Aug. 27, 1963 E. E. REED 3,101,874

FLOATING SUCTION FOR SUBMERSIBLE PUMP

Filed Oct. 7, 1960 2 Sheets-Sheet 1

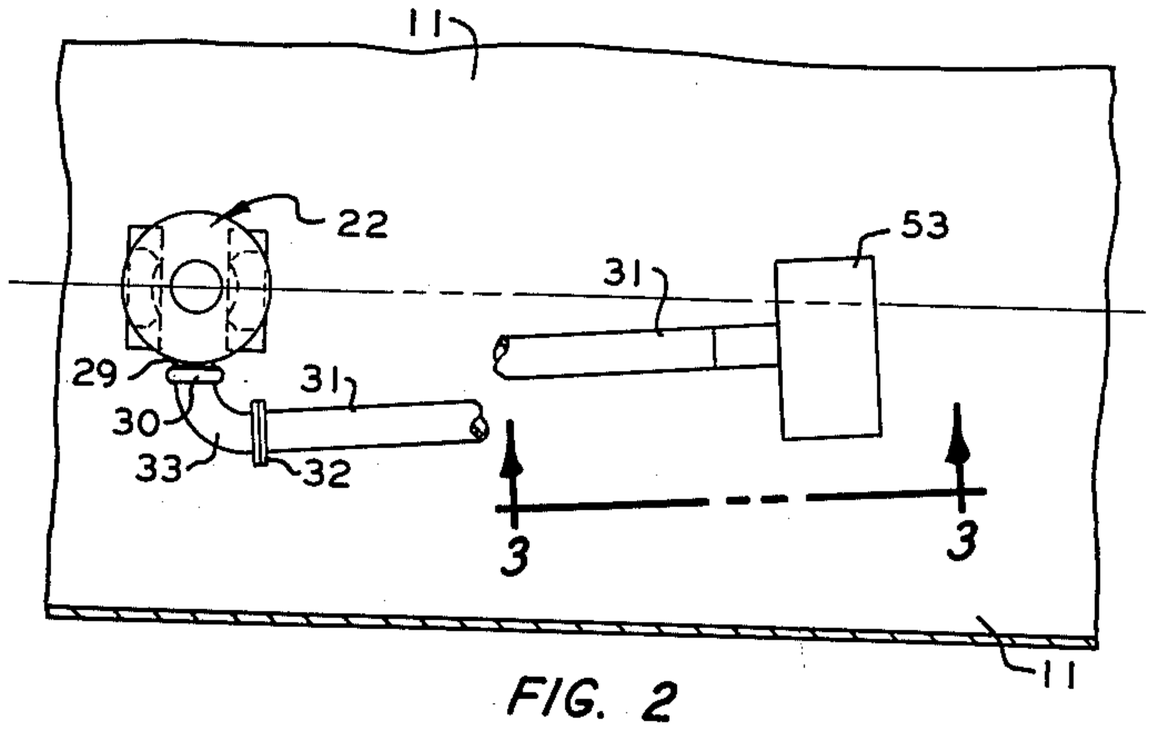

FIG. 2

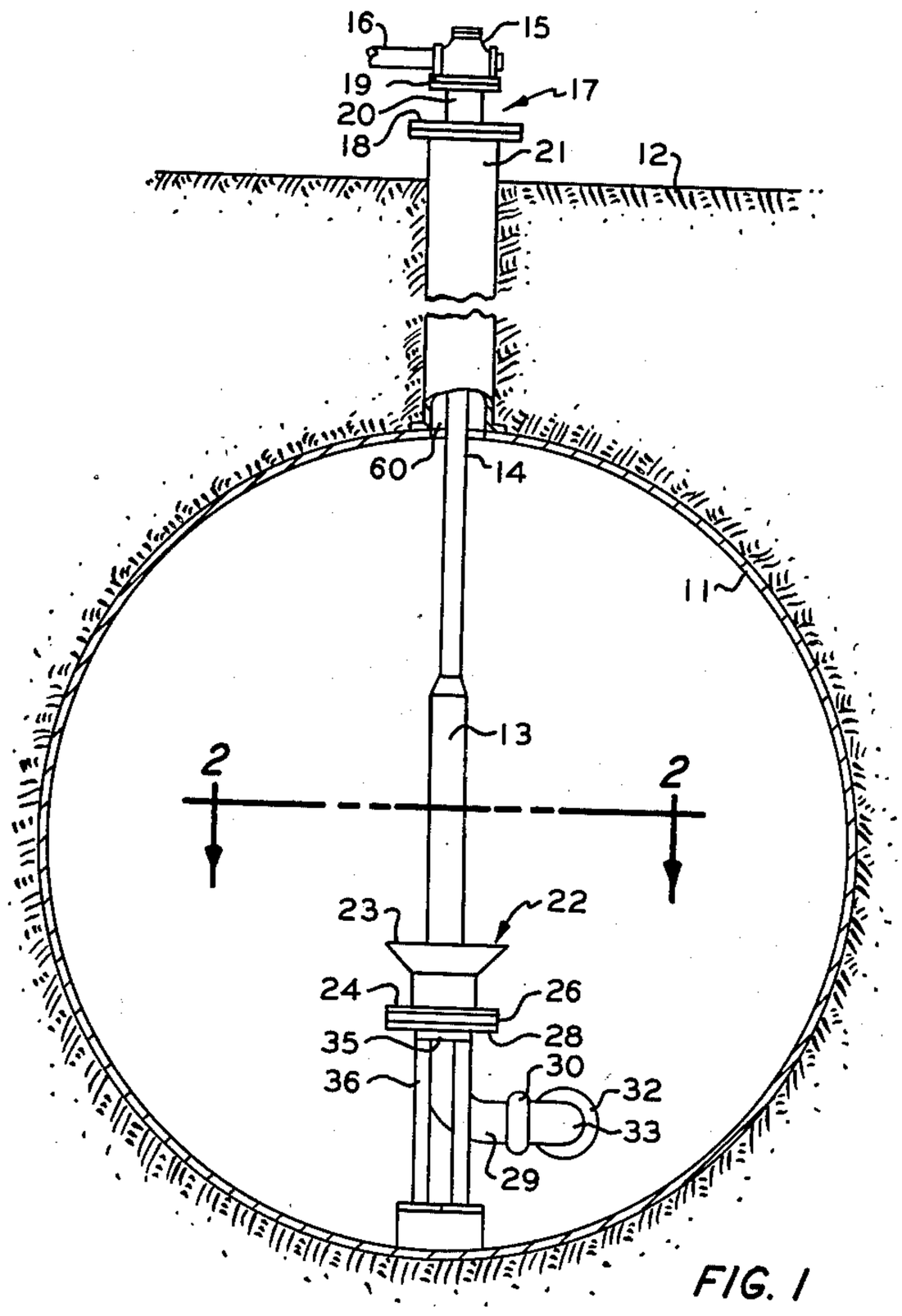

FIG. 1

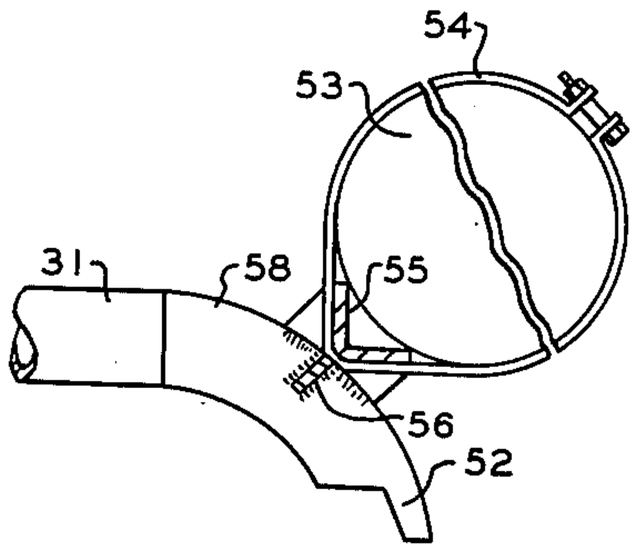

