(No Model.) 3 Sheets—Sheet 1.

I. H. VENN & R. C. SMITH.

HYDRAULIC VALVE APPARATUS.

No. 414,610. Patented Nov. 5. 1889.

Fig. 1.

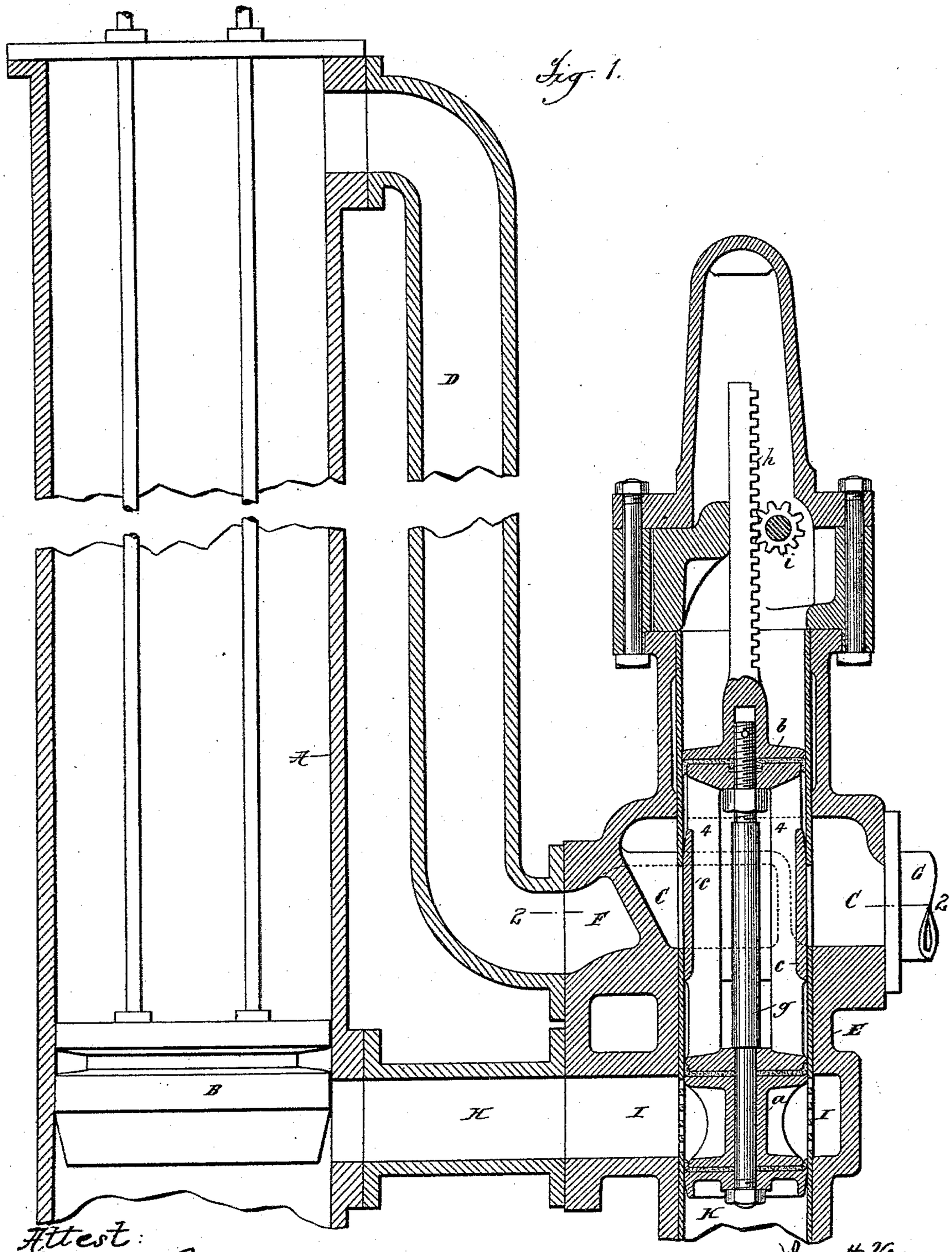

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Fig. 2.

