(No Model.) 5 Sheets—Sheet 1.

C. W. BALDWIN.

HYDRAULIC ELEVATOR.

No. 248,908. Patented Nov. 1, 1881.

Fig. 2.

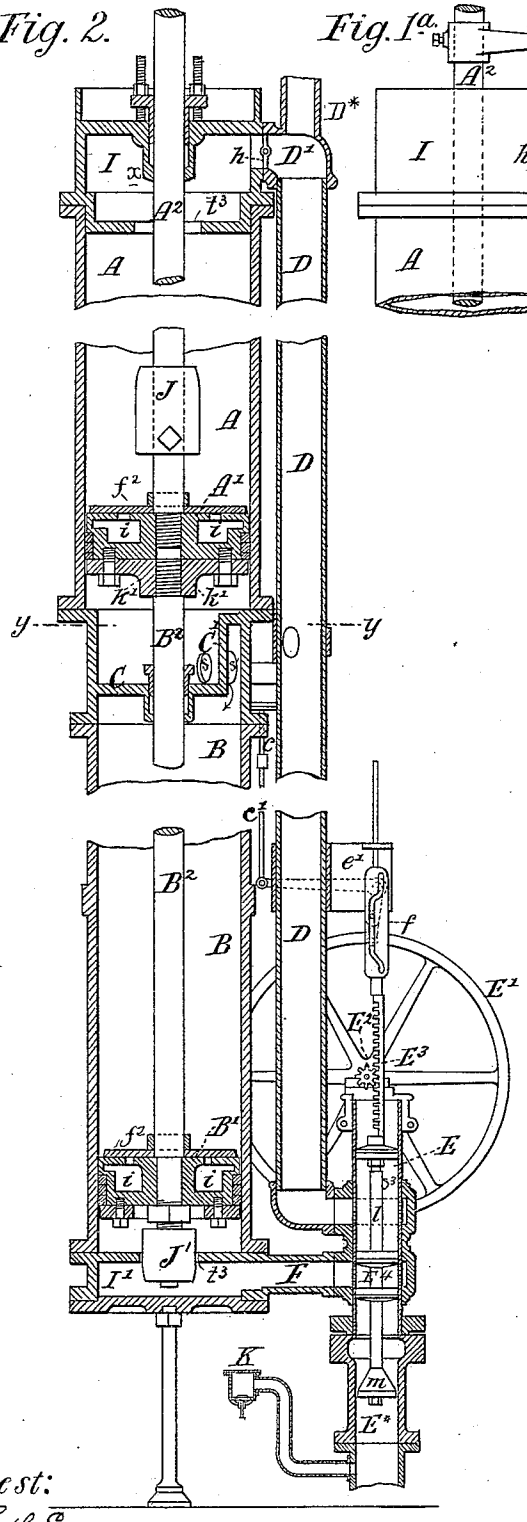
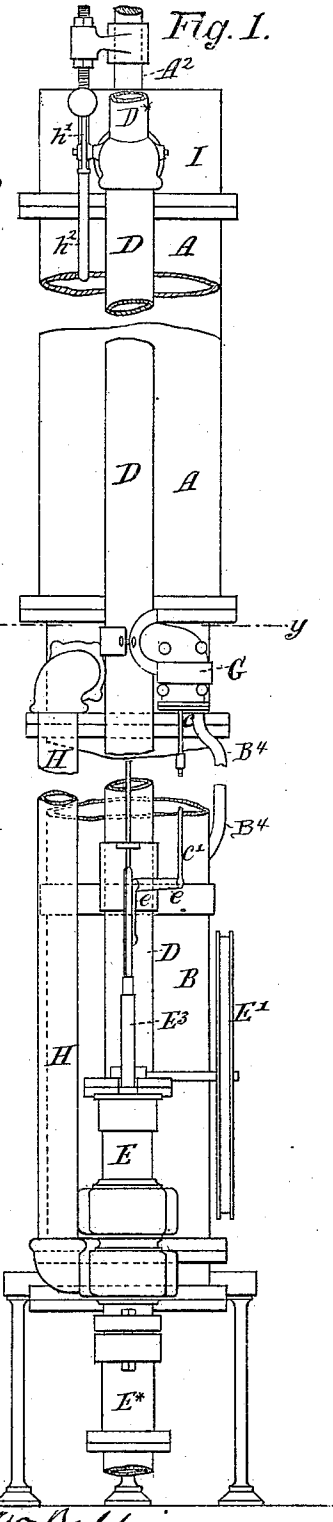


Fig. 1ª.

Fig. 1.



Attest:
Jas. L. Ewin
William Paxton.

C. W. Baldwin
By his atty Chas. F. Foster

(No Model.) 5 Sheets—Sheet 2.

C. W. BALDWIN.

HYDRAULIC ELEVATOR.

No. 248,908. Patented Nov. 1, 1881.

Fig. 3.

