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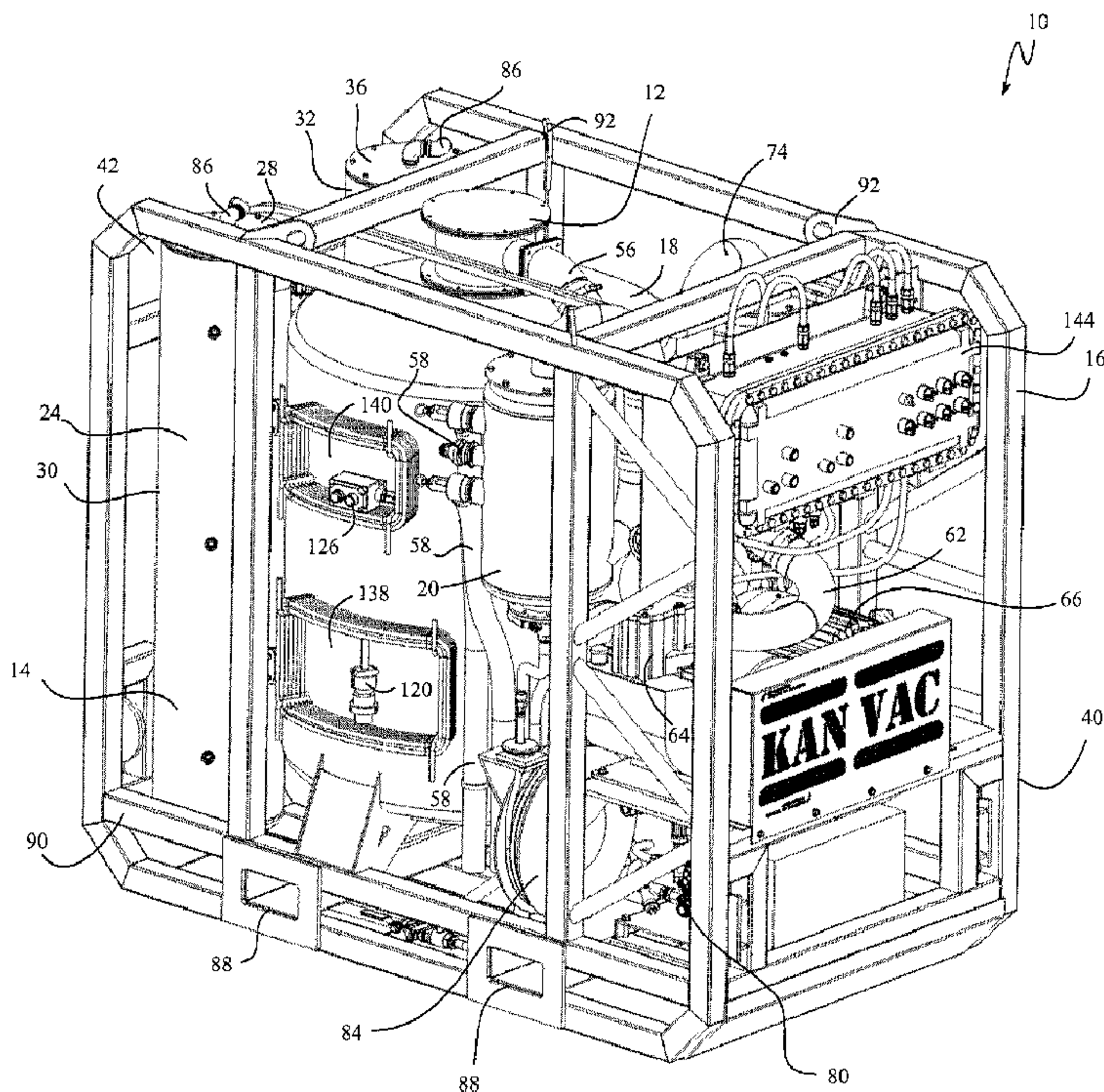
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(54) Title: WASHING APPARATUS



(57) Abrégé/Abstract:

A washing apparatus has a vacuum unit and a pressure washer unit. The vacuum unit has a mud tank, a first centrifuge, and a second centrifuge, and the pressure washer unit has a first water tank having a bottom, a top and a side, and a second water tank

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

having a bottom, a top and a side. A frame having a top, a base and four corners supports the vacuum unit and pressure washer unit. The first centrifuge and the second centrifuge are fixed in respective first and second corners of the frame, and the first water tank and second water tank are fixed in respective third and fourth corners of the frame.

ABSTRACT OF THE DISCLOSURE

A washing apparatus has a vacuum unit and a pressure washer unit. The vacuum unit has a mud tank, a first centrifuge, and a second centrifuge, and the pressure washer unit has a first water tank having a bottom, a top and a side, and a second water tank having a bottom, a top and a side. A frame having a top, a base and four corners supports the vacuum unit and pressure washer unit. The first centrifuge and the second centrifuge are fixed in respective first and second corners of the frame, and the first water tank and second water tank are fixed in respective third and fourth corners of the frame.

WASHING APPARATUS

TECHNICAL FIELD

[0001] Washing apparatus

BACKGROUND

[0002] Industrial cleaning, such as the cleaning of oil rigs, often requires the use of industrial vacuums and pressure washers. Vacuum trucks are used to bring pressure washers and vacuums to industrial operations. However, these trucks require a large space to operate it in. Small scale vacuums and pressure washers are preferable to clean interior or difficult-to-access areas in factories, plants, oil rigs, and other industrial operations.

SUMMARY

[0003] In an embodiment, there is provided a washing apparatus, comprising a vacuum unit, the vacuum unit comprising a tank, a first centrifuge, and a second centrifuge; a pressure washer unit, the pressure washer unit comprising a first water tank having a bottom, a top and a side, and a second water tank having a bottom, a top and a side; a frame having a top, a base and four corners; the frame supporting the portable vacuum unit and pressure washer unit, the first centrifuge and the second centrifuge being fixed in respective first and second corners of the frame, and the first water tank and second water tank being fixed in respective third and fourth corners of the frame.

[0004] In an embodiment, there is provided a washing apparatus, comprising a vacuum unit, the vacuum unit comprising a tank, the tank comprising an upper portion, a lower portion, an inlet, an outlet, and a tube; the outlet being formed in the lower portion of the tank and the inlet being formed above the outlet at waist height on the tank; the tube extending interior to the tank from the inlet to the upper portion of the tank; a pressure washer unit; and a frame, the frame supporting the portable vacuum unit and pressure washer unit.

[0005] In an embodiment, there is provided a washing apparatus, comprising a vacuum unit, the vacuum unit comprising a tank and a pump; a sensor suspended inside the tank for detecting the level of fluid in the tank; a pressure washer unit; a frame, the frame supporting the portable vacuum unit and pressure washer unit; the tank comprising an inlet and an outlet, a first actuator and a second

actuator; the first actuator initiating the pump to pump material into the inlet and the second actuator not operating when the sensor does not detect fluid at a pre-determined height in the mud tank; and the second actuator initiating the pump to pump material out of the mud tank through the outlet and the first actuator not operating when the sensor detects fluid at a pre-determined height in the mud tank.