FIG. 3

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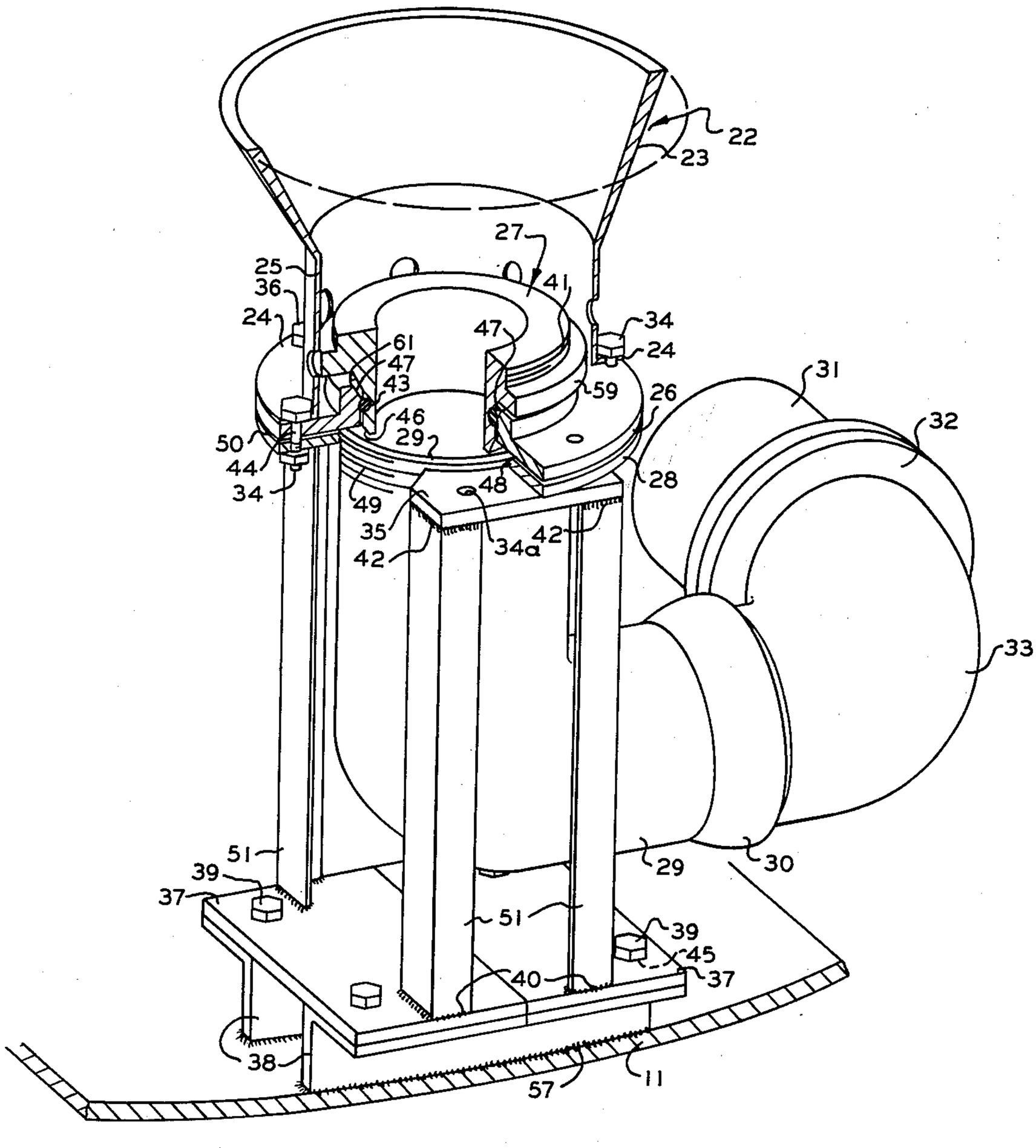

FIG. 4

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FLOATING SUCTION FOR SUBMERSIBLE PUMP

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6 Claims. (Cl. 222—385)

This invention relates to floating pump suctions for use in liquid fuel storage tanks. In one aspect it relates to the use of floating pump suctions with large capacity pumps in underground liquid fuel storage tanks.

