Feb. 3, 1948. B. SAMELSON 2,435,470

PUMP

Filed June 23, 1944 3 Sheets-Sheet 1

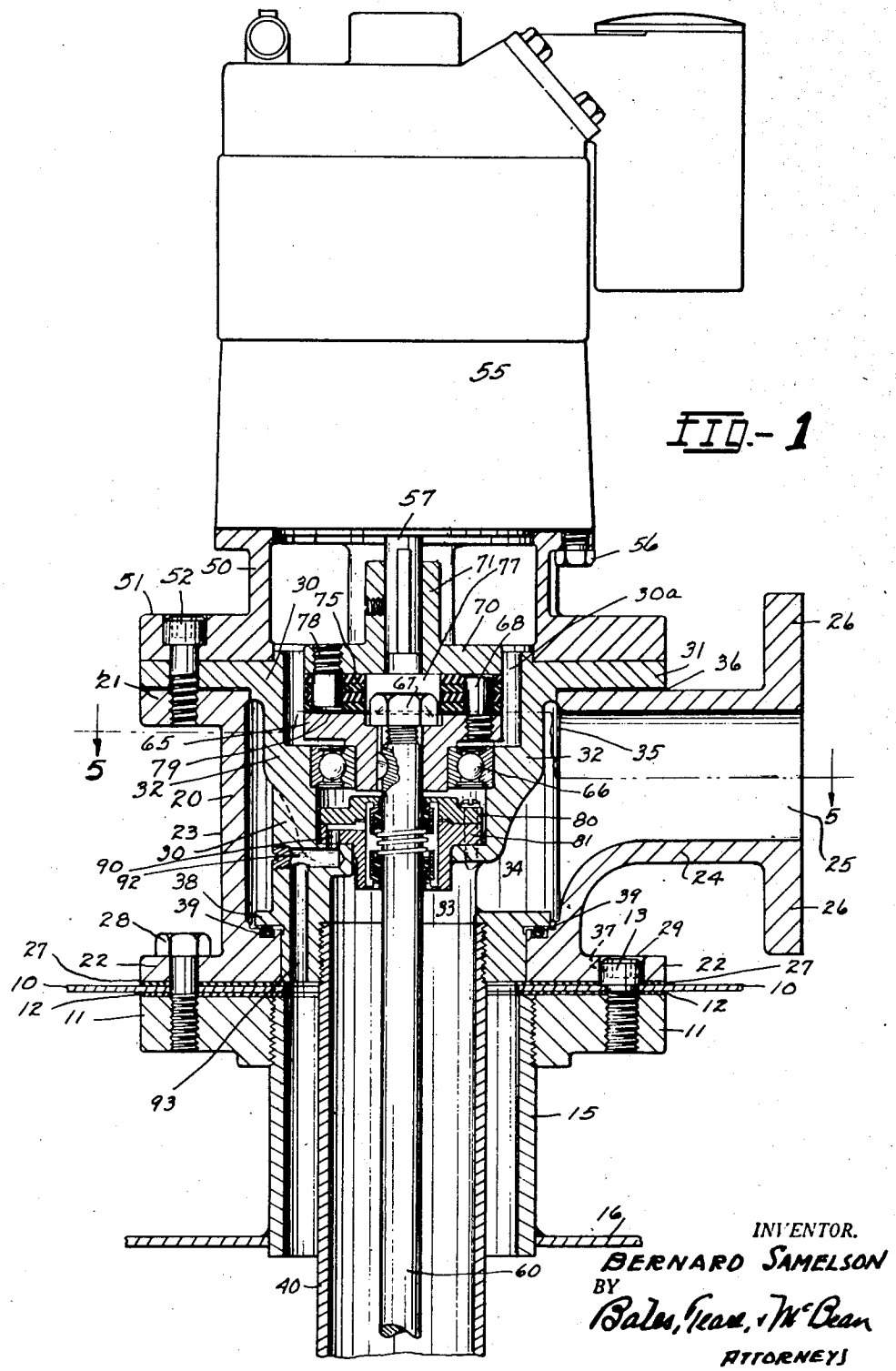


FIG. 1

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Feb. 3, 1948. B. SAMELSON 2,435,470

