(No Model.) 3 Sheets—Sheet 1.

T. W. EATON.

HYDRAULIC ELEVATOR.

No. 446,620. Patented Feb. 17, 1891.

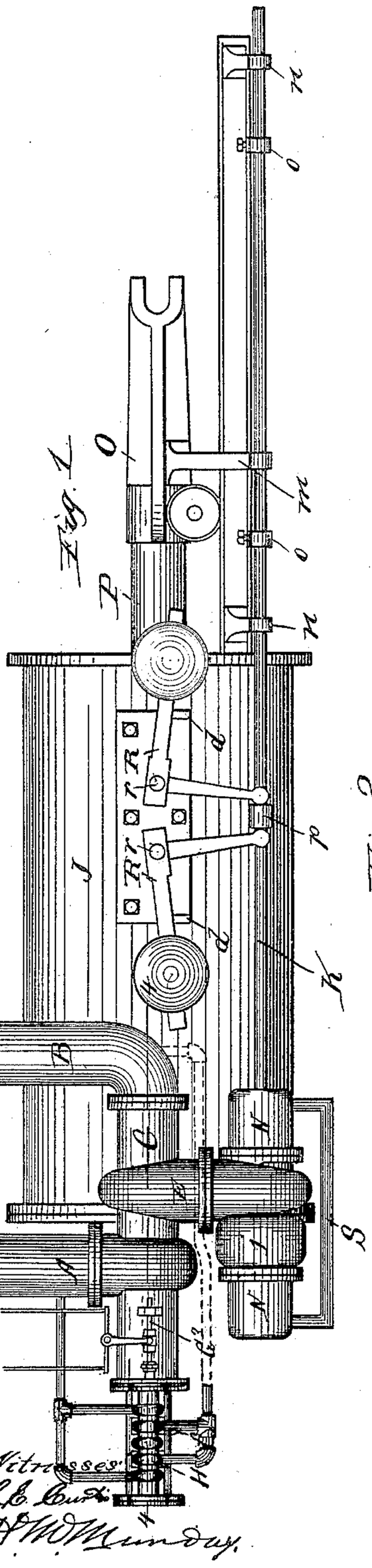

Fig. 1.

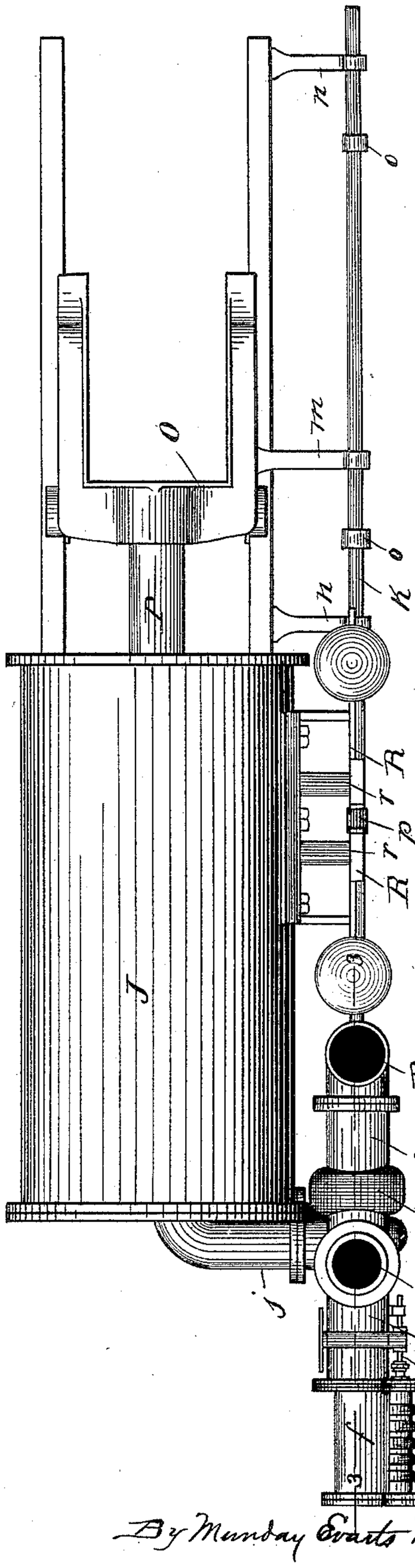

Fig. 2.