[0006] In an embodiment, there is provided a washing apparatus, comprising a frame; a vacuum unit mounted within the frame, the vacuum unit comprising a vacuum tank, a first centrifuge, and a second centrifuge; a pressure washer unit mounted within the frame, the pressure washer unit comprising a first water tank and a second water tank; the vacuum tank being situated within the frame with variable distance between the vacuum tank and nearest portions of the frame, the variable distance creating pockets within the frame, the first centrifuge, the second centrifuge, the first water tank and the second water tank being located within the pockets.

[0007] In an embodiment, there is provided a washing apparatus, comprising: a frame defining a volume having a boundary; a vacuum unit mounted on the frame, the vacuum unit comprising a mud tank, the mud tank having a top and a bottom; an outlet from the bottom of the mud tank extending from within the mud tank to the boundary; an inlet into the mud tank above the outlet, the inlet extending from within the mud tank to the boundary; a tube extending from the inlet upward into the mud tank; and a pressure washer unit mounted on the frame within the boundary.

[0008] In various embodiments, there may be included any one or more of the following features: the first water tank has a first viewing window and a second viewing window on the side of the first water tank, the first viewing window being nearer to the bottom of the first water tank than the second viewing window; the frame has a pair of holes extending through the base of the frame for receiving forks of a lifting device; the frame has lifting lugs on the top of the frame to permit lifting of the frame by a crane or helicopter; the frame has a front and a back, the front of the frame has a first sling hook and a second sling hookup, and the back of the frame has a third sling hookup and a fourth sling hookup for attaching the frame to a skid mount; the base of the frame is a skid plate for containing leaks from the vacuum unit and pressure washer unit; and the vacuum tank is a vertically oriented cylindrical tank and the frame is rectangular with corners and the pockets are corners of the frame.

[0009] These and other aspects of the device and method are set out in the claims, which are incorporated here by reference.

BRIEF DESCRIPTION OF THE FIGURES

[0010] Embodiments will now be described with reference to the figures, in which like reference characters denote like elements, by way of example, and in which:

[0011] Fig. 1 is a perspective view of an embodiment of a washing apparatus.

[0012] Fig. 2 is a side view of an embodiment of a washing apparatus.

[0013] Fig. 3 is a further side view of an embodiment of a washing apparatus.

[0014] Fig. 4 is a front view of an embodiment of a washing apparatus.

[0015] Fig. 5 is a back view of an embodiment of a washing apparatus.

[0016] Fig. 6 is a top view of an embodiment of a washing apparatus.

[0017] Fig. 7 is a bottom view embodiment of a washing apparatus.

[0018] Fig. 8 is a perspective view of an embodiment of part of a washing apparatus.

DETAILED DESCRIPTION

[0019] Immaterial modifications may be made to the embodiments described here without departing from what is covered by the claims. In the claims, the word “comprising” is used in its inclusive sense and does not exclude other elements being present. The indefinite articles “a” and “an” before a claim feature do not exclude more than one of the feature being present. Each one of the individual features described here may be used in one or more embodiments and is not, by virtue only of being described here, to be construed as essential to all embodiments as defined by the claims.

[0020] As shown in *Figs. 1-7*, in an embodiment, a washing apparatus **10** comprises a vacuum unit **12**, a pressure washer unit **14**, and a frame **16**. The vacuum unit **12** comprises a mud tank **18**, also called a vacuum tank, a first centrifuge **20**, and a second centrifuge **22**. The pressure

washer unit **14** comprises a first water tank **24** having a bottom **26**, a top **28** and a side **30**, and a second water tank **32** having a bottom **34**, a top **36** and a side **38**. The frame **16** may support the vacuum unit **12** and the pressure washer unit **14**. In an embodiment, the frame **16** defines a volume having a boundary **40**, and the vacuum unit **12** and the pressure washer unit **14** may be mounted in the frame **16**. The vacuum tank **12** may be situated within the frame **16** with variable distance between the vacuum tank **12** and nearest portions of the frame **16**, the variable distance creating pockets **42** within the frame **16**, the first centrifuge **20**, the second centrifuge **22**, the first water tank **24** and the second water tank **32** being located within the pockets **42**. The frame **16** may be rectangular with corners. The frame **16** may include a top **44**, a base **46** and four corners **48**, **50**, **52** and **54**, as shown in *Figs. 6 and 7*.

[0021] As shown in *Fig. 6*, the first centrifuge **20** and the second centrifuge **22** may be fixed in or adjacent to the respective first and second corners **48** and **50** of the frame **16**, and the first water tank **24** and the second water tank **32** may be fixed in or adjacent to the respective third and fourth corners **52** and **54** of the frame **16**. The first centrifuge **20** may be in fluid connection with the mud tank **18**, for example through a first connector tube **56**. When the vacuum unit **12** is in suction mode, fluid flows through the first connector tube **56** in the mud tank **18** to the first centrifuge **20**. The first connector tube **56** may penetrate the side of the first centrifuge **20**, allowing fluid to flow into the centrifuge **20**. As shown in *Fig. 2*, the first centrifuge **20** then separates the immiscible solids or fluids, discharging heavy liquids and solids into waste tubes **58**. A release valve **60** and a release tube **61** at the base of the first centrifuge **20** provides release of accumulated fluids and solids at the base of the first centrifuge **20**. Lighter fluids flow out of the top of the first centrifuge **20** into a second connector tube **62**.

[0022] As shown in *Figs. 1-3 and 5*, the vacuum unit **12** may further comprise a pump **64**, driven by a motor **66**. The first centrifuge **20** may be in fluid connection with the pump **64** through the second connector tube **62**. As shown in *Fig. 6*, the pump **64** may be in fluid connection with the second centrifuge **22** through a third connector tube **68**. *Fig. 3* shows separated fluids and solids are discharged from the second centrifuge **22** through a waste tube **70** having a release valve **72**. The remaining fluid flows out of the top of the second centrifuge **22** through an end tube **74**.

[0023] As shown in *Figs. 2, 3 and 8*, in the pressure washer unit **14**, the first water tank **24** and the second water tank **32** are connected by, respectively, a first water tube **76** and a second water

tube 78 to a motor pump unit 80. As shown by arrows 81 in *Fig. 8*, during operation of the pressure washer unit 14, water flows from either the first water tank 24 through the first water tube 76 or from second water tank 32 through second water tube 78 to the motor pump unit 80, which pressurizes the water and pumps the water out through a hose 82. The hose 82 may be coiled around a reel 84. At the top of each of the first water tank 24 and the second water tank 32 there may be water inlets 86.

[0024] As shown in *Figs. 1-7*, the mud tank 18 may be a vertically oriented cylindrical tank. By being positioned in the pockets 42 or the corners 48, 50, 52 and 54, the weight of the first centrifuge 20, the second centrifuge 22, the first water tank 24 and the second water tank 32 is distributed within the frame 16 to provide stability to the washing apparatus 10.