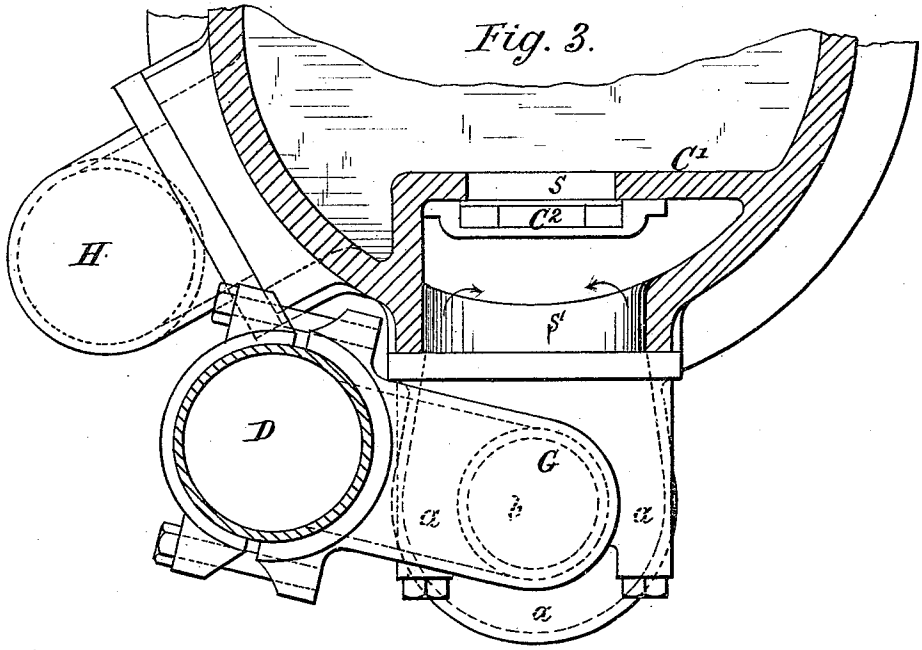
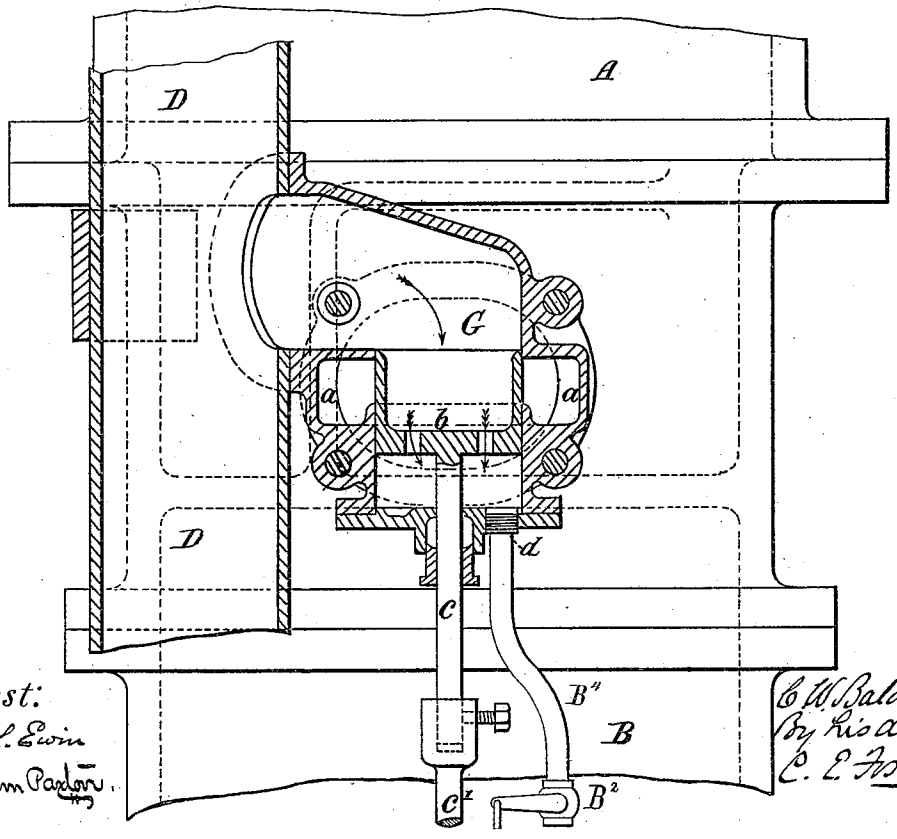


Fig. 4.



Attest:
Fa. L. Ewin
William Parker

C. W. Baldwin
By his atty
C. E. Foster

(No Model.) 5 Sheets—Sheet 3.

C. W. BALDWIN.

HYDRAULIC ELEVATOR.

No. 248,908. Patented Nov. 1, 1881.

Fig. 5.

