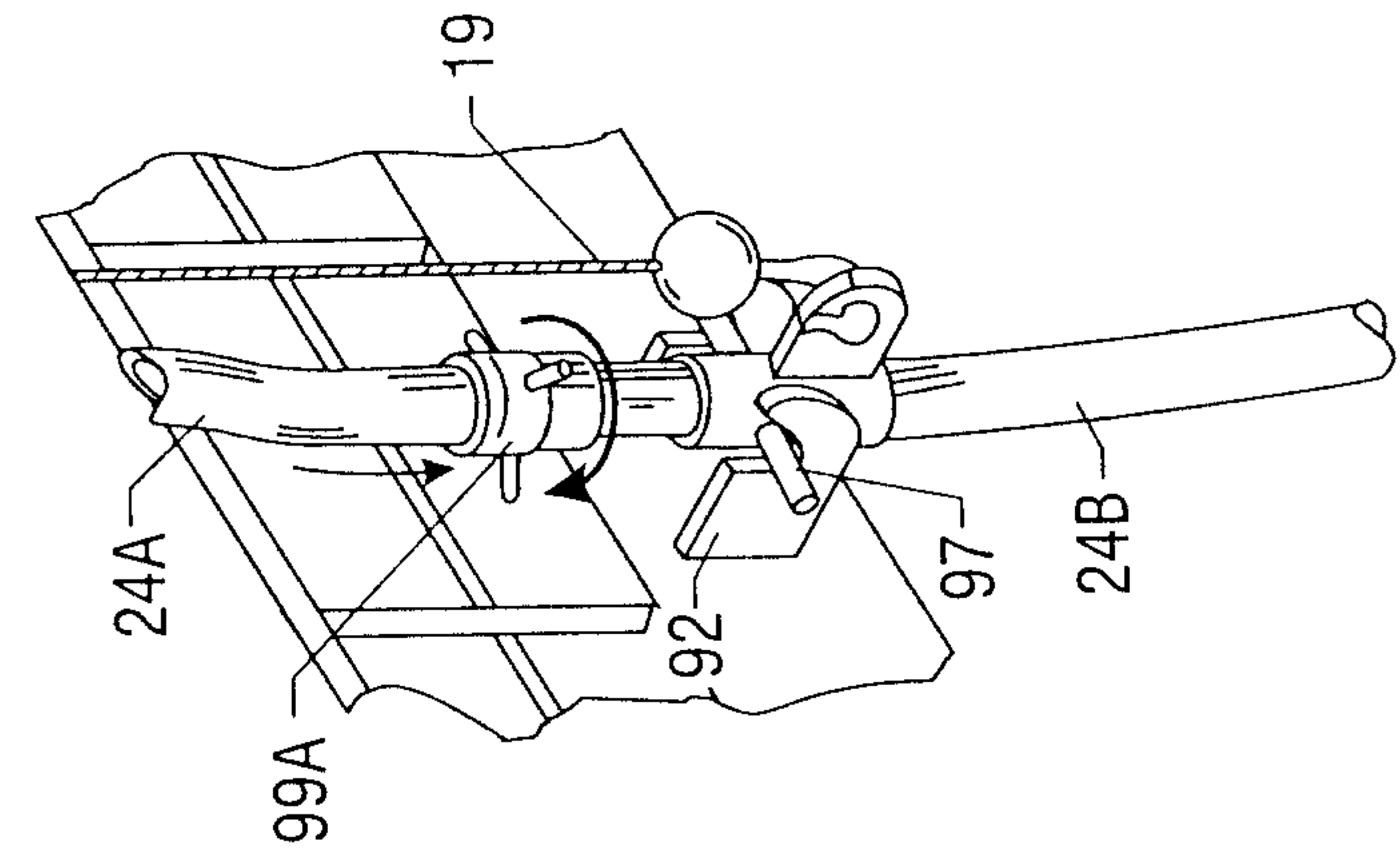


FIG. 15

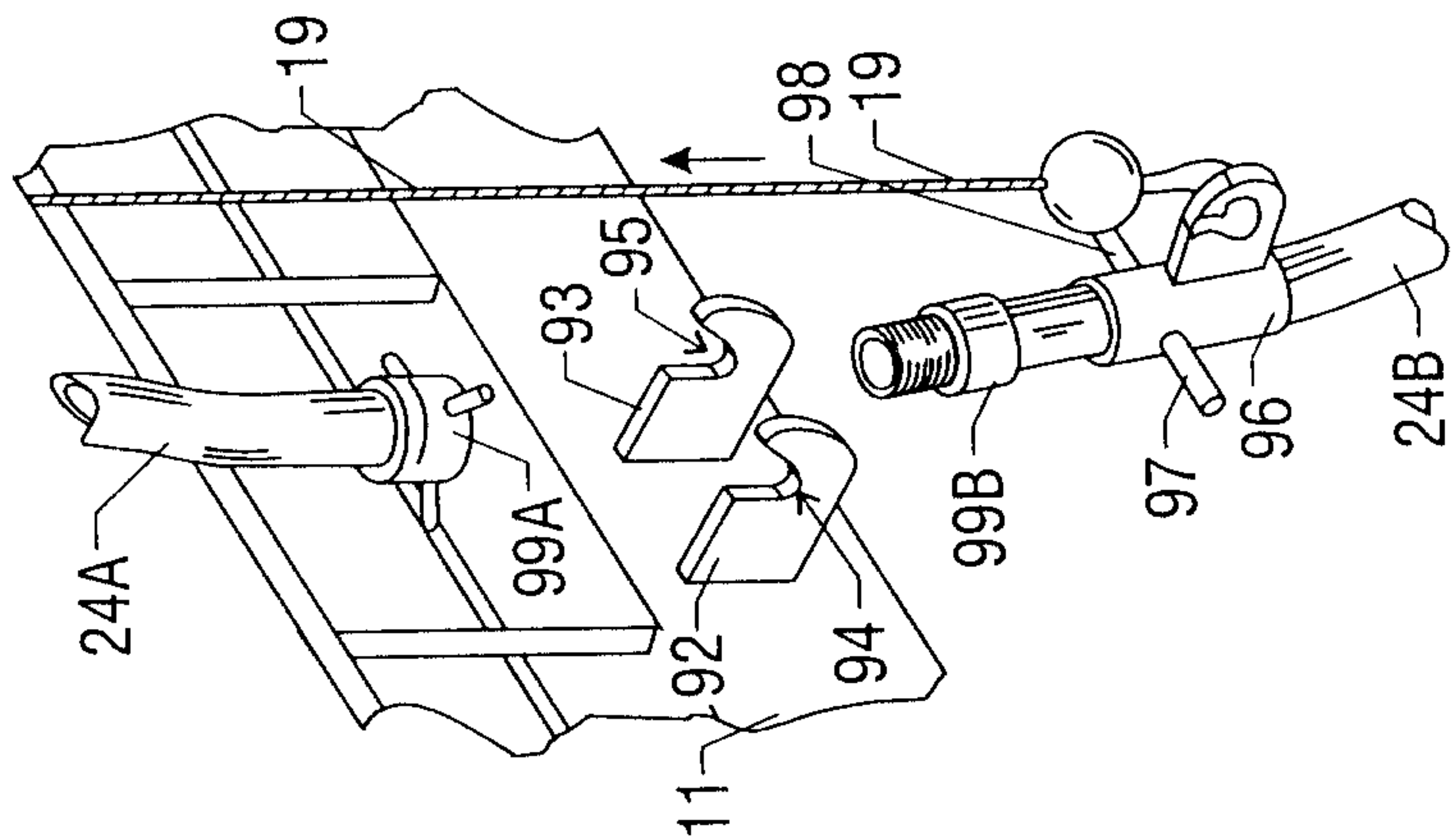


FIG. 14

