E. L. GALE, SR.

TRACTION ELEVATOR.

APPLICATION FILED JUNE 17, 1907.

1,132,769.

Patented Mar. 23, 1915.

4 SHEETS—SHEET 1.

Fig. 2.

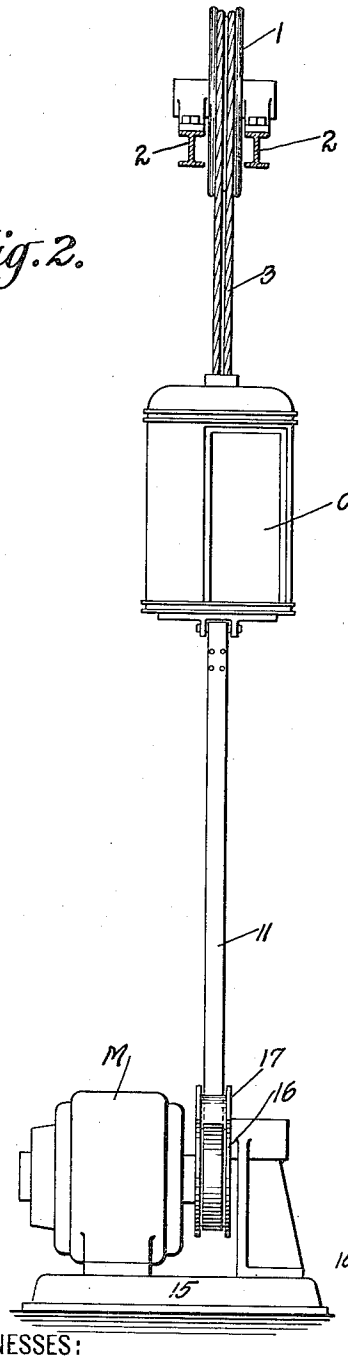
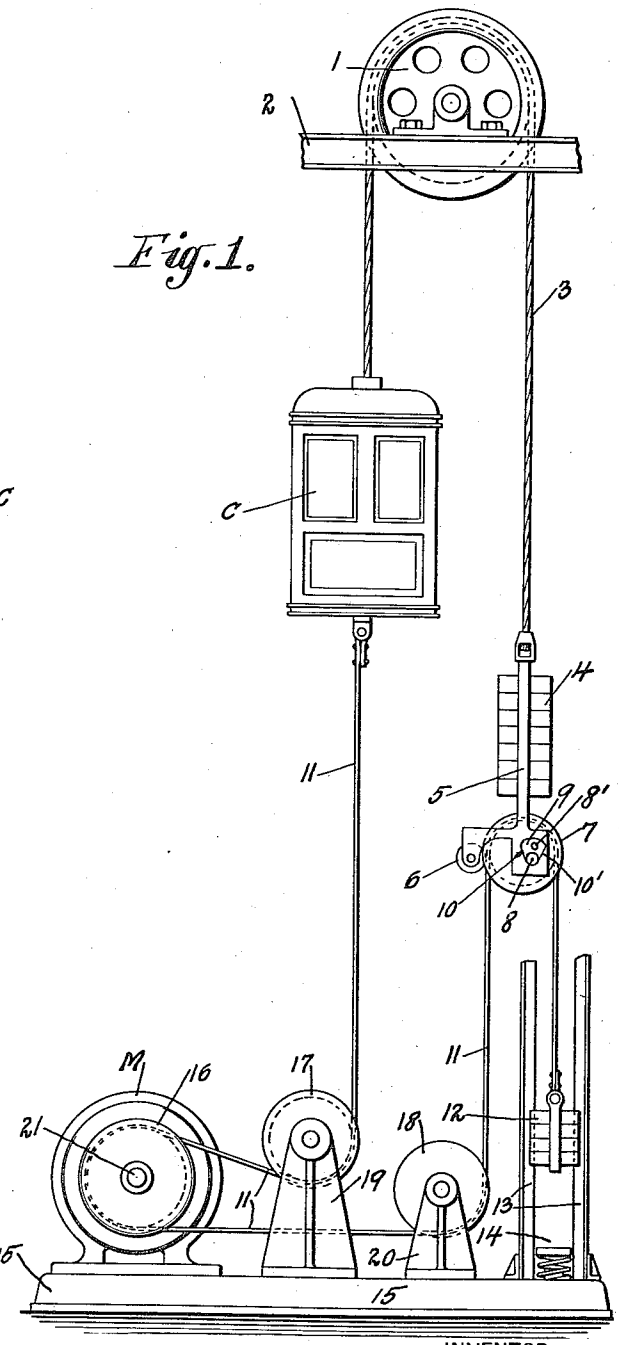


Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 4.

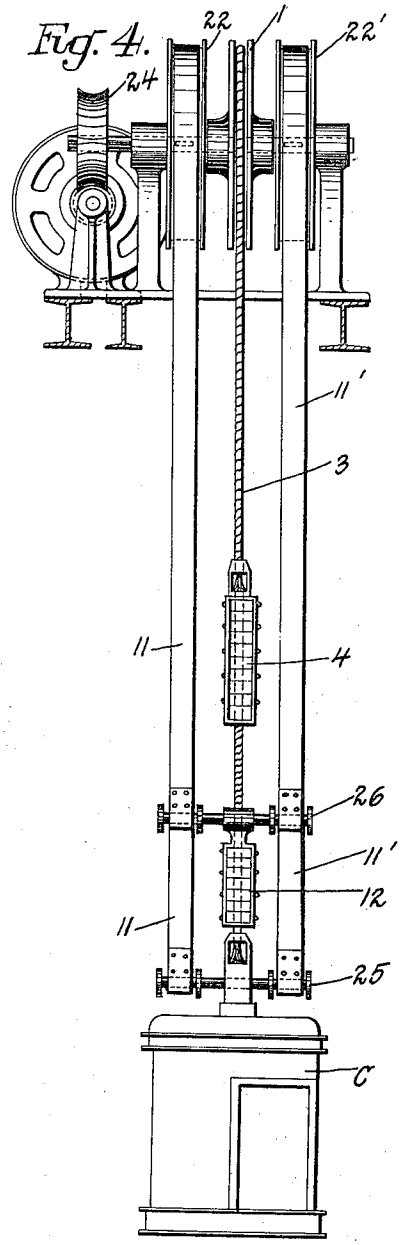
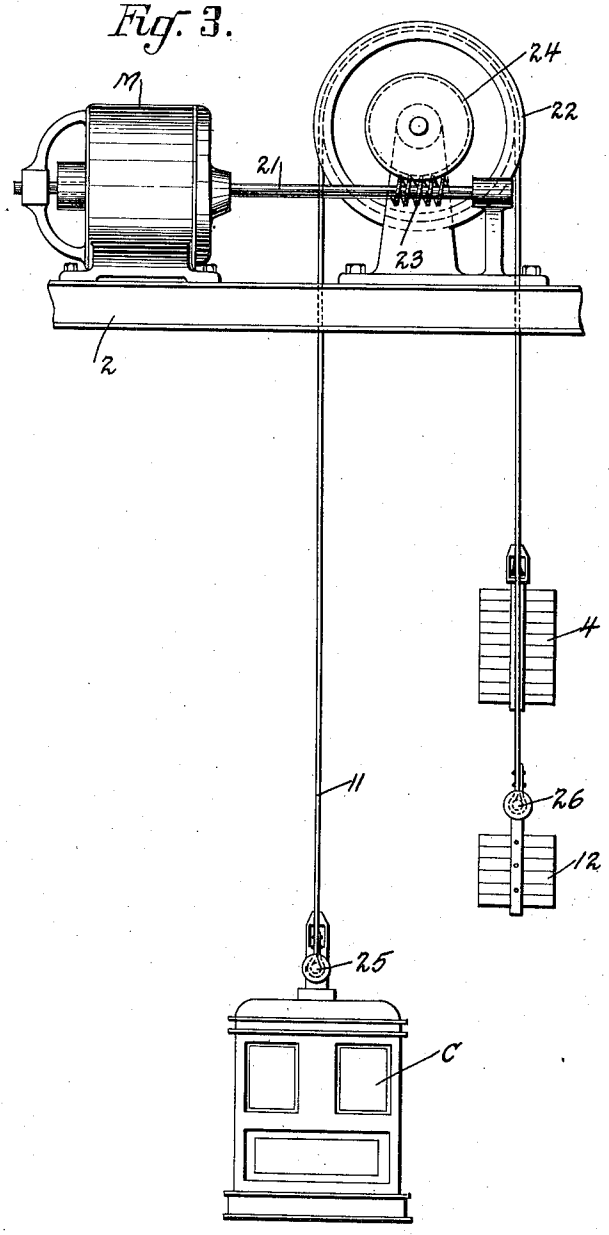


