E. BOENING.

ROPE DRIVE ELEVATOR.

APPLICATION FILED DEC. 17, 1908.

1,132,761.

Patented Mar. 23, 1915.

4 SHEETS—SHEET 1.

Fig. 1.

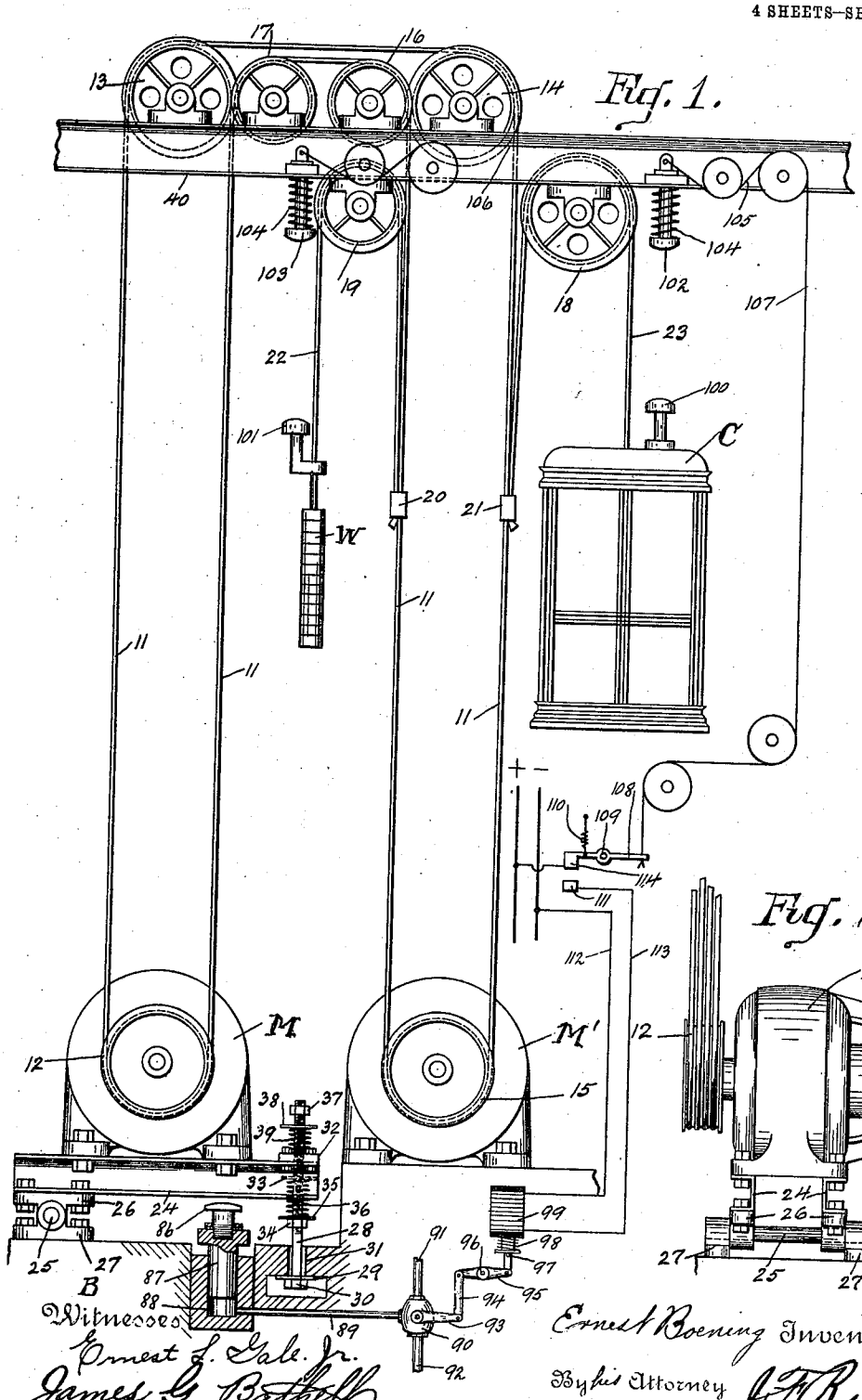


Fig. 2.

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4 SHEETS—SHEET 2.

Fig. 3.