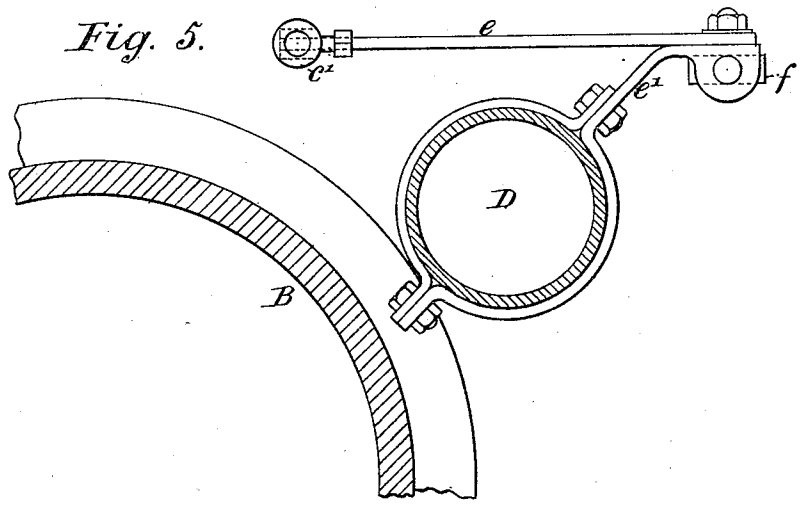
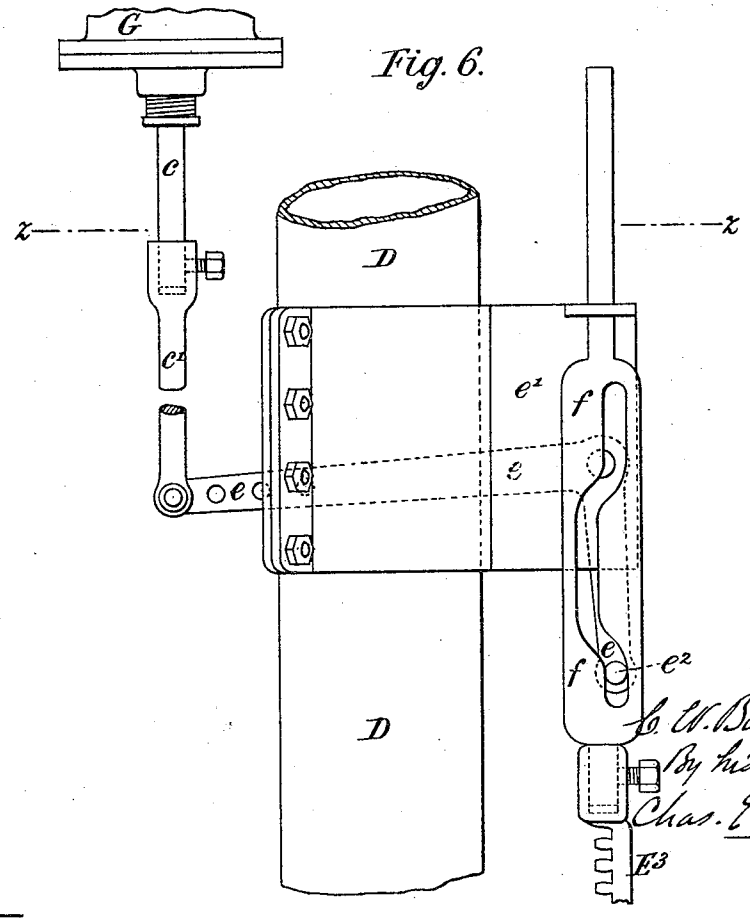


Fig. 6.



C. W. Baldwin
By his atty
Chas. E. Foster

Attest:
Chas. L. Ewen
William Paxton

(No Model.)

5 Sheets—Sheet 4.

C. W. BALDWIN.

HYDRAULIC ELEVATOR.

No. 248,908. Patented Nov. 1, 1881.

Fig. 7

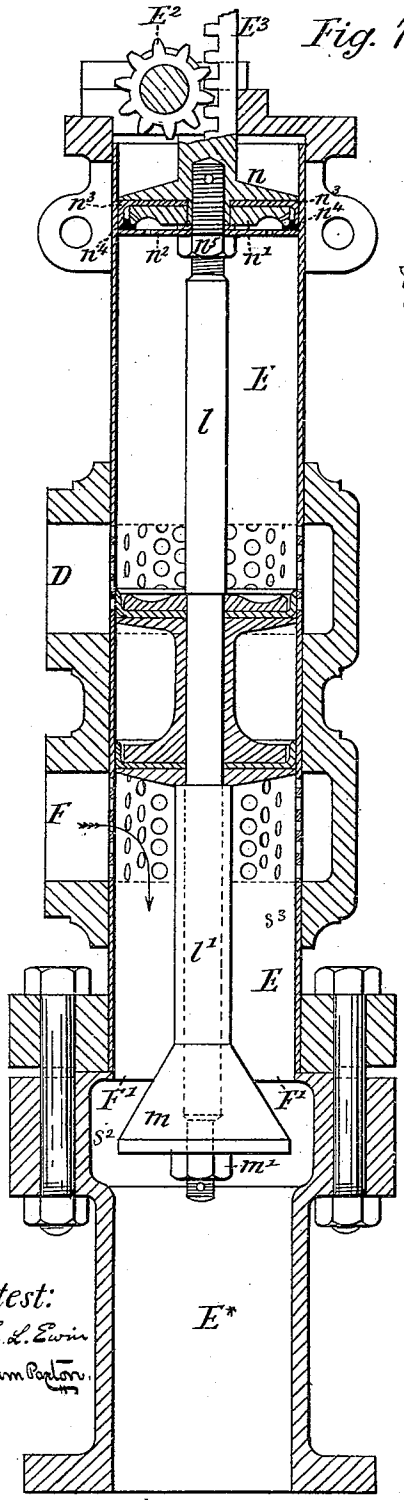


Fig. 7a.

