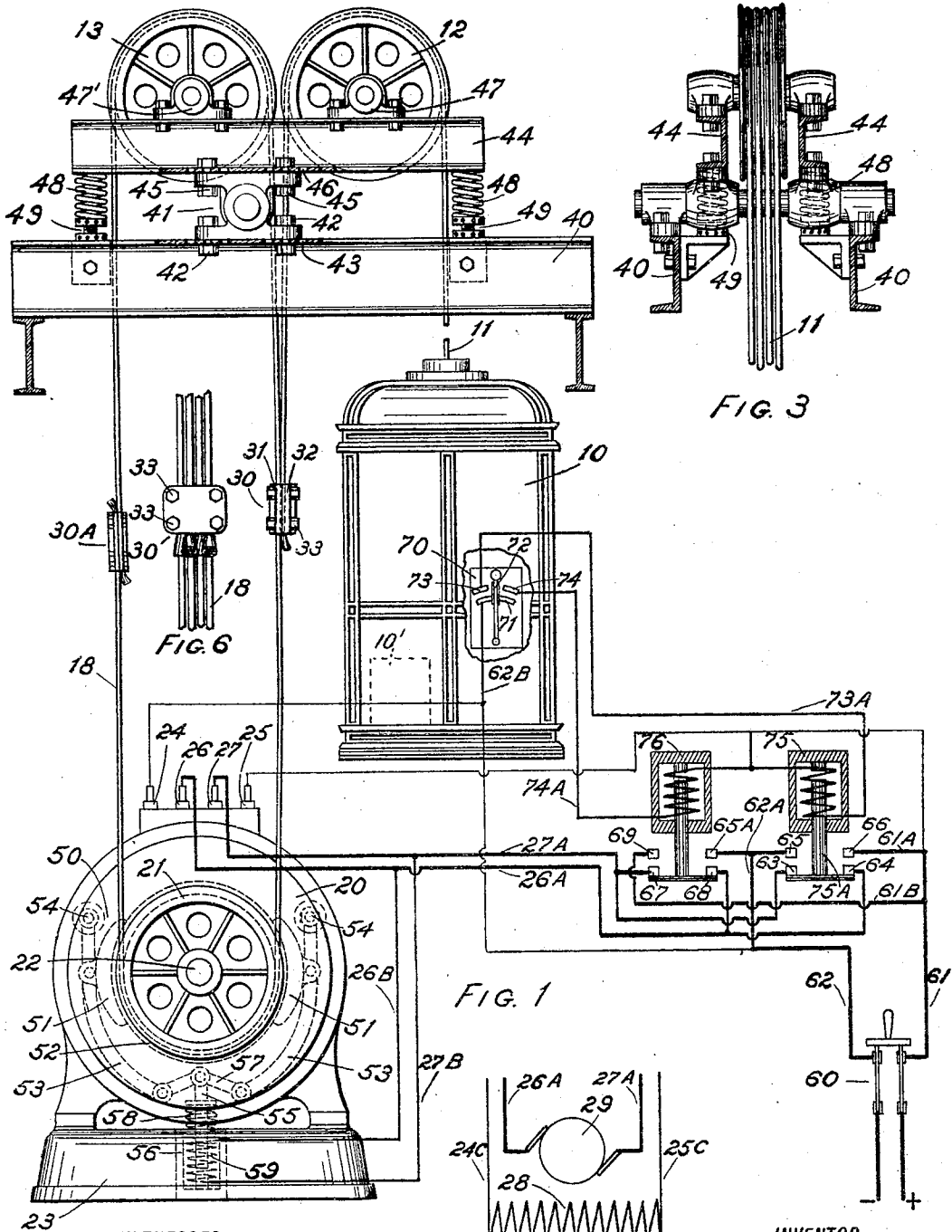


E. BOENING.
FRICTION ROPE DRIVE ELEVATOR.
APPLICATION FILED FEB. 26, 1906.

932,432.

Patented Aug. 31, 1909.