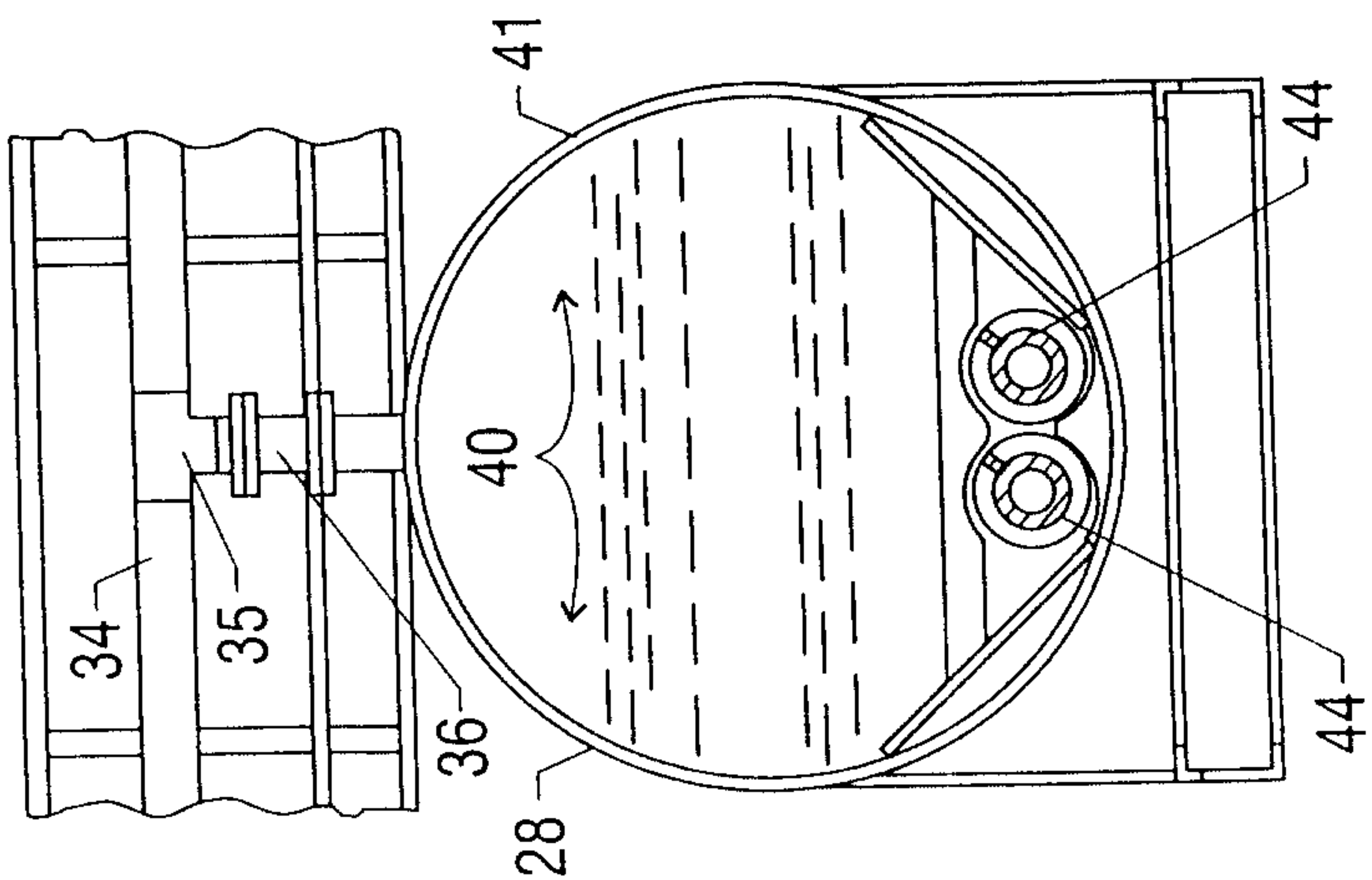


FIG. 13

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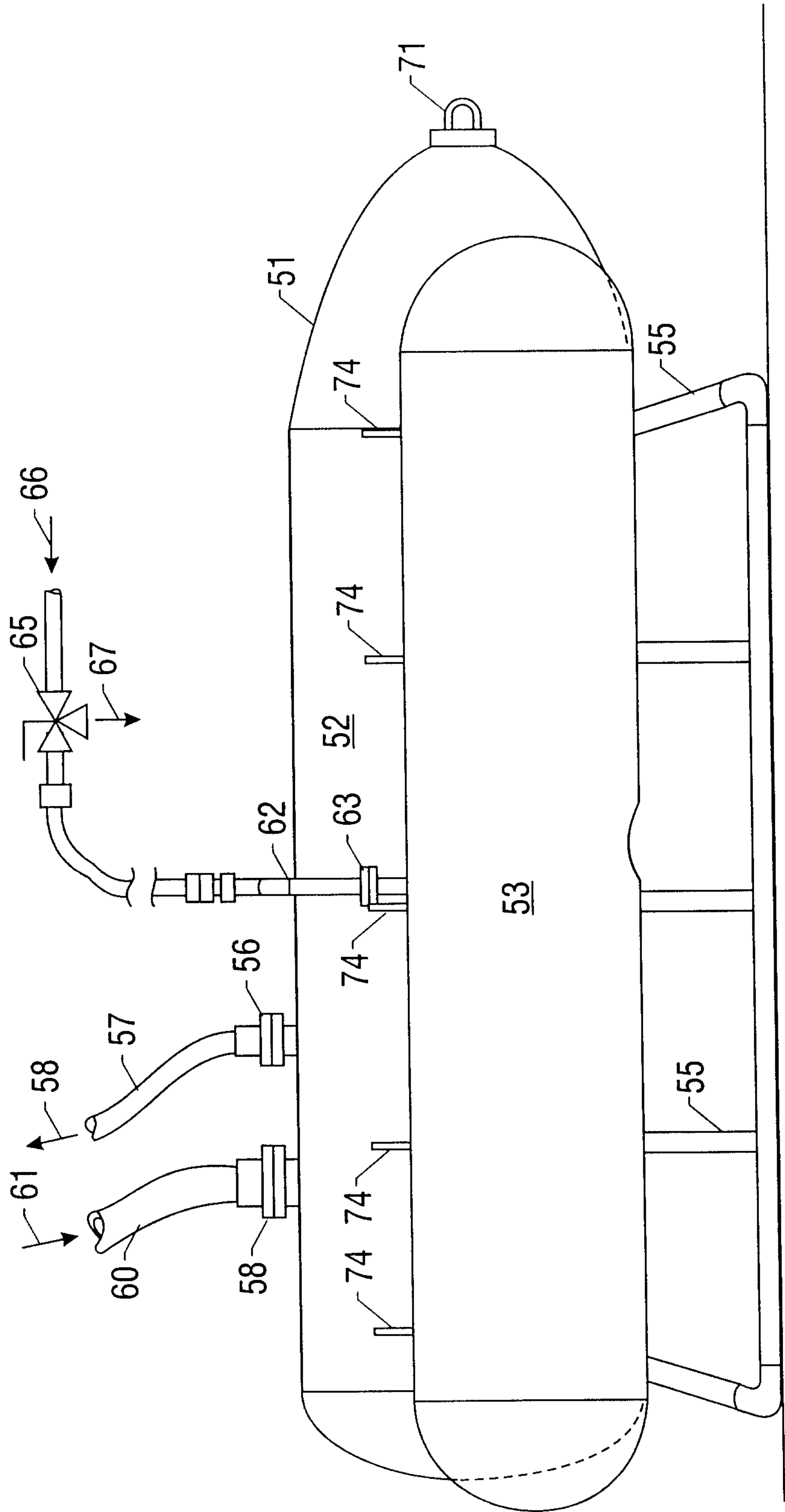


