No. 756,903. PATENTED APR. 12, 1904.

I. H. SPENCER & J. W. SIMPSON.

FLUID PUMP.

APPLICATION FILED OCT. 27, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

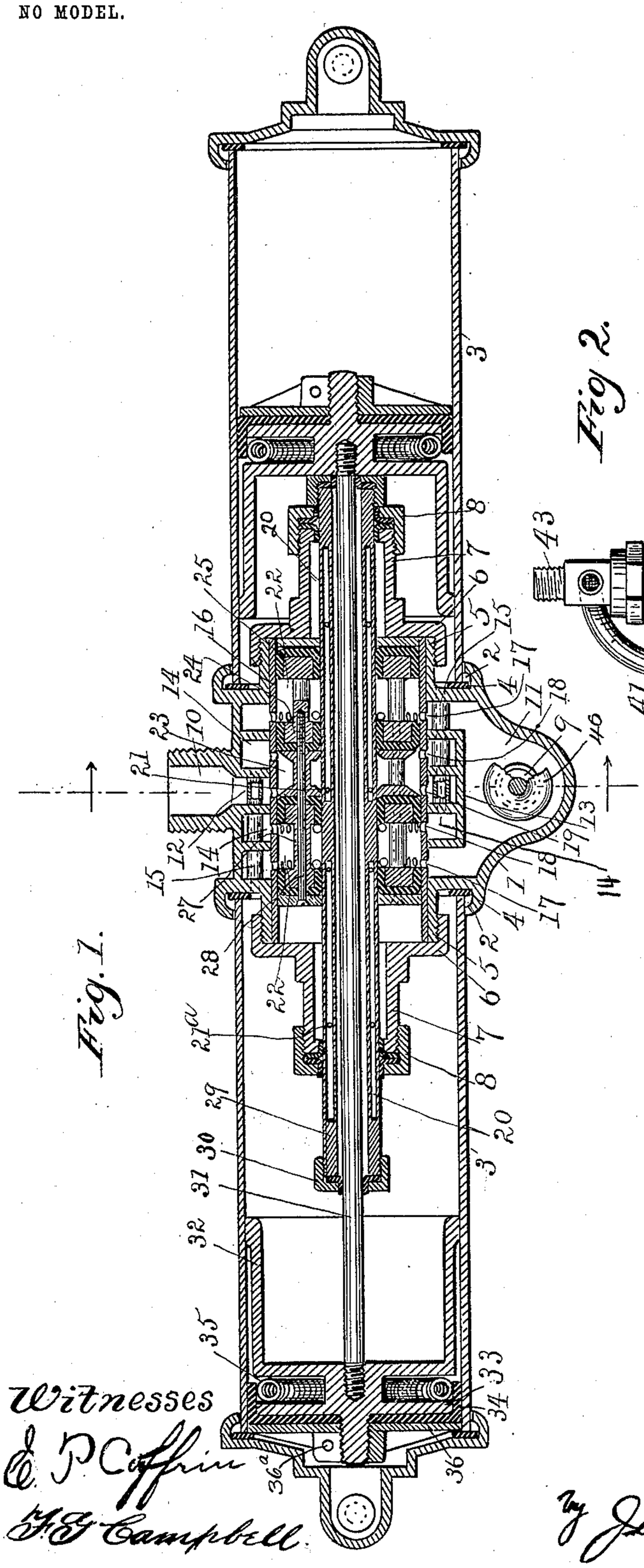
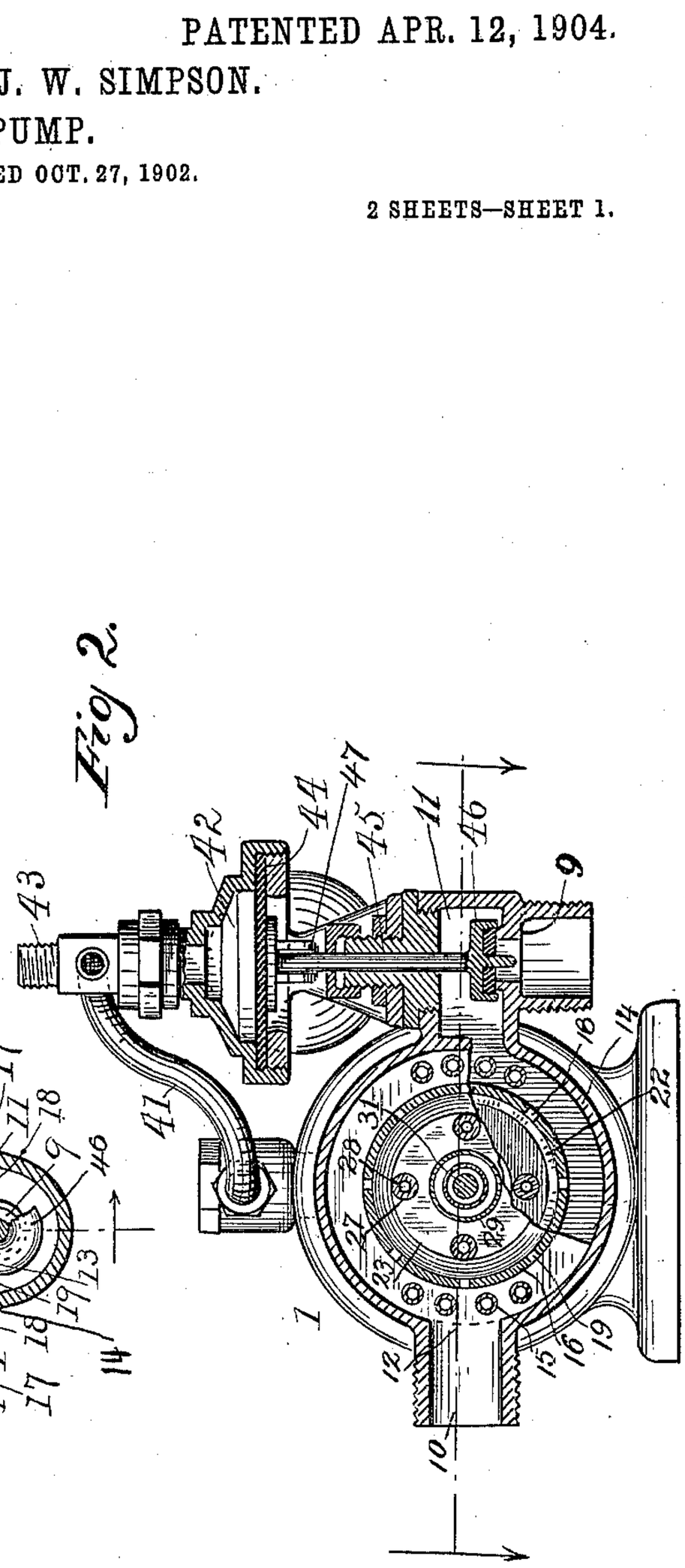


