(No Model.)

F. E. HERDMAN.

ELEVATOR.

No. 510,914. Patented Dec. 19, 1893.

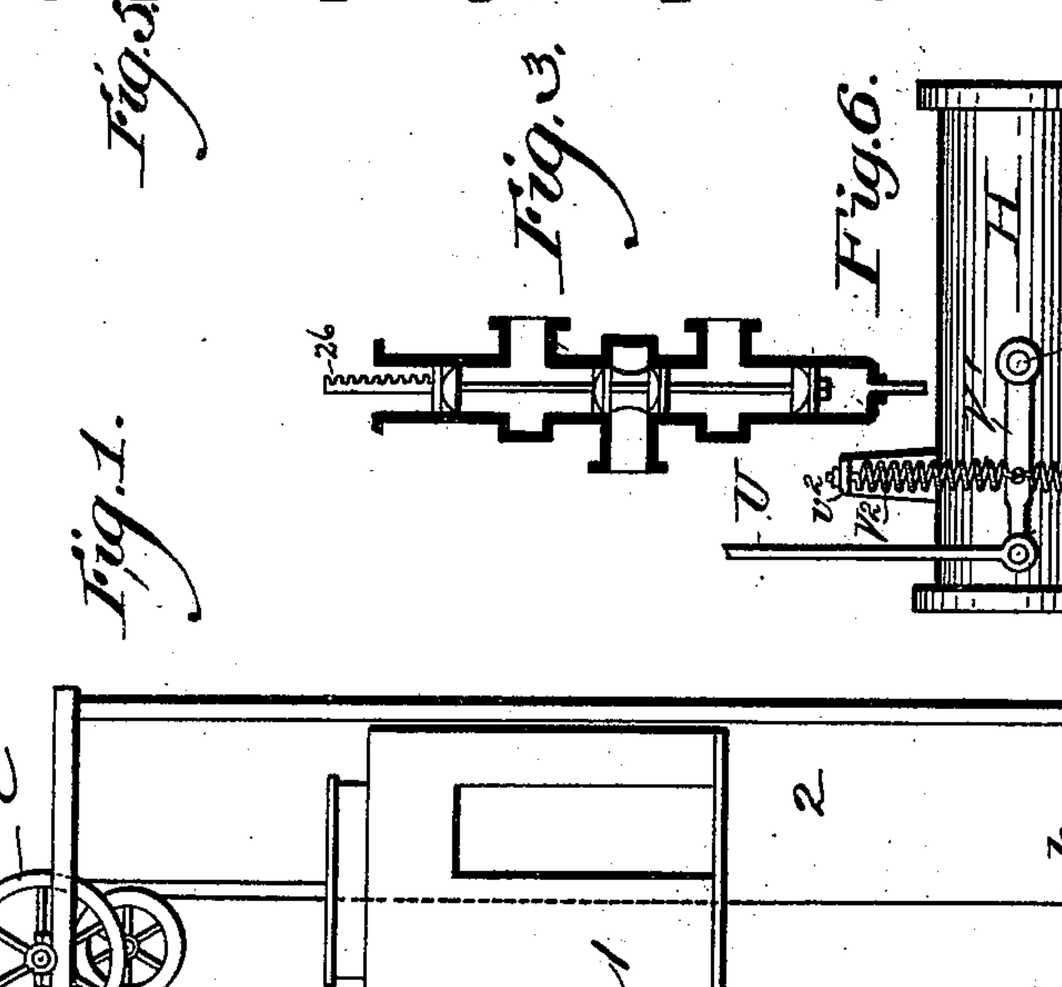

Fig. 4.