FIG. 16

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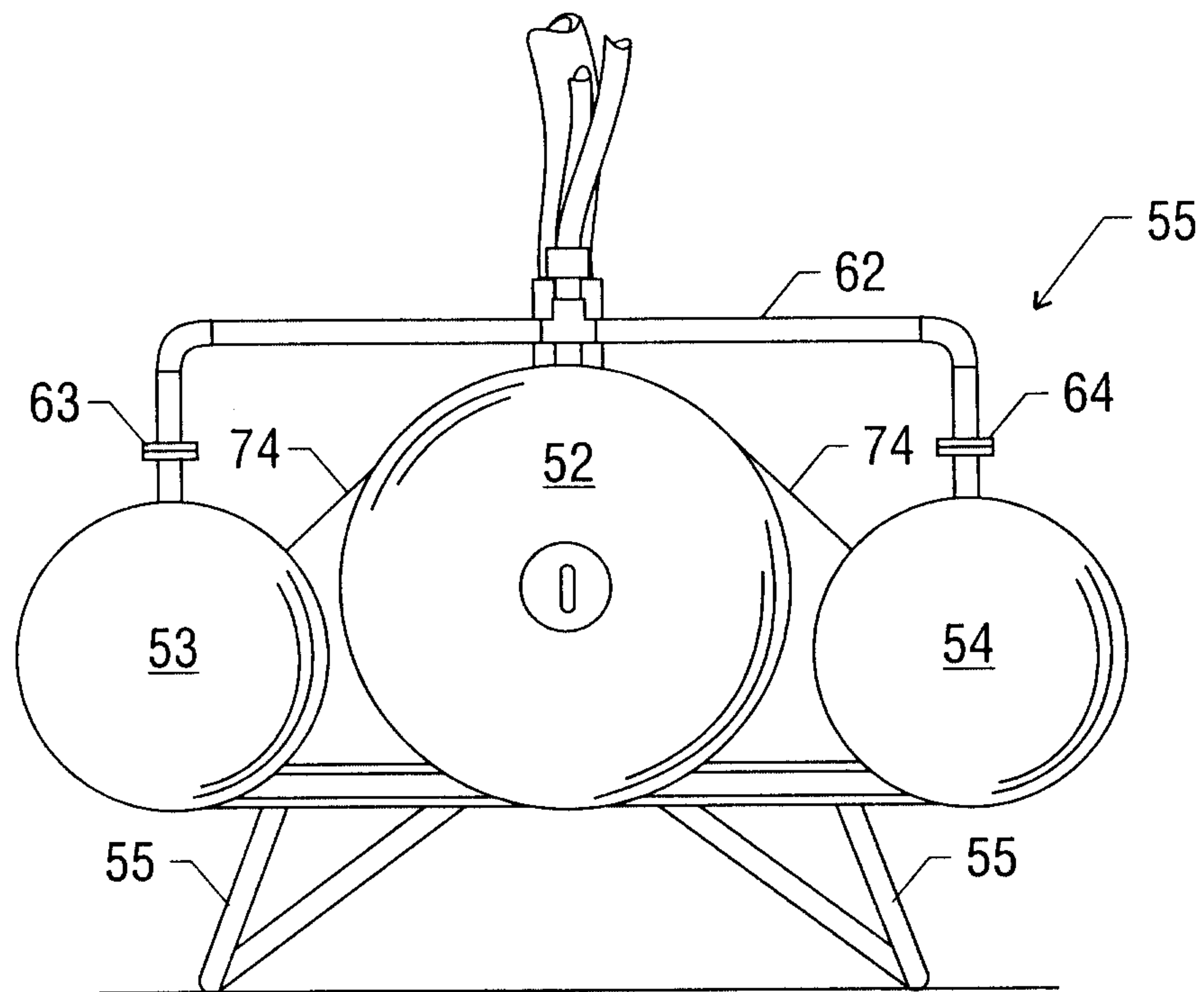


