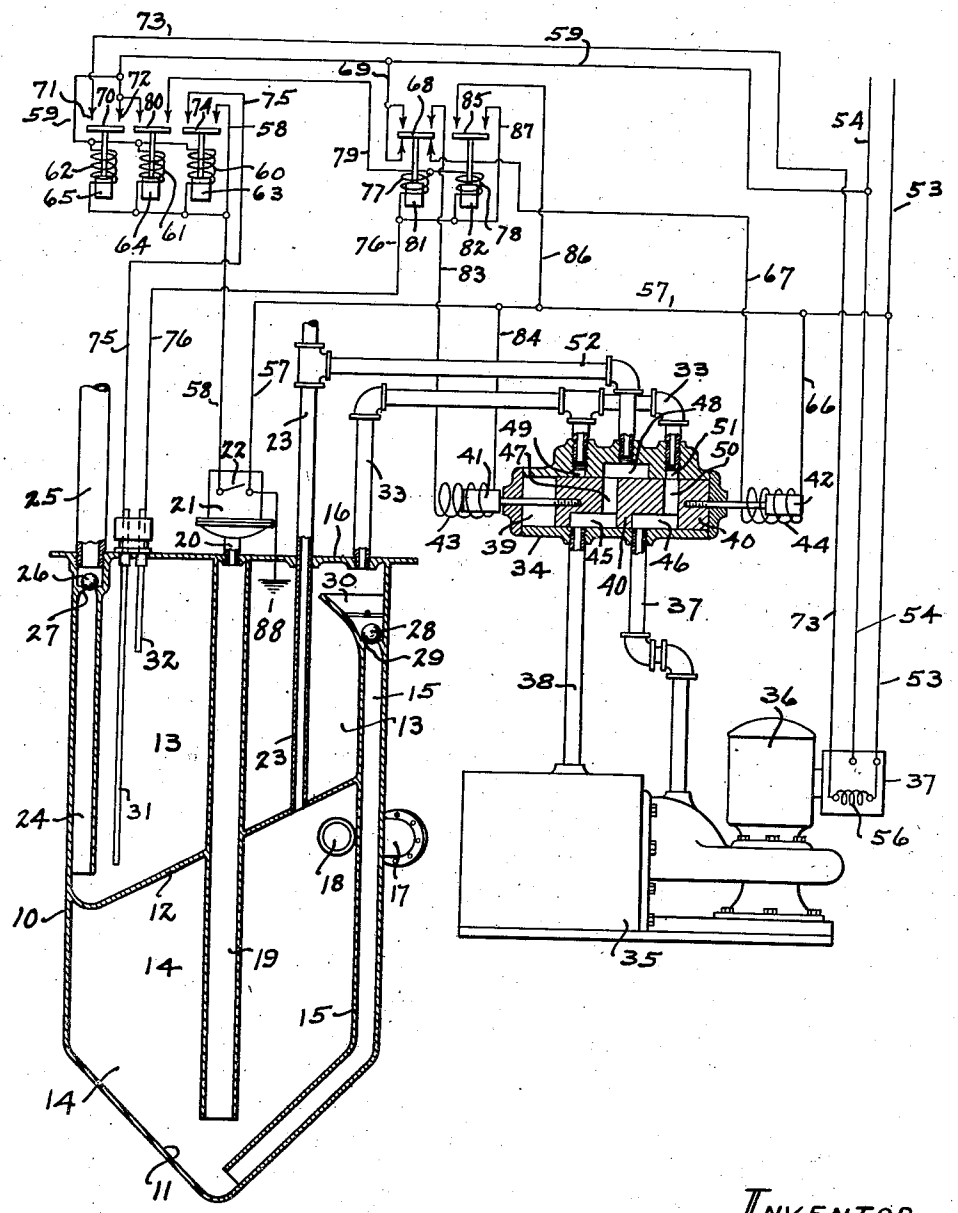
Jan. 6, 1948. W. P. WHITTINGTON 2,434,027

SEWAGE LIFT

Filed April 20, 1946 2 Sheets-Sheet 1

Fig. 1.



