No. 840,876. PATENTED JAN. 8, 1907.

G. F. STEEDMAN.

REGULATED HOIST.

APPLICATION FILED DEC. 4, 1905.

3 SHEETS—SHEET 1.

Fig. 3.

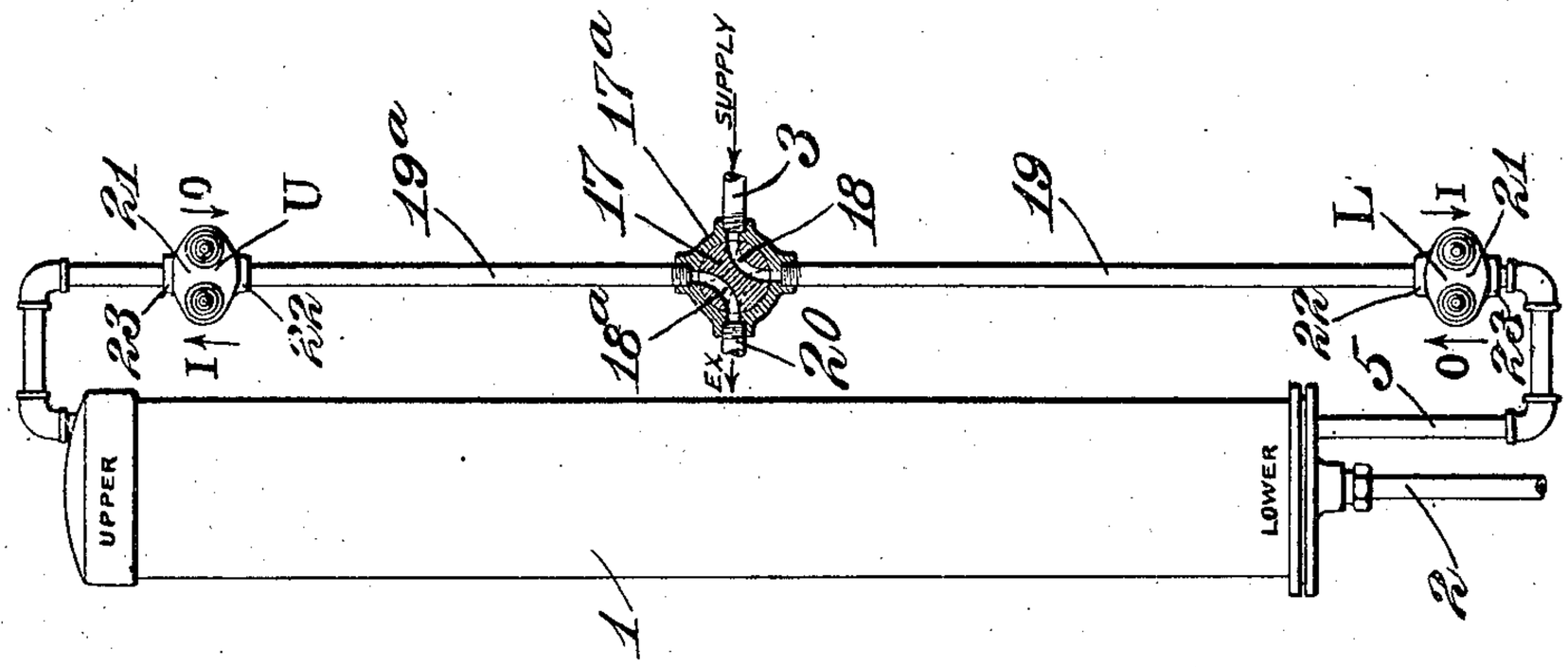


Fig. 2.

