E. BOENING.

FRICTION ROPE DRIVE ELEVATOR.

APPLICATION FILED MAR. 9, 1906.

994,112. Patented June 6, 1911.

3 SHEETS—SHEET 1.

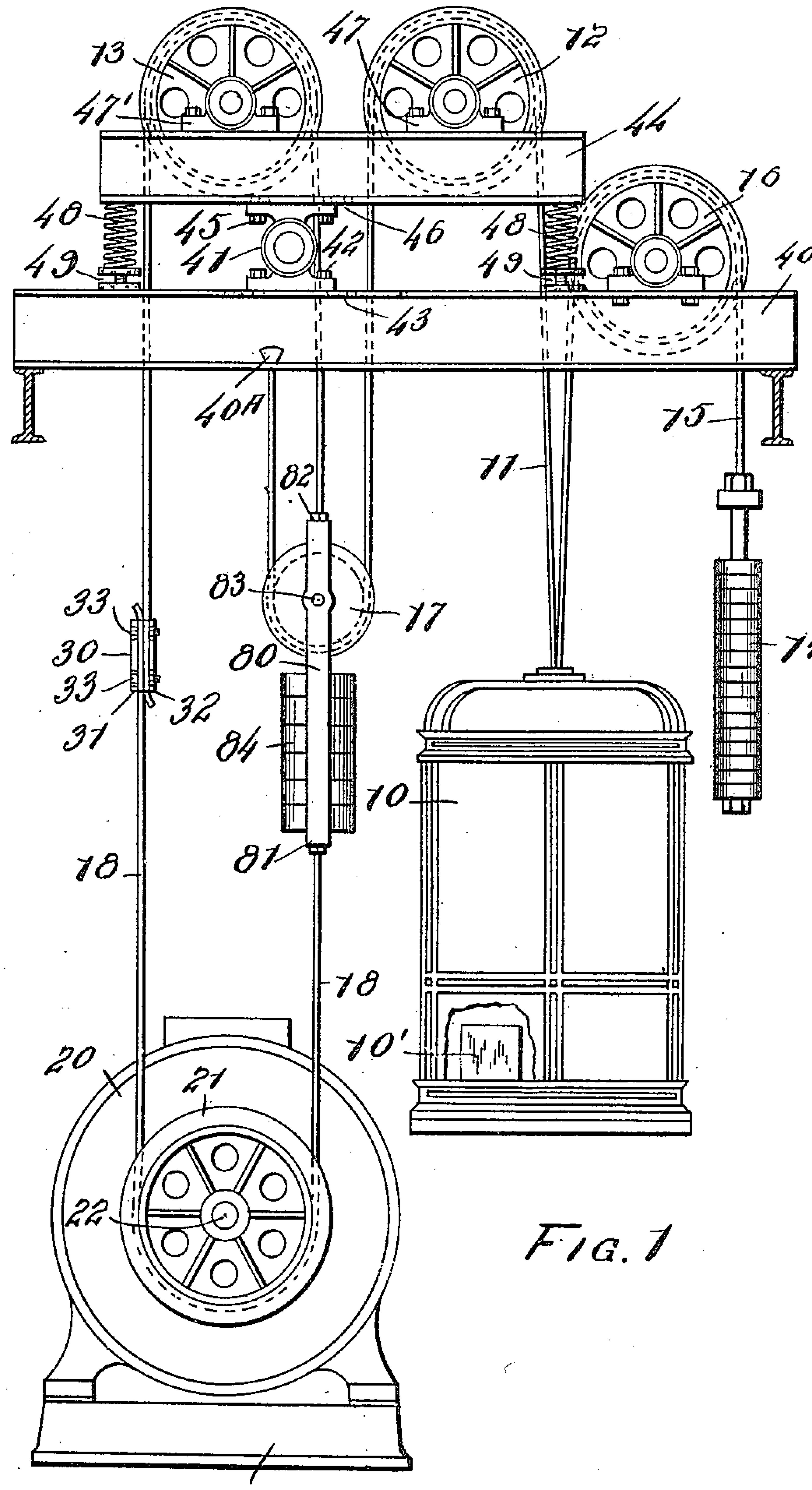

Fig. 1

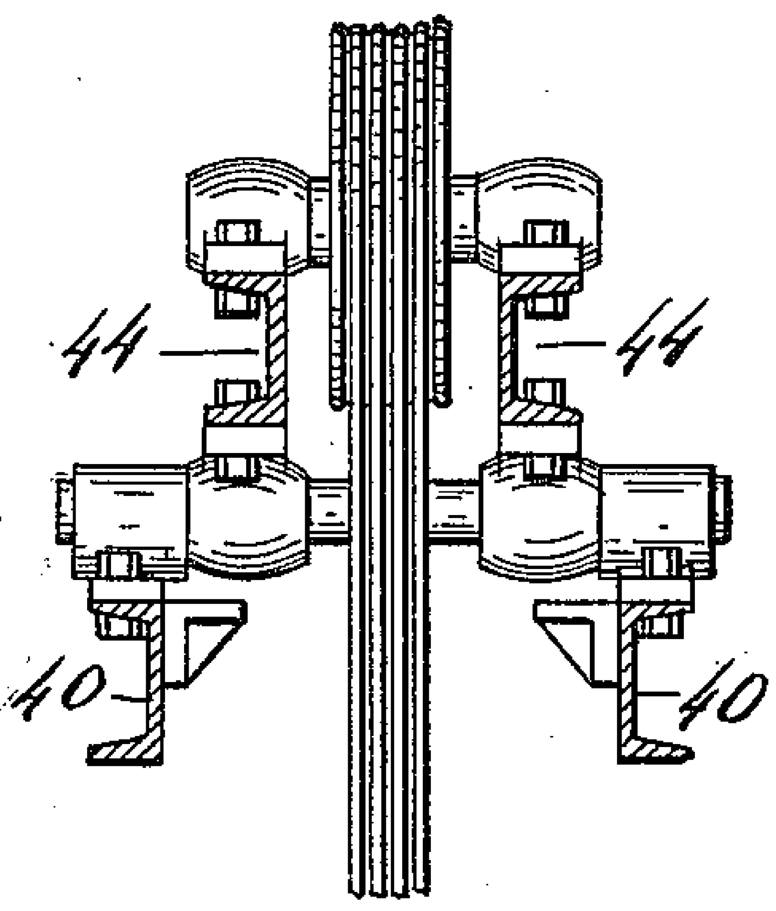

Fig. 2.

