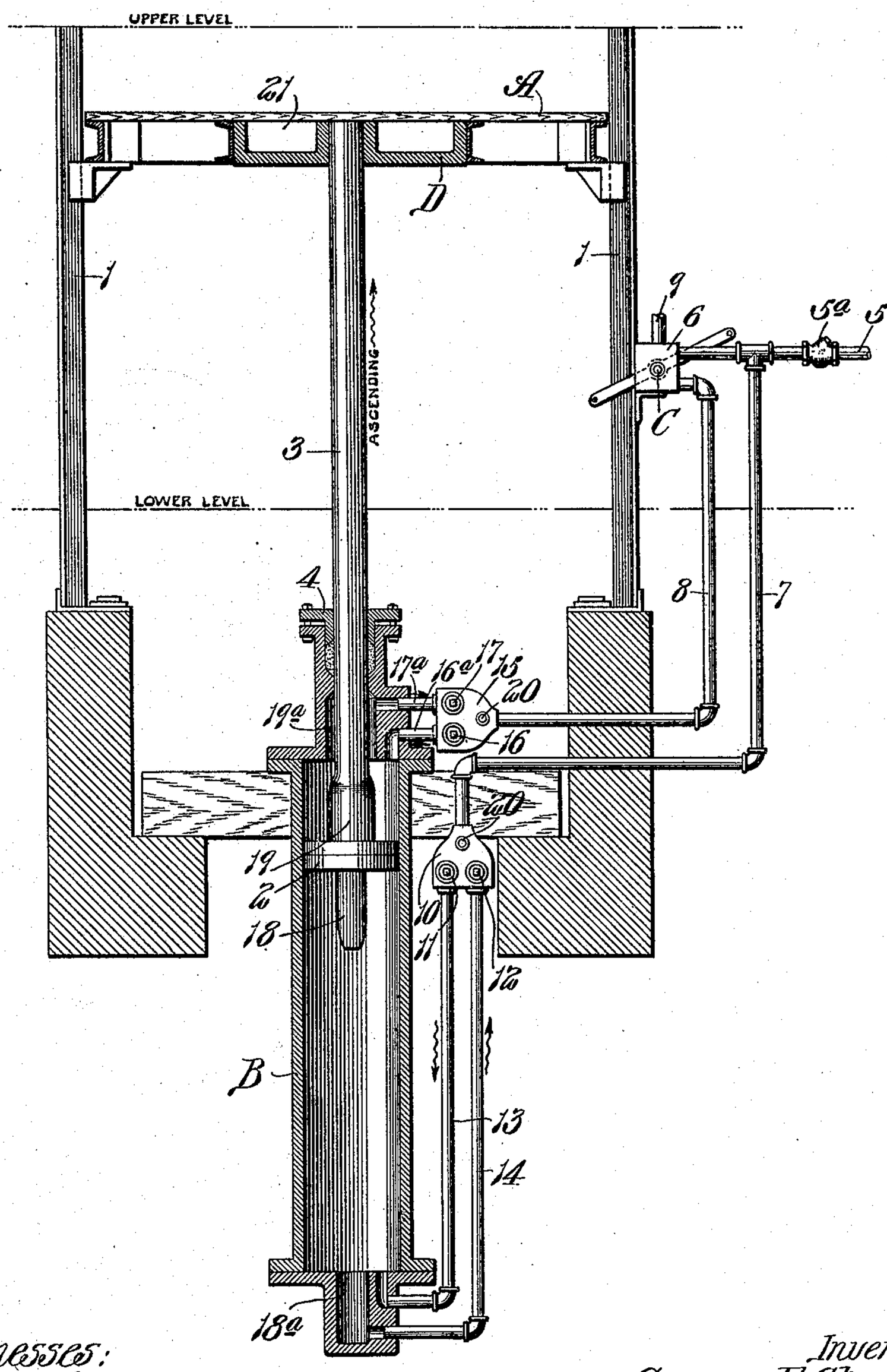
G. F. STEEDMAN.

BALANCED PRESSURE ELEVATOR.

APPLICATION FILED MAR. 12, 1909.

932,726. Patented Aug. 31, 1909.



