(No Model.) 2 Sheets—Sheet 1.

C. I. HALL.

HYDRAULIC ELEVATOR VALVE.

No. 463,042. Patented Nov. 10, 1891.

Fig. 3.

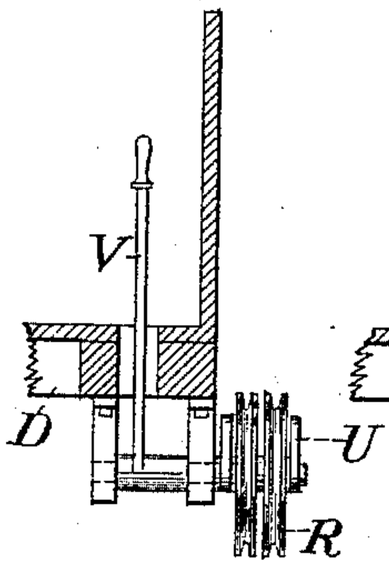
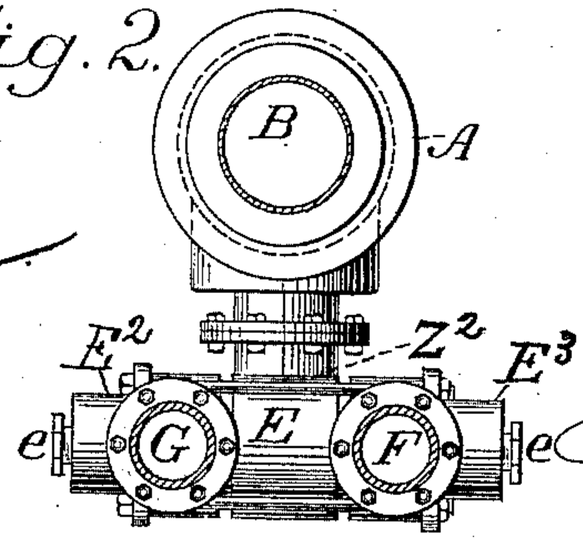


Fig. 1.

Fig. 2.



Witnesses:

E. A. Brandau

W. D. Bentley

Inventor:

Clifford I. Hall

By his Atty

John Richards

(No Model.) 2 Sheets—Sheet 2.

C. I. HALL.

HYDRAULIC ELEVATOR VALVE.

No. 463,042. Patented Nov. 10, 1891.

Fig. 4.

