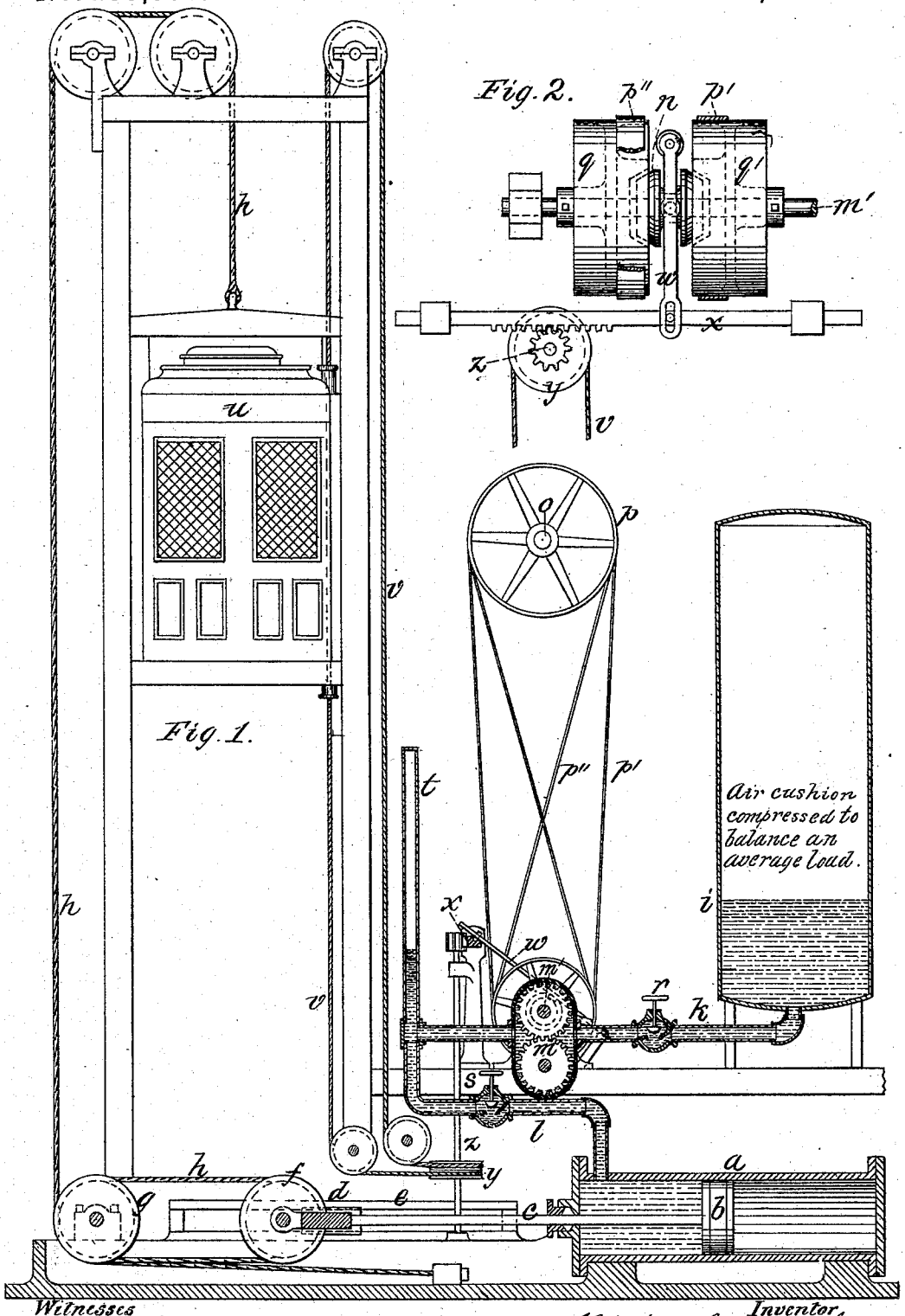
(No Model.)

W. M. BAILEY.

ELEVATOR.

No. 269,994. Patented Jan. 2, 1883.



