(No Model.) 3 Sheets—Sheet 1.

# O. S. HARMON.

## ELEVATOR.

No. 421,569. Patented Feb. 18, 1890

Fig. 1.

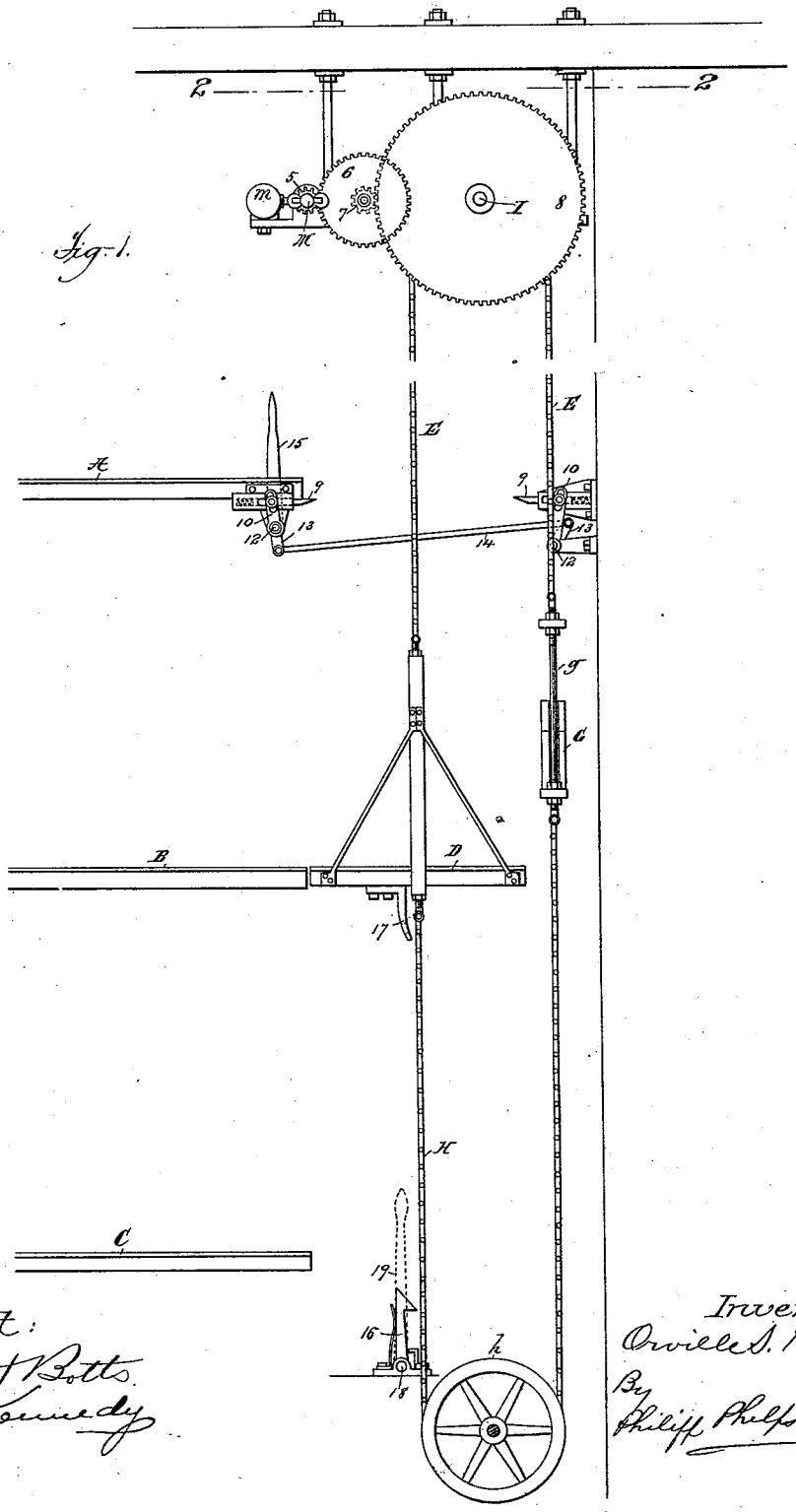


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Fig. 2.