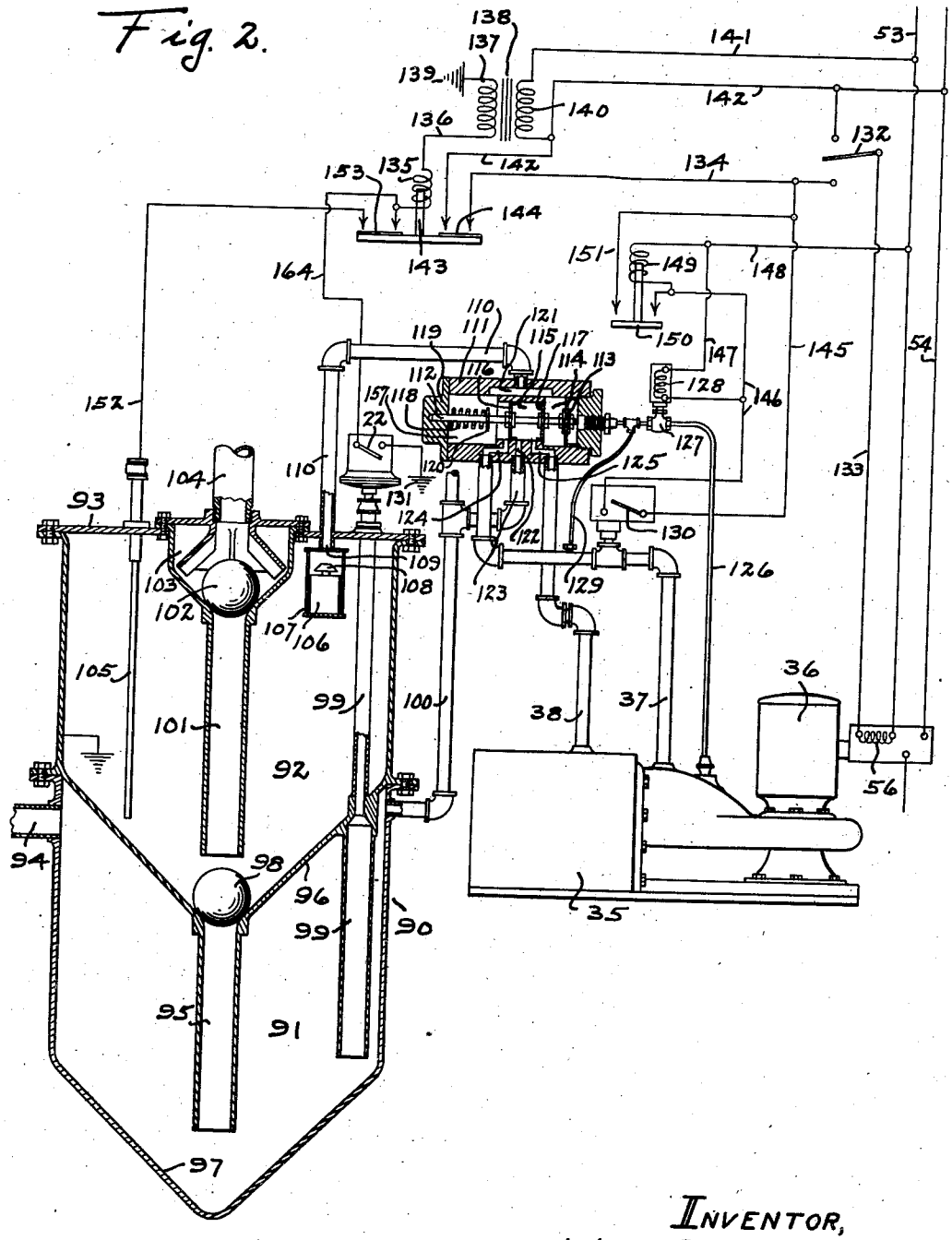
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Fig. 2.



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SEWAGE LIFT

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Application April 20, 1946, Serial No. 663,663

7 Claims. (Cl. 103—25)

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This invention relates to means for elevating flowable materials such as sewage which cannot be handled by the ordinary reciprocating or centrifugal pumps. In many instances, the elevation at which sewage must be collected in buildings is below the elevation of the sanitary sewage systems in nearby stores. This means that the sewage must be collected and then elevated back up to the sewage system. In many cases, such as with restaurants, the discharging effluent carries considerable grease and this grease frequently coagulates or solidifies to present a further problem in the handling of the effluent.

By use of my invention, very simple means are provided to collect and elevate the effluent in an automatic manner without being disturbed or hindered in its action by the presence of such grease. A primary advantage of the invention resides in the fact that it is practically trouble free and will operate automatically over long periods of time with the minimum of attention. Other objects and advantages of the invention will become apparent to those versed in the art in the following description of the invention as illustrated more or less diagrammatically in the accompanying drawings, wherein,

Fig. 1 is a diagrammatic representation of one form of the invention; and,

Fig. 2, a like diagrammatic representation of a modified form of the invention.

Like characters of reference indicate like parts in the two views in the drawings.

Referring first to that form of the invention as illustrated in Fig. 1, a tank 10 is provided to have a generally conical floor 11. This tank can be made out of any suitable material practical for the purpose employed, steel or iron being normally satisfactory. A transverse floor 12 is fixed within the tank 10 to be inclined from the horizontal sufficiently to cause fluids to collect initially or finally at the lowermost portion of that floor 12 adjacent the tank wall therearound. Thus the tank 10 is divided into the upper and lower chambers 13 and 14 respectively.