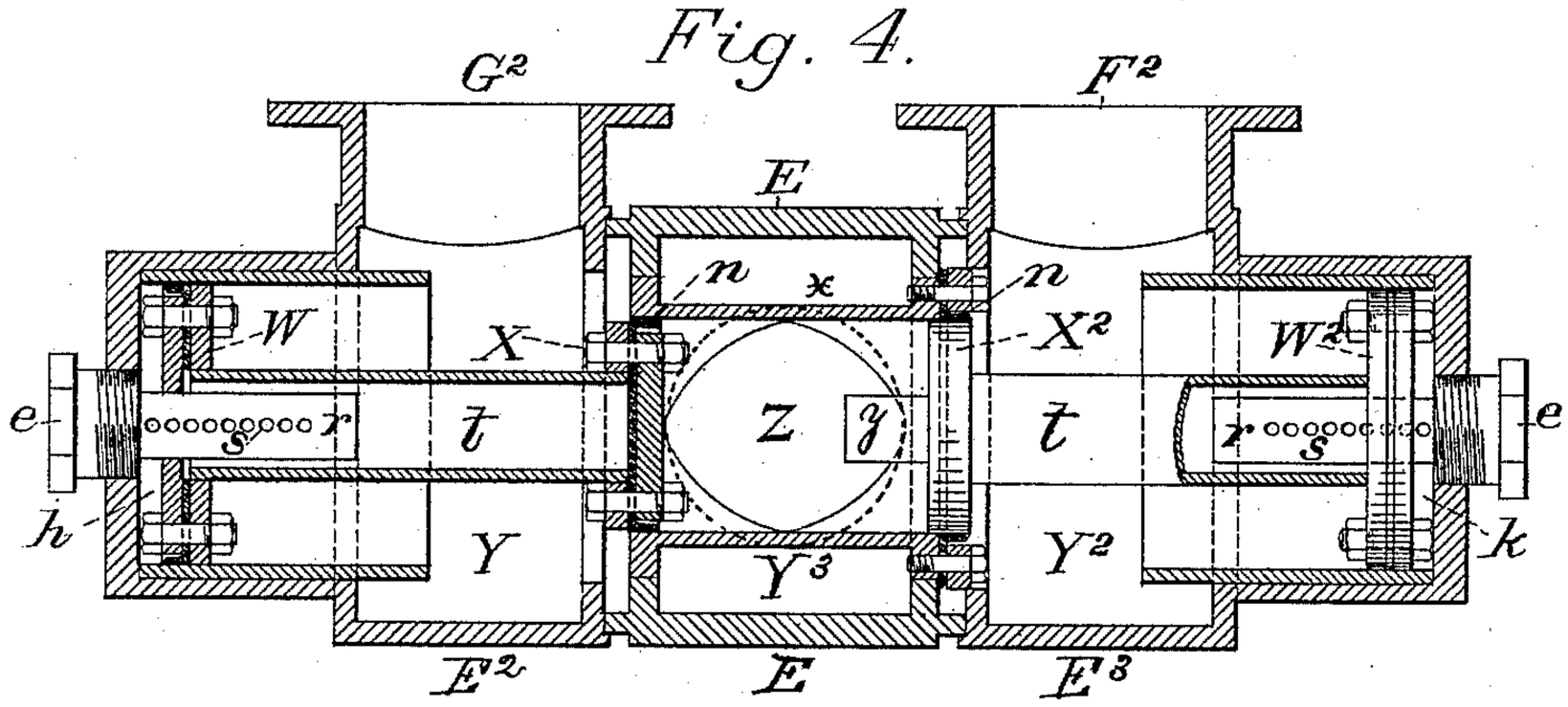


Fig. 5.

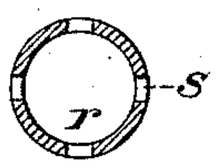


Fig. 6.

