No. 609,089. Patented Aug. 16, 1898.

C. N. DUTTON.

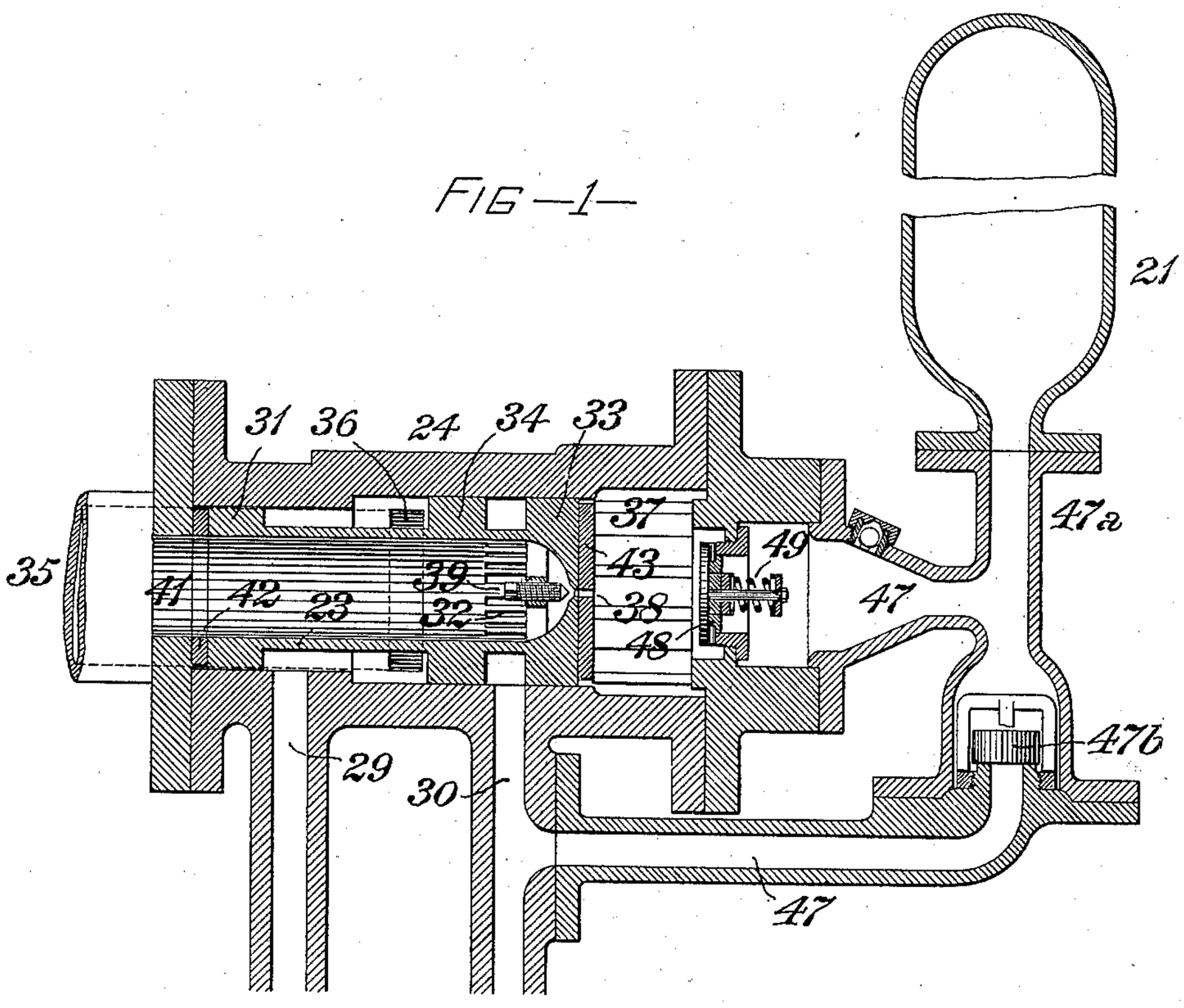
FLUID ACTUATED VALVE.

(Application filed Nov. 13, 1897.)