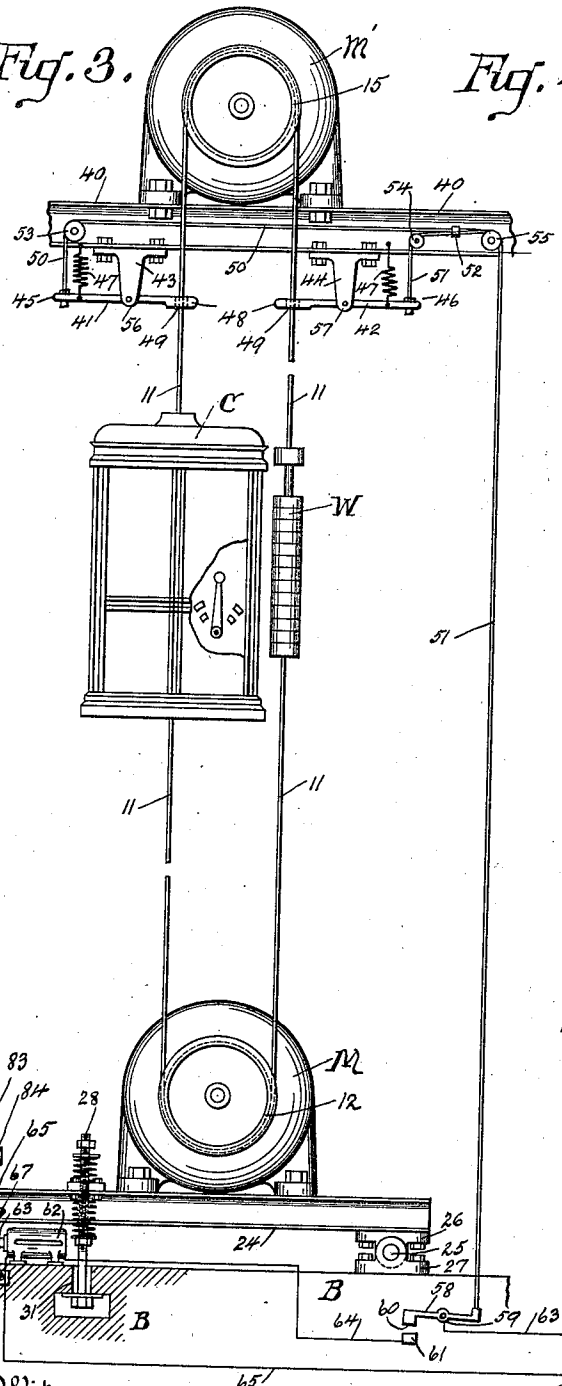


Fig. 4.

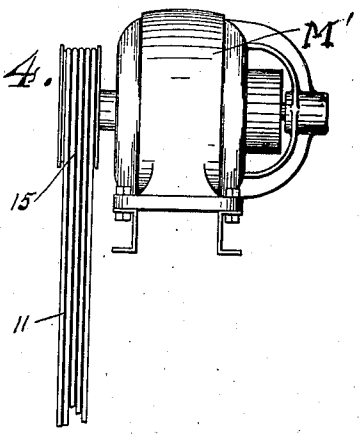
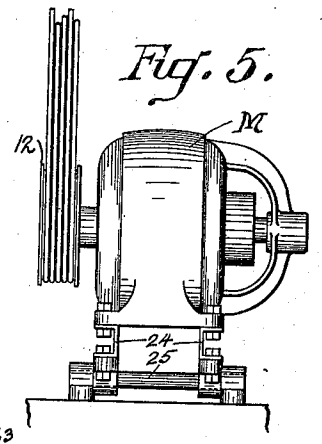


Fig. 5.



