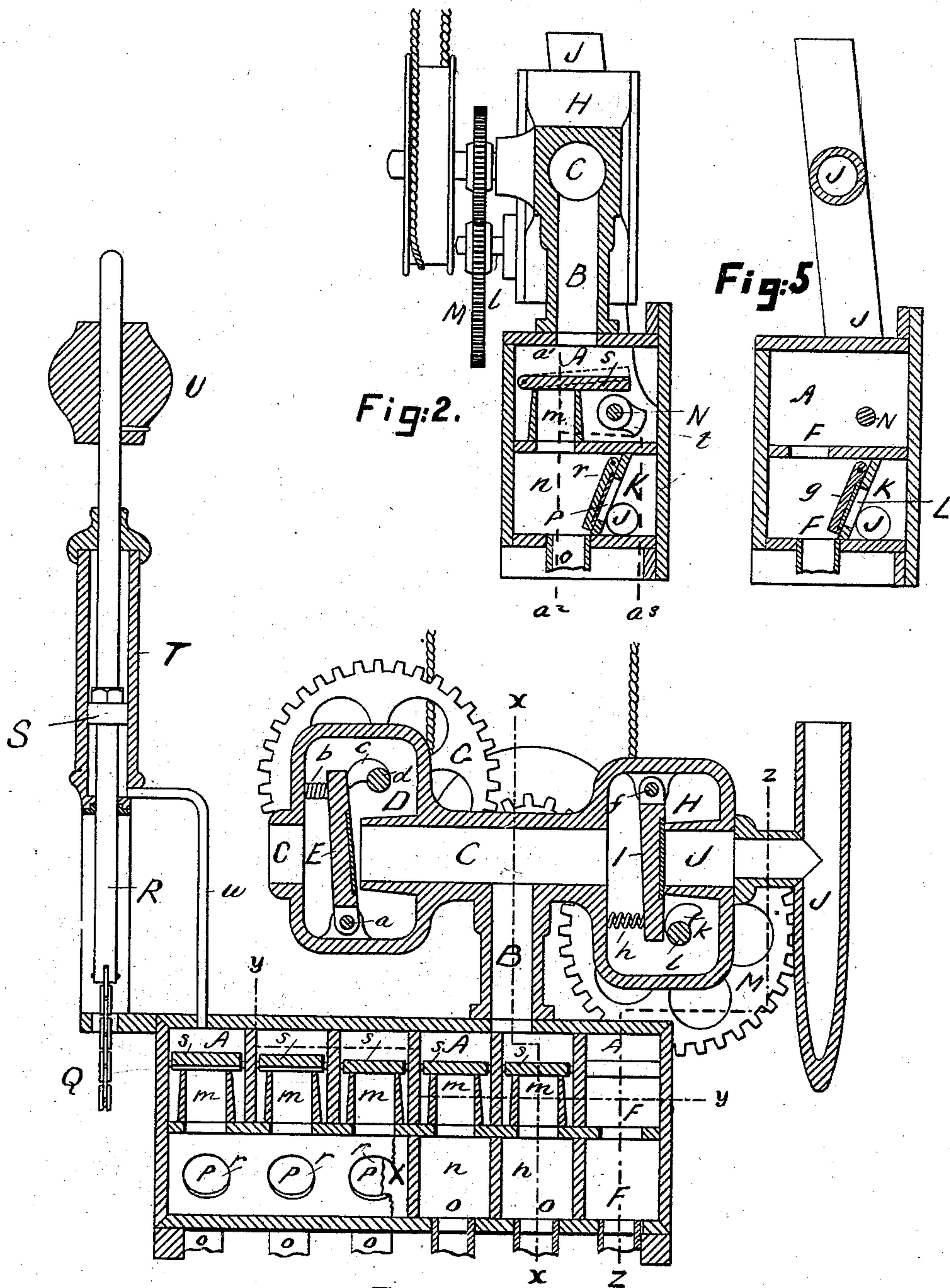


S. C. ROWELL.  
Hydraulic Elevator.

No. 221,940.