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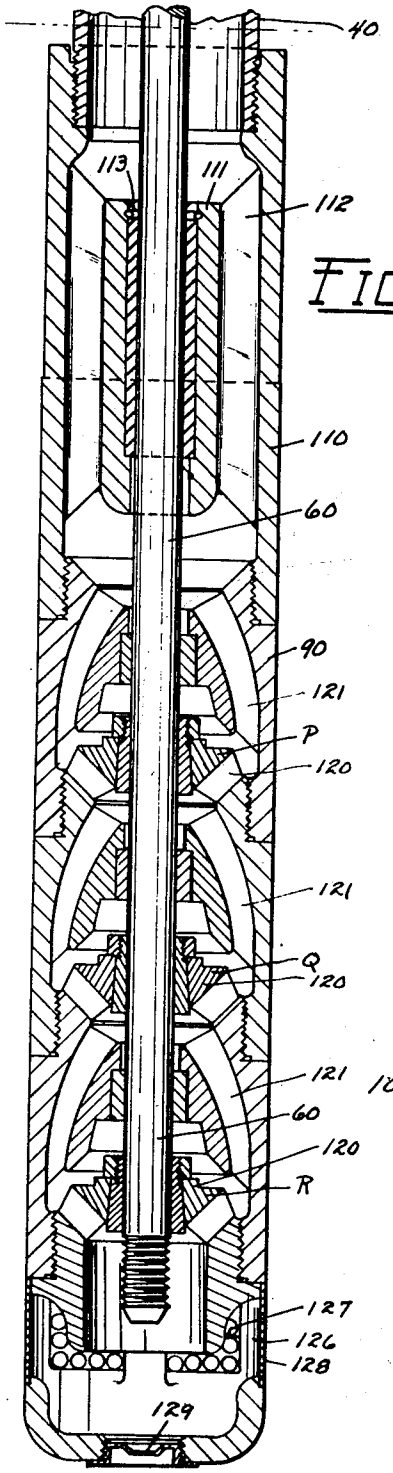


FIG.-2

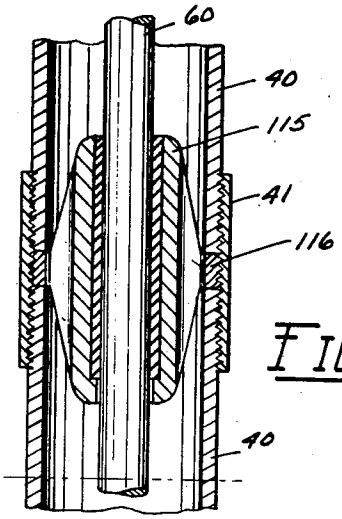


FIG.-3

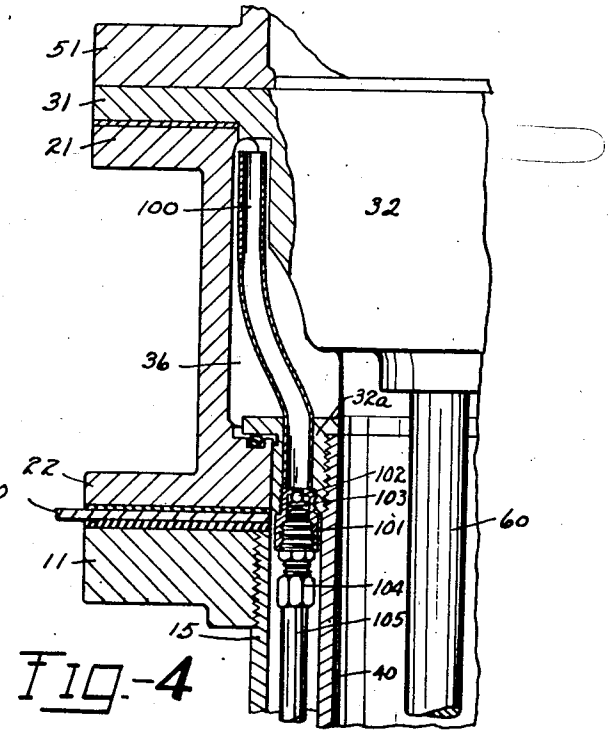


FIG.-4

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Feb. 3, 1948. B. SAMELSON 2,435,470

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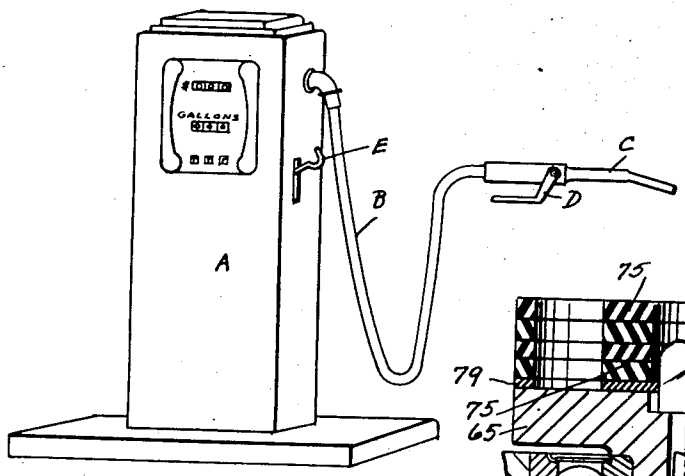