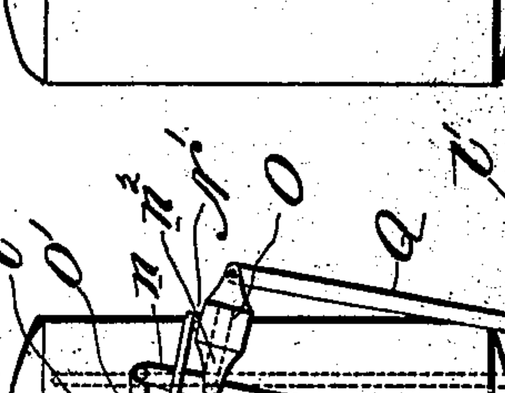

Fig. 2.

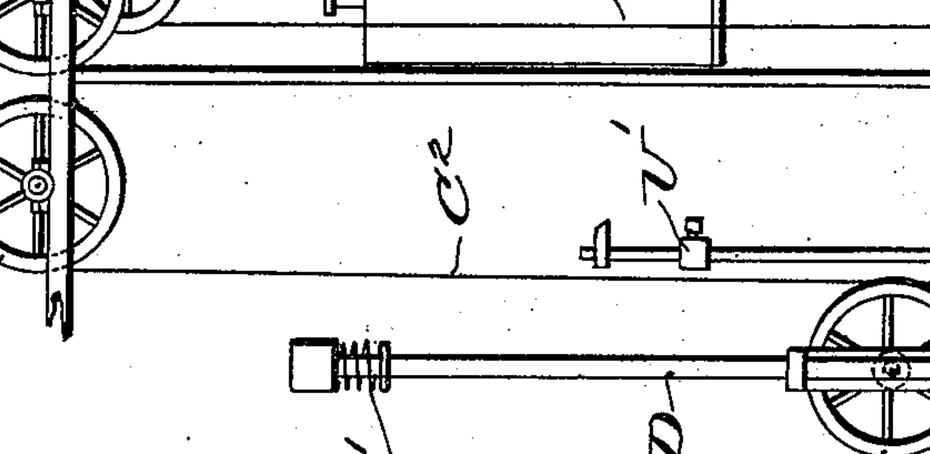

Fig. 5.

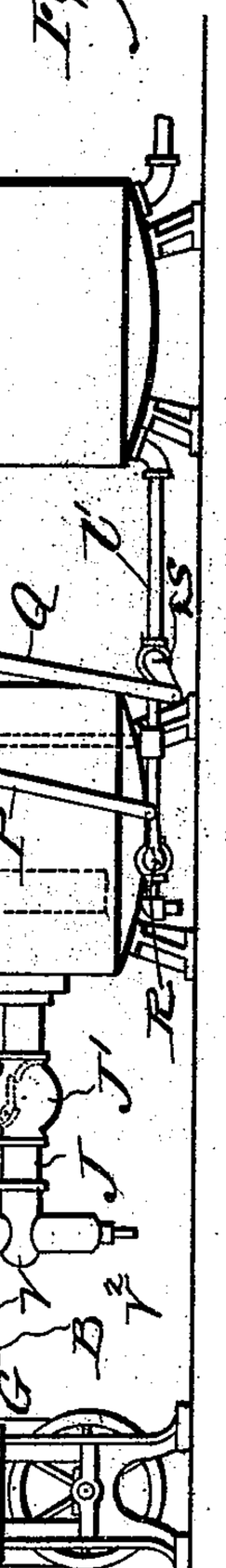

Fig. 2*.

Fig. 3.

Fig. 6.

Fig. 1.

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ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 510,914, dated December 19, 1893.

Application filed November 22, 1892. Serial No. 452,783. (No model.)

To all whom it may concern:

Be it known that I, FRANK E. HERDMAN, a citizen of the United States, residing at Indianapolis, county of Marion, and State of Indiana, have invented a new and useful Improvement in Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

The object of this invention, as will hereinafter be fully described, is to regulate the pressure used so that it shall be proportionate to and dependent upon the amount of weight to be lifted.