Patented Nov. 25, 1879.



Witnesses.

W. H. Emerson

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Fig:6

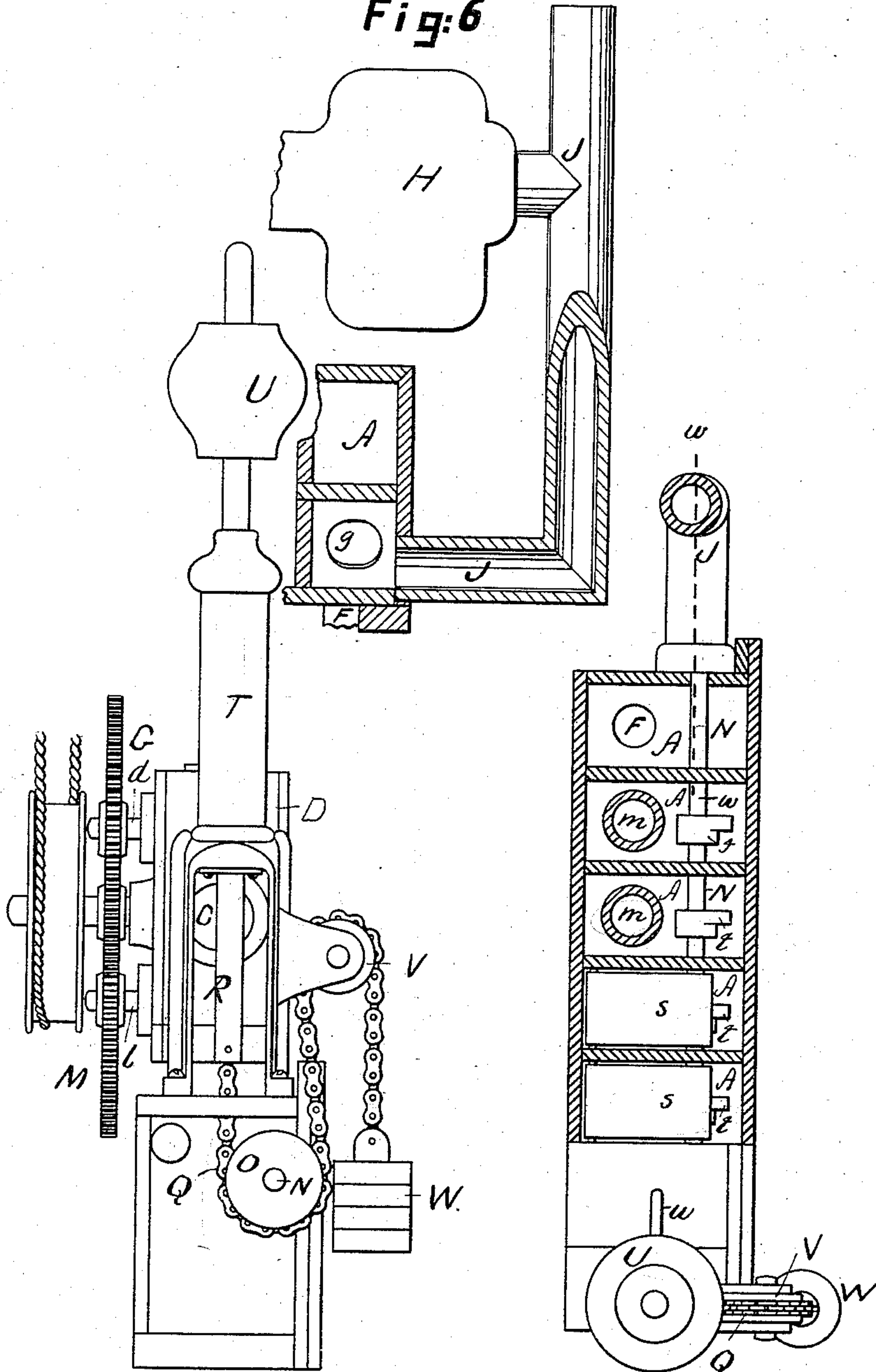


Fig:4.