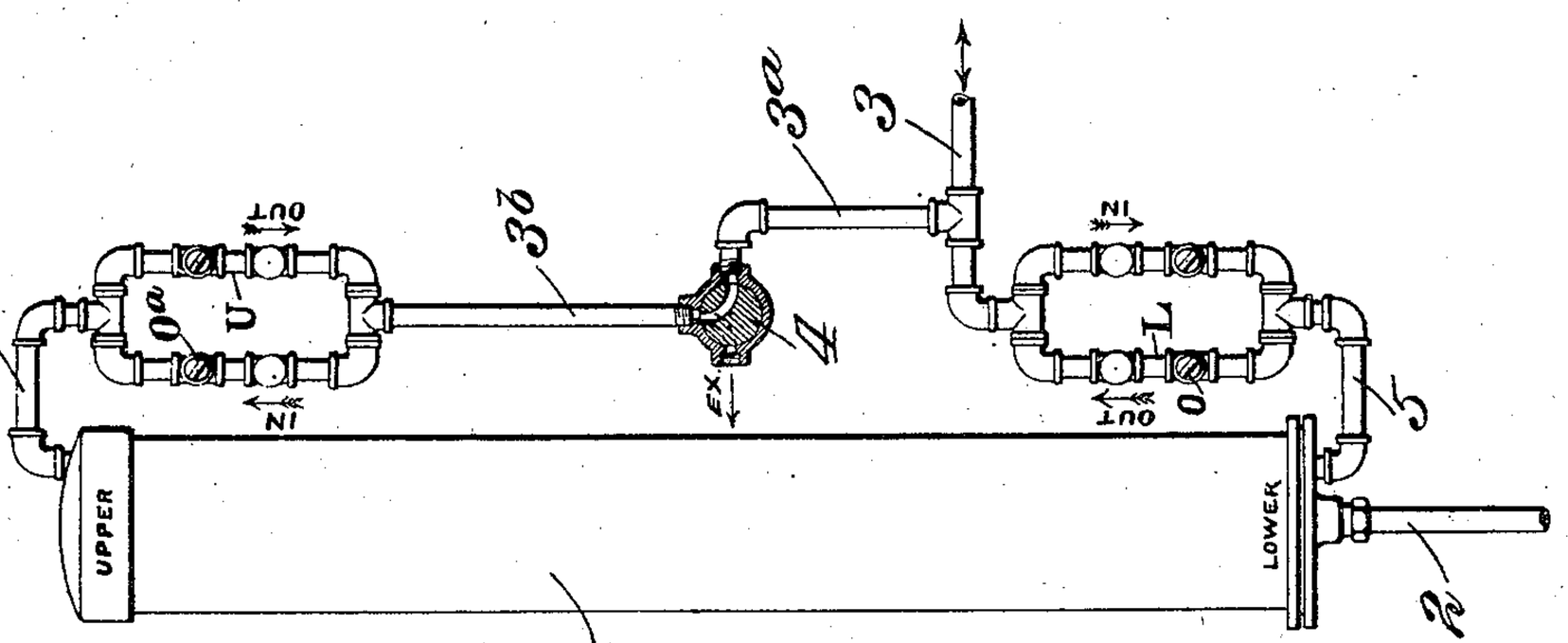
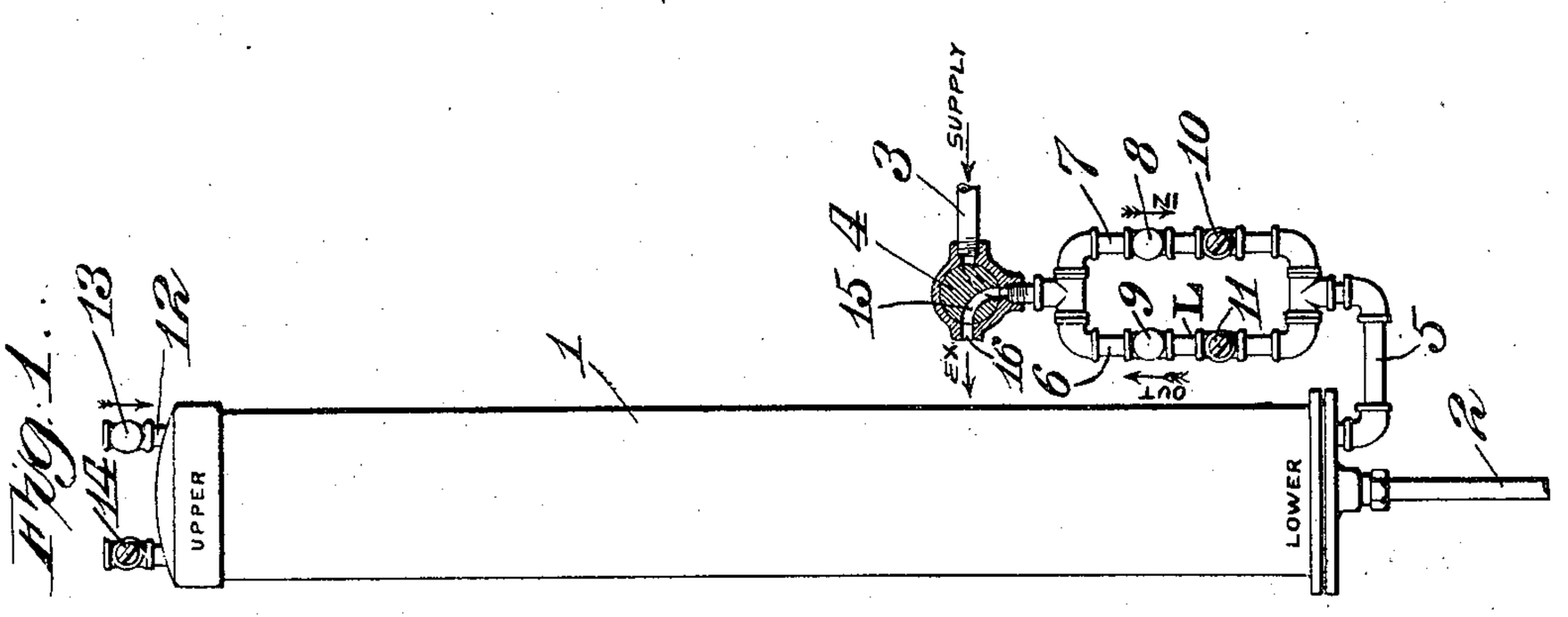


Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 4.

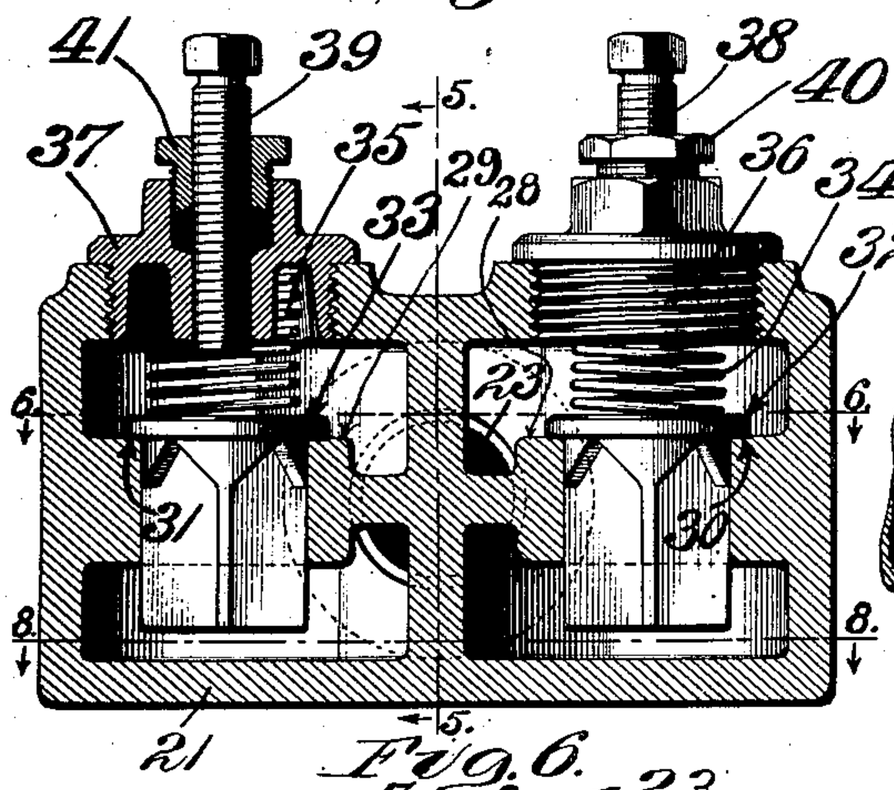


Fig. 5.