FIG. 7

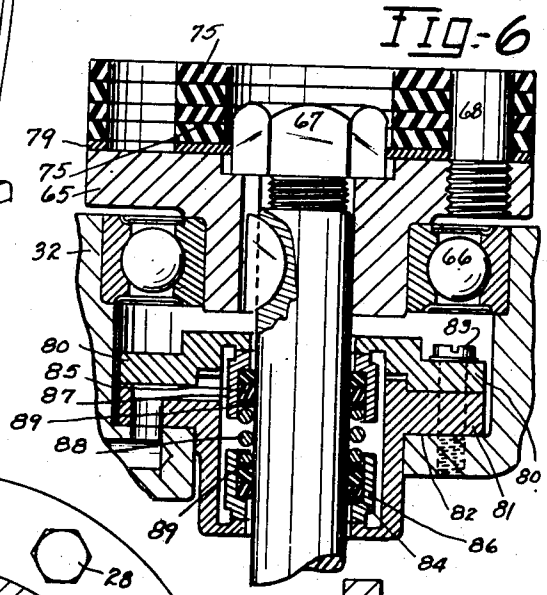


FIG. 6

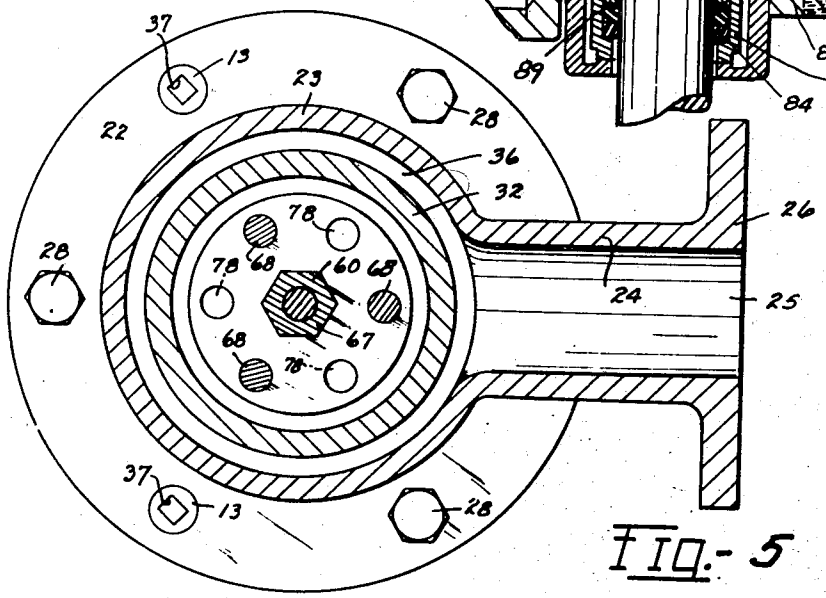
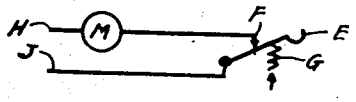


FIG. 5

FIG. 8



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Patented Feb. 3, 1948

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UNITED STATES PATENT OFFICE

2,435,470

PUMP

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Application June 23, 1944, Serial No. 541,711

8 Claims. (Cl. 103—102)

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This invention relates to a pump of the deep well type wherein a pumping unit is located some distance below the surface of the ground and is operated by means above such surface to raise liquid and discharge the same at a region above the surface. The pumping unit is preferably of the impeller type operated by a vertical shaft driven by a motor coupled to the upper end of the shaft.

One of the objects of the invention is to so form the pump, and so connect its parts, that all moving parts may be readily withdrawn for inspection, cleaning, or repair, without disturbing the connection from the pump to the discharge pipe.

Another object of the invention is to so relate a withdrawable part of a pump to the fixed part that suitable gaskets may be effectively employed to make tight joints between the fixed part of a pump and both upper and lower surfaces of the movable part which seat on the fixed part.