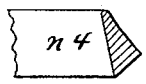
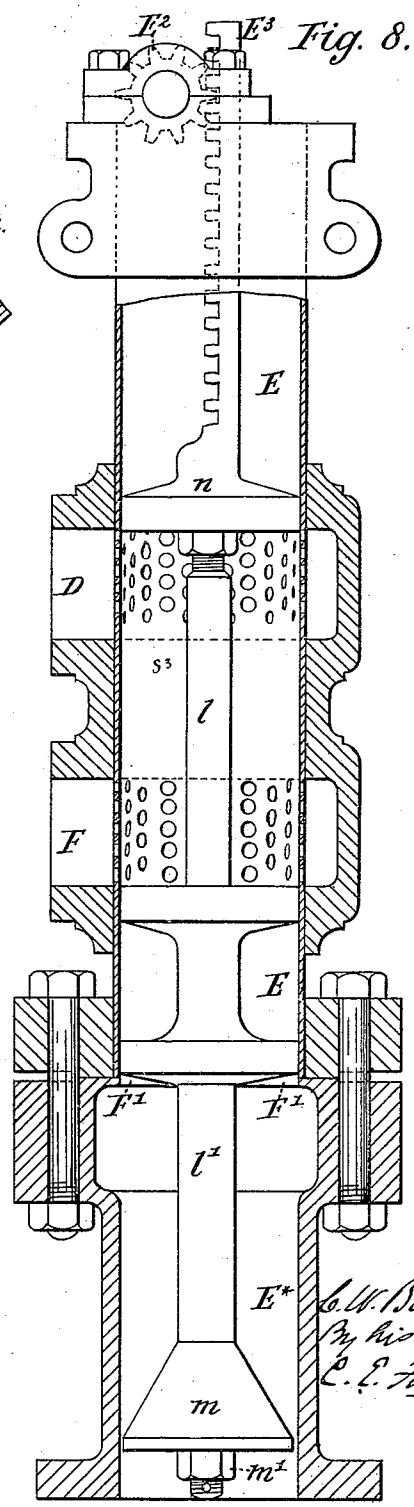


Fig. 8.



Attest:
Jas. L. Ewin
William Baxton.

C. W. Baldwin
By his atty
C. E. Foster

(No Model.) 5 Sheets—Sheet 5.

C. W. BALDWIN.

HYDRAULIC ELEVATOR.

No. 248,908. Patented Nov. 1, 1881.

Fig. 9.

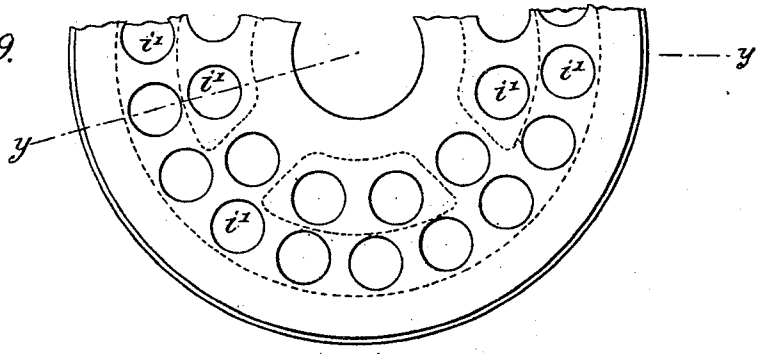


Fig. 10.

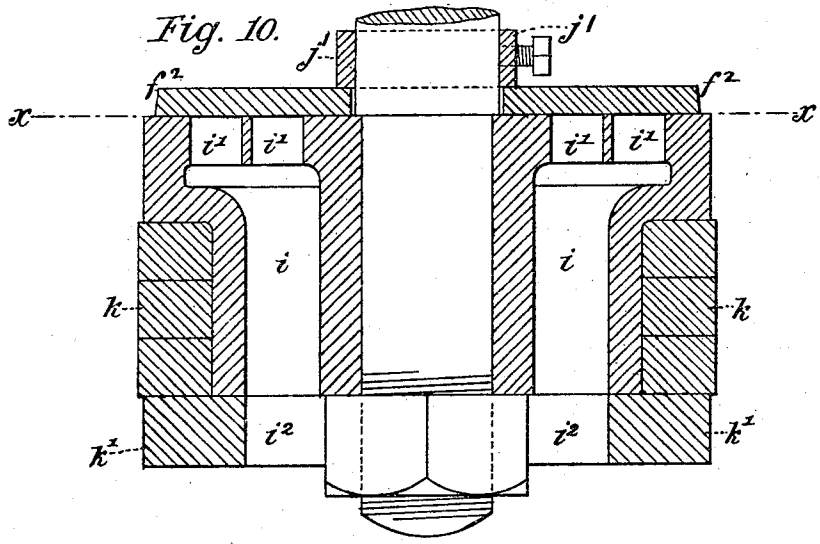
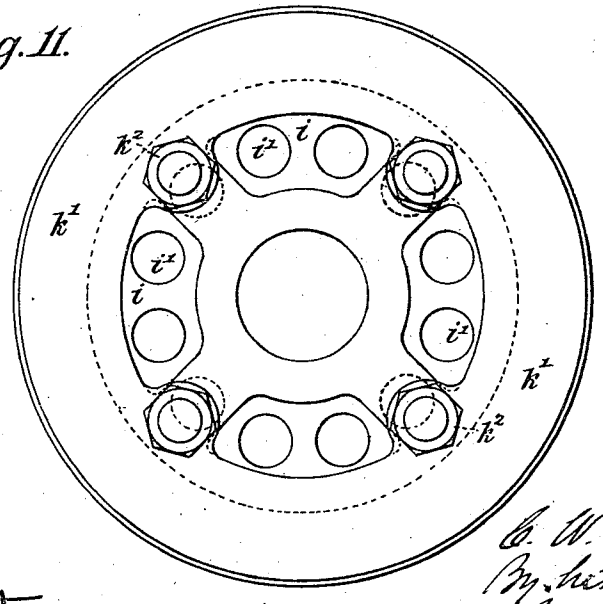