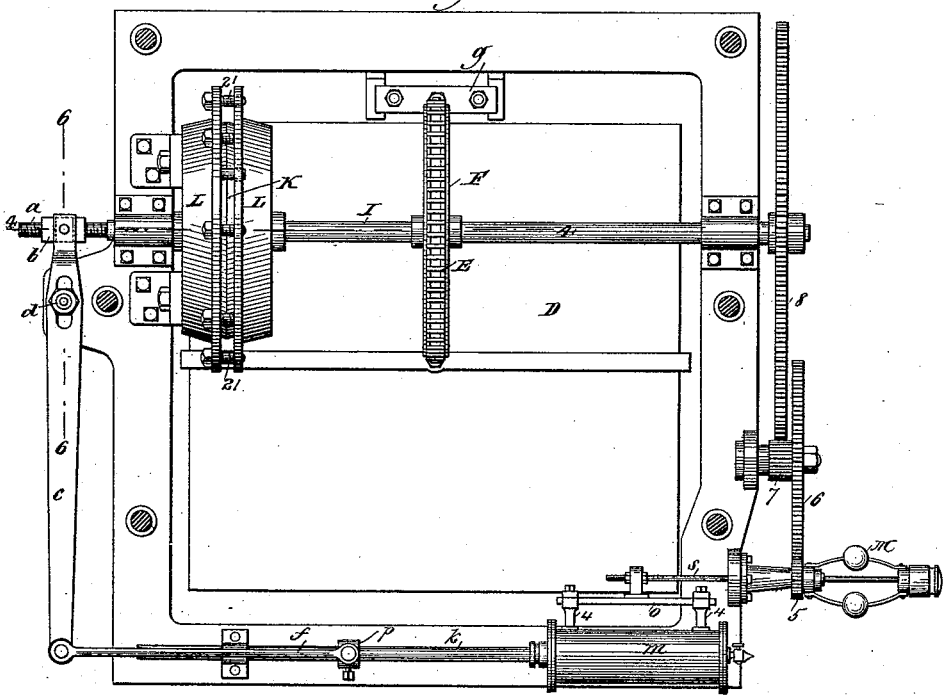


Fig. 3.

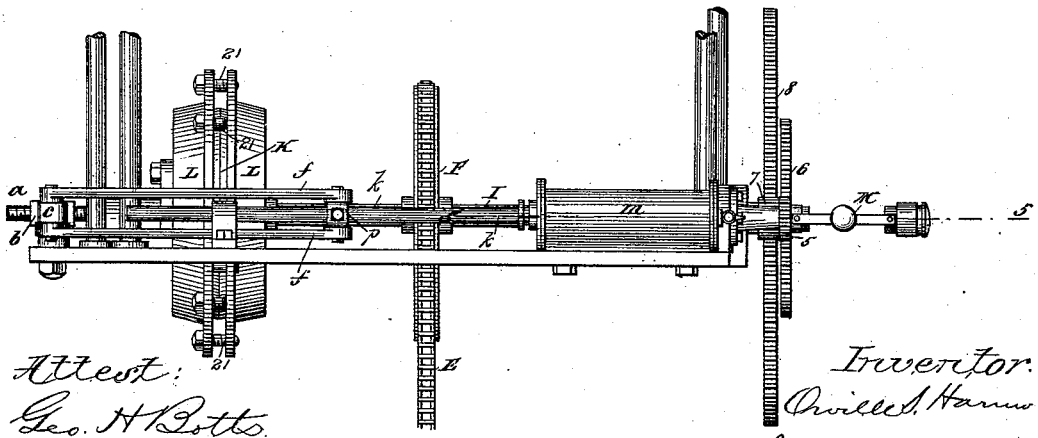


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Fig. 4.

