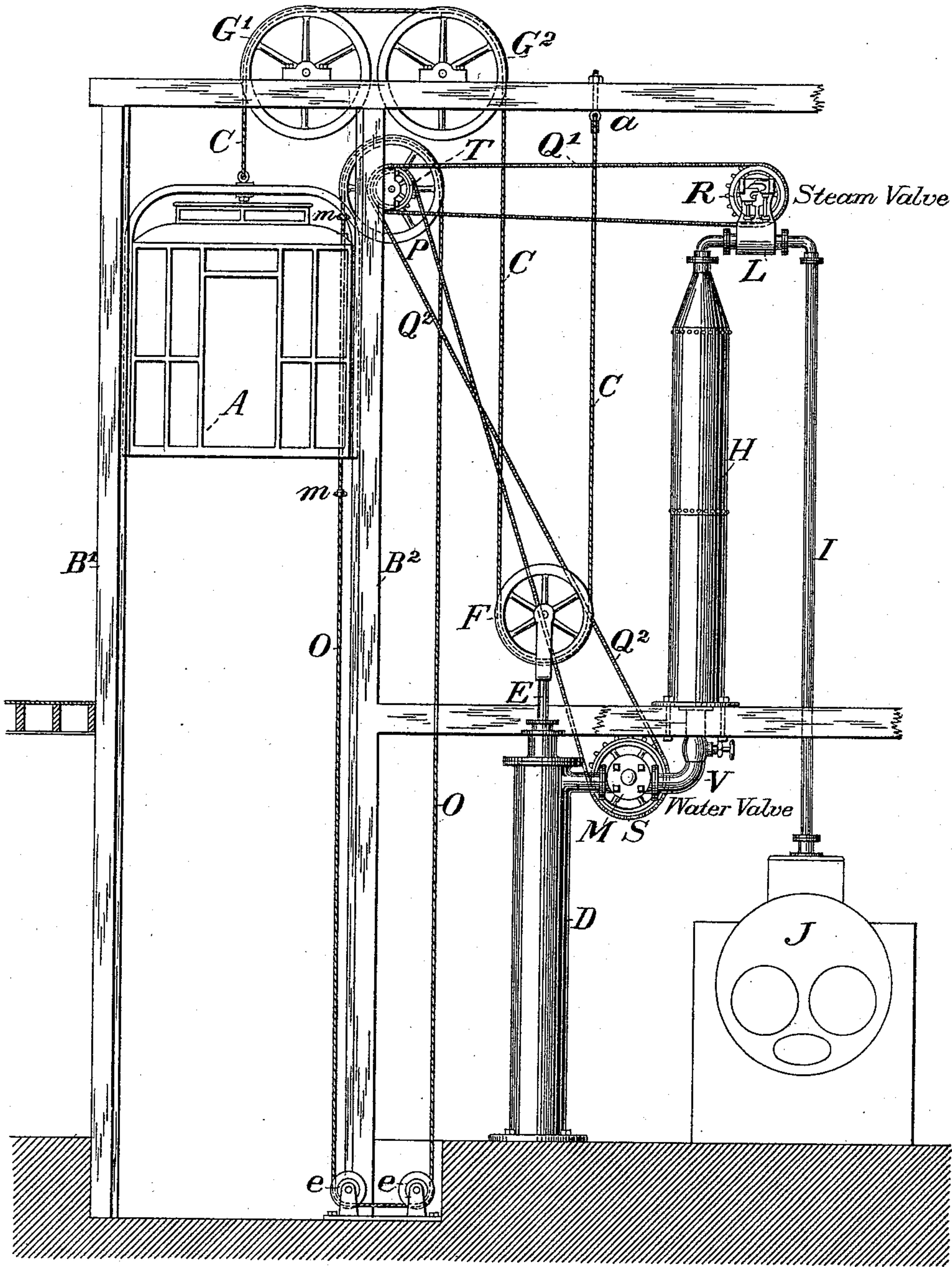


(No Model.)

C. I. HALL.  
HYDRAULIC ELEVATOR.

No. 488,891.

Patented Dec. 27, 1892.



Witnesses:

H. C. Behr.

V. D. Burt.

Inventor:

C. I. Hall

By John Richards  
Atty



# UNITED STATES PATENT OFFICE.

COFRAN I. HALL, OF SAN FRANCISCO, CALIFORNIA.

## HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 488,891, dated December 27, 1892.

Application filed September 30, 1891. Serial No. 407,235. (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  
5 useful Improvements in Hydraulic Elevators; and I hereby declare the following specification, with the drawing forming a part of the same, to be a full and exact description of my invention.

10 My improvements relate to elevators for raising and lowering passengers and goods, operated by hydraulic apparatus, and also by steam or air, in conjunction therewith, and especially to a means of counterweighting or  
15 balancing the platforms or cages of such elevators.

It also consists in so arranging the hydraulic apparatus of such elevators that the water displaced by the descending cages or plat-  
20 forms will be forced upward to a height corresponding to the stroke of the hydraulic piston and sufficient to counterbalance the gravity of the cages or platforms to any desirable extent, thus avoiding the use of suspended  
25 counterweights and their connected parts, such as are commonly employed.