Floating suctions in liquid fuel tanks have been required by some airlines to make certain that foreign matter present in the fuel tank cannot pass to the fuel tank of the aircraft. The main foreign matter which inadvertently is present in liquid fuel storage tanks is water. Liquid water ordinarily is not passed into the fuel storage tank with the fuel to be stored because such fuels are ordinarily dewatered and filtered before they are placed in the storage tank. However, during normal breathing of a tank, particularly above ground storage tanks, moist air is drawn into the tanks. Such breathing takes place from night to day and from day to night due to the temperature changes. Fuel tanks are usually vented to the atmosphere and a portion of the moisture in the air entering the tank through the vent may be condensed to liquid water. Underground tanks, however, do little breathing as a result of daily temperature changes. However, during withdrawal of liquid from underground and from above ground storage tanks moist air is drawn into the tanks. Thus, water is present in such storage tanks even though it does not accompany the liquid fuel to be stored.

Condensed moisture, as water, is more dense than the fuel being stored and thus settles to the bottom of the storage tank. If the suction to the fuel withdrawal pump took suction from the bottom of the tank, some small quantities of water could very easily be withdrawn from the tank and passed with the fuel to the airplane fuel tanks. Obviously water in airplane fuel tanks is to be avoided at all costs.

An advantage in the use of a floating suction for withdrawal of liquid fuel from a fuel storage tank is that the liquid is always withdrawn from a level at least near the surface of the liquid. Since fuel pumped into the tank for future use is ordinarily pumped into the tank at a level near the bottom then withdrawal of fuel from the top surface of the tank always makes certain that none of the fuel is allowed to remain in the tank for sufficient periods to become deteriorated. While it is difficult to reason that mixing of fuel in a given tank is not relatively complete during introduction of new fuel mixing is not complete at such a time as when the tank is nearly full.

An object of this invention is to provide an efficient floating pump suction for use with submersible pumps for withdrawal of liquid from storage tanks. Another object of this invention is to provide a pump suction for use in underground tanks which permits easy installation and removal of submersible pumps. Still another object of this invention is to provide such floating pump suctions for use with large capacity pumps. Still another object of this invention is to provide such a pump suction which is relatively simple, easy to install, and which requires little to no maintenance. Still other objects and advantages of this invention will be realized upon reading the following description which, taken with the attached drawing, forms a part of this specification.

In the drawing FIGURE 1 is an elevational view, partly in section, of one form of the invention. FIGURE 2 is a plan view of a portion of a tank provided

with the pump suction of this invention and taken along the line 2—2 of FIGURE 1. FIGURE 3 is an elevational view looking at a portion of the apparatus of FIGURE 2 from the line 3—3. FIGURE 4 is a perspective view, with parts broken away of a portion of the pump suction of this invention of an enlarged scale.

In the drawing reference numeral **11** identifies a fuel storage tank of circular cross section positioned below the surface **12** of the ground. A pipe **21** connected with tank **11** provides a conduit through which a pump **13** can be lowered into or raised from the tank. An adapter **17**, which is actually a pipe reducer is connected with the upper end of pipe **21** and leads to a head **15**. Head **15** is substantially a pipe cross with one outlet being plugged, another outlet being provided with a plug or blanking plate and the third outlet being connected to a discharge pipe **16**.

Reference numeral **13** identifies a pump, for example a submersible centrifugal pump, which discharges liquid upwardly through a tubing **14** for passage through the discharge pipe **16**. The lower end of pump **13** extends through an adapter guide **23** and into fluid-tight relation with a pipe L **29**.

The construction of the floating suction and its support is better understood upon reference to FIGURE 4. A pair of angle irons **38** are welded at **57** to the bottom surface of the tank shell **11** and parallel to each other. Immediately on the top surface of these angle irons are positioned a pair of plates **37**, each plate extending from one angle iron to the other in a form to provide a base for a superstructure. Plates **37** are attached to angle irons **38** by bolts **39**. On the top surface of plates **37** are welded the lower ends of vertically positioned angle irons **51** by welds **40**. On the upper ends of the angle irons **51** are disposed a pair of plates **35** shaped as illustrated in FIGURE 4. On the top surface of plates **35** is disposed a threaded flange **28** which is provided with threads around its inner circumference. On the top surface of the flange **28** is disposed a modified reducing flange **26**. A plurality of bolts **34** holds the modified reducing flange to the threaded flange **28** with an asbestos gasket **50** in between the two flanges. The small plates **35** are welded at welds **42** to the upper ends of the angle irons **51**. As will be seen on reference to FIGURE 4 each plate **35** is provided with two bolt holes **34***a* for accommodation of bolts **36**. The bolts **36** which extend through holes **34***a* in plates **35** are longer than the remainder of the bolts **34**.