Fig. 2.



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NO MODEL. 2 SHEETS—SHEET 2.

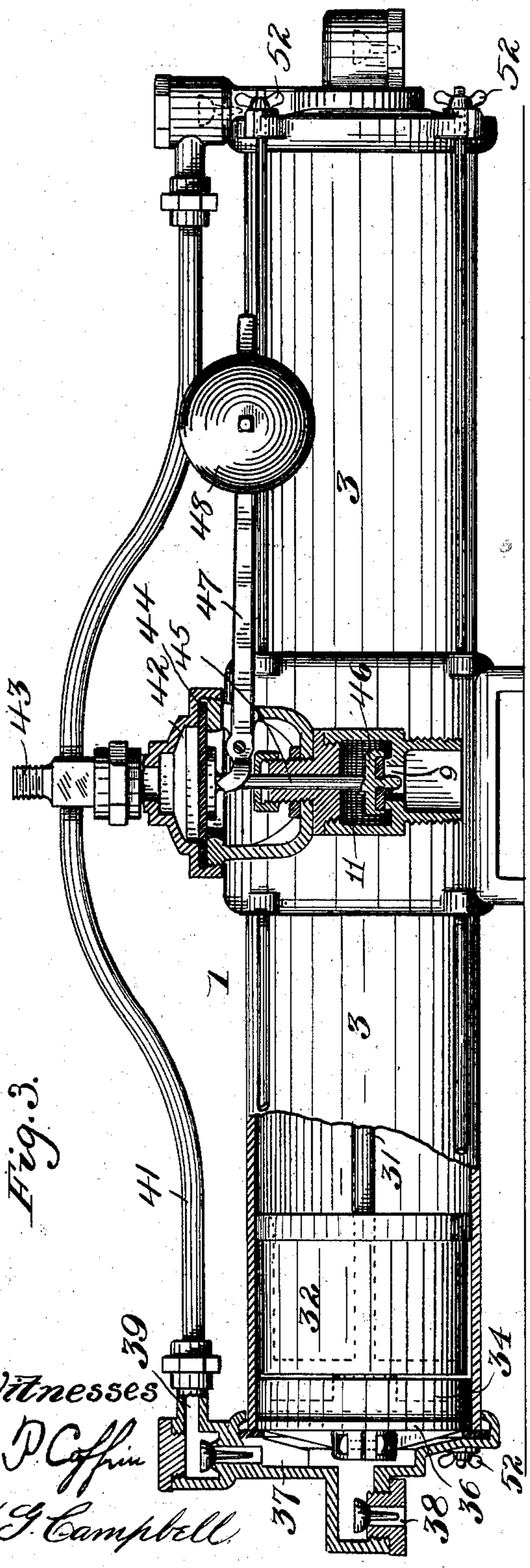

Fig. 3.

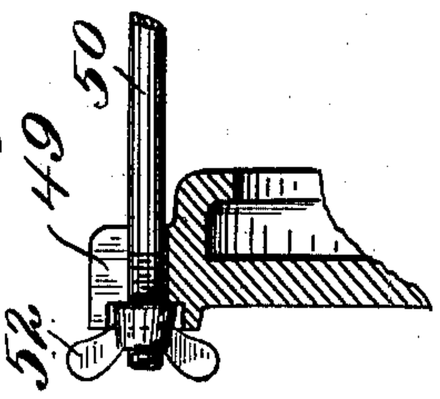

Fig. 5.

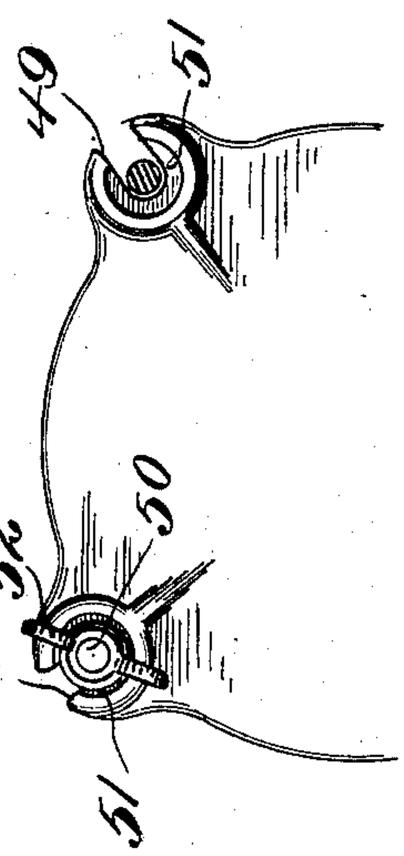

Fig. 4.

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UNITED STATES PATENT OFFICE.

IRA H. SPENCER, OF HARTFORD, AND JOHN W. SIMPSON, OF WATERBURY, CONNECTICUT.

FLUID-PUMP.

SPECIFICATION forming part of Letters Patent No. 756,903, dated April 12, 1904.

Application filed October 27, 1902. Serial No. 128,896. (No model.)

To all whom it may concern:

Be it known that we, IRA H. SPENCER, a resident of Hartford, in the county of Hartford, and JOHN W. SIMPSON, a resident of Waterbury, in the county of New Haven, State of Connecticut, citizens of the United States, have invented certain new and useful Improvements in Fluid-Pumps, of which the following is a specification.