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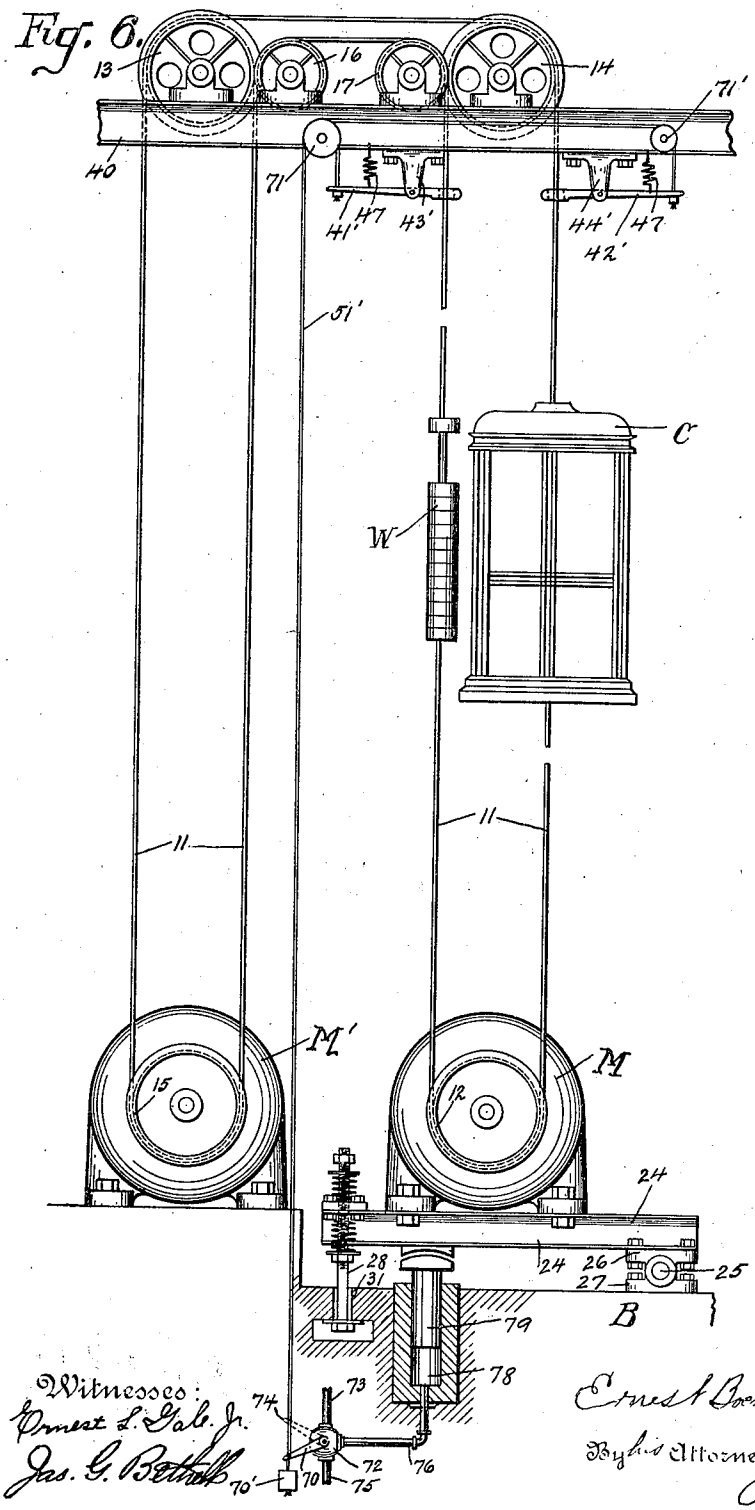
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4 SHEETS—SHEET 3.

Fig. 6.