FIG. 17

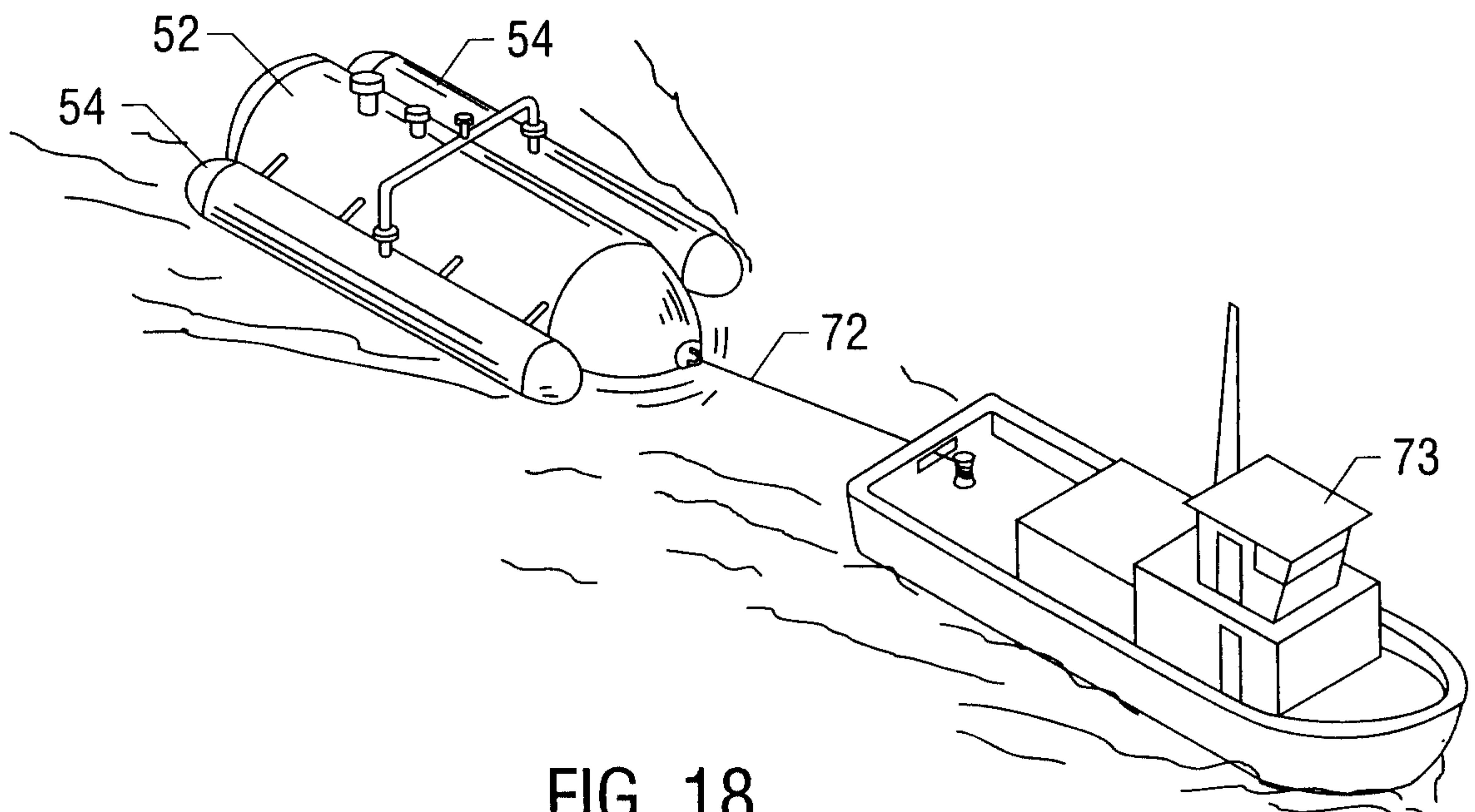


FIG. 18

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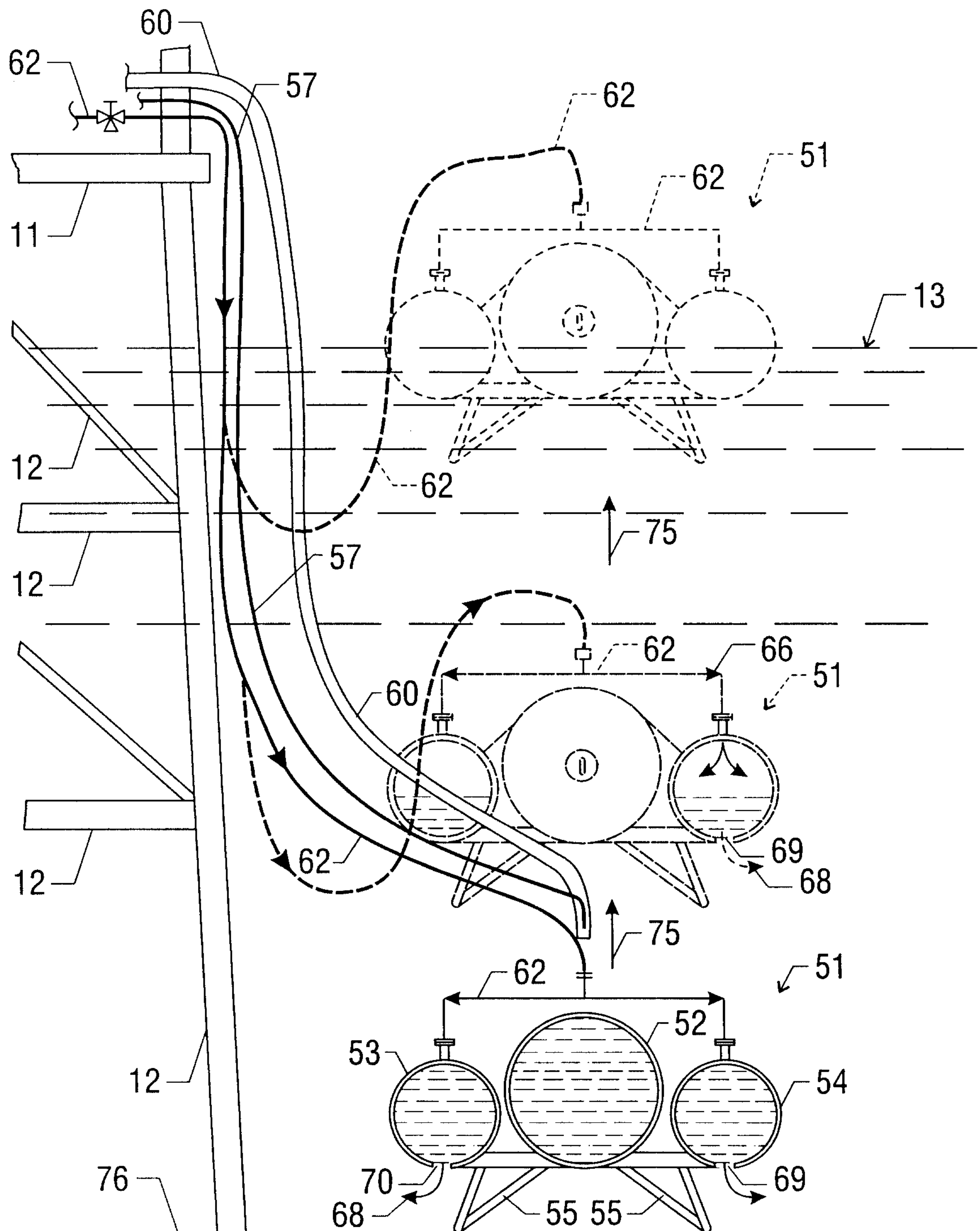


