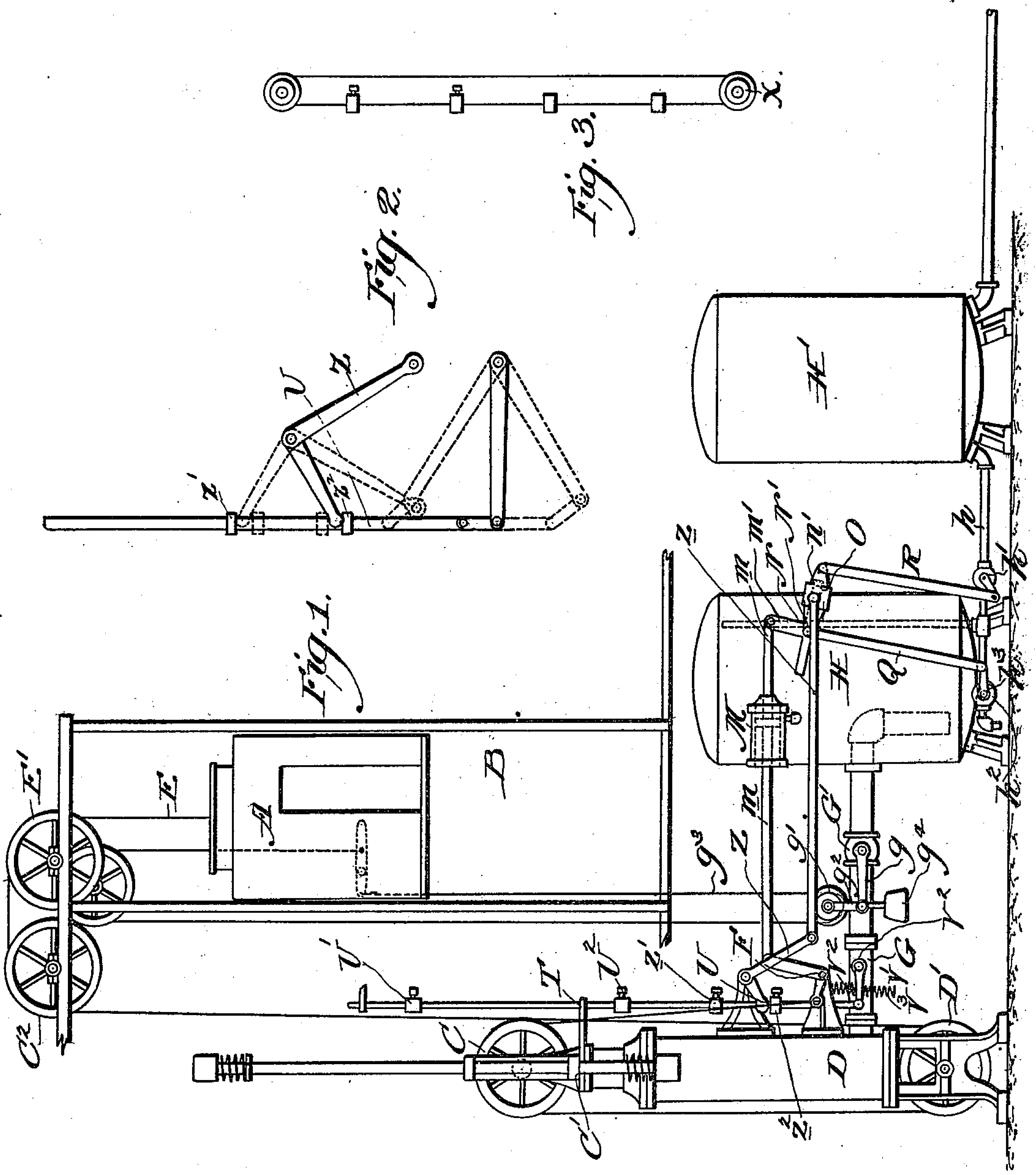
(No Model.) 2 Sheets—Sheet 1.

F. E. HERDMAN.

ELEVATOR.