Another object of the invention is to provide a double rotary seal about the shaft driving the impeller with a draining passageway between the two members of this seal. Pumps of the present type are being well employed for pumping gasoline, for instance, from a submerged storage tank. In such case the drain from the rotary seal passes back to the supply tank, so that any leakage past the first seal will be returned to the tank, without reaching the driving mechanism for the shaft.

Another object of the invention is to provide for the vertical adjustment of the shaft itself and thereby adjust the presentation of the impellers on the shaft to their stationary mating surfaces, without disturbing the bearing at the upper end of the shaft or the rotary seal below such bearing.

Still another object of the invention is to provide a very simple and efficient flexible coupling between the rotary shaft and the driving motor above it, this coupling being combined with the adjustment of the device for the shaft, thereby simplifying the mechanism and saving space.

Finally, it is an object of the invention to provide means whereby the air or vapors accumulating in the discharge conduit of the pump can be vented from the high point thereof and forced by pump pressure back into the tank, with the result that if the pump is running while the discharge valve is shut, as frequently happens at the filling stations, the liquid thereby retained and put under pressure in the pump conduits can do no harm.

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My invention provides efficient mechanism for accomplishing the above-mentioned objects, and having other advantageous features, as hereinafter more fully explained in connection with the description of a preferred embodiment illustrated in the drawings.

In the drawings, Fig. 1 is a sectional side elevation of the driving and discharge portion of my pump and a portion of the parts below the surface or in the tank; Fig. 2 is a vertical section of a multiple pumping unit located below the surface and connected to the delivery pipe and operating shaft, shown in Fig. 1; Fig. 3 is a vertical section of an intermediately located bearing for the rotating shaft, in the delivery pipe between the pumping unit of Fig. 2, and the pump parts of Fig. 1; Fig. 4 is a fragmentary vertical section in a plane at right angles to Fig. 1 and showing the means for venting the vapors and excess liquid in the pump; Fig. 5 is a cross section in offset planes extending through the flexible coupling and the discharge passageway, as indicated approximately by the line 5—5 on Fig. 1; Fig. 6 is an enlarged sectional view of portions of the coupling, shaft bearing and double rotary seal shown in Fig. 1; Fig. 7 is a view illustrating an ordinary gasoline dispensing device wherein the removal of the discharge nozzle from its supporting hook results in the energization of the motor to actuate the pump; Fig. 8 is a diagram illustrating the circuit to the motor controlled by the movable hook which supports the nozzle in idle position.

In Fig. 1, 10 indicates a horizontally extending plate which forms the support for the pump and its various cooperating parts. Firmly secured to the underside of this plate is a collar 11, a suitable gasket 12 being interposed, and the parts being held together by cap screws 13. Frequently, the plate 10 is the bottom of a pit tank beneath which is a tank to contain fluid, and in such case a sleeve 15 is screw-threaded into the central opening of the collar 11 and this sleeve near its lower end is welded to the top plate of the tank, indicated at 16 in Fig. 1.

Above the plate 10, is a hollow member 20 which forms the base for the pump, as hereinafter explained, and also provides a discharge passageway. This member may conveniently be a single integral casting. As shown in Fig. 1, it has a flat top 21, a flat bottom 22, a vertical cylindrical wall 23 connecting these parts and merging at one side into a horizontal cylindrical wall 24 which forms the discharge passageway 25. This horizontal extension is shown as terminat-

ing in an outwardly extending flange 26 adapted to be bolted to a discharge pipe.

The base member 20 rests on a gasket 27 on the top of the plate 10 and is secured in position by bolts 28 which pass through the plate 10 and its gaskets and are threaded into the collar 11 on the underside of the plate. The heads of the cap screws 13, which secure the collar 11, are preferably round and seat in cylindrical openings 29 in the member 20, the cap screws having angular cavities for an internal wrench to turn them.

It will be seen that the construction described, while it firmly secures the hollow base member 20 in place above the collar 11, and clamps the supporting plate 10 between the base and collar, nevertheless allows the base 20 to be removed without disturbing the connection of the collar to the plate. Accordingly, the installation of the container tank and the top of the pit tank and connections between them may readily be installed and the pump construction thereafter applied and adapted to be removed should there be occasion for it.

Secured to the flat top of the base member 20 is a closure head 30 which carries the delivery pipe 40 with its impeller pumping mechanism and the shaft to operate the impeller as hereinafter described in detail. For the present, it may be noted that the head 30 has a horizontal top flange 31 resting on the top 21 of the base and a downwardly extending tubular body 32 into the lower end of which the pipe 40 is threaded. The axial opening in the body 32 is internally stepped to support the shaft bearing and the rotary seal, as hereinafter described.