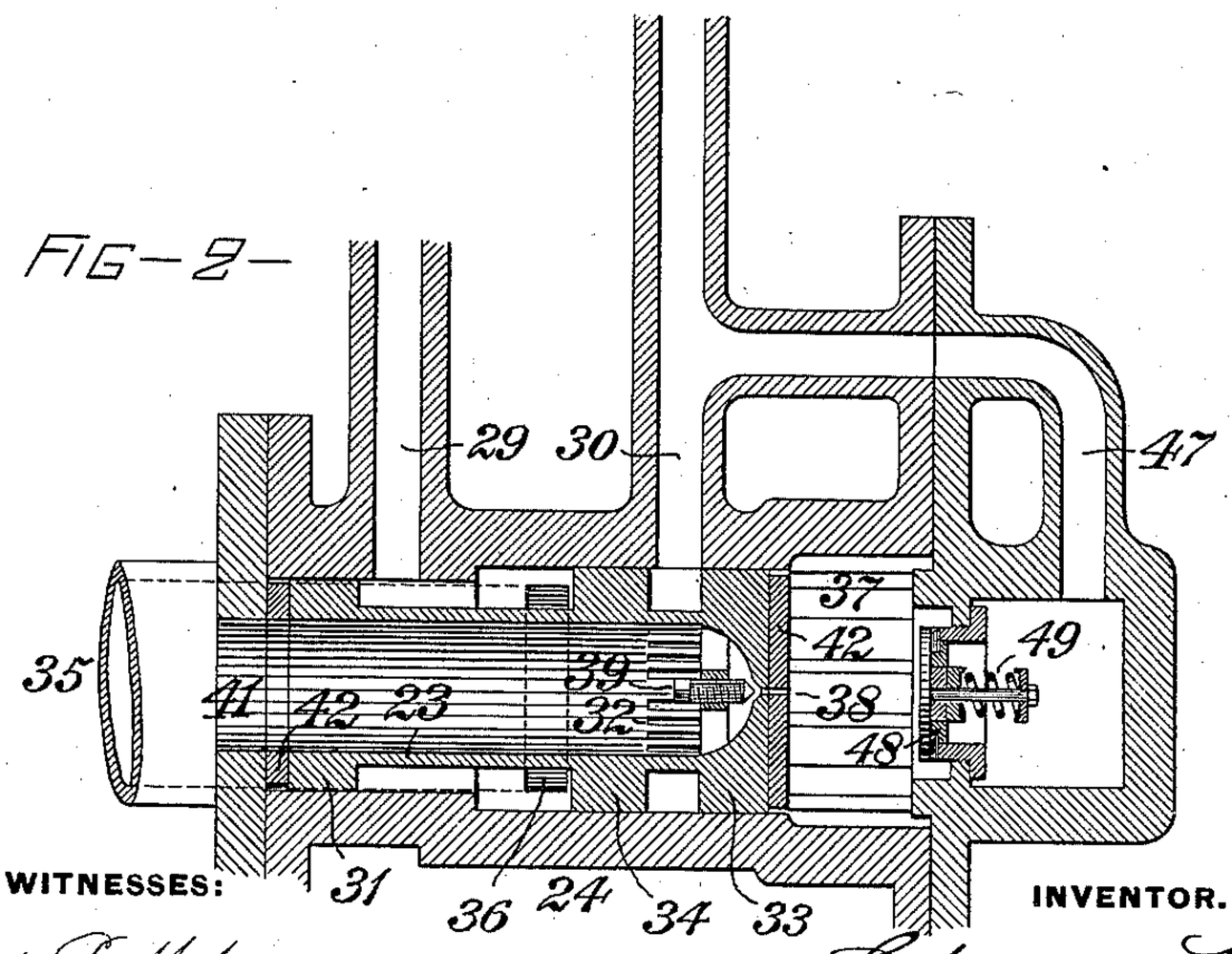
(No Model.)