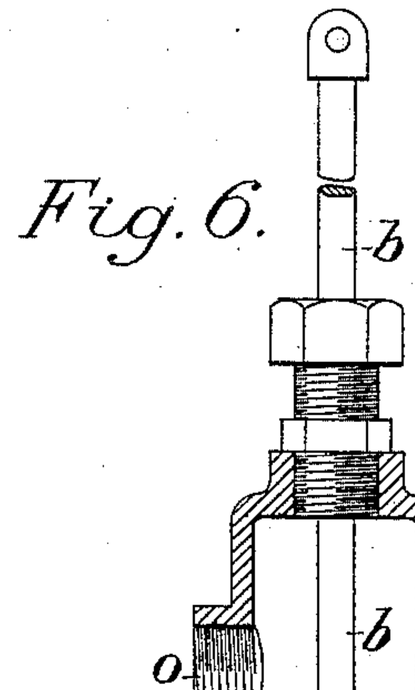
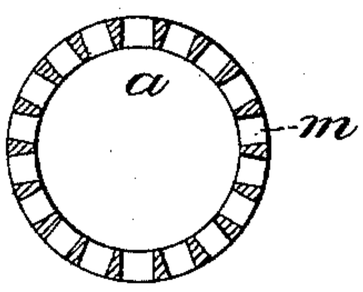
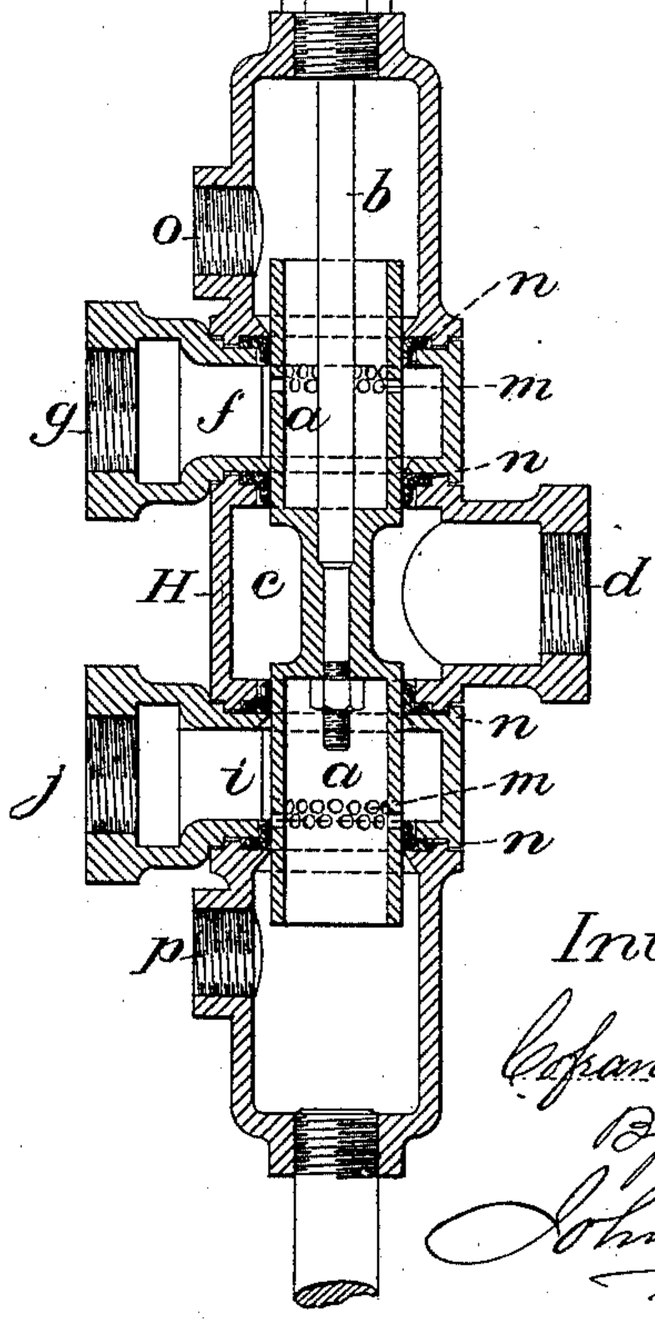


Fig. 7.





Witnesses:

E. A. Brandau.

W. D. Bentley Jr.

Inventor:

Chas. I. Hall

By his Atty

John Richards

UNITED STATES PATENT OFFICE.

COFRAN I. HALL, OF SAN FRANCISCO, CALIFORNIA.

HYDRAULIC-ELEVATOR VALVE.

SPECIFICATION forming part of Letters Patent No. 463,042, dated November 10, 1891.

Application filed July 21, 1890. Serial No. 359,451. (No model.)

To all whom it may concern:

Be it known that I, COFRAN I. HALL, of the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Hydraulic Elevators; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the drawings accompanying and forming part of this specification.

My invention relates, mainly, to the valves for controlling the movements of hydraulic elevators, and to the method of constructing and operating the same, so as to secure proper admission and release of the water.

It consists of main inlet and outlet valves inclosed in connected or separate chambers, each valve operating automatically and independently of the other by means of water-pressure and without mechanical connections or control.

It also consists in an auxiliary distributing valve for operating the main valves, constructed with two inlet and two outlet passages, both inlet-passages to be closed and both outlet-passages to be open when the valve is in the center of its stroke.

My invention also includes the employment of cup-leather packings for the valves, so arranged as not to be forced out of shape by the pressure of the water, and thus guard against their being abraded or torn by the pistons. It also includes the employment of perforated inlet-tubes for causing a gradual supply of water to the main valve and regulating its movement, and in various mechanical details required to apply my improvements, as will be more fully explained in connection with the drawings.

Figure 1 is an elevation of one of my improved hydraulic elevators with its various parts connected. Fig. 2 is a transverse section on line *a b* of Fig. 1, showing the position of the main valve and ram. Fig. 3 is a detail showing the mechanism employed in operating the valves from the cage of the elevator. Fig. 4 is a longitudinal section through the main valve. Fig. 5 is a detail of Fig. 4. Fig. 6 is a central vertical section through the auxiliary valve, which distributes water to the main one. Fig. 7 is a detail of Fig. 6.