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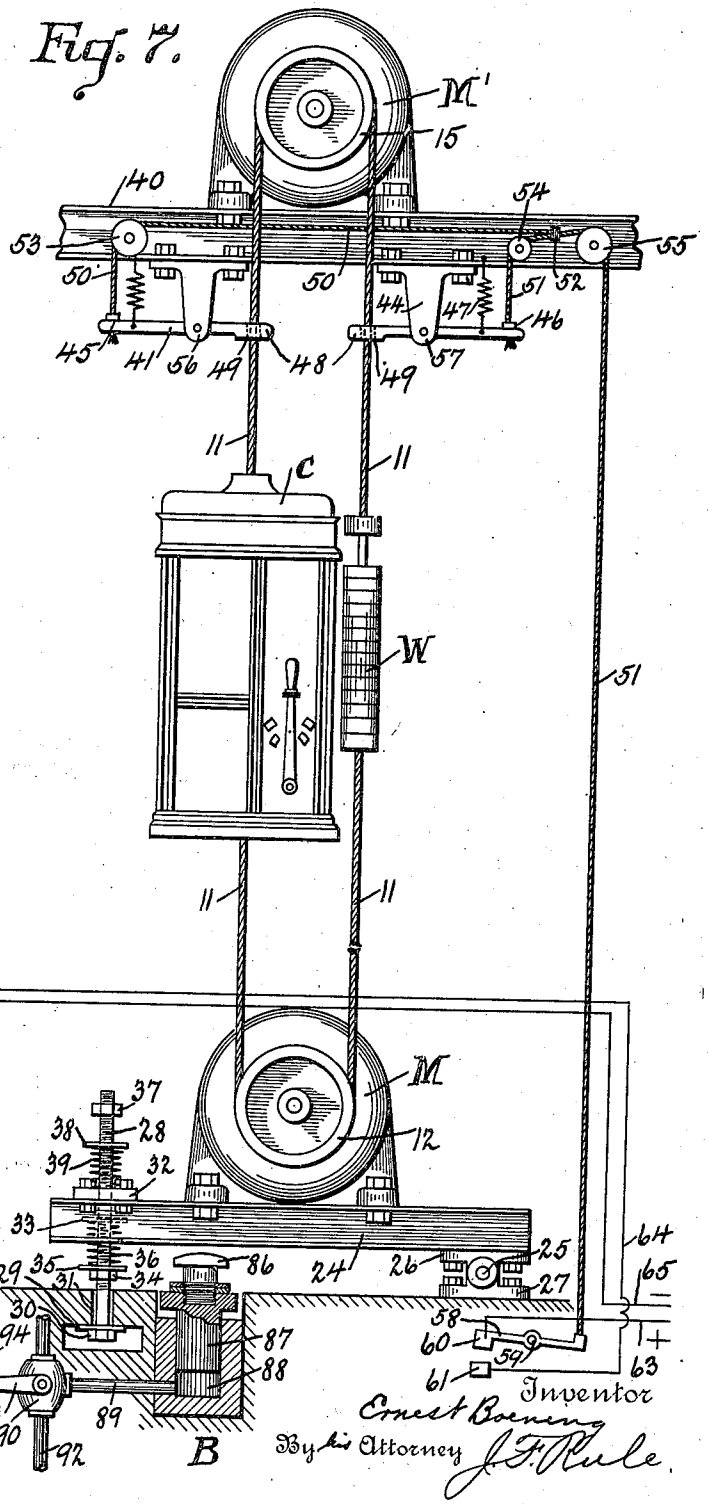
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1,132,761.

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4 SHEETS—SHEET 4.

Fig. 7.



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UNITED STATES PATENT OFFICE.

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

ROPE-DRIVE ELEVATOR.

1,132,761. Specification of Letters Patent. Patented Mar. 23, 1915.

Application filed December 17, 1908. Serial No. 468,011.

To all whom it may concern:

Be it known that I, ERNEST BOENING, 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 Rope-Drive Elevators, of which the following is a specification.

My invention relates to friction rope-drive elevators or traction elevators, and one of the objects is to provide an improved means for maintaining the tension of the driving ropes for this class of elevators.

A further object is to provide an apparatus of this character in which there is improved traction facility and equilibrated rope tension.

A further object is to provide improved means for preventing vibration of the cables and see-sawing of the car and counterweights.

A still further object is to provide means for automatically relieving the tension on the driving cables whenever the car passes beyond its normal limit of travel in either direction, so that the cables can readily slip on the drive sheaves and thus prevent damage to the apparatus in case the motors are not stopped at the proper time by the usual controlling and safety appliances.

A still further object is to provide an improved apparatus of this character which shall be simple and durable, and effective and efficient in operation.

For the attainment of these ends and the accomplishment of other new and useful objects, the invention consists in the features of novelty in the construction, combination and arrangement of the several parts hereinafter more fully and completely described, and claimed in the appended claims.

Figure 1 is an elevation view, partly diagrammmatic, of an elevator system constructed in accordance with the present invention; Fig. 2 is a side view of a motor, and also showing the pivot mounting of a tension beam to which the motor is secured; Fig. 3 is a view similar to Fig. 1, but showing various modifications in the construction and arrangement of parts; Figs. 4 and 5 are side views of the two motors shown in Fig. 3; Fig. 6 is an elevation view showing still other modifications, and Fig. 7 shows a still different arrangement combining features shown in Figs. 1 and 3.