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UNITED STATES PATENT OFFICE.

GEORGE F. STEEDMAN, OF ST. LOUIS, MISSOURI.

BALANCED-PRESSURE ELEVATOR.

932,726. Specification of Letters Patent. Patented Aug. 31, 1909.

Application filed March 12, 1909. Serial No. 482,938.

To all whom it may concern:

Be it known that I, GEORGE F. STEEDMAN, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Balanced-Pressure Elevators, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to pneumatic elevators, and particularly pneumatic elevators in which the cylinder is directly underneath the cage.

In my numerous prior patents, I have shown several different types of pneumatic elevators. In the direct type, the cylinder is placed directly over the elevator cage, and the piston rod is connected directly to the upper part of the cage. In the rope type, the cage is lifted by means of wire rope attached to the upper portion of the cage. In both the direct and rope type elevators, the piston rod is in tension and lifts the cage by pulling on it.

The types of elevators just described are not suitable for certain special uses, as, for instance, what is termed a "sidewalk elevator", where it is necessary that the cylinder be directly underneath the elevator cage or platform.

The object of my present invention is to adapt the use of a pneumatic hoisting cylinder to a direct-acting elevator, in which the cylinder is directly underneath the platform and raises the platform by pushing it upward.

A further object of my invention is to provide an elevator of this type, which is safe and reliable.

The accompanying drawing represents an elevator of this type and illustrates the preferred embodiment of my invention.

It is usually desirable in elevators of this class that the support on which the load rests be in the nature of a platform and not a cage. The use of a shallow platform requires that the piston rod be sufficiently strong to support without distortion the platform when the entire load is carried near one end or side thereof, which necessitates a piston rod of comparatively large diameter.

The figure of the drawing is a vertical sectional view of an elevator, embodying my present invention.

Referring to said drawing, A designates the cage or platform of an elevator which travels on vertically disposed tracks 1, and B designates the operating cylinder that is arranged underneath said cage. The piston 2 in said cylinder has a piston rod 3 connected to its upper face, and said rod projects through a stuffing box 4, in the upper end of the cylinder, and is connected to the lower side of the cage A.

The actuating fluid, which is preferably air under pressure, is contained in a tank, not shown, and said tank communicates with a supply pipe 5, that leads to the casing 6 of a two-way controlling valve C, said supply pipe having a branch 7 that communicates with the lower end of the cylinder. A pipe 8 that communicates with the upper end of the cylinder, leads to said valve casing 6, and said valve casing is provided with an exhaust pipe 9, that communicates with the atmosphere.

The means employed in the elevator herein shown for controlling the actuating fluid to and from the cylinder is similar to that shown in my prior patent No. 840,876, dated January 8th, 1907, so that I will only briefly describe the operation of said means.

The supply pipe 5 is provided with a check valve 5^a arranged between the branch 7 and the supply tank, so as to prevent the fluid from backing up into the supply tank, and said branch 7 leads to a speed-controlling box 10, having a pair of oppositely opening check valves 11 and 12, that permit the motive fluid pressure to travel in opposite direction through said box, as indicated by the arrows. A pipe 13, that coöperates with the inwardly opening check valve 11, introduces the actuating fluid into the lower end of the cylinder, and a pipe 14, that cooperates with the outwardly opening check valve 12, permits the fluid on the underside of the piston to exhaust from the lower end of the cylinder, when the cage descends. The pipe 8 that is tapped into the casing of the controlling valve C, communicates with a speed-controlling box 15 having an inwardly opening check valve 16 that cooperates with a pipe 16^a which leads to the up-

per end of the cylinder, said box also having an outwardly opening check valve 17 that coöperates with a pipe 17ª which leads to the upper end of the cylinder. As the branch 7 from the supply pipe communicates at all times with the lower end of the cylinder, the motive force will be constantly exerted on the under side of the piston and thus tend to move it in a direction to raise the cage.