A discharge pipe 15 leads from near the lowest point of the floor 11 upwardly through the floor 12 to discharge within the chamber 13 near the top end thereof. The upper chamber 13 has a cover 16 fixed thereacross. The discharge of the pipe 15 is spaced a distance sufficiently below the cover 16 to permit overflow from the pipe 15 into the chamber 13. In the present showing of the structure in Fig. 1, this pipe 15 is fixed along the wall of the floor 11 and thence upwardly along the side wall of the tank 10. An entrance pipe

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17 discharges into the chamber 14 through an opening 18 well up toward the uppermost portion of the floor 12.

An air pressure column 19 hangs from the cover 16 to extend downwardly through the chamber 13, through the floor 12, and well down in the chamber 14 to terminate by an open end in spaced relation from the apex of the floor 11. This column 19 is in communication at its upper end through the pipe 20 with a pressure actuated switch mechanism 21 of the usual and well-known construction wherein a switch 22 is normally open, and is closed by a predetermined pressure being created in the column 19, the switch 22 opening again following a predetermined drop in that pressure. In such commercial pressure switch mechanisms, there is a differential operating pressure range between the initial closing of the switch and the subsequent opening of it. The details of such mechanism do not form a part of my invention per se and therefore are not herein illustrated since the structure is commercially obtainable and well-known to those versed in the art.

The chamber 14 is vented to the atmosphere through a vent pipe 23 opening by its lower end through the floor 12 near the upper portion thereof, and carried on upwardly through the chamber 13 through the cover 16. Normally this vent pipe 23 would be connected to some stack (not shown) leading to the highestmost elevation at least of the building in which the tank 10 may be installed.

A discharge pipe 24, herein shown as being along the side wall of the tank 10 leads from near the lowest portion of the chamber 13 over the floor 12 and is carried upwardly to the cover 16 from which a discharge flow pipe 25 leads. Interposed between the pipes 24 and 25, near the top of the chamber 13, is a valve of some sort normally closing off the pipe 24, but opening readily with upward flow in the pipe 24. In the present showing, this valve consists of a ball 26 resting by gravity on a seat 27 carried by the pipe 24 in its upper end portion. Similarly the upper end of the discharge pipe 15 leading from the lower chamber 14 is normally closed off by a valve preventing backflow down through that pipe. In the present showing, this valve consists of a ball 28 dropping by gravity on a seat 29 carried at the upper end of the pipe 15. The ball 28 is preferably carried at the lower end of an outwardly flaring mouth 30 at the upper end of the pipe 15 so that the ball 28 will normally roll back onto the seat 29 under the influence of

gravity when there is no upwardly flow of the pipe 15 forcing it off of that seat.

Carried by the cover 16 is a pair of electrodes 31 and 32 hanging downwardly within the chamber 13. The electrode 31 extends well down into the chamber 13 to terminate by a lower end at a distance slightly above the discharge pipe 24. The other electrode 32 is considerably shorter than the electrode 31 and terminates by its lower end in the upper portion of the chamber 13, the difference in the lengths of these two electrodes being further explained in describing below the operation of the invention.

A vacuum pipe 33 leads from the chamber 13 through the cover 16 to a valve generally designated by the numeral 34. A vacuum producing device generally designated by the numeral 35 is operated by an electric motor 36. This vacuum producing device 35 has an intake pipe 37 interconnecting with the valve 34, and also a pressure discharge pipe 38 interconnecting with the valve 34. In other words the pipe 37 is a vacuum line and pipe 38 is a pressure line. The exact construction of the vacuum producing device 35 is not herein shown but is preferably of a high vacuum type such as is produced by air ejectors operating under water all of a type commercially obtainable.

The valve 34 contains a central cylindrical chamber 39 within which is mounted a shiftable cylinder 40 controlled as to position by the solenoid armatures 41 and 42 being shifted through energizing of their windings 43 and 44. The cylinder 40 has a longitudinal side slot 45 within which the pipe 38 may discharge regardless of position of the cylinder 40 within the bore 39. A second side slot 46 is formed along the cylinder 40 to be in communication with the outlet pipe 37 regardless of cylinder position. These two slots 45 and 46 are separate one from the other without intercommunication.

Diametrically extending across the cylinder 40 is a transverse passageway 47 leading from the slot 45 and opening from the opposite side of the cylinder 40 to be selective in registry with a central chamber 48 in the body of the valve 34 and the orifice 49 at which the vacuum pipe 33 is connected. Likewise a transverse passageway 50 leads diametrically across the cylinder 40 from the slot 46 to be in selective registry with the center chamber 48 and the orifice 51 through which communication is had with the vacuum pipe 33. A valve intake pipe 52 leads from any suitable source such as the stack pipe 23 to discharge into the chamber 48.