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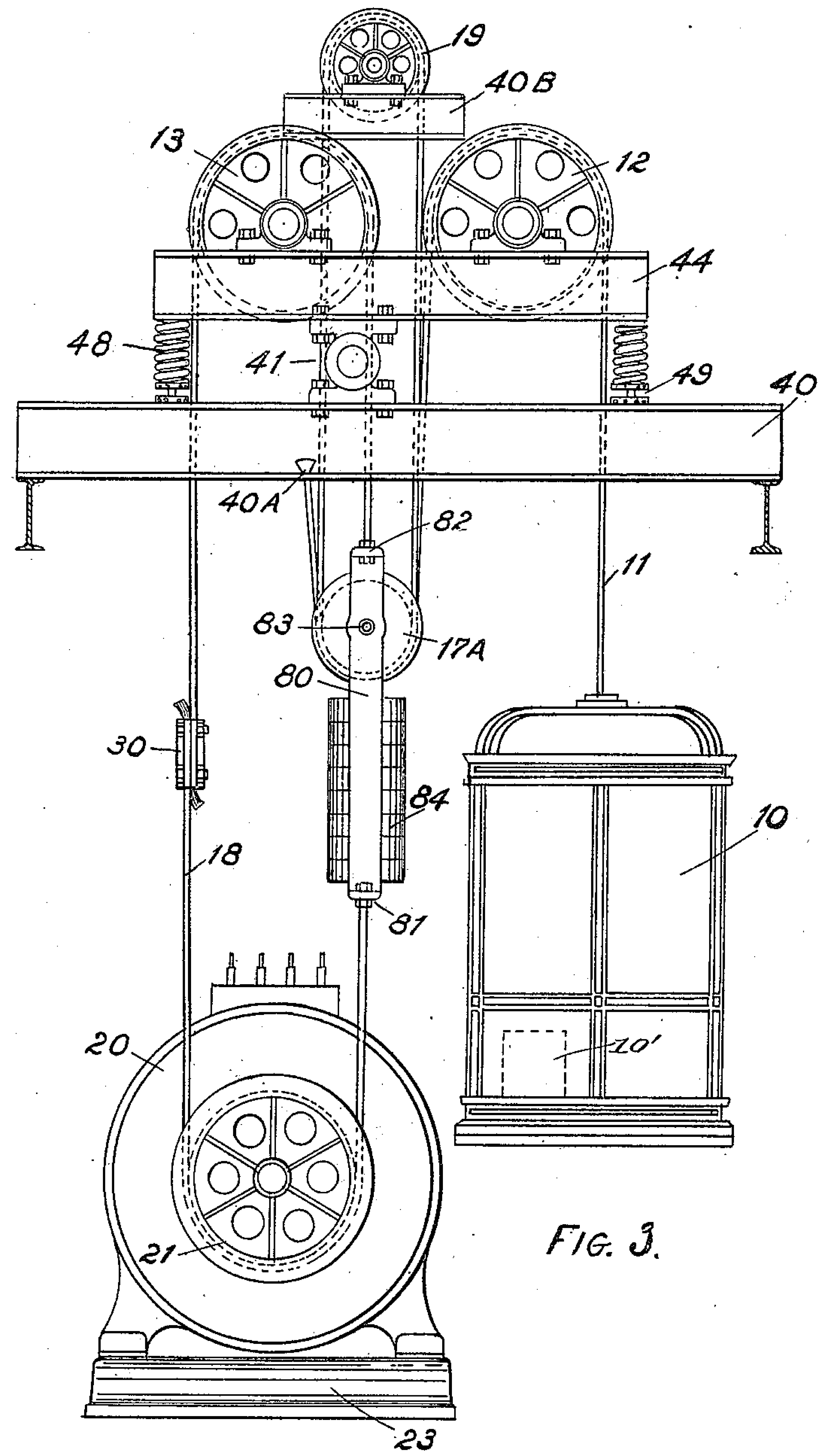

FIG. 3.