3 Sheets—Sheet 1.

FIG—1—



FIG—2—



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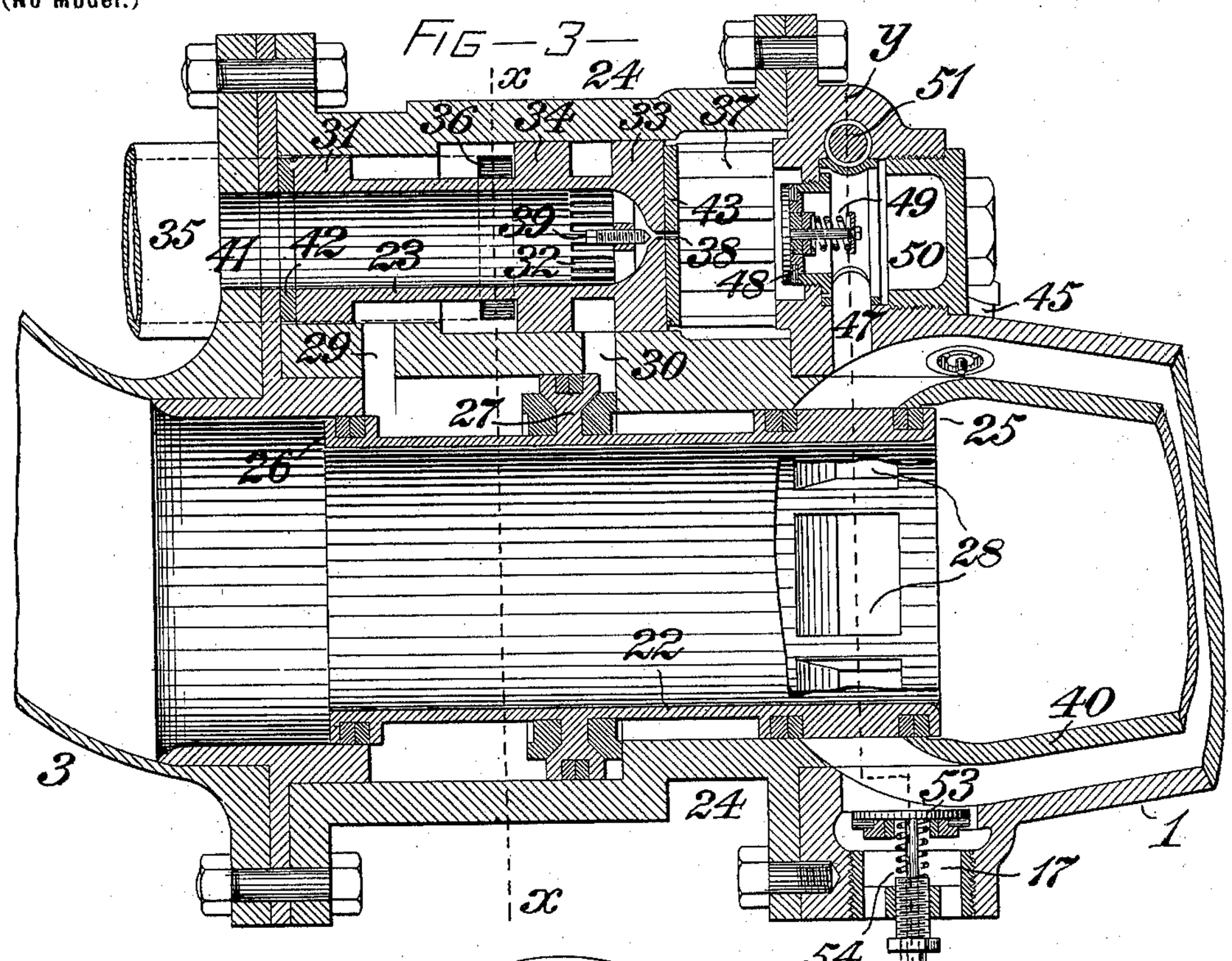