FIG. 19

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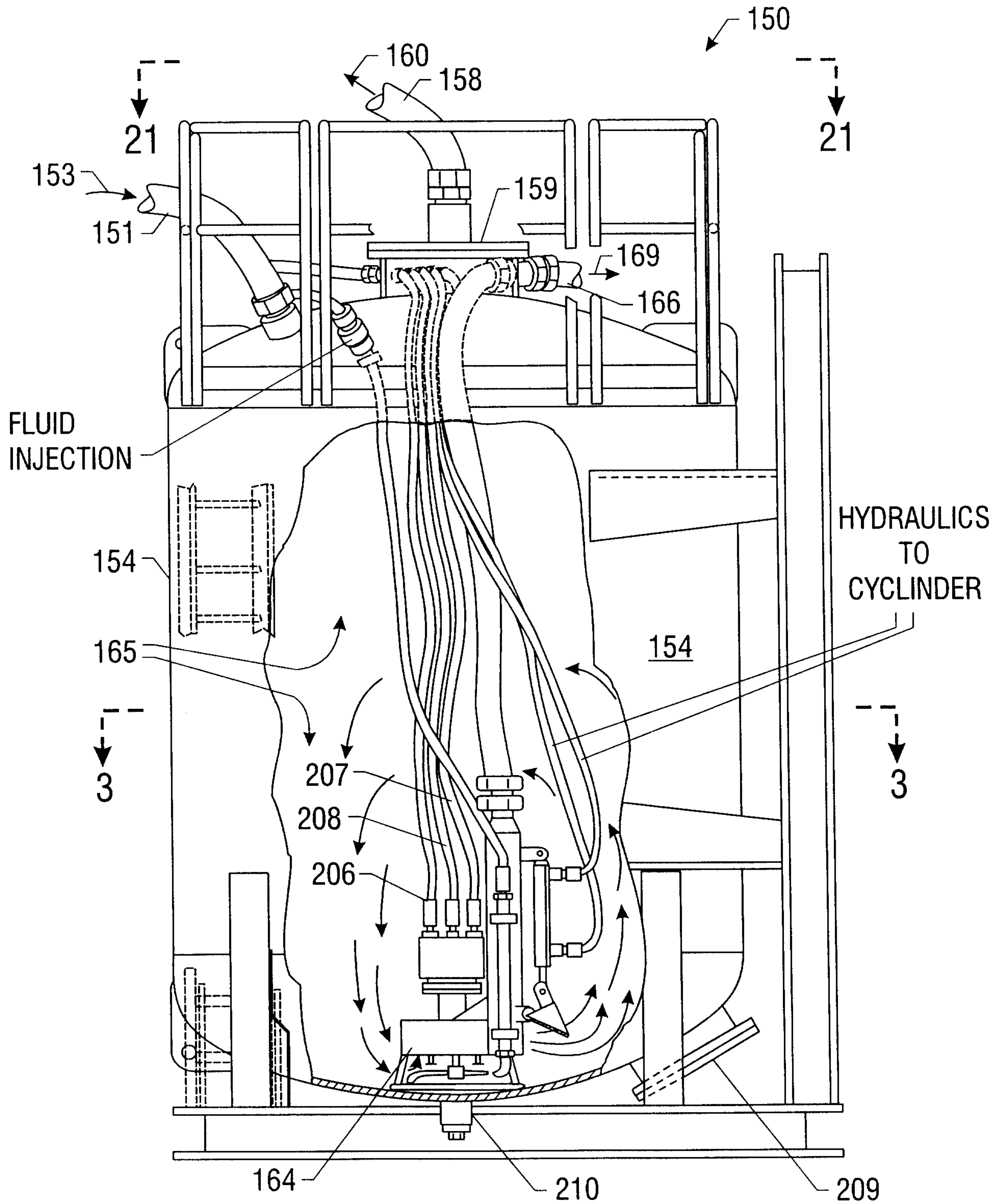


FIG. 20

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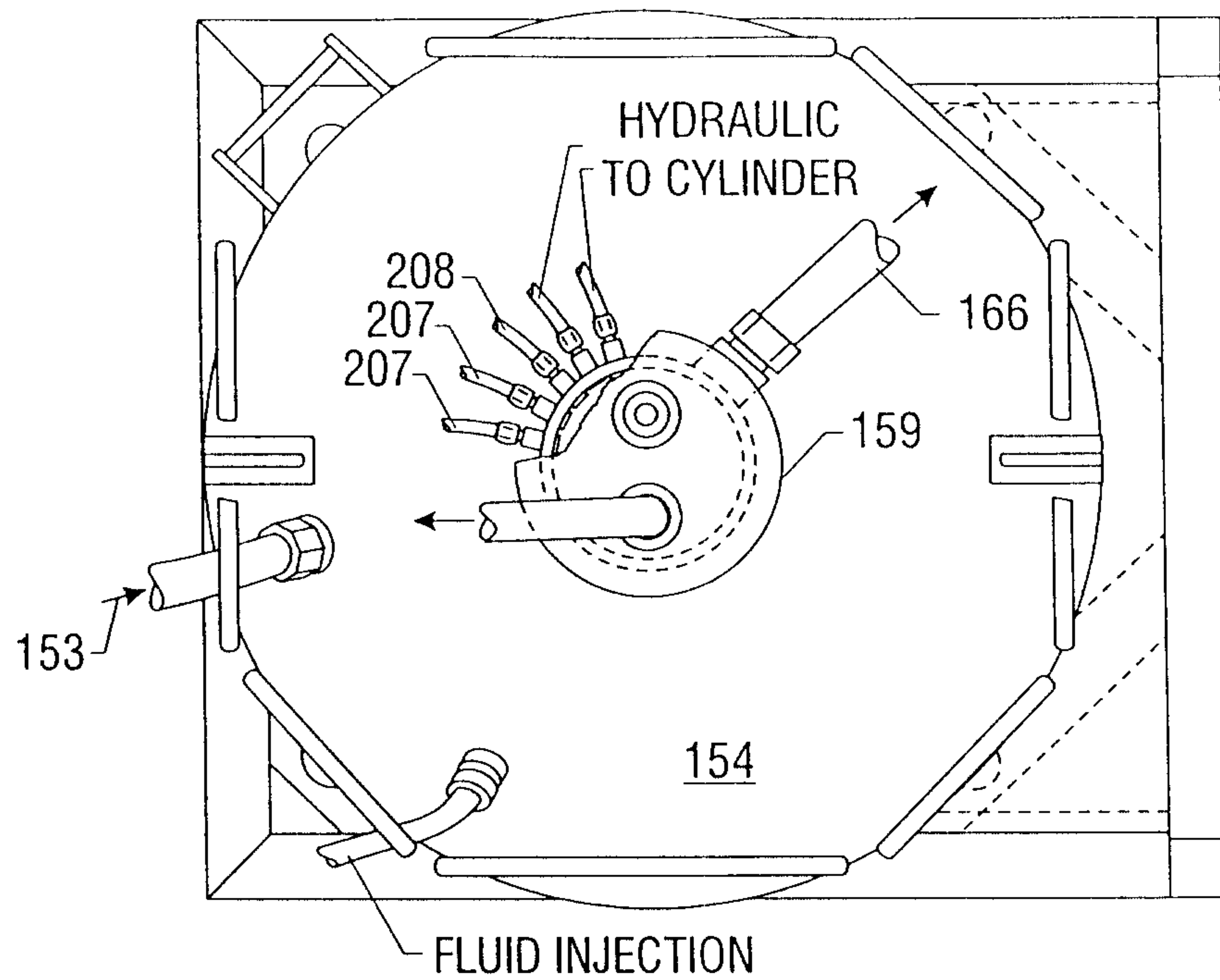