The closure head 30 has an open lower portion 33 registering internally with the interior of the pipe 40 and then by lateral portion 34 communicating with the discharge passageway 25. The exterior of the upper portion of the body 32 is cylindrical and of less diameter than the cylindrical interior of the base wall 23, so that there is an annular passageway 35 between the two walls entirely surrounding the body 32 and intersecting the continuous passageways 33, 34, 25 from the interior of the pipe 40 to the final discharge from the pump.

Attention is called to the fact that the annular passageway 35 rises higher than the topmost portion of the discharge passageway 25, thus leaving a small annular chamber at the top of the annular passage in which vapors may accumulate and which may be drawn off by means hereinafter explained.

The flange 31 rests on top of the base 21 with an interposed flat gasket 36 so that these parts may be tightly secured together. The flange may be secured by its own cap screws (the heads of which may occupy sockets in the surmounting part, after the manner of the pit tank screws 13 heretofore described) or I may use merely the same bolts which secure the motor support on top of the flange, as hereinafter described.

At its lower portion the body 32 is formed with an outward flange 38 overhanging an inward portion of the base, and in that region I have provided a compressible gasket 39 in the form of a rubber ring round in cross section. This gasket lies in a groove in the base casting ledge and maintains a tight junction between the two members while allowing a slight variation in presentation of the body 32 to the base casting. This enables the head 30 to have a liquid-tight engagement adjacent both its top and bottom, it being merely necessary to put the head in position on its two gaskets and then to turn in the clamping bolts.

The motor support is shown at 50 in Fig. 1. It has an outward bottom flange 51. Suitable cap screws 52 extend through this flange and through the flange 31 of the head and are threaded in the top 21 of the base. Accordingly, when these screws are tightened all three parts are bound tightly together. Fig. 1 shows a motor casing 55 held by screws 56 on the top of the motor support 50. Depending centrally from within the casing is a driven shaft 57 which may be the armature shaft of the motor.

The shaft 57 driven by the motor is coupled with the aligned impeller shaft 60 which extends downwardly centrally within the delivery pipe 40 and operates the pump mechanism, one form of which is shown in Fig. 2 and will be hereinafter explained. This motor shaft 57 is connected with the pump shaft 60 by a flexible coupling which is combined with means for adjusting the shaft 60 axially to make a proper presentation of the parts at the pump surfaces. This coupling and adjusting construction is shown in Fig. 1 and comprises the following elements:

A collar 65 located within a well in the head 30 has a reduced lower portion carrying the inner raceway of a ball-bearing 66, the outer raceway of which seats snugly within the body 32 and above an inward ledge of that body. The shaft 60 is splined in the collar 65 so that the two rotate together. The shaft, however, is adjustable longitudinal of the collar by means of a nut 67 threaded on the shaft and resting on the top of the collar.

Above the collar 65 is a collar 70 having an upwardly extending sleeve portion 71 embracing the drive shaft 57 and keyed or pinned to it. Between the two collars are a series of surmounting yielding discs 75, preferably of leather. These discs are connected in certain regions with the collar 65 by upwardly extending vertical pins 68 and connected with the collar 70 by downwardly extending vertical pins 78.

It will be seen that the flexible coupling described provides for the rotation of the shaft 60 by the motor shaft 57 without danger of binding and without requiring exact alignment of the two shafts.

The nut 67 which adjusts the impeller shaft 60 lies partly in a recess in the collar 65 and partly in central openings 77 in the flexible discs 75. This nut has an angular exterior suitable for the application of a wrench and is normally held from rotating by occupying an angular opening of corresponding size in a metal plate 79 (best shown in Fig. 6) which lies between the lowermost yielding disc 75 and the collar 65 and is held in place by the pins 68.

It results from the construction described that when the parts are assembled, as shown in Figs. 1 and 6, the adjusting nut 67 cannot rotate and the impeller shaft 60 is held in definite position longitudinally and is readily rotatable by the motor. The shaft may be adjusted whenever desired by removing the cap screws 52 and then removing the motor with the motor support and with the collar 70 on the motor shaft, the pins 78 withdrawing from the flexible coupling discs. Then such coupling discs may be removed from the pin 78 and the locking plate 79 removed while the collar 65 retains its position in the clamped head 30. Now a wrench to be applied to the nut

67 may adjust the shaft 60 up or down, as desired.

The removal of the motor parts also, of course, may be availed of to repair the coupling itself if it should be necessary. The consolidation of the coupling and the adjustment feature into a combined unit as shown in the drawing, consolidates the parts and reduces the space required.