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 5.

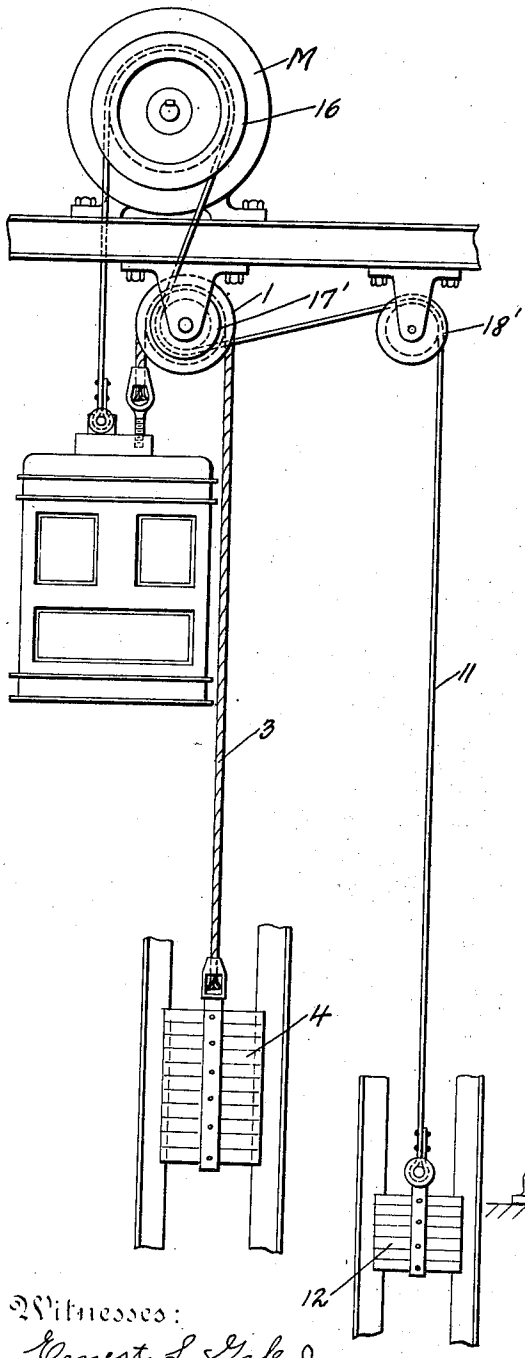
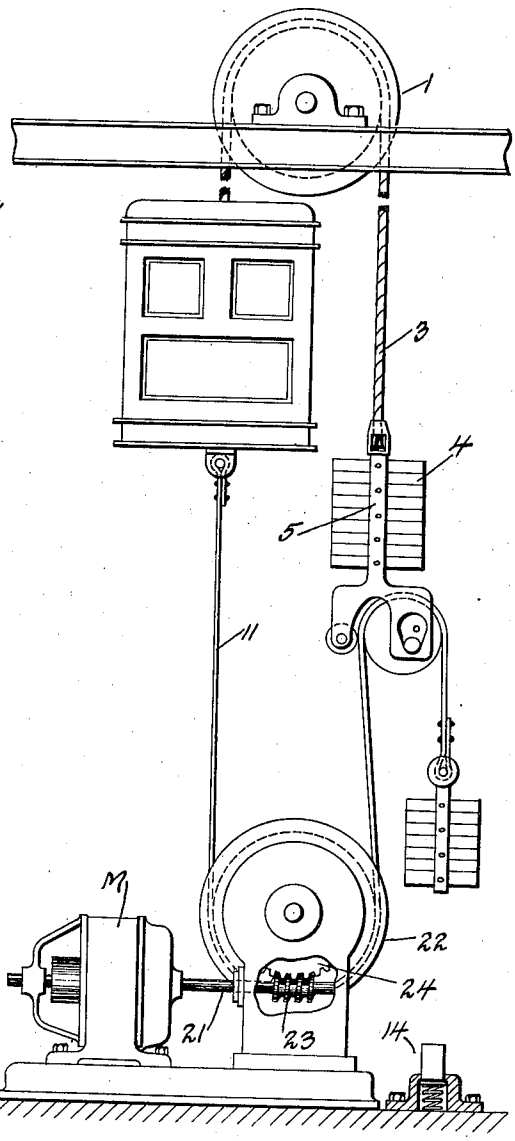