3 SHEETS—SHEET 1.



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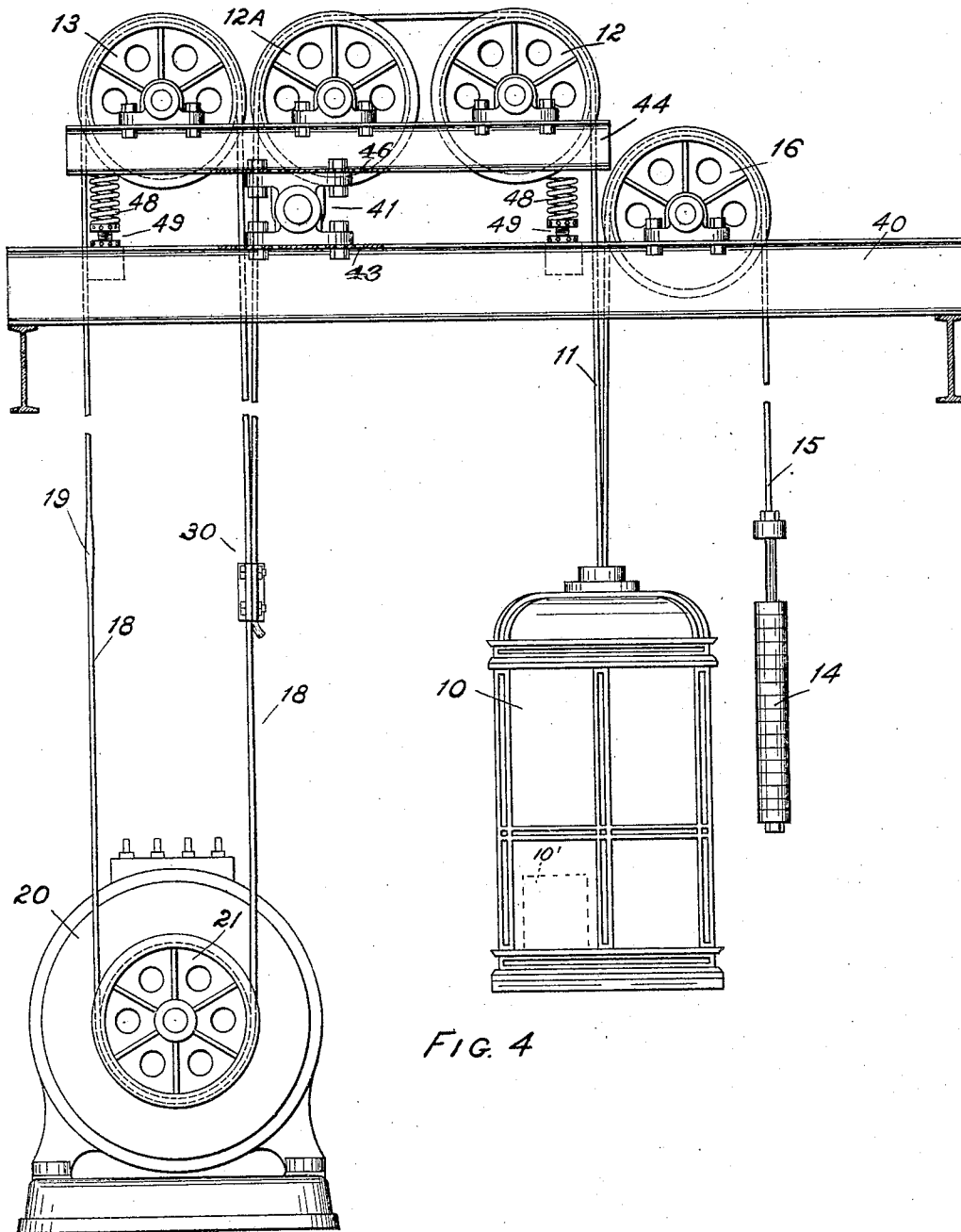