Fig:3.

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# UNITED STATES PATENT OFFICE.

SAMUEL C. ROWELL, OF BOSTON, MASSACHUSETTS.

## IMPROVEMENT IN HYDRAULIC ELEVATORS.

Specification forming part of Letters Patent No. **221,940**, dated November 25, 1879; application filed April 11, 1879.

*To all whom it may concern:*

Be it known that I, SAMUEL C. ROWELL, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Hydraulic Elevators, of which the following is a full, clear, and exact description.

This invention relates to hydraulic elevators having a series of separate and distinct piston-cylinders, which are severally so connected with the water-pressure that the water can be made or caused to act in either one or two, or more, or all of them, at one and the same time, according as the work or labor put upon the elevator from time to time is more or less.

In this class of elevators as heretofore constructed the water is opened to the several cylinders, either one or more, as the load on the elevator may require, by the hand of the operator or the person in charge of the running of the elevator, who, through mechanism suitably arranged therefor, manipulates the valves employed to govern the flow or passage of the water to the several piston-cylinders in a manner to open such of them, one after another, until, with the water-pressure at command, sufficient power is given to the elevator to accomplish the work or labor required.

This invention pertains mainly to governing the passage of the water to such a series of piston-cylinders after it has been opened to the first of the series.

To this end the invention, in substance, consists, first, in the combination, with the common or with any other suitable construction and arrangement of mechanism for opening and closing one of the said series of piston-cylinders for the passage of the water to and from it for its action therein, as ordinarily in hydraulic elevators, of a series of valves or ports for the other and additional piston-cylinders, (one valve or port for each cylinder,) and of a weighted piston-head which moves in a cylinder of its own in communication with the water-pressure when it is opened, as above described, to the first of the series of piston-cylinders, and is so arranged therein relative to the said several valves or ports for the said piston-cylinders that, as it is moved forward and backward in its cylinder or chamber under the action of the water-pressure which is

therein, it will, in moving in the one direction, open the said valves or ports to the said additional cylinders one after the other, and in moving in the other and opposite direction close the said valves or ports to the said additional cylinders one after the other, the valve first opened being the first closed, and vice versa, and the elevator being otherwise constructed and arranged in its several parts as ordinarily; second, in the combination, with the common or with any other suitable construction and arrangement of mechanism for opening and closing one of a series of piston-cylinders for the passage of water to and from it for its action therein, as ordinarily in hydraulic elevators, of a series of valves, one for each of the additional cylinders, and severally adapted to open and close passages leading from a water-pressure chamber in common with the said series of piston-cylinders, and of a weighted piston-head which moves in a cylinder or chamber of its own in communication with the said water-pressure chamber, in common with the said series of piston-cylinders, and is connected with a shaft adapted to rotate in such a manner that, as said piston-head is moved forward and backward in its cylinder under the action of the water-pressure which is therein and in the said common chamber for the said series of piston-cylinders, said shaft will be rotated either in the one or the other direction, as the case may be, said shaft being so constructed and arranged relatively to each and all of the said valves that as it is turned, as above stated, in the one direction it will open the said valves one after the other, and as it is turned, as above stated, in the other and opposite direction it will close or allow the said valves to close, one after the other, the valve first opened being the last to be closed or to close, and vice versa, and the elevator being otherwise constructed and arranged in its several parts as ordinarily, all substantially as hereinafter described.