FIG. 21

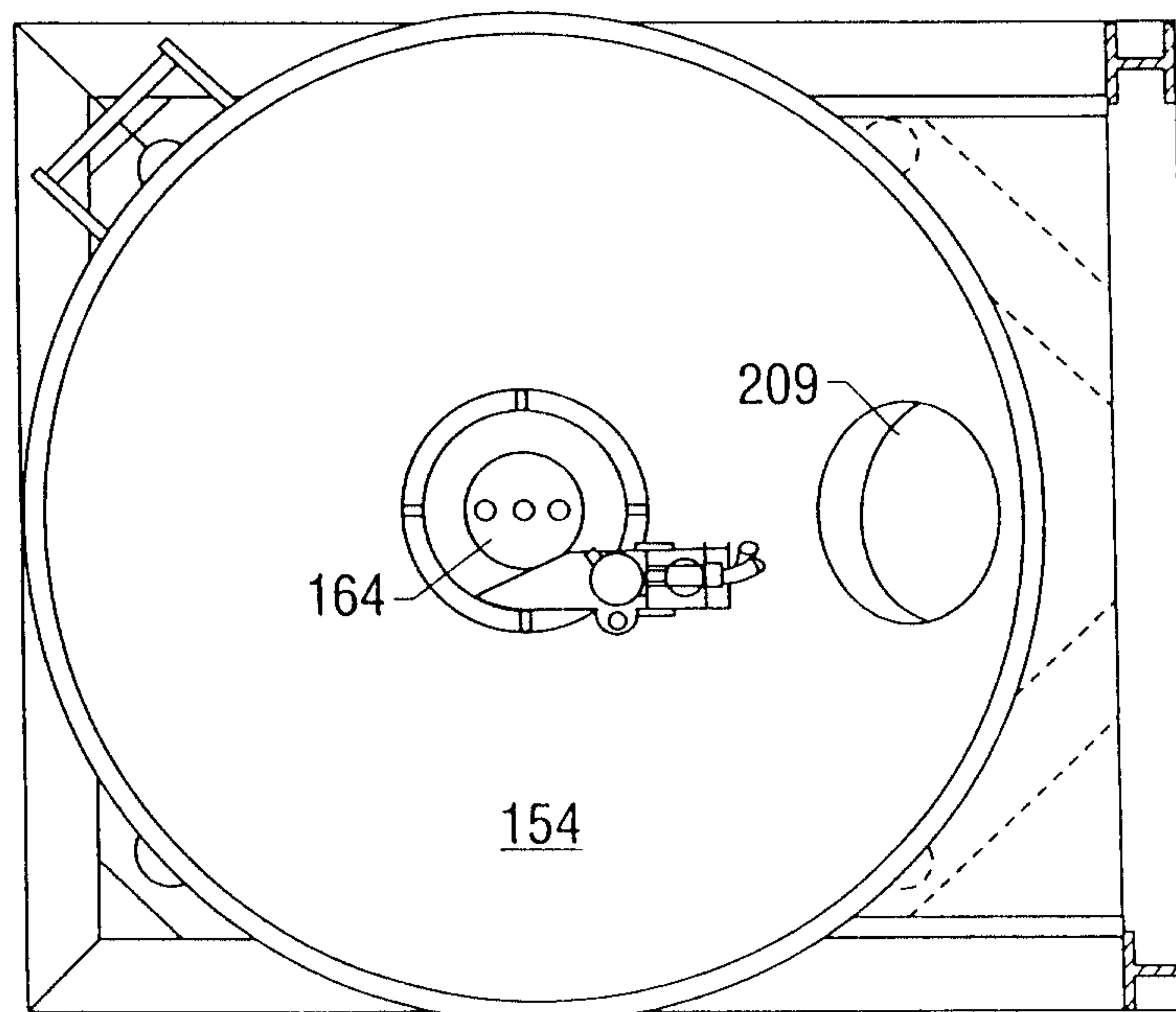


FIG. 22

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