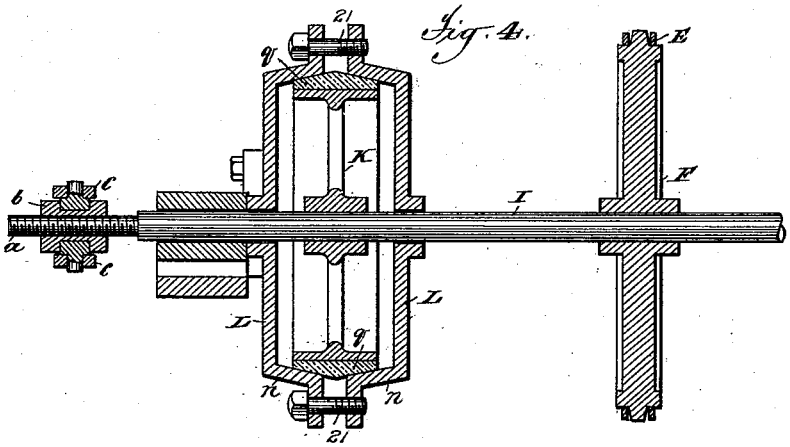



Fig. 5.

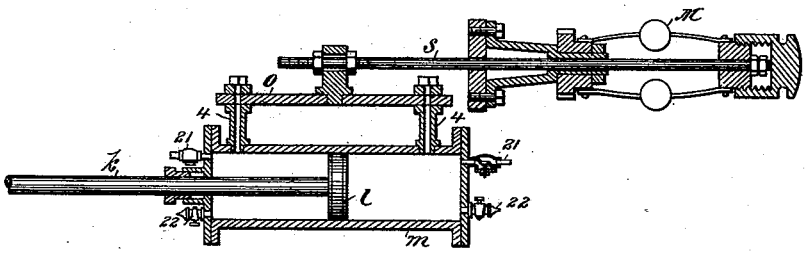
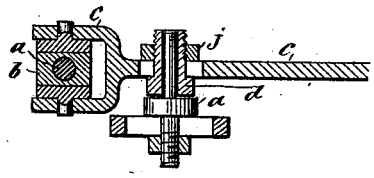



Fig. 6.

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# UNITED STATES PATENT OFFICE.

ORVILLE S. HARMON, OF BROOKLYN, NEW YORK, ASSIGNOR TO PIERRE LORILLARD, PIERRE LORILLARD, JR., CHARLES H. BARKELEW, GEORGE D. FINLAY, AND ETHAN ALLEN, OF JERSEY CITY, NEW JERSEY.

## ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 421,569, dated February 18, 1890.

Application filed February 11, 1889. Serial No. 299,417. (No model.)

*To all whom it may concern:*

Be it known that I, ORVILLE S. HARMON, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Apparatus for Lowering Freight, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to an apparatus which is especially designed for use in stores, warehouses, and other similar places for the purpose of lowering merchandise or freight, or any load, from one floor to another of the building, it being the object of the invention to provide an apparatus for this purpose in which the load will be lowered by its own gravity and in which the speed of descent will be automatically controlled so that the car and its load will be prevented from acquiring an undue speed and will be arrested at the limit of their downward movement without undue shock or strain upon the machinery, and in which, the load having been removed, the car will be automatically restored to its original position preparatory to receiving another load.

In order to convey a full understanding of the invention and the manner of its operation, it will now be described in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating the general organization and operation of the apparatus. Fig. 2 is an enlarged horizontal section taken upon the line 2 of Fig. 1. Fig. 3 is an enlarged side view of the parts shown in Fig. 2, looking from the left of Fig. 1. Fig. 4 is an enlarged vertical section taken on the line 4 of Fig. 2. Fig. 5 is a horizontal section taken on the line 5 of Fig. 3, and Fig. 6 is an enlarged vertical section taken on the line 6 of Fig. 2.

Referring to said figures, it is to be understood that A B C represent the several floors of a warehouse or other building in which it is desired to lower heavy freight from one floor to another, and D a suitable car or platform traveling in a properly-arranged well, so as to be brought to rest at any one of the several floors. The car D may be of any suitable form, but is herein shown as a simple platform which is suspended from a chain E, which passes over a sprocket-wheel F, mounted upon a revolving shaft at the top of the well, and has its opposite end connected to a weight G, which is adjusted to more than counterbalance the car, so that when no load is upon the car the weight will operate to raise the car to the upper limit of its movement. For this purpose the weight G is preferably made up of a number of sections which are carried in a suitable frame *g*, suspended from the chain so that they can be removed and replaced and thus properly adjust the weight.