Witnesses:
L. C. Cook
W. W. Munday.

Inventor:
T. W. Eaton
By Munday Evarts & Adcock
His Attorneys.

(No Model.)

3 Sheets—Sheet 2.

T. W. EATON.

HYDRAULIC ELEVATOR.

No. 446,620. Patented Feb. 17, 1891.

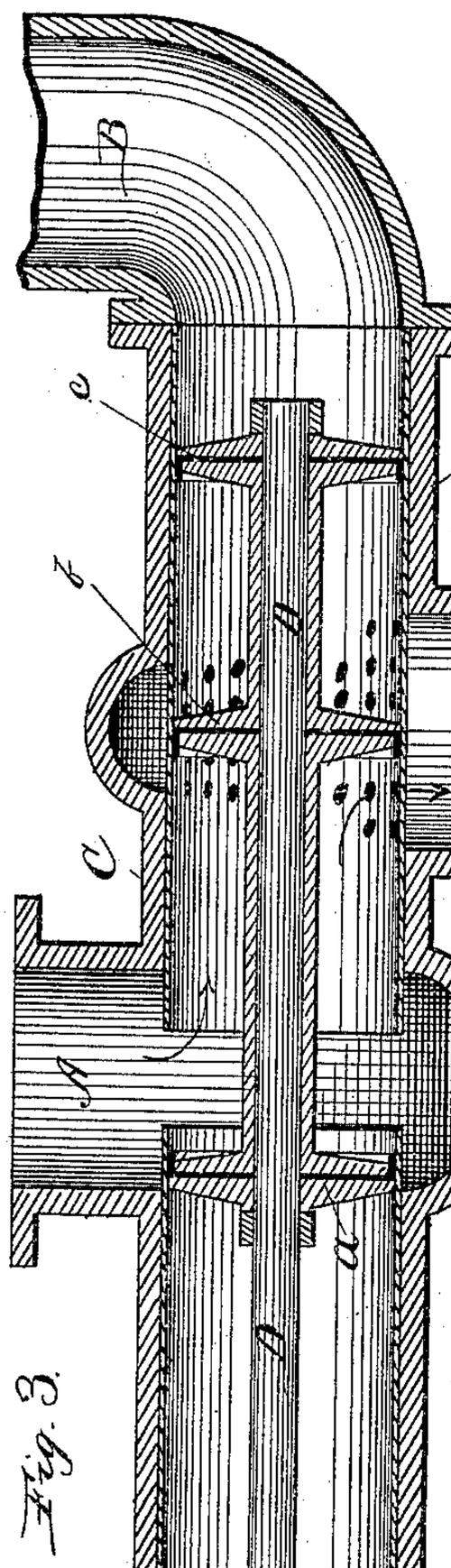

Fig. 3.