The invention relates to the class of devices employed for creating a pressure of fluid, as air or the like; and the object of the invention is to provide a device of this class in which the parts are compact, thereby insuring simplicity of construction, and also one in which the parts are so arranged as to greatly increase the efficiency of the device and insure the certainty of its operation at all times.

A form of device by the use of which these objects may be attained is illustrated in the accompanying drawings, in which—

Figure 1 is a view in longitudinal section through the device on the axis of the cylinders and with parts broken away to show construction. Fig. 2 is a view in cross-section through the device on the dotted line shown in Fig. 1 and with parts broken away. Fig. 3 is a view in side elevation of the device with parts broken away to show construction. Fig. 4 is a detail view of a portion of one of the cylinder parts, showing construction; and Fig. 5 is a detail view in section through a portion of the same.

In the accompanying drawings the numeral 1 denotes a valve-chest that may be of iron or other suitable metal or material formed to shaped in any desired manner. On opposite ends of the chest are provided flanged recesses 2 for the reception of the cylinders 3, the ends of which project within the recesses and rest against a cylinder-packing 4, located in the bottom of the recess and away from its edge. Annular projections 5 are also located at each end of the chest and to which caps 6 are secured, as by means of interengaging screw-threaded parts. These caps have projections 7, and to each of these projections is secured a packing-nut 8. The chest is provided with an inlet-opening 9 and an outlet-opening 10, the former communicating with the valve-chest chamber 11 and the latter with the exhaust-chamber 12.

A valve-case 13 is formed within the valve-chest and contains inlet-chambers 14 and the outlet or exhaust chamber 12. The inner wall of each of these annular inlet and exhaust chambers is formed by a valve-shell 16 that is open at each end and extends within each of the projections 5, extending from end to end of the latter. This valve-shell 16 is provided with two series of inlet-ports 17, open to the valve-chest chamber 11, with two series of inlet and exhaust ports 18, opening into the inlet-chambers 14, and also with a series of exhaust-ports 19, that open into the exhaust-chamber 12.

A main valve is located and movable lengthwise within the valve-shell 16 and consists of four walls—two end walls and two interior walls—dividing the valve into three compartments—two main-valve inlets 22 and a main-valve outlet or exhaust 23. Each of these walls includes an annular disk 24, with a cup-shaped annular packing 25, embracing the annular disk on both its inner and outer edges. This packing may be formed of any suitable material and serves to pack the joint between the edges of each of the walls and the parts against which the valve as a whole moves on its outer and inner edges. Stays 27 are interposed between the several walls and connected, as by means of screws or bolts 28, as shown in Fig. 1 of the drawings, these several parts being rigidly connected and forming the main valve. This valve as a whole is located in the chamber in the valve-shell, the ends of this chamber being formed by the caps 6 and the packing-nuts 8 on the ends of the projections from said caps.

A secondary valve 29 is located in the central opening formed through the main valve and also in the openings through the packing-nuts 8, the latter being suitably packed, as shown, against the flow of fluid between the outer wall of the secondary valve and the opening through the cap. This secondary valve is tubular and is provided at each end with a packing-nut 30, through which extends

a piston-rod 31. This secondary valve is divided into two compartments by a wall located centrally of the valve. Each of the chambers 20 in this secondary valve is provided with a series of ports 21, located near the inner end of the chamber, and a series of ports 21ª, located near the opposite end of the chamber, the ports 21 being adapted to register with the main-valve inlets and outlet and the ports 21ª to register with the chambers back of the main valve.

The tubular connections 15 are arranged to conduct fluid from each of the inlet-chambers 14 to the pressure-chamber in front of each of the pistons 32, and by the term "in front" is meant that side toward the center of the pump.

The piston-rod 31 projects at each end beyond the secondary valve 29, and a piston 32 is secured at each end of the piston-rod. These pistons are each preferably of cup shape, as shown, and are also provided with a packing-flange 33, each of which is embraced by a cup-shaped packing 34 and a packing-ring 35, consisting of a spiral spring placed in the form of a circle and located in the recess between the flange 33 and the body or main part of the piston. This packing-ring serves to expand the packing against the inner walls of the cylinders 3.