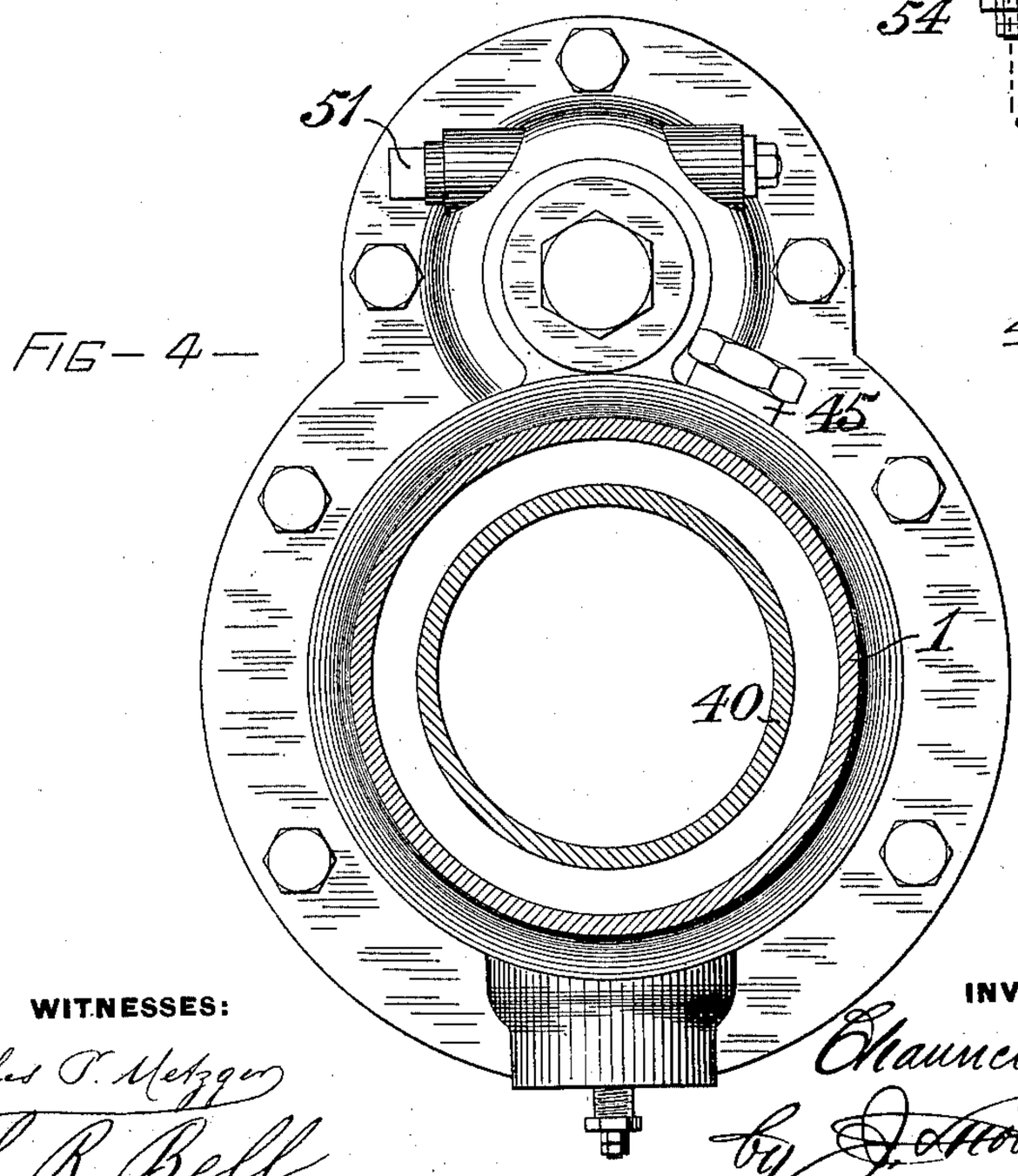
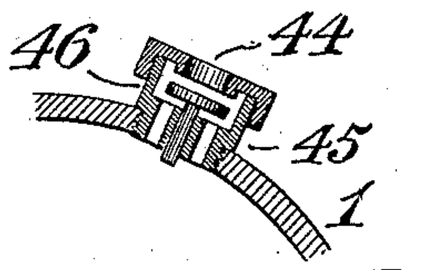
(No Model.) 3 Sheets—Sheet 2.