In the drawings:—Figure 1 is an elevation of elevator with attachments. Fig. 2 is a detailed view of butterfly valve used between the cylinder and controlling valve. Fig. 2* is a detailed view of butterfly valve in a different position. Fig. 3 is a view of valve H. Fig. 4 shows in detail operation of pressure valves. Fig. 5 is a modified form of rod U. Fig. 6 is a view showing the springs which return the butterfly valve to its central position and their supports.

1 is the elevator car operating in the shaft 2; B the sheave attached to the under side of the cylinder, and C traveling sheaves attached to a cross head on the upper end of the plunger C′.

D are guide rods in which the cross head carrying the sheave C slides.

C^2 is the lifting cable, which is attached to the car 1 and passes around the sheaves C^3 C^4 and down and around one of the sheaves B, up and around one of the sheaves C and down again, making as many turns as are necessary for the desired gear of the machine. The end of the cable is fastened to the bell crank F. The weight of the car is sufficient to cause it to descend, and in order to lift the car, the pressure is admitted below the plunger forcing the sheave C up, thereby lifting up the cable and elevating the car.

G is the conduit for the admission of the pressure fluid to the cylinder and to this conduit is connected the valve H, which is an ordinary piston valve having the supply and discharge ports I and J. The valve H is shown in detail in Fig. 3. It is operated by the sheave K which has on its shaft a pinion 25 meshing into a rack 26 on the end of the valve stem. The sheave K is controlled by the shipper rope *k*, which passes through the car around the guide pulley *k′* and around the sheave K. The supply port I is connected with the tank L and has between it and the tank a check valve I′. The discharge port J is also connected with the tank L and has between it and the tank a check valve J′. The valve I′ opens toward the cylinder A and the valve J′ opens toward the cylinder L.

M is a cylinder one end of which is connected with the tank L, the other end being open.

l is the piston rod which passes through both ends of the cylinder M, the left hand end of the piston rod being connected with the bell crank lever F (to the other member from that with which the lifting cables C^2 are connected). The other end of the piston rod is attached to the upright arm *m* of the bell crank lever N pivoted at N′. On the horizontal arm n^2 of this bell crank lever (which arm extends in both directions from the pivot point) is placed the weight O. The arm n^2 is connected to the weight O so that said weight can slide along said arm. This weight O is connected to the operating sheave K by means of the link O′. The weight O is attached to an arm to the ends of which are connected the links P and Q, the link P being connected with the lever of the valve R, and the link Q being connected with the lever of the valve S.

L′ is the pressure reservoir and *l′* the conduit from the pressure reservoir to the tank L.

The relation of the arms of the bell crank lever F is such that with the maximum load desired in the car pressure brought against the piston in the cylinder M by the load of the car will be balanced by the maximum pressure in the pressure tank L upon the piston *l*, when the weight O is in its central position. The tank L′ is filled with compressed air or other flexible gas at the maximum pressure. The valve S is placed in the pipe connection between the tank L and the tank L′. The valve R is placed in the discharge pipe from the tank L.

Fig. 4 shows in detail the valves R and S and the connections between the same and

the weight O; also the bell crank N. The weight O is made sufficient to give a good working pressure to overcome friction and give speed to the car.