As shown in Fig. 1, two traction motors M and M′ are employed. Endless traction ropes or cables are arranged in frictional contact with the drive sheaves or pulleys 12 and 15 secured to the armature shafts of the motors M and M′, respectively, and extend over guide sheaves 13, 14, 16 and 17 journaled in bearings mounted on the overhead beams 40. The elevator car C is connected to the drive cables 11 by means of ropes or cables 23 attached to the car and extending over the guide sheave 18. The counterweight W has a similar connection with the drive cables by means of cables 22 passing over the sheave 19. The motors run in the same direction and are provided with the usual or any desired controlling and operating mechanism and electrical circuits. The motor M′ is mounted in the usual way on a solid base or support. The motor M is mounted on beams 24 which are pivoted at one end by means of a pivot pin 25 which extends through the bearing blocks 26 and 27 secured to the beams 24 and the base B, respectively. Near the free ends of the beams 24 is located a spring buffer device which also forms a stop for limiting the upward and downward movements of the beams. This device comprises a rod or bolt 28 extending loosely through an opening 31 in the base B and provided with a head 30 in an enlargement at the bottom of said recess. A washer 29 may also be placed in said enlargement. The bolt 28 extends upwardly through the cross-bar 32 bolted to the beams 24. The bolt is threaded to receive adjustable nuts 34 and 37 located below and above the bar 32, respectively. Interposed between the bar 32 and the nut 34 are washers 33 and 35 and the coil spring 36 surrounding the bolt between the said washers. The coil spring 39 and the washer 38 are placed between the upper nut 37 and the bar 32. The weight of the motor M and connected parts comes directly on the drive cables 11 and therefore places a constant tension on the cables. This weight may be partially supported by the spring 36, the tension on said spring being adjustable by means of the nut

34. The springs 36 and 39 also form yielding stops to limit the movement of the motor M in either direction.

The arrangement above described has an advantage over the use of a single motor, by providing a large traction surface for the cables 11 as secured by the use of the two traction sheaves 12 and 15. The use of the motor M itself as a means for placing tension on the cables dispenses with the use of additional weights for this purpose.

In order to take the tension off the drive cables and allow the motors to run free whenever the car exceeds its normal limit of travel in either direction, due to the failure of the usual safety devices to operate, or from any other cause, the following means is provided. Located beneath the motor M is a piston or plunger 87 movable up and down in the cylinder 88. The plunger 87 carries the head 86, movable into engagement with the beams 24, which head, if desired, may be made of some yielding material, such as leather or rubber. A three-way valve 90 is adapted to connect either a supply pipe 92 or an exhaust pipe 91 with a to-and-from pipe 89 leading from the valve to the cylinder 88. The pipe 92 is connected to any suitable source of fluid pressure supply, preferably a liquid such as water or oil. The valve is operated by means of an electromagnet 99. The core of this magnet is connected through a lever 95 pivoted at 96 and a link 94 to the operating lever 93 of the valve. A spring 98 placed between the magnet frame and the stop 97 on the core of the magnet holds the magnet core normally in its lowered position and the valve in position to establish communication between the exhaust 91 and the cylinder 88. Mounted for vertical movement in the overhead beam 40 are depending rods 102 and 103 located in the path of movement of stop devices 100 and 101 carried by the car and counterweight, respectively. Operating ropes 105 and 106 are connected to the upper ends of these rods, the opposite ends of said ropes being connected to a rope 107 leading down to an electric switch lever 108. The lever 108 is pivoted at 109 and carries the switch contact 114, movable into engagement with the stationary contact 111. The spring 110 holds the switch lever normally in open position. Whenever the car moves upward beyond its normal limit of travel, the stop 100 strikes the rod 102, moves the latter upward, and pulls the ropes 105 and 107 upward to close the switch 108. In a similar manner, when the car moves downward below its normal limit, the stop 101 on the counterweight raises the rod 103 and through the ropes 106 and 107 closes the switch. When the switch is closed, a circuit is established to the winding of the electromagnet 99. This circuit may be traced from the positive main, through the switch contacts 114, 111, wire 113, winding of the electromagnet 99, and wire 112 to the negative main. The magnet 99 being energized, operates the three-way valve 90 to establish communication between the pressure supply and the cylinder 88, and thereby move the plunger 87 upward. The head 86 engages the beams 24 and lifts the latter upward so as to take the tension off the drive cables 11. The motors are therefore free to run independently of the cables so that the strain which would otherwise be placed on the motors, cables and other parts is avoided. Springs 104 may be placed on the rods 102 and 103 and may be made of sufficient strength to act as buffers to assist in stopping the car or counterweight.