Fig. 11.



Attest:
Jas. L. Ewin
William Paxton.

C. W. Baldwin
By his attorney
Charles E. Foster

UNITED STATES PATENT OFFICE.

CYRUS W. BALDWIN, OF LONDON, ENGLAND.

HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 248,908, dated November 1, 1881.

Application filed March 19, 1880. (No model.)

To all whom it may concern:

Be it known that I, CYRUS W. BALDWIN, a citizen of the United States, now residing in London, England, have invented certain new and useful Improvements in Hydraulic Elevators, of which the following is a full, clear, and exact description.

My invention relates to that class of hoisting-engines in which an inelastic fluid under pressure acts upon and imparts movement to one or more pistons, the object of my invention being to remedy difficulties incident to such engines as heretofore constructed, render the apparatus less complex, facilitate the operation and manipulation, and prevent injury resulting from the sudden stoppage of the outlet, as well as prevent said outlet from being fully closed until the speed of the piston is reduced.

In the drawings forming part of this specification, Figure 1 is an elevation showing a vertical apparatus embodying my invention. Fig. 1ª is a detached side view; Fig. 2, a sectional elevation; Fig. 3, a transverse section on the line *y y*, Fig. 1; Fig. 4, an elevation of the parts shown in Fig. 3, partly in section; Fig. 5, a part section on the line *y y*, Fig. 2; Fig. 6, a side elevation of the parts shown in Fig. 5 and adjuncts; Figs. 7 and 8, section elevations of the valve-chest and valves, showing the valves in different positions; Fig. 7ª, a detached view of part of the packing-ring; Fig. 9, a part plan of one of the pistons; Fig. 10, a sectional elevation of a piston; Fig. 11, an inverted plan of the piston. The views 4 to 11 are drawn to an enlarged scale.

In many of its general features the apparatus shown is similar to that for which Letters Patent of the United States were granted to me on the 2d day of April, 1878.

A and B are two cylinders, which may be horizontal, but are shown in the drawings as placed one above the other, and containing a piston, A′ B′, and piston-rod A^2 B^2. The two pistons A′ B′ are connected together in any suitable manner, and the piston-rod A^2 is connected with the car in the manner described in the specification of the patent above referred to or otherwise. The cylinders A and B are separated by a partition, a part, C, of which is horizontal or transverse, and a part, C′, vertical or longitudinal. The part C carries a stuffing box for the piston-rod B^2, and in the part C′ is made an opening, *s*, which forms the only direct means of communication between the cylinders A and B. This opening is closed by an ordinary clack-valve, C^2, Fig. 3, which, when there is no pressure of water in the cylinder B, is free to open or close; but when the water under pressure is turned on the valve will fall naturally to its seat, thereby obviating the objections to the use of spring-valves, which are apt to get out of order, and which must necessarily be employed when the valve-seat is horizontal.

D is the supply-pipe, in connection at D^x with a cistern or the city mains or reservoir, containing an inelastic fluid under pressure, and opening at its upper end into the cylinder A, and at its lower end into the valve-chest E.

F is the discharge-pipe from the cylinder B into the valve-chamber s^3. The valve-chest E contains a stopping and starting valve, E^4, (shown as a series of disk-valves,) the construction and working of which is fully described in the specification of my aforesaid patent and other patents granted to me.

E′ is a pulley suitably mounted, and round which passes the endless cord for stopping and starting the apparatus. This cord passes through the car and round a pulley on the upper part of the lift-framing, and is worked by the attendant in the car. On the axle of the pulley E′ is a pinion, E^2, which gears with a rack, E^3, attached to the stem of the disk-valves, and by which they are worked.

I take the supply of water for the cylinder B direct from the supply-pipe D, the connection being provided with a cut-off valve, *b*, to be hereinafter described.

