(No Model.) 2 Sheets—Sheet 1.

H. ROWNTREE.

ELECTRIC ELEVATOR.

No. 599,015. Patented Feb. 15, 1898.

Fig. 1.

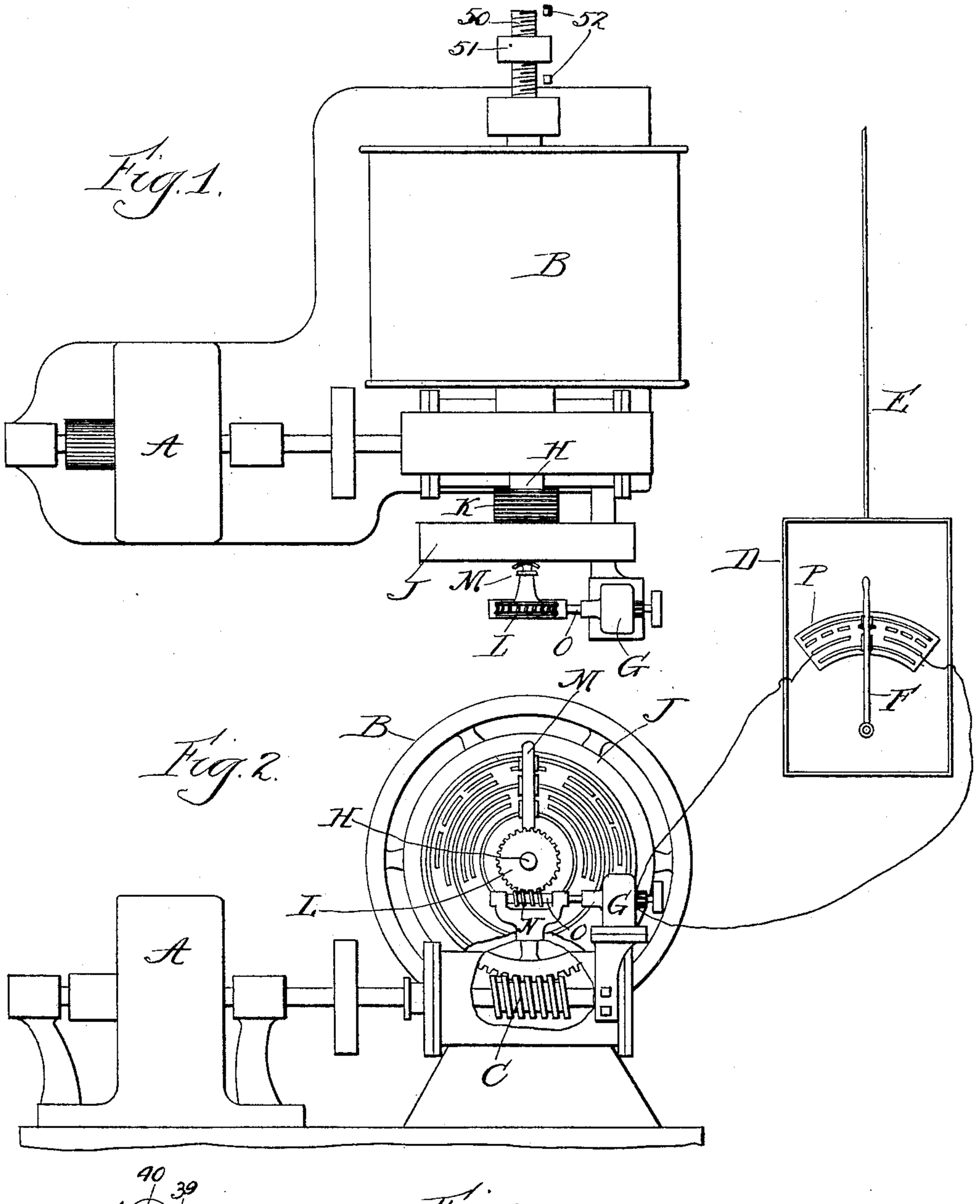
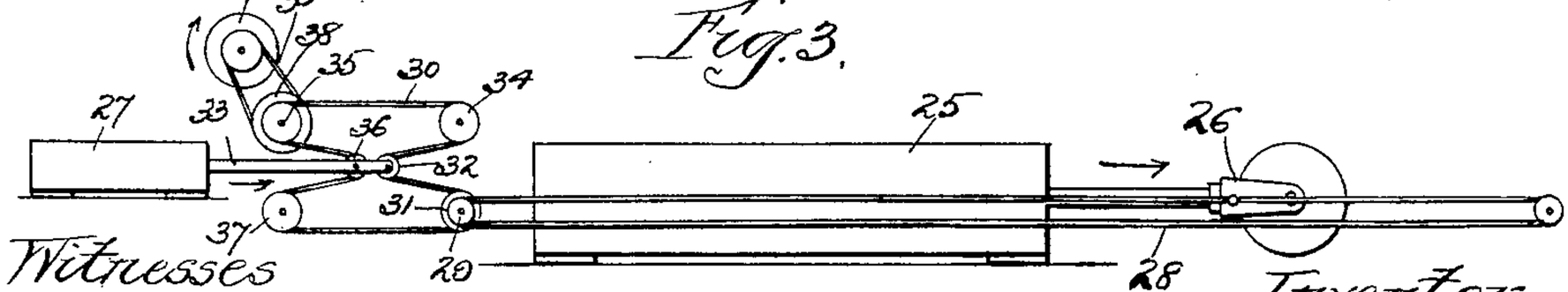