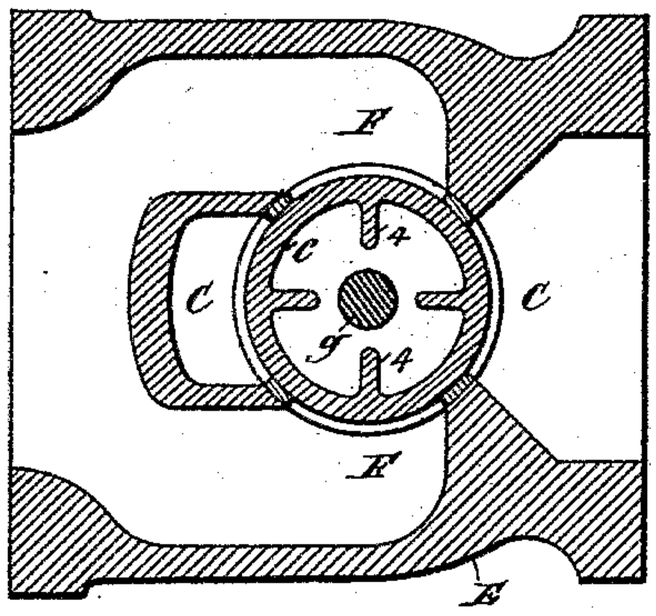
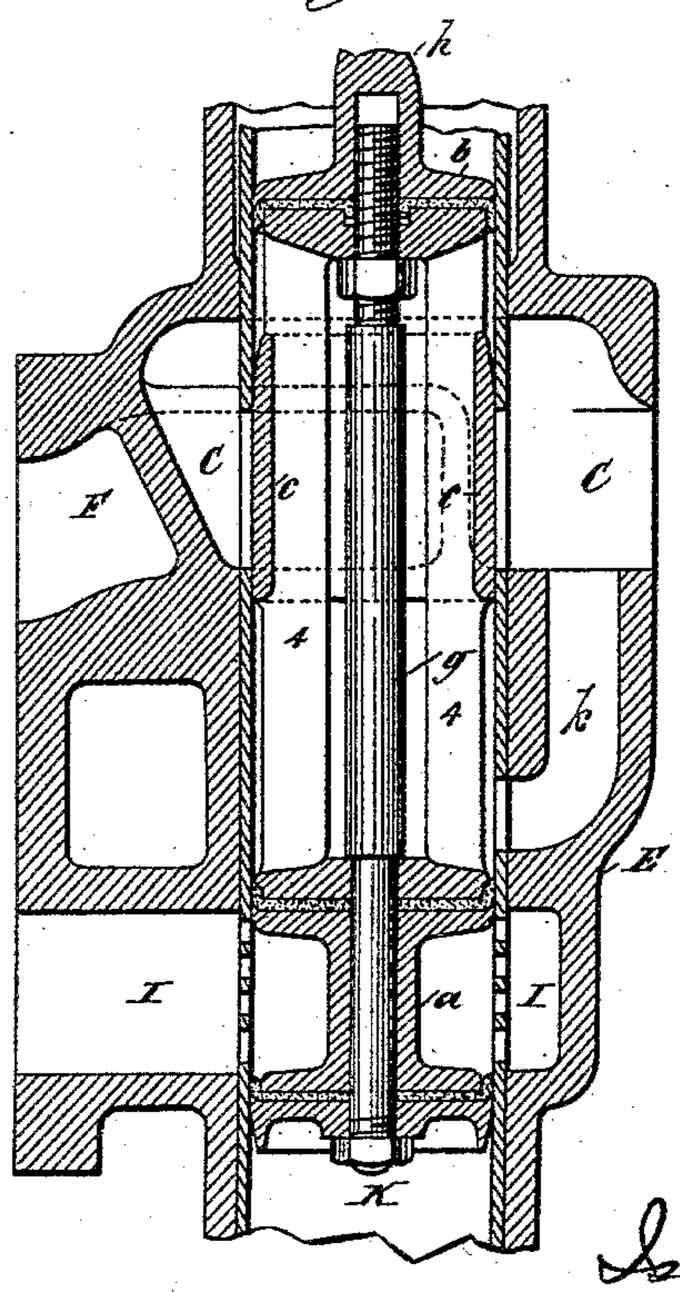


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

I. H. VENN & R. C. SMITH.

HYDRAULIC VALVE APPARATUS.

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Fig. 4.