[0025] As shown in *Figs. 1-6*, the frame 16 has a pair of holes 88 extending through the base 46 of the frame 16 for receiving forks of a lifting device, such as a forklift. The frame 16 may include supporting arms 90 which partially or fully support the vacuum unit 12 and the pressure washer unit 14 above the base 46 of the frame 16. Lifting lugs 92 on the top 44 of the frame 16 permit lifting of the frame 16 by a crane or helicopter. *Figs. 4 and 5* show a front 94 and a back 96 of the frame 16. The front 94 of the frame 16 may have a first sling hookup 98 and a second sling hookup 100, and the back 96 of the frame 16 has a third sling hookup 102 and a fourth sling hookup 104. As shown in *Fig. 7*, the base 46 of the frame 16 may be a skid plate 106 for containing leaks from the vacuum unit 12 and the pressure washer unit 14.

[0026] As shown in *Figs. 2 and 8*, the mud tank 18 has a bottom 108 and a top 110. An outlet 112 may come from the bottom 108 of the mud tank 18 and extend from within the mud tank 18 to the boundary 40 of the frame 16. There may be an inlet 114 into the mud tank 18, and the inlet 114 may extend from within the mud tank 18 to the boundary 40. A tank tube 115 may extend from the inlet 114 upward into the mud tank 18. The mud tank 18 further may have a lower portion 116, and an upper portion 118. The outlet 112 is formed in the lower portion 116 of the mud tank 18 and the inlet 114 may be formed above the outlet 112 at waist height on the mud tank 18. The tank tube 115 may extend interiorly to the mud tank 18 from the inlet 114 to the upper portion 118 of the mud tank 18. *Fig. 8* shows an inflow 119a of fluid through the inlet 114 to the mud tank 18 and into the upper portion 118 of the mud tank 18 through the tank tube 115. *Fig. 8* also shows an outflow 119b of fluid out of the mud tank 18 through the outlet 112.

[0027] As shown in *Figs. 1 and 2*, a sensor **120** suspended inside the mud tank **18** may be used to detect the level of fluid in the mud tank **18**, and to send signals to the power board **144** to reverse the operation of the pump **64** when the tank is full or empty. The vacuum unit **12** may operate as follows: a first actuator **122** initiates the pump **64** to pump material into the inlet **114** and a second actuator **124** does not operate when the sensor **120** does not detect fluid at a pre-determined height in the mud tank **18**; and the second actuator **124** initiates the pump **64** to pump material out of the mud tank **18** through the outlet and the first actuator **122** does not operate when the sensor **120** detects fluid at a pre-determined height in the mud tank **18**. When the first actuator **122** is operating, the pump **64** provides suction to bring material into the mud tank **18** and through the vacuum unit **12**. When the second actuator **124** is operating, the pump **64** discharges material from the mud tank **18**.

[0028] The outlet **112** and the inlet **114**, together with the first and second actuators **122** and **124**, are installed as low as possible on the mud tank **18** to provide for safe operation of the washing apparatus **10**. A low height for the inlet and outlet allows an operator to easily lift and connect a hose to the outlet **112** or the inlet **114**. By the tank tube **115** being in fluid connection from the inlet **114** to the upper portion **118** of the mud tank **18**, the inlet **114** may be lowered without causing back flow of material if operation of the vacuum unit **12** is stopped when the fluid level in the mud tank **18** is above the inlet **114** but has not yet reached the height of the fluid sensor **120**. The first and second actuators **122** and **124** may be turned on or off using a selector switch **126**. When the first and second actuators **122** and **124** are turned on, the vacuum unit **12** runs automatically using the fluid sensor **120** and actuators **122** and **124**, thus eliminating the need to have an operator remain at the washing apparatus **10** while the vacuum unit **12** is in use. When the first actuator **122** and the second actuator **124** are turned off using the selector switch **126**, the vacuum unit **12** may be operated manually, using a first hand-wheel **127a** and a second hand-wheel **127b**, respectively.

[0029] As shown in *Fig. 4*, the side **30** of the first water tank **24** may have a lower viewing window **128** and an upper viewing window **130**, the lower viewing window **128** being nearer to the bottom of the first water tank **24** than the upper viewing window **130**. The second water tank **32** may also have a lower viewing window **134** and an upper viewing window **136**, having the same configuration as the viewing windows in the first water tank **24**. The mud tank **18** may also have a lower viewing window **138** and an upper viewing window **140** on the side of the mud tank **18**, the lower viewing window **138** being nearer to the bottom of the mud tank **18** than the upper viewing window **140**. Using some or all of the viewing windows **128**, **130**, **134**, **136**, **138** and **140** an operator

may observe the level of fluid or material in the mud tank **18** or the water tanks **24** and **32** in order to determine whether to stop or alter the operation of the washing apparatus **10**. An operator may assess the fluid level in the mud tank **18** using the viewing windows **138** and **140** to determine when to manually reverse the operations of the vacuum unit **12**.

[0030] As shown in *Fig. 3*, the mud tank **18** has an access door **142** to allow periodic cleaning of the interior of the mud tank **18**.

[0031] As shown in *Figs. 1-3, 5 and 6*, the power board **144** supplies power to and electronically connects sensors, actuators, motors and pumps.

What is claimed is:

1. A washing apparatus, comprising:
 - a vacuum unit, the vacuum unit comprising a mud tank, a first centrifuge, and a second centrifuge;
 - a pressure washer unit, the pressure washer unit comprising a first water tank having a bottom, a top and a side, and a second water tank having a bottom, a top and a side;
 - a frame having a top, a base and four corners;
 - the frame supporting the vacuum unit and pressure washer unit, the first centrifuge and the second centrifuge being fixed respective to the first and second corners of the frame, and the first water tank and second water tank being fixed respective to the third and fourth corners of the frame.
2. The washing apparatus of claim 1 in which the mud tank further comprises an upper portion, a lower portion, an inlet, an outlet and a tank tube, and the outlet is formed in the lower portion of the mud tank and the inlet is formed the above the outlet.
3. The washing apparatus of claim 2 in which the inlet is formed at waist height on the mud tank.
4. The washing apparatus of any one of claims 1-3 further comprising a sensor suspended inside the mud tank for detecting the level of fluid in the mud tank.
5. The washing apparatus of any one of claims 1-4 in which the vacuum unit further comprises a pump.
6. The washing apparatus of claim 5 in which the mud tank further comprises a first actuator and a second actuator, the first actuator initiating the pump to pump material into the inlet and the second actuator not operating when the sensor does not detect fluid at a pre-determined height in the mud tank, and the second actuator initiating the pump to pump material out of the mud tank through the outlet and the first actuator not operating when the sensor detects fluid at a pre-determined height in the mud tank.