FIG. 4

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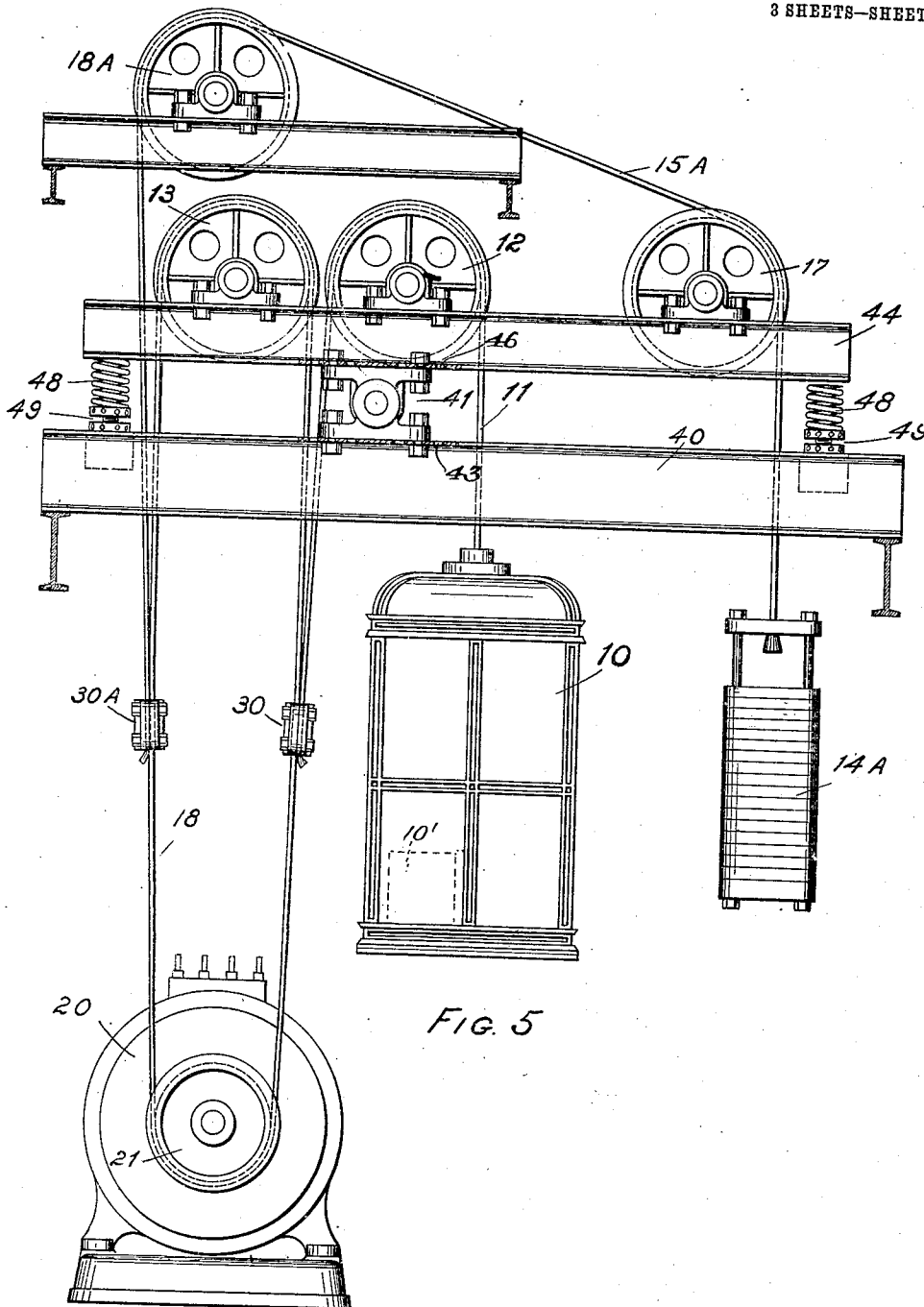


FIG. 5

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FRICITION-ROPE-DRIVE ELEVATOR.

932,432.

Specification of Letters Patent.

Patented Aug. 31, 1909.

Application filed February 26, 1906. Serial No. 302,886.

To all whom it may concern:

Be it known that I, ERNEST BOENING, a citizen of the United States, and a resident of Yonkers, in the county of Westchester and State of New York, United States of America, have invented certain new and useful Improvements in Friction - Rope - Drive Elevators, of which the following is a specification.

My invention relates to friction rope drive elevators and its object is to improve upon apparatus of this class and to provide a simple and efficient means for automatically maintaining the tension on the driving-ropes of such elevators.

I will describe my invention in the following specification and point out its novel features in claims.

Referring to the drawings, Figure 1 represents in side elevation a friction rope-drive elevator made according to my invention together with an electric motor and certain electrical circuits which are shown diagrammatically. Fig. 2 is a detail of the wiring of certain of the apparatus shown in Fig. 1. Fig. 3 is an elevation of the overhead sheaves and their supporting parts which are shown in Fig. 1, the view being taken at right angles to that shown in Fig. 1. Fig. 4 represents in side elevation a friction rope-drive elevator made according to my invention, but in a form somewhat modified from that shown in Fig. 1. Fig. 5 represents in side elevation another modification of my invention. Fig. 6 is a detail of a rope connection.