In the accompanying plate of drawings the carrying out of this invention is illustrated, Figure 1, Plate 1, being a central longitudinal vertical section through the common water-pressure chamber, which is constructed to communicate with the several piston-cylinders, and through other parts connecting therewith, being on two sectional lines, the portion of the figure at the left of the letter *x* being on the line



$a' a^2$ , Fig. 2, and the other portion of the figure on line  $a' a^3$ , Fig. 2; Fig. 2, a transverse vertical section on line  $x x$ , Fig. 1. Fig. 5 is a vertical section on line  $z z$ , Fig. 1; Fig. 3, Plate 2, a horizontal vertical section on line  $y y$ , Fig. 1; Fig. 4, an end elevation; Fig. 6, a detail vertical section on line  $w w$ , Fig. 3.

In the drawings, A represents a chamber, which, at B, communicates through a pipe, C, with the water-supply. The pipe C is enlarged or chambered at D, and in such chamber is a vertical plate or gate-valve, E, hinged at its lower end,  $a$ , and adapted to open and close the said pipe C to the passage of water through it to the chamber A, and thence to a piston-cylinder of the elevator in communication at F with said chamber.

The gate-valve E is opened against a spiral spring,  $b$ , by the action of a cam,  $c$ , on a shaft,  $d$ , which turns in bearings of the pipe-chamber D, and exteriorly is adapted, as ordinarily, through gearing G, to be manipulated by a rope running up and down in the space through which the elevator is to travel.

The pressure of the water closes the gate-valve E when the cam  $c$  leaves the valve, and the spiral spring  $b$  keeps the valve E, when closed, on its seat, and prevents its chattering or vibrating. The pipe C is also enlarged or chambered at H on the opposite side to that of the chamber D. This chamber H has a vertical gate-valve, I, hinged at its upper end,  $f$ , and adapted to open and close a pipe, J, leading from it to a reservoir or tank and to a chamber, K, in communication with the chamber A, before referred to, through a passage, L, which is provided with a hinged plate or clapper-valve,  $g$ , arranged to close against the passage of water from the chamber A to the chamber K, but to open to the passage of water in the reverse direction—that is, from the chamber K to the chamber A.

The gate-valve I is opened against a spiral spring,  $h$ , by the action of a cam,  $k$ , on a shaft,  $l$ , which turns in bearings of the valve-chamber H, and exteriorly is adapted, through gearing M, to be manipulated by the rope before referred to. The pulling of the said rope in one direction opens the first valve, E, and in the opposite direction opens the second valve, I, closing the first. This opening of the valve E lets the water through the pipe C into the chamber A, and from thence the water passes into the piston-cylinder which is in communication with said chamber A and on the piston-head in said piston-cylinder. The water so passing acts through its pressure to raise the elevator-platform.

The opening of the valve I lets the water escape from the piston-head in the cylinder, which secures the fall of the elevator; and if such water be run into a tank, and a back passage through pipe J, chamber K, and clapper-valve  $g$  be provided, as above described, the piston-cylinder, under or over, as the case may be, its piston-head, can be kept always full of water, ready for the pressure of the wa-

ter to act when water is allowed to enter it, as described.

The several parts hereinbefore described in detail, neither in their construction, arrangement, nor operation, except as to the gate-valves E and I, constitute any part of this invention, and they have only been thus fully described so that what constitutes, in the main, the present invention can be the better illustrated and described, which will now be done.

$m m m m m$  are five separate passages or tubes, each leading from the water-pressure chamber A, hereinbefore referred to. These several tubes  $m$  are side by side, and they each pass from the water-pressure chamber A into a series of separate and distinct chambers,  $n n n n n$ , one chamber  $n$  for each tube  $m$ .

Each chamber  $n$  connects at  $o$  with a separate piston-cylinder, and at P, by an opening in each chamber  $n$ , with the chamber K, hereinbefore referred to. These separate openings P are each closed by a separate clapper-valve,  $r$ , arranged to open for the passage of water from the said common chamber K to the separate chambers  $n$ ; but to close against the passage of water from the said separate chambers  $n$  to the said common chamber K.