The direction of movement of the cage is governed by the controlling valve C, which is adapted to be turned into such a position, that the fluid on the upper side of the piston can escape through the pipe 17ª, speed-controlling box 15, and pipe 8 to the exhaust pipe 9 that leads from the casing of the controlling valve. The elevator is so designed that the cage does not stop between its upper and lower levels, and when the cage approaches either of said levels, its speed is gradually reduced by means of plungers 18 and 19 on the lower and upper sides of the piston that project into cushioning chambers 18ª and 19ª in the heads of the cylinder, as shown and clearly described in my prior patent No. 845,827, dated March 5th, 1907, the speed-controlling boxes being provided with leak valves 20 that permit the fluid to escape gradually from said cushioning chambers.

When the cage is at its upper level and it is desired to have it descend, the valve C is turned into such a position that communication will be established between the supply pipe 5 and the pipe 8, thus permitting the fluid to enter the upper end of the cylinder and exert downward pressure on the upper side of the piston, so as to balance the upward pressure or force that is exerted on the lower side of the piston. In view of the fact that the piston rod is large and is connected to the upper side of the piston, the area of the upper face of the piston is much less than the area of the lower face of the piston, so that the cage would not descend when it is not provided with a load, if some means in addition to the fluid that is introduced into the upper end of the cylinder were not provided for overcoming the excessive pressure that the fluid exerts on the under side of the piston. Therefore, I have so designed the cage and the piston rod that the combined weight of same, plus the pressure that the fluid exerts on the upper side of the piston will exceed the upward pressure that the fluid exerts on the under side of the piston. This result can be accomplished in various ways, such, for example, as providing the cage with a heavy member D that is permanently connected to the cage, so that it forms part of the cage. Said member D adds enough weight to the cage, so that the combined weight of the cage and piston rod will be sufficient to cause the cage to descend unloaded, when the full working pressure is admitted to both sides of the piston or when the pressure on both sides of the piston is equalized. In other words, the piston rod and empty cage have sufficient weight to return themselves against the unbalanced forces of the hoist, it being understood, of course, that the location of the piston rod on the upper side of the piston prevents the forces of the hoist from being in balance. I prefer to use the member D, which is formed of iron or some other heavy material and provided with recesses 21 that can be filled with some suitable heavy material that adds weight to the cage, thus enabling the permanent weight on the piston rod to be varied by placing material in the recesses of the member D or removing it therefrom. I do not wish to be understood, however, that my broad idea is limited to this exact construction, for the piston can be weighted in numerous other ways, without departing from the spirit of my invention.

In my previous patents, I have shown the use of the balanced pressure air hoist adapted to pneumatic elevators where the pistons act on the cage by pulling. In the type of elevator herein illustrated; namely, one in which the piston rod is connected to the under side of the cage, direct air pressure has heretofore been used, but such an elevator is not safe.

In an elevator of the character herein described, but operated on the single acting principle, pressure would be admitted to the lower side of the piston to raise the load and exhausted from said lower side to lower the load. If the empty cage were forced upward, only a comparatively light air pressure would be required to raise the cage, and if, when the cage reached its upper level, the full load the elevator is designed for were placed upon the cage, there would not be sufficient sustaining power underneath the piston and the cage would descend, until the air in the cylinder was compressed sufficiently to support the load. With the balanced hoist principle herein shown, however, the action is decidedly different. Air under full pressure is constantly admitted to the lower side of the piston and air must be exhausted from the upper side of the piston to permit the cage to ascend, and when the cage has reached its upper limit, there is the full supporting pressure exerted on the under side of the piston, and the air is all exhausted from the upper side of the piston, so that the full load can be placed upon the cage immediately upon its arrival at the upper limit. With this explanation, it is obvious

that the balanced pressure air hoist is necessary for a safe elevator of this character, but the necessarily large diameter of the piston rod would apparently prohibit the use of the balanced pressure hoist, and it is only by means of the novel expedient of adding sufficient weight to the ordinary rod and cage that I have been able to employ the balanced air hoist to elevators as herein described.

I have spoken only of pneumatic elevators throughout, but it is apparent that steam or any gas under pressure can be used in place of compressed air, and when I speak, in the claims, of pneumatic elevators, I wish it to be understood that steam or any other gas under pressure can be substituted.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a balanced pressure hoist, a cylinder provided with a piston, a piston rod connected to the upper side of said piston and projecting upwardly through the upper end of said cylinder, a direct connection between the lower end of the cylinder and a supply of fluid under pressure, and means for introducing fluid under pressure into the upper end of the cylinder to cause the piston to move in one direction and for exhausting the fluid from the upper end of the cylinder to cause the piston to move in the opposite direction, the piston rod carrying a permanent load which is of sufficient weight to cause said piston to descend when the actuating fluid is introduced into the upper end of the cylinder.

