June 19, 1923. 1,459,360

F. H. COLE

PUMP

Filed Feb. 28, 1921 4 Sheets-Sheet 1

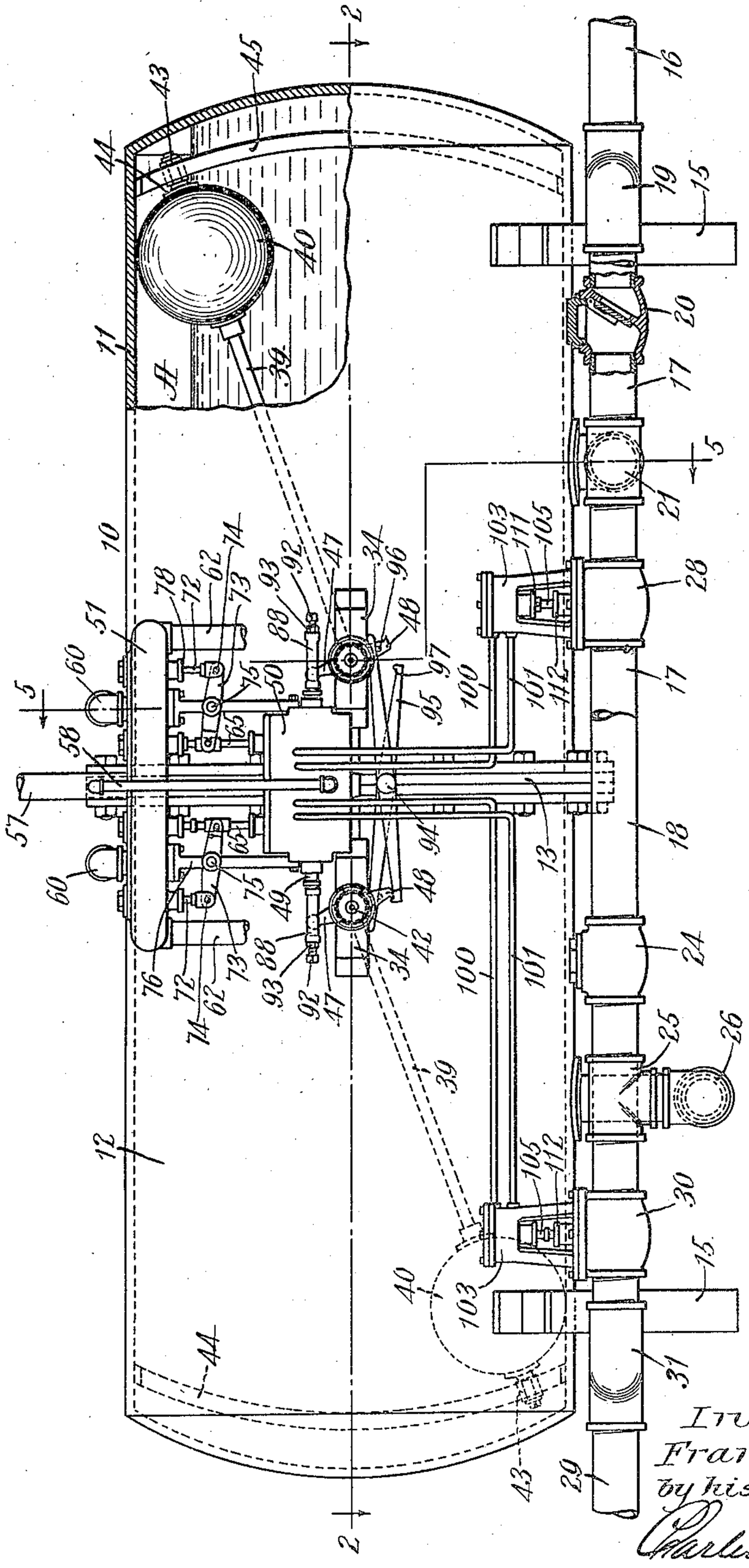

Fig. 1.

