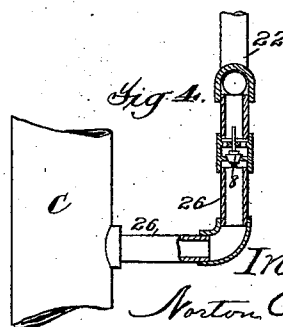
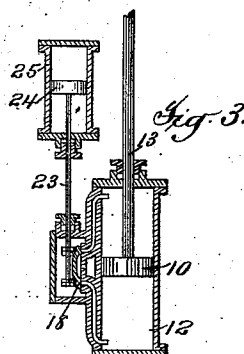
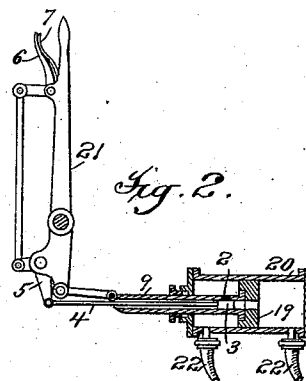
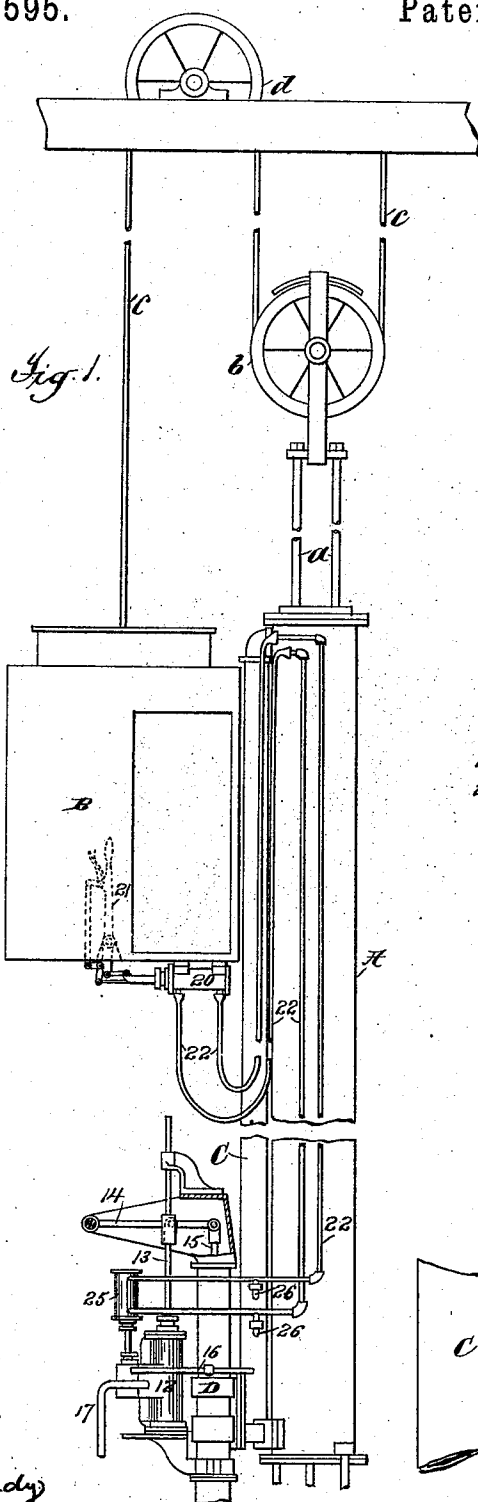


(No Model.)

N. P. OTIS,
ELEVATOR.

No. 531,595.

Patented Dec. 25, 1894.



Attest
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UNITED STATES PATENT OFFICE.

NORTON P. OTIS, OF YONKERS, NEW YORK, ASSIGNOR TO THE NATIONAL COMPANY, OF CHICAGO, ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 531,595, dated December 25, 1894.

Application filed August 30, 1892. Serial No. 444,513. (No model.)

To all whom it may concern:

Be it known that I, NORTON P. OTIS, a citizen of the United States, residing at Yonkers, county of Westchester, and State of New York, have invented certain new and useful Improvements in Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to improvements in apparatus for controlling and operating, for example, the valve or other stopping and starting mechanism of an elevator, by means of hydraulic pressure communicated from the elevator car and under the control of the conductor. Such controlling and operating apparatus though designed especially for use in connection with elevators, is, with the improvements thereon constituting the present invention, capable of application to a variety of other mechanisms. For convenience, however, this apparatus, together with the improvements of the present invention, will be described particularly in connection with elevator mechanism.