Each tube  $m$  within the common water-pressure chamber A has a similar plate or clapper valve,  $s$ , closing its opening to said chamber A; and all of these valves are hinged so as to swing upward, and, when swung in that direction, to open their respective tubes  $m$  to the common water-pressure chamber A.

For each valve  $s$  there is a cam,  $t$ , and all of these cams are on a common shaft, N, which is arranged to turn in suitable supports or bearings of the common water-pressure chamber A, and to project at one end of said chamber, where it is adapted to be turned, as will be hereinafter described. These several cams  $t$  are shaped so that as their common shaft N is turned in one direction they will lift the valves  $s$  one after the other, and so that each valve-plate lifted will remain lifted until the cam is withdrawn, and, furthermore, (provided the shaft is turned sufficiently far in that direction,) until the last valve is lifted, and then so long as that remains lifted, and as said common shaft is turned in the other or opposite direction, so that they will allow the valves to close one after the other, the last valve opened being the first closed, and the first one opened being the last to close.

On the projecting end of the shaft N is a pulley, O, connected by chain Q to the rod R of a piston-head, S, which is adapted to move within a piston cylinder or chamber, T, of its own. This piston-cylinder T communicates with the common water-pressure chamber A for the series of valves  $s$  and lifting piston-cylinders of the elevator through a pipe,  $u$ ; and the piston-head S of said cylinder T is weighted, as shown at U, which weight U is increased by additional smaller weights, according to the difference between the initial pressure and the pressure when the water is moving.



The chain Q, connecting the pulley O of valve-shaft N with the rod R of piston-head S, is continued over and partially around another pulley, V, and at its free end it is provided with a weight, as at W, like the weighing-beam of a scale.

Obviously the weight on the piston-head S from the connecting-weight W, above described, can be regulated at pleasure, of course within given limits—that is, made greater or lesser, as may be required.

The operation of the parts above described is as follows: Suppose the water-pressure available for a hydraulic elevator has an initial pressure when at rest of forty pounds to the square inch, and a pressure when moving of twenty-five pounds to the square inch, the cause of this reduction in pressure being well known and needing no explanation herein; again, suppose an elevator to be constructed to run with such water-pressure to have its initial water-piston cylinder in open and direct communication with the water-supply, when the inlet-valve E is opened, adapted to work and lift three hundred pounds and below on the elevator with the water at the initial and reduced pressure stated; now, suppose the load on the elevator exceeds the possibilities of the initial water-piston cylinder from the water-pressure at command, then come into operation the valves s for their respective water-piston cylinders of the additional cylinders of the series, either one or more of them, as the case may require, as and in a manner as will appear from the description which follows.

Obviously the elevator, being, as above stated, loaded over the lifting capabilities of the one or initial cylinder, stands still, which causes an accumulation of the water-pressure in the water-pressure and valve chamber A—that is, it causes the water-pressure in said chamber to rise above what the water has when the elevator is moving. The increased water-pressure in the said chamber A finally acts on the weighted piston-head S, the weight of which has been adjusted to a little below—say about ten pounds—the initial pressure of forty pounds of the water, and, raising such weighted piston, begins the opening of the valves, as hereinbefore described, which brings into play additional piston-cylinders, one or more, until the load starts, when the raising of said valves stops and the elevator proceeds, as desired.

The arrangement of valves s herein described is such as to secure an automatic operation of them, and one directly from the pressure of the water itself; and in this regard, obviously, it is far in advance of the mode heretofore employed for the operation of the valves by the hands of the operator or of the person running the elevator, as, plainly, it places the elevator, after once the water is let on, as ordinarily, wholly under the action of the water-pressure as to the number of cylinders required to be opened to it to do the work or labor then upon the elevator, thus secur-

ing absolute economy in the use of water, except so far as what is necessarily required to do the work on the elevator.