Like characters of reference designate corresponding parts in all of the figures.

10 designates an elevator-car of any desired form or construction; 11 is its hoisting cable or cables which are attached to the car and run up and over a sheave 12 mounted near the top of the shaft; 10' designates a load in the car which load may be a variable quantity. The cable or cables 11 may be run from the sheave 12 down to the driving rope or ropes 18, to which they are connected at 30. The driving rope or ropes are in the form of a loop which passes under a driving-sheave or pulley 21 which is rigidly mounted upon the shaft 22 of a motor 20, and over another sheave 13 mounted near the top of the shaft. These ropes may be spliced together as at 19, or their ends may be connected by an adjustable fastening 30^A in

such a way that any stretching of the ropes may be taken up at will. The fastening 30^A and the adjustable fastening 30 may be made in two parts, such as 31 and 32, which are arranged to be rigidly held together by means of bolts 33, 33, but which may be loosened so that the fastening may be shifted to change the position of the rope connection or to take up any slack caused by stretching of the cables.

40, 40 designate channel-irons which form a part of the overhead work or framework of the building or structure in which the elevator is placed. Upon these channel-irons is mounted a hinge-block 41 which may be rigidly fastened to the channel-irons by means of bolts 42 which pass through openings 43 in the channel-irons. The upper part of the hinge-block 41 may be attached to secondary channel-irons 44, 44 by means of bolts 45 which pass through openings 46 in the channel-irons 44. These openings 43 and 46 in the channel-irons 40 and 44 are provided for the purpose of shifting the position of the hinge-block 41 if desired. The overhead sheaves 12 and 13, over which the hoisting cables 11 and driving ropes 18 pass, are attached to the channel-irons 44, 44 by means of stationary bearings 47, 47. Springs 48, 48 are provided near the ends of the secondary channel-irons 44, 44 and these springs may be provided with adjusting screws 49, 49 by means of which the pressure of these springs may be regulated. The motor 20 in this case is shown as a shunt-wound electric motor. This is mounted upon a base 23 which should be rigidly attached to a suitable foundation.

50 designates a brake which comprises brake-shoes 51, 51 arranged to be applied to a brake-pulley 52 which is preferably mounted directly upon the motor shaft 22 and arranged to move in unison with the driving-sheave 21. These brake-shoes may be mounted upon levers 53, 53 which are pivoted at 54, 54 to the motor frame, or to some other stationary points. The other ends of these pivoted levers may be connected as shown to the core 55 of an electromagnet 56 by means of a toggle-joint 57. A spring 58 may be arranged to press this toggle-joint upward and to apply the brake-shoes 51, 51 to the brake-pulley 52 when the magnet 56 is not energized. The magnet 56 may be provided with a winding 59 which, when energized, will

cause the magnet 56 to draw its core 55 downward and to release the brake-shoes through the mechanism above described.

The electrical wiring diagram which is shown in Figs. 1 and 2 is an arbitrary arrangement of circuits which may be used to operate the motor and the brake from the car by means of a manually-operated switch.

I will now briefly point out the electrical circuits and describe their operation. + and - designate mains from a suitable source of electrical supply, which, after passing through main-line switch 60, pass to various parts of the apparatus as follows: The positive or + main extends by a conductor 61 directly to the shunt field motor terminal 25, and by conductors 61^A and 61^B to stationary contacts 66 and 69. The negative or - main extends through the conductor 62 directly to shunt field motor terminal 24, and by conductor 62^A to stationary contacts 65^A and 65, and by conductor 62^B to a stationary contact 71 in the car-switch 70. The shunt field of the motor is therefore connected permanently across the mains.

The car-switch 70 comprises a pivoted contact lever 72 which bears upon the stationary contact 71 and which may be moved into contact also with either stationary contact 73 or stationary contact 74. These stationary contacts 73 and 74 are connected by conductors 73^A and 74^A respectively to electromagnets 75 and 76 which form part of an electrically-actuated reversing switch. The magnet 75 has a core 75^A. Connected to but insulated from this core 75^A are contacts 63 and 64 which are adapted to be raised by the magnet 75 into contact with stationary contacts 65 and 66. Magnet 76 comprises similar parts and is arranged to raise contacts 67 and 68 against contacts 69 and 65^A.