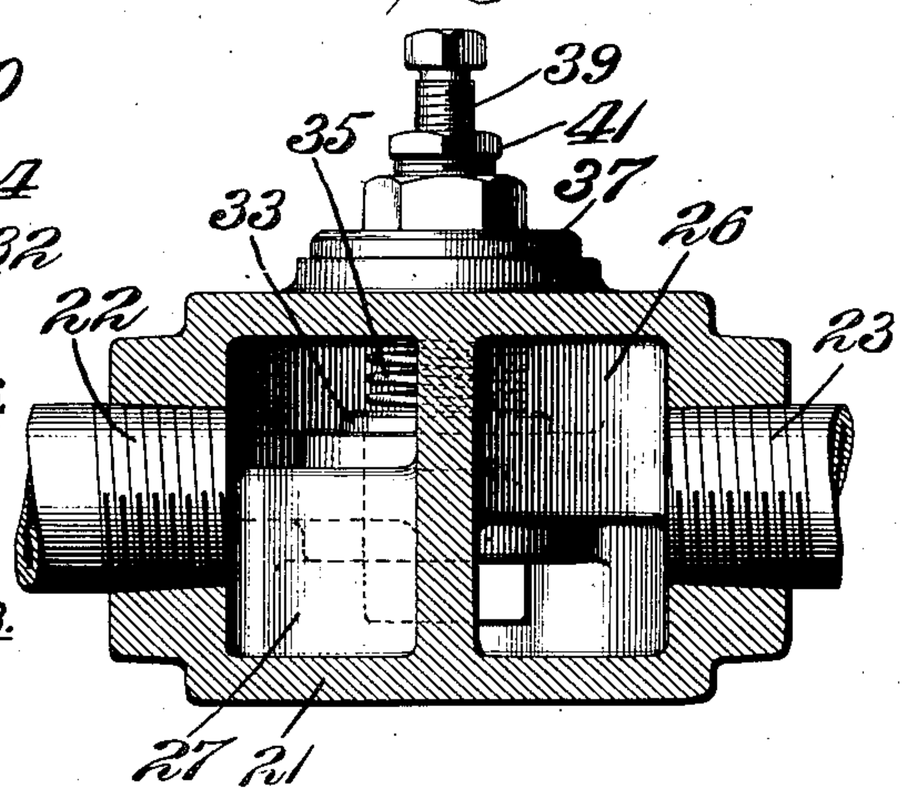


Fig. 6.

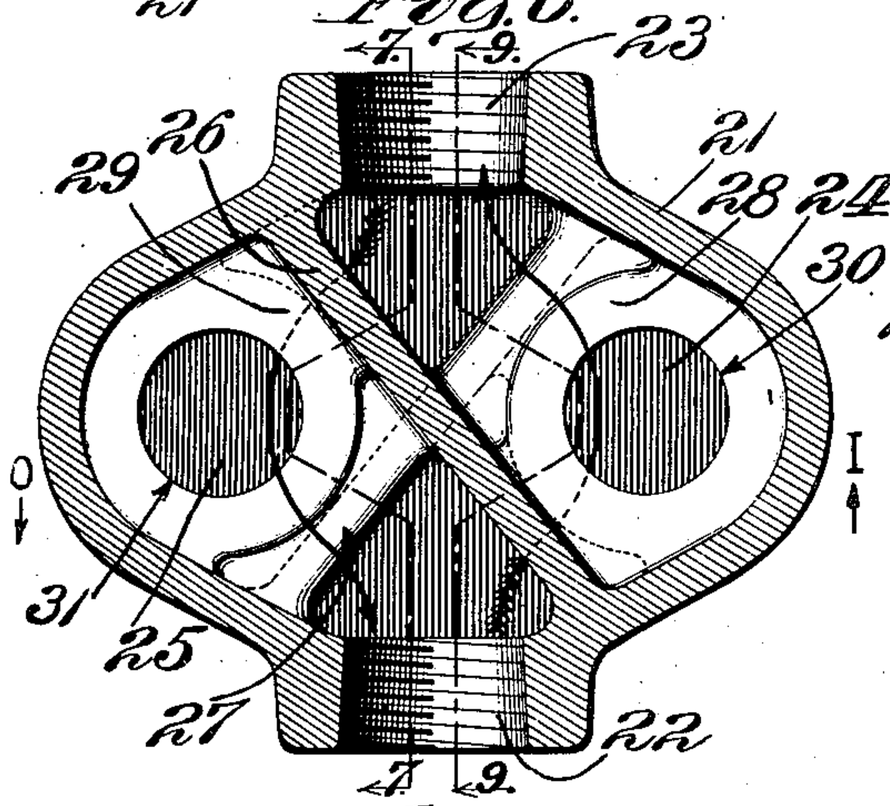


Fig. 7.