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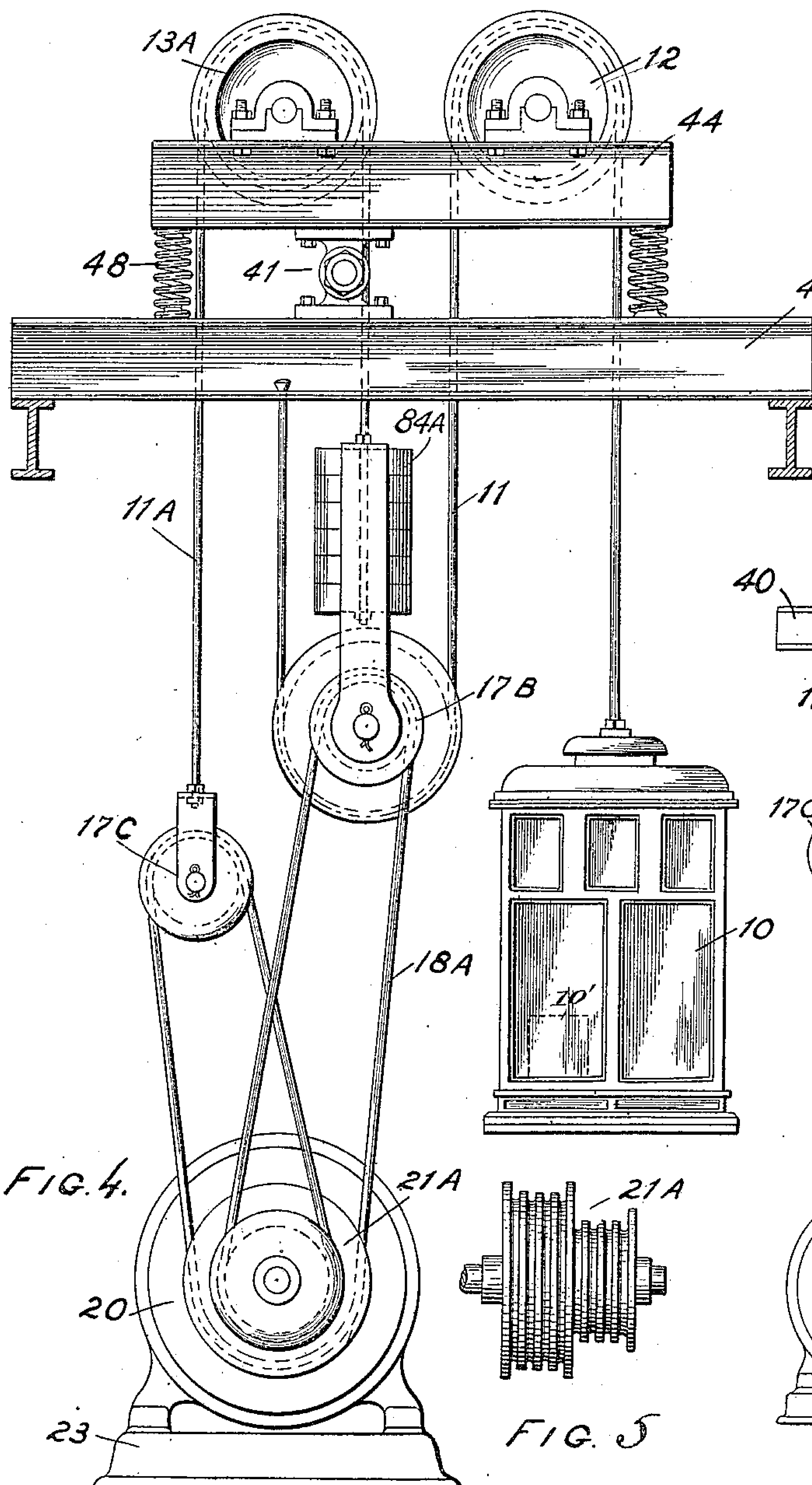

FIG. 4.