2. In a balanced pressure fluid-actuated hoist, a cylinder provided with a piston having a piston rod that projects upwardly through the upper end of the cylinder, said rod being adapted to have a permanent load imposed on the upper end thereof, the lower end of the cylinder being in constant communication with a supply of fluid under pressure, and means for introducing a balancing pressure into the upper end of the cylinder and exhausting it therefrom, the weight of the piston rod and the permanent load thereon being sufficient to cause the load to descend when the pressure on the two sides of the piston is equalized.

3. In a balanced pressure elevator, a cylinder provided with a piston, a piston rod connected to the upper side of said piston and projecting upwardly through a stuffing box in the upper end of the cylinder, a cage or supporting platform connected to the upper end of said piston rod, means for establishing a direct connection between the lower end of the cylinder and a supply of fluid under pressure so that upward pressure will be constantly exerted on the lower side of the piston, and means for admitting a fluid under pressure into the upper end of the cylinder and exhausting it therefrom, the weight of said cage and piston rod being sufficient to cause the cage to descend when the pressure of the actuating fluid on the two sides of the piston is equalized.

4. In a balanced pressure fluid-actuated elevator, a cage, a cylinder arranged under the cage and provided with a piston, a rod connected to the upper side of said piston for sustaining the entire weight of said cage, said rod being of great enough cross sectional area that it will not bend when the cage is loaded unevenly, means for establishing direct connection between the lower end of the cylinder and a supply of fluid under pressure, a controlling valve for admitting fluid under pressure into the upper end of the cylinder and for exhausting it therefrom, and a permanent weight carried by said cage to compensate for the space which the piston rod takes up in the cylinder and thus cause the cage to descend when the pressure on the opposite sides of the piston is equalized.

5. In a balanced pressure fluid-actuated elevator, an operating cylinder provided with a piston, a piston rod connected to the upper side of said piston and projecting upwardly through a stuffing box in the upper end of the cylinder, an elevator cage or platform connected to the upper end of the piston rod, said cage being so constructed that permanent weights can be added thereto or taken away therefrom to vary the permanent weight imposed on the piston rod, a supply pipe leading from a supply of fluid under pressure and communicating with the lower end of the cylinder, so as to cause pressure to be exerted on the lower side of the piston constantly, and a two-way valve for exhausting fluid from the upper side of the piston to permit the cage to ascend and for introducing fluid onto the upper side of the piston, to cause the cage to descend.

6. In a pneumatic elevator, wherein the cylinder is underneath the platform, a source of compressed air connected directly to the lower end of the cylinder, and connected to the upper end of the cylinder, by means of a two-way valve, permitting the flow of compressed air into or out of the upper end of the cylinder, the combined weight of the empty platform and piston rod being sufficient to cause the cage to descend, when the compressed air is admitted to both ends of the cylinder.

7. In a pneumatic elevator of the character described, a balanced pressure air hoist arranged to push on the piston rod, the motive pressure being connected to the lower end of the cylinder, the balancing pressure

being admitted to and exhausted from the upper end of the cylinder, and the piston rod and empty cage having sufficient weight to return themselves against the unbalanced forces of the hoist.

8. In a pneumatic elevator of the type described, a balanced pressure air hoist having a piston rod arranged under the cage and being of sufficient strength to support the cage when unsymmetrically loaded, the motive pressure being connected directly to the lower end of the cylinder, the balancing pressure being connected by means of a two-way valve to the upper end of the cylinder, and the piston rod and empty cage having sufficient weight to return the empty cage against the unbalanced forces of the hoist, when the balancing pressure is admitted to the upper end of the hoist.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this ninth day of March, 1909.

GEORGE F. STEEDMAN.

Witnesses:

GEO. E. HOFFMANN,

WILLIAM F. HARRISON.