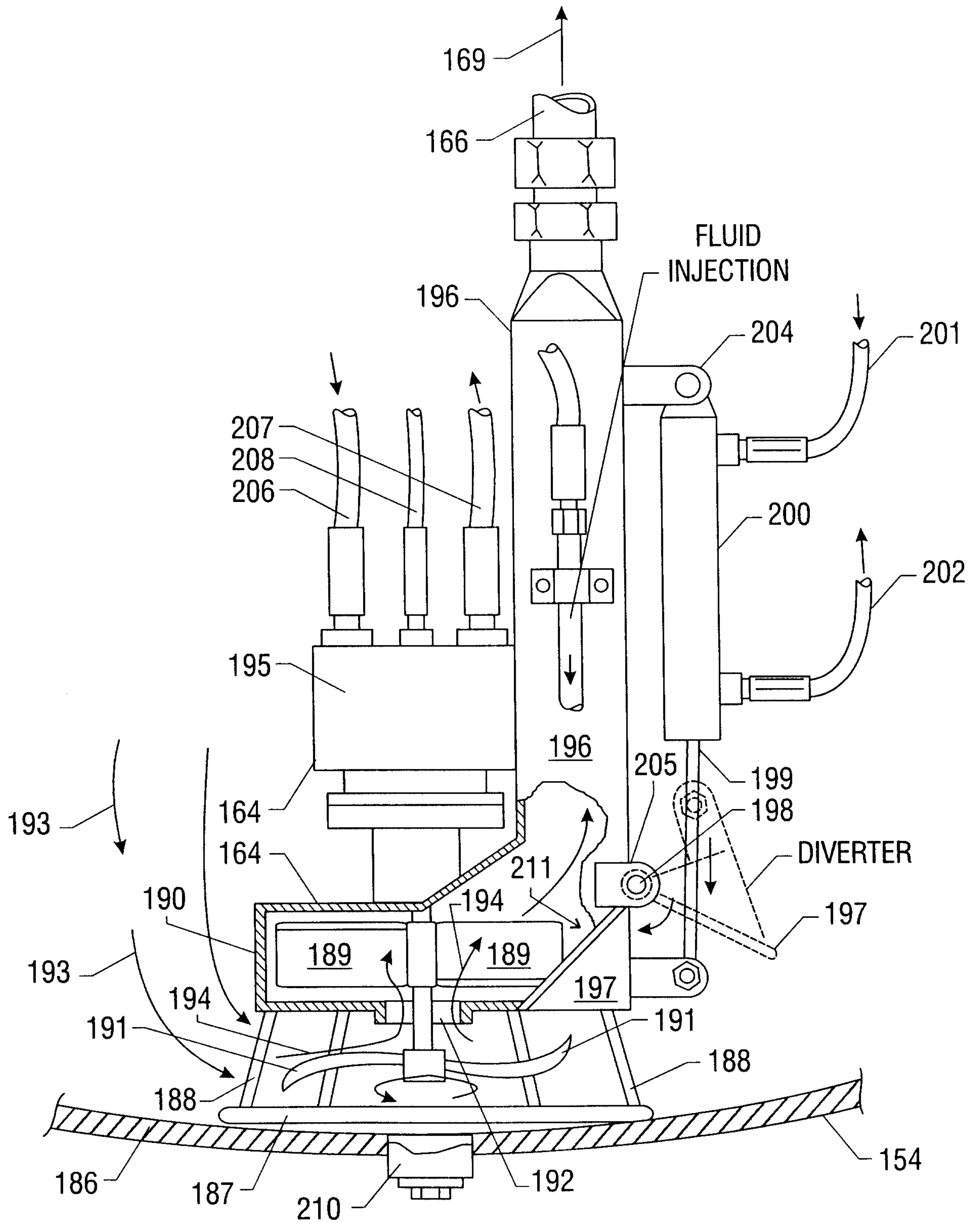
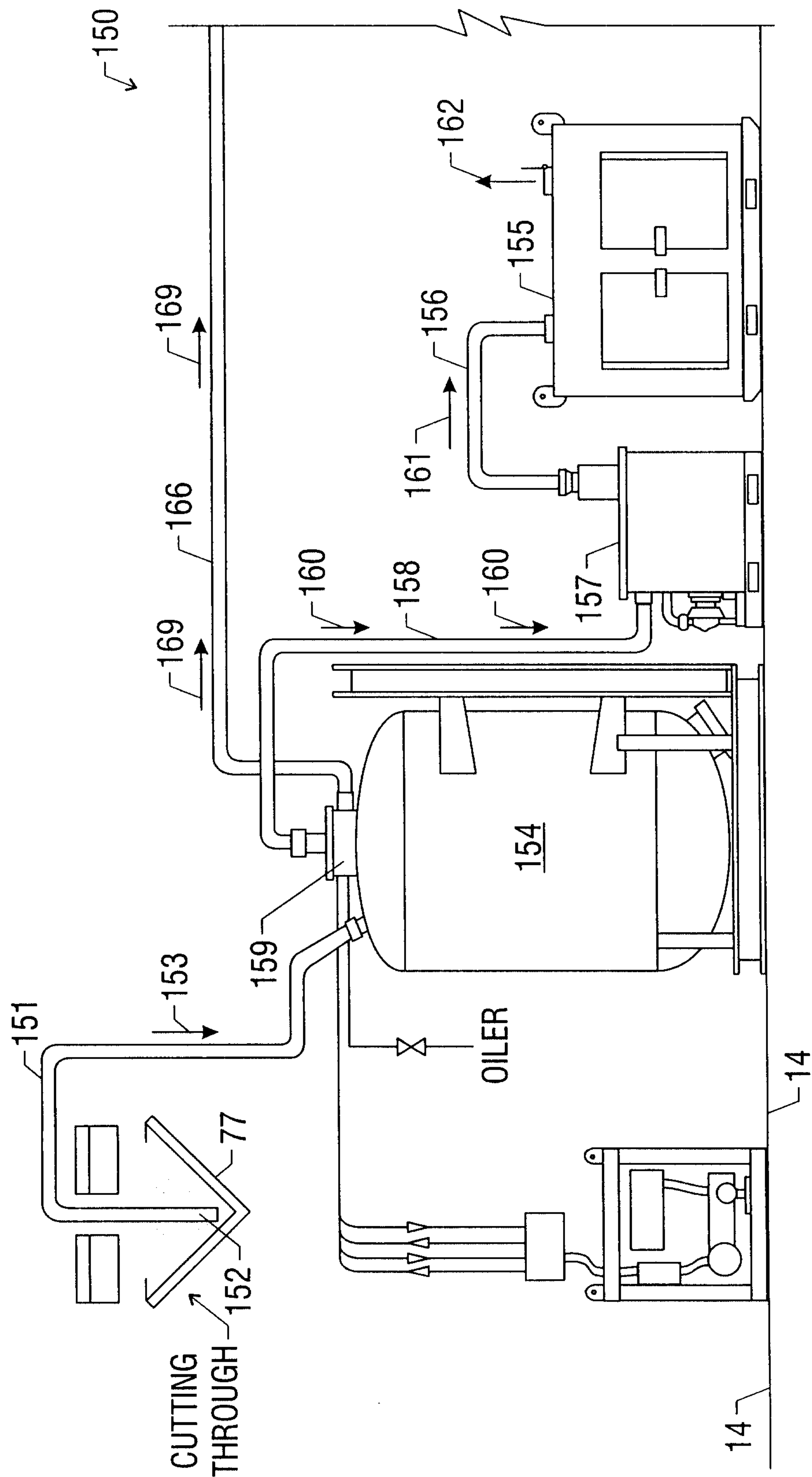