Fig. 2.

Fig. 3.



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(No Model.)

2 Sheets—Sheet 2.

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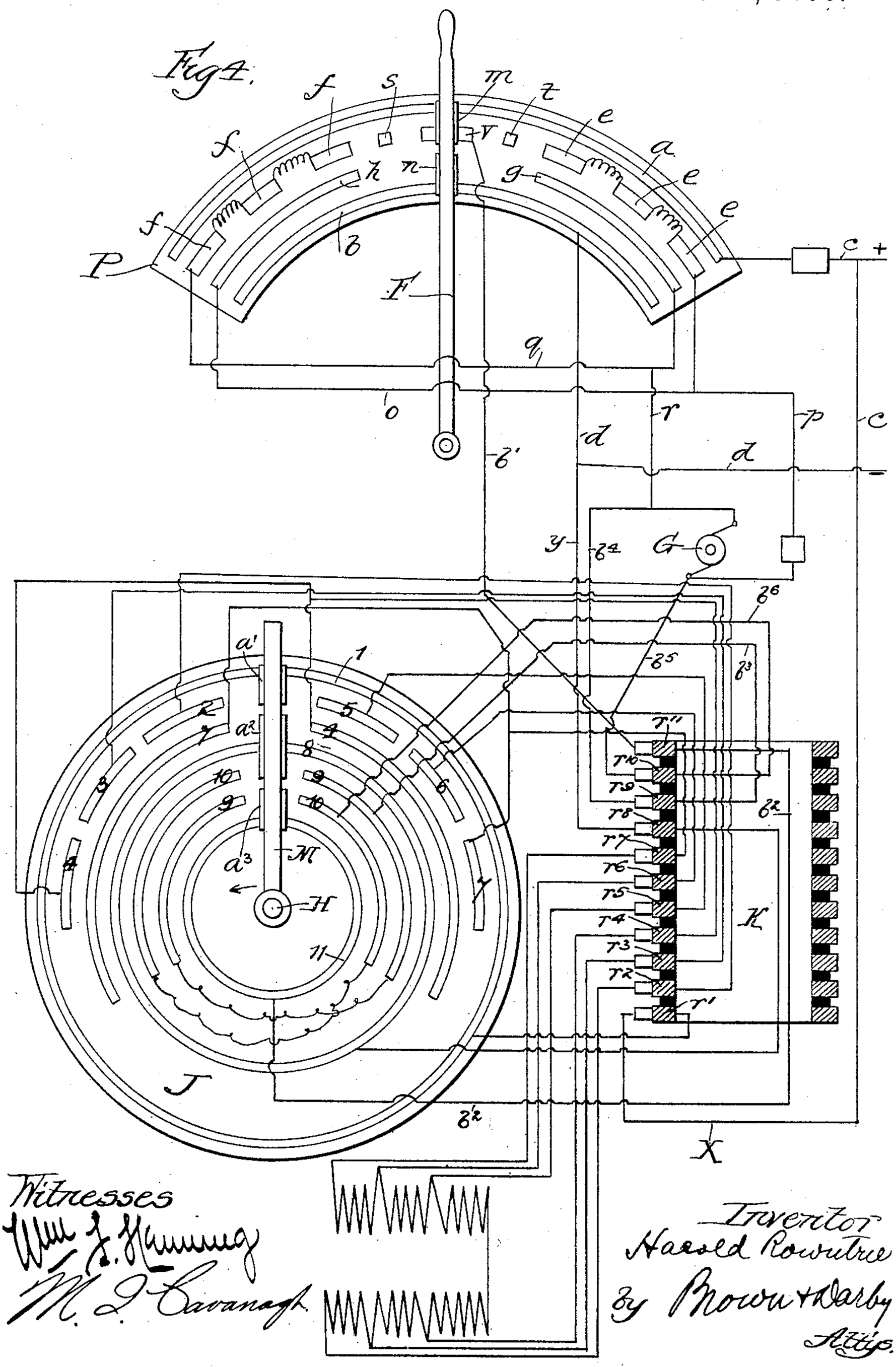
Fig 4.