A somewhat different arrangement is shown in Fig. 3. The motor M is mounted on pivoted beams 24 substantially as in Fig. 1, but the stationary motor M′ is in this instance located overhead, being preferably mounted at the top of the shaft upon the beams 40. In this arrangement the traction rope or cable 11 is connected directly to the car and counterweight and forms with said parts a closed loop in frictional driving engagement with the motor traction sheaves 12 and 15. Attached to the beams 40 or some other suitable part, are brackets 43, 44 to which are pivoted at 56 and 57 the levers 41, 42. These levers 41, 42 are provided with openings 49 near their inner ends 48, through which the rope 11 may pass freely. The springs 47 are adapted to maintain the levers in a normal position. To the arm 46 of the lever 42 is attached a rope 51 which passes over pulleys 54, 55 and downward to a switch lever 58. A rope 50 is secured to the arm 45 of lever 41 and passes over a pulley 53 and is secured to the rope 51 by some suitable means 52. The switch lever 58, pivoted at 59, carries a contact 60. When the rope 51 raises the lever arm, the contact 60 makes connection with a stationary contact 61, thus closing a circuit from the supply mains to the winding of an electromagnet 62. This circuit may be traced from the positive (+) supply main through wire 63, lever contact 60, contact 61, wire 64, through the magnet winding, thence through wire 65 back to the negative (—) supply main. When the car travels beyond its upper or lower normal limit of travel, the car or counterweight engages the lever 41 or 42, as the case may be, and operates the switch lever 58. The magnet 62 controls the action of the core 63 connected by rod 69 to the junction 66 of the arms 64, 65, pivoted respectively at 68 to the base B and at 67 to the beams 24. When the circuit to the magnet winding is closed, the magnet core 63 is pulled inward and operates the toggle joint, thereby raising the

beams 24 and the motor M. A weight w' may be mounted on the beams 24 to increase the tension on the hoisting cables, and may be adjustable longitudinally of the beams to vary its effectiveness to any extent desired. The action of the toggle joint raising the beams relieves the strain on the rope 11, caused by the weight of the motor M, its supporting apparatus, and the adjustable weight w'. The bolt 28 which has been previously described may be employed to limit the upward or downward movement of the beams 24, and an additional device limiting the upward movement of the same, is shown, comprising a threaded bolt 83 adjustable in a fixed nut 84 and located in position to form a stop for the beams 24. The relative positions of the motors M and M′ and their sheaves 12 and 15 are shown by the side views, Figs. 4 and 5. The traction surface for the hoisting ropes may be made as large as necessary or as desired by increasing the width of the said pulley sheaves and the number of hoisting ropes or cables 11.

Fig. 6 shows an arrangement of parts somewhat similar to Fig. 1, in that both the motors are located at the bottom of the hatchway. The car and counterweight, however, are connected directly to the hoisting cables 11 and form therewith an endless loop. The hydraulic device in Fig. 6 for lifting the motor M when the car reaches its limits of travel is similar to that shown in Fig. 1. The three-way valve 72, however, is in this instance mechanically operated without the use of an electro-magnet. The valve lever 70 is connected to an operating rope 51′ which extends upwardly to a guide pulley 71 on the overhead beam 40, where the rope branches, one branch being connected to a lever 41′ pivoted to the bracket 43′ and the other branch extending over a guide pulley 71′ and being connected to a lever 42′ pivoted to a bracket 44′. The driving cables 11 extend through openings in the inner ends of the levers 41′ and 42′ which are adapted to be operated respectively by the counterweight and car as the latter approaches its lower or upper limit of travel. The valve lever 70, as shown in full lines, is in position to maintain communication between the cylinder 78 and the exhaust 73 by way of the to-and-from pipe 76. When either of the levers 41′ or 42′ is operated, the rope 51′ moves the valve lever 70 to the dotted line position 74 and connects the pressure supply 75 to the cylinder 78 and operates the plunger 79 to lift the motor M and reduce the driving tension on the cables, so that the drive sheaves will slip in the cables as before explained. The weight 70′ connected to the lower end of the rope 51′ serves to return the valve lever 70 to normal position when the car and counterweight are out of contact with the levers 41′ and 42′. The springs 47 may also be used, if desired, to return the levers to normal position, thereby reducing the duty required of the weight 70′.