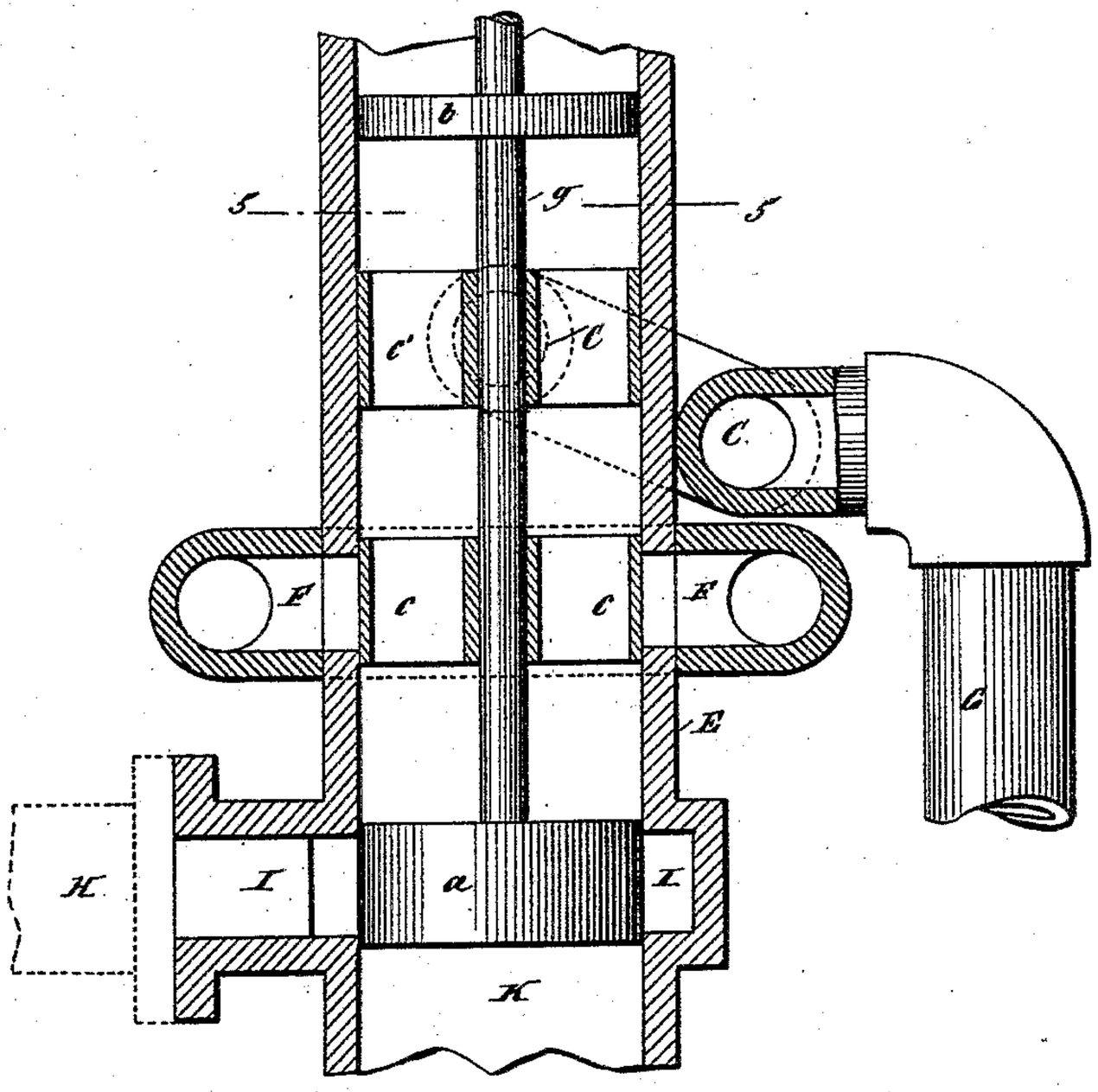
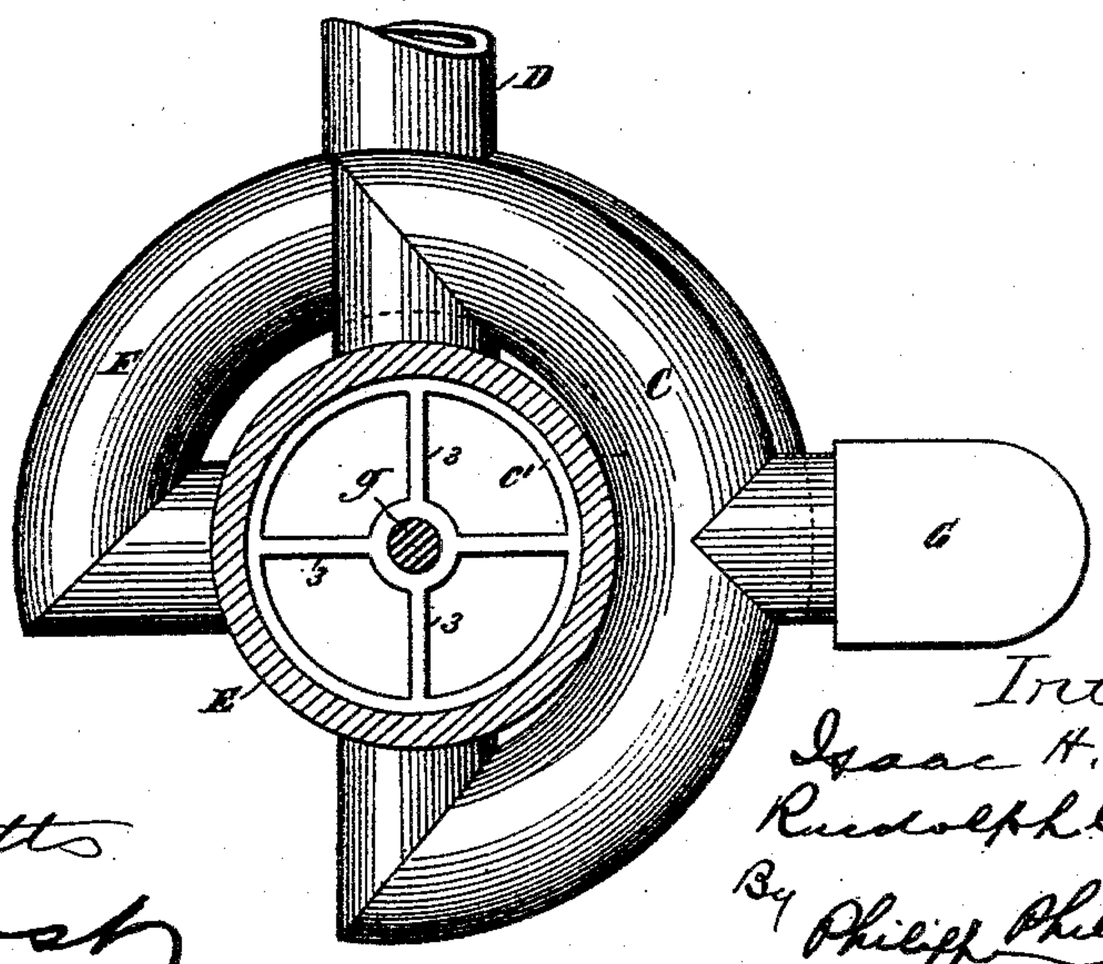