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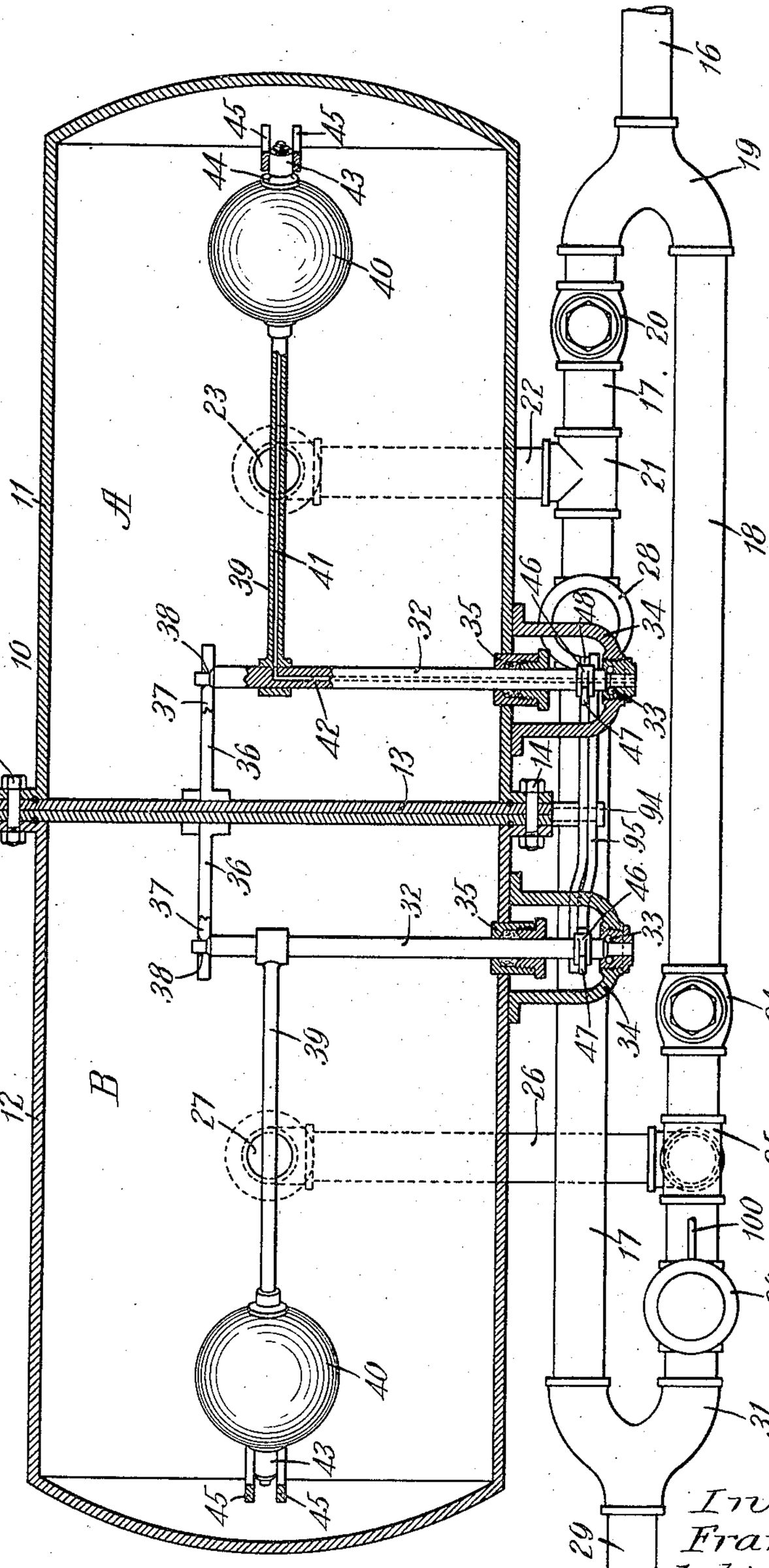

Fig. 2.

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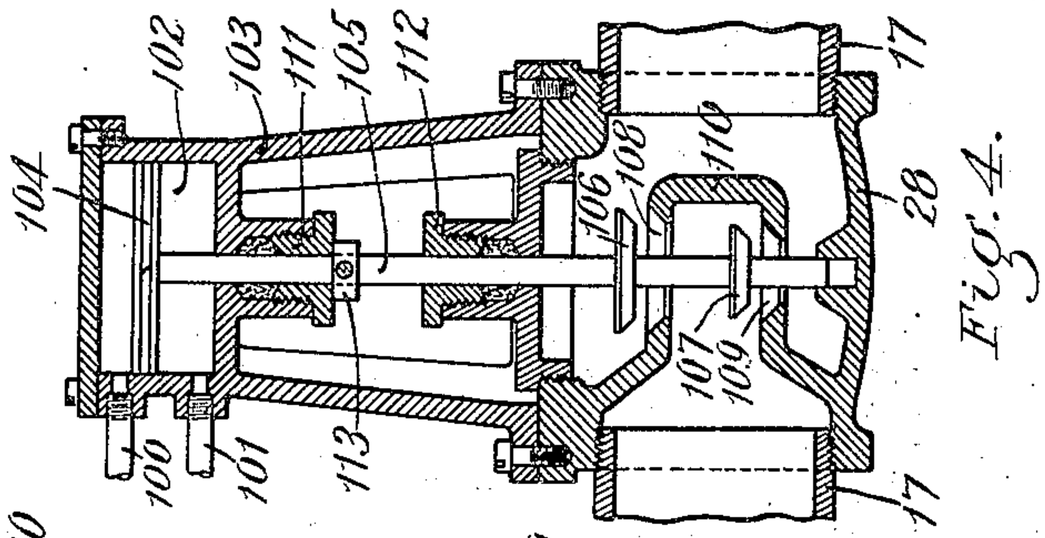

Fig. 4.