Contacts 64 and 68 are connected together and to motor terminal 26 by a conductor 26^A. Contacts 63 and 67 are connected together and to motor terminal 27 by a conductor 27^A. The winding 59 of the brake-magnet 56 is connected to conductors 26^A and 27^A by conductors 26^B and 27^B.

28 designates the shunt field of the motor 20, and this may be connected to the motor terminals 24 and 25 by conductors 24^C and 25^C.

29 designates the armature of the motor and this may be connected to the motor terminals 26 and 27 by conductors 26^A and 27^A.

If an operator in a car moves the pivoted lever 72 of car-switch 70 to the left so that the contacts 71 and 73 are bridged, a circuit is completed thereby from the positive main through conductor 61, the winding of magnet 75, conductor 73^A, contact 73, pivoted lever 72, contact 71, conductors 62^B and 62 to the negative main. The magnet 75 will be energized thereby and will raise contacts 63

and 64 against contacts 65 and 66 and will thereby close the positive main to the motor armature terminal 26, and the negative main to the motor armature terminal 27, and at the same time connect brake-magnet winding 59 directly across the mains. This will cause the motor to be energized and to rotate in one direction.

When the operator brings the pivoted lever 72 back to its central position, he will thereby break the circuit through magnet 75 and cause the armature circuit and the brake-magnet circuit to be broken. This will cause the motor armature to be deenergized and the brake 50 to be applied by spring 58 and the motor will come to rest.

If the operator moves the pivoted lever 72 in the opposite direction so that it bridges contacts 71 and 74, a circuit will be completed thereby through magnet 76, and it will cause contacts 67 and 68 to be closed against contacts 69 and 65^A and to thereby energize brake-magnet 56 and connect the motor armature 29 to the main line in the opposite direction. This will cause the motor to rotate in the opposite direction and it will continue to rotate until the operator again returns the pivoted lever 72 of the car-switch to its central position, when the motor will be deenergized and the brake applied so that it will again come to rest.

It may be seen that the sheave 12 is placed to one side of the hinge-block 41 so that the weight of the car 10 upon this sheave will cause the supporting beams 44 to tilt downward on that side and thereby cause its other end, upon which is mounted the sheave 13, to be raised. In this way the supporting beams form a tilting leverage system which automatically produces a strain upon the loop of the rope or ropes 18 which are between the driving sheave 21 and the overhead sheave 13 and thereby produces a frictional contact between the rope or ropes and the driving sheave. This frictional contact or tension which is thus produced will be proportional to the weight of the car and its load, and it will also be distributed equally over the rope or ropes 18 so that they will be pulled up under tension on both sides of the driving sheave 21.

The position of the hinge-block 41 may be shifted or changed to the left or right to increase or decrease this leverage. It is often desirable to place under the ends of the tilting beams 44 springs 48, 48 to partially support them, and to also take up any jar which may be upon the system in running. These springs 48, 48 are arranged, as shown, to be regulated or adjusted by means of screws 49, 49.

It may be readily seen that any stretch of the ropes may be taken up by means of the adjustable fastening 30^A which may be so placed that it runs between driving sheave 21

and the overhead sheave 13 without having to pass over the sheaves.

In Fig. 4 I have shown a slightly modified arrangement of my system. In this case the car is provided with a counterweight 14 which is connected to the car by means of a rope or cable 15 passing over a stationary overhead sheave 16. In this case it is desirable to have the position of the sheave 12 on the tilting supporting beams 44 at a greater distance from the hinge-block 41 than in the former case, and to accomplish this end and to provide means for the rope or ropes 18 to run in their proper relation, an auxiliary overhead sheave 12^A is used. The operation of this form of my invention is the same as that already described.

In Fig. 5 I have shown still another form of my invention, in which case the counterweight 14^A is connected to the rope or ropes 18 by means of a rope or cable 15^A which passes over a sheave 17 mounted upon the tilting supporting beams 44; thence, over a stationary sheave or pulley 18^A and to the rope or ropes 18, to which they are attached at 30^A. By this arrangement it is possible to have the counterweight 14^A of greater weight than the weight of the car 10 so that it may be used to balance the car and a part or the whole of the load which is to be placed in the car. In this case, also, a part of the weight of the counterweight may be utilized to tilt the supporting tilting beams 44 and to increase the tension on the loop of the rope or ropes 18. The sheave 12 is in this case also set to one side of the hinge-block 41 so that the weight of the car 10 and its load will tilt the channel-irons 44 and thereby maintain the proper tension on the rope-loop 18.

