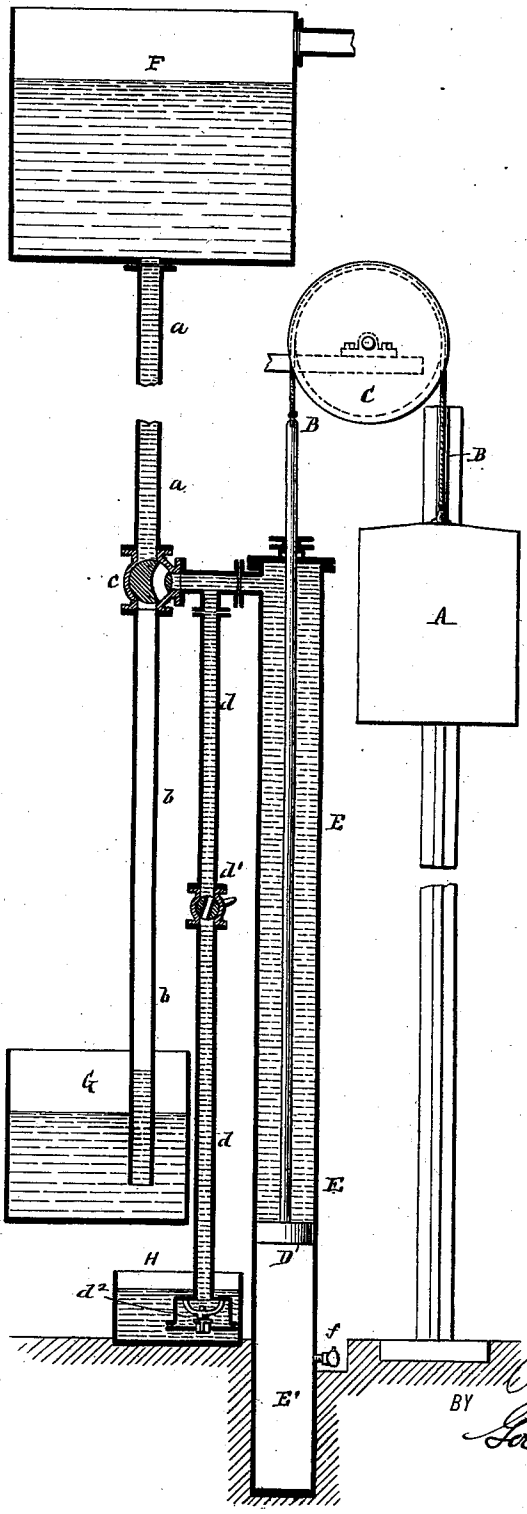
(No Model.)

R. C. SMITH.

HYDRAULIC ELEVATOR.

No. 357,345. Patented Feb. 8, 1887.



WITNESSES:

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UNITED STATES PATENT OFFICE.

RUDOLPH C. SMITH, OF YONKERS, NEW YORK.

HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 357,345, dated February 8, 1887.

Application filed February 12, 1886. Serial No. 191,738. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH C. SMITH, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Hydraulic Elevators, of which the following is a specification.

My invention relates to hydraulic elevators having an operating-cylinder arranged in a vertical or inclined position, and in which the weight and force exerted to move the piston downward and raise the car increases as the piston descends by reason of the increased head or pressure of water acting on the piston, and by reason of the increased weight of the ropes which are transferred from the car side of the machine to the engine side as the piston descends.

The objects of my invention are to equalize, so far as possible, the effect of the pressure of water on the piston throughout its stroke, to prevent the formation of a vacuum in the upper part of the cylinder when the supply-valve is closed in order to stop the engine, and to provide a water-column brake whereby the car and piston will be arrested when the supply-valve is closed.

In carrying out my invention in an elevator-engine in which the car is raised by water admitted to the top of the cylinder above the piston under pressure from any suitable source—as an elevator-tank, an accumulator, or a weighted plunger—I make the lower portion of the cylinder air-tight and of sufficient length below the piston's travel to serve as an air-chamber wherein air will be gradually compressed as the piston descends, and will be caused to exert a gradually-increasing counter-balancing force on the piston.

In order to form a water-column brake, I connect the cylinder above the piston by a pipe with an open tank located at a lower point, so as to constitute a negative head of water, which will arrest the piston and car when the supply-valve is closed to stop the car in its ascent and the piston in its descent.

The accompanying drawing represents a sectional elevation of my improved hydraulic elevator, illustrating the operating-cylinder as prolonged downward to form an air-chamber wherein air will be compressed to form an air-pressure counter-balance to the piston in its descent.