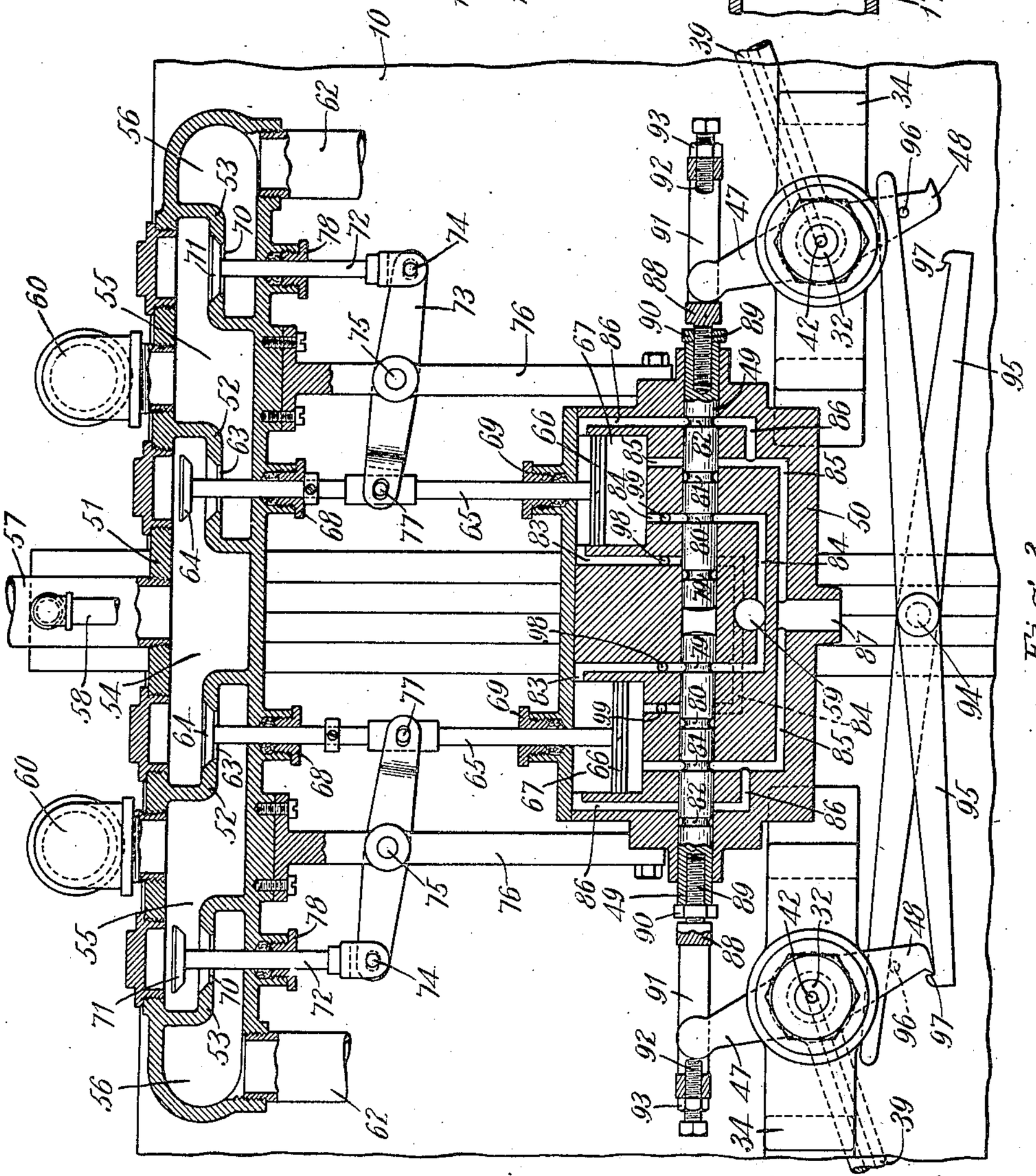

Fig. 3.

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4 Sheets-Sheet 4

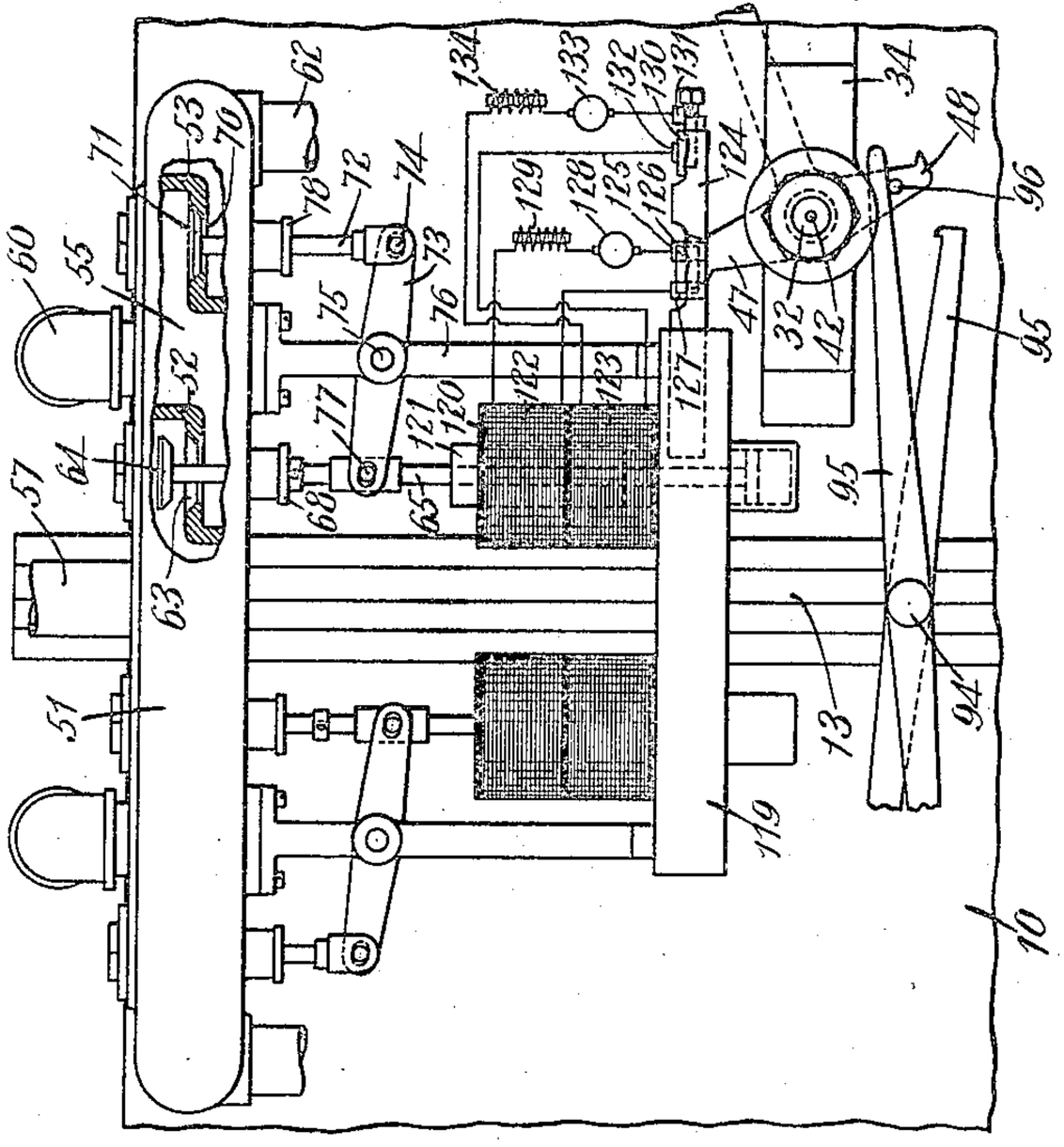

Fig. 6.