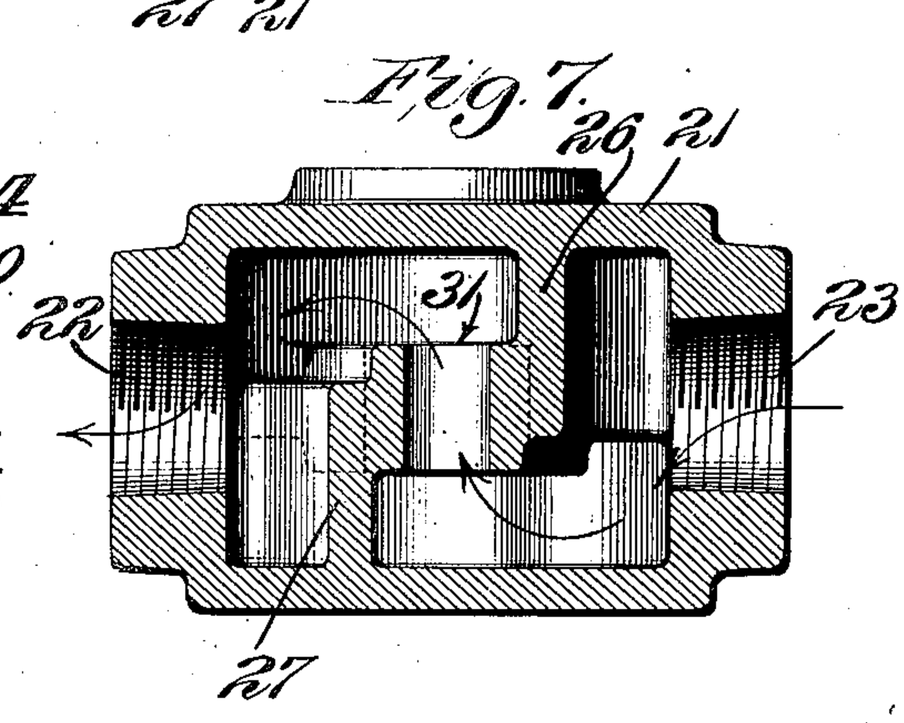


Fig. 8.

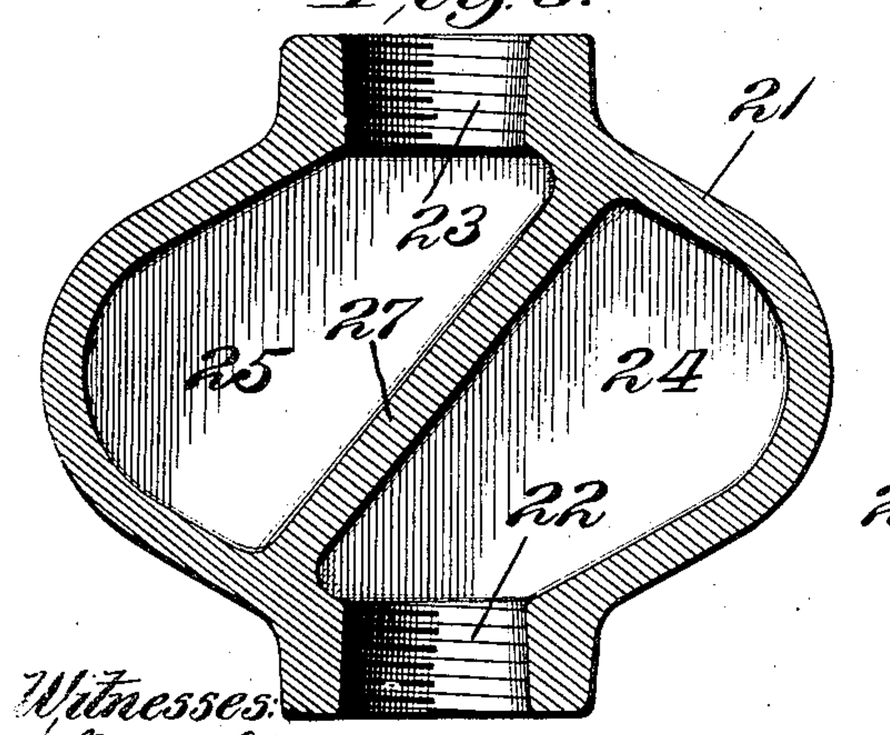
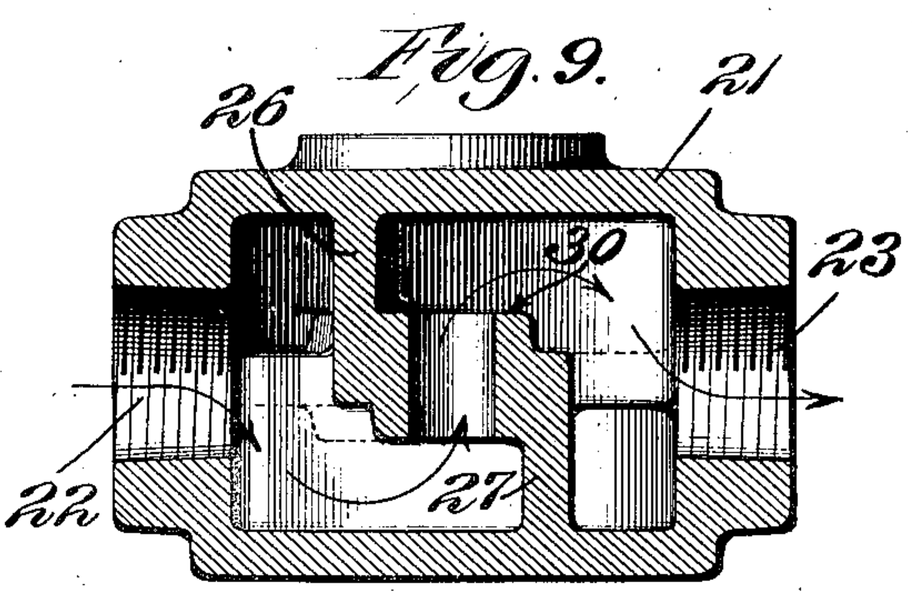


Fig. 9.



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No. 840,876. PATENTED JAN. 8, 1907.