FIG—3—



FIG—4—





FIG—5a

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C. N. DUTTON.

FLUID ACTUATED VALVE.

(Application filed Nov. 13, 1897.)

(No Model.)

3 Sheets—Sheet 3.

FIG-6-

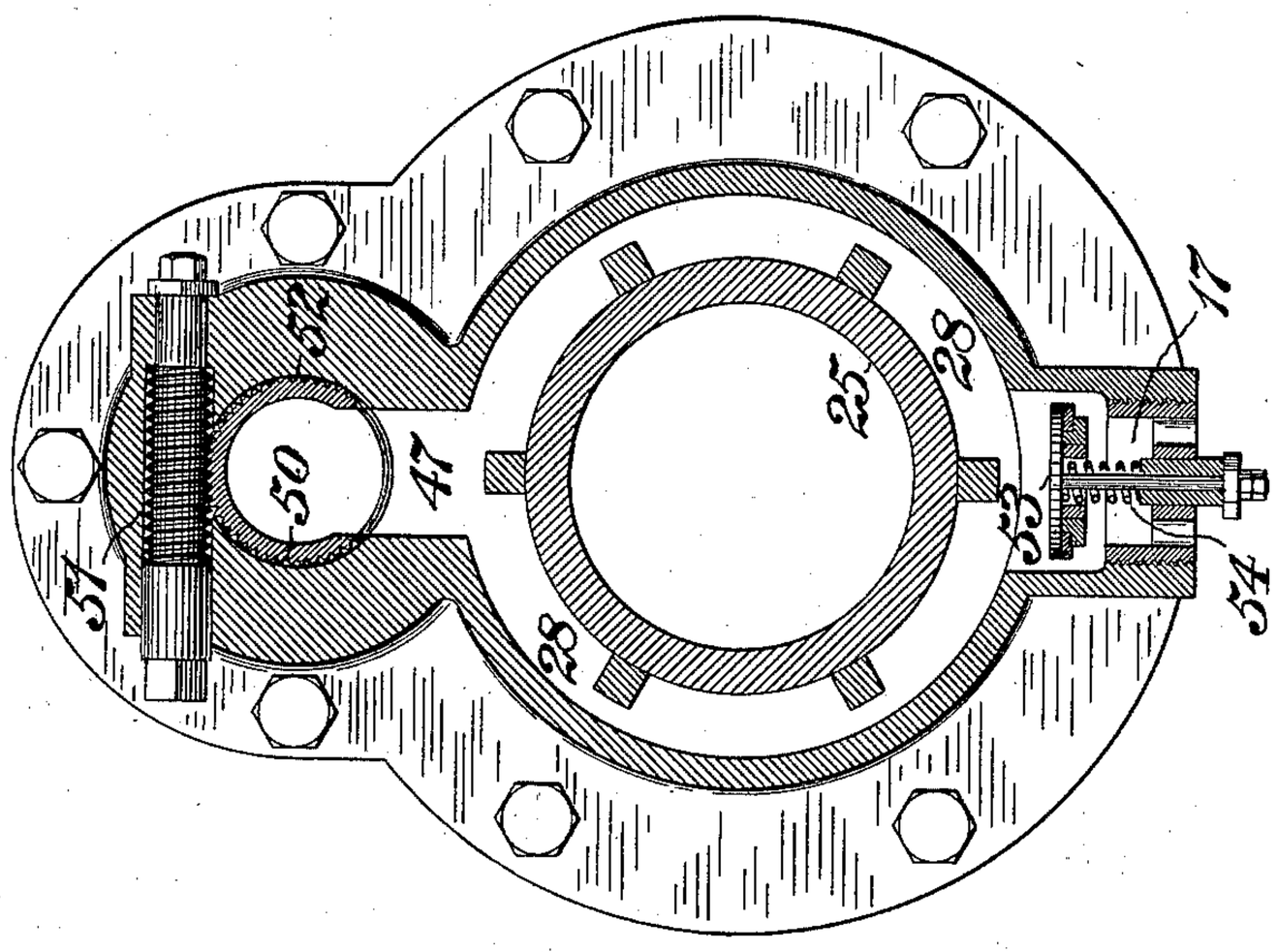
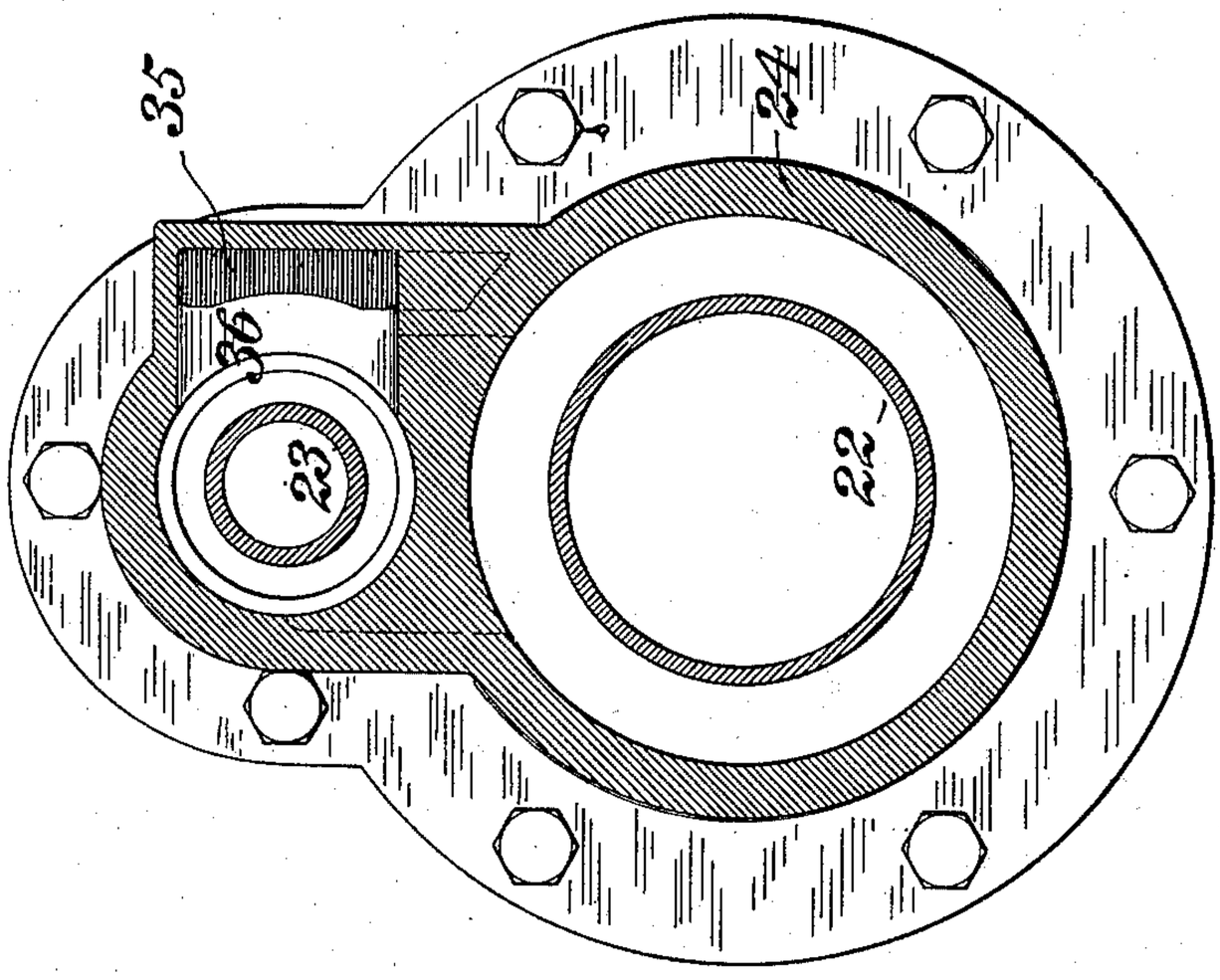