7. The washing apparatus of any one of claims 1-6 in which the first water tank has a first viewing window and a second viewing window on the side of the first water tank, the first viewing window being nearer to the bottom of the first water tank than the second viewing window.
8. The washing apparatus of any one of claims 1-7 in which the frame has a pair of holes extending through the base of the frame for receiving forks of a lifting device.
9. The washing apparatus of any one of claims 1-8 in which the frame has lifting lugs on the top of the frame to permit lifting of the frame by a crane or helicopter.
10. The washing apparatus of any one of claims 1-9 in which the frame has a front and a back, the front of the frame has a first sling hook and a second sling hookup, and the back of the frame has a third sling hookup and a fourth sling hookup for attaching the frame to a skid mount.
11. The washing apparatus of any one of claims 1-10 in which the base of the frame is a skid plate for containing leaks from the vacuum unit and pressure washer unit.
12. The washing apparatus of any one of claims 1-11 in which the mud tank is a vertically oriented mud tank.
13. A washing apparatus, comprising:
 - a vacuum unit, the vacuum unit comprising a mud tank, the mud tank comprising an upper portion, a lower portion, an inlet, an outlet, and a tank tube;
 - the outlet being formed in the lower portion of the mud tank and the inlet being formed above the outlet at waist height on the mud tank;
 - the tank tube extending interior to the mud tank from the inlet to the upper portion of the mud tank;
 - a pressure washer unit; and
 - a frame, the frame supporting the portable vacuum unit and pressure washer unit.

14. A washing apparatus, comprising:
- a vacuum unit, the vacuum unit comprising a mud tank and a pump;
 - a sensor suspended inside the mud tank for detecting the level of fluid in the mud tank;
 - a pressure washer unit;
 - a frame, the frame supporting the vacuum unit and the pressure washer unit;
 - the mud tank comprising an inlet and an outlet, a first actuator and a second actuator;
 - the first actuator initiating the pump to pump material into the inlet and the second actuator not operating when the sensor does not detect fluid at a pre-determined height in the mud tank; and
 - the second actuator initiating the pump to pump material out of the mud tank through the outlet and the first actuator not operating when the sensor detects fluid at a pre-determined height in the mud tank.
15. A washing apparatus, comprising:
- a frame;
 - a vacuum unit mounted within the frame, the vacuum unit comprising a vacuum tank, a first centrifuge, and a second centrifuge;
 - a pressure washer unit mounted within the frame, the pressure washer unit comprising a first water tank and a second water tank;
 - the vacuum tank being situated within the frame with variable distance between the vacuum tank and nearest portions of the frame, the variable distance creating pockets within the frame, the first centrifuge, the second centrifuge, the first water tank and the second water tank being located within the pockets.
16. The washing apparatus of claim 15 in which the vacuum tank is a vertically oriented cylindrical tank, the frame is rectangular with corners and the pockets are corners of the frame.

17. The washing apparatus of any one of claims 15 and 16 in which the vacuum tank has a top and bottom.
18. The washing apparatus of any one of claims 15-17 in which the frame defines a volume having a boundary.
19. The washing apparatus of claim 18 further comprising an outlet from the bottom of the vacuum tank extending from within the vacuum tank to the boundary, an inlet into the vacuum tank above the outlet, the inlet extending from within the vacuum tank to the boundary, and a tank tube extending from the inlet upward into the vacuum tank.
20. The washing apparatus of any one of claims 15-19 further comprising a sensor suspended inside the mud tank for detecting the level of fluid in the vacuum tank.
21. The washing apparatus of any one of claims 15-20 in which the vacuum unit further comprises a pump.
22. The washing apparatus of claim 21 in which the vacuum tank further comprises a first actuator and a second actuator, the first actuator initiating the pump to pump material into the inlet and the second actuator not operating when the sensor does not detect fluid at a pre-determined height in the vacuum tank, and the second actuator initiating the pump to pump material out of the vacuum tank through the outlet and the first actuator not operating when the sensor detects fluid at a pre-determined height in the vacuum tank.
23. The washing apparatus of any one of claims 15-22 in which the first water tank has a first viewing window and a second viewing window on the side of the first water tank, the first viewing window being nearer to the bottom of the first water tank than the second viewing window.
24. The washing apparatus of any one of claims 15-23 in which the frame has a pair of holes extending through the base of the frame for receiving forks of a lifting device.
25. The washing apparatus of any one of claims 15-24 in which the frame has lifting lugs on the top of the frame to permit lifting of the frame by a crane or helicopter.

26. The washing apparatus of any one of claims 15-25 in which the frame has a front and a back, the front of the frame has a first sling hook and a second sling hookup, and the back of the frame has a third sling hookup and a fourth sling hookup for attaching the frame to a skid mount.

27. The washing apparatus of any one of claims 15-26 in which the base of the frame is a skid plate for containing leaks from the vacuum unit and pressure washer unit.

28. A washing apparatus, comprising:

a frame defining a volume having a boundary;

a vacuum unit mounted on the frame, the vacuum unit comprising a mud tank, the mud tank having a top and a bottom;

an outlet from the bottom of the mud tank extending from within the mud tank to the boundary;

an inlet into the mud tank above the outlet, the inlet extending from within the mud tank to the boundary;

a tank tube extending from the inlet upward into the mud tank; and

a pressure washer unit mounted on the frame within the boundary.