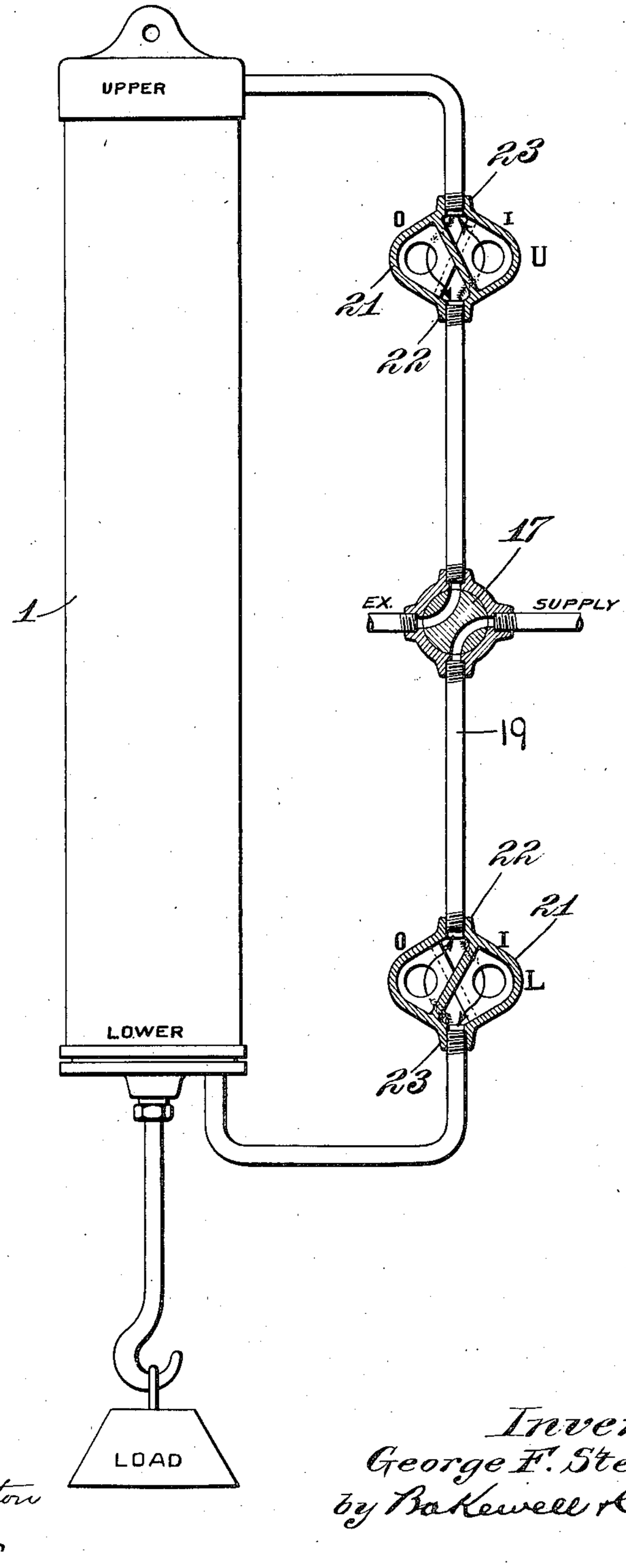
G. F. STEEDMAN.

REGULATED HOIST.

APPLICATION FILED DEC. 4, 1905.

3 SHEETS—SHEET 3.

Fig. 10.



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UNITED STATES PATENT OFFICE.

GEORGE F. STEEDMAN, OF ST. LOUIS, MISSOURI.

REGULATED HOIST.

No. 840,876. Specification of Letters Patent. Patented Jan. 8, 1907.

Application filed December 4, 1905. Serial No. 290,179.

To all whom it may concern:

Be it known that I, GEORGE F. STEEDMAN, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Regulated Hoists, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevational view of a single-acting hoist embodying my invention. Fig. 2 is a side elevational view of a balanced hoist embodying my invention. Fig. 3 is an elevational view of a double-acting hoist. Fig. 4 is a cross-sectional view through the regulating-casing. Fig. 5 is a cross-sectional view on the line 5 5 of Fig. 4. Fig. 6 is a sectional view on the line 6 6 of Fig. 4. Fig. 7 is a sectional view on the line 7 7 of Fig. 6. Fig. 8 is a sectional view on the line 8 8 of Fig. 4. Fig. 9 is a sectional view on the line 9 9 of Fig. 6, and Fig. 10 is a diagrammatic view of the cylinder and the appurtenances coöperating therewith.

This invention relates to fluid-actuated hoists in which a cylinder is employed for containing a piston to be actuated by a suitable fluid, preferably air.

The object of the invention is to provide a means whereby the speeds of hoisting and lowering in fluid-actuated piston-hoists can be adjusted and controlled independently of the usual operating-valve.

Broadly stated, the invention consists in providing a cylinder, a piston therein, a pipe or tubular connection between the cylinder and source of fluid-supply, the tubular connection being divided into branches having check-valves opening in opposite directions independent upon whether the conductor is an exhaust or supply, and means for regulating the sizes of the openings in the branches to govern the supply and exhaust openings from the cylinder.

As illustrating the principle of my invention I have shown in Fig. 1 a cylinder 1, having contained therein a piston with an outwardly-projecting stem 2. A supply-tube 3 has in its path a three-way valve 4, which may be turned, as shown in dotted lines in Fig. 1, to direct a flow of fluid, such as air, into one end of the cylinder through the inlet-tube 5 or may be turned, as indicated in full lines in Fig. 1, to exhaust from the end of the cylinder. Communication may be had between the tubes or pipes 3 and 5 through conductor branches 6 and 7 in a loop interposed between the tubes 3 and 5. The branch 7 is provided with a check-valve 8 of ordinary construction and so arranged that it is capable of opening only to admit the air into the tube 5 by flowing in the direction indicated by the arrow. A similar but oppositely-opening check-valve 9 is arranged in the branch 6, and this check-valve is adapted to open only when the fluid flows in the direction indicated by the arrow adjacent to the valve 9 and out through the exhaust, as will be presently explained. 10 and 11 indicate cocks in the respective branches 7 and 6, which may be manipulated so as to regulate the size of either of the openings in both of the branches 6 and 7, so as to control the amount of air flowing therethrough. In the end of the cylinder opposite the tube 5 is a ported tube 12, having an inwardly-opening check-valve 13 therein, and in the same end of the cylinder is illustrated a valved tube 14.