The discharge-passage from the upper cylinder, which in the former patented machine was made in the walls of the lower cylinder I dispense with, and in place thereof I employ an external pipe, H, which I connect at its upper end in any convenient manner to the cylinder A, and at its lower end with the discharge-passage F of the cylinder B. By thus arranging these passages I am enabled to simplify the construction both of the lower cylinder, B, and the valve-chest E, as in the latter I dispense with one of the openings into

the valve-chamber and reduce the throw of the valve.

The supply-opening in the cylinder A and the discharge-passage in the cylinder B are so arranged that should any accident occur to the apparatus, the discharge of the water from one or other of these openings will be partially stopped, and a cushion of water will be formed in one case above the piston A, and in the other case below the piston B, which will prevent the pistons striking against the cylinder ends. To this end the cylinder-head consists of a circular box or casing, I, through which the piston-rod A^2 passes. The top of the box I is provided with a stuffing-box for the piston-rod, and in the bottom of the box I is one or more circular openings, t^3, to receive corresponding plugs, J, of somewhat less diameter, and mounted in any convenient manner adjustably on the piston-rod A^2, immediately above the piston. The supply-pipe D communicates with the box I. The bottom end of the cylinder B is closed by a similar hollow head or casing, I′. In this case, however, no stuffing-box is required when the piston does not descend through it, and the circular opening is made in the top of the box I′ to receive a circular plug, J′, also of less diameter than the opening I′, and secured in any convenient manner adjustably, if desired, to the under side of the piston B′. The discharge-passage F communicates with this box.

It will be seen that should the piston A′, from any accidental cause, rise to the top of the cylinder A, so that the plug J enters the opening in the bottom of the box I, the discharge of water from the top of the cylinder A will be partially (and gradually if the plug is tapering) cut off, and the working of the apparatus will be retarded, while the striking of the piston against the cylinder end will be prevented by the cushion of water which will be formed in the cylinder above the piston. In like manner the plug J′, entering the opening in the box I′, will gradually and partially close the discharge of water from the bottom of the cylinder B with results similar to those indicated above.

I would here remark that when in ordinary work it is not proposed that the piston shall rise or fall to such an extent as to cause the plugs J or J′ to enter the openings in their respective boxes I and I′.

G is a hollow casting or conduit and valve-case, which is bolted or otherwise secured to the supply-pipe D and the cylinder B. In the sides of this casting is formed an annular passage, *a*, which communicates at one side with the inlet-port *s′*, closed by a piston-valve or other valve, *b*, mounted on a piston-rod, *c*, which may be worked either by hydraulic power or mechanically from the valve-stem *l*. When hydraulic power is to be employed for working this piston the piston-rod *c*, which projects through a suitable stuffing-box, may be connected to a suitably-placed counterweighted rocking arm, the object of which is to always maintain the piston *b* at its highest position and close the opening into the passage *a*. (See Fig. 4.) A pipe, B^4, in connection with the discharge-passage F, communicates with the valve-case G at *d*, and is provided with a cock, B^2, which is opened and closed in any convenient manner from the valve-stem *l* or otherwise. When the cock is opened the water in the pipe and under the piston *b* will escape into the discharge F, and the pressure of the supply-water from the pipe D will force down the piston *b* and open the passage *a*, thereby allowing water to flow into the top of the cylinder B.

To prevent the too sudden descent of the piston *b* when the pressure is exerted on its upper surface, I make two or more holes in the piston, which will allow some of the water to pass through to the under side, and thus form a temporary cushion before it escapes down the pipe into the discharge F. When the cock is closed the water will continue to flow through the openings in the piston until the pipe is full, when the column of water in the pipe will neutralize the pressure of the water on the piston *b*, which will be caused to rise into the position shown at Fig. 4 by the action of the counterweight.

When mechanical means are to be employed for opening the passage *a*, I connect the piston-rod *c* by means of a link-rod, *c′*, to one arm of a bell-crank lever, *e*, which is pivoted to a bracket, *e′*, carried by the supply-pipe D. (See Figs. 1, 2, 5, and 6.) The other arm of this lever *e* is provided with a pin or stud, e^2, which works in a slotted plate, *f*, attached to the rack E^3 of the spindle *l*. When the pin e^2 is in the position shown at Fig. 2 the piston-valve *b* will be raised, and the opening *a* will be closed, as seen at Fig. 4; but when, through the rising or falling of the plate *f*, the pin e^2 is brought past either of the inclined portions to the ends of the slot (into the position shown at Fig. 6, for instance) the lever *e* will be rocked on its center and depress the rod *c*, which will, in turn, draw down the piston *b* and open the passage *a*.