Fig. 7 shows the same arrangement of car and hoisting apparatus as disclosed in Fig. 3. Hydraulic means is employed, however, in this instance for lifting the motor M. This hydraulic mechanism as shown is substantially like that of Fig. 1, and therefore needs no further description. The valve operating electro-magnet 99 is controlled by the switch 58 which together with the switch operating mechanism is identical with that shown in Fig. 3. With this improved arrangement it may be seen that since the rope tension is at all times equilibrated, the vibration of the ropes or cables is very limited, the traction surface is large because of the two motors, and the arrangement of one of the motors on the tension beams equilibrates the traction so that the see-sawing of the car and counterweight is greatly reduced. Another feature of the improvement is that if one of the motors is out of order, the other may be used to operate the apparatus alone.

I wish not to be limited to the exact construction and arrangement herein set forth, as it is evident that various changes may 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. The combination with an elevator car, of a driving rope or cable therefor, means for applying tension to the cable, and a fluid motor for relieving the said tension on the cable at a predetermined point in the car travel.

2. The combination with a fixed motor, of a cable forming an endless loop, a movable motor having its drive pulley suspended in a bight of the cable and placing a portion of the weight of the motor on the cable, both of said motors driving said cable, and means for varying the amount of tension placed on the cable.

3. The combination with a fixed motor, of an endless cable loop, a movable motor, means comprising said movable motor for applying tension to said cable, and means for automatically releasing the tension on the cable.

4. In elevator controlling apparatus, the combination with an elevator car, of a cable therefor, a fixed motor, a movable motor, means for utilizing the movable motor as a tension weight for said cable, and means for automatically reducing the tension on the cable.

5. In elevator controlling apparatus, the combination with an elevator car, of a rope with ends attached to the top and bottom of said car, a fixed motor, a movable motor, means for utilizing the movable motor as a

tension weight for the cable, and means associated with the cable for automatically releasing the said tension.

6. The combination with an elevator car, of a cable therefor, means for applying a tension weight to said cable, and a fluid operated motor associated with the cable and operable automatically to release the said tension when the car approaches certain limits.

7. The combination with an elevator car, of a cable and counterweight therefor, a motor, means for utilizing said motor as a tension weight for said cable, and means for releasing the tension on the cable when the car reaches a certain predetermined limit.

8. The combination with an elevator car, of a cable and counterweight therefor, a fixed motor, a movable motor, operative connection between the car and both motors, means for utilizing the movable motor as a tension weight on said cable, a device for releasing said cable tension, and means for automatically operating said releasing device.

9. The combination with an elevator car, of a rope or cable attached to the top and bottom of said car, a counterweight for the car, a fixed motor, a movable motor utilized as a tension weight for said cable, a device for releasing tension on the cable, and a lever operatively connected to said device and engaged by some moving part to automatically actuate the device.

10. The combination with an elevator car, of a rope or cable with its ends attached to the top and bottom of said car, a counterweight for said car, a fixed motor, a movable motor utilized as a tension weight for said cable, means for releasing tension on said cable, and levers operatively connected to said releasing means to automatically control the same.

11. The combination with an elevator car, of a rope or cable with its ends attached to the top and bottom of the car, a counterweight, a fixed motor, beams pivoted at one end, a motor mounted thereon and forming a tension weight on the cable, and means for tilting said beams.

12. The combination with an elevator car, of a rope or cable having its ends attached to the top and bottom of the car, a counterweight for the car, a fixed motor, beams pivoted at one end, a motor mounted thereon providing a tension weight for said cable, means for tilting said beams, levers adjacent the cable, and connections between the levers and said last named means.

13. The combination with an elevator car, of a rope or cable with ends attached to the top and bottom of the car, a counterweight for the car, a fixed motor, beams pivoted at one end, a motor mounted thereon providing a tension weight for the cable, a lifting device for the free ends of the beams, means for operating said device to release tension on the cable, levers operatively connected to actuate the lifting device and automatically engaged by the car or counterweight to control the said device.