Fig. 5.



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UNITED STATES PATENT OFFICE.

ISAAC H. VENN AND RUDOLPH C. SMITH, OF YONKERS, ASSIGNORS TO OTIS BROTHERS & COMPANY, OF NEW YORK, N. Y.

HYDRAULIC-VALVE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 414,610, dated November 5, 1889.

Application filed February 2, 1889. Serial No. 298,479. (No model.)

To all whom it may concern:

Be it known that we, ISAAC H. VENN and RUDOLPH C. SMITH, citizens of the United States, residing at Yonkers, county of Westchester, State of New York, have invented certain new and useful Improvements in Hydraulic-Valve Apparatus, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a valve apparatus for use in connection with hydraulic elevators and other similar hydraulic apparatus to control the movements of the motor-piston. The valves which have been heretofore employed for this purpose have in many instances produced so much noise when in use as to prove an annoyance to occupants of buildings in which they were located, and this annoyance has been greatest where there was considerable difference in pressure between the supply and discharge, and has been due to the fact that the motor-fluid under a high pressure has been caused to pass through contracted channels or ports into chambers in which the pressure was comparatively low.

It is the object of the present invention to overcome this objectionable feature; and to that end the invention consists in a valve apparatus constructed and organized in the manner that will now be described in connection with the accompanying drawings, in which—

Figure 1 is a sectional elevation of an elevator-motor provided with a valve apparatus constructed according to the present invention. Fig. 2 is a cross-section taken on the line 2 of Fig. 1. Figs. 3, 4, and 5 illustrate slight modifications, which will be hereinafter referred to, Fig. 5 being a cross-section upon the line 5 of Fig. 4.