Referring to the drawing, it represents a common elevator, having a cage or carriage A moving between two guiding posts B', B<sup>2</sup>,  
30 by means of a rope or cable C, to which the cage is suspended. This rope, or cable C, is connected to and operated by a hydraulic cylinder D, having a piston rod E, with a pulley or pulleys F, at the top. The rope, or cable  
35 C, is fastened to the shackle a, passes around the pulley F on the piston E, thence around the guiding pulleys G', G<sup>2</sup>, at the top, and is attached to the cage A as shown, causing the  
40 cage A, to move twice as far as the piston E, but this relative movement of the cage and piston can be arranged at will by the number of pulleys or sheaves interposed, and to meet the requirements in any case. This method  
45 of gearing being well understood, and the drawing mainly to show my method of counterbalancing, further description of the rope C and its gearing is not required.

The hydraulic cylinder D is of the usual construction, having a close fitting piston and  
50 may be open on the bottom if desired, the water being admitted on the top only, of the

piston. This far the machinery, and all parts mentioned, correspond to common practice in constructing such elevators.

To compress the water in the cylinder D 55 and supply power to raise the cage A, I employ by preference what is known as the hydro-steam system, described in Letters Patent No. 433,644 granted to me December 30, 1890, for improvements in elevator valve 60 mechanism, also in my application for Letters Patent for improvements in elevator valves, No. 391,381 filed May 2, 1891, the flow of the water and steam, or air, being controlled by valves having simultaneous move- 65 ment but different functions, as will hereinafter be more fully explained.

At some point above the hydraulic cylinder D I place a vessel H called a receiver, the cubic capacity of which, to some extent, ex- 70 ceeds that of the hydraulic cylinder D and with its diameter corresponding thereto so that the water may remain relatively the same in each. Connecting to the top of the receiver H is a pipe I which leads to a steam boiler J, 75 as shown in the diagram, or some other initial source for supplying air or steam under pressure. At L I employ a valve which in one extreme position admits steam from the boiler J to the top of the receiver H, and in 80 the other extreme position exhausts the steam from the receiver to the atmosphere, and acts as a stop valve, preventing flow in either way when in its central or neutral position. At M I employ another valve that controls the 85 flow of water from the receiver H to the hydraulic cylinder D through the pipe V and also the reverse way, but so constructed that when closed, in either direction, there is a free flow back, in other words, the valve closes in 90 one direction only and opens automatically in the other direction if there is a superior pressure in the vessel to which the valve opens, as set forth in the Letters Patent, and application for Letters Patent hereinbefore 95 referred to. To operate these valves L and M I employ a cord or rope O passing over the pulleys e e at the bottom and pulley P at the top. On the axis of the pulley P are two smaller pulleys or wheels T, over which pass chains Q'-Q<sup>2</sup> 100 to the pulleys or wheels R and S which operate the valves L and M. The rope O has stops



*m m* that cause the valves L and M to close automatically at the extreme upper and lower stroke of the cage A, and these valves are reversed to change the course of the cage A  
5 from its interior in the usual manner.

It is customary in constructing elevators, to compensate partially the difference in weight between the cage A and the piston carried by rod E by means of counterweights commonly  
10 suspended on ropes passing over pulleys, leaving, however, enough excess in favor of the cage A to cause it to descend without a load.

In the present case counterweights are dispensed with by placing the receiver H at some  
15 position above the hydraulic cylinder D, the operation being as follows: Supposing the cage A to be in the position shown in the drawing or at the top of its range or stroke, and the piston in the hydraulic cylinder D to  
20 be at the bottom of its stroke, then this cylinder D will be filled with water expelled from the receiver H, and replaced by steam from the boiler J. Then suppose the valves M and L to be reversed so that the steam  
25 in the receiver H will escape to the atmosphere, and the water in the cylinder D be forced back into the receiver H as the cage A descends. Now if the cylinder D and receiver H are of like diameter the weight of  
30 the water thus discharged therein will offer a constant resistance to the descent of the cage A, proportioned to the height of the receiver H above the cylinder D. In this manner I am able to counterbalance the cage A to any  
35 desirable extent, and uniformly at all points of the stroke by the relative positions of the receiver H and the hydraulic cylinder D, and without providing therefor any mechanism or operating detail whatever; also avoiding the  
40 wear, danger of derangement, and expense of providing counterbalances. The amount of the counterbalancing force is dependent on the height of the receiver H above the cylinder D, and the quantity of water being in the  
45 same proportion.

The cylinder D is set in a vertical position as shown in the drawing made with its diameter substantially the same as that of the receiver H so that the relative level of the water in the main cylinder D and the receiver  
50 H will remain the same at all points of the stroke.

Having thus described the nature and objects of my invention, what I claim and desire to secure by Letters Patent, is:

1. In a hydraulic elevator, in combination, a cage or platform A, a hydraulic cylinder D, a vapor receiver H of the same diameter as cylinder D but having a cubical capacity in excess of said cylinder D, and a piston working in the cylinder D, whereby as the piston rises in the cylinder the water rises the same distance in the vapor receiver H, and as the piston descends in said cylinder the water descends accordingly in the vapor receiver and  
65 the water level in receiver H remains a certain distance relative to the piston in cylinder D at different points in the latter's stroke, substantially as described.

2. In a hydraulic elevator, in combination, a cage or platform A, a hydraulic cylinder D provided with a piston, a vapor receiver H having a cubical capacity in excess of the cylinder D but of the same diameter as said cylinder, whereby as the piston rises in the  
75 cylinder the water rises the same distance in the vapor receiver, and as the piston descends in the main cylinder the water descends accordingly in the vapor receiver, and the water level in receiver H remains a certain distance  
80 relative to the piston in cylinder D, in different points of the latter's stroke, 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,  
WILSON D. BENT, Jr.