In order to prevent the counterbalance between the car and the weight from being affected by the shifting of the chain E from one side to the other of the sprocket-wheel as the car travels up and down the well, and also to steady and guide the car and the weight in their movements, the car is preferably provided upon its under side with a second chain H, which passes from the bottom of the car downward in the well and returns around a pulley *h* to the lower end of the frame *g*.

From what has been said it will readily be seen that when no load is upon the car the weight G will cause the car to ascend until either the weight or car is arrested. It will also be seen that as soon as any load has been placed upon the car sufficient to overcome the preponderance of the weight G the car will decend by the gravity of its load until it is arrested. The descent of the car in this manner would, however, unless means were provided for preventing it, be constantly accelerated, and it would finally attain such speed, particularly if the load were heavy, that the shock when it was arrested would be so violent as to damage or destroy the apparatus and the load.

The descent of the car and its load might of course be controlled by a brake mechanism operated by an attendant; but in such case the safety of the apparatus and its load would be entirely dependent upon the skill

and attention of such attendant, and this could not always be relied upon for the purpose, and furthermore the constant employment of an attendant to operate the apparatus would entail expense, which it is desirable to avoid. For the purpose, therefore, of automatically controlling the speed of the car in its descent and of arresting it at the proper point without shock or strain upon the machinery, the shaft I, upon which the sprocket-wheel F is mounted, is provided with a threaded extension *a*, upon which works a nut *b*, having trunnions which enter openings in the forked end of a lever *c*, which is fulcrumed upon a stud *d*, and is connected at its opposite end by links *f* with the rod *k* of a piston *l*, which works in a cylinder *m*, the parts being so adjusted and proportioned that when the car reaches the limit of its movement in either direction the piston *l* will be moved to a position near the corresponding end of the cylinder *m*. The cylinder *m* is provided near its opposite ends with ports 4, which are so located that just before the car reaches the limit of its movement in either direction the piston *l* will cover the port 4 at the corresponding end of the cylinder and thereby confine a body of air in the end of the cylinder, so as to cushion the piston and arrest it without shock.

The shaft I, which carries the sprocket-wheel F, is made capable of a slight longitudinal movement in its bearings, and is provided with a brake-pulley K, the rim of which is provided with a covering *q*, of wood of other suitable material, which is inclined in opposite directions, as shown in Fig. 4. Located upon opposite sides of the pulley K are a pair of fixed disks L, having flanges *n*, which overlap the rim of the pulley and are correspondingly inclined, the disks L being so adjusted that when the pulley K is in its normal position its rim will have no contact, or a very slight contact, with the flanges *n* of the disks, but that when the shaft I is moved longitudinally in either direction the corresponding inclined side of the pulley K will be pressed against the inclined flange *n*, so as to apply a greater or less amount of friction to the pulley, depending upon the extent to which the shaft is moved.

The ports 4 of the cylinder *m* are controlled by a valve *o*, the rod *s* of which is acted upon by an ordinary centrifugal governor M in such manner that as the speed of the governor increases beyond the proper limit for which it is adjusted it will operate to shift the valves *o* and close or partly close the ports 4, and thus prevent the escape of air from the cylinder *m*. The governor M is driven by means of a train of gears 5 6 7 8, which receive motion from the shaft I.