In elevator systems of this type it has been necessary to employ a counterweight or two cars in order to hold the rope in sufficient frictional contact with the driving sheave.

Another new and useful result which I obtain is that I provide a simple and efficient means for maintaining the tension on the driving ropes at a sufficient degree to prevent slipping on the driving-sheave and to have this friction increased as the load in the car is increased. This is done in the most desirable manner as the increased tension upon the driving ropes is placed equally on both sides of the loop and not entirely on one side as is the result of many arrangements previously used. Slipping of the driving ropes on the driving-sheave wears the cables very rapidly and is also a cause of great danger. The pressure on the bight of the driving ropes must be sufficient to hold the car and its load when the driving-sheave is at rest and to drive the car and its load when the driving-sheave is set in motion.

In other systems it has been found neces-

sary to maintain the tension on these ropes to an extent sufficient to hold the maximum load which, of course, puts an undue strain upon the ropes and causes them to wear rapidly. In the present arrangement, however, the tension on the driving ropes need only be sufficient to hold or to drive the empty car, as any load which is added to the car increases this tension.

I have just stated that by my arrangement a car can be driven without any counterweight. It is also possible to use a counterweight to balance the weight of the car or to use a counterweight to overbalance the car. I have shown this to illustrate the fact that my system is applicable to many different arrangements of rope systems, and to show that I do not confine myself to any particular arrangement of parts.

The driving ropes 18 are in the form of an endless loop. The stretching of the rope or ropes forming this loop may be taken up by any suitable arrangement. For example, turnbuckles may be placed in the ropes or an adjustable fastening 30^A, which is similar to the fastening 30 previously described, may be used.

What I claim is:

1. In a rope-drive elevator, a car, a motor, a driving sheave, a rope system in frictional contact with said sheave, a tilting lever, sheaves on said lever, said sheaves and lever forming a support for the car, and arranged to control the frictional contact between the rope system and the driving sheave.

2. In a rope-drive elevator, a car, a motor, a driving sheave, a rope system, a part of which system runs around and by two sides of said sheave, a plurality of other sheaves over which the rope system is run, and a tilting lever supporting said other sheaves and arranged to transmit the weight of the car to said rope system and to produce an equalized tension on both sides of that part of the rope system which runs by the driving sheave.

3. In a rope-drive elevator, a car adapted to carry a load, a motor, a driving sheave, a rope system in frictional contact with said sheave, a plurality of other sheaves over which the rope system is run, and a tilting lever supporting said other sheaves and arranged to transmit the weight of the car and its load to the rope system to produce an equalized tension on the rope system proportional in strength to the weight of the car and the load.

4. In a rope-drive elevator, a car adapted to carry a load, a motor, a driving sheave, a rope system, a part of which runs around and by two sides of said sheave, a plurality of other sheaves over which the rope system is run, and a tilting lever supporting said other sheaves and arranged to transmit the weight of the car and the load to the rope

system and to produce an equalized tension on both sides of that part of the rope system which runs by the driving sheave, said tension being proportional in strength to the weight of the car and the load.

5 5. A motor, a driving sheave connected thereto, a brake, a rope or ropes passing around and by two sides of said sheave, an elevator-car connected to said rope or ropes and a tilting lever arranged to support the car and to produce an equalized tension on the rope or ropes on both sides of the sheave in proportion to the weight of the car.

6. In a rope-drive elevator, a car, a motor, a driving sheave, a rope system in frictional contact with said sheave, a tilting lever, sheaves on said lever, said sheaves and lever forming a support for the car and arranged to control the frictional contact between the rope system and the driving sheave, a fulcrum for said lever, and means for changing the position of the fulcrum to vary the leverage.

7. A driving sheave, a receptacle adapted to carry a load arranged to be moved by said sheave, a rope system connecting the receptacle and the driving sheave, a tilting lever arranged to support the receptacle and to cause the weight of the receptacle and its load to make tension on the rope system, a fulcrum for said tilting lever, means for changing the position of the fulcrum to vary the leverage, and springs under said lever.