Referring to said drawings, it is to be understood that A represents a hydraulic cylinder, and B its piston, the two forming the motor for the elevator. As shown in the drawings, the cylinder A is arranged vertically; but this is not material, as it may be arranged horizontally, if preferred.

Communicating with the upper end of the motor-cylinder is an induction and circulating pipe D, the lower end of which communicates by means of ports F with a valve-chest E. The supply-pipe G, through which the water is supplied to the cylinder A, also communicates with the valve-chest E by means of ports C, which are preferably arranged in the same plane or substantially the same plane with the ports F. The ports C F will preferably be arranged in pairs opposite each other to counterbalance the pressure and to destroy by the opposing streams their energy. This, however, is not absolutely essential. One of the ports C may be omitted, and also one of the ports F may be omitted. The lower end of the valve-chest E is provided with a port I, which communicates through a short pipe H with the lower end of the cylinder A, and which is also capable of being brought into communication with the ports C F and with the discharge-outlet K of the valve-chest.

The valve-chest E contains a valve *a* of the ordinary form for controlling the port I to permit the circulation and discharge of the water to and from the lower end of the motor-cylinder, it being understood that the term "lower end" is herein used for convenience to indicate the end of the motor-cylinder from which the water is finally discharged. The valve *a* is provided with a rod *g*, which passes upward in the valve-chest and carries a piston *b*, located above the ports C F, and which serves to balance the valve. The rod is also provided with the usual rack *h*, which is engaged by a pinion *i*, by which through suitable connections the valve is operated. In addition to the valve *a*, the valve-chest contains a supplemental valve *c*, for controlling the ports C F. This supplemental valve *c* is preferably made of annular form or is perforated, so as to permit the water to circulate through it in passing from the ports C F to the port I. The valve *c* may be secured either directly to the rod *g* by means of spokes 3, as shown in Figs. 4 and 5, or may be secured to the piston *b* and valve *a* by means of light ribs 4, as shown in Figs. 1, 2, and 3. The supplemental valve *c* is so arranged with relation to the valve *a* that as the latter valve is moved upward or downward to open the port I and permit the water to enter or escape from the lower end of the cylinder A the former

valve will open the ports C F to a corresponding extent, so as to permit the water to pass out of the pipe D into the valve-chest at the same rate it is permitted to pass from the valve-chest into the pipe H, or to permit the water to pass from the supply-pipe G to the valve-chest and from the valve-chest to the pipe D and the upper end of the cylinder at the same rate at which it is permitted to escape from the lower end of the cylinder through the port I.

The operation of the valve apparatus thus organized is as follows: Let it be assumed that the piston B is at the upward limit of its movement and that the cylinder beneath it is filled with water and the valves *a c* are in position to cut off the supply and discharge of water to and from the cylinder. When it is desired to lower the piston to raise the elevator-car or other load, the valve *a* will be raised, so as to partly or wholly uncover the port I, and thus allow the water to escape from the lower end of the cylinder. At the same time the supplemental valve *c* will be correspondingly raised and open the ports C F to a corresponding extent, and thus permit the water to pass into the upper end of the cylinder. By this means the rate of admission of water above the piston is made to conform to the rate of its discharge from below the piston, and as a consequence the water, instead of being forced out of the lower end of the cylinder, so as to occasion a hissing noise in passing through the port I into the discharge K, flows through the port I easily and without noise. When it is desired to raise the piston, the valves *a c* will be moved downward until the ports C F I are partly or wholly uncovered. The weight of the load will then raise the piston and cause the water above it to circulate through the pipe D and ports F I to the lower end of the cylinder. The supplemental valve *c*, being made of annular form or perforated vertically, will permit the water to pass through it in passing from the ports F to port I, and the ports C, being opened to the same extent that the ports F are opened, will also put the port I in communication with the supply-pipe G during circulation, so as to permit sufficient water to enter the lower end of the cylinder to compensate for the volume of the piston rod or rods. During this circulation of the water the water beneath the piston is subjected to little or no pressure, while the water above the piston and in the pipe D is subjected to a pressure due to the weight of the load, and if the load is heavy the pressure of the water might be so great as to produce the objectionable noise before referred to were it not that the difference in pressure between the upper and lower sides of the piston is gradually reduced by the supplemental valve. To illustrate: The water in passing from the pipe D through the ports F is throttled more or less, thereby reducing the pressure in the valve-chest between the valve *a* and piston *b*, and the water in passing from the valve-chest through the port I is again throttled, so as to reduce the pressure in the pipe H and the lower end of the cylinder. During this operation the water in passing from the pipe G through the ports C to the valve-chest is correspondingly throttled. When the valves *a c* are lowered, so as to fully open the ports F C, the water in circulating from the upper to the lower end of the cylinder will in the construction shown in Figs. 1, 2, 4, and 5 have to pass through the valve *c*, and as the space within the valve-chest is somewhat contracted by the presence of the valve the circulation will be slightly retarded, and it may therefore in some cases be desirable to provide the valve-chest with a supplemental port or by-pass *k*, as shown in Fig. 3, which will allow the water to circulate around the valve *c*, and by making the port *k* of sufficient size the entire volume of water may circulate through the port, and in such case the supplemental valve need not be of annular form or be perforated.