The operation of the apparatus thus organized is as follows: The car D having been raised to the floor where it is to receive its load, the load will be placed upon the car and the latter released and allowed to descend by the gravity of the load without any manual control. As the car descends, the shaft I will be revolved, thereby causing the nut *b* to travel outward upon the threaded portion *a* of the shaft, and this will, through the lever *c* and the connections which have been described, cause the piston *l* to move in the cylinder *m* toward its outer end. The ports 4 being open, the air will escape from the cylinder *m* in front of the piston and enter the cylinder behind the piston, and as a consequence no resistance will be offered to the movement of the piston and the nut *b* will move freely outward without any tendency to move the shaft I longitudinally, and as a consequence little or no friction will be applied to the pulley K by the flanges *n*. As the car descends by gravity, its speed will of course be rapidly accelerated, and this increase of speed will be communicated through the train of gears to the governor M, and as soon as the speed of the car increases beyond the proper limit the governor will operate to shift the valve *o* and close or partly close the ports 4, thereby preventing the air from escaping from the cylinder *m* in front of the advancing piston *l*. As soon as this takes place, the air will be compressed in the cylinder in front of the piston, and the resistance thus offered to the piston will be communicated through the lever *c* to the nut *b* to resist the outward movement of the nut, and this will in turn move the shaft I longitudinally, so as to bring the rim of the pulley K into engagement with the flange *n*, and thus apply friction to retard the movement of the car until its speed is reduced within the proper limit. As soon as the car has resumed the proper speed, the governor will operate to move the valve *o* and open the ports 4 and allow the piston *l* to again advance without resistance, and thus remove the friction from the pulley K, and so the operation will be repeated, the speed of the car being checked from time to time so as to be maintained within the proper limit. As the car nears the limit of its downward movement, the piston *l* will arrive near the end of the cylinder *m* and cover the port 4 at that end of the cylinder, and thus confine a body of air in the cylinder in front of the piston, which will act to cushion and arrest the piston and apply the brake so as to arrest the car at the limit of its downward movement without an abrupt shock or strain upon the apparatus, and this will be the case even though the governor, by reason of breakage or derangement, should allow the car to attain an undue speed. The load having been removed, the weight G will operate to automatically raise the car to the proper floor to receive the next load, and in the upward movement of the car the operation will be the same, except that the piston *l* will be moved in the opposite direction.

In the practical operation of the apparatus it will of course be desirable to provide

means by which the car will be supported at any floor until it has received its entire load, as otherwise the car would commence to descend as soon as it had received a sufficient part of the load to overcome the weight G. This can be accomplished in a variety of ways. One simple form of apparatus suitable for the purpose is illustrated in Fig. 1 in connection with one of the floors, it being understood, of course, that the same or similar apparatus will be provided for each floor.

The apparatus, as illustrated, consists of two or more sliding bolts 9, located to project from opposite sides of the well, so as to extend beneath the car and support it at the floor. These bolts are perfectly spring-seated, so as to be normally protruded into the path of the car, being inclined upon their under sides, as indicated, so as to permit the car to retract them as it moves upward. For the purpose of withdrawing the bolts 9 when it is desired to allow the car to descend, they are acted upon by arms 10, projecting from rock-shafts 12, having rock-arms 13, which are connected by a link 14 in such manner that the bolts upon the two sides of the well can be retracted simultaneously. The shaft 12 at one side of the well is provided with an operating-lever 15, of any suitable form, by which, through the connections which have been described, both the shafts 12 can be simultaneously rocked to retract the bolts. The car having been brought to the proper floor will be supported there by the bolts 9 until it has received its load. The attendant will then by rocking the lever 15 withdraw the bolts 9 and allow the car to descend, as before described. When one or more floors intervene between the floors at which the car is loaded and the floor at which the load is to be discharged, the bolts at such intervening floor or floors will be permanently retracted to allow the car to descend, and this can be readily done by rocking the lever or levers 15, so as to retract the bolts, and then securing the lever by a hook or otherwise. It is also desirable in practice to provide means by which the car will be retained at the lower limit of its travel until the entire load has been removed, as otherwise the weight G might cause the car to ascend before the entire load had been removed. As shown in the present case, this is accomplished by means of a pivoted spring-pressed hook 16, which as the car arrives at the downward limit of its movement engages with a loop 17, attached to the bottom of the car. The shaft 18, upon which the hook 16 is pivoted, is provided with a suitable hand-lever 19, extending upward at one side of the car, by which the hook can be retracted, so as to be disengaged from the loop 17 after the load has been removed and it is desired to allow the car to ascend.