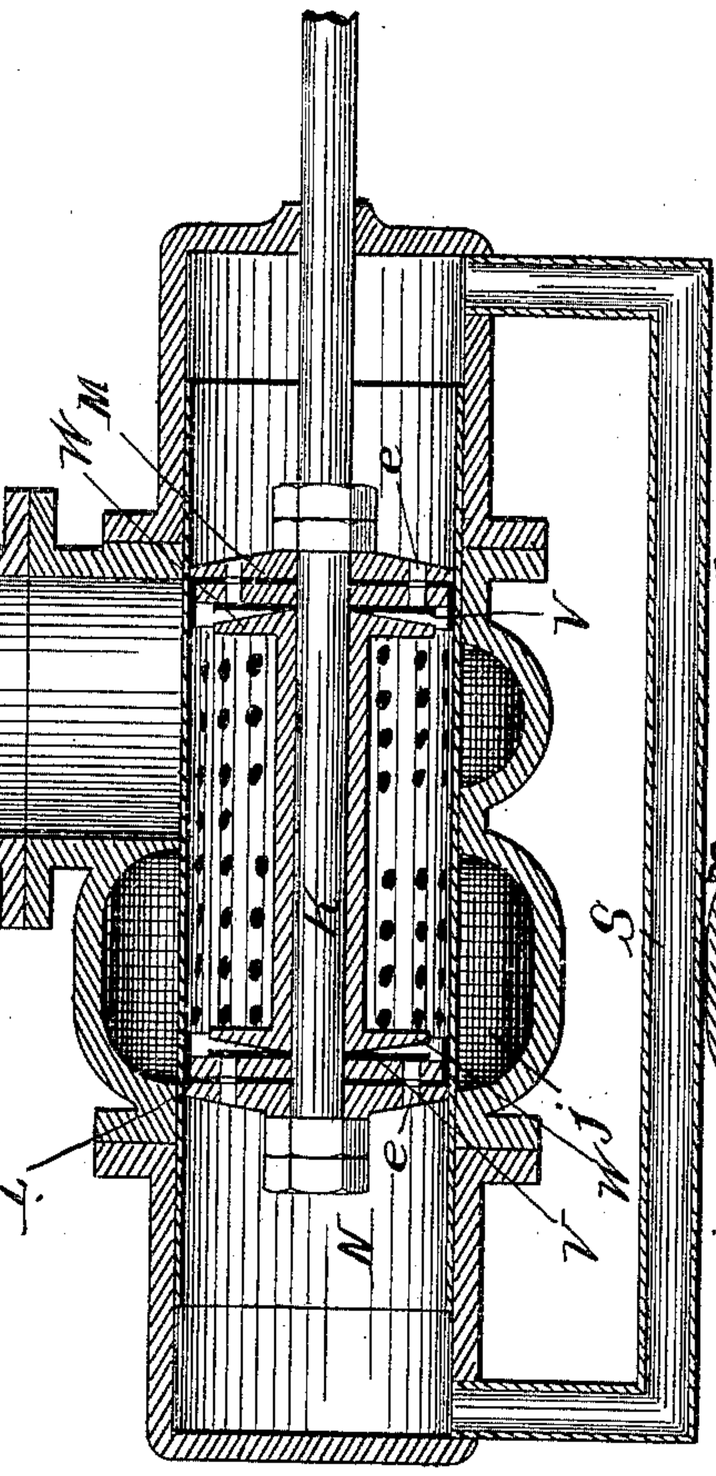

Fig. 6.

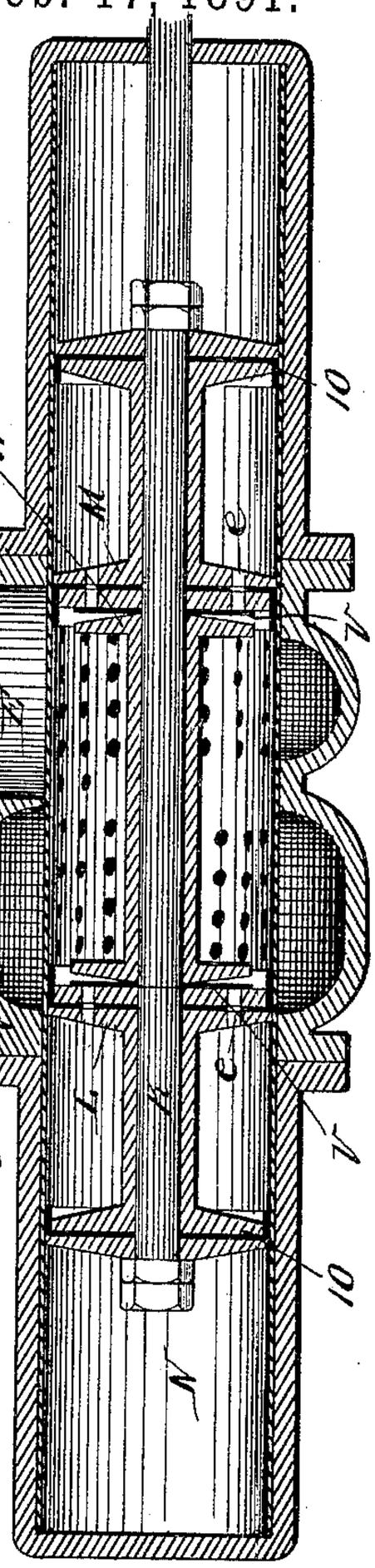

Fig. 8.