Fig. 1 shows the mechanism in position for the car to ascend. When at rest, the valve sheave is thrown so as to bring the piston valve H to the central position, which position is shown in Fig. 3. When in this position the link O′, which connects the weight O with the valve sheave K, is also in its central position, and the weight O is in the central position of the bell crank N. In order to ascend, the operating valve is thrown down so as to give a free opening to the cylinder from the delivery port, which movement causes the weight O to be thrown to the right upon the bell crank N which places an additional force upon the piston of the cylinder M to hold it to the right; consequently, to keep the piston to the left, there must be a greater pressure in the tank L than would otherwise be necessary to counterbalance the pressure from the bell crank F, due to the load in the car; this difference in pressure being sufficient to operate the elevator and give the desired speed. If there is not sufficient pressure upon the piston *l* to counterbalance the weight of the car then the weight O drops and draws the piston to the right. In dropping, the weight O, through the medium of the link Q, opens the valve S, admitting air from the reservoir L′ to the tank L. At the same time the valve R remains in the same position, to wit: closed in consequence of the connection between the link P and the weight O being at the point on which the bell crank N swings. Compressed air continues to be admitted into the tank L until the pressure in the tank L is sufficient to overcome the pressure on the opposite side of the piston *l*, due to the load in the car and the weight of the weight O. When the pressure in this tank has reached this point, the piston in the cylinder M travels to the left and raises the weight O, at the same time closing the valve S. The car continues to travel at the will of the operator in this direction, and if during its travel the pressure in the tank L at any time falls below the required amount, the weight O again drops and admits additional pressure from the reservoir L′, and in this way the pressure in the tank L is maintained sufficiently to raise the load in the car, and only sufficient power is consumed to overcome the load in the car and operate the elevator. Thus if the load be light, then the strain on the bell crank F through the cable is correspondingly light, and the pressure in the tank L to overcome this is also correspondingly less than if the strain on the bell crank be greater. In descending of course the pressure in the cylinder must be less than the load in the car. To accomplish this the operator in opening the discharge port of the elevator valves, which he does by throwing the hand cable in the opposite direction, also throws the weight O to the left of the bell crank N; being in this position it tends to force the piston *l* in the cylinder M to the left and consequently aids the pressure in the tank L in doing this; the load acting against these two forces. If the pressure in the tank is sufficient to carry the piston to the left then the weight O drops and by means of the link P opens the valve R, thereby allowing the air from the tank L to be discharged and in consequence reducing the pressure in this tank. The point at which the link Q is attached to the weight being over the point at which the bell crank is pivoted, when the weight is in this position, the latter does not move the valve S. The air continues to discharge from the tank L until the pressure is reduced to such an amount that the load in the car through the bell crank F is sufficient to overcome this pressure, and the weight, and force the piston *l* in the cylinder M to the right, and in doing so it closes this valve R. In consequence the pressure in the tank L is reduced sufficiently to allow the car to descend and the contents of the cylinder A to be discharged into this tank. A check valve is placed in the delivery pipe, opening toward the cylinder, so that when it is desired to ascend, and the valve H is open in that direction, if the pressure in the tank L should be low, the water from cylinder A cannot return in this tank, thereby allowing the car to descend instead of ascend. Consequently the car would remain at rest until the pressure in the tank L is sufficiently increased from the tank L′ to overcome the load in the car and raise it. The check valve in the discharge pipe opening toward the tank L is placed for the same reason to prevent the car from ascending if at such time the pressure in the tank L should be greater than in the cylinder A when the valve is opened to descend.

By the arrangement described, the elevator can be operated, consuming power proportionately to the load. That is, if it requires ten pounds pressure in excess of that actually required for the load to overcome friction and give the necessary speed to the car, then the weight O is adjusted and the pressure in the tank L is maintained to this amount, thereby raising the load in the manner desired and at the same time consuming no unnecessary power in doing so. Also in descending, if the same amount of additional power is necessary in the car to bring the car down, this weight O by being thrown in the right direction, reduces the pressure in the tank L to that amount; and in consequence when descending with the full load, instead of allowing that much power wasted, the difference of power necessary to bring down the load is stored in the tank.

Instead of using air pressure in the tank L, the pipe L′ could be in direct connection from the boiler, admitting steam into it; and a layer

of paraffine, being placed in the tank, and which would of course float on the top of the water, would form a non-conductor between the water and the steam so as to save excessive condensation.