The particular form of controlling and operating apparatus as applied to elevators to which the present invention relates is that in which two hydraulic cylinders are employed, one of which is carried by and runs with the car and is provided with a piston, the rod of which is connected to a hand lever which is in convenient position to be operated by the conductor, and the other of which is stationary and located adjacent to the elevator engine and is provided with a piston, the rod of which is connected to and operates the valve or other mechanism which controls the movements of the car, and flexible connections by which each end of each cylinder communicates with one end of the other; the two cylinders and their flexible connections being filled with water or other non-elastic fluid, thus forming a hydraulic connection between the pistons of the two cylinders, through which the conductor, by moving the piston of the cylinder carried by the car, in either direction, is enabled to impart a corresponding movement to the piston of the stationary cylinder and thus operate the valve or other stopping and starting mechanism to control the move-

ments of the car. In such apparatus, in order to insure its perfect working, it will be found in practice necessary to make provision for maintaining a constant supply of liquid in the cylinders to compensate for leakage, evaporation, &c.; and the present invention has for one of its objects the provision of means for this purpose. In such apparatus also it will be found desirable, owing to the liability of the pistons to sometimes get out of their proper relation to each other, by reason of leakage or for some other cause, to make provision for the restoration of the pistons in such cases to their proper relative positions; and the present invention has for a further object the provision of means for this purpose also.

As a full understanding of the invention can best be given by an illustration and a detailed description of the complete apparatus as applied to an elevator, such description will be given, reference being had to the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating the general organization of the apparatus. Fig. 2 is an enlarged section of the moving cylinder or the cylinder carried by the car, showing also the operating lever. Fig. 3 is a similar view of the stationary or working cylinder, and Fig. 4 is an enlarged sectional view of a detail which will be hereinafter referred to.

Referring to said figures it is to be understood that the particular elevator which has been selected for the purpose of illustrating the application of the invention is one of the common forms of hydraulic elevator in which A is the main hydraulic cylinder, *a* the piston-rod of said cylinder, to which is attached the traveling pulley *b*.

B is the car, and *c* the lifting cable, which passes over the stationary pulley *d* at the top of the shaft and beneath the traveling pulley *b*.

C is the usual circulating pipe through which the water passes from the upper to the lower end of the cylinder A, and D is the casing of the main valve which is of the ordinary form and controls the circulation of the water and its final discharge from the lower end of the cylinder. The main valve is operated by a piston 10 which works in an

auxiliary cylinder 12, and the rod 13 of which is connected to a lever 14 which is also connected to the rod 15 of the main valve.

The auxiliary cylinder 12 is supplied with water under suitable pressure for operating the piston 10, through a pipe 16 which communicates with the circulating pipe C or any other source, and the water after performing its work in the cylinder is exhausted through a pipe 17. The admission and discharge of the water to and from the cylinder 12 is controlled by an auxiliary valve 18 which is controlled and operated by the conductor in the car.

The organization for operating the main valve by means of an auxiliary piston which has just been described, forms no part of the present invention and although desirable inasmuch as it relieves the conductor of the labor of operating the main valve directly is not essential as the main valve may be controlled and operated directly.

Located upon the car, preferably beneath its floor, and moving with the car, is a small cylinder 20 having a piston 19 the rod 9 of which is connected to a hand lever 21 which is arranged in convenient position to be operated by the conductor. The cylinder 20 communicates upon opposite sides of the piston 19 with flexible hose or pipes 22 which in turn communicate with the corresponding ends of a cylinder 25 having a piston 24, the rod 23 of which is connected to the valve 18. The cylinders 20, 25 and the connections between the two cylinders being filled with water or other non-elastic fluid, it will be readily seen that any movement imparted to the piston 19 in either direction will, through the column of liquid, impart a corresponding movement to the piston 24 the latter in turn, through its rod 23, performing the work of moving the valve 18 and controlling the movement of the auxiliary piston 10 and through that piston the movement of the main valve, the main piston in the cylinder A and the car.

The operation of the apparatus as thus far described is as follows: When the car is at rest the main valve, the auxiliary piston and valve, and the pistons 19 and 24 and the lever 21 will be on center. To start the car, up for example, the lever 21 will be rocked to the right. This will move the piston 19 to the left and by reason of the body of non-elastic liquid which fills the cylinders 20, 25 and the connections between the cylinders, impart a corresponding upward movement to the piston 24 and shift the valve 18 so as to start the piston 10 upward and this will move the main valve upward, thus allowing the water to escape from the lower end of the cylinder A and causing the car to ascend. To stop the car, the lever 21 will be rocked back to center and over to the left. This will have the same effect as before but will move the piston 24 downward so as to reverse the valve 18 and cause the piston 10 to move downward and carry the main valve back to its central

position and stop the car. As soon as the car stops the lever 21 will be moved back to center. This will move the pistons 19, 24 and the valve 18 back to center and arrest the piston 10. To start the car downward the operation will be the same except that the lever 21 will be moved to the left. By moving the valve 18 to center at any time, the piston 10 will be arrested in whatever position it then occupies and thus the speed of the car can be controlled.