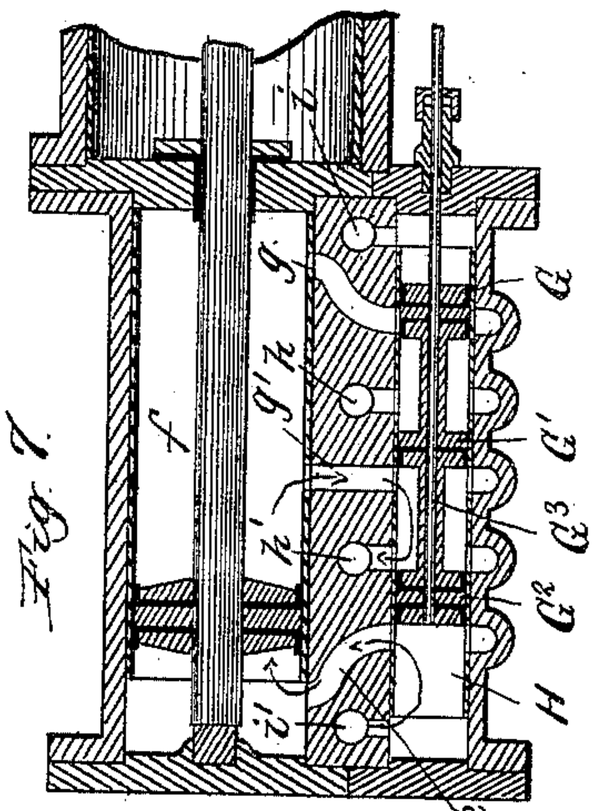

Fig. 7.

Witnesses:
Lew. E. Curtis.
P. W. Munday

Inventor:
T. W. Eaton
By Munday Evarts & Adcock
His Attorneys.

(No Model.) 3 Sheets—Sheet 3.

T. W. EATON.

HYDRAULIC ELEVATOR.

No. 446,620. Patented Feb. 17, 1891.

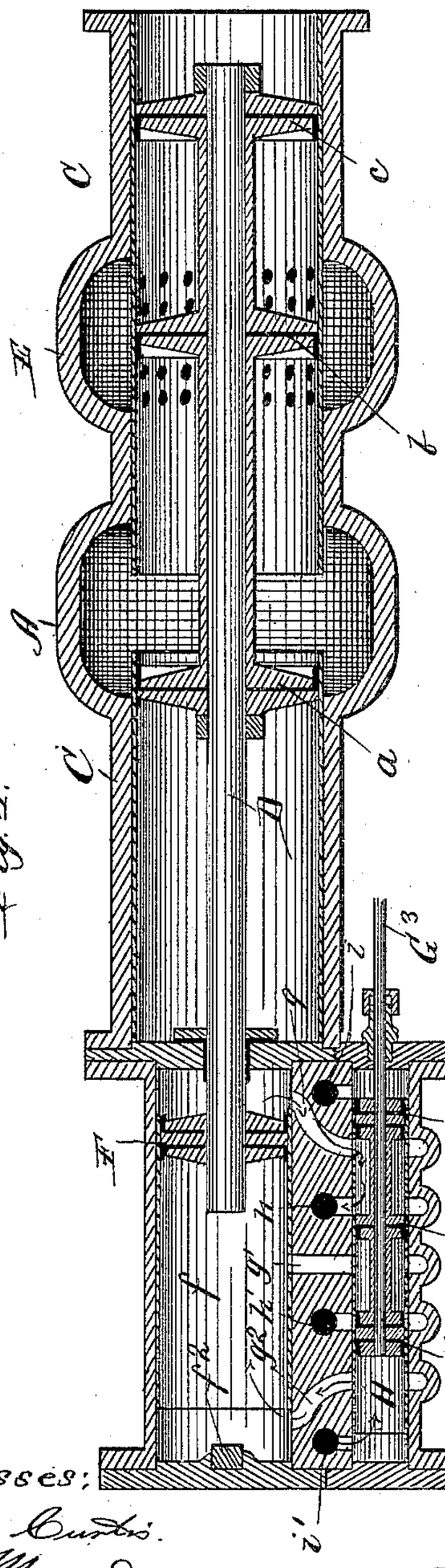

Fig. 4.