Similar letters of reference indicate corresponding parts of the different figures.

Referring to the drawings, A is the cylinder, and B the ram or piston, of a direct-acting elevator, and D a section of the floor of a cage for passengers or goods.

At E is the main valve that controls the admission and escape of water from A.

F is the supply-pipe containing water under pressure, and G the exhaust or waste pipe through which the water escapes after acting on the ram B and during the descent of the cage.

At H is shown an auxiliary valve for moving and controlling the main one at E by means of direct water-pressure, the supply passing from F through the pipe I and other connections, as will be hereinafter explained. The movement of the auxiliary valve at H permits the pressure to act on either end of the main valves at E by means of the two pipes J and K, connecting to the ends of the casing or chamber E at *e* and *e*, as shown. The waste-water from the ends of the valve at H, after performing its functions there, escapes through the pipes L, M, and O into the main waste-pipe G. The construction of these valves will be explained in connection with enlarged detail views to be referred to in future. The auxiliary valve at H is operated by the lever P, which is in turn moved by the cords Q and Q^2, attached to the ends of P, as shown. The cord Q passes over an idle-pulley R, under a pulley R^2, thence up to the idler-pulleys S, and is attached to the weight T. The other cord Q^2 passes similarly in an opposite direction, first over R^2, then under R, and so on to the weight T, the same as cord Q. The idle-pulleys R and R^2 are supported on a swing-frame U, controlled by the lever V, and are mounted on and travel with the platform D, as shown in Figs. 1 and 3. As the platform D moves up or down no lineal movement of the cords Q and Q^2 takes place, unless the lever V is moved to the right or left. Then such movement acts on these cords and on the lever P the same as if the cage D was standing still, thus giving control of the valve at H in all positions and movements of the cage.

Referring next to the operation of the valves

and machinery, the auxiliary valve *a* (shown in Fig. 6) is moved up or down by the stem *b*, which is attached to the lever P, Fig. 1, as before explained. The chamber *c* is all the time filled with water under pressure, entering at *d* from the pipes F and I. If the valve *a* is raised, the water from *c* flows into the chamber *f* and out at *g* into the pipe K, and thence to the chamber *h*, Fig. 4, acting on the piston W. If the valve *a* is depressed, then water flows from *c* into the chamber *i* and out at *j*, through the pipe J, into the chamber *k*, acting on the piston W^2, Fig. 4. When the valve *a* is brought to a central position, as shown in Fig. 6, both chambers *h* and *k* of Fig. 4 are in communication with the waste-pipes by means of the perforations *m* and through pipes L and M, so the pistons W and W^2, with the valves X and X^2, assume automatically the position shown in Fig. 4.

Referring to Fig. 4, the main shell or casing E is composed of three sections E^1, E^2, and E^3, held together by bolts, as shown in Figs. 1 and 2. This shell may consist of two parts containing independently the induction and eduction valves X and X^2, with their pistons W and W^2; but the construction shown is preferable. On the two end sections E^2 and E^3 are formed inlet and waste nozzles F^2 and G^2, and on the central one E a nipple Z^2, connecting with the cylinder A, as seen in the plan, Fig. 2.

The central section E is fitted with a shell or bush *x*, in which move the valves or pistons X and X^2. This shell *x* has two outlets of oblong form, as shown in Fig. 4, communicating with the chamber Y^3, and this in turn with the cylinder A. The two pistons W and W^2 are connected rigidly with the valves X and X^2 by the hollow stems *t*, so they move together as shown. Referring first to the operation of the induction-valve X^2, the chamber Y^2 being filled with water under pressure, the force on W^2 exceeds that on X^2 as the difference in their area, forcing W^2 back into the position shown, cutting off communication between the chambers Y^2 and Y^3.