The operation of the device in the form illustrated in Fig. 1 is as follows: Suppose the valve 4 is turned to admit air through the branch 7, through the tube 5, and then into the cylinder. The air cannot pass through the branch 6, for the reason that the check-valve 9 would prevent it; but it must pass through the branch 7 into the tube 5 and into the cylinder, so as to actuate the piston within the cylinder to move it from the end adjacent the tube 5 toward the opposite end. The speed of hoisting or inward motion of the piston will depend upon the load to be lifted and the size of opening of valves 10 and 14. For the maximum load on piston-rod 2 the valve 10 will be adjusted so as to give proper speed, the valve 14 meantime being full open. For the minimum load on rod 2, the adjustment of valve 10 being unchanged, the speed of hoist is regulated by the valve 14. By a harmonious adjustment of valves 10 and 14 the speed of hoisting is made approximately uniform irrespective of load. It is understood that in the operation the check-valves 9 and 13 cause the tubes 6 and 12 to be temporarily inoperative, also that valve 4 is in wide-open admitting position. It will be assumed that the cylinder is arranged in a vertical plane and that the operation just described has resulted in raising the piston.

Now suppose it is desired to lower the piston or to permit it to descend. The valve 4 will be operated so that its port 15 will register with the exhaust-port 16 in its casing and with the loop formed by the branches 6 and 7. In order to cause the port 15 to register with the exhaust-port 16 in the valve-casing, it will be necessary to cut off communication between the loop and the supply-pipe 3. In this position of the valve the air can pass from the bottom of the cylinder only through the tube 5, through the branch 6, through the valve-plug, and then exhaust to atmosphere. The descending speed of the piston will be under the control of the operator, not by the valve 4, but through the medium of the regulating-cock 11, which may be so adjusted as to permit the requisite amount of air to escape therethrough. That the piston will have a tendency to descend by gravity will be obvious, as the check-valve 13 in the tube 12 will open inwardly and prevent a vacuum being formed between one face of the piston and the opposite end of the cylinder.

In the form of hoist just described, which I designate as "single-acting," the actuating fluid enters the lower or piston-rod end of the cylinder only.

From the foregoing description it will be seen that in general I regulate the speed of hoisting and lowering the variable load by providing an adjustable force resisted by an adjustable resistance thereto, which in practice I have found to produce regulation which is more effective than the regulation of either the force or the resistance separately.

In Fig. 2 I have illustrated what I designate as a "balanced" hoist. In this form two supply-tubes (designated by the numerals 5 and 5[a]) are employed, one for each end, and these supply pipes or tubes 5 and 5[a] are provided with the same appurtenances as the tube 5. (Illustrated in Fig. 1.) It is contemplated to have the tube 3 in communication with a reservoir or tank under a pressure. In the form illustrated in Fig. 2 the piston may be raised by admitting air into the cylinder through the lower tube 5, connected to the lower loop, which is designated as L. The speed of travel of the piston will be governed by the adjustment of the regulating exhaust-cock in the upper loop, (designated by the letter U,) the exhaust branch in the upper loop performing the same function as the tubes 12 and 14 in Fig. 1. When the piston has reached the limit of its stroke and it is desired to permit the piston to descend, the valve 4 will be moved into the position shown in Fig. 2, so as to permit the air to enter from the tube 3 through the tube 3[a] into the valve-casing, through the tube 3[b], through the branch of the loop U, and into the cylinder through the tube 5[a]. In this position of the valve a uniform pressure will be reached in the cylinder on both sides of the valve. However, the area of the upper face of the piston against which the pressure will be exerted will be slightly in excess of the resisting area of the lower face of the piston, due to the fact that the piston-rod is connected to the lower face of the piston. In other words, the resisting area of the upper face of the piston will be equal to the resisting area of the lower face of the piston plus the cross-sectional area of the piston-rod. It therefore follows that if the same pressure exists in the cylinder on both sides of the piston and a greater area of resistance exists on the upper face of the piston the tendency of the piston will be to descend, even when no load is carried by the rod, and this tendency to descend will be augmented by the weight of the rod, and additionally so by any weight carried by the rod. The descending speed of the piston may be governed by adjusting the regulating-cock, (designated by the letter O in the loop L and O[a] in the loop U.) Therefore it will be obvious that the speed of the piston in either direction will be controlled by adjusting the regulating-cocks to govern the inlet and exhaust irrespective of the opening of the valve 4.

In Fig. 3 I have illustrated the invention as being adapted to be applied to a double-acting hoist, the same generic principles being followed in this form as are utilized in the forms illustrated in Figs. 1 and 2. In this form I have illustrated the supply and exhaust tubes as being intersected intermediate their ends by a regulating device comprising a box or casing containing inwardly and outwardly opening check-valves, the details of construction of this box being illustrated in Figs. 4 to 9, inclusive. In this form the supply-tube 3 is in communication with a reservoir or other source of supply and also in communication with a valve-casing 17[a] of a four-way valve 17, as illustrated. It will be assumed that the air is entering through the tube 3 into the valve-casing, through the port 18 into the pipe 19, and through the side I of the regulating device L, thence through the tube 5 into the lower end of the cylinder 1, so as to raise the piston. The ascending speed of the piston will be governed by the degree or size of the opening permitted by the valve on the side O of the regulating device U at the upper end of the cylinder and the admission-valve I of the regulating device L at the lower end. When the piston has reached the limit of its upper or inner stroke and it is desired to lower it, the valve 17 will be turned so as to bring the port 18[a] into communication with the tubes 3 and 19[a] and the port 18 of the valve into communication with the tube 19 and the exhaust-port 20, as shown in dotted lines. The pressure will then be relieved from the lower face of the piston and applied to the upper face

thereof, the descending speed being governed by controlling the valve in the side O of the regulating device L and the valve I of the regulating device U, so as to govern the exhaust through the tube 19 and through the exhaust-port 20 in the valve-casing 17ª.