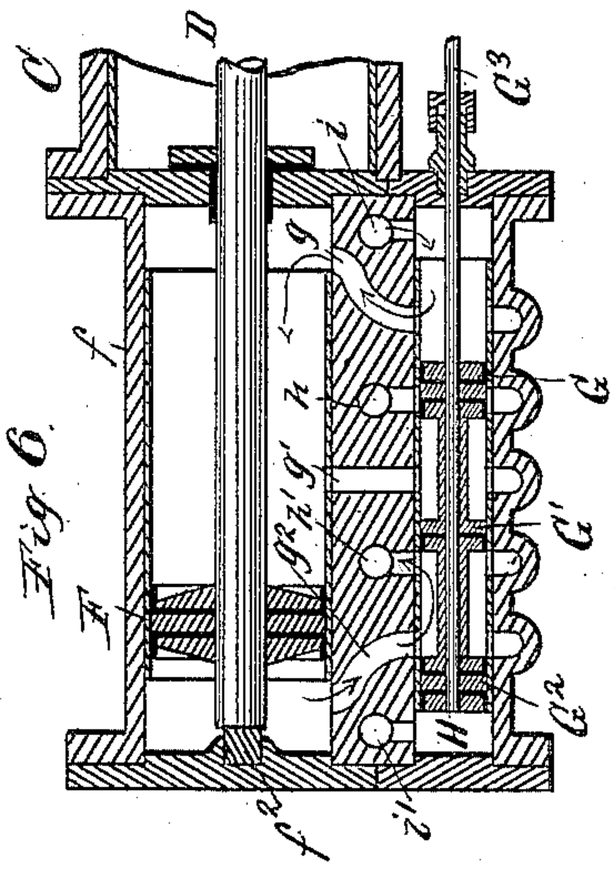

Fig. 6.

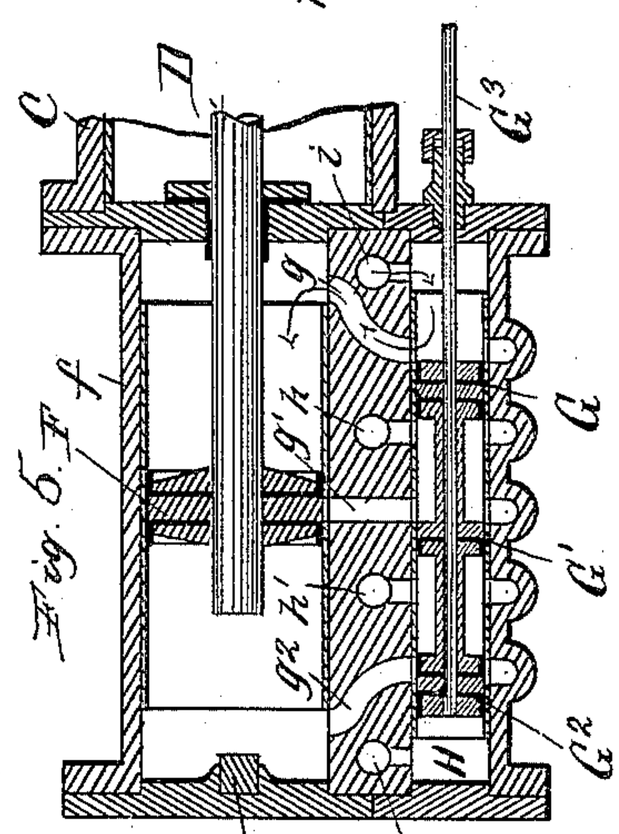

Fig. 5.

Witnesses:
Lew. E. Curtis.
H. W. Munday.

Inventor:
T. W. Eaton
By Munday Evarts & Adcock
His Attorneys.

UNITED STATES PATENT OFFICE.

THOMAS W. EATON, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE EATON & PRINCE COMPANY, OF SAME PLACE.

HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 446,620, dated February 17, 1891.

Application filed September 20, 1889. Serial No. 324,553. (No model.)

To all whom it may concern:

Be it known that I, THOMAS W. EATON, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Hydraulic Elevators, of which the following is a specification.

This invention applies to that class of hydraulic elevators wherein the water-supply-inlet and the discharge-outlet valves are mounted upon a common stem and are actuated in one direction or the other by a piston-head secured upon the same stem and located in a cylinder adjoining the water-passage in which said valves are placed.

The invention relates more particularly to the water-passages and auxiliary valve, whereby said valve-actuating piston is controlled by the operator upon the elevator-car, and also to means for automatically stopping the flow of water to and from the main cylinder at the conclusion of the limit of travel by the car in either direction.