Fig. 6.



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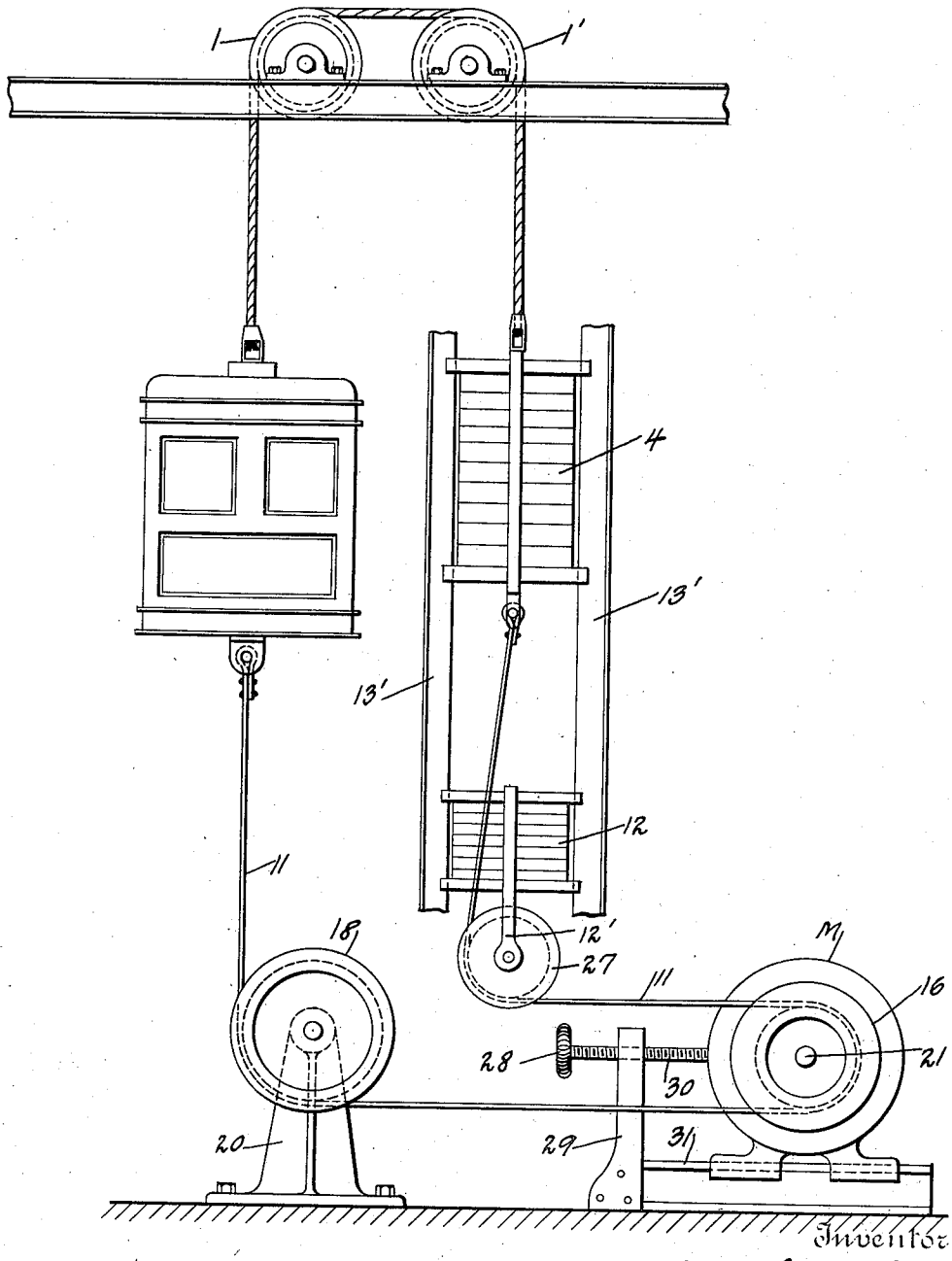
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4 SHEETS—SHEET 4.