In order to provide the elevator with an automatic stop in the pipe connection between the cylinder A and the valve H, a butterfly valve V is placed, held in its central position by the springs V′ and V². To the lever of this valve is attached the rod U extending up alongside of the cylinder A. To the cross head of the plunger is attached the arm T extending out and surrounding the rod U. When the car is near the top the arm T strikes the button U′ which is adjustably connected to the rod U, in time to throw it, which closes the butterfly valve. In Fig. 2 this butterfly valve is shown in detail. This figure shows the valve in its central position. Fig. 2* shows the valve closed in the manner described. When closed in this way water cannot pass into the cylinder A and in consequence the travel of the car is stopped. In descending, after this automatic valve has acted, there must be means provided for the water to pass from the cylinder A into the discharge tank until the automatic valve comes to its central position. To accomplish this the center of the butterfly valve is cut out and a disk 20 is placed over the opening, this disk being held tight over the opening when the water attempts to pass into the cylinder, but when the valve H is opened to descend, the water passing in the opposite direction raises this disk and allows the car to descend. As soon as the arm T drops sufficiently the spring V′ brings the butterfly valve to its central position at the lower end of the travel of the elevator. In descending, the arm T strikes the button U² placed upon the rod U, so that the rod U, closes the butterfly valve before the car reaches the bottom. At this point of the travel the butterfly valve is closed in the direction opposite to that before described, so that the disk prevents the passage of the water from the cylinder and admits it to the cylinder. This position is shown by dotted lines, Fig. 2*. Instead of using the rod U a cable can be used, as shown in Fig. 5. The lower sheave of this cable acts as a lever to the butterfly valve. At the top and bottom of the guide rods D, I place springs D′ and D² for the cross heads to strike at either extreme travel of the plunger, thus giving a spring bumper at either end of the travel and stopping the further travel of the plunger if the automatic valve should not properly act.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In an elevating apparatus, in combination with the operating cylinder a source of pressure supply, a pressure tank connection between said tank and source of pressure supply, an outlet valve from said tank, a cylinder connected with the pressure tank a piston in said cylinder, connection between said piston and the lifting cable and connection between the piston and the outlet valve.

2. In an elevating apparatus, in combination with the operating cylinder, a source of pressure supply, a pressure tank, connection between the source of pressure supply and said tank, a valve in said connection, an outlet valve from said tank, a cylinder connected with the pressure tank, connection between the piston in said cylinder and the lifting cables and connection between said piston and the outlet valve, and connection between said piston and the valve in connection between the tank and the source of pressure supply.

3. In a hydraulic elevator the combination of a pressure tank, an outlet from said tank, a valve on said outlet, lifting cables, a cylinder opening into said pressure tank provided with a piston, connection between said piston and the lifting cables, a weight, connection between said weight and the piston and between said weight and the valve.

4. In a hydraulic elevator the combination of a pressure tank, an inlet to said tank from the source of pressure supply a valve on said inlet, an outlet from said tank, a valve on said outlet, lifting cables, a cylinder opening into said pressure tank provided with a piston, connection between said piston and the lifting cables, a weight connection between said piston and said weight and between said weight and said valves.

5. In a hydraulic elevator, the combination of a pressure tank, an inlet in said tank from the source of pressure supply to a valve upon said inlet, lifting cables, a cylinder opening into said pressure tank provided with a piston, connection between said piston and the lifting cables, a weight movably sustained, connection between said weight and the piston and between said weight and the valve, and means substantially as described to shift said weight.

6. In a hydraulic elevator the combination of a pressure tank, an outlet from said tank, a valve on said outlet, lifting cables, a cylinder opening into said pressure tank provided with a piston, connection between said piston and the lifting cables, a weight, movably sustained, connection between said weight and the piston and between said weight and the valve and means substantially as described to shift said weight.

7. In a hydraulic elevator the combination of a pressure tank, an inlet to said tank from the source of pressure supply a valve on said inlet, an outlet from said tank, a valve on said outlet, lifting cables, a cylinder opening into said pressure tank provided with a piston, connection between said piston and the lifting cables, a weight movably sustained, connection between said piston and said weight and between said weight and said valves and means substantially as described to shift said weight.