Operation

Assuming a flow of liquid comes through the pipe 17 and discharges through the opening 18 into the lower compartment 14 of the tank 10, the liquid mass will rise to first close off the lower end of the column 19 and thus trap air therewithin. As the liquid continues to rise in the chamber 14, the air in that column 19 tends to become compressed to apply a pressure through the pipe 20 against the switch actuating mechanism in the unit 21. Since the chamber 14 is vented to the atmosphere through the pipe 23, no restriction is applied to the liquid as it rises in the chamber 14. In other words no pressure is applied to its surface so that the discharge into the chamber through the opening 18 is freely had.

When the pressure in the column 19 reaches a predetermined amount for which the mechanism 21 has been set or designed, the switch 22 is closed by reason of that predetermined pressure being reached.

The motor 36 may be of any type desired, having the power lines 53 and 54 leading to the starting box 37, the wire 53 being connected to one end of the starting coil 56. The exact details of the starting mechanism do not form a part of the invention per se, and since that mechanism is commercially obtainable and well-known to those versed in the art, the details of that mechanism are not herein shown. From one side of the switch 22 is carried a wire 57 to interconnect with the conductor or wire 53.

From the other side of the switch 21 leads a wire 58 to have connected across between it and a wire 59 connecting to the power conductor 54 three relay energizing coils 60, 61 and 62. A circuit is thus completed by the closing of the switch 22 between the power lines 53 and 54 to energize those three relay coils. Upon the energizing of these three coils, their respective armatures 63, 64 and 65 are lifted to close circuits to be described.

First it is to be observed however that in the valve 34, the cylinder 40 is maintained in the right hand position, Fig. 1, by reason of the fact that the coil 44 is energized to pull the armature 42 to the right, by reason of the fact that the coil 44 is interconnected by the wires 66 and 67 between the power line 57 and the contactor bar 68 through the wire 69 to the wire 59.

At the relay operated by the coil 62, the contactor bar 70 interconnects the contact members 71 and 72 to close the circuit through the wire 73 leading to one side of the starting coil 56 and the wire 59 leading to the power line 54, this closed circuit causing the motor 36 to start and to continue in operation as long as that circuit is maintained. The operation of the motor 36 produces a vacuum in the pipe 37 and thus across the valve cylinder 40, and the pipe 33, tending to create a vacuum in the upper chamber 13. The reduction in pressure tends to seat the ball 26 against entrance of atmospheric air and tends to unseat the ball 28 to produce the lowered pressure in the pipe 15 and thereby set up a flow of liquid from the chamber 14 upwardly through the pipe 15 to discharge over the member 30 into the upper chamber 13. When the liquid makes contact with the electrode 31, it closes a circuit through itself between the tank wall and the electrode 31. The tank 10 being normally supported on the ground or within the ground is grounded itself in most instances, but in any event is grounded, as at 88, through the wire 57 to that side of the line 53. In thus closing the circuit from the ground 88 from the line 53, through the wire 57 (also possibly directly through the ground to the grounded line 53), the circuit continues through the electrode 31, the wire 75, across the bar or bridge connector 74, through the wire 58, thereby forming a parallel circuit with the switch 22 to include the relay windings 60, 61, 62, and the wire 59 to the line 54.

As the fluid level rises within the chamber 13, the pressure in the column 19 drops to allow the switch 22 to open, but the relay windings 60, 61, and 62 remain energized by the circuit just above described which has been closed through the electrode 31.

Continued rising of the fluid level in the chamber 13 will cause the fluid to reach and submerge at least the lower end of the electrode 32. Thereupon a new circuit is established between the line 53, through the ground 88, the fluid itself, the electrode 32, the wire 76, the two relay windings

77 and 78, the wire 79, the relay bridge connecter 80, the wire 59, and the line 54. Now when these relay windings 77 and 78 are energized through this particular circuit, their armatures 81 and 82 are lifted to the upper circuit closing positions. A circuit is established from the line 54, the wire 59, the wire 69, the relay bridge 68, the wire 83, the solenoid winding 43, the wire 84, and the wire 57, to the other line wire 53. The energizing of the winding 43 pulls the armature 41 to the left to shift the valve cylinder 40 accordingly. It is to be understood, that initially with the relay winding 77 not energized, the relay connecter bar 68 remains in the position shown in Fig. 1 whereby a circuit is normally closed from the line wire 54, through the wire 59, the wire 69, the bar 68, the wire 67, the solenoid winding 44, the wire 66, and the wire 57 connecting with the other line wire 53. This energizes initially the winding 44 to maintain the valve cylinder 40 in the right hand position until the relay winding 77 is energized to break that circuit by lifting the bar 68 to the uppermost position to establish the circuit above described through the solenoid winding 43.