FIG-5-



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UNITED STATES PATENT OFFICE.

CHAUNCEY N. DUTTON, OF NEW YORK, N. Y.

FLUID-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 609,089, dated August 16, 1898.

Application filed November 13, 1897. Serial No. 658,439. (No model.)

To all whom it may concern:

Be it known that I, CHAUNCEY N. DUTTON, of the city, county, and State of New York, have invented a certain new and useful Improvement in Fluid-Actuated Valves, of which improvement the following is a specification.

The object of my invention is to provide a simple, effective, and inexpensive automatic valvular mechanism by the employment of which an alternating or intermittent supply of fluid to a point of utilization or discharge may be desirably effected.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a longitudinal central section through a valvular mechanism, illustrating an application of my invention; Fig. 2, a similar view of the same, showing a modification in detail of its connections; Fig. 3, a similar section illustrating the application of the mechanism in connection with an air-compressor; Fig. 4, a transverse section through the compressing-chamber of Fig. 3, showing the valve-casing in end elevation; Fig. 5, a transverse section through the valve-casing at the line *x x* of Fig. 3; Fig. 5ª, a central section through the air-supply chamber, and Fig. 6 a transverse section through the valve-casing at the line *y y* of Fig. 3.

In the practice of my invention I provide a casing or chamber 24, having an open exhaust-port 41 at one end, a bore adjacent thereto and connecting with a larger bore, and a chamber 37 at its opposite end, which is enlarged or provided with longitudinal grooves and is closed by a suitable cap connected with a passage 47, said passage being controlled by a check-valve 48, held to its seat by a spring 49.

Fluid is supplied by a passage or tube 35 to a central supply-port 36 and delivered to and exhausted from delivery-ports 29 and 30, located at opposite sides of the supply-port 36. The passage 47 communicates also with one or the other of the delivery-ports—as, for example, with the adjacent one 30.

A differential piston-valve 23 is fitted in the valve-casing and is operated therein automatically by the fluid. This valve 23 has a small end piston 31, fitting and working in the smaller bore of the valve-casing, a larger piston 33 on the opposite end, and an intermediate piston 34, which is shown in the drawings as adjacent to the piston 33 and separated therefrom by a space about equal to the width of the port 30. The body of the valve 23 is hollow and is open at one end, so as to communicate freely with the exhaust-port 41. Ports 32 are formed in the body of the valve between the intermediate piston 34 and one of the end pistons—for example, the piston 33—and one end of the valve is closed, except as to a small port 38, the area of which can be regulated by an adjacent conical-ended screw 39, so as to control and regulate the speed at which fluid can be exhausted through the port 38 out of the enlarged chamber or bore 37 of the valve-casing between the differential valve and the check-valve 48 after the same is seated. The faces of the pistons 31, 33, and 34 are slightly wider than the delivery-ports 29 and 30, and elastic cushions 42 and 43 are fixed on the ends of the valve to reduce shock.

While the preferred construction is that shown in the drawings, it will be obvious to those skilled in the art that the restricted passage 38 could, if desired, be formed in a wall of the enlarged chamber 37 of the valve-casing and also that the intermediate piston 34 could be located in the smaller bore of the valve-casing with the ports 32 between it and the outer small piston. Further, the outer end of the valve 23 might have a covering provided with the restricted port 38 and adjusting-screw 39, either or all of these changes being practicable without variation of the operative principle of the device as an automatic fluid-actuated valve. They might, however, effect a change in the period of its stroke, making it quicker or slower in action, as desired.

The valve 23 is moved in one direction—that is to say, to the right—by fluid admitted to the casing 24 between the pistons 31 and 34 through the supply-port 36. The pressure of the fluid upon the unbalanced area of the piston 34 moves the valve to the right, the motion being at first comparatively slow because of the small difference in areas of the

pistons 31 and 34 and also because of a restricted discharge of fluid from behind the piston 33.

The movement of the valve in the opposite direction—that is, to the left—is effected by a portion of the fluid from one of the delivery ports or passages, (as shown, the port 30,) which enters the valve-casing 24 through the port or passage 47, which, as before stated, is controlled by a check-valve 48, normally closed by a spring 49.