In order to arrest the car in its upward movement at the proper floor, there may be provided any suitable device, which can be interposed into the path of the weight or the car at each floor—such, for example, as a bolt or bolts similar to the bolts 9.

When it is desired to cause the car D to be automatically arrested in its downward movement at any floor above the lower one, the bolt 9 of that floor will be protruded, and in such case the governor will be adjusted to maintain the speed of the car at such a point that it will be arrested by the bolts without undue shock or strain.

The two disks L are adjustable to and from each other, and are maintained in the proper position to apply the desired friction to the pulley K by means of adjusting-screws 21.

The stud *d* is made adjustable in slots in the frame-work and in the lever *c* to change the fulcrum of the lever, and thus adjust the speed and extent of movement of the piston *l*.

The cylinder *m* will preferably be provided at its opposite ends with check-valves 21, which will prevent the air from escaping from the cylinder, but will permit the air to enter the cylinder, so as to allow the piston *l* to move freely backward after it has been moved past either of the ports 4. The cylinder *m* will also preferably be provided at each end with petcocks 22, which can be adjusted to allow more or less air to escape from the cylinder, and thus adjust the resistance upon the piston to conform to different requirements.

In some cases, where it is not desired that the car shall attain more than a very moderate degree of speed, the governor and the valve *o* may be dispensed with by adjusting the size of the port 4 by cocks or otherwise, so that the escape of the air from the cylinder *m* will be retarded, and thus prevent the piston *l* from attaining more than the proper degree of speed.

What I claim is—

1. The combination, with a car, of a brake for controlling the car, and a cylinder having a piston driven by the movement of the car through permanent connections independent of the brake, the piston being connected to the brake to apply it to check the car when the car attains an undue speed, substantially as described.

2. The combination, with a car and counterbalance-weight G for raising the car, of a brake for controlling the car and a cylinder having a piston driven by the movement of the car through permanent connections independent of the brake, the piston being connected to the brake to apply it to check the car when the car attains an undue speed, substantially as described.

3. The combination, with the car, of a brake for controlling the car and a cylinder having a piston driven by the movement of the car through a threaded shaft and nut and connected to the brake to apply it when the speed of the car becomes excessive, substantially as described.

4. The combination, with the car, of the

shaft I, driven by the car and having the nut *b* and a brake-pulley, and a piston working in a cylinder and connected to said nut to apply the brake when the movement of the car becomes excessive, substantially as described.

5. The combination, with the car, of a brake for controlling the car, a cylinder having a piston which is driven by the movement of the car and connected to the brake, and a valve controlling the escape of the fluid from the cylinder to regulate the resistance to the piston, substantially as described.

6. The combination, with the car, of a brake for controlling the car, a cylinder having a piston which is driven by the movement of the car and connected to the brake, a valve controlling the escape of the fluid from the cylinder to regulate the resistance to the piston, and a governor driven by the car and connected to operate said valve, substantially as described.

7. The combination, with the car, of the shaft I, driven by the car and having the nut *b* and a brake-pulley, a piston working in a cylinder and connected to said nut to apply the brake when the movement of the car becomes excessive, and a valve controlling the escape of the fluid from the cylinder, substantially as described.

8. The combination, with the car, of the shaft I, driven by the car and having the nut *b* and a brake-pulley, a piston working in a cylinder and connected to said nut to apply the brake when the movement of the car becomes excessive, a valve controlling the escape of the fluid from the cylinder, and a governor driven by the car and connected to operate said valve, substantially as described.

9. The combination, with the car, of a brake for controlling the car, a cylinder having a piston driven in both directions by the movement of the car, and connections between the piston and brake, whereby the piston applies the brake when the car attains an undue speed in either direction, substantially as described.

10. The combination, with the car, of a brake for controlling the car, a cylinder having a piston which is driven by the movement of the car and connected to the brake to apply it, a valve controlling the outlet from the cylinder to regulate the resistance to the piston, and a check-valve for admitting air to the cylinder as the piston is reversed, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ORVILLE S. HARMON.

Witnesses:
GEO. D. FINLAY,
J. J. KENNEDY.