Fig. 7.



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UNITED STATES PATENT OFFICE.

ERNEST L. GALE, SR., OF YONKERS, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

TRACTION-ELEVATOR.

1,132,769. Specification of Letters Patent. Patented Mar. 23, 1915.

Application filed June 17, 1907. Serial No. 379,500.

To all whom it may concern:

Be it known that I, ERNEST L. GALE, Sr., a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented a new and useful Improvement in Traction-Elevators, of which the following is a specification.

My invention relates more specifically to the type of elevators known as direct drive or traction elevators, in which the power is transmitted to the hoisting cable through its engagement with a portion of the periphery of a driving sheave or pulley as distinguished from the ordinary drum driven elevator, in which the hoisting cable is attached to or wound about the periphery of a winding drum. One advantage of the direct drive type of elevator lies in its special adaptability to the long range of travel made necessary by the great heights of buildings at present being erected. As the hoisting cable merely passes from one side of the driving pulley to the other, any increase in the height of buildings and consequent length of travel of the elevator car merely involves an increase in length of the hoisting cable, while with the drum driven elevator serious practical difficulties are encountered in attempts to provide drums of sufficient capacity to wind and stow the long cables incident to elevators of great range of car travel.

Among the objectionable features met with in the practical operation of direct or sheave drive elevators is the slipping of the driving cables about the driving pulley with the attendant loss of traction and power. This is especially prevalent upon starting and stopping the elevator car. Various means have been proposed to overcome this slipping, among which might be mentioned the employment of a magnetic pulley or driving sheave, but this latter is very wasteful of current and helps matters but little. Another disadvantage which contributes to the unsuccessful operation of this type of elevator is the difficulty of keeping a constant tension upon the driving cables whereby the car is liable to jump when stopping. Still another difficulty in elevators of this sort arises in the excessive loss by friction, which is unavoidable when the weight of the total load is brought to bear upon the armature of the motor or other running parts connected therewith.

One object of my invention is to overcome the objectionable features above enumerated in a simple, practical and efficient manner.

Other objects will appear more fully hereinafter.