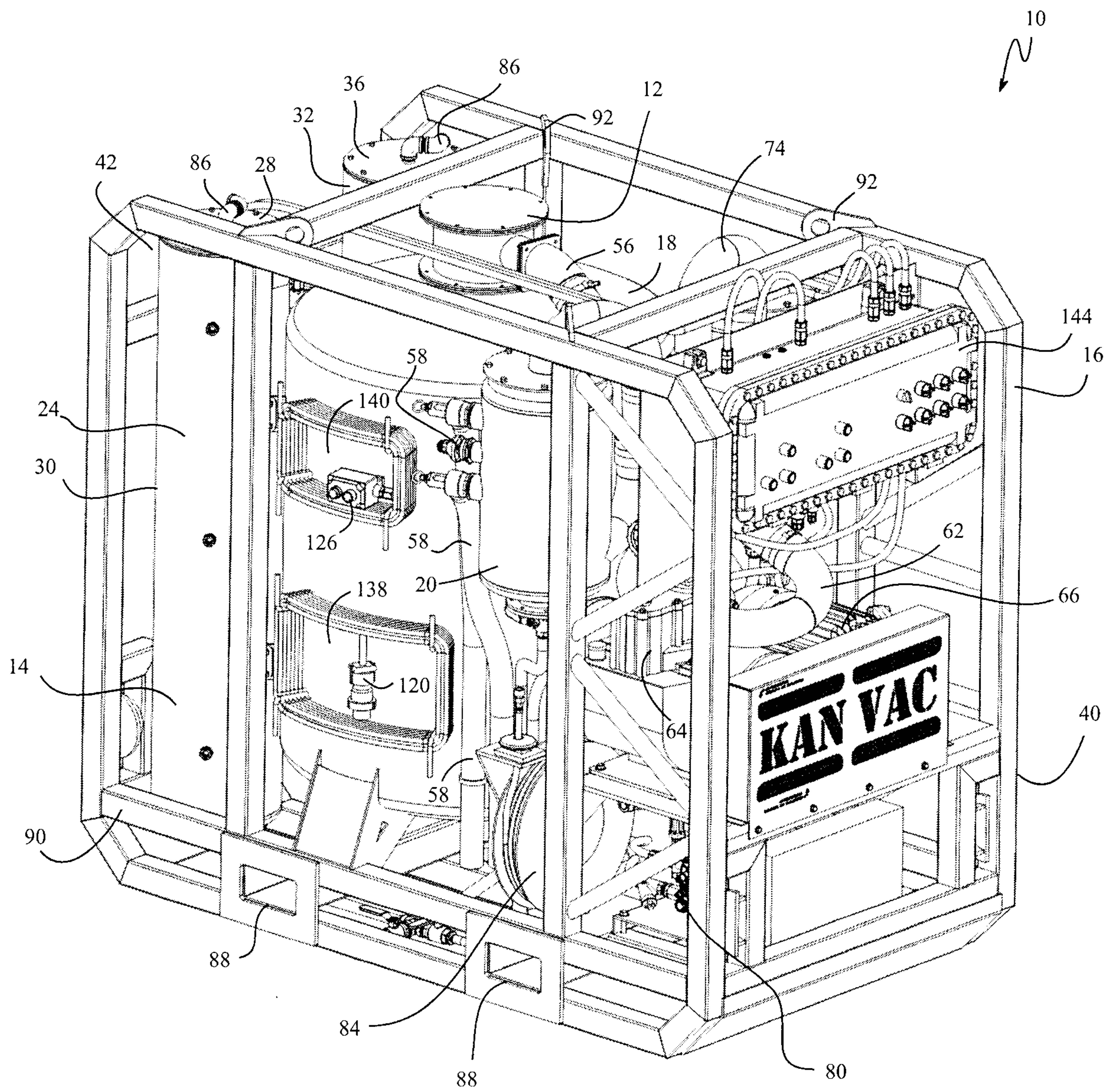


Fig. 1

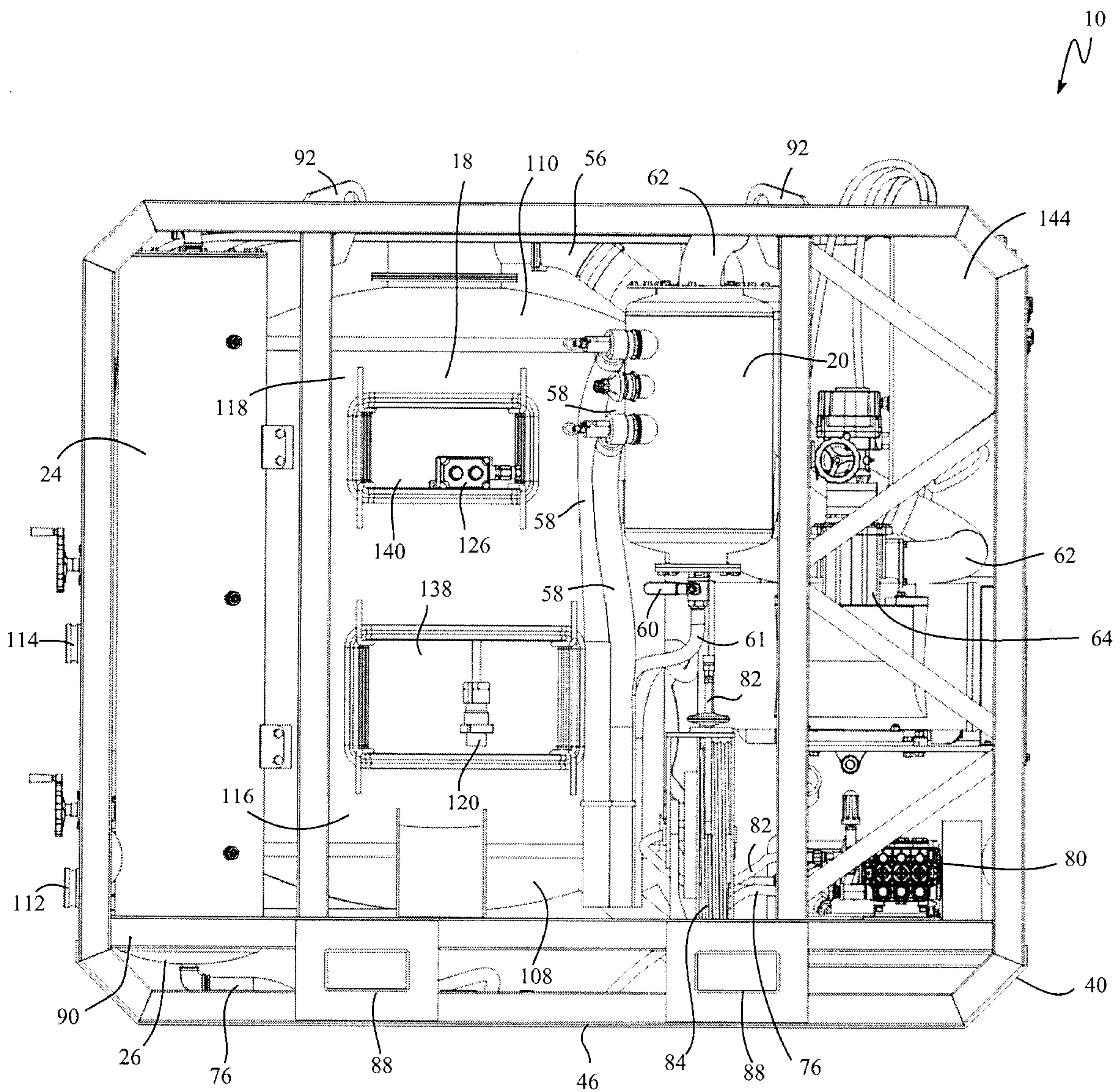


Fig. 2