It has been stated that it is preferable that the ports C F should be arranged in the same plane; but this is not absolutely essential. They may be arranged on different planes, as shown in Figs. 4 and 5. In such case the valve *c* will be made in two parts *c c'*, as shown, one part controlling the ports F and the other part controlling the ports C. Wherever the supplemental valve *c* is referred to it is therefore to be understood as including the construction in which the valve is made in two parts as well as a construction in which it is made in one part.

As shown in Figs. 4 and 5, the passages forming the ports F C, instead of being formed in the walls of the valve-chest, are formed by branches of the pipes D G, as indicated. This in some cases will be preferable.

In some cases it may be preferable to so arrange the valve *a* and the supplemental valve that the ports C F will be closed slightly in advance of the port I, or, in case where the supplemental valve is made in two parts, so that the ports C will be closed slightly in advance of the ports F and the ports F slightly in advance of the port I.

What we claim is—

1. The combination, with the main cylinder, piston, supply, circulating, and discharge pipes, of the valve-chest E, communicating with said pipes, the main valve *a*, controlling the discharge and circulation, and the supplemental valve *c*, moving with the main valve and controlling the rate of flow of water into the cylinder to conform to the rate of its discharge, said supplemental valve being perforated to permit the water to flow through it to circulate from one end to the other of the cylinder, and also to afford communication between the supply-pipe and the discharge end of the cylinder during circulation, substantially as described.

2. The combination, with the valve-chest E, having the ports F I, of the valve *a*, controlling the port I, the balancing-piston *b*, and the perforated supplemental valve *c*, located between the valve *a* and piston *b* and controlling the port F, substantially as described.

3. The combination, with the main cylinder and the pipes D H, communicating with the opposite ends of the cylinder, of the supply-pipe G, the valve-chest E, having the ports F I C, communicating, respectively, with said pipes, the valve *a*, controlling the port I, the balancing-piston *b*, and the supplemental valve *c*, located between the valve *a* and piston *b* and constructed and arranged to cover both the ports C F, and thereby throttle the water as it enters the valve-chest through the port C and as it leaves or enters the valve-chest through the port F, substantially as described.

4. The combination, in a hydraulic-valve apparatus, of a valve-chest provided with ports C F, arranged in pairs opposite each other, and with a port I, said ports communicating with pipes G D H, a rod carrying the valve for controlling the port I, a balancing-piston *b*, and a perforated valve arranged to control the ports C F, substantially as described.

5. The combination, with a valve-chest having ports C F and a port I, of a valve-rod carrying a valve at one end, a balancing-piston at the other end, and an intermediate valve *c*, for controlling the ports C F, with openings to permit the free discharge of the water between the piston and the valve at the end of the rod, substantially as described.

6. The combination of the valve-chest having ports C F I, a rod carrying a lower valve *a*, an upper piston *b*, and perforated intermediate valves for closing the ports C F, the lap of the valve for closing the port C being greater than that for closing the port F, and the lap of the latter valve being greater than that of the valve *a*, substantially as described.

7. The combination, in a hydraulic-valve apparatus, of the valve-chest having the inlet-port C for the supply, the port F, for communication with the top of the motor-cylinder, the port I, for communication with the bottom of the same and with the discharge K, a piston-valve for controlling the port I, a counterbalancing-piston *b*, and a perforated supplemental valve *c*, arranged to throttle the inlet-port and the outlet-port to the top of the motor, and also to allow the water to circulate through the same under pressure, substantially as described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

ISAAC H. VENN.
RUDOLPH C. SMITH.

Witnesses:
W. H. SWENY,
JNO. C. HARRIGAN.