With the cylinder 40 shifted to the left hand position, the orifice 51 is closed and the cross passageway 50 registers with the chamber 48 to afford passage across the cylinder through the slot 46 from the pipe 52 to the vacuum pipe 37. Also the pressure pipe 38 is then interconnected through the cross slot 45, the transverse passage 47, and the orifice 49, to provide a discharge therethrough into the pipe 33 and consequently into the chamber 13 to establish a pressure therein as opposed to the theretofore existing vacuum. It is to be remembered that the motor 36 continues operating as long as the relay winding 62 remains energized.

With the closure of the circuit described by the liquid contacting the short electrode 32, the lifting of the armature 82 at the relay coil 78 closes a circuit leading from the ground or the line wire 53 through the wire 57, the wire 86, the relay connector 85, the wire 87, the two windings 77 and 78, the wire 79, the relay connecting bar 80, and the wire 59, to the line 54, this circuit being established to maintain the energization in the coils 77 and 78 after the fluid drops below the lower end of the short electrode 32 to maintain the cylinder 40 in the left hand position.

Under this pressure cycle, the fluid in the chamber 13 will continue to drop as it is forced out of the discharge pipe 24 until the fluid level falls below the lower end of the long electrode 31. When this event happens, the holding circuit above described from the ground 88 through the liquid, the electrode 31, and the relay winding 60, 61, and 62, through the wire 59 to the line wire 54 is opened. Since the switch 22 is also open, the motor 36 is no longer energized and comes to a stop. In the meantime the fluid draining from the pipe 17 into the lower chamber 14 will again initiate the vacuum cycle first above described by producing the pressure in the column 19 to institute the vacuum and pressure cycles one after another. The chambers 13 and 14 are so proportioned as to their relative sizes in conjunction with the size of the vacuum-pressure pump 35, that the upper tank 13 will fill and discharge before the pressure in the column 19 again builds up sufficiently to close the switch 22.

Second form of invention

Referring now to Fig. 2 of the drawing, to show another form of structure within the spirit of the invention, a two-compartment tank generally designated by the numeral 90 is employed wherein there is a lower chamber or collecting basin 91 shown as having a conical floor, and an upper discharging chamber 92 also shown as having a conical floor. To facilitate assembly, the lower chamber 91 is preferably made in one unit to have the upper chamber 92 in a second unit to be fitted over the lower unit and secured thereto in any suitable air-tight manner. The upper chamber 92 is sealed at its top and by the cover 93.

A drain pipe 94 discharges through the side wall of the tank into the upper portion of the lower chamber 91. A discharge pipe 95 is suspended from the floor 96 of the chamber 92, centrally thereof, to terminate by lower end down within the apex portion of the floor 97 of the lower chamber 91. Normally this pipe 95 which opens through the floor 96 is closed off at its upper end by some sort of a valve, herein shown as by a ball 98 resting by gravity over the discharge end of the pipe 95. An air pressure column 99 leads up through the floor 96 from the lower chamber 91 through the chamber 92 (it may be outside of that chamber, but is shown as passing therethrough for convenience in assembly) and interconnects with a pressure actuated switch mechanism operating the switch 22 by changes of pressure appearing within the column 99. A vent pipe 100 leads from the uppermost portion of the chamber 91 to discharge into the atmosphere at any suitable position.

In the upper chamber 92, there is suspended from the cover 93 throughout the major height of the chamber 92, a discharge pipe 101 having its inlet opening spaced a short distance above the ball 98. In the upper end of the discharge pipe 101 there is mounted a valve of any suitable nature adapted to close normally the outlet of the pipe 101. In the form herein shown, this valve comprises a ball 102 normally dropping by gravity into closed position across the upper end of the pipe 101. A bell 103 forms the interconnection between the upper end of the pipe 101 and the cover 93 to give room for the rolling of the ball 102 off of its seat and to permit discharge therepast of the fluid contents from the chamber 92 through the outer final discharge pipe 104.

There is suspended within the chamber 92 an electrode 105 insulated from the tank 90 and having its lower end spaced above the lower intake end of the pipe 101, but down within the conical portion of the chamber 92. A float 106 is carried in the upper portion of the chamber 92 by a bracket 107. When the fluid level in the chamber 92 floats the member 106 sufficiently, a valve plug 108 carried on the upper end of the float 106 is pushed into the lower orifice 109 at the end of the pipe 110 leading exteriorly of the tank 90.

As in the first form of the invention described, there is employed a vacuum-pressure pump unit 35 driven by the motor 36, and having the vacuum intake pipe 37 and the pressure discharge pipe 38, both of which pipes connect with a control valve 111. This valve 111 is of that type actuated in one direction by a spring and in the other direction by pressure.