8. In a hydraulic elevator, the combination

of a pressure tank, an inlet in said tank from the source of pressure supply a valve upon said inlet, lifting cables, a cylinder opening into said pressure tank provided with a piston, connection between said piston and the lifting cables, a weight movably sustained, connection between said weight and the piston and between said weight and the valve, and connection between said weight and the power controlling mechanism.

9. In a hydraulic elevator, the combination of a pressure tank, an outlet from said tank, a valve on said outlet, lifting cables, a cylinder opening into said pressure tank provided with a piston, connection between said piston and the lifting cables, a weight, movably sustained, connection between said weight and the piston and between said weight and the valve and connection between said weight and the power controlling mechanism.

10. In a hydraulic elevator, the combination of a pressure tank, an inlet to said tank from the source of pressure supply a valve on said inlet, an outlet from said tank, a valve on said outlet, lifting cables, a cylinder opening into said pressure tank provided with a piston, connection between said piston and the lifting cables, a weight movably sustained, connection between said piston and said weight and between said weight and said valves, and connection between said weight and the power controlling mechanism.

11. In a hydraulic elevator, the combination of a pressure tank, an inlet to said tank from the source of pressure supply, a valve on said inlet, lifting cables, a bell crank to which said cables are secured, a cylinder opening into said pressure tank and provided with a piston, one end connected to said bell crank, a bell crank one end connected to the other end of said piston, a weight upon the other member of said last mentioned bell crank and connection between said weight and the inlet valve.

12. In a hydraulic elevator, the combination of a pressure tank, an outlet from said tank, a valve on said outlet, lifting cables, a bell crank to which said cables are secured, a cylinder opening into said pressure tank and provided with a piston, one end connected to said bell crank, a bell crank one end connected to the other end of said piston, a weight upon the other member of said last mentioned bell crank and connection between said weight and the outlet valve.

13. In a hydraulic elevator, the combination of a pressure tank, an inlet to said tank from the source of pressure supply, a valve on said inlet, an outlet from said cylinder, a valve on said outlet, lifting cables, a bell crank to which said cables are secured, a cylinder opening into said pressure tank and provided with a piston, one end connected to said bell crank, a bell crank one end connected to the other end of said piston, a weight upon the other member of said last mentioned bell crank and connection between said weight and the valves.

14. In a hydraulic elevator, the combination of a pressure tank, an inlet to said tank from the source of pressure supply, a valve on said inlet, lifting cables, a bell crank to which said cables are secured, a cylinder opening into said pressure tank and provided with a piston, one end connected to said bell crank, a bell crank one end connected to the other end of said piston, a weight movable upon the other member of said last mentioned bell crank and connection between said weight and the inlet valve, and connection between said weight and the power controlling mechanism.

15. In a hydraulic elevator, the combination of a pressure tank, an outlet from said tank, a valve on said outlet, lifting cables, a bell crank to which said cables are secured, a cylinder opening into said pressure tank and provided with a piston, one end connected to said bell crank, a bell crank one end connected to the other end of said piston, a weight movable upon the other member of said last mentioned bell crank and connection between said weight and the outlet valve, and connection between said weight and the power controlling mechanism.

16. In a hydraulic elevator, the combination of a pressure tank, an inlet to said tank from the source of pressure supply, a valve on said inlet, an outlet from said cylinder, a valve on said outlet, lifting cables, a bell crank to which said cables are secured, a cylinder opening into said pressure tank and provided with a piston, one end connected to said bell crank, a bell crank one end connected to the other end of said piston, a weight movable upon the other member of said last mentioned bell crank and connection between said weight and the valves and connection between said weight and the power controlling mechanism.

In testimony of which invention I have hereunto set my hand.

F. E. HERDMAN.

Witnesses:
W. V. MARTIN,
E. B. KERR.