FIG. 5

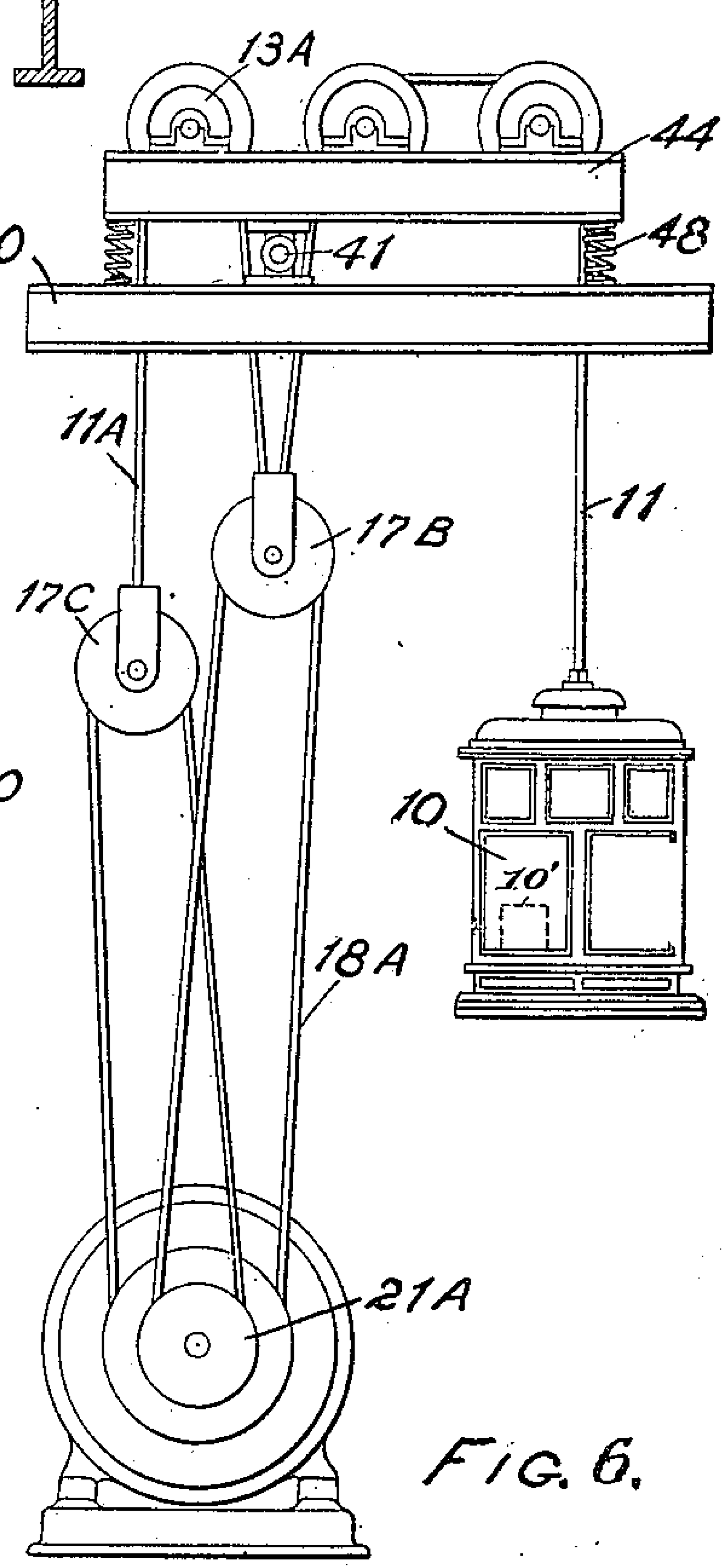

FIG. 6.

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

FRICTION ROPE-DRIVE ELEVATOR.

994,112. Specification of Letters Patent. Patented June 6, 1911.

Application filed March 9, 1906. Serial No. 305,034.

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-rope 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. Fig. 2 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. 3 represents in side elevation a friction rope-drive elevator made according to my invention, but in form somewhat modified from that shown in Fig. 1. Fig. 4 shows in side elevation another modification of my invention, and Fig. 5 is an end view of certain of the parts shown in Fig. 4. Fig. 6 shows diagrammatically another arrangement of my invention.

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 supported 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 and under a movably supported sheave 17; thence up to a supporting beam 40 to which it is attached at 40^A.

18 designates the driving rope or ropes which are in the form of an endless loop in which is interposed the movably supported sheave 17. These driving ropes 18 run down and under a driving sheave 21 which is rigidly mounted upon the shaft 22 of a reversible motor 20, and over another sheave 13 which is supported near the top of the shaft. These ropes may be spliced together, or their ends may be connected by an adjustable fastening 30 in such a way that any stretching of the ropes may be taken up at will.

80 designates the traveling frame to which the driving rope or ropes 18 are connected at 81 and 82. The sheave 17 is mounted upon this frame upon a shaft 83.

84 designates a counterweight which may be used to partially balance the car 10 and its load.

The 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 ropes may be shifted in the fastening to take up any slack in the ropes which may be caused by their stretching.

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 sheaves 12 and 13, over which the hoisting cable or cables 11 and driving rope or ropes 18 pass, are supported on the channel-irons 44, 44 by means of stationary bearings 47 and 47′. Springs 48, 48 may be 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 on these springs may be regulated.

14 designates a counterweight which may be arranged to balance a portion of the weight of the car 10. It is connected to the car 10 by a cable 15 which passes up and over a sheave 16 supported upon the channel-irons 40 above the run of the elevator-car.