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UNITED STATES PATENT OFFICE.

WALTER M. BAILEY, OF NEW YORK, N. Y.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 269,994, dated January 2, 1883.

Application filed April 19, 1882. (No model.)

To all whom it may concern:

Be it known that I, WALTER M. BAILEY, of the city, county, and State of New York, have invented certain new and useful Improvements in Freight and Passenger Elevators, of which the following is a specification.

My present invention proceeds upon the old maxim, which is particularly applicable to elevators, that "whatever goes up must come down," and therefore aims to utilize the descending load which has been previously raised to assist in raising subsequent loads.

It will be readily understood that in all elevators, whether for freight or passengers, the loads which have been once raised by the car must eventually descend by the car, and particularly is this the case with freight-elevators, for while some of the passengers brought up in a passenger-elevator often descend by the stairs, yet it is a general fact in the operation of passenger-elevators in large buildings that the car carries its ordinary number of passengers on the down as on the up trip, so that the descending load is thus, on the average, equal to the load raised. It thus becomes obvious that by a proper construction which would utilize this descending load the elevator might be made to do its work with very little additional power, or sufficient to overcome friction and the variations between a minimum and maximum load.

The main feature of my invention may therefore be stated to consist in the combination, with the car, of a fixed or constant counter-balance equal to a normal or average load, with an operative connection between the car and the counter-balance, and a motive device to propel said operative connection one way or the other, according as the load is less or greater than the average, and thereby raise or depress the car by the expenditure of but little power.

My invention is also embodied in the special construction and arrangement of parts, as hereinafter fully set forth.

Figure 1 in the annexed drawings presents a sectional elevation of an elevating apparatus embodying my invention and constructed on a hydraulic plan; but the invention may also be readily embodied in other than a hydraulic construction. Fig. 2 is a detail of the stopping and starting mechanism.

In the drawings, *a* indicates an ordinary single-acting hydraulic lifting-cylinder of about the same construction as is employed in existing hydraulic elevators, and placed preferably in horizontal position. *b* is a hydraulic piston, fitted to said cylinder, the piston-rod *c* of which works through a stuffing-box in the head of the cylinder and connects to a cross-head, *d*, which slides in the fixed guides *e*. The cross-head *d* carries a set of movable sheaves, *f*, while a corresponding set of fixed sheaves, *g*, are journaled at the end of the guides, the two sets of sheaves thus forming a large compound pulley, over which the hoisting-cable *h* passes in the well-known manner and extends to the car *u*, so that if the piston is moved outward in its cylinder the movable sheaves *f* will recede from the fixed sheaves *g*, and the end of the cable connected with the car will be moved through a space equal to the stroke of the piston multiplied by the loops of the cable around the sheaves, as will be readily understood by those familiar with this class of machinery. Now, *i* indicates a water-reservoir, which is connected at the base through the pipes *k l* and pump *m* with the cylinder *a*, the fluid in the pipes *k l*, pump *m*, and cylinder *a* forming of course an operative hydraulic connection between the movable piston, the pump, and the water-reservoir, as will be understood. Now, the pump *m* is preferably of a well-known rotary kind, or consists simply of two accurately-cut gear-wheels of small pitch, meshing together and revolving in a closely-inclosing oval case, the shaft of one of the wheels projecting from the case through a stuffing-box, whereby power may be applied thereto, while the connecting-pipes from the reservoir to the cylinder open respectively into and out of opposite sides of the case in line with the junction of the gear-wheels, as shown in the drawings. It is therefore obvious that if the pump is revolved in one direction it will withdraw the water from the reservoir and force it into the cylinder, thus moving the piston outwardly therein and raising the car, and if the pump is revolved in the opposite direction it will withdraw the water from the cylinder and force it into the reservoir, and thus cause the piston to retreat and the car to descend. Now, the water-reservoir *i* is preferably inclosed, and of such a size