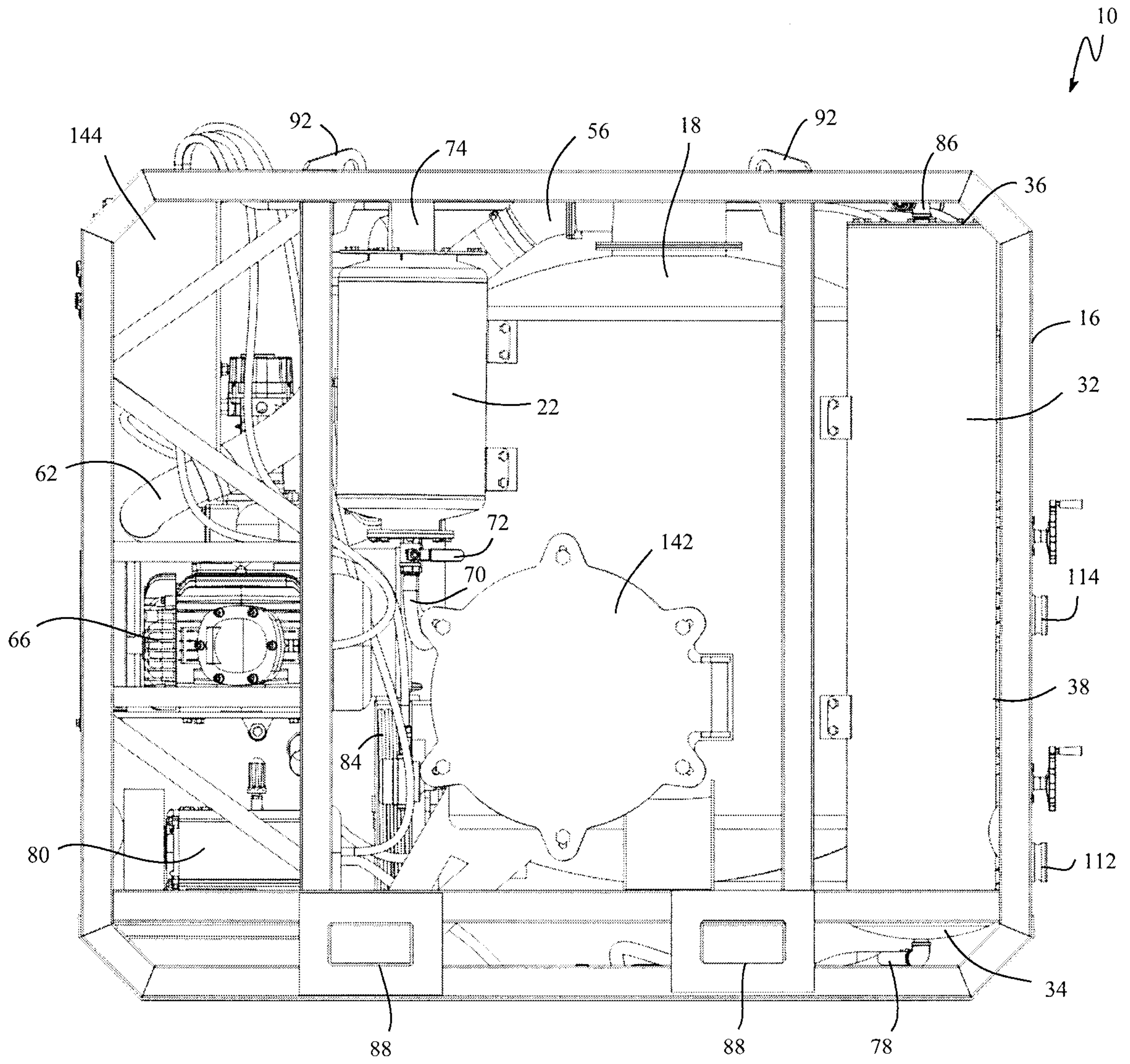


Fig. 3

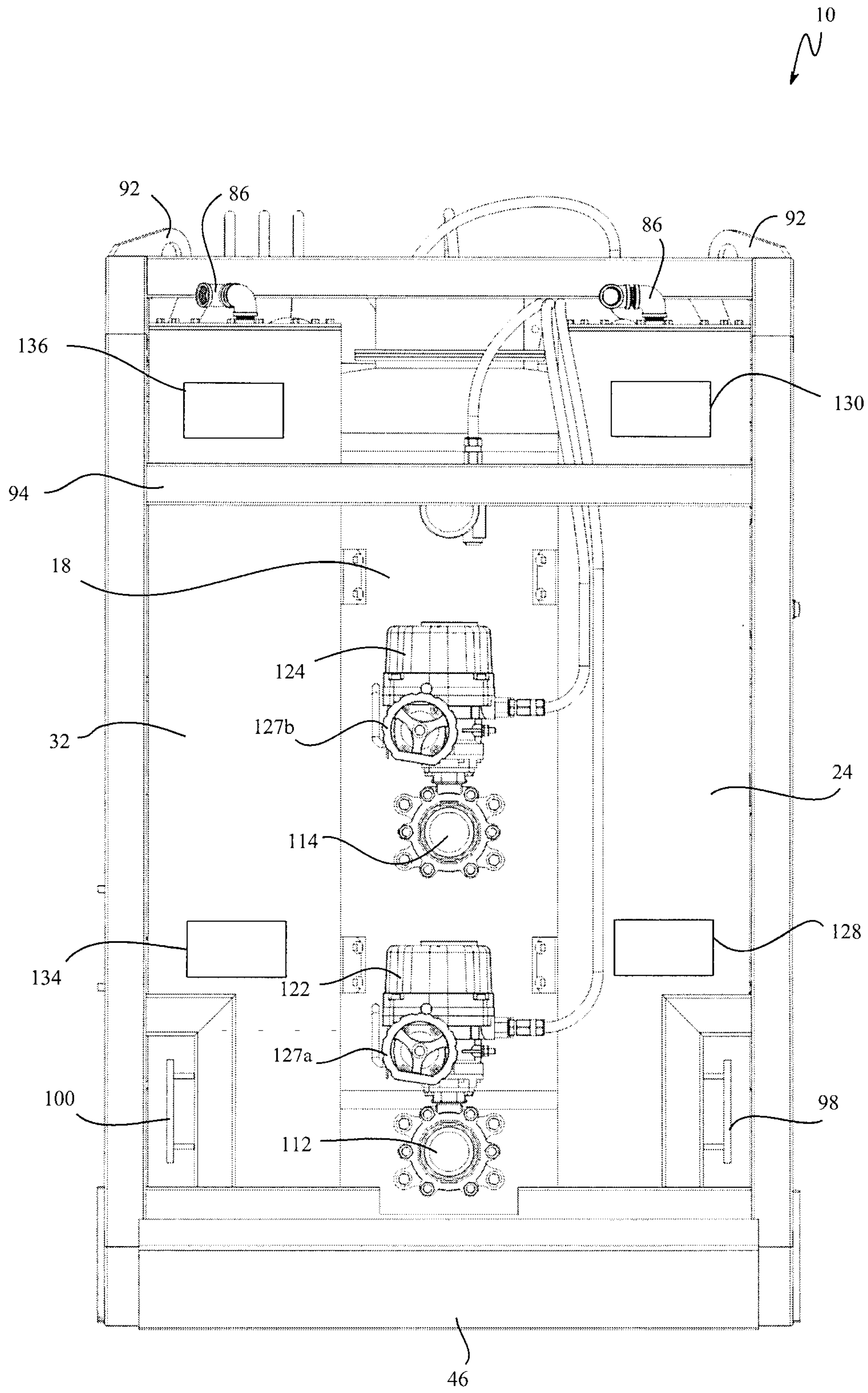


Fig. 4