I provide a double rotary seal about the shaft 60 between the passageway 33 and the shaft bearing 66, thus preventing the pumped liquid from passing up into the coupling. As shown in Figs. 1 and 6, this seal is housed within two cooperating collars 80 and 81 which have external flanges overhanging an inwardly extending ledge 82 on the body 32, to which the seal is secured by screws 83. The collars have central cavities in which are mounted suitable packings. These comprise a lower annular packing 84 within a cylindrical cup 86, an upper annular packing 85 within a cup 87 and a helical compression spring 88 of a few turns bearing against washers 89 on the packings and pressing the packings respectively downwardly and upwardly against the end portions of their cups which in turn bear against the inner faces of the collars.

The construction just described makes an effective double rotary seal with an annular space between the two members of the seal. A suitable drain passageway communicates with this annular space, so that if any liquid does get past the lower seal it will be drained away and have no pressure tending to force it beyond the upper seal.

When the pump is installed for pumping liquid from a tank, the drainage passageway preferably returns to the tank so that no liquid is lost. This is the arrangement shown in Fig. 1 where a downward passage 90 through the collar 81 leads to an outward passage 92 and thence to a downward passage 93 which communicates with the annular space outside of the delivery pipe 40 and within the pipe 15.

To by-pass the vapors or excess liquid from the top of the annular chamber 36 about the pump head, I provide the construction shown in Fig. 4 which is hidden from view in Fig. 1. This comprises a tubular conduit 100 extending downwardly from near the upper end of the annular passage 36 to the casing 101 of a check valve. This casing is a tubular member screw-threaded into the bottom portion 32a of the body 32. The check valve is shown as a ball 102 normally maintained on its seat by a compression spring 103. The valve casing is connected by a coupling 104, a pipe 105, which leads downwardly in the annular space between the pipes 40 and 15 to the tank.

My pump is especially well adapted for forcing gasoline from an underground supply to a delivery stand having a discharge hose for supplying an automobile. Such stand of a frequent type is illustrated as A in Fig. 7, its hose B having a nozzle C normally shut by a valve controlled by hand lever D. When the hose is idle the nozzle is usually hung on a hook E which controls an electric switch to the pump motor, the switch being automatically closed when the hook is elevated as shown in Fig. 7, but open when the hook is lowered. This is illustrated in Fig. 8, where M indicates the pump motor and E the switch hook and F the electric terminals, which are in contact when the hook is elevated by a spring G, to establish a circuit [illegible]

Normally, the nozzle C is hung on a hook E and maintains the terminals F out of contact, so that the pump motor is idle; however, when the attendant is about to supply gasoline to an automobile tank, as he removes the nozzle from the hook, the rising from the hook establishes the circuit to the motor and the pump starts, while the nozzle valve is closed. The pump continues to operate with the nozzle valve closed until the attendant has placed the nozzle in the receiving tank of the car and opened the valve D.

The above outlined normal operation at the filling station results in the pump being driven by the motor to pump liquid into a closed conduit, with the result that pressure builds up within the conduit tending to force out vapors from the gasoline. When such pressure starts it is above the normal discharging pressure and, hence, supplies an increased pressure in the venting pipe 100 which opens the check valve 102, so that the vapors and gasoline from the pump may pass back into the tank.

It will be seen, therefore, that there is no venting or loss of efficiency while the pump is running and delivering liquid, but as soon as the abnormal situation develops of the pump running without being able to deliver liquid, the venting takes place and prevents any troublesome accumulation of vapors.

I have referred to the impeller shaft 60 as operating any suitable pumping mechanism carried by the pipe 40 within the supply tank or at least below the pump base. The adjustment I provide for the shaft 60, however, is especially well adapted for adjusting the relation between impellers on the shaft and the cooperating surfaces carried by the delivery pipe. Accordingly, I have shown in Fig. 2 a multiple impeller pump with the impellers mounted directly on the shaft 60 and coacting with surfaces carried on the lower end of the delivery pipe 40, and the construction there shown will now be described.

The pumping device carried by the delivery pipe 40 is in the form shown, of multi-stage turbine type and comprising a series of impellers operated by the shaft 60 and each discharging into the impeller unit above it, the topmost unit discharging into a connecting sleeve attached to the lower end of the delivery pipe 40. Fig. 2 shows three of the impeller units P, Q and R, just alike, the bottom unit R receiving its supply at the lower end of the device and discharging into the unit Q, which discharges into the unit P, the latter unit being coupled to a sleeve 90 which is screwed onto the lower end of the pipe 40. The casing of the unit P is shown as screwing into the sleeve 110, the casing of the unit Q screwing into the unit P, and the casing of the unit R into the unit Q. At the lower end of the unit R is a hollow intake fitting S.