No. 510,915. Patented Dec. 19, 1893.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

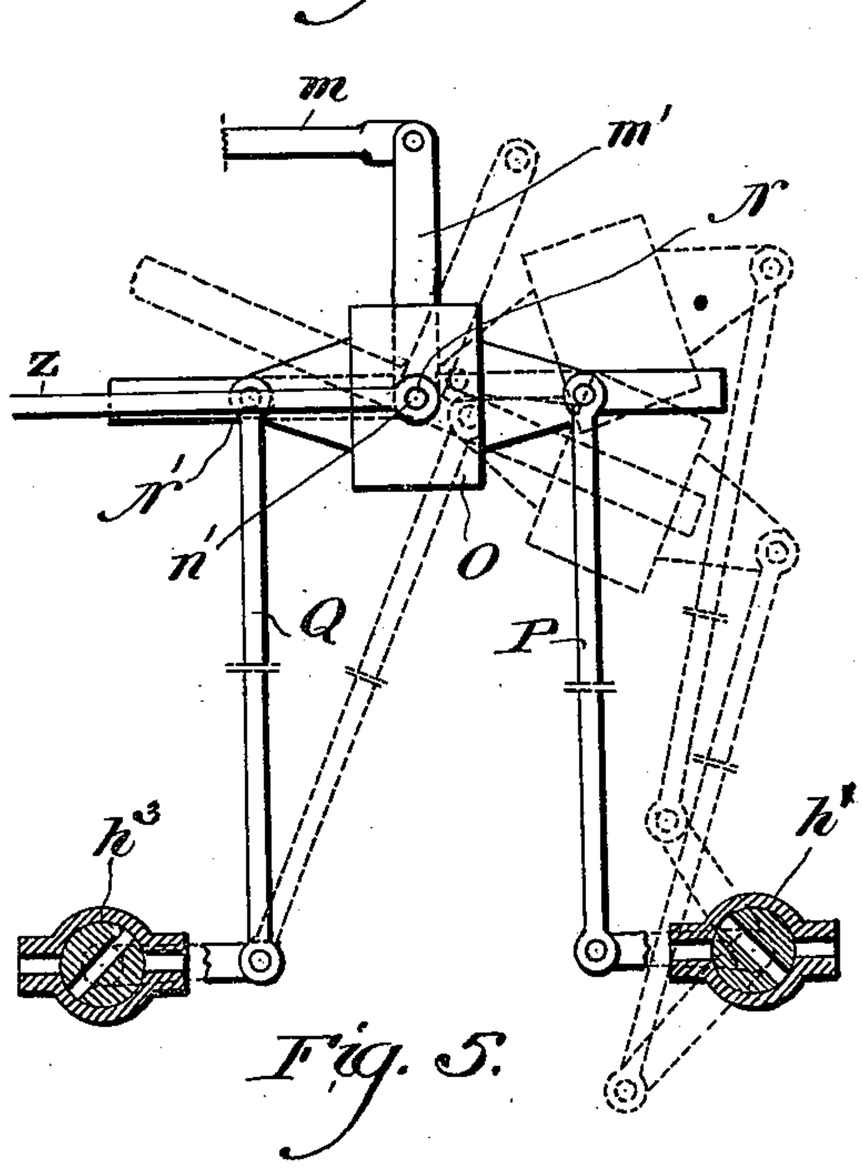
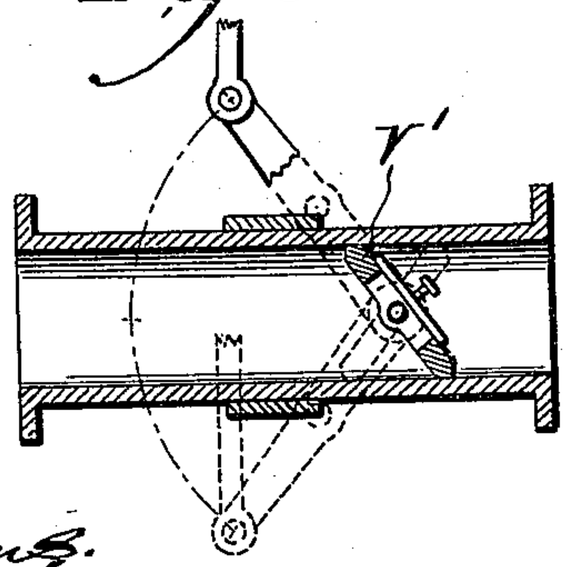


Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF INDIANAPOLIS, INDIANA.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 510,915, dated December 19, 1893.

Application filed November 22, 1892. Serial No. 452,784. (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.

In the drawings:—Figure 1 is a front elevation of elevator and elevating mechanism. Fig. 2 is a detail of the operation of the bell crank Z. Fig. 3 is a modified form of rod U. Fig. 4 is a view of the shifting weight and its connections showing also the operation of the valves h', h^3. Fig. 5 is a view of the springs V^2, V^3, and their supports. Fig. 6 is a detailed view of the butterfly valve used between the cylinder and controlling valve.

A is the elevating car operating in the shaft B.

C is the traveling sheave connected to the plunger C′.