as will provide a confined-air space above the water-level considerably greater than the charge of water, as illustrated, and in this air-space the air is compressed to such density or pressure as will balance a normal or average load on the lifting-piston *b*, which of course represents a normal or average load on the car, which is sustained by the piston. It will therefore be seen that the pump *m* forms a hydraulic propelling or motive device between the cylinder and reservoir, and also a form of valve which either permits or prevents the transfer of fluid from one to the other, and thus serves to control the motion of the piston. Thus, if the car should be at the bottom of the shaft and should receive a load less than the average, it will be readily seen that by simply releasing the pump so as to leave the wheels free to revolve in the case the pressure from the reservoir will act through the pump and exert itself on the lifting-piston *b* so as to raise the car to the desired height without any additional power, and if it is desired to stop the car at any point in its ascent this will be effected by arresting the motion of the pump by a suitable brake or clutch. On the other hand, if the car should receive more than an average load when at the top of the shaft the descending pressure of the car on the piston will of course exceed the lifting-pressure from the reservoir *i*, so that if the pump be left free to revolve the car will descend, the piston will retreat, and force the water back from the cylinder into the reservoir against the air-pressure therein, as will be understood, thus requiring no additional power in either of the instances just mentioned to operate the elevator. If, however, the car should be required to lift a load greater than the average or to lower a load less than the average, it will then of course be necessary to apply additional power to revolve the pump in either way, but only sufficient to make up the difference between the average and the minimum or maximum loads, or, in other words, the difference between the constant confined pressure in the counterbalancing-reservoir *i* and the variable weight of the car, as will be readily understood, which, in ordinary use, will be slight, so that by this system it is obvious that a remarkable saving of power can be effected.

It will thus be seen that the only expenditure of power necessary to operate my improved elevator will be that required to overcome the variations from an average load, and this small additional power I prefer to obtain from a power-shaft, *o*, which may be driven by steam-engines or other motors employed for other purposes in the building in which the elevator is erected. The power is taken from a large pulley, *p*, on this shaft *o* by an ordinary arrangement of straight and cross belts, P′ P″, which revolve loose independent pulleys *q q′* on the shaft *m′* of the pump *m*. A double friction-clutch, *n*, keyed to the pump-shaft, may play between the pulleys, so that when shifted in one direction one pulley will be engaged with the shaft and the pump revolved in one direction, and when shifted in the opposite direction the other pulley will be engaged and the pump moved in the reverse direction, while, when the clutch is moved to its mid-position, both pulleys will be disengaged, and a brake (not shown) will be applied to hold the pump stationary, so as to thus cause the car to ascend or descend, or remain stationary at any point, as may be desired. The device *w x y z* for thus shipping the clutch will of course be operated by the check-rope *v*, extending to the car, in precisely the same manner as now generally employed in existing elevators; and as the described arrangement of clutch-shipping mechanism, &c., is substantially the same as now employed in hoists it is not here claimed.

The gear-wheels of the pump, as before stated, are preferably made of a fine pitch, and are designed to be revolved rapidly, so that their displacing action will be practically continuous, and thus produce a smooth, steady motion on the piston and prevent vibrations of the car. A small air-vessel, *t*, rises from the connecting-pipe *l* between the pump *m* and cylinder *a* to neutralize any slight vibrations in the action of the pump. The pipes *k l* are also preferably provided with valves *r s*, either of which may be closed when it is desired to allow the car to remain at rest for some time, so as to prevent any slow leakage through the pump, which might otherwise cause the car to gradually move up or down. The valves *r s* will also enable the flow of water to be shut off when it is desired to examine the pump *m* or cylinder *a*, as will be understood.

It will be readily understood that instead of compressing air in the closed reservoir *i*, in order to obtain a pressure on the water sufficient to balance an average load on the piston, the same result may be accomplished by simply elevating the water-tank to a certain height and leaving the tank open at the top, so that the head of water thus obtained will serve to balance an average load on the piston. Indeed, my invention may be thus readily applied to the common form of existing hydraulic elevators in which a column of water is taken from an elevated tank to propel the lifting-piston. In such case it will only be necessary to introduce the rotary pump *m* in the pipe leading from the elevated reservoir to the lifting-cylinder, with driving mechanism, substantially as shown in the drawings, to operate the pump, and this simple addition will greatly increase the capacity of such elevators without altering their present arrangements or proportions. Hence in such elevators, where the pressure from the tank is not now sufficient to lift the heaviest loads which the car will admit, this pressure may be used to lift average loads, while additional power may be furnished by the pump *m* in moving loads less or greater than the average, on the principle already described, as will be readily understood. Hence

by this system a very smooth-working elevator, having great capacity and being very economical in the use of power, will be produced.