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 side, upon which is mounted the sheave 13, to be raised. In this way the supporting beams form a tilting leverage system which takes up any slack there may be in the loop of the driving-rope or ropes 18 which are between the driving sheave 21 and the overhead sheave 13, and automatically produces a strain upon these ropes and thereby produces a frictional contact between the rope or ropes and the driving sheave. The 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 this tension on both sides of the driving sheave 21. The position of the hinge-block 41 may be shifted to the left or to the right to increase or decrease this leverage. The use of the counterweight 84 permits the weight of the car to be counterbalanced to any desired extent without decreasing the tension on the driving ropes 18. For example, if the counterweight 84 is 1000 pounds, it will counterbalance 500 pounds weight on the car. The tension on the driving ropes 18 due to the weight of the car and its load is the same however, as if no counterweight 84 was used. An increase in the counterbalance weight 84 will not alter the tension placed on the drive ropes due to the weight of the car and load. The counterweight 14 however not only counterbalances a portion of the weight on the car, but also decreases the tension placed on the drive sheaves by the car and its load. By varying the counterweights 14 and 84 the tension on the driving ropes 18 may be increased or decreased as desired, and at the same time the car and its load may be counterbalanced to any desired extent. 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 while it is running. These springs 48, 48 are arranged, as shown, to be regulated or adjusted by means of screws 49, 49. It may be seen that any stretch of the ropes 18 may be taken up by means of the adjustable fastening 30. This fastening may be so placed in the rope-loop that it may be run between the driving sheave 21 and the overhead sheave 13 without having to pass over it.

Whenever the motor is rotated in one direction or the other and thereby causes driving sheave 21 to be rotated in one direction or the other, the driving rope or ropes 18 will be moved thereby and will cause the frame 80, which is a part of the loop, to be moved up or down in proportion to the speed of the driving sheave 21. The car ropes or cables, which pass under the movably supported sheave 17, will be acted upon thereby and the movement of the frame 80 will be transmitted to the car, but increased in amount. Whenever the frame 80 is moved up a certain distance the car 10 will be moved down twice that distance. Similarly, when the frame 80 is moved down, the car 10 will be raised twice the distance of the movement of the frame 80.

In Fig. 3 I have shown a modified arrangement of my system. In this case the frame 80 is provided with two sheaves 17^A which are mounted upon the shaft 83. The car-supporting cable or cables 11 in this case run up and over a sheave 12, supported, as above described, upon the tilting lever 44; thence down and under one of the sheaves 17^A; up and over a stationary sheave 19 supported upon the beam or bracket 40^B; thence the cable or cables 11 pass down and under the other of the sheaves 17^A and up to the channel-irons 40, to which they are attached at 40^A. The operation is similar to that previously described, but in this case the movement of the car 10 will be four times that of the traveling frame 80 on account of the manner in which the cables are run. It is possible, also, to so arrange the run of the various ropes as to give any desired ratio between the speed of the driving sheave and that of the car. By arranging the run of the ropes somewhat differently the car may be arranged to move at a lower rate of speed than the speed of the driven rope-loop. For example, I have shown in Fig. 4 an arrangement wherein the rope-loop 18^A is driven over a differential sheave 21^A. The loop is run over two traveling sheaves 17^B and 17^C. These are connected together by other rope or ropes 11^A which pass over and are supported by a sheave 13^A on the tilting lever 44. The traveling sheave 17^B may be provided with grooves for the driving ropes 18^A and for the car ropes 11. A counterweight 84^A may also be connected to the sheave 17^B if desired.

Fig. 5 shows a side view of the differential driving sheave 21^A. The operation of this form of my invention is similar to that previously described, except that the cable 11, which supports the car, will run at a lower rate of speed than that of the driving ropes 18^A. The arrangement shown in Fig. 6 is similar, but in this case the car rope or ropes 11 are attached to the frame which supports the traveling sheave 17^B. Of course, many other arrangements may be made to obtain various other speed reductions.