Similar letters of reference designate corresponding parts.

A designates the elevator car or cage fitted to travel along vertical guides or ways and connected by hoisting-cables B, which pass over an overhead sheave, C, with a piston, D, fitted to travel in an operating-cylinder, E, which may be arranged either vertically or in an inclined position.

F designates an elevated tank, which represents a source of supply for water under pressure, and from which a supply-pipe, *a*, leads downward to the upper portion of the cylinder E above the piston. With the upper end of the cylinder is also connected a discharge-pipe, *b*, which leads to a discharge-tank, G. The communication between the supply-pipe *a* and cylinder and between the cylinder and discharge-pipe is controlled by any suitable valve, a three-way cock or plug-valve, *c*, being here shown as a simple illustration of such valve.

From the cylinder E above the piston a suction-pipe, *d*, leads downward to and enters an open tank, H, which is arranged some distance below the lowermost position of the piston D. The pipe *d* is here shown as leading from the working branch pipe, which leads from the valve *c* to the cylinder, and is therefore in free communication with the cylinder. In the pipe *d*, I have represented a valve, *d'*, whereby the passage through it may be more or less throttled or restricted, and at the lower end of the pipe is a check-valve or foot-valve, d^2.

When the valve *c* is shifted to cut off the supply of water to the cylinder, the piston, if it has a tendency to travel farther by its momentum and the increased weight of the ropes on the engine side, will produce a suction in the upper part of the cylinder, by which water will be drawn upward through the pipe *d*, and the formation of a vacuum in the upper part of the cylinder prevented. This feature is old and well known, and I lay no claim to the same. By arranging the tank H below the lowermost position of the piston D and extending the pipe *d* into this tank to a point also below the lowermost point of the piston's travel, a water-column brake is obtained, which will have the effect of gradually arresting the motion of the piston. The effect of this water-column brake may be increased or dimin-

ished by more or less closing or opening the valve *d'* in the pipe *d*. For counterbalancing a part of the pressure and weight on the top of the piston, air or any other elastic fluid is employed below said piston for this purpose.

The cylinder E is prolonged downward below the lower end of the piston's travel sufficiently to form an air-tight chamber, E', below the piston D. In this chamber the air will be gradually compressed by the downward movement of the piston, and as the piston nears the lower end of its travel the air will become compressed to such determined degree as will sufficiently counterbalance the downward pressure and weight on the piston. In order to maintain the supply of air in the air-chamber E', I may apply thereto an inwardly-opening air-valve, *f*. During the upward movement of the piston the body of air in the chamber E' is expanded and rarefied, owing to the increasing size of the expansion-chamber, so that a diminishing pressure is exerted on the piston. By thus varying the pressure on the under side of the piston the increased pressure of the weight of the water-column and of the weight of the rope on the top of the piston D is counterbalanced.

Although I have referred only to water as the motive fluid for operating the elevator, it is obvious that oil or other liquid may be used.

The necessary construction of the valves and other parts of the apparatus will be readily understood by mechanics familiar with elevator construction, and I have here shown them in their simplest form in order that my invention may be more readily understood.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of an elevator car or cage, an operating-piston, ropes or cables connecting the car or cage with the piston, a lifting-cylinder to which a liquid under pressure is supplied above the piston, and a closed chamber or reservoir connected with the lifting-cylinder below the lowermost position of the piston and containing air or other elastic fluid, whereby a varying pressure is exerted by the elastic fluid on the under side of the piston, so as to assist in counterbalancing the varying pressure of the weight of the water column and ropes on the upper side of the piston, substantially as set forth.

2. The combination, with an elevator car or cage, of a piston and cylinder for operating the same, a suction-pipe leading downward from the cylinder on that side of the piston to which a liquid under pressure is supplied for making the working-stroke, a check-valve in said suction-pipe, and an open tank located below the lowermost position of the piston, the said suction-pipe being extended downwardly into the tank, so as to prevent a vacuum at the upper part of the cylinder and form a water-column brake, substantially as set forth.

3. The combination, with an elevator car or cage and a piston and cylinder for operating the same, a suction-pipe leading downward from the cylinder on that side of the piston to which a fluid is supplied for making the working-stroke of the piston, a check-valve in said suction-pipe, a regulating-valve also arranged in said suction-pipe, and a tank located below the lowermost position of the piston, said suction-pipe being extended downward into the tank, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

RUDOLPH C. SMITH.

Witnesses:
MARTIN PETRY,
CARL KARP.