Within the valve 111 is a piston rod 112, on the right end of which is mounted a piston 113 within the bore 114. The rod 112 extends axially through a smaller diameter bore 115 within which slidingly fit the spaced apart pistons 116 and 117, both fixed to the rod 112. Then the rod 112 extends on to the left through a bore 157 of substantially

the same diameter as that of the bore 114. A compression spring 118 surrounds the rod 112 to bear by one end against the valve head 119 and by its other end against an abutment member 120 fixed on the rod 112 spaced between the head 119 and the piston 116. The body of the valve 111 is provided with an upper chamber 121 from which leads the pipe 110. The body of the valve 111 is provided with a central passageway 122 from which leads a pipe 123 to the atmosphere, herein shown as connected to the pipe 100. This passageway 122 opens into the smaller diameter bore 115 at that position whereby the opening thereof will always be between the two pistons 116 and 117.

On the left hand side of the passageway 122 is a passageway 124 leading from the bore 115 to be interconnected by the vacuum pipe 37. On the other side of the passageway 122, to the right, is shown a third passageway 125 to which is interconnected the pressure pipe 38.

A small diameter pressure line 126 leads from the pump unit 35 to connect into the bore 114. Interposed in this line 126 is a valve 127 normally closed to be opened by a solenoid, the winding 128 of which is shown. A bleed line 129 interconnects the line 126 from a position between the valve 111 and the valve 127 with the vacuum pipe 37.

A vacuum operated switch 130 is provided to be operated from the vacuum pipe 37 from a normally open position at low vacuum to a closed position at the higher degree of vacuum produced by the unit 35. The mechanism for operating the switch 130 is of the usual and well-known type to those versed in the art and commercially obtainable, and therefore the details of which are not herein shown or described.

Operation

Assuming the effluent to be pouring in from the pipe 94 into the collecting basin 91, the level of this fluid will reach and submerge the lower end of the pipe 99, and as the level continues to rise, pressure of the air entrapped within the column 99 will increase to close the switch 22 otherwise normally open. Since the upper portion of the basin 91 is vented through the pipe 100, no restriction is placed upon the fluid against rising within the basin 91. One side of the switch 22 is grounded as indicated at 131. A control switch 132 is closed for automatic operation initially to interconnect the line wire 53, the motor starting winding 56, the wire 133, and the wire 134. The closing of the switch 22, as indicated, closes a circuit from the ground 131, through the switch 22, the wire 164, a relay winding 135, the wire 136, and the secondary winding 137 of a transformer 138, to the ground 139 of the winding 137. The primary winding 140 of the transformer 138 is normally energized through the circuit formed between the line wires 53 and 54 through the respective wires 141 and 142.

When that circuit is closed by the switch 22, the armature 143 is elevated to close a circuit from the line wire 54, the wire 142, the relay connecting bar 144, the wire 134, the switch 132, the wire 133, and winding 56, to the other line wire 53, thereby starting the motor 36 into operation. The switch 130 is open initially before this motor 36 starts.

The members within the valve 111 are initially in the position indicated in the drawing, Fig. 2, as determined by the spring 118. A vacuum is produced in the upper chamber 92 through the pipe 110, the valve chamber 121, the bore 157 to the left of the piston 116 and the bore 115 to the left of the piston 116, the passageway 124, and the vacuum pipe 37. The pressure discharge from the unit 35 is through the pipe 38, the passageway 125, bore 115, passageway 122, and the pipe 123.

As the air is exhausted from the chamber 92, to a sufficient degree, the fluid in the lower chamber 91 is pulled upwardly past the ball 98, lifted off its seat, into the upper chamber 92. As the degree of vacuum increases in the chamber 92, the switch 130 will close upon reaching the predetermined degree of vacuum to interconnect the line 54, wire 142, relay interconnector 144, wire 134, wire 145, switch 130, wire 146, solenoid winding 128, wire 147, and wire 148, connecting with the line wire 53, also interconnecting from the wire 146, the relay winding 149, through the wire 148 with the line wire 53. Energizing the winding 149 causes the relay connector bar 150 to interconnect the wire 146 with the wire 151 establishing a part of a circuit to be later utilized upon the opening of the vacuum switch 130. Incidentally the vacuum switch 130 does not close until the fluid has lifted the float 106 to close off the orifice 109 by the plug 108.

Going back, as the fluid level rises in the chamber 92, the lower end of the electrode 105 becomes submerged to establish a current conducting path from the grounded wall of the tank 90 through the electrode 105, the wire 152, the relay connecter bar 153, the relay winding 135, the wire 136, the transformer secondary winding 137, and the ground 139. This is in parallelism with the switch 22.