The nature of my improvement will be fully understood from my description given below when considered in connection with the accompanying drawings, in which latter—

Figure 1 is a side elevation of that portion of an elevator to which my invention relates. Fig. 2 is a plan of the parts shown at Fig. 1. Fig. 3 is a vertical section upon the line 3 3 of Fig. 2. Fig. 4 is a horizontal section upon the line 4 4 of Fig. 1. Figs. 5, 6, and 7 are detail sections of the auxiliary valve and its water-passages, showing the different positions of said valve. Fig. 8 shows a modified construction of the automatic cut-off valve.

Similar letters of reference indicate like parts throughout the several figures.

In said drawings, A represents the pipe leading from the source of water-supply, and B the final water-discharge. These both connect with the pipe C, in which is placed the main valve consisting of heads *a b c*, mounted upon a common stem D. From the pipe C, about midway between the connections with the inlet and discharge, is a passage E, leading toward the elevator-cylinder J, and the heads *a*, *b*, and *c* control the entrance of the water into this passage E, and also the exit thereof from the passage E into pipe C when on its way to discharge. When in the position shown at Figs. 3 and 4, the water flows from the inlet into passage E, as indicated by the arrows; but if said valve be moved to the left until the head *c* occupies the position now occupied by the head *b* the incoming of fresh water would be shut off and freedom would be given to the water from the cylinder to flow to the discharge. These movements of the valve are obtained by admitting water under pressure to one side or the other of a head F, secured upon the same stem with said valve and located in a small cylinder *f*, adjoining the pipe C, as clearly shown. This head F at one limit of the stroke strikes buffers *f'*, and the end of the stem D strikes a buffer f^2 at the other end of the stroke.

For the purpose of controlling the water by which the head F is actuated I employ an auxiliary or multiple piston-valve consisting of series of three piston-heads G G' G^2, mounted upon a stem G^3, which is connected to the car of the elevator and under the control of the operator thereof. This valve is placed in the valve-chamber H at the side of the cylinder *f*. Leading from the valve-chamber H to the cylinder *f* are three passages *g* *g'* g^2, located as shown. Said valve-chamber is also provided with two discharge-ports *h h'* and with two water-inlets *i i'*, also located as shown and connected to the discharge and feed pipes, respectively.

With the construction above described, if it is desired to raise the elevator-car the auxiliary valve is moved to the position shown at Fig. 4, which admits water to one side of piston F through ports *i'* and g^2 and allows it to flow out from the other side of said piston through ports *g h*, the central port *g'* being closed. This results in bringing piston F and the main valve to the position shown at Figs. 3 and 4, and in which water enters from the source of supply A and passes to the main cylinder. To lower the car and move the main valve to a position in which it will give exit to the water without opening the inlet, the auxiliary valve is moved to the location illustrated at Fig. 6, in which water is admitted to the piston F through ports *i g* and discharged from the other side thereof through g^2 *h'*, the central passage being wholly closed.

This carries piston F to the extreme of its stroke in one direction, as indicated at said figure, and thereby the main-valve head *c* is carried beyond or partially beyond passage E.

If the car is to be stopped at the end of its upward run or before it reaches that point, the auxiliary valve is moved by the operator to the position shown in Fig. 5. This opens ports *i g*, so that water can come in thereat and against the right-hand side of piston F, and closes inlet *i'*, and also shuts port g^2, so that water cannot pass either way through the same. The active pressure from ports *i g* will now carry piston F to a position midway of its cylinder and until it closes the center passage, such movement being permitted by the exit of the water at *g'* and *h* until the piston so closes *g'*. In this movement of the piston F the main valve is moved so that its head *b* lies between the supply A and passage E, thereby shutting off the entrance of water to the elevator-cylinder without, however, opening the main discharge.

To stop the car at the end or midway of its downward run, the auxiliary valve is moved to the position given at Fig. 7, in which ports *i'* g^2 are open for the admission of water and ports *g' h'* for its discharge. This also brings piston F to its central position and shuts off the water at the main valve.