8. A motor, a driving sheave connected thereto, a brake, a rope or ropes passing around and by two sides of said sheave, an elevator-car connected to said rope or ropes, a tilting lever arranged to support the car and to increase the tension on the rope or ropes on both sides of the sheave, and adjustable springs under the lever.

9. In a rope-drive elevator, a car, a motor, a driving sheave, a rope or ropes connected together to form an endless loop, a driven sheave in said loop and a leverage system whereby the weight of the car produces an equalized tension on both sides of the loop.

10. In a rope-drive elevator, a car, a motor, a driving sheave, a rope or ropes connected together to form an endless loop, said loop being in frictional contact with the driving sheave, a lever, sheaves on said lever, one of which sheaves supports the endless loop and another of which supports the car, and a fulcrum for said lever between the sheaves.

11. In a rope-drive elevator, a car, a counterweight therefor, a motor, a driving sheave, a rope or ropes connected together to form an endless loop, said loop being in frictional contact with the driving sheave, a tilting lever, sheaves on said lever, one of which sheaves supports the endless loop and another of which sheaves supports the car, a fulcrum for said lever between the sheaves,

said lever being arranged to control the frictional contact between the rope-loop and the driving sheave.

12. In a rope-drive elevator, a car, a motor, a driving sheave, a rope or ropes connected together to form an endless loop, said loop being in frictional contact with the driving sheave, a tilting lever, sheaves on said lever, one of which sheaves supports the endless loop and another of which sheaves supports the car, a fulcrum for said lever between the sheaves which it supports and means for changing the position of the fulcrum.

13. A driving sheave, a second sheave, a rope or ropes passing around said sheaves, a receptacle adapted to carry a load connected to said rope or ropes, and a tilting lever arranged to support the receptacle and the second sheave, and to shift the position of said second sheave according to the effective weight of the receptacle and to thereby increase the tension on said rope or ropes.

14. A driving sheave, a rope or ropes passing around and by two sides of said sheave, a movable member connected to said rope or ropes, a tilting lever arranged to support the movable member and to cause said movable member to increase the tension on the rope or ropes on both sides of the driving sheave, a fulcrum for said lever and means for changing the position of the fulcrum to vary the leverage.

15. A rope or ropes with their ends substantially connected together to form an endless loop, a driving sheave, a driven sheave, a lever upon which said driven sheave is supported, both of said sheaves being in the loop, said lever and sheaves being arranged to produce an equalized tension on both sides of the loop, and a movable member supported by the lever and arranged to actuate the lever, said movable member being connected to the loop and arranged to be driven thereby.

16. A rope or ropes with their ends substantially connected together to form an endless loop, a driving sheave, a driven sheave, a lever upon which said driven sheave is supported, both of said sheaves being in the loop, and a movable member connected to said loop and arranged to be driven thereby, said movable member being supported by the lever and arranged with said lever and sheaves to provide an equalized tension on both sides of the loop.

17. A rope or ropes connected together to form an endless loop, a driving sheave, a fixed support therefor, a driven sheave, a lever upon which said driven sheave is mounted, both of said sheaves being in said loop, a receptacle adapted to carry a load, said receptacle being connected to the loop and arranged to be driven thereby, said receptacle being supported by the lever and

arranged to produce an equalized tension on both sides of the loop proportional in strength to the weight of the receptacle and its load.

5 18. A rope or ropes connected together to form an endless loop, a driving sheave, a fixed support therefor, a driven sheave, a lever upon which said driven sheave is mounted, both of said sheaves being in said
10 loop, a receptacle adapted to carry a load connected to said loop and arranged to be moved thereby, said receptacle being supported by the lever and arranged to tilt the lever and to cause it to take up slack in the
15 loop, and to maintain the loop in frictional contact with the driven sheave with a pressure proportional to the load.

19. A rope or ropes connected together to form an endless loop, a driving sheave, a
20 fixed support therefor, a driven sheave, a

lever upon which said driven sheave is mounted, both of said sheaves being arranged in said loop, and a receptacle arranged to carry a load, said receptacle connected to said loop and arranged to be moved 25 thereby, said receptacle being supported by the lever and arranged to tilt the lever and to cause it to take up slack in the loop and to maintain the loop in frictional contact with the driven sheave with a pressure proportional to the load, and additional means in 30 the loop for adjusting the length of the loop.

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

ERNEST BOENING.

Witnesses:

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ELLA TUCH.