In elevators of this type with the usual arrangement 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. The present invention provides a system in which the car may be driven by a frictional sheave and may be used to maintain the proper tension on the driving cables without the use of a counterweight or another car. Another new and useful result is that I provide a simple and efficient means for maintaining the tension on the driving ropes at a degree sufficient 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, regardless of the direction of rotation of the driving sheave. Slipping of the driving rope or ropes on the driving sheaves wears the ropes very rapidly and is also a cause of great danger. The pressure of the bight of the driving ropes must be sufficient to hold the car and its load when the driving sheave is not in motion. In other systems it has been found necessary 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 may be driven without any counterweight; in other words, the system in operative without the use of the counterweights 14 and 84. It is also possible to use a counterweight such as 14 to balance the weight of the car, or it is possible to use a counterweight such as 84 to overbalance the car. If desired, the counterweight sheave 16 may be mounted upon the tilting lever 44 so that the counterweight thus adds to the effect of the leverage system and helps to maintain the tension on the driving ropes 18. The load may be arranged to run faster or slower than the driving ropes and in any desired ratio to the speed of the driving ropes.

The invention is capable of many modifications. The present application shows several modifications of my invention and I have shown other modifications in the companion application, Serial No. 302,886, filed February 26th, 1906.

What I claim is:

1. A driving sheave, a rope or ropes passing around and by two sides of said sheave, a frame to which said ropes are attached, a movable sheave supported by the frame, a receptacle adapted to carry a load, a cable connected to said receptacle and passing under the movable sheave, and a tilting lever arranged to support the receptacle and to increase the tension on said rope or ropes on both sides of the driven sheave in proportion to the weight of the receptacle and its load.

2. A driving sheave, a fixed support therefor, a rope or ropes connected together to form an endless loop, a movable frame in said loop, a driven sheave, a yielding support therefor, both of said sheaves being in said loop, a car associated with the frame and arranged to be moved thereby and means depending upon the weight of said car for moving the yielding support of the driven sheave and thereby producing an equalized tension on both sides of the loop.

3. A rope or ropes connected together to form an endless loop, a frame in said loop, a movable sheave supported by the frame, 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 the loop, a second sheave supported upon said lever, a car, and a cable connected to the car and supported by said second sheave, said cable being associated with the movable sheave and arranged to cause the weight of the car to maintain the loop in frictional contact with the driving sheave.

4. In a rope drive elevator, a car, 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 frame in said loop, a traveling sheave supported by the frame, a cable connected to the car and associated with the traveling sheave, a tilting lever, sheaves on said lever, one of which sheaves supports the endless loop and another of which supports the car, a fulcrum for said lever between the sheaves which it supports, said lever being arranged to control the frictional contact between the rope loop and the driving sheave.

5. In a rope drive elevator, a car, 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 frame in said loop, a traveling sheave supported by the frame, a cable connected to the car and associated with the traveling sheave, a tilting lever, sheaves on said lever, one of which sheaves supports the endless loop and another of which supports the car, and with an adjustable fulcrum for said lever between the sheaves which it supports.

6. In a rope drive elevator, a car, 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 frame in said loop, a counterweight connected to the frame, a traveling sheave supported by the frame, a cable connected to the car and associated with the traveling sheave, and a leverage system whereby the weight of the car produces an equalized tension on both sides of the loop.

7. In a rope drive elevator, a car, a motor, a driving sheave, a rope or ropes connected together to form an endless loop, a frame

in said loop, a counterweight connected to the frame, a traveling sheave supported by the frame, a tilting lever, sheaves on said tilting lever, one of which sheaves is arranged to support the endless loop and another of which is arranged to support the car, a cable connected to the car and associated with the car-supporting sheave and with the traveling sheave and connected to a fixed point, and a fulcrum for said tilting lever between the sheaves on the lever.

8. 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 receptacle, means for associating said receptacle with the loop and arranged to cause the receptacle to be moved by the loop at a different rate of speed from the loop, and means depending upon the weight of said receptacle for causing the receptacle to make tension on the loop.

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

ERNEST BOENING.

Witnesses:
Ella Luch,
Ernest W. Marshall.