A nut 36 is secured to each of the pistons, between which and the packing-flange the cup-shaped packing is clamped. This nut consists of a disk and a split hub projecting from the disk. A clamping-bolt may be located in the opening 36ª, extending through the hub, and a nut acting in connection therewith to close the split portion and clamp the nut firmly on the screw-threaded projection from the piston which is engaged by the nut.

The ends of the cylinders are each closed by a cap in which is formed an air-chamber 37, having an air-inlet 38 and an air-outlet 39, each controlled by suitable valves to regulate the admission and exhaust of air from said chamber. These caps are provided with slots 49, in which stay-bolts 50 are located, an annular flange 51 extending partially around the slot and forming a recess for a thumb-screw or lock-nut 52. It will be noted from the construction that the stay-bolt may be inserted laterally into the slot, and when the thumb-screw 52 is in place on the end of the bolt the latter is locked securely against removal. This affords a very simple construction which enables the device to be easily and conveniently assembled.

The pipe 41 conducts air into a diaphragm-chamber 42 and to an outlet 43, which extends to the receptacle to be supplied with air from the device. This chamber 42 contains a diaphragm 44, to which is attached a stem 45 of a safety-valve 46. An arm 47 is connected with the stem of the safety-valve, on which is located the usual weight 48 for determining the amount of pressure of air to be contained within the chamber 42.

The safety-valve is located at the side of the valve-chest 1, the arm 47 being connected with the stem 45 of the safety-valve 46. This construction tends to hold the valve 46 normally open, so that fluid, as water, may pass freely through the opening 9 for the purpose of operating the piston. When the operation of the piston has caused a pressure in the diaphragm-chamber 42 and the pipes leading therefrom sufficient to raise the weight 48, this pressure on the diaphragm 44 causes a downward movement of the stem 45 and closes the opening 9, thus shutting off the flow of fluid, as water, and stops the operation of the pump.

In the operation of the device, the parts being in the position shown in Fig. 1 and Fig. 2 of the drawings and the pressure of air in the chamber 42 being reduced so as to allow the safety-valve to raise and a fluid, as water under pressure, to flow through the inlet-opening 9 in the valve-chest chamber 11, the fluid passes from said chamber 11, through the inlet-ports 17 and the inlet and exhaust ports 18, (shown at the left of the section-line of Fig. 1,) into the inlet-chamber 14. (Shown at the left of said section-line.) From this chamber 14 the fluid passes through the tube 15 (located as to its greater part to the right of said section-line) into the chamber in which the piston 32 on the right is located. The pressure thus created in said chamber forces the piston to the end of the cylinder. The fluid in the other end of the cylinder escapes through the tube 15 (at the left of the section-line) into the chamber 14 (shown at the right of the section-line) and from said chamber through the exhaust and inlet ports 18 and 19 (shown at the right of the section-line) and into the exhaust-chamber 12 and thence out. Before the piston 32 at the left-hand end of the cylinder reaches its extreme limit of movement toward the right its inner surface encounters the secondary valve 29 and moves it in the same direction as that in which the piston is moving. This movement of the secondary valve continues until the port 21 in its chamber 20 on the right and at the inner end of said chamber opens into the chamber 22 at the right of the section-line. This chamber 20 then receives fluid from the chamber 22, the fluid passing out of the port 21ª, located at the right-hand end of the chamber in the secondary valve and into the opening back of the main valve. At the time that the port 21 at the inner end of said chamber in the secondary valve has opened into the chamber 22 the port at the inner end of the chamber 20 at the opposite end of the secondary valve has opened into the exhaust-chamber 23, so that fluid can pass from behind the main valve through the chamber 20 in the secondary valve and