14. The combination with an elevator car, of a rope cable with ends attached to the top and bottom of the car, a counterweight for the car, a fixed motor, beams pivoted at one end, a motor mounted thereon providing a tension weight for the cable, a lifting device for the free ends of the beams, means for automatically operating the lifting device to release tension on the elevator cable, and a device for limiting the vertical travel of the free ends of the beams.

15. The combination with an elevator car, of a rope or cable with ends attached to the top and bottom of the car, a counterweight for the car, levers suitably arranged to be operated by contact with the car and counterweight, a fixed motor and a movable motor directly driving the car by the rope or cable, and means for utilizing the movable motor as a tension weight on the cable to equilibrate the tractive effort of the two motors.

16. The combination with an elevator car, of a rope or cable with ends attached to the top and bottom of the car, a counterweight for the car, a fixed motor, beams pivoted at one end, another motor carried by the beams movable therewith and providing a tension weight for the rope or cable, means for raising the pivoted beams and the motor to release the tension on the said rope or cable, a device for actuating said releasing means, and levers operatively connected to the actuating device and automatically engaged by the car or counterweight to operate the said device.

17. In an elevator, the combination with a load-carrying device, of a motor, a flexible traction driving member having a fixed connection to the load carrying device held under tension by the weight of the motor, and means independent of the weight of the motor for varying said tension automatically.

18. In an elevator, the combination with a car, of a hoisting rope or cable connected to travel with the car, a drive sheave in frictional engagement with the cable, means for applying tension through said sheave to both leads of the cable extending therefrom, and additional means for varying the tension in said cable automatically.

19. The combination with a car, of a motor, and a traction driven hoisting rope or cable fixedly connected to the car and supporting the motor, and additional means controlled by the car for supporting the weight of the motor.

20. In an elevator, the combination with a car, of a hoisting rope or cable fixedly connected thereto, an electric motor suspended by the rope or cable and having a frictional driving connection therewith, and means independent of the weight of said motor for varying the tension in said rope or cable when the car approaches its limit of travel.

21. In an elevator, the combination with a car, of a motor, a friction drive sheave connected to the motor, a hoisting rope or cable fixedly secured to the car and connecting the car and drive sheave and suspending the motor, means to prevent lateral displacement of the motor, and means dependent on the position of the car for varying the tension in said hoisting rope or cable.

22. In an elevator, the combination with a car, of a hoisting rope or cable, a driving motor for the cable movable vertically and forming a tension weight for the cable, and a lifting motor operable to lift the driving motor and reduce the tension on the cable.

23. In an elevator, the combination with a car, of a hoisting cable, a driving motor supported by said cable, a lifting motor, and automatic means for operating the latter to take the weight of the driving motor off the hoisting cable.

24. In an elevator, the combination with a car and counterweight, of a hoisting cable, a driving motor suspended by the cable, a lifting motor arranged to support the driving motor, and means controlled by the car and counterweight for automatically effecting the operation of the lifting motor when the car approaches its limit of travel in either direction.

25. In an elevator, the combination with a car, of a hoisting cable, a driving motor therefor supported by the cable, a lifting motor operable into position to support the driving motor and take the weight of the latter off the driving cable, and automatically operated electro-mechanical means for effecting the operation of the lifting motor.

26. In an elevator, the combination with a car, of a hoisting cable, a driving motor therefor suspended by the cable, a fluid pressure lifting device for the motor, and means to automatically effect the operation of said device.

27. In an elevator, the combination with a car, of a hoisting cable, a driving motor, and a hydraulic motor controlled by the car and operable to lift the driving motor.

28. In an elevator, the combination with a car, of a hoisting cable, a tension device for the latter, a motor operable to move said device into position to relieve the tension on the hoisting cable, and means to automatically effect the operation of the said motor.

29. In an elevator, the combination with a car, of a hoisting cable, a tension weight supported by said cable, a hydraulic motor operable to lift said weight, a valve controlling the supply of pressure to the motor, a lever located in position to be operated by the car, and an operating connection between said lever and the valve.

30. The combination with a car, of a hoisting cable, a driving motor, a drive sheave on the motor and in frictional engagement with the hoisting cable, a pivoted support to which the motor is connected, a device for lifting the motor, and means to automatically operate said device when the car reaches a predetermined position in its travel.

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

ERNEST BOENING.

Witnesses:

CAMPBELL SCOTT,

EDWARD H. STEELE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."