It is not of course necessary to confine my invention to elevators on the hydraulic plan, as it may also be embodied in a simple gravity form of elevator—that is, the car may be suspended by a cable passing over pulleys to a counter-weight, the cable passing over a winding-drum or other motive or propelling device between the car and counter-weight. In this case the counter-weight will of course balance an average load on the car, as before, and additional power may be furnished by the winding-drum or intermediate device to propel the cable one way or the other, and thus raise or depress the car in cases when the load is less or greater than the average, as will be readily understood.

I am aware that an elevator has been proposed, as shown in Marvin's patent, No. 182,280, in which the car contains a water-tank, and is suspended from a cable which passes over a pulley and connects to a second water-tank, which forms a counter-balance to the car. A pump is arranged to transfer the water from the counterbalancing-tank to the tank on the car, and thus cause the weight of either to preponderate, and thereby force the car to ascend or descend. In this case, therefore, there is no fixed or constant counter-balance, but a variable weight or counter-balance, and the pump or motive device acts to shift the excess of this weight from the counter-balance to the car, and vice versa. This organization is hence obviously distinct from mine, as in my case the counter-balance is fixed or constant and equal to an average load, and no transfer of weight whatever occurs between the car and the counter-balance; but the motive device acts simply to propel the operative or sustaining connection between them one way or the other, according as the weight of the car is greater or less than the average. In the construction which I have illustrated the counter-balance is a cushion of compressed air and the sustaining-connection is a confined water column between this air-chamber and the piston which lifts the car, and the motive device is a pump, which acts to transfer or force this sustaining-connection or water column in one way or the other, so as to move it against the stress of the car in one direction if the car overbalances the air-cushion, or against the stress of the air-cushion in the other direction if the cushion overbalances the car. In the Marvin apparatus the cable between the car and counter-balance is the sustaining-connection between the two, and this is an entirely passive element, and has no motive device whatever to propel it one way or the other, for the motive device in this reference acts entirely separate from the sustaining-connection, and operates simply to shift the excess of weight from car to counter-balance, whereas in my case, as before noted, the counter balance is constant and equal to an average load, and no transfer of weight between the car and counter-balance occurs; but, on the contrary, the sustaining-connection between the two is an active element, and is propelled one way or the other, according as the load on the car is greater or less than the average, thus producing an elevating apparatus of a distinctly new type.

What I claim is—

1. The combination, with an elevator car or platform, of a constant counter-balance equal to the weight of the car with an average load, or nearly so, with a sustaining-connection between the car and the counter-balance, and a motive device to propel said connection one way or the other, according as the load is greater or less than the average, substantially as and for the purpose herein set forth.

2. The combination, with an elevating car or platform, of a hydraulic lifting piston and cylinder operatively connected with the car, a liquid-reservoir connected with said cylinder, and a charge of liquid in or between said reservoir and cylinder under pressure sufficient to balance an average load on the lifting-piston, with a transferring-pump in the connection between said reservoir and cylinder adapted to propel the liquid in either direction, and thereby raise or depress the car when loaded with less or more than the average weight, substantially as herein shown and described.

3. The combination, with an elevating car or platform, of a hydraulic lifting piston and cylinder operatively connected with the car, an inclosed reservoir containing a charge of hydraulic liquid communicating with the cylinder, and a charge of confined air above the liquid compressed to a pressure equal to an average load on the piston, or nearly so, with a transferring-pump in the connection between the cylinder and reservoir adapted to propel the liquid in either direction and thereby raise or depress the car, substantially as and for the purpose set forth.

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