In order to regulate the speed at which fluid is admitted to the right-hand side of the valve, as is desirable in one of its applications hereinafter described, the area of opening of the port 47 to the valve-chamber may, if desired, be made variable by means of a regulating device, which in this instance, as shown in Figs. 3 and 6, consists of a ring 50, having an opening on its side adjacent to the port 47 and which is angularly adjustable to increase or decrease the delivery area of the port 47 by a worm 51, rotatable in a bearing in the valve-chamber 24 above the ring 50 and engaging a worm-gear 52, cut on the periphery of said ring to rotate it, and thereby regulate the opening of the port 47.

Fig. 1 shows a construction in which the delivery may be either downward or sidewise, and therefore the delivery from the port or passage 30 when an inelastic fluid is employed cannot exert back pressure on the valve to completely reverse it after the valve has closed said port unless there be an upward continuation of the connecting port or passage 47. This port is therefore provided with an upward extension 47ª and, if desired, with an air-chamber 21, so that when the valve is at the right-hand side of the valve-chamber and delivering through the port or passage 30 fluid will pass therefrom through the passages 47 and 47ª into the air-chamber at the same time that it is passing into the right-hand end of the valve-chamber through the opening controlled by the check-valve 48. The pressure of the fluid in the passages 47 47ª will at this time create a head or compress air in the air-chamber, so that after the valve has moved far enough to cover the port or passage 30 the head or air-pressure in the upward extension-pipe 47ª or in the air-chamber 21 will cause fluid to pass into the adjacent end of the valve-chamber through the opening controlled by the check-valve 48 and exert sufficient power to move the valve 23 to the left-hand limit of its traverse, so as to exhaust the fluid which has actuated it through the right-hand port 30 and delivering fluid through the left-hand port 29. Backflow of fluid from the upward extension 47ª to the port 30 is prevented by a check-valve 47ᵇ.

The valve shown in Fig. 2 is adapted for operation below the level at which liquid is delivered by the upwardly-extending ports 29 and 30, and therefore liquid from the right-hand port 30 can pass downwardly through the direct passage 47 after the port 30 has been closed by the valve and exert its pressure upon the larger right-hand end of the valve.

The preliminary movement of the valve 23 to the right is, as before stated, made comparatively slow, as the waste or back fluid which has effected its previous stroke to the left can only escape through a restricted port 38 in the right-hand piston 33 of the valve, the transverse area of which port may be varied by an adjusting-screw 39, having a conical end. The speed at which the valve travels to the right may thus be properly regulated in accordance with the requirements of special service in which it may be employed.

When the valve has been moved sufficiently far to the right to close both the ports 29 and 30, its right-hand piston 33 passes into an enlarged bore 37 in the valve-chamber, and the waste or back fluid on its right-hand side escapes freely around the piston 33 and through a series of ports 32 in the tubular body of the valve to the discharge-port 41. The valve then rapidly completes its right-hand stroke.

It will be seen that the small port 38 and regulating-screw 39 are not necessarily located in the valve, as their function would be similarly performed if the port is made to lead through the wall of the enlarged bore 37 of the valve-chamber from which it discharges fluid.

Figs. 3 to 6, inclusive, illustrate the valve mechanism above described, applied in an air-compressor actuated by the impact of falling water, for the purpose of effecting an intermittent supply of water thereto.

Inasmuch as the specific novel features of such application do not form part of my present invention and are, moreover, fully set forth in a separate application filed by me July 27, 1896, Serial No. 600,651, the same need not be herein described further than will suffice to exemplify an instance of the utilization of my invention in an apparatus adapted for the performance of a specified duty or work. To this end Figs. 3 to 6, inclusive, show the delivery ports or passages 29 and 30 as leading to opposite sides of the central head 27 of a hollow or tubular piston 22, which as it performs the functions of opening and closing supply-ports 28 has been termed in my application, Serial No. 600,651, aforesaid a "main valve." The piston 22 is provided with end heads 25 and 26 of smaller diameter than its central head 27 and is fitted to reciprocate in a chamber which is shown as cast integral with the valve-chamber 24 and which communicates at one end with a water-supply pipe 3 and at the other end through ports 28, controlled by the piston-head 25, with a compressing-chamber 1. The ports 28 are formed in the larger end of a conical deflector 40, formed on the end of the casing next the compressing-chamber 1 and projecting axially into the latter, so that water shall be delivered thereto in an annular body.