The slot in the plate *f* is so arranged that the supply of water under pressure to the cylinder B shall be cut off while the discharge-opening F is closed. The central portion of said slot is of such length that the ordinary movements of the spindle *l* to open and close the ports of the cylinder A may be effected without any movement of the lever *e* and valve *b;* but by a slightly-increased movement in either direction the valve *b* may be lowered either to admit the motor fluid upon the piston B′ to increase the power, or to open communication with the pipe D, when the pistons rise, to facilitate the descent of the load. The like result may be secured by a nut traveling on a shaft and striking the lever *e* or by other means. As an additional precaution, the supply-opening D′ to the cylinder A may be partially closed as the piston A′ nears the bottom of its cylinder. This may be effected, among other ar-

rangements, by a butterfly-valve, h, the stem of which projects through the walls of the casting and carries at its outer end a counter-weighted finger, h'. The valve h is closed by a rod, h^2, (secured in any convenient manner to and descending with the piston-rod A^2,) striking against the end of the finger h', which rocks the valve on its center and brings it into the position shown at Fig. 2, the finger assuming the position shown at Fig. 1^a. As the rod h^2 ascends with the piston-rod A^2 it will allow the valve h to open by the action of the counterweight.

To stop the ascent of the car, the discharge F is closed, and as there will then be no exit for the water from below the pistons, the pressure of water above the pistons will be neutralized, and the working of the apparatus will be necessarily arrested. The too-sudden closing, however, of this discharge F will cause a shock or jerk to the car when stopping, and will also tend to strain considerably the parts of the apparatus. As a means of preventing these shocks or jerks, which are most detrimental in this class of machinery, I employ a valve so formed and arranged as to throttle to a great extent the discharge-opening F′ from the valve-chamber s^3. This arrangement is shown in Fig. 2 and in the enlarged sectional views at Figs. 7 and 8. The bottom of the valve-chamber being open when the valves are raised into the position shown at Fig. 7, a free discharge of the water from both cylinders, A B, when both are working, through the passage F takes place. When only one cylinder is working, which is generally the case with a light load, a portion only of the water from cylinder A is discharged through pipe H and discharge-passage F, the remainder passing through the clack valve C^2 into cylinder B above the piston B′.

The valve-stem l, I prolong to receive a conical valve, m, which is held in the required position between a sleeve, l', on the stem l and a nut, m', screwed on the end thereof. The diameter of the valve m will depend upon the amount of throttle it is desired to give to the discharge, but in all cases it must be somewhat less than that of the passage F. The conical valve works in a prolongation of the valve-chamber E, an enlargement, s^2, being made therein to allow full space for the flow of the discharge-water around the valve m. The diameter of this enlargement should be such that when the valve m is in the enlargement (see Fig. 7) the area of the annular space round the base of the cone shall be equal to the area of the opening F′ of the discharge-port F. (See Figs. 2 and 8.)

It will be seen, on referring to the respective figures, that the disk and conical valves are shown in three positions. In Fig. 7 the position shown would be that assumed by the valves when the car is ascending with both cylinders working, the discharge-passage F from the bottom of both cylinders, A B, being open. In Fig. 2 this discharge is closed by lowering the valves, and the car is thus arrested in its descent. While in Fig. 8 the supply D is in connection with the discharge-passage F, the valves h and b being also open, the pressure of the water is equalized on both sides of the piston, and the car will thus descend by its own weight, the water above the piston A′ being forced out of the cylinder A at D′ into the supply-pipe D, and thence through the valve-chest E into the discharge F, and up the pipe H into the cylinder A, below its piston A′. In like manner the water above piston B′ is forced out through the valve b into the supply-pipe D, whence it passes through the valve-chest E and discharge F into the cylinder B, below its piston B′.

The stopping of the car in its descent is effected by raising the valves into the position shown at Fig. 2, when the connection between the passages D and F will be broken at the same time that the discharge-passage F is closed. The valve m, as it descends with the disk-valves, will gradually lessen the area of the discharge-space round the base of the cone until it enters the port E*, from which point the discharge space will remain the same, and the speed of the outflow of the discharge-water will be correspondingly diminished. By this time the disk-valve will have descended only about one-third of the depth of the discharge-opening F, and so long as any portion, however small, of the discharge F remains open, the outflow of the discharge-water will continue, but its speed will be diminished so gradually that the final closing of the opening F will be hardly perceived.

The valve m may form a prolongation of the lower disk-valve, and may be of any form serving to gradually diminish the flow of the discharge-water before it can be wholly cut off.

I perforate the pistons A′ and B′ to allow the water under any momentary unusual pressure to pass through them from below to above the pistons.

The manner in which I construct my pistons is shown in detail, on an enlarged scale, at Figs. 9, 10, and 11. In these figures the piston is formed with an annular passage, i, therein. A number of circular openings are made through the upper face of the piston, to communicate with the passage i, and a series of enlarged openings, i^2, are made in the under side of the piston, also to communicate with the passage i. The openings i', as well as the upper face of the piston, are covered by a disk-valve, f^2, of india-rubber, or of other suitable material, which is secured to the piston by the collar j' and clamping-screw. k is the packing, which is held in place by the ring k', secured to the under side of the piston by the screws k^2.

Any unusual pressure of the water on the under side of the piston, whether produced by the closing of the discharge F during the rapid descent of the piston, or by any other cause, will cause the valve f^2 to rise and allow some of the water below it to pass upward into the space above it until the pressure below is reduced, when the descent of the piston will be arrested and the ascending car stopped.