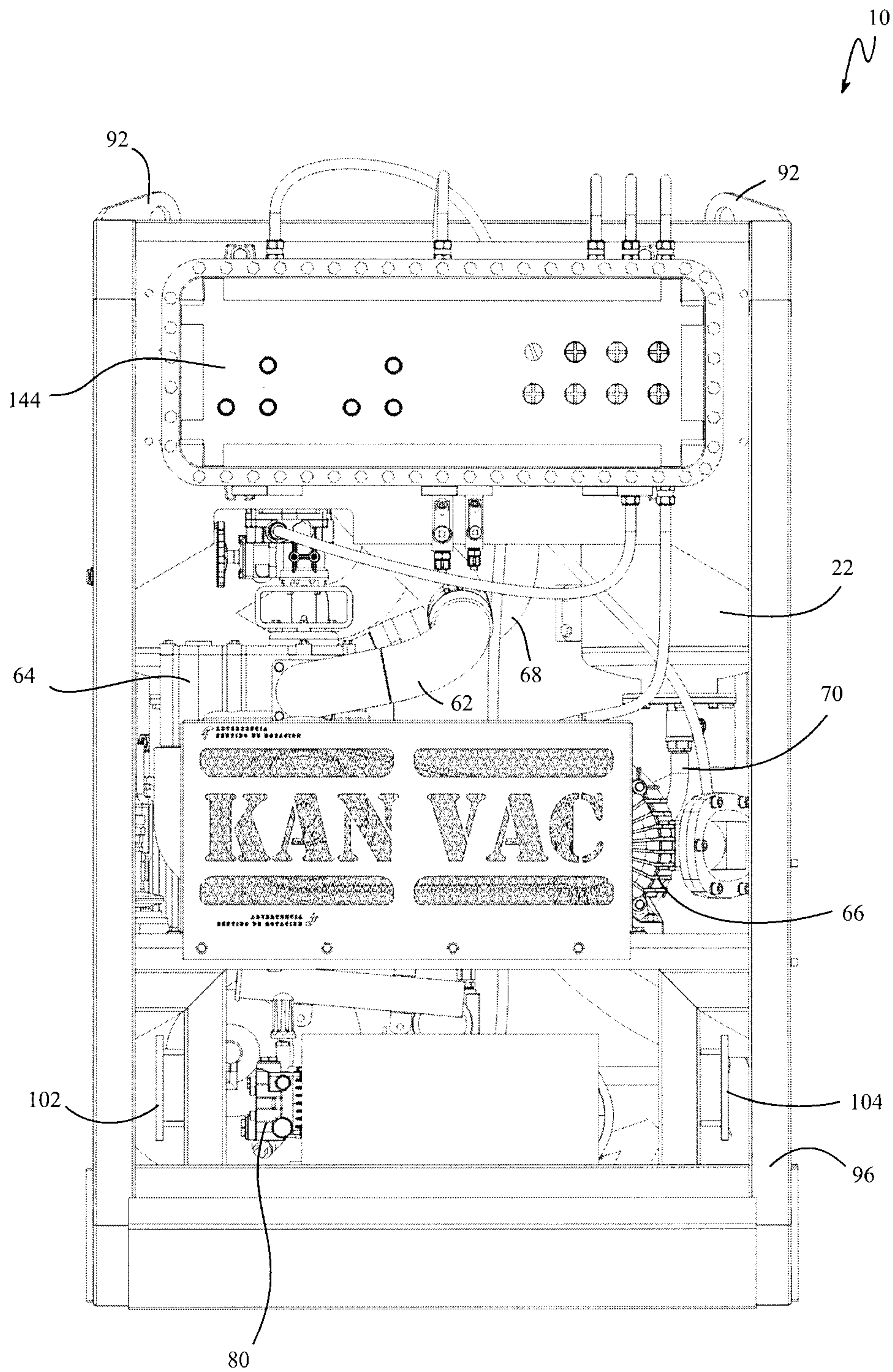


Fig. 5

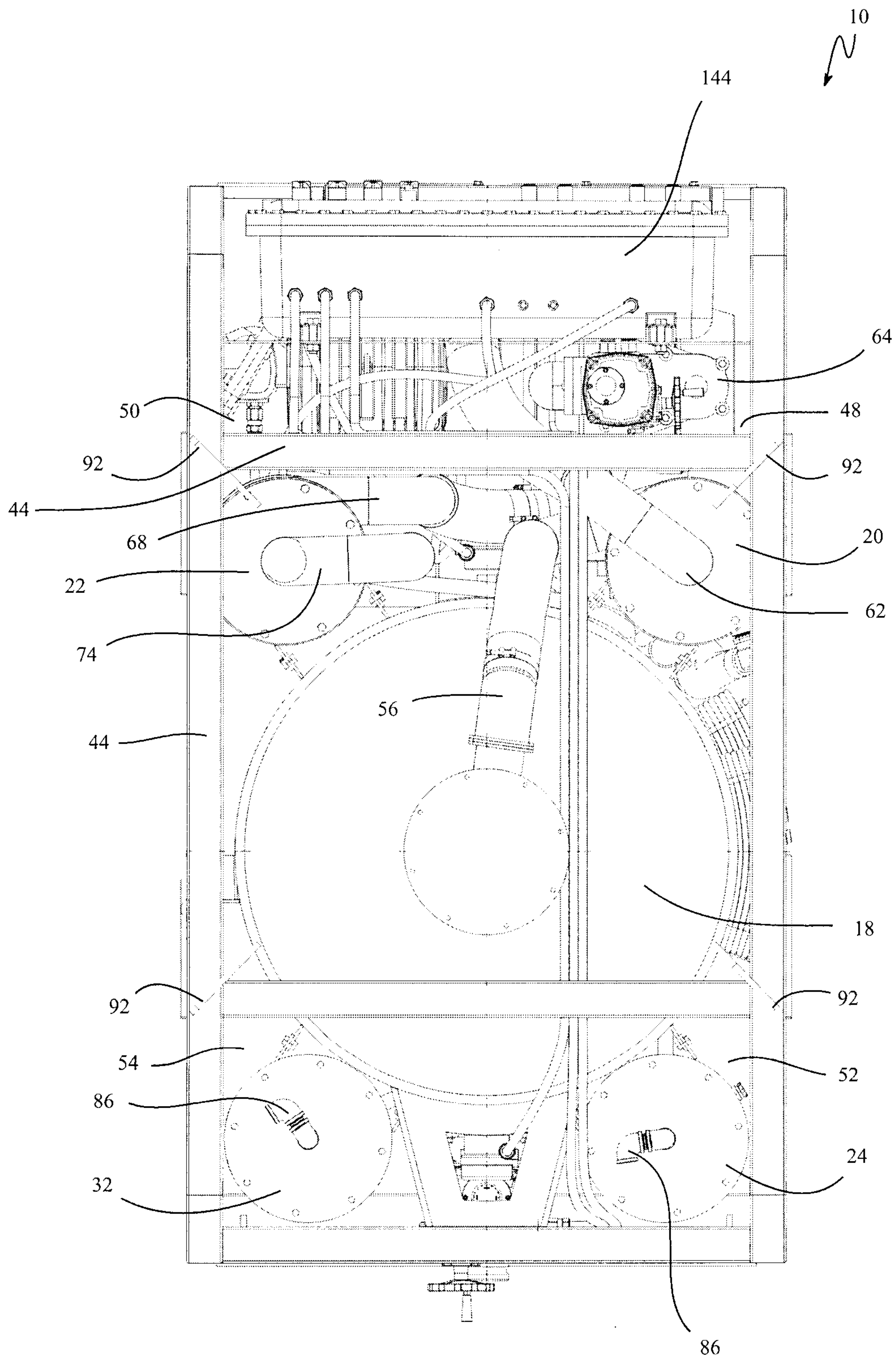


Fig. 6