through the exhaust-opening. This allows the main valve to begin its movement toward the left and before the secondary valve has reached the limit of its movement toward the right, the two valves now moving in opposite directions at the same time. This movement of the two valves in opposite directions is of vast importance in a machine of this class, in which the parts move very slowly, as in such operation the ports are sure to be uncovered, and the device will not, therefore, become stalled. When the main valve has reached the opposite limit of its play, the ports through the shell 16 have been uncovered on the right of the section-line, so that the pressure of fluid passes through the ports 17 and 18 into the chamber 14 on the right of the section-line and through the tube 15 at the left and into the chamber on the left, thus moving the piston 32 toward the left. The operation of the main valve, above described, has reversed the operation of the parts, and the device will continue to operate until the pressure of the fluid is cut off. This may be done by shutting off the entire supply to the device in any ordinary manner; or when the pressure in the air-reservoir 42 has reached a predetermined degree regulated by the weight 48 on the safety-valve lever 47 the closing of the opening 9 will effect this result.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. A valve-chest having inlet and exhaust chambers, a valve-shell located within the chest and having inlet and exhaust ports, a main valve located within said shell, a secondary valve extending through the main valve and through the valve-chest and having ports for the reception of fluid, a piston-rod extending through the secondary valve, a piston secured to each end of the rod, and a cylinder inclosing each of the pistons.

2. A valve-chest having inlet and exhaust chambers, a valve-shell located within the valve-chest, a main valve within said shell, a secondary valve extending through the main valve, a piston-rod extending through the secondary valve and cylinders secured to opposite sides of the valve-chest, the axes of the valve-chest, main and secondary valves, piston rod and cylinders being coincident, and a piston secured to each end of the piston-rod.

3. A valve-chest having inlet and outlet openings, a valve-case formed within the chest, a valve-shell located within the valve-case, a main valve located within the shell and having ports to register with the inlet and outlet chambers in the valve-case, a secondary valve extending through the main valve and having ports for the reception of fluid, a piston-rod extending through the secondary valve, a cylinder secured to each side of the valve-casing, said valve-chest, valve casing and shell, main and secondary valves and piston rod and cylinder having their axes coincident, and a piston secured to each end of the piston-rod.

4. A valve-chest having inlet and outlet openings, a valve-case located centrally of the chest and having inlet and outlet chambers, a valve-shell located within the valve-case and forming one wall of the inlet and outlet chambers and with inlet and outlet ports communicating with said chambers, a main valve located centrally within the shell, a secondary valve extending centrally through the main valve and having chambers and ports for the reception of fluid, a piston-rod extending centrally through the secondary valve, a piston secured to each end of the piston-rod, a cylinder secured to each side of the valve-casing and inclosing the pistons, an air-chamber formed at each end of the cylinder, a main reservoir, and connections between the air-chambers and the main reservoir.

5. A valve-chest having annular projections, a valve-shell extending into each of said projections and having inlet and outlet ports, a main valve located within the valve-shell, a cap secured to each of said projections and having a neck, a secondary valve having a bearing in said necks and having ports for the reception of fluid, a piston-rod movable through the secondary valve, pistons secured to each end of the piston-rod, and cylinders secured to the valve-chest and inclosing each of the pistons.

6. In a fluid-pump, in combination, a valve-chest having inlet and exhaust ports, cylinders secured to opposite sides of said chest, a main valve, a tubular secondary valve and a piston-rod all concentrically arranged one with respect to the other in said chest and cylinders, and pistons secured to each end of the piston-rod beyond the ends of said valves.

7. In a fluid-pump, in combination, a valve-chest having inlet and exhaust ports, cylinders secured to opposite sides of said chest, a main valve, located within the chest, a piston-rod concentrically arranged with respect to the main valve, pistons secured to each end of said rod, and a tubular secondary valve concentrically arranged with respect to the piston-rod and main valve and with its ends located in the path of movement of the pistons.

8. In a fluid-pump, in combination, a valve-chest having inlet and exhaust chambers, cylinders secured to the opposite sides of said chest, a main valve located within the chest, a tubular secondary valve projecting through the main valve, a piston-rod projecting through the secondary valve, and pistons secured to each end of the piston-rod beyond the ends of the secondary valve.

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