For the purpose of stopping the car at the upper and lower landings automatically, and thus guarding against accidents due to oversight or forgetfulness upon the part of the operator, I employ, preferably, in connection with the apparatus above described, the following devices: Interposed in the water-passages leading from the main valve to the elevator-cylinder is an automatic balanced valve, consisting of the heads L and M, mounted upon the stem K and located in a cylinder N, communicating at one side with the main passage E and at the other side with the pipe *j*, leading to the cylinder J. The heads L and M are sufficiently far apart to span the mouths of both pipe E and pipe *j*, so that when they are in their normal position the water may flow uninterruptedly back and forth through said pipes. The stem K extends beyond the cylinder N and is connected by an arm *m* to the cross-head O, carried by the piston P of cylinder J, and is supported in proper bearings *n* at intervals throughout its length. The arm *m* fits the stem loosely, so that it may move along the latter without actuating the same until it strikes one or the other of the collars *o*, carried by the stem. When contact with these collars takes place, the stem and the heads L and M are of course moved with the cross-head, resulting in placing one or the other of said heads between the pipe E and pipe *j*, and causing a cessation of the flow from one to the other of said pipes and a stoppage of the piston P. For purposes hereinafter to be explained, the heads L and M are provided with passages *e*, extending through them; but said passages are guarded by flexible flaps V upon the inner sides of the heads, so that water can pass through the same in one direction only. Disks W are preferably present to support said flaps. The opposing pressures exerted upon this valve when it is not in its normal position are equalized by the water-passage S, connecting the extreme ends of the valve-cylinder, as shown. This shut-off valve is also automatic in returning to its normal position. Thus as soon as the operating-valve is reversed a limited flow is started through the passages *e* of one or the other of the heads L or M, which soon causes the main current to conform to the changed position of the operating-valve and allows the piston P to retreat, thereby carrying arm *m* away from contact with the collar *o* and leaving the valve free to be moved back by the power of a weighted lever R, pivoted at *r* and pressing against a collar *p* upon the stem K. Two of these levers are provided, one for moving the valve in each direction, and they are so placed as to be lifted by the stem each time the valve is carried from its normal position by the piston P. When they have returned the valve to its normal position, they cease action, the weights being then sustained by stops *d*.

The automatic cut-off in shutting off the water always moves against the current—that is to say, in a direction contrary to the direction of the current. Thus, supposing the cut-off to be moved from the position shown at Fig. 3, until the head L stands between the ports E and *j*, (this being the movement imparted at the end of the upward run in an elevator constructed in the manner shown,) said head L moves against the incoming water from pipe E. If, while the current is moving away from the cylinder toward the discharge, (the same being the opposite direction from that indicated at said figure,) the cut-off be moved to bring head M between the ports E and *j*, said head will be moved against the outgoing water. When thus shut off in either direction by the cut-off, the water will remain stationary until the pressure is reversed by the reversal of the main valve, when the openings *e* in the heads will enable some of the water to pass through the heads in the direction to which the pressure has been changed. This permits in the case first supposed an outward flow from *j* to E through the ports of the heads, thus starting the main piston in its retreat, and in the other case it permits the flow through the heads from E to *j*, thus starting the main piston again forward.

Instead of balancing the automatic cut-off valve by a connecting water-passage, as S, the inclosing cylinder may be lengthened and heads 10 be applied to the valve-stem, as indicated at Fig. 8. The collars *o* are adjustable upon the stem K by means of set-screws, as shown. This adjustment allows of the positioning of the collars so as to stop the car at any point in its line of travel.

I claim—

1. In a hydraulic elevator, the combination, with the main valve, of the piston F for moving said valve and the auxiliary valve and water-passages g g' g^2, inlets i i', and discharge-ports h and h', substantially as specified.

2. The combination, with the main valve and its actuating-piston F, of the auxiliary valve having three heads for controlling the water acting upon said piston, the three water-passages connecting the piston-chamber with the valve-chamber, and suitable water-inlets and suitable water-outlets leading to and from the latter chamber, substantially as specified.

3. The combination, with the piston F and its chamber, of a valve for controlling the water acting upon said piston, suitable passages connecting the valve-chamber with the ends of the piston-chamber, and a central passage between said chambers, adapted to be closed by the piston, substantially as specified.

4. The combination of the piston F and its cylinder with the controlling-valve and its cylinder, said cylinders being connected by suitable passages, one of which is a central passage adapted to be closed by the piston, substantially as specified.

THOMAS W. EATON.

Witnesses:
H. M. MUNDAY,
EDW. S. EVARTS.