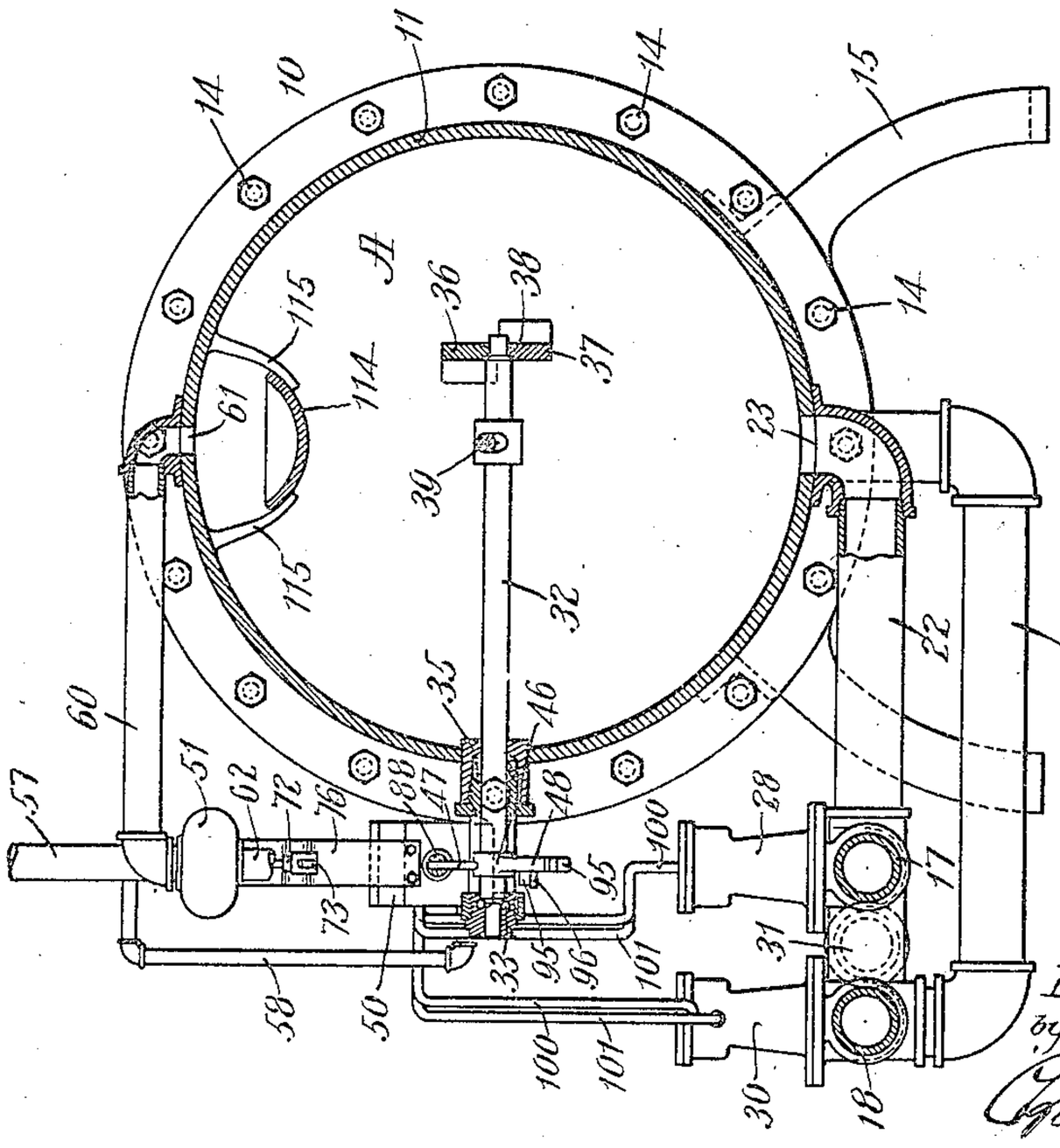

Fig. 5.

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Patented June 19, 1923. 1,459,360

UNITED STATES PATENT OFFICE.

FRANK H. COLE, OF CHELSEA, MASSACHUSETTS.

PUMP.

Application filed February 28, 1921. Serial No. 448,308.

To all whom it may concern:

Be it known that I, FRANK H. COLE, a citizen of the United States, residing at Chelsea, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Pumps, of which the following is a specification.

This invention relates to a pump.

The object of the invention is to provide a tank divided into two chambers each of which is adapted to automatically receive water at any temperature and at any pressure, said water being discharged from said chambers alternately in a continuous flow by alternately admitting a suitable fluid under high pressure to said chambers above the surface of said water, thus creating a pressure within said chambers and thereby forcing said water therefrom.

Another object of the invention is to positively operate the valves which control the passage of water and pressure fluid into and out of each of the chambers by means of pressure fluid, the flow of which is controlled by slide valves operated by the rising and falling of floats in each of the chambers.

Still another object of the invention is to provide means for automatically locking each float in its lowered position after the water has been forced from a chamber to hold said float in said lowered position while a fresh supply of water is flowing into said chamber, the float being automatically released when the chamber is again filled to a predetermined high level by the float in the other chamber when the latter float reaches its lowered position having fallen with the water in the latter chamber as said water has been forced therefrom.

The invention consists in the combination and arrangement of parts whereby the above objects and certain other objects hereinafter appearing may be attained as set forth in the following specification and particularly as pointed out in the claims thereof.

Referring to the drawings:

Figure 1 is a front elevation of a pump embodying my invention, a portion of the tank thereof being broken away and illustrated in section.

Fig. 2 is a horizontal section partly in elevation taken substantially on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged vertical section partly in elevation of a portion of the valve mechanism of the pump.