Although it is preferable, as before stated, to operate the main valve indirectly through an auxiliary piston, this is not essential. The rod 23 of the piston 24 may be connected directly to the lever 14 or to the main valve and it is also to be understood that the stationary working piston 24, instead of operating a valve, may operate any other form of stopping and starting mechanism, as for example, a belt shifter.

It will be observed that the connections 22 are so arranged that the ends of the cylinder 20, 25 through which the piston-rods pass, are connected by one of the pipes, while the opposite ends are connected by the other pipe. This, though not essential, is desirable because the presence of the rods makes the displacement due to the movement of the pistons in one direction less than in the other. By extending the rods 9, 23 through the pistons and the opposite ends of the cylinders this may, however be avoided.

The connections 22 may be flexible for their whole length, but in practice it is preferable to make these connections in part of rigid pipes which extend from the cylinder 25 upward to a point about one-half the height of the shaft; the remainder of the connections from that point to the car being of flexible tubes or hose.

As before stated it will in practice be found necessary and it is the object of this invention to provide means by which the supply of the liquid in the cylinders 20, 25 and their connections will be constantly maintained to compensate for leakage through the stuffing boxes, evaporation, &c. To effect this the stationary working cylinder 25, or the pipes 22, are arranged to communicate by small pipes 26 with the circulating pipe C or with some other source of liquid supply, each of the pipes 26 being provided with a small check valve 8 which opens to allow the liquid to pass into the cylinders and connections, to supply any deficiency, but closes to prevent the liquid from passing in the opposite direction; the supply of liquid in the cylinders and their connections being thus maintained constant, any loss, from leakage, evaporation, &c., being immediately compensated for.

In operating the apparatus also, as before stated, it will sometimes happen, owing to leakage or other cause, that the pistons 19, 24 will get out of their proper relative positions, and it is therefore important that means should be provided by which in such case they

can be restored to their proper relative positions by the conductor. For this purpose the piston rod 9 of the cylinder 20 is made hollow and is provided with an opening 2 by which communication can be established between the opposite sides of its piston 19. The opening 2 is controlled by a valve 3 the rod 4 of which extends through the hollow rod 9 and is connected to a bell-crank 5 which is pivoted upon the lever 21 and is arranged to be operated by a supplemental lever 6 also pivoted upon the lever 21. The lever 6 is acted on by a spring 7 which normally holds the valve 3 in position to close the opening 2 and cut off communication between the opposite sides of the piston 19. If at any time, however, the pistons 19, 24 get out of proper relative adjustment, the conductor will shift the lever 21 until the piston 24 is moved to center, and by then moving the valve 3 so as to open communication between the opposite sides of the piston 19, the latter piston can be moved to center. The valve 3 will be closed and the apparatus will operate properly.

The arrangement just described for adjusting the position of the piston 19 is well adapted for effecting the desired result, but the passage for affording communication between the opposite ends of the cylinder may be arranged in any other position and may be controlled by any other suitable form of apparatus.

As before stated the controlling and operating apparatus, which have, for convenience, and because it is particularly applicable thereto been illustrated and described in connection with elevators for operating the stopping and starting mechanism thereof, is capable of use equally well in connection with many other forms of machines, and for operating mechanisms other than such stopping and starting mechanism; and in such other uses the improvements of the present invention are equally applicable.

What I claim is—

1. The combination with a stationary working cylinder and piston and mechanism oper-

ated by the latter, of a moving cylinder and piston controlled by an attendant for operating said working piston, flexible connections between each end of each cylinder and one end of the other, a volume of liquid filling the two cylinders and the connections, a passage through said moving piston and its piston rod affording communication between the opposite ends of said moving cylinder, a valve apparatus controlling said passage, and a lever for operating said valve apparatus, substantially as described.

2. The combination with cylinder 25 and its piston 24, cylinder 20 and its hollow piston 19, flexible connections between each end of each cylinder and one end of the other, and a volume of liquid filling the two cylinders and the connections, of hollow piston rod 9 connected with piston 19 and provided with opening 2 affording communication between the opposite ends of cylinder 20, valve 3 controlling said opening, and lever 4 and connections for operating said valve, substantially as described.

3. The combination with a cylinder having a piston connected to operate the stopping and starting mechanism of an elevator, of cylinder 20 carried by the car and provided with hollow piston 19 controlled by the conductor on the car, flexible connections between each end of each cylinder and one end of the other, and a volume of liquid filling the two cylinders and the connections, of hollow piston rod 9 connected with piston 19 and provided with opening 2 affording communication between the opposite ends of cylinder 20, valve 3 controlling said opening, and lever 4 and connections within the car controlled by the conductor, for operating said valve, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

NORTON P. OTIS.

Witnesses:

A. E. HALL,
R. C. SMITH.