Generally speaking, my invention consists in having the combined weight of the loaded car and its counterbalance supported by the overhead sheaves, the driving means is thereby only required to overcome the unbalanced load and a small amount of friction. In order to obtain the necessary friction to drive this unbalanced load without slipping, I use a wide flexible belt of leather or other suitable material kept under a uniform tension by means of a weight.

The accompanying drawings illustrate various ways in which my invention may be applied to a traction or direct drive elevator system, in which—

Figure 1 shows in elevation a direct drive elevator system with means for increasing the frictional contact of the driving belt and the driving pulley by increasing the arc of contact; also means for automatically keeping the tension of said driving belt constant, except under certain conditions, when this tension is automatically released. Fig. 2 is a side elevation of the apparatus shown in Fig. 1; Fig. 3 shows a plurality of driving belts and means for adapting a high speed motor to the comparatively slow speed driving pulley. Fig. 4 is a side view of the apparatus shown in Fig. 3. Fig. 5 shows an overhead drive which is otherwise similar in many respects to the construction shown in Figs. 1 and 2. Fig. 6 shows a modified arrangement of parts involving principles found in the constructions shown in Figs. 1 to 4. Fig. 7 shows means for automatically keeping a constant tension on the driving belt; also manually operated means for varying the position of the driving motor.

Similar characters of reference denote similar parts throughout the different figures.

Referring to Figs. 1 and 2, C designates an elevator car at the top of which are connected cables 3 which pass up over the overhead sheave 1 pivoted in suitable bearings mounted upon the overhead beams 2, 2. These cables lead down the hatchway and

are connected to the frame 5 of the counterweights 4 which latter together with the weights 12, are preferably of the same weight as the combined weights of the elevator car and the average load carried thereon. M designates the hoisting motor which in the present instance is shown as an electric motor, but which may equally well be a steam, hydraulic, or other suitable prime mover.

An eccentrically pivoted belt pulley 7 is pivoted upon a shaft 8 resting in a slot 9 in the lower portion of the counterweight frame 5. This slot has inclined sides 10, 10', the purpose of which will be pointed out later. A stop pin 8' on the pulley 7 allows a small rotative movement of the latter, limited in extent by the sides of the slot 9. A roller 6 is carried by the frame 5 and has its center in a plane substantially horizontal with the center of the shaft 8 of the eccentric pulley 7. Fastened to the bottom of the elevator car C is a belt 11 which leads down and under a guide pulley 17 carried by bearings 19 supported on the bed 15. The belt 11 is carried around a driving pulley 16 which is securely fastened to the shaft 21 of a motor M, and leads under a guide pulley 18 supported by bearings 20 and up over the eccentric pulley 7. The other end of this belt 11 is connected to a suitable tension weight 12 adapted to slide on vertical guides 13. A spring buffer 14 is located directly under the weight 12. Since the weight of the counterweight 4 together with the weight 12 is substantially equal to the combined weights of the car and the average load carried thereon, the only power required to move the elevator car in either direction is to overcome the friction and the unbalanced load. In order to cause the car to descend the motor is made to revolve in a counter-clockwise direction, which will produce a downward pull upon the car C by means of the belt 11. At the same time the belt 11 will be paid off on the other side of the driving pulley 16, thus allowing the counterweight 4 to ascend. In order to raise the car C, the motor is rotated in a clockwise direction, which will exert a downward pull on the counterweight 4 through the belt 11, and the counterweight will descend with a corresponding rise of the car. The eccentrically pivoted pulley 7 together with the roller 6, constitute a take-up device for the belt 11. This arrangement of an eccentric pulley and a fixed pulley or roller co-acting with the belt 11, allows the latter to be taken up on the side of the tension weight 12, but does not allow the belt to pass in the other direction, since any tendency to do so merely jams the belt between the peripheries of the pulleys 7 and 6, and prevents it from being slackened. The movement of the eccentric pulley 7 is limited by the stop-pin 8' moving in the slot 9; and while this stop-pin allows the pulley 7 to rotate in a clockwise direction a sufficient amount to release the belt jam and thereby enable the weight 12 to slide the belt over the surface of the pulley 7 and remove all slack, yet as soon as the motor produces a downward pull upon the counterweight 4 through the belt 11, the latter is at once jammed between the pulleys 7 and 6. It is readily seen that this arrangement keeps a uniform tension upon the belt 11 and automatically takes up all slack. In the event of the car overrunning its upward limit of travel, the tension weight 12 bottoms on the buffer 14 and it no longer exerts a downward pull upon the belt 11, and since the motor is at this time exerting a downward pull upon the counterweight 4, the shaft 8 of the eccentric pulley 7 will move up a short distance in the slot 9, and since the sides of this slot are inclined, the pulley 7 will move away from the fixed pulley 6, and the belt jam be thereby released. This of course allows the belt to slacken and thus lessen the friction between the belt and the driving pulley 16, and the motor may continue to revolve without producing any corresponding upward movement of the car. This safety feature I consider important since it effectually prevents the car from being pulled up into the overhead work, in which event serious damage would be the inevitable result.