D is the cylinder having at its lower end the fixed sheave D′.

E is the lifting cable which passes around the fixed sheaves E′ C^2 and down and around a sheave D′ and up and around the sheave C, and so on the number of times required to give the desired gear to the machine, and is finally connected to the bell crank F.

G is the conduit leading from the cylinder D to the pressure tank H, and G′ is the valve upon said conduit. The lever g of this valve is connected to the sheave g' by the rod g^2, and the operating cable g^3 passes around this sheave and through the car so that the operator by moving the operating cable can control the valve in one direction, the weight g^4 returning the valve in the other direction.

At the side of the tank H or at any other convenient place is secured the cylinder M, the right end of which is connected with the pressure tank L, the other end being open. The piston rod m passes through both ends of the cylinder, the left end of said rod being connected with the end of the bell crank F other than that to which the lifting cable E is connected. The other end of the piston rod is attached to the arm N of the bell crank lever, the latter being pivoted at N′. On the horizontal arm n' of this bell crank which extends in both directions from the pivot point is placed a weight O. The weight O is upon the arm so that it can travel from one end to the other of said arm. This weight O is attached to a bell crank Z by means of the link z the other end of the bell crank Z surrounding the rod U, the end of the rod U being connected with the lever V^2 of a valve V′, in the conduit G. Upon this rod are the buttons z' z^2.

To the cross head of the plunger is attached a rod T extending out and surrounding the rod U and upon this rod U are the stops U′ U^2.

H′ is the pressure reservoir connected with the pressure tank H by the pipe h. Upon this pipe is the valve h' and upon the outlet pipe h^2 from the tank H is the valve h^3. The weight O is attached to an arm the ends of which are connected to the links R and Q, the link R connecting the lever of the valve h', and the link Q connecting the lever of the valve h^3. The relation of the arm and the bell crank F to each other is such that with the maximum load in the car the pressure brought upon the piston in the cylinder M due to the load in the car, would be balanced by the maximum pressure in the pressure tank H when the weight O is in the central position.

Fig. 1 shows the mechanism in position for the car to ascend. When the car is ascending the bell crank Z is in the position shown in Fig. 1, and when the car reaches the top the arm T strikes the button U′ lifting the automatic lifting rod U and closing the valve V′. The raising of rod U causes the button Z^2 to strike and raise the bell crank Z and the weight O is moved to the left, when the mechanism is in position for the descent of the elevator car. When the car reaches the bottom the arm T strikes the button U^2 pushing rod U and closing valve v' which causes the button z' to strike the arm of the bell crank Z and throw the weight O to the right, when the mechanism is in position for the car to ascend. When the automatic valve is in this position for the car to ascend, and closes in this direction, the button z' follows up the arm of the bell crank Z, but when the bell crank starts in the opposite direction of course the automatic valve being relieved the

spring V³ brings it to the center, and consequently raises the button z' free from the bell crank Z and brings the button z^2 in position to control the bell crank Z, when the arm strikes the upper button U'. The different positions of the bell crank Z are shown in detail in Fig. 2. By this arrangement when the car is at the bottom the operator is free to ascend to anywhere between the lower landing and the top landing but cannot reverse between the bottom and the top. He can stop at pleasure and run up, but the mechanism is such that he cannot descend until he has reached the top landing, when the bell crank z^2 operates and throws the weight O in proper position. With this arrangement it is only necessary to have a direct pipe connection with the tank H and simply an ordinary cock or other simple opening to the valve G', the operator opening the valve in the same direction in either ascending or descending. In ascending the operating valve is open so as to give a free opening to the cylinder delivery port, and at the same time the weight O is thrown to the right of the bell crank. When in this position it places an additional force to hold the piston of the cylinder M to the right; consequently to keep the piston to the left there must be a greater pressure in the tank H than otherwise would be necessary to counterbalance the pressure from the bell crank F to the load in the car, this difference in pressure being sufficient to operate the elevator and give it desired speed. If this additional pressure is not sufficient to counterbalance the piston M then the weight O drops and draws the piston to the right. In dropping, the weight, O, by means of the link P opens the valve h' admitting air from the reservoir H' to the tank H. While this occurs the valve h^3 remains in the same position in consequence of the connection between link Q and the weight O being at the point on which the bell crank N swings. Compressed air continues to be admitted into the tank H until the pressure in the tank H is sufficient to overcome the pressure on the opposite side of the piston cylinder M, due to the weight of the car and the weight O. When the pressure in the tank has reached this point then the piston travels to the left and raises the weight O, at the same time closing the valve h'. The car continues to travel at the will of the operator in this direction, and if, during its travel, the pressure in the tank H at any time falls below the required amount the weight O again drops and admits additional pressure from the reservoir H'. In this way the pressure in the tank H is maintained sufficiently to raise the load in the car, and by this means only sufficient power is consumed to overcome the load in the car and operate the elevator; for, if the load is light then the strain on the bell crank through the cable is correspondingly light, and the pressure in the tank to overcome this may also be correspondingly less. 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 valve, which he does as before described through the operating cable, and, as before described, at this period when the elevator has reached its maximum elevation the weight O is thrown to the left of the bell crank N, and being in this position it tends to force the piston in the cylinder M to the left and consequently aids the pressure in the tank H 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 Z and link Q opens the valve h^3, thereby allowing the air from the tank H to be discharged, and in consequence reducing the pressure in this tank. The point at which the link Z is attached to the weight being over the point at which the bell crank is pivoted, it does not move the valve h'. The air continues to discharge from the tank H 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 in the cylinder M to the right, and in doing so it closes this valve. In consequence, the pressure in the tank H is reduced sufficiently to allow the car to descend and the contents of the cylinder D to be discharged into this tank. By the arrangement described I am enabled to operate the elevator consuming power proportionate to the load. That is, if it requires ten pounds pressure over and above what is actually required for the load to overcome the friction and give the necessary speed to the car, then the weight O is adjusted by the means described, and the pressure in the tank H is maintained at this additional 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 H to that amount and in consequence, when descending with the full load instead of allowing that much power to be wasted, the difference necessary to bring down the load is stored in the tank and by the additional mechanism hereinbefore described, when the car once starts to ascend the operator can not reverse it nor can he reverse it when it starts to descend.