Fig. 4 is a detail central vertical section of one of the valve mechanisms.

Fig. 5 is a transverse section partly in elevation taken substantially on the line 5—5 of Fig. 1.

Fig. 6 is a view similar to Fig. 3 illustrating a modified embodiment of my invention.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, referring to Figures 1 to 5 inclusive, 10 represents a closed tank of any suitable size and construction but preferably formed in two sections 11 and 12 and divided centrally by a vertically disposed double wall partition 13 into separate chambers A and B. The section 11 and 12 and partition 13 are all fastened together simultaneously by bolts 14. The tank is mounted upon a plurality of suitable supports 15.

Water is admitted to the chambers A and B alternately as will be hereinafter more fully described, said water flowing from a main supply pipe 16 into branch pipes 17 and 18 which form a junction with the main supply pipe at 19. The water entering the chamber A flows through a check valve 20, T 21 and pipe 22 into the bottom of said chamber through an orifice 23. The water entering the chamber B flows through the pipe 18, check valve 24, T 25 and pipe 26 into the bottom of said chamber through an orifice 27.

When discharged from the chamber A the water flows through the orifice 23, pipe 22, T 21 into the pipe 17 where upon being prevented from returning toward the main sup-

ply pipe 16 by the check valve 20 it flows in the opposite direction, passing through a valve 28 which was formerly closed but has now been opened by mechanism which will be hereinafter described, and continuing through the pipe 17 passes into a main discharge pipe 29, when discharged from the chamber B the water flows through the orifice 27, pipe 26, T 25 into the pipe 18 where upon being prevented from returning toward the main supply pipe 16 by the check valve 24 which flows in the opposite direction passing through a valve 30 similar in construction to the valve 28 and thence into the main discharge pipe 29. At their discharge ends the pipes 17 and 18 form a junction with the main discharge pipe 29 at 31.

The water within the chambers A and B is forced therefrom alternately by admitting to said chambers a suitable fluid such as steam or air under pressure and the admission of said fluid into said chambers and also its discharge therefrom is automatically controlled by mechanism which is duplicated for each chamber and a description therefore of one of these mechanisms will suffice for both and is as follows:—Extending through the wall of the section 11 of the tank 10 is a float shaft 32. The outer end of the shaft 32 is mounted in a ball bearing 33 which, in turn, is supported upon a bracket 34 which is preferably welded to the outer surface of the tank. In entering the chamber A the shaft 32 passes through a stuffing box 35. The inner end of the shaft 32 is mounted between brackets 36 and 37 fast to the partition 13 and each of said brackets is provided with a knife edge 38 which bears against said shaft. Fast to the shaft 32 is a float arm 39 upon the outer end of which is a float 40. The interior of the float 40 is connected with the atmosphere by passages 41 and 42 in the float arm 39 and shaft 32 respectively.

Means are provided for guiding the float 40 to prevent a lateral movement thereof as it rises and falls, said means comprising a roller 43 mounted upon a member 44 fast to the float 40, the axis of said roller being in alignment with the axis of the float arm 39. The roller 43 is located between a pair of parallel guides 45 which extend from top to bottom of the chamber A, being fastened to the wall of the tank.

Rigidly fastened to the float shaft 32 upon the exterior of the tank 10 is a lever 46 having oppositely disposed arms 47 and 48 each of which is positioned at right angles to the float arm 39. The arm 47 is adapted to operate a slide valve 49 mounted in a valve casing 50 and thereby control the passage of the pressure fluid through said valve casing to operate the various valves as follows: Mounted upon the tank 10 in any suitable manner is a casing 51, the interior of which is subdivided by a plurality of partitions 52 and 53 into a central chamber 54, a pair of intermediate chambers 55 and a pair of outer chambers 56. Connected with the central chamber 54 is a fluid pressure supply pipe 57. A branch pipe 58 connects the pipe 57 with a main inlet passage 59 provided in the valve casing 50. A pipe 60 connects the chamber 55 of the casing 51 with the chamber A of the tank 10, the pressure fluid entering the top of said chamber A through an orifice 51. A pipe 62 constituting a discharge pipe connects the chamber 56 with any suitable point of discharge for the exhaust fluid.

Located in the partition 52 is a port 63 which is opened and closed by a puppet valve 64 which is connected by a valve stem 65 with a piston 66 adapted to reciprocate in a cylinder 67 formed in the valve casing 50. The valve stem 65 extends through suitable stuffing boxes 68 and 69 provided in the casing 51 and valve casing 50 respectively. Located in the partition 53 is a port 70 which is opened and closed by a puppet valve 71 connected by a valve stem 72 with one end of a rocker arm 73 at 74, said rocker arm being pivoted at 75 to a support 76 which extends between the casings 50 and 51. The other end of the rocker arm 73 is connected at 77 with the valve stem 65 and the valves 64 and 71, therefore operate in unison, the puppet valve 71 opening while the puppet valve 64 is closing and vice versa. The valve stem 72 extends through a stuffing box 78 provided in the casing 51.

The slide valve 49 is preferably cylindrical and is provided with a plurality of channels 79, 80, 81 and 82 extending around the periphery thereof which are adapted to align with passages 83, 84, 85 and 86 respectively provided in the valve casing 50. The passages 83 and 84 are inlet passages and are connected with the main inlet passage 59. The passages 85 and 86 are exhaust passages and the passage 86 joins the passage 85 and connects with a main exhaust passage 87 which discharges directly into the atmosphere or may be connected by a suitable pipe to any desired point. When the chamber A is filled with water to a predetermined high level and the float 40 is raised by said water to the position illustrated in Figure 1, the arm 47 forces the right hand slide valve 49 into the position illustrated in Figure 3 at which time the channel 80 of said slide valve aligns with the passage 84 of said valve casing thereby admitting fluid pressure from the main inlet passage 59 to the cylinder 67 beneath the piston 66 thereby forcing said piston upwardly. At this time the channel 82 of the slide valve 49 aligns with the passage 86 of the valve casing 50, thereby allowing the pressure fluid which has formerly been located in the cylinder 67

above the piston 66 to be exhausted therefrom. When the slide valve 49 is in this position the passage 83 leading to the cylinder above the piston 66, and the exhaust passage 85 leading from said cylinder to the atmosphere are closed.