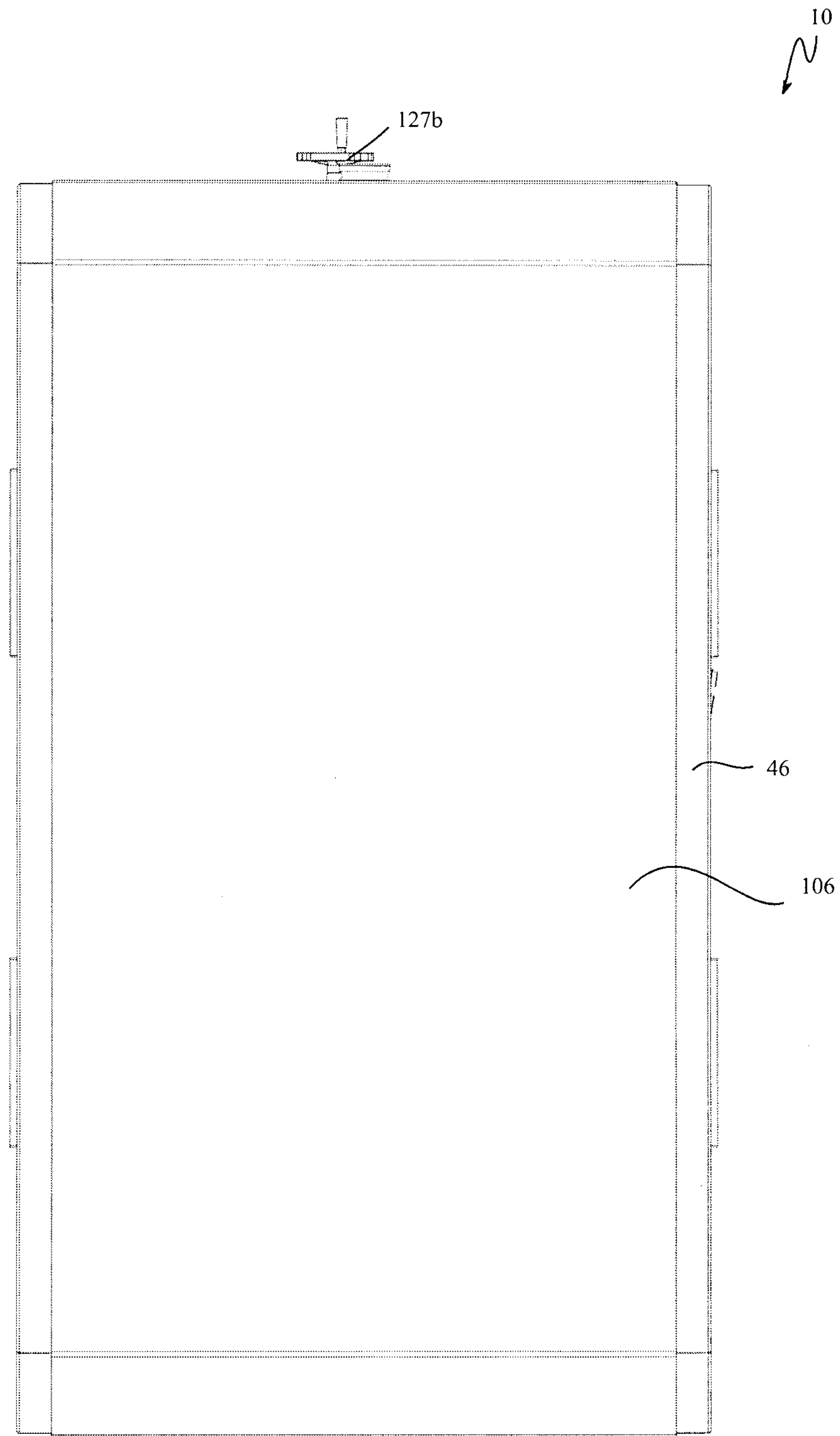


Fig. 7

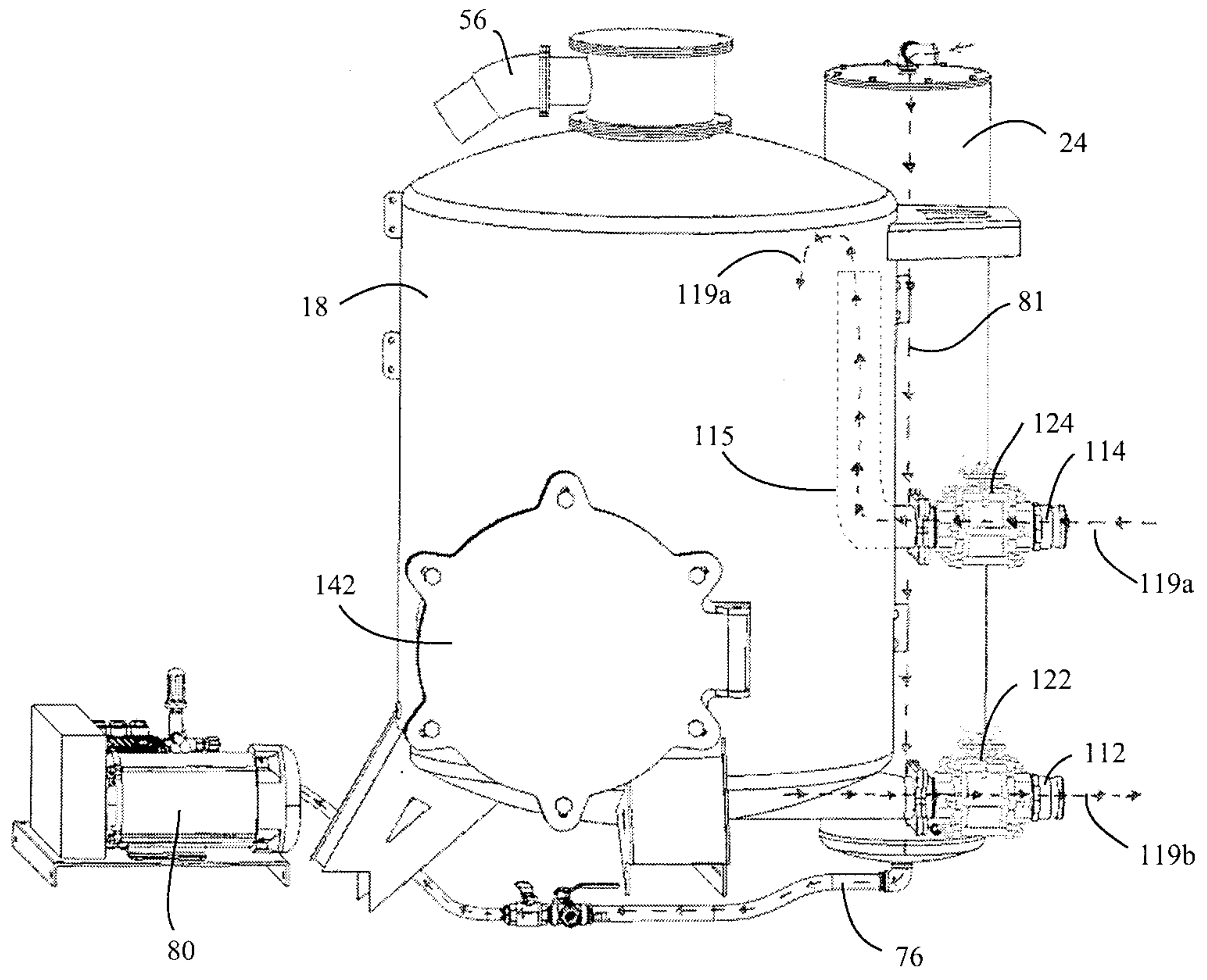


Fig. 8