Instead of a rod U, as shown, it is evident that a chain may be used provided with projections, the lower wheel X over which said chain passes being connected with the arm or valve V', as shown in Fig. 3.

In an application filed by me on the date of the filing of this application, Serial No. 452,783, I have illustrated and described, in an hydraulic elevator, a pressure tank, an outlet and a valve thereupon, an inlet from the source of supply and a valve thereupon, a

cylinder opening into the pressure tank and having a piston working therein connected with a bell crank in the tank which has a slidable weight upon it, the other end of the piston being connected with another bell crank which in turn is connected with the lifting cables, and a connection between the sliding weight and the valves above mentioned, which in construction and operation are substantially similar to what I show and describe herein. I claim therein specifically in combination the details just enumerated, and also claim broadly such of those parts as I consider essential to my invention. I do not herein claim as new what is therein claimed, but

What I do claim, and desire to protect by Letters Patent, is—

1. In a hydraulic elevator, the combination of lifting cables, an operating cylinder, a pressure tank, connection between the pressure tank and operating cylinder, a cylinder opening into said pressure tank, a piston in said cylinder, one end of said piston connected to the lifting cables, a movable weight connected to the other end of said piston, an inlet from the source of pressure supply to the pressure tank, a valve on said inlet, connection between said weight and said valve, a bell crank, connection between said bell crank and weight O, an upright movable device extending up along the operating cylinder, projections upon said upright device in line with which is the other arm of said bell crank, a plunger in the operating cylinder, a projection from said plunger, projections upon said upright device in line with said projection.

2. In a hydraulic elevator, the combination of lifting cables, an operating cylinder, a pressure tank, connection between the pressure tank and operating cylinder, a cylinder opening into said pressure tank, a piston in said cylinder, one end of said piston connected to the lifting cables, a movable weight connected to the other end of said piston, an outlet from said pressure tank, a valve on said outlet, connection between said weight and said valve, a bell crank, connection between said bell crank and weight, and upright movable device extending up along the operating cylinder, projections upon said upright device in line with which is the other arm of said bell crank, a plunger in the operating cylinder, a projection from said plunger, projections upon said upright device in line with said projection.

3. In a hydraulic elevator, the combination of lifting cables, an operating cylinder, a pressure tank, connection between the pressure tank and operating cylinder, a cylinder opening into said pressure tank, a piston in said cylinder, one end of said piston connected to the lifting cables, a movable weight connected to the other end of said piston, an inlet from the source of pressure supply to the pressure tank, a valve on said inlet, an outlet from said tank, a valve upon said outlet, connection between said weight and said valves, a bell crank, connection between said bell crank and weight, an upright movable device extending up along the operating cylinder, projections upon said upright device in line with which is the other arm of said bell crank, a plunger in the operating cylinder, a projection from said plunger, projections from said upright device in line with said projection.

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

F. E. HERDMAN.

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