To raise the ram B the auxiliary valve *a*, Fig. 6, is depressed, permitting the high-pressure water from F to flow through *d*, *c*, *f*, and J into the chamber *k*, balancing the pressure on each side of W^2. The valve or piston X^2 is then driven forward by the pressure in Y^2, opening communication between Y^2 and Y^3 through the aperture at Z. The water then passes on to the cylinder A, raising the ram B. To stop the motion of the ram, the valve *a* is moved back to its central position, as shown in Fig. 6, relieving the pressure in chamber *k*, and on the outside of the piston W^2. The water in *k* then flows back through the pipe J to the chamber *i* through the holes *m* and escapes into the waste-pipe L. The differential pressure on W^2 and X^2 from the chamber Y^2 then closes X^2, shutting off communication between Y^2 and Y^3. To lower the ram B, the valve *a*, Fig. 6, is raised, permitting water to flow from *c* into *f*, and thence through the pipe K into the chamber *h*, acting on the piston W. The valve or piston X sustains at the same time the pressure in Y^3 due to the pressure caused by the weight of the ram and cage; but the difference in area between W and X causes them to move forward, opening communication between Y and Y^3 through Z, permitting the water in A to escape through Y^3 and Y to the nozzle G^2 and the ram B to descend. To arrest the downward motion of B, the valve *a* is returned to its central position, as before, relieving the pressure in *h* and permitting the piston W to move back by the pressure on X from the chamber Y^3, thus closing communication between Y and Y^3 and the flow of water from A to the waste-pipe G. In stopping the motion of the ram B, whether in ascending or descending, it is not necessary to reverse the supplementary valve *a*, its functions ceasing when it comes to a central position, and the main valve X and X^2 closing automatically by water-pressure and independent of the attendant, and permitting a neutral range of any desired extent for the auxiliary valves at H. In the movements of X and X^2 it will be observed that the apertures at Z by reason of their oblong form permit a gradually-increasing flow of water as the valves move forward, and consequently the motion of the ram B is gradually started or arrested without shock. This gradual starting and stopping of elevators being a matter of much importance, I provide in addition to the oblong apertures at Z other means of attaining the object so arranged as to permit of adjustment and control.

Referring still to Fig. 4, the water entering at *e e* to move the pistons W and W^2 is admitted through holes *s* in the perforated nozzles *r*, (shown in Figs. 4 and 5,) so arranged that the amount of water and the consequent movement of the ram B is gradual and cumulative. At first only a single row of holes are opened; but as the pistons W and W^2 move toward the center, more holes are uncovered in an increasing ratio, causing the ram B to start slowly without shock and with a gradually-increasing speed until a maximum is reached. The same effect is produced in both the ascent and descent of the ram B, the valves X and X^2, with their pistons W and W^2, moving with a gradually-reduced speed, permitting the ram B to stop without shock.

By increasing or diminishing either the number or size of the holes *s*, I gain complete control over the starting and stopping movements of the cage D and its load. When the valves X and X^2 are placed in one shell, as shown in Fig. 4, and operate in conjunction, the movement by water-pressure is supplemented by mechanical connections as follows: An extension *y* is formed on one of the valves X or X^2, so that in case of delayed ac-

tion of either it will be closed by the movement of the other, thus preventing both from being open at the same time. This extension *y* also constitutes a stop and governs the range or stroke of the valves X and X^2 and their attached pistons, so they will not exceed the required range of movement.

At *n n n n*, Fig. 6, are cup-leather packing-rings, which, it may be observed, do not move with the piston *a*, but are stationary, and thus avoid the wear to which such packing is exposed when it moves with pistons over perforated or grated surfaces. The several pistons of the main valve, Fig. 4, have also leather packing moving with the pistons, except in the case of X^2, but not moving over perforations, except in the case of X. The piston X^2, and also the inner ends of the auxiliary valve *a*, which pass out of the packing, are made with rounded or beveled edges, so as to re-enter without abrading the leather or unduly wearing it.

I have shown my improvements applied to a direct-acting or ram elevator; but it is obvious that they are equally applicable to any other type moved by hydraulic force.