Sometimes it may be necessary, and perhaps desirable, to connect the discharge-port of the valve-case E with a tank or reservoir to receive the discharge-water. In this case the closing of the discharge would cause a back rush of the discharge-water and a consequent hammering on the conical and disk valves. To prevent this I employ a relief-valve, K, (see Fig. 2,) which may consist of an ordinary clack-valve opening inward, inclosed in a suitable valve-box communicating with the conical-valve chamber by a short pipe.

The operation of this valve is as follows: The rushing out of the water will tend to cause a vacuum to form behind it and below the valves, and will cause the valve K to open and admit a sufficient quantity of air to fill the vacuum and form a cushion to prevent hammering or shock from the back rush of the water.

As it is very important that the top valve of the series of disk-valves shall not leak, I construct this valve as shown at Fig. 7—that is, I form the valve of three disks, n n' n^2, two of which, n and n^2, are of the same diameter, or nearly so, as the valve-chamber s^3, while the disk n' is of less diameter. The disk n is secured in any convenient manner to the valve-stem l, and between the disks n and n', I place a disk of leather or other suitable material, n^3, the diameter of which shall be such that when the disk is placed in the valve-chamber its edges shall turn down and present a flat surface to the sides of the valve-chamber E, constituting a cup-leather packing. The edges of the leather disk n^3 are kept constantly in contact with the cylinder E by a ring, n^4, preferably of india-rubber, and triangular-shaped in cross-section. (See Fig. 7ª.) The apex of this triangle is inserted between the periphery of the disk n' and the flange of the leather disk n^3, and the ring is supported in position by the disk n^2, which rests on the nut n^5, screwed on the valve-stem l.

Holes are made in the disks n' n^2, to allow water to pass into the space between the edge of disk n^2 and the rubber disk n^4, the object being to prevent a vacuum being formed in the space, which would tend to draw the flat part of the rubber away from the valve-cylinder E. As the disk n^3 wears away, it is only necessary to screw up the nut n^5, when the ring n^4 will be caused to press outward the edges of the leather or other disk n^3, and thus maintain the disk-valve water-tight.

While I have shown the valve-chest E with its ports communicating with the pipe D leading to two cylinders, the same arrangement of chest, parts, and valve is applicable, as are other features of my invention, where but a single cylinder is used.

It will be obvious that various valve-operating appliances may be employed in connection with the valves herein described; that the forms of the valves may be changed; that various appliances may be used for manipulating them from the cage or from various parts of the apparatus; and that the structure of the different parts of the apparatus may be varied according to the circumstances under which it must be employed, and yet retain the features which constitute my improvements.

I do not here claim the perforated valve b combined with the pipe leading from below the valve and its cock, as this may constitute the subject of a separate application for Letters Patent.

I claim—

1. The contiguous cylinders A B, their pistons and ports, and the intermediate partition having a longitudinal part, C′, with an opening and a self-closing valve arranged vertically, substantially as set forth.

2. The combination of the cylinders A B and the valve-chest E, communicating with both cylinders through two ports only, the communication with the ends farthest from the chest being through one port and the pipe D, and with the ends nearest the chest through the other port and the passage F and pipe H, substantially as set forth.

3. The combination, with the cylinder having a port, D′, of a valve, h, arm h^2, and appliances on the piston-rod whereby the valve is closed as the piston approaches the end of the cylinder, substantially as set forth.

4. The combination, with the contiguous cylinders A B and their pistons, each receiving water upon both sides, of the pipe or passage D, communicating with each cylinder near one end, and provided with a valve, b, controlling the passage to the cylinder B, and with appliances for actuating said valve, substantially as set forth.

5. The combination, with the valve b and valve-chest E and its valves E^4 and valve-operating appliances, of devices whereby the valve b is moved as the movement of the valves E^4 is completed, substantially as set forth.

6. The combination, with the valves E^4 and operating appliances, and with the valve b, of devices whereby said valve b is operated by continuing the movement of the appliances for operating the valves E^4, substantially as set forth.

7. The combination of the valves E^4, stem l, plate f, slotted, as described, lever e, and valve b, connected to said lever, substantially as set forth.

8. The combination, with the valve-stem l, of the plate n, perforated plates n' n^2, packing n^3, and ring n^4, substantially as set forth.

9. The combination, with the valves E^4 and chest E, of a supplementary valve, m, arranged to partially close the outlet-port before the discharge-port is fully closed, for the purpose set forth.

10. In an elevator having a closed cylinder, piston, and piston-rod, the combination, with the head of the operating-cylinder, of one or more openings through which the water passes from or to the port, and projections carried by the piston or piston-rod and arranged to partially close said openings as the piston completes its stroke, substantially as set forth.

11. In an elevator having a closed cylinder, piston, and piston-rod, the combination, with a cylinder, of a chest, I, forming the head, communicating with the outlet-port, and having an opening, t^3, adapted to a plug, J, carried with the piston, substantially as set forth.

12. The piston having ports and provided with a relief valve, in combination with the cylinder, its inlet and outlet passages, and valve for closing the latter, substantially as set forth.

13. The combination of the discharge-pipe leading from the valve-chest E, of a hydraulic elevator and an inlet-valve K, substantially as set forth.

CYRUS W. BALDWIN.

Witnesses:
A. STANDING,
WM. A. TALCOTT.