It is desirable that the slide valve 49 may be adjustable relatively to its operating means and for this reason the outer portion thereof is formed of a separate member 88 which has screw-threaded engagement with the inner portion at 89 and is locked thereto by a lock nut 90. The member 88 is provided with a slot 91 through which the arm 47 oscillates and when the float 40 is falling to its lowered position the arm 47 contacts with a screw 92 provided in the member 88 and locked thereto by a lock nut 93.

When the water has been forced from the chamber A and the float 40 is in its lowered position it is desirable that said float may be locked in said lowered position while a fresh supply of water is entering said chamber, or until the water is discharged to a predetermined low level from the chamber B. Means are, therefore, provided for automatically locking and releasing the floats as follows: Pivotally mounted at 94 upon the tank 10 are a pair of levers 95 each of which is longer and heavier upon one side of the pivot 94 than upon the other side. The long arm of each lever 95 rests upon a pin 96 projecting from the arms 48 while the short arm of said lever is notched at 97 to interlock with the lower extremity of the arm 48 as illustrated in Figure 3.

Means are also provided for positively opening and closing the valves 28 and 30, which are identical in construction, by means of fluid pressure in order to allow the water to flow into the chamber A or B and also to allow said water to be discharged therefrom at the proper time. This mechanism is as follows:—Connecting with the passages 83 and 84 respectively of the valve casing 50 between the slide valve 49 and the cylinder 67 are passages 98 and 99, said passages in turn being connected by pipes 100 and 101 with a cylinder 102 provided in a casing 103 forming a portion of the structure of the valve 28 which is illustrated in detail in Figure 4. Located in the cylinder 102 is a piston 104 which is mounted upon a valve steam 105. The pipe 100 enters the cylinder 102 above the piston 104 while the pipe 101 enters said cylinder below said piston. Fast to the valve stem 105 are valves 106 and 107 which are adapted to open and close ports 108 and 109 respectively provided in a partition 110 formed in the lower part of the valve mechanism 28. The valve stem 105 passes through suitable stuffing boxes 111 and 112 and the upward movement of the piston 104 is limited by a collar 113 which is fast to said valve stem and contacts with the stuffing box 111. It will, therefore, be seen that the passage of water through the valve 28 will be controlled by raising or lowering the valves 106 and 107 by admitting pressure fluid within the cylinder 102 either below or above the piston 104 and the flow of said pressure fluid to said cylinder is controlled by the movements of the slide valve 49.

Located within the chambers A and B directly beneath the orifice 61 is a deflector 114 which is supported by a plurality of fingers 115 which project downwardly from the top of said chambers. The deflectors 115 are located in the path of the pressure fluid to defuse said fluid as it enters the chambers.

The general operation of my improved pump is as follows: Assuming that the chamber A is filled with liquid to a predetermined high level and the float 40 of said chamber is in its raised position as illustrated in Figure 1 and the chamber B is approximately empty and the float 40 of said chamber is in its lowered position, the various valves will all be located as illustrated in Fig. 3. Referring, therefore, particularly to Fig. 3, the right hand slide valve 49 is in its extreme position toward the left, having been moved to said position by the arm 47 as the float 40 of the chamber A reaches its extreme upward position. At this time the left hand slide valve 49 is at its extreme position toward the left, having been moved to said position by the arm 47 as the float 40 of the chamber B is lowered by the lowering of the level of the water in said chamber and the float 40 is locked in its lowered position by means of the lever 95 engaging the lower end of the arm 48.

Referring now particularly to the right hand slide valve 49, the channels 80 and 82 are located in alignment with the passages 84 and 86 respectively of the valve chamber 50. This allows pressure fluid from the main inlet passage 59 to flow through the inlet passage 84 into the cylinder 67 beneath the piston 66, thereby forcing said piston upwardly and allowing the pressure fluid formerly located in the cylinder above said piston to exhaust through the exhaust passage 86 to the atmosphere. As the piston 66 rises it lifts the puppet valve 64 and opens the port 63 and also through the medium of the rocker arm 73 lowers the puppet valve 71 and closes the port 70. The opening of the port 63 allows pressure fluid from the inlet pipe 57 to pass from the central chamber 54 into the intermediate chamber 55 and thence through the pipe 60 to flow to the chamber A where when a sufficient pressure is created above the surface of the water, said water will be forced therefrom.

As the pressure fluid enters the chamber A through the orifice 61 it is defused by means of the deflector 114 located directly

below the orifice 61. In passing from the chamber A the water passes through the orifice 23, pipe 22, T 21 into the pipe 17 and upon being prevented from passing through the check valve 20 located in said pipe, will flow in the opposite direction through the valve 28 and thence outwardly into the main discharge pipe 29. The valve 28 which was formerly closed was opened simultaneously with the raising of the puppet valve 64 by means of the passage of air through the passage 99 and pipe 101 into the cylinder 102 beneath the piston 104 thereby raising said piston and opening the ports 108 and 109 of said valve 28 and thereby permitting the water to pass therethrough. The pressure fluid will continue to enter the chamber A until a greater part of the liquid has been forced therefrom.