A convenient form of regulating device is illustrated in Figs. 4 to 9, inclusive, and said regulating device may be conveniently substituted for the loops illustrated in both Figs. 1 and 2, the same generic principle being followed out in each case. The regulating device illustrated in Figs. 4 to 9 is shown as comprising a casing 21, having diametrically oppositely located openings 22 and 23, which are adapted to alternately become inlet and outlet openings. In one case the opening 22 will be the inlet-opening to the casing—for example, when the fluid is entering the casing to actuate the piston—and in the other case, as when the fluid is entering the opening 23 as an exhaust, the opening 22 will become the outlet-opening. The casing is divided into two chambers 24 and 25, which are supply and exhaust chambers at all times, these chambers being divided by the intersecting diagonal partitions 26 and 27 and the horizontal partitions 28 and 29 in the chambers 24 and 25, respectively. The horizontal partitions are provided with valve-seats 30 and 31 for the reception of the upwardly-movable check-valves 32 and 33, normally held on their seats by coil-springs 34 and 35 and limited in the opening motion by the adjusting-screws 38 and 39, each of which may be adjusted independently of the other to control the extent of opening movement of its respective check-valve, so as to regulate the size of opening through the valve-seat, and thereby govern the exhaust or supply, as the case may be. These regulating devices may be secured in their adjusted positions by the lock-nuts 40 and 41, threaded on said screws and constituting parts of the stuffing-boxes surrounding them.

In order that the specific operations of the parts within the regulating devices may be understood, it will be assumed that the casing 21 is properly connected to the tube 19 and it is desired to turn on the supply through said casing. The air would enter through the opening 22, and owing to the depending portion of the horizontal partition 27 on the O side of the casing the air would have to pass to the I side, so as to raise the valve 32 and pass out from the top of the horizontal partition through the opening 23 and into the cylinder. When the time came to exhaust, the operation would be reversed—that is to say, the air would enter through the opening 23 and being retarded against actuating the valve 32 on account of the depending portion of the horizontal partition adjacent to the opening 22 and the vertical partition 26 it would have to enter beneath the valve 33 and up through the opening through the seat 31. After passing up through the opening the air will be permitted to pass out through the opening 22. Thus it will be apparent that these valves must operate independently of each other and that when one is being raised from its seat the other is closed. The springs utilized in this casing are merely for returning the valves to their seats, so as to insure their being seated each time after being raised. The ease with which the screws may be manipulated and their nicety of adjustment will permit the exhaust and supply openings to be so controlled that the speed of the piston may be regulated to any desired degree.

To further illustrate the method of controlling the speeds, I show, Fig. 10, a double-acting hoist suspended in a vertical position. To make the speed adjustments, I would proceed as follows: All the adjusting-screws over the check-valves are run out to give full travel to check-valves. The full load is attached to the piston-rod, the air is exhausted from the upper head by valve 17, and speed of hoist limited by adjusting-valve I in regulator L. Next the load is removed and speed of hoisting of empty hook regulated by adjusting-valve O in regulator U. I next regulate the speed of lowering the empty hook by adjusting the valve I in regulator U, and lastly I regulate the speed of lowering the full load by adjusting the valve O in regulator L. When these adjustments are once made, all loads from maximum to minimum can be raised or lowered at approximately uniform speed irrespective of any regulation by means of valve 17.

In describing the above invention I have referred to the cylinders as being of the vertical type in which the piston has an ascending and descending movement. However, I reserve the right to arrange the cylinders horizontally or at any other angle, if desired, and wherever the terms "vertical," "ascending," or "descending" are employed I would have it understood that they are not to be construed literally, but merely for the sake of distinguishing one movement from the other.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a cylinder, a piston therein, an operating-valve, a tubular connection between the valve and the cylinder, said tubular connection being divided into connecting-passages, and means for cutting off communication between the cylinder and valve in one of the passages when the other passage is open; substantially as described.

2. The combination of a cylinder, a piston therein, an operating-valve, a tubular connection between the valve and the cylinder, said tubular connection being divided into connecting-passages, and means for auto-

matically cutting off communication between the cylinder and valve in one of the passages when the other passage is open; substantially as described.

3. The combination of a cylinder, a piston therein, an operating-valve, a tubular connection between the valve and the cylinder, said tubular connection being divided into connecting-passages, and oppositely-opening check-valves in the said passages; substantially as described.

4. The combination of a cylinder, a piston therein, an operating-valve, a tubular connection between the valve and the cylinder, said tubular connection having independent connecting-ports, and means for regulating the size of each port; substantially as described.

5. The combination of a cylinder, a piston therein, an operating-valve, a tubular connection between the valve and the cylinder, said tubular connection being divided into independent connecting-passages, oppositely-opening check-valves in the respective passages, and means for regulating the size of each passage; substantially as described.

6. The combination of a cylinder, a piston therein, an operating-valve, a tubular connection between the valve and the cylinder, said tubular connection being divided into separate branches, one of which is a supply to the cylinder and the other an exhaust, means for automatically closing one branch when the other is opened, and means for regulating the size of the port in each branch; substantially as described.

7. The combination of a cylinder, a piston therein, an operating-valve, a tubular connection between the valve and the cylinder, said tubular connection being divided into separate branches, one of which is a supply to the cylinder and the other an exhaust, means for automatically closing one branch when the other is opening, and means for regulating the size of the port in the exhaust branch; substantially as described.

8. The combination of a cylinder, a piston therein, an operating-valve, a tubular connection between the valve and the cylinder, said tubular connection being divided into separate branches, one of which is a supply to the cylinder and the other an exhaust, means for automatically closing one branch when the other is opening, and means for regulating the size of the port in the supply branch; substantially as described.

9. A regulating device of the class described, having two ports adapted to alternately receive and discharge a fluid, said device having independent interior openings, one for each port and each separate from the other port; substantially as described.

10. A regulating device of the class described, comprising tubular portions, and valved branches intermediate the tubular portions and having oppositely-opening check-valves therein; substantially as described.

11. A regulating device of the class described, comprising tubular portions, incased valve-seats intermediate the tubular portions, each tubular portion having a valve-seat common to itself, and valves in the seats each of which is adapted to open when the other is closed; substantially as described.

12. A regulating device of the class described, comprising a structure divided into connecting-passages, and oppositely-opening check-valves in said passages; substantially as described.