The weight or weights W, which are applied to the weighted piston-head, as above described, secure the rotation of the valve-shaft on the return movement of the piston-head S when the water-pressure has ceased to act on the said head; but if a rack-and-gear connection be made between the said valve-shaft and said piston-head, obviously no such weighting would be necessary for such a purpose. The arrangement described, however, is preferable, as it enables the weight of the said weighted piston-head to be the better and more easily adjusted in relation to the water-pressure available from time to time in the water-supply with which the elevator is connected, as well as being less expensive to manufacture.

The total amount of the weight which is on the weighted piston-head S, either of itself or with that of the weight on the chain-connection herein described, and that of the friction of said head and its connection with the valve-shaft N, together with the friction of the working parts of the cylinder-valves s, should equal the amount of the pressure exerted on said head when the water is running through the pressure-chamber, or, in other words, when the elevator is running under the action of the piston cylinder or cylinders. This, obviously, maintains the weighted piston-head in a stationary position while the elevator is running; but it insures its rising on any increase of the water-pressure beyond the running pressure of the water from loading the elevator over the power of the piston-cylinder or piston-cylinders then open or working, which rising of the weighted piston-head secures the further opening of the remaining piston-cylinders, either one or more, as has been described, until the water again runs, or, in other words, until the elevator moves, when the weighted piston-head again stands still, and so on, as is obvious without further description.

The arrangement of valves s herein described, obviously, is not limited as to number, whether more or less; and, again, it is plain that the principle involved in their working, as herein described, may be carried out or secured in other ways than that herein particularly explained—as, for instance, by having the several piston-cylinders of the series in communication side by side, but by a separate passage for each, with a common water-pressure chamber, which chamber of itself constitutes the chamber for the movement of the weighted piston-head, and in which said piston-head is so arranged relatively to said communicating passages for the series of piston-cylinders that its movement along the said chamber in the one direction secures the opening of said communicating passages, one after the other, and in the other direction secures the closing of said communicating passages, one after the other, the first opened being the last closed, and vice versa.



Such a construction and arrangement of parts have been devised by me, and it is my intention to protect the same by separate application for Letters Patent, they being only referred to herein, as above, simply as an illustration of how the present invention may be carried out under another form of construction in detail, but which in substance is the invention herein described and represented.

It is obvious that this invention, although herein particularly described in connection with hydraulic elevators, may be used in connection with other hydraulic-power apparatus.

All the working piston-cylinders, when not open to the initial water-pressure, are filled with water from the tank through the chamber K and the passages P, having the clapper-valves *r*, which open from the chamber K to each of said piston-cylinders the same as described for that one of the working piston-cylinders which is the first to operate, and this filling of such cylinders with water is for the same purpose as that stated for the said first-operating piston-cylinder.

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

1. In a hydraulic elevator, or other hydraulic apparatus, having a series of lifting or working piston-cylinders, a series of valves or ports for said cylinders and a weighted piston-head which moves in a cylinder or chamber in communication with the water-pressure

opened to the piston-cylinders, and arranged relatively to said valves or ports to open and close the same, all substantially as described, for the purpose specified.

2. In a hydraulic elevator, or other hydraulic apparatus, having a series of lifting or working piston-cylinders, a series of valves for said cylinders arranged to open and close, and to be acted upon by the forward and backward travel of a weighted piston-head moving in a cylinder or chamber in communication with the water-pressure opened to the piston-cylinder, substantially as and for the purpose described.

3. In a hydraulic elevator, or other hydraulic apparatus, having a series of lifting or working piston-cylinders, a series of valves, *s*, for said cylinders, arranged to open and close, and to be operated by cams *t* on a shaft which is rotated by the forward and backward travel of a weighted piston-head moving in a cylinder or chamber in communication with the water-pressure opened to the piston-cylinders, substantially as and for the purpose specified.

4. The combination, with a weighted piston-head, U, arranged and used for the purpose substantially as herein described, of the chain Q, pulley V, and weight W, arranged in relation to said head, substantially as and for the purpose specified.

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Witnesses:

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