At the high vacuum condition in the chamber 92, which is that condition wherein the level of the fluid is well up in the upper portion of the chamber 92, and the switch 130 is closed to energize the solenoid winding 128, the valve 127 opens to cause a pressure to be produced in that part of the bore 114 to the right of the piston 113 and thereby forcing the piston 113 to the left to position the pistons 116 and 117 to the left to set up an interconnection between the passageway 122 and 124 (pulling air from the atmosphere into the vacuum line 37) and a pressure connection from the passageway 125 on the right side of the piston 117 through the chamber 121 and the pipe line 110. The pressure forces the float 106 downwardly and pushes the liquid contents of the chamber 92 outwardly through the discharge pipe 101 past the ball 102 into the outer discharge pipe 104. As the fluid level drops, the switch 22 has opened during the upflow of the liquid from the chamber 91 to the chamber 92 by reason of the drop in pressure in the column 99, but the presence of the fluid about the electrode 105 forms the circuit above indicated to maintain operation of the pump unit 35. The fluid in the chamber 92 will continue to be lowered in level until it drops below the lower end of the electrode 105 thereby interrupting the circuit through the fluid between that electrode and the ground. Immediately this happens, the relay winding 135 is de-energized and the connecters 144 and 153 drop to the open circuit positions. In so doing, the circuit to the motor starter winding 56 is broken and the motor 36 stops. Also the holding relay winding 149 becomes de-energized to in turn drop the relay connecter 150 and thereby de-energizes the solenoid winding 128 to permit the valve 127 to close (switch 130 has opened upon the reduction of the vacuum in the

pipe 37 in the pressure cycle) to permit the spring 118 to return the various valve pistons to the positions as indicated in the drawing. In this returning travel, the fluid which may be entrapped in that end of the bore 114 to the right of the piston 113 may escape slowly through the bleed line 129 connection with the vacuum line. All of the various circuits are then returned to the initial position awaiting refilling of the collecting basin 91 for subsequent operations as above described.

The switch 132 may be thrown to the upper position to interconnect the wire 133 directly with the wire 142 to provide hand-controlled operation. Otherwise the switch 132 remains closed as between the wires 133 and 134.

While as above indicated, the invention is diagrammatically illustrated in the two forms, of which Fig. 2 embodies a more simplified electric control, it is obvious that structural changes may be employed such as in the particular vacuum-pressure control valve, the tank structure and valves therein, all without departing from the spirit of the invention, and I therefore do not desire to be limited to the precise forms shown and described beyond the limitations as may be imposed by the following claims.

I claim:

1. In a sewage lift, a receiving basin; a discharge compartment; a transfer pipe leading from near the floor of said basin to discharge into the upper portion of said compartment; a discharge pipe leading from near the floor of said compartment to discharge therewithout; a valve for each of said pipes normally seating in the opposite direction of normal flow therein; vacuum-pressure producing means; valve means selectively applying to said discharge compartment vacuum and pressure from said producing means; electric means for controlling the actuating of said valve means; a motor actuating said producing means; an electrode extending into said discharge compartment to have a portion at least submerged at a predetermined liquid level therein; an electric control switch actuated by change in level of fluid in said basin; and electric circuit means automatically energized and deenergized by interconnection with a source of current through said electrode and said switch by changes in levels of fluid in said basin and said compartment to actuate said motor and said valve means in accordance with said levels.

2. In a sewage lift, a receiving basin; a discharge compartment; a transfer pipe leading from near the floor of said basin to discharge into the upper portion of said compartment; a discharge pipe leading from near the floor of said compartment to discharge therewithout; a valve for each of said pipes normally seating in the opposite direction of normal flow therein; vacuum-pressure producing means; valve means selectively applying to said discharge compartment vacuum and pressure from said producing means; electric means for controlling the actuating of said valve means; a motor actuating said producing means; an electrode extending into said discharge compartment to have a portion at least submerged at a predetermined liquid level therein; an electric control switch actuated by change in level of fluid in said basin; and electric circuit means automatically energized and deenergized by interconnection with a source of current through said electrode and said switch by changes in levels of fluid in said basin and said compartment to actuate said motor and said valve means in accordance with said levels; said electric circuit means including a holding circuit maintained through said electrode when said switch opens upon predetermined fall in liquid level in said basin, the holding circuit maintaining said motor in operation.

3. In a sewage lift, a receiving basin; a discharge compartment; a transfer pipe leading from near the floor of said basin to discharge into the upper portion of said compartment; a discharge pipe leading from near the floor of said compartment to discharge therewithout; a valve for each of said pipes normally seating in the opposite direction of normal flow therein; vacuum-pressure producing means; valve means selectively applying to said discharge compartment vacuum and pressure from said producing means; electric means for controlling the actuating of said valve means; a motor actuating said producing means; an electrode extending into said discharge compartment to have a portion at least submerged at a predetermined liquid level therein; an electric control switch actuated by change in level of fluid in said basin; and electric circuit means automatically energized and deenergized by interconnection with a source of current through said electrode and said switch by changes in levels of fluid in said basin and said compartment to actuate said motor and said valve means in accordance with said levels; said electric circuit means including a holding circuit maintained through said electrode to retain said valve means controlling means in an energized state while said switch is open and said motor is operating.