13. A regulating device of the class described, comprising a structure having inlet and outlet ports, said structure being interiorly divided into passages separate from each other but each connecting the inlet and outlet ports, and oppositely-opening check-valves in said passages to alternately open communication between said ports through one passage and close communication between said ports through the other passage; substantially as described.

14. A regulating device of the class described, comprising a structure having inlet and outlet ports, said structure being interiorly divided into passages separate from each other but each connecting the inlet and outlet ports, oppositely-opening check-valves in said passages to alternately open communication between said ports through one passage and close communication between said ports through the other passage, and means for regulating the degree of communication between the said passages; substantially as described.

15. In a device of the class described, the combination with a cylinder, of a piston therein, a ported connection at the upper end of the cylinder, a tubular port in communication with the lower end of the cylinder, divided branches in each of said tubular ports, and means for cutting off communication between the cylinder and its source of supply; substantially as described.

16. In a device of the class described, the combination with a cylinder, of a piston therein, means for regulating the active fluid-pressure on one side of the piston, and adjustable means for regulating the resisting fluid-pressure on the opposite side of the piston; substantially as described.

17. In a device of the class described, the combination with a cylinder, and a piston therein, of automatically-operating means for regulating the active fluid-pressure on one side of the piston, and means for regulating a resisting fluid-pressure on the opposite side of the piston; substantially as described.

18. In a device of the class described, the combination with a cylinder and a piston

therein, of a fluid-supply tube having an operating-valve, means independent of the operating-valve for regulating the active fluid-pressure on one side of the piston, and means for regulating a resisting fluid-pressure on the opposite side of the piston; substantially as described.

19. In a device of the class described, the combination with a cylinder having a piston therein, of tubular ported parts at both ends of the cylinder, an operating-valve, means independent of the operating-valve for simultaneously regulating the flow of fluid into one end of the cylinder and the egress of the fluid from the opposite end of the cylinder; substantially as described.

20. In a device of the class described, the combination with a cylinder having a piston therein, of tubular ported parts at opposite ends of the cylinder, an operating-valve, an adjustable means independent of the operating-valve for simultaneously regulating the flow of fluid into one end of the cylinder and the egress of the fluid from the opposite end of the cylinder; substantially as described.

21. In a device of the class described, the combination with a cylinder, a piston therein, and ported parts at opposite ends of the cylinder, of an operating-valve, and automatically-operating means independent of the operating-valve for simultaneously regulating the flow of fluid into one end of the cylinder and egress of the fluid from the other end of the cylinder; substantially as described.

22. In a device of the class described, the combination with a cylinder and a piston therein, of ports at opposite ends of the cylinder, an operating-valve, and means independent of the operating-valve for simultaneously regulating the flow of fluid into one end of the cylinder and the egress of the fluid from the other end of the cylinder; substantially as described.

23. In a device of the class described, the combination with a cylinder, of a piston therein, ports at opposite ends of the cylinder, and regulating devices in communication with said ports, said regulating devices comprising tubular portions and valved branches intermediate the tubular portions and having oppositely-movable check-valves therein; substantially as described.

24. In a device of the class described, the combination with a cylinder, a piston therein, of ported parts at opposite ends of the cylinder, regulating devices communicating with said ported parts, one of said regulating devices comprising a structure divided into connecting-passages, and oppositely-opening check-valves in said passages; substantially as described.

25. In a regulating device, a casing with two connecting-passages, check-valves seated in said passages and arranged to permit the flow of fluid in one direction only through each of said passages; substantially as described.

26. In a regulating device, a casing with two connecting-passages, check-valves seated in said passages and arranged to permit the flow of fluid in one direction only through each of said passages, and adjusting-screws on said check-valves to limit the opening movement of said check-valves; substantially as described.

27. The combination with a cylinder, of a piston therein, a tubular port at the upper end of the cylinder, a tubular port at the lower end of the cylinder, and regulating devices comprising incased valve-seats intermediate the ends of the tubular ports, each tubular port having a valve-seat common to itself, and valves in the seats, each of which is adapted to open when the other is closed; substantially as described.

28. The combination with a cylinder, of a piston therein, a tubular port at the upper end of the cylinder, a tubular port at the lower end of the cylinder, and a regulating device communicating with one of the tubular ports and having ports adapted to alternately receive and discharge fluid, said device having independent interior openings, one for each port and each separate from the other port; substantially as described.

29. The combination with a cylinder, of a piston therein, and pressure-regulating devices communicating with opposite ends of the cylinder, each pressure-regulating device comprising a structure having inlet and outlet ports, said structure being interiorly divided into passages separate from each other but each connecting the inlet and outlet ports, oppositely-opening check-valves in said passages to alternately open communication between said ports through one passage and close communication between said ports through the other passage, and means for regulating the degree of communication between said passages; substantially as described.

30. In a regulating device of the character described, a casing having a port permitting only admission of air to the cylinder, a port permitting only the exhaust of air from the cylinder, and a means for regulating independently the effective areas of said ports; substantially as described.

31. The combination with a cylinder having an admission-port and an exhaust-port communicating with its opposite ends, of a piston therein, an operating-valve, means for regulating the area of the admission-port to one end of the cylinder, and independent means for regulating the area of the exhaust-port from the opposite end of the cylinder; substantially as described.

32. The combination of a cylinder with piston therein, of an operating-valve, and

independent admission and exhaust ports communicating with each end of the cylinder; substantially as described.

33. The combination of a cylinder and piston therein, an operating-valve, a means independent of the operating-valve for throttling the admission of air to one end of the cylinder, and a means independent of the operating-valve for throttling the exhaust of air from the other end of the cylinder; substantially as described.

34. The combination of a cylinder and a piston therein, of an operating-valve, a regulatable means independent of the operating-valve for throttling the admission of air to one end of the cylinder, and a regulatable means independent of the operating-valve for throttling the exhaust of air from the other end of the cylinder; substantially as described.

35. In a regulating device of the character described, a casing with an exhaust-opening, and an admission-opening, and independent means for regulating each of said openings; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 21st day of November, 1905.

GEORGE F. STEEDMAN.

Witnesses:

HARRY A. HEPER,

T. R. CLARKSON.