Having thus explained the nature and objects of my improvements, the manner of constructing and applying the same, what I claim, and desire to secure by Letters Patent, is—

1. In a hydraulic elevator, the combination of the main cylinder, a ram or piston moving therein, a main valve that controls the admission and escape of water in the main cylinder, a water-supply pipe and an exhaust or waste pipe connected to said main valve, the auxiliary valve H, consisting of an open-ended perforated piston *a*, sliding through fixed packing-glands and so arranged that when it is in a central position both ends of the valve will be open with the waste or exhaust connections, said auxiliary valve having a central chamber *c*, inlet *d*, through which water enters under pressure, chamber *f*, with outlet *g*, through which water passes to one end of the main valve, a chamber *i*, with outlet *j*, through which water passes to the other end of the main valve, the supply-pipe I, running from pipe F to the auxiliary valve, the water-pipes J and K, entering opposite ends of the main valve and running to the auxiliary valve, and the waste-pipes L and M, connected to the auxiliary valve and also to the pipe O, which connects with the main exhaust-pipe, substantially as described.

2. In a hydraulic elevator, the combination of the main cylinder, a ram or piston moving therein, a main valve that controls the admission and escape of water in the main cylinder, a water-supply pipe and an exhaust or waste pipe connected to said main valve, an auxiliary valve consisting of an open-ended perforated piston, the supply-pipe I, running from pipe F to the auxiliary valve, the water-pipes J and K, entering opposite ends of the main valve and running to the auxiliary valve, and the waste-pipes L and M, connected to the auxiliary valve and also to the pipe O, which connects with the main exhaust-pipe, substantially as described.

3. The combination of the main cylinder, the ram, and the main valve, together with the supply and waste pipes, said main valve consisting, essentially, of two independent pistons X and X^2, moving within a shell provided with outlets and surrounded by an annular space, said pistons X and X^2 being rigidly connected with the pistons W and W^2 by the hollowed stems *t*, substantially as described.

4. The combination, with the main cylinder, ram, auxiliary valve, and supply and waste pipes, of the main valve, consisting, essentially, of the casing having inlet and waste nozzles F^2 and G^2, and inlets *e e* at each end, the pistons X and X^2, moving in a shell or bushing *x*, provided with outlets and surrounded by an annular chamber Y^3, said pistons X and X^2 being rigidly connected with the pistons W and W^2 by means of the hollow stems *t*, the chamber *k*, adjacent to the piston W^2, and the chamber *h*, adjacent to the piston W, all the parts being arranged substantially as described.

5. The combination, with the main cylinder, the ram, the auxiliary valves, and the supply and waste pipes, of the main valve, consisting, essentially, of the pistons X and X^2, moving independently and connected rigidly with the pistons W and W^2, the inlets *e e* at each end of the main valve, the chambers between the pistons W and W^2, and the adjacent inlets *e e*, and the nozzles *r r*, provided with the perforations *s*, so arranged that the amount of water and the consequent movement of the ram may be gradual, said perforated nozzles *r* lying in a horizontal position and projecting through the pistons, substantially as described.

6. The combination, with the main cylinder, the ram, and the supply and waste pipes, of the main valve, consisting, essentially, of the pistons X and X^2, arranged to act independently with respect to the water-pressures, one of said pistons being provided with a tappet or projection extending toward the other piston, so arranged that one piston will move and close the other in the case of tardy action, and so arranged that both cannot be open at the same time.

7. In a hydraulic elevator, the combination of the main cylinder, a ram, the main valve E, the supply-pipe F entering it, and the exhaust-pipe G passing from it, the pistons X and X^2, moving within the apertured bushing *x*, which is surrounded by an annular chamber, said pistons X and X^2 being connected by tubular connections *t t* with the pistons W and W^2, and the auxiliary valve H, consisting, essentially, of the open-ended perforated piston sliding through fixed glands, and the water-pipes J and K, passing from

said auxiliary valve and entering the opposite ends of the main valve, substantially as described.

8. In a hydraulic elevator, the combination, with the main cylinder and the ram, of the main valve provided with the perforated inlet-nozzles *r*, arranged in a horizontal position, the pistons W and W², rigidly connected by tubular connections *t t* with the pistons X and X², said perforated nozzles entering the said tubular connections *t t*, all arranged so as to prevent sudden movement or shock in opening and closing the valves X and X², substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

COFRAN I. HALL.

Witnesses:
ALFRED A. ENQUIST,
W. D. BENT, Jr.