On top of the upper surface of the modified reducing flange **26** is positioned the lower end flange **24** of an adapter guide **22**. This adapter guide is in general funnel-shaped with the guide or open funnel end **23** being open upward. A central section or collar **25** of the adapter guide is integeral at its upper end with the lower end of the funnel and the lower end of the collar being integral with the adapter guide flange **24**. Bolt holes are provided in the adapter flange **24** and the bolts **34** and **36** extend through those holes as well as through the corresponding holes in the reducing flange and the threaded flange.

A pipe L **29** contains threads **49** for threading into the threads of the flange **28** prior to assembly of the several flanges with the adapter guide flange. To the lower end of the L **29** is operably attached a swivel **30**. A pipe L **33** is attached operably to the other side of the swivel **30** so that the far end of L **33** can be rotated around the swivel as the center. L **33** is provided with a flange **32** for attachment of the flange of a suction tube **31**. This suction tube or pipe **31** has an appreciable length and its far end extends for some distance from the portion of the apparatus illustrated in FIGURE 4.

To the far end of the suction tube 31 is attached by welding another L 58, as shown in FIGURE 3, with its free end extending generally downward. The distant end of L 58 terminates as a lip 52. This lip 52 is intended to be a spacing means for preventing the open end of L 58 from taking suction off the bottom surface of the tank at such a time that the liquid level in the tank is low. A float 53 can, if desired, be a small drum of from for example 6 to 10 gallons capacity. The float is attached to the L 58 as illustrated in FIGURE 3. The means illustrated for attaching the float to the L involves use of metal straps 54 which are fastened to the L by a gusset 55 which in turn is attached to the L by welds 56.

Referring now to FIGURE 4 a pump adapter 27 is threaded at 41 for attachment of the lower end of pump 13. Adapter 27 is provided with a large diameter flange 59 which is actually a guide flange and as the pump 13 with adapter 27 threaded to the bottom thereof is lowered through the opening 60 in the top of the wall of the tank 11 this funnel-shaped guide 23 in cooperation with flange 59 directs the lower end of the pump into its operable position with respect to the floating suction. The lower end of the adapter 27 is beveled about 15° on surface 46 to assist in centering the pump during its installation. Pump adapter 27 is intended to pass downward with its lower end extending all the way through the reducing flange 26 until a surface 61 of the adapter 27 contacts the beveled surface 47 of the flange 26. When the adapter 27 is in its fully lowered position an O-ring 43 provides a seal between the adapter 27 and the reducing flange 26 so that nothing can enter the pump suction from the funnel-shaped guide member 22.

Both holes 44 in flanges 26 and 28 are for accommodation of bolts 34. Reference numeral 48 identifies the threads on the inner surface of flange 28.

Adapter 17 consists of a large flange 18 for attachment to a corresponding flange on the top of pipe 21, flange 19 corresponding to a flange on the lower end of the cross 15. Flanges 18 and 19 are connected and held spaced with relation to one another by a short length of pipe 20. The pump tubing 14 extends through flanges 18 and 19 and pipe section 20 to the inlet side of the cross 15.

In the operation of the apparatus of this invention since the adapter 27 is threaded fluid-tight to the bottom end of the pump 13 and the adapter 27 fits fluid-tight within flange 26. No fluid whatever can get to the suction of the pump other than that which is transmitted through the floating suction portion of the apparatus herein disclosed.

In this manner there is no drawdown with the possibility of sucking the vapor into the suction of the pump because liquid cannot reach the suction of the pump sufficiently rapidly.