Referring to Figs. 3 and 4, I use a comparatively high speed motor connected by a shaft 21, worm 23 and worm wheel 24, to belt pulleys 22 and 22'. These belt pulleys are securely keyed or otherwise fastened to the worm wheel shaft and are revolved thereby. Between the belt pulleys 22 and 22' and loosely mounted upon the same shaft, is a cable sheave 1 over which passes a cable 3 connected to the car C and counterweight 4, as in Figs. 1 and 2. Both belts 11 and 11' are connected to the car by a bar 25 provided with collars to keep the belts in their proper positions. The tension weight 12 has attached to it a similar bar 26 provided with collars to which the other ends of the belts 11 and 11' are connected. Motion is imparted to the car by means of the belts 11 and 11', which are positively driven by the motor and its connected mechanism, and the strain on these belts is never more than that required to overcome the friction and the unbalanced load which may be very small, the weight of the car and its counterbalance being supported by the steel cable or cables 3. In case one of the belts 11 or 11' should break, the other would still operate the elevator satisfactorily.

In Fig. 5 the motor is placed overhead and the driving pulley 16 drives the belt 11 direct, that is, without the intervention of a worm and worm wheel. The weight of the

car and counterbalance is supported by the cable 3 and the pulley 1. Another pulley 17′ is loosely mounted on the same shaft as the pulley 1 and is for the purpose of deflecting the belt 11 in such manner as to increase the arc of contact of the driving pulley 16 and the belt in order to increase the traction or friction between them. 18′ designates a direction pulley over which the belt passes and leading down the hatchway is connected to the tension weight 12, as shown.

In Fig. 6 I employ a fast running motor geared to the driving pulley 22 by the usual worm 23 and worm wheel 24. In the construction shown in this figure, the counterweight frame 5 is provided with the automatic take-up device already described in connection with Figs. 1 and 2, and the operation throughout is the same.

In Fig. 7 is shown a way in which it is possible to bodily move the motor in a direction to tighten or slacken the driving belt 11. The motor rests on the slide rails 31, 31, to which is attached an upright 29, the upper portion of which is screw-threaded, containing a screw 30 having a hand wheel 28 by means of which the motor may be moved along the slide rails in a well known manner. The tension weight 12 slides on the counterweight guides 13′ and is provided with an idler pulley 27 carried by the weight frame 12′, the object of this arrangement being to keep a uniform tension on the driving belt 11. As the belt 11 gradually stretches when in constant use, the tension weight 12 will settle lower and lower until finally it will be necessary to bodily move the motor to the right by means of the screw 30 and hand wheel 28, which will restore the tension weight 12 to its proper relative position.