During a greater part of the downward movement of the float 40 the arm 47 fast to the float shaft 32 is moving through the slot 91 formed in the outer portion of the slide valve 49. When, however, the float arrives at approximately its lowered position, the arm 47 contacts with the screw 92 located at the outer extremity of the slide valve 49 and at the end of the downward movement of the float 40 the slide valve will be forced toward the right thereby shutting off the passage of pressure fluid through the inlet passage 84 and also through the exhaust passage 86 and at the same time aligning the channels 79 and 81 with the inlet passage 83 and exhaust passage 85 of the valve chamber 50. At this time the right hand slide valve 49 will be located in a position similar to that occupied by the left hand slide valve as illustrated in Fig. 3. This position of the slide valve admits pressure fluid from the main inlet passage 59 through the inlet passage 83 to the cylinder 67 above the piston 66, thereby forcing said piston downwardly and forcing the pressure fluid formerly located in the cylinder 67 beneath the piston outwardly through the exhaust passage 85 to the atmosphere.

The lowering of the piston 66 closes the port 63 preventing further passage of the pressure fluid into the chamber A and at the same time opens the exhaust port 70 and as the water is again admitted to the chamber A provides a vent for the pressure fluid located in the chamber A to be exhausted from said chamber as the fresh supply of water flows into the chamber. Simultaneously with the admitting of pressure fluid above the piston 66, pressure fluid flows through the passage 98 and pipe 100 to the cylinder 102 above the piston 104, thereby forcing said piston downwardly and closing the ports 108 and 109 of the valve 28. When water again enters the chamber A, it will be prevented from passing beyond the valve 28 as said valve is then closed. During the interval that the water in the chamber A is being discharged therefrom water is entering the chamber B and the float in said chamber B is held locked in its lowered position by one of the levers 95, At the end, however, of the downward movement of the float 40 of the chamber A a pin 96, projecting from the arm 48, contacts with the lower edge of the lever 95 which is holding the float of the chamber B in its lowered position and rocks said lever upon its pivot 94 sufficiently to disengage said lever from the arm 48 of the lowered float. This will immediately allow the float 40 of the chamber B to rise and as it reaches its extreme upward position its arm 47 will force the left hand slide valve 49 toward the right, thereby admitting pressure fluid to the chamber B and causing the water in said chamber to be forced therefrom in exactly the same manner as previously described in connection with the chamber A. During the rising and falling of the floats 40 said floats are guided and prevented from moving laterally by means of the parallel guides 45.

It is evident that any type of liquid may be delivered to this device and forced therefrom by means of the pressure fluid.

In Figure 6 is illustrated a modified embodiment of my invention in which the puppet valves 64 and 71 and the valves 28 and 30 are operated by an electrically operated mechanism. In this mechanism in place of the valve chamber 50 a base 119 is provided upon which are mounted solenoids 120 surrounding the valve stems 65 to which armatures 121 are secured. The solenoids 120 are divided midway the height thereof and each division is wound with electric wires to allow separate electric circuits to pass therethrough in different directions, the upper portion or coil 122 being adapted to raise the armature 121 and the lower portion or coil 123 being adapted to lower the armature. A member 124 similar in construction to the slide valve 49 with the channels eliminated is mounted in the base 119 and constitutes a switch member having a reciprocatory motion imparted thereto by means of the arm 47. The switch member 124 has a contact plate 125 fast thereto insulated from the member 124 which in the position illustrated in Figure 6 completes a circuit between contact plates 126 and 127 completing the electric circuit to the upper coil 122 of the solenoid 120, thereby lifting the puppet valve 64. Included in the electric circuit is an electric generator 128 and another solenoid 129 adapted to raise the valve stem 105 of the valve 28 and open said valve. Also fast to the member 124 is another contact plate 130 also insulated from said member. When the member 124 has been moved by the arm 47 to its extreme right hand position, the contact plate 130

contacts with other contact plates 131 and 132 to complete an electric circuit to the lower coil 123 of the solenoid 120, thereby positively pulling the valve stem 65 downwardly and closing the puppet valve 64. This electric circuit also includes an electric generator 133 and a solenoid 134 adapted to lower the valve stem 105 of the valve 28 and close said valve. In this embodiment of my invention the member 124 is reciprocated by the rising and falling of the water within the chambers but in this instance instead of controlling the passage of pressure fluid, the said member constitutes a circuit opening and closing device to control the opening and closing of the puppet valves 64 and 70 and also the valves 28 and 30 in the water discharge passages.

I claim:

1. A pump comprising a tank provided with a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, valves adapted to admit pressure fluid into said chambers alternately and thereby force said liquid therefrom, means to operate said valves, a float located in each chamber adapted to be raised and lowered by said liquid and thereby control the operation of said valve operating means, means to lock each float in its lowered position while the liquid is entering the chamber in which said lowered float is located and means to release said lowered float by the float of the other chamber when all of the liquid has been discharged from the latter chamber.

2. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston and a float in each chamber adapted to be raised and lowered by said liquid and thereby impart a reciprocatory motion to said slide valve.

3. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder whereby a reciprocatory motion may be imparted to said piston, and means to lock each float in its lowered position while the liquid is entering the chamber in which said lowered float is located.

4. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder whereby a reciprocatory motion may be imparted to said piston, and means to lock each float in its lowered position while the liquid is entering the chamber in which said lowered float is located, said float being automatically released by the float of the other chamber when the liquid has been discharged from the latter chamber to a predetermined low level.

5. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder whereby a reciprocatory motion may be imparted to said piston, a float in each chamber adapted to be raised and lowered by said liquid and thereby impart a reciprocatory motion to said slide valve and means to prevent a lateral movement of said float during the upward and downward movements thereof.

6. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston, a float in each chamber adapted to be raised and lowered by said liquid and thereby impart a reciprocatory motion to said slide valve, a pair of vertically disposed parallel guides mounted in each chamber, and a roller mounted upon each float and projecting between said guides adapted to prevent a lateral movement of said floats.