Air is admitted to the compressing-chamber through an air-supply port or passage 44, formed in the cap of an air-supply chamber 45, fixed on the upper side of the compressing-chamber and communicating by open ports therewith. The air-supply port is controlled by a check-valve 46, working in the chamber 45. The bodies of water by which air is compressed in the compressing-chamber 1 are successively discharged therefrom through a water-discharge passage 17, controlled by an inwardly-opening discharge-valve 53, which is normally held off its seat by a spring 54 and is closed by the pressure within the compressing-chamber during each compressing operation and opened for the discharge of water thereafter by the spring 54.

In the operation of the apparatus the valve 23 is reciprocated in the manner hereinbefore described, and the water which it delivers through the ports or passages 29 and 30 is alternately supplied to opposite sides of the central head 27 of the tubular piston or main valve 22. By the reciprocation of said main valve the ports 28, leading to the compressing-chamber 1, are alternately opened and closed, and an intermittent supply of water from the pipe 3 through the tubular body of the main valve is effected to the compressing-chamber.

It will be obvious that the piston-head 27 may be employed to perform the ordinary and well-known function of the piston of a water-pressure engine in lieu of the specific supply-valve function which it performs in the air-compressing apparatus shown without departure from the spirit or essential features of my invention and without involving more than the ordinary skill of a mechanic familiar with the art.

I claim as my invention and desire to secure by Letters Patent—

1. The combination of a valve chamber or casing, a fluid-supply port leading thereinto, fluid-delivery ports leading therefrom on opposite sides of the supply-port, an end discharge-port leading therefrom, and a differential piston-valve fitted to be moved in opposite directions in the valve-chamber by the pressure of fluid from the supply-port and one of the delivery-ports respectively, said valve having pistons controlling the delivery-ports and a passage through its body communicating with the discharge-port.

2. The combination of a valve chamber or casing, a fluid-supply port leading thereinto, fluid-delivery ports leading therefrom on opposite sides of the supply-port, an end discharge-port leading therefrom, a differential piston-valve fitted to be moved in opposite directions in the valve-chamber by the pressure of fluid from the supply-port and one of the delivery-ports respectively, said valve having pistons controlling the delivery-ports and a passage through its body communicating with the discharge-port, a chamber or casing communicating at opposite ends with the delivery-ports, and a piston adapted to be reciprocated in said chamber by fluid from the delivery-ports.

3. The combination of a valve chamber or casing, a fluid-supply port leading thereinto, fluid-delivery ports leading therefrom on opposite sides of the supply-port, an end discharge-port leading therefrom, a differential piston-valve fitted to be moved in opposite directions in the valve-chamber by the pressure of fluid from the supply-port and one of the delivery-ports respectively, said valve having pistons controlling the delivery-ports and a passage through its body communicating with the discharge-port, and means for effecting a limited exhaust of fluid from behind an end piston of said valve in the preliminary portion of its traverse in one direction, and a free exhaust around said piston in the succeeding portion of the same.

4. The combination of a valve chamber, or casing, a fluid-supply port leading thereinto, fluid-delivery ports leading therefrom, a differential piston-valve fitted to be moved in opposite directions in the valve-chamber by the pressure of fluid from the supply-port and one of the delivery-ports respectively, said valve having pistons controlling the delivery-ports, a tubular body continuously open to the discharge-port, and ports in said tubular body, and a passage leading from one of the delivery-ports, of limited area relatively to the ports in the valve-body, through which exhaust of fluid may be effected from one end of the valve independently of said ports.

5. The combination of a valve chamber or casing, bored for the reception of larger and smaller pistons, and having an enlargement for the free passage of fluid around a piston, a piston-valve having a tubular body, and heads fitting the larger and smaller bores of the valve-chamber, an intermediate head, and ports in its tubular body between its intermediate and one of its end heads, a supply-port which is always open to the valve-chamber between the intermediate and an end head of the valve, delivery-ports leading out of the valve-chamber, in position to be opened and closed by an end head and the intermediate head, respectively, of the valve, a passage from one of the delivery-ports to the enlargement of the valve-chamber, and a discharge-port which is always open to the tubular body of the valve.

6. The combination of a valve chamber or casing, a fluid-supply port leading thereinto, fluid-delivery ports leading therefrom on opposite sides of the supply-port, an end discharge-port leading therefrom, a valve fitted to reciprocate in the valve-chamber and having a tubular body in open communication with the discharge-port, an end head on the valve which cuts off communication between the supply and discharge ports, and alternately opens and closes communication between the supply-port and one of the delivery-

ports, an opposite end head of larger diameter which makes a portion of its traverse in an enlarged bore in the valve-chamber, an intermediate head, which alternately opens and closes communication between the supply-port and a delivery-port, and ports in the tubular body between the intermediate and an end head, a passage from one of the delivery-ports to the enlarged bore of the valve-chamber, and a vertical extension communicating with said passage, to admit of the formation of a head of fluid to act upon the larger end head of the valve during closure of the adjacent delivery-port.

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