FIG. 23

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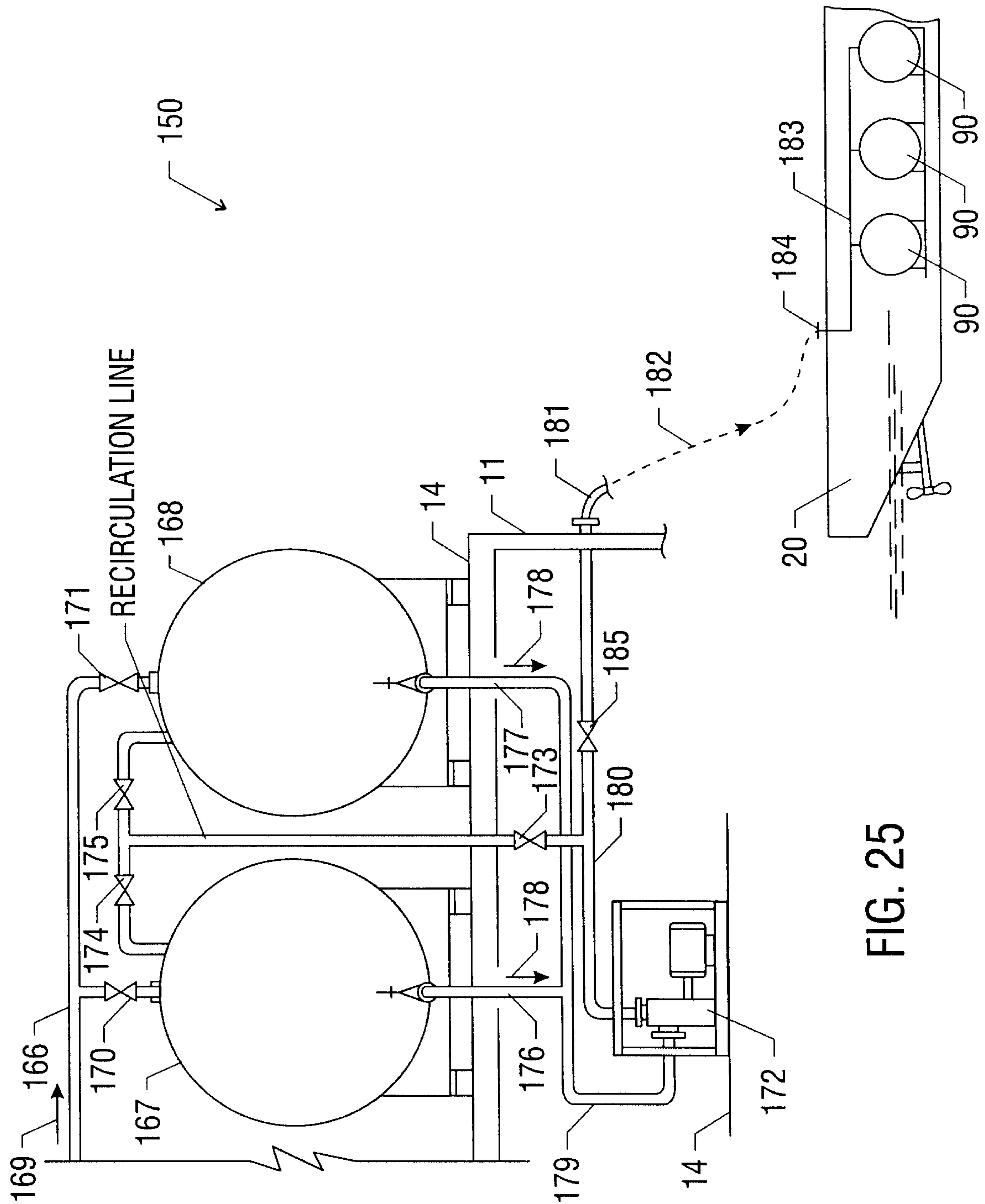


FIG. 25

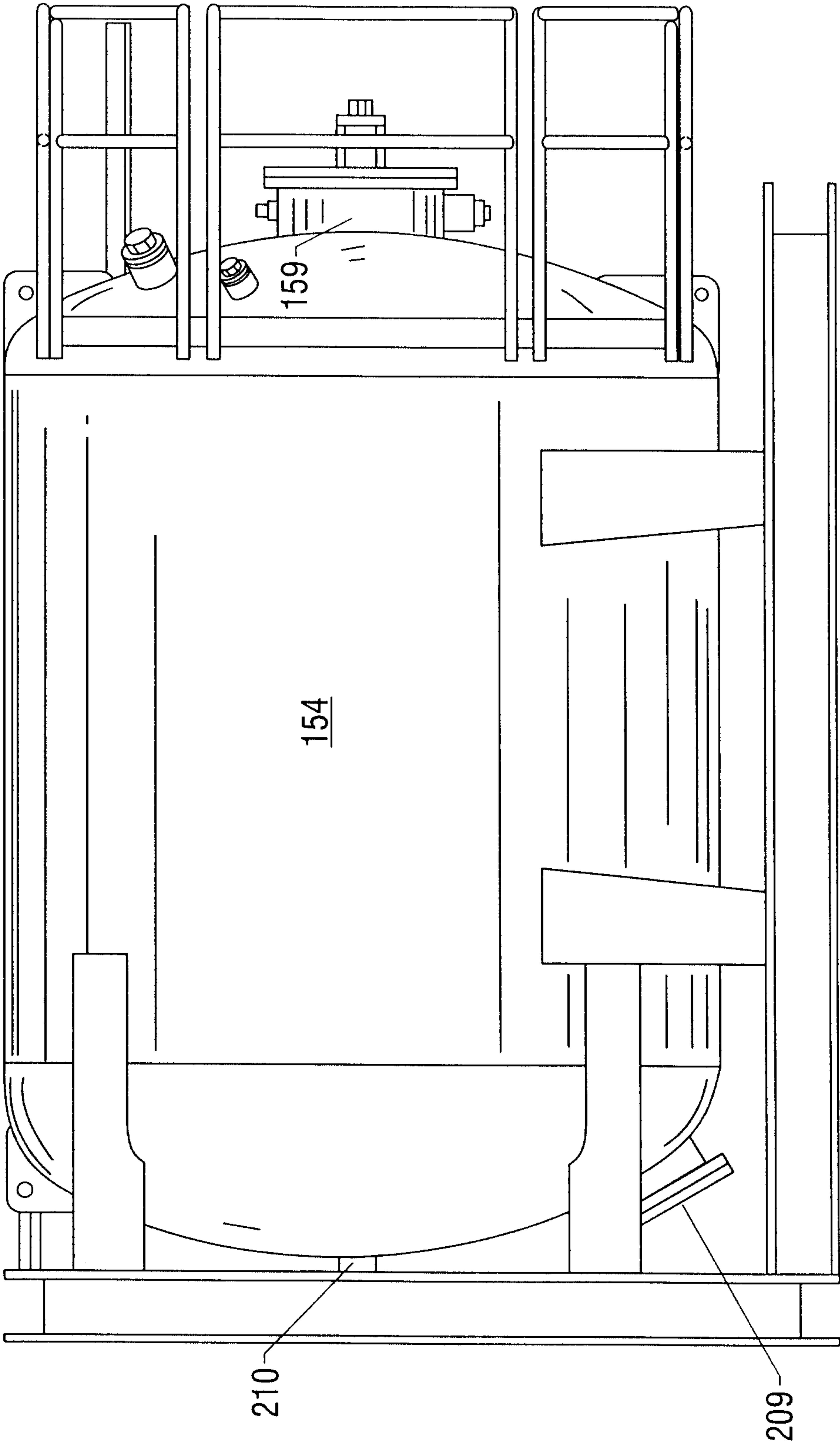


FIG. 26