7. A pump comprising a tank divided into

a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, puppet valves adapted to admit pressure fluid into said chambers, a plurality of cylinders, a piston located in each of said cylinders and operatively connected with said puppet valves, puppet valves adapted to discharge exhaust pressure fluid from said chambers, means operatively connecting said inlet and discharge puppet valves adapted to operate said valves simultaneously, slide valves adapted to control the flow of pressure fluid to said cylinders, whereby a reciprocatory motion may be imparted to said pistons and floats adapted to operate said slide valves.

8. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, puppet valves adapted to admit pressure fluid into said chambers, a plurality of cylinders, a piston located in each of said cylinders and operatively connected with said puppet valves, puppet valves adapted to discharge exhaust pressure fluid from said chambers, slide valves adapted to control the flow of pressure fluid to said cylinders, whereby a reciprocatory motion may be imparted to said pistons, means operatively connecting said inlet and discharge puppet valves adapted to close said discharge puppet valve when said inlet puppet valve is opened and open said discharge puppet valve when said inlet puppet valve is closed and floats adapted to operate said slide valves.

9. A pump comprising a tank provided with a plurality of chambers adapted to contain liquid, inlet and discharge pipes for said liquid, a check valve located in said inlet pipe, a valve located in said discharge pipe adapted to be operated by pressure fluid, puppet valves adapted to admit pressure fluid into said chambers alternately and thereby force said liquid therefrom, a plurality of cylinders, a piston located in each of said cylinders and operatively connected with said puppet valves, slide valves adapted to control the flow of pressure fluid to said cylinders and to the valve in said discharge pipe and thereby operate said puppet valves and the valve in said discharge pipe simultaneously and floats adapted to operate said slide valves.

10. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston, a shaft extending from the exterior of said tank through the wall thereof into the interior of one of said chambers, an arm fast to said shaft within said chamber, a float fast to said arm, the interior of said float communicating with the atmosphere through a passage extending through said arm and through said shaft and means fast to said shaft adapted to impart a reciprocatory motion to said slide valve.

11. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston, a shaft extending from the exterior of said tank through the wall thereof into the interior of one of said chambers, an arm fast to said shaft within said chamber, a float fast to said arm, means to prevent a lateral movement of said float during the upward and downward movements thereof, and means fast to said shaft adapted to impart a reciprocatory motion to said slide valve.

12. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston, a shaft extending from the exterior of said tank through the wall thereof into the interior of one of said chambers, an arm fast to said shaft within said chamber, a float fast to said arm, means to prevent a lateral movement of said float during the upward and downward movements thereof, means fast to said shaft adapted to impart a reciprocatory motion to said slide valve, and means to adjust said slide valve longitudinally relatively to its operating means.

13. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means

to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston, a shaft extending from the exterior of said tank through the wall thereof into the interior of one of said chambers, an arm fast to said shaft within said chamber, a float fast to said arm, means to prevent a lateral movement of said float during the upward and downward movements thereof, means to lock said float in its lowered position while the liquid is entering the chamber in which said lowered float is located, and means fast to said shaft adapted to impart a reciprocatory motion to said slide valve.

14. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston, a shaft extending from the exterior of said tank through the wall thereof into the interior of one of said chambers, an arm fast to said shaft within said chamber, a float fast to said arm, means to prevent a lateral movement of said float during the upward and downward movements thereof, means to lock said float in its lowered position while the liquid is entering the chamber in which said lowered float is located, said float being released by the float of the other chamber when the liquid has been discharged therefrom to a predetermined low level and means fast to said shaft adapted to impart a reciprocatory motion to said slide valve.

15. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston, a shaft extending from the exterior of said tank through the wall thereof into the interior of one of said chambers, an arm fast to said shaft within said chamber, a float fast to said arm, means to prevent a lateral movement of said float during the upward and downward movements thereof, a pair of arms fast to said shaft upon the exterior of said tank, one of said exterior arms being operatively connected with said slide valve and a lever pivotally mounted upon the exterior of said tank adapted to interlock with the other of said exterior arms and thereby lock said float in its lowered position while the liquid is entering the chamber in which said lowered float is located.

16. A pump comprising a tank divided into a plurality of chambers adapted to contain liquid, means to direct the flow of liquid into and out of said chambers, means to control the flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder, whereby a reciprocatory motion may be imparted to said piston, a shaft extending from the exterior of said tank through the wall thereof into the interior of one of said chambers, an arm fast to said shaft within said chamber, a float fast to said arm, means to prevent a lateral movement of said float during the upward and downward movements thereof, a pair of arms fast to said shaft upon the exterior of said tank, one of said exterior arms being operatively connected with said slide valve and a pair of levers pivotally mounted upon the exterior of said tank, each of said levers being adapted to interlock with the other of said exterior arms and thereby lock each float in its lowered position while the liquid is entering the chamber in which said lowered float is located, said float being released by the float of the other chamber when the liquid has been discharged from the latter to a predetermined low level, the corresponding exterior arm contacting with said lever and disengaging said lever from said arm.

17. A pump comprising a tank embodying therein a pair of oppositely disposed sections, the adjacent ends of said sections being open and provided with a flange extending around the periphery thereof, the other ends of said sections being closed, a plurality of plates located between the flanged ends of said sections and constituting a partition dividing said chamber into a pair of chambers, means to fasten said sections and plates together simultaneously, means to direct the flow of liquid into and out of said chambers, means to control the

flow of pressure fluid into and out of each chamber, said means embodying therein a pair of puppet valves for each chamber, a cylinder and a piston located in said cylinder and operatively connected with each of said puppet valves, a slide valve adapted to control the flow of pressure fluid to said cylinder whereby a reciprocatory motion may be imparted to said piston, and means to lock each float in its lowered position while the liquid is entering the chamber in which said lowered float is located.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FRANK H. COLE.

Witnesses:

FRANKLIN E. LOW,

HAZEL F. LA MUDGE.