As shown, each impeller unit comprises an impeller 120 mounted tightly on the shaft 60, tapered clamping means being shown to effect the clamping. Each impeller is shown as having a conical form with an annular row of veins on its conical surface, so that it receives liquid from the underside in the annular region about the shaft and discharges upwardly and outwardly. The discharge from the impeller of each unit is conducted upwardly by conduits 121 leading to the space beneath the surmounting impeller. Suitable packing 122 about the shaft prevents [illegible]

hamber within the sleeve 110 and thence up hrough the delivery pipe 40.

The hollow intake fitting S at the lower end of the bottom-most impeller unit R is shown as a ubular fitting 125 which screws into the frame of the bottom unit R and carries a protecting vall 126 at its lower end. Suitable intake openngs 127 are made through the wall of this unit and are shown as surrounded by a foraminous screen 128. A clean-out plug 129 is provided at the bottom of the fitting.

It will be seen that when the motor is operated and the shaft 60 thereby rotated, the impellers left liquid entering through the screen 125 upwardly through the pipe 40 into the passageway 33 in the head 30, thence downwardly through the passageways 34 and 24 to the discharge pipe.

The member 110 which connects the uppermost pump unit to the lower end of the delivery pipe 40 is formed with a suitable internal sleeve 111 carried by radial wings 112 and having a liner 113 forming a bearing for the shaft close to the uppermost pumping unit. Additional bearings may be provided in the pipe 40. Thus, as shown in Fig. 3, the pipe 40 may be made in sections coupled together by a coupling providing an additional bearing. As shown, this additional bearing 115 has an outward flange 116 extending between the meeting ends of the two pipe sections 40. The exterior of the flange 116 may be threaded, and thus after a coupling sleeve 41 is put on one pipe section the bearing may be screwed into the sleeve tightly against such section and thereafter the other section screwed into the sleeve tightly against the bearing flange.

For the pump to operate most efficiently, the rotating impeller surfaces, of course, should be quite close to the stationary surfaces. The shaft adjustment provided normally by my pump enables this to be readily accomplished, and the original setting to be adjusted from time to time as wear may require. With the impeller unit and the pump base and head assembled, the impellers may first stand in actual contact with their mating surfaces and the nut 67 turned down into engagement with the collar 65. Then a slight additional turn of the nut will raise the impellers out of contact with the stationary surfaces just the desired amount. By having a comparatively fine thread on the shaft 60, a very accurate adjustment may be made, and the nut, if hexagon, given one or more turns of a sixth of a rotation and relocked by the locking plate in its new position.

A finer adjustment may be made by adjusting the locking plate with reference to the collar 79. I have shown three equidistant pins 68 projecting upwardly from that collar, and with that arrangement the disc 79 must have at least three holes, one for each pin. By multiplying the number of holes the plate may be given intermediate positions enabling a setting of the hexagon nut by a step equal to a fraction of a sixth of a turn, or providing a number of holes which is not related to the number of sides of the nut (making the nut with five sides, for instance) I may provide a differential setting resulting in a still finer adjustment.

As already explained, the removal of the motor and coupling will allow repair of the coupling if the rotary seal needs attention, then a removal of the nut 67 and the collar 65 and the bearing 66 provides access from above to the seal and the entire seal may be removed by turning out the screws 83. Then the seal members may be separated, new packing supplied, and the seals restored.

It will be seen that the various parts of my pump have been so designed as to allow separation at any point where there may be occasion for it without disturbing the rest of the installation. The entire pump including the delivery connections may be removed without disturbing the attachments to the container tank and the pit tank. All of the operating parts of the pump may be withdrawn from the base without disturbing its connection to the top of the pit tank or to the discharge pipe, and the motor and coupling may be withdrawn without disturbing the connection between the pump head and the base.

I claim:

1. The combination with a horizontal plate having an opening through it, a collar on the underside of the plate surrounding the opening, bolts extending through the plate from above and engaging the collar to hold it to the underside of the plate, a pump above the plate having a base resting on the plate with a recess to receive the heads of the bolts, and other bolts passing through the plate and connecting the base above the plate to collar below it, and pumping mechanism carried by the base including a delivery pipe extending downwardly through the opening in the plate to the region below it.