4. In a sewage lift, a receiving basin; a discharge compartment; a transfer pipe leading from near the floor of said basin to discharge into the upper portion of said compartment; a discharge pipe leading from near the floor of said compartment to discharge therewithout; a valve for each of said pipes normally seating in the opposite direction of normal flow therein; vacuum-pressure producing means; valve means selectively applying to said discharge compartment vacuum and pressure from said producing means; electric means for controlling the actuating of said valve means; a motor actuating said producing means; an electrode extending into said discharge compartment to have a portion at least submerged at a predetermined liquid level therein; an electric control switch actuated by change in level of fluid in said basin; and electric circuit means automatically energized and deenergized by interconnection with a source of current through said electrode and said switch by changes in levels of fluid in said basin and said compartment to actuate said motor and said valve means in accordance with said levels; means actuated by rise in liquid level in said discharge compartment cutting off said vacuum application independently of said valve means.

5. In a sewage lift, a receiving basin; a discharge compartment; a transfer pipe leading from near the floor of said basin to discharge into the upper portion of said compartment; a discharge pipe leading from near the floor of said compartment to discharge therewithout; a valve for each of said pipes normally seating in the opposite direction of normal flow therein; vacuum-pressure producing means; valve means selectively applying to said discharge compartment vacuum and pressure from said producing means; electric means for controlling the actuating of said valve means; a motor actuating said pro-

ducing means; an electrode extending into said discharge compartment to have a portion at least submerged at a predetermined liquid level therein; an electric control switch actuated by change in level of fluid in said basin; and electric circuit means automatically energized and deenergized by interconnection with a source of current through said electrode and said switch by changes in levels of fluid in said basin and said compartment to actuate said motor and said valve means in accordance with said levels; said electric circuit means including a holding circuit maintained through said electrode when said switch opens upon predetermined fall in liquid level in said basin, the holding circuit maintaining said motor in operation; and said circuit means also including a holding circuit maintained through said electrode to maintain energization of said valve means controlling means when said switch opens while said motor continues to operate.

6. In a sewage lift, a receiving basin; a discharge compartment; a transfer pipe leading from near the floor of said basin to discharge into the upper portion of said compartment; a discharge pipe leading from near the floor of said compartment to discharge therewithout; a valve for each of said pipes normally seating in the opposite direction of normal flow therein; vacuum-pressure producing means; valve means selectively applying to said discharge compartment vacuum and pressure from said producing means; electric means for controlling the actuating of said valve means; a motor actuating said producing means; an electrode extending into said discharge compartment to have a portion at least submerged at a predetermined liquid level therein; an electric control switch actuated by change in level of fluid in said basin; and electric circuit means automatically energized and deenergized by interconnection with a source of current through said electrode and said switch by changes in levels of fluid in said basin and said compartment to actuate said motor and said valve means in accordance with said levels; and a second electrode entering said discharge compartment in spaced relation from said first electrode to be contacted by the liquid therein upon reaching a higher level than that of initial first electrode contact; and said circuit means including a circuit through the second electrode upon being contacted by the fluid to include said valve means

controlling means to actuate the valve means from vacuum to pressure application condition.

7. In a sewage lift, a receiving basin; a discharge compartment; a transfer pipe leading from near the floor of said basin to discharge into the upper portion of said compartment; a discharge pipe leading from near the floor of said compartment to discharge therewithout; a valve for each of said pipes normally seating in the opposite direction of normal flow therein; vacuum-pressure producing means; valve means selectively applying to said discharge compartment vacuum and pressure from said producing means; electric means for controlling the actuating of said valve means; a motor actuating said producing means; an electrode extending into said discharge compartment to have a portion at least submerged at a predetermined liquid level therein; an electric control switch actuated by change in level of fluid in said basin; and electric circuit means automatically energized and deenergized by interconnection with a source of current through said electrode and said switch by changes in levels of fluid in said basin and said compartment to actuate said motor and said valve means in accordance with said levels; means actuated by rise in liquid level in said discharge compartment cutting off said vacuum application independently of said valve means; a second pressure actuated switch normally open and automatically closing only upon being subjected to a higher degree of vacuum than that existing in said discharge compartment upon actuation of said level actuated vacuum cutting off means; and said circuit means including a circuit through said second switch and said valve means control means to energize said last control means upon closing of said second switch to apply pressure in said discharge compartment.

WILLIAM P. WHITTINGTON.

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