It is readily seen that by using the arrangement of belts and cables, as shown, no slack is permitted in the cables above the car or counterweight, and therefore any tendency for the car or counterweight to jump upon stopping is overcome. Another advantage of the arrangement shown is that a supplementary counterbalance for the cable is not required. It is well known that the wearing qualities of a leather belt are far superior to steel cables; also it is a very simple process to repair such a belt should the occasion arise; whereas, in the case of a steel cable repairs are made with a great deal of trouble, and the results are very unsatisfactory. And again, since the strain of the driving belt is only that necessary to overcome the unbalanced load and friction, and this load may be so adjusted as to be very small, it is readily seen that a belt arranged as shown will last indefinitely and retain its strength. Another great advantage of a belt over a cable is, that with the former the difficulty due to slipping is positively overcome, whereas when the latter is used alone, it is almost impossible to obtain the necessary friction to properly drive the elevator apparatus without slipping, and just as soon as a steel cable slips it will wear very fast, which will rapidly weaken it to such an extent as to make it unsafe, thereby necessitating an entire new set of cables which are very costly.

Having described my invention and shown its adaptation to an elevator in various ways, and while not limiting myself to such use, since it is equally well adapted to numerous other power-transmission uses, and also not limiting myself to the details of construction and arrangement of parts shown, since various changes in such details might be made without departing from the spirit and scope of the invention, what I claim and desire to secure by Letters Patent of the United States is:—

1. In an elevator, the combination of a car, a rotatable driving element, a flexible member having a fixed connection at one end to the bottom of the car, a weight connected to the free end of the flexible member for maintaining it under tension and in frictional engagement with the driving element, and means to remove said tension and allow the driving element to rotate independently of the flexible member when the elevator reaches its limit of travel.

2. In an elevator, the combination with a car, of a flexible member connected to the car, a motor having a driving element frictionally engaging the flexible member, means for holding the flexible member under tension, means between the motor and tension means for preventing the flexible member being retracted against the action of the tension means, and a connection between said second-named means and the car.

3. In an elevator, a car, a flexible driving member therefor, a take-up device with which the flexible member engages, and movable therewith, means for moving the flexible member relatively to the take-up device in one direction to take up slack in the flexible member, and means to prevent such relative movement in a reverse direction.

4. In an elevator, the combination with a car, of a counterweight, a cable uniting the car and counterweight, a flexible driving member having one end connected to the car and movable therewith, a take-up device carried by the counterweight and with which the flexible driving member engages, means to move the flexible member relatively to the take-up device in one direction, and means to prevent such relative movement in a reverse direction.

5. In a take-up device, a frame having slots or openings, a rotatable member eccentrically journaled in said slots or openings,

a second rotatable element journaled in the frame in position to coöperate with the eccentrically journaled member, said eccentric member being movable in the slots to a position permitting rotation of the eccentric member.

6. In an elevator, the combination with a car, of a counterweight, a cable uniting and supporting said parts, a flexible member connected to the counterweight and having a fixed connection to the car, a tension weight operatively connected to the portion of the flexible member connected to the counterweight, the combined counterweight and tension weight acting as counterbalance for the weight of the car and its load, and a frictional driving device for the flexible member.

7. In an elevator, the combination with a car, of a flexible driving member secured thereto, a weight at the free end of said member and placing a tension thereon, a frictional driving device for said member, means for receiving and supporting said weight as the car nears its limit of travel, an additional flexible member forming with the car and said driving member an endless loop, and means to prevent slack in the loop.

8. In an elevator, the combination with a car, of a flexible driving member having a fixed connection therewith, a weight carried thereby and placing tension thereon, a stop in the path of said weight, means for operating said flexible member, a cable forming with the car and said driving member an endless loop, and means to automatically take up or prevent slack in the loop.

9. In an elevator, the combination with a car, of a driving belt having a fixed connection thereto, a drive sheave in contact with the belt, and a gripping device for positively and automatically preventing slack in the belt between the drive sheave and car.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

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