2. In a pump, the combination of a base, a pumping mechanism carried by the base comprising a driving mechanism and a vertical shaft driven thereby and extending downwardly to a region below the base, a delivery pipe extending downwardly through the base, a lateral passageway from the top of the delivery pipe to a discharge chamber in the base, a double seal embracing the shaft between the driving mechanism and the lateral passageway, said seal comprising two vertically spaced packings each in a cup embracing the shaft and means for pressing each packing against the bottom of its cup and means providing a draining passageway from the space between the packings.

3. In a pump, the combination of a base, a head mounted thereon, a pumping mechanism carried by the head comprising a driving mechanism and a vertical shaft driven thereby and extending downwardly through the base to a region below it, a delivery pipe carried by the head and extending downwardly through the base, there being a lateral passageway from the top of the delivery pipe to a discharge chamber in the base, a rotary seal embracing the shaft between the driving mechanism and the lateral passageway, said rotary seal comprising a casing secured to the head and surrounding the shaft, a pair of rotatable annular members within the casing surrounding the shaft and bearing against the top and bottom of the casing respectively, packings surrounding the shaft and resting against the rotatable annular members, and means for pressing said packings against the members whereby the packings and members may rotate with the shaft.

4. In a pump, the combination of a base, a head carried thereby and having a tubular portion depending within the base, a driving mechanism mounted above the head, a vertical pump shaft having a bearing in the head and depending therefrom below the base, a driving mechanism connecting said shaft with the driving mechanism on the head, a double rotary seal embracing the shaft beneath its bearing and above the discharge space from a depending de-

livery pipe carried by the head, said rotary seal comprising a casing body resting on an inwardly extending ledge of the head and having a base portion with a smooth annular upper surface about the shaft, and a cover for the body closing the top thereof and embracing the shaft and having a smooth annular undersurface about the shaft, a pair of cups within the annular space in the casing about the shaft, one cup bearing on said smooth surface of said body and the other cup bearing on said smooth surface of the cover, packings within said cups snugly embracing the shaft, and a helical compression spring surrounding the shaft and bearing against the two packings.

5. In a pump, the combination of a base, a head carried thereby and having a tubular portion depending within the base, a driving mechanism mounted above the head, a vertical pump shaft having a bearing in the head and depending therefrom below the base, a driving mechanism connecting said shaft with the driving mechanism on the head and a double rotary seal embracing the shaft beneath its bearing and above the discharge space from the depending delivery pipe carried by the head, said rotary seal comprising a casing body resting on an inwardly extending ledge of the head, a cover for the body closing the top thereof and embracing the shaft, a pair of annular packings within said casing snugly embracing the shaft, a helical compression spring surrounding the shaft and bearing against the two packings, and there being a draining passageway from the space between the packings, said passageway passing outwardly between the cover and body to a region over the supporting ledge, thence downwardly within the ledge and discharging into the space outside of the delivery pipe.

6. The combination, with a tank adapted to contain liquid, of a pump for raising liquid therefrom including a casing connected with the tank and a delivery pipe within the casing and spaced therefrom, a pumping mechanism carried by the delivery pipe adapted to force liquid from the tank up the pipe, a discharge passageway in the pump for said liquid, a return passageway from a point of the delivery passageway in the pump to the annular space between the delivery pipe and the casing connecting the pump with the tank, and a check valve controlling such conduit and adapted to remain closed during normal delivery pressure in the discharge conduit but open on an excess pressure therein.

7. The combination in a pump, of a pump frame, a driving shaft, a driven shaft, an impeller on the driven shaft, means carried by the

pump frame providing a coacting surface adjacent the impeller, a yielding coupling between the driving shaft and driven shaft comprising a collar on the driving shaft, a collar splined on the driven shaft, a bearing mounted in the pump frame for the latter collar, an annular disc between the collars connected at one region to one collar and at another region to the other collar mounted in the bearing and adapted to adjust the position of the impeller with reference to its mating surfaces, said nut having a non-circular exterior and occupying a confining space within the annular disc.

8. In a pump for raising liquid from a tank, the combination of a casing adapted to be connected with the tank, a delivery pipe within the casing and spaced therefrom, a pumping mechanism adapted to force liquid from the tank up the delivery pipe, a discharge passageway in the pump for said liquid, a shaft for operating said pumping mechanism, a pump head having a depending portion, a seal on such depending portion coacting with the shaft, there being an annular space about such depending portion, part of which intersects the discharge, and a pipe in this annular space leading down through the annular space between the casing and delivery pipe and discharging into the tank and carrying a check valve.

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