In some prior art floating suction apparatus having a casing surrounding the pump, the pump can draw down liquid in the casing and go on vapor when the floating suction cannot provide liquid sufficiently rapidly to the pump suction. In such a case the capacity of the pump should be limited by the rate of flow by gravity of the liquid to be pumped through the floating suction to the area at the suction end of the pump. In case the pump is a high capacity pump and being suspended freely in a well open only to the floating suction it could pump liquid faster than the floating suction could supply it and thus go on vapor. Obviously as will be realized by those skilled in the art a pump designed to pump liquid should not be allowed to go on vapor. In the present case no liquid whatever can enter the suction of the pump excepting that which comes through the floating suction line. Thus, there is no pumpdown when using the apparatus of this invention.

While certain embodiments of the invention have been described for illustrative purposes, the invention obviously is not limited thereto.

What is claimed is:

1. Apparatus for recovering liquid from a container comprising, in combination, a funnel-shaped guide supported by an inner surface of the wall of said container, said guide having an opening throughout its length with its axis vertically oriented, the larger diameter end of said guide being open upwardly, a hollow cylindrical sleeve attached to the smaller diameter end of said guide and extending downwardly therefrom, a flange extending around the lower end of said sleeve and having a smaller inner diameter than the inner diameter of said sleeve, a collar within said sleeve and companionable with said flange, a conduit having one end positioned fluid-tight with respect to the lower portion of said flange, the other end of said conduit being a floatable suction end, a swivel operatively connecting the floatable suction end with said one end of said conduit, a pump having its discharge end uppermost and a bottom suction end seated fluid-tight with respect to said collar, a vertically positioned discharge tube leading from the discharge end of said pump to a level above the tank and means for actuating said pump.

2. Apparatus for recovering liquid from a below ground container comprising, in combination, a funnel-shaped guide supported by the inner surface of the bottom wall of said container, said guide having an opening throughout its length with its axis vertically oriented, the larger diameter end of said guide being open upwardly, an inner flange within and around the entire inner surface of the wall of the smaller diameter portion of said guide, a conduit having one end positioned fluid-tight with respect to the lower end portion of said guide, the other end of said conduit being a floatable suction end, a swivel operatively connecting the floatable suction end with said one end of said conduit, spacing means attached to said other end of said conduit maintaining said other end of said conduit at a spaced distance from the container bottom at the lowermost end of movement of said other end of said conduit, a collar companionable with said inner flange, said collar extending fluid-tight into said flange and being removable therefrom, a pump having its discharge end uppermost and its suction end attached fluid-tight to said collar, a discharge tube leading from the upper and discharge end of said pump vertically upward to above ground and means for actuating said pump.

3. In the apparatus of claim 2, wherein said one end of said conduit comprises a conduit L, the other and floatable suction end of said conduit also having a conduit L operatively attached thereto with its free end pointing downward, a spacing lip on said free end maintaining said free end at a spaced distance from the container bottom at the lowermost end of movement of said floatable suction end of said conduit, and said swivel operatively connecting the L's.

4. Apparatus for recovering liquid from a below ground container comprising, in combination, a guide supported by the inner surface of the bottom wall of said container, said guide having an opening throughout its length with its axis vertically oriented, said guide being open upwardly, an inner flange within and around the entire inner wall of said guide, a conduit having one end positioned fluid-tight with respect to the lower end portion of said guide, the other end of said conduit being a floatable suction end, a swivel operatively connecting the floatable suction end with said one end of said conduit, a collar companionable with said inner flange, said collar extending fluid-tight into said flange and being removable therefrom, a pump having its discharge end uppermost and having its suction end attached fluid-tight to said collar, a vertically positioned discharge tube leading the discharge end of said pump to above ground and means for actuating said pump.

5. In the apparatus of claim 1, a spacing means attached to the floatable suction end of said conduit maintaining the suction end at a spaced distance from the tanks' bottom at the lowermost end of its movement.

6. The apparatus of claim 5 wherein said spacing means is a lip extending downward.

References Cited in the file of this patent

UNITED STATES PATENTS

1,890,984 Gulick ---------- Dec. 13, 1932
2,192,438 Gulick ---------- Mar. 5, 1940
2,832,512 Brooks ---------- Apr. 29, 1958
2,900,112 Edwards ---------- Aug. 18, 1959

FOREIGN PATENTS

608,121 Great Britain ---------- Sept. 9, 1948