Witnesses
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M. J. Savanagh.

Inventor
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UNITED STATES PATENT OFFICE.

HAROLD ROWNTREE, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE BURDETT-ROWNTREE MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 599,015, dated February 15, 1898.

Application filed February 28, 1896. Serial No. 581,128. (No model.)

To all whom it may concern:

Be it known that I, HAROLD ROWNTREE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Elevators, of which the following is a specification.

This invention relates to elevators.

The object of the invention is to provide a novel and useful arrangement of apparatus for operating passenger and other elevators, hoisting-cranes, and the like.

The invention consists, substantially, in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and reference-signs appearing thereon, Figure 1 is a plan view of an apparatus embodying the principles of my invention as applied to electric elevators. Fig. 2 is a view in side elevation of the same, illustrating the relation of the parts and the control device on the car. Fig. 3 is a view illustrating the application of the principle of my invention applied to hydraulic elevators. Fig. 4 is a view illustrating, diagrammatically, the principle of operation of an electrical apparatus embodying my invention.

The same reference-sign designates the same part wherever it occurs throughout the several views.

In the drawings, A designates an electric motor; B, the winding-drum for the car-hoisting cable; C, the gearing by which said drum is actuated from the motor-shaft; D, the car; E, the car-hoisting cable; F, the control-lever on the car for controlling the action of the hoisting-motor, and G a small auxiliary or pilot motor controlled from the car and through the medium of which the main or hoisting motor circuits are controlled, as will be more fully hereinafter explained.

Suitably mounted on and to rotate with the shaft H of drum B is a disk J, which I shall term the "contact-disk," and which carries therewith the commutator K, composed of insulated segment-rings, in the usual manner, through which the various circuits, hereinafter to be described, are controlled.

Mounted to revolve loosely and independently upon shaft H is a gear L, carrying a contact-making arm M, having brushes arranged to make a contact with the strips or rings carried by the contact-disk J, as will more fully hereinafter appear. The gear L is arranged to be engaged and driven by a gear N on the shaft O of the auxiliary or pilot motor G.

The operation is as follows: The lever F in the car, which controls the pilot-motor circuits, is manipulated to start, stop, or reverse the pilot-motor G. In case the pilot-motor is started up the arm M is rocked upon shaft H by gears L and N. As soon as the brushes carried by said arm make contact with the contact-strips carried by the contact-disk J the main motor starts up in one direction or the other, according to the direction in which the pilot-motor is actuated, and hence according to the direction in which the arm M is thrown thereby. The arrangement, as will presently more fully appear, is such that the speed of the main motor A, and consequently the speed of rotation of contact-disk J, is coincident with the speed of the auxiliary or pilot motor, which is controllable from the car, and by so varying the speed of the pilot-motor G as to vary the relative speed of contact-disk J and brush-carrying arm M the speed of the main or hoisting motor is correspondingly and automatically varied by the brush-carrying arm cutting in or out of circuit the means whereby the speed of said hoisting-motor is controlled. I will now explain the arrangement whereby this operation is secured, particular reference being had to Fig. 4 of the drawings, wherein P designates a suitable insulating board or support carried by the car and upon which are mounted contact-strips *a* and *b*, respectively included in circuit with the main positive and negative wires *c* and *d*. Also mounted upon base or support P are the contacts *e e e* and *f f f*, the contacts *e e e*, &c., being coupled up in series with suitable interposed resistances, and the contacts *f f f* similarly coupled up in series with similarly-interposed resistances, as shown.

Also carried by support P are the contact-strips *g h*, the strip *g* being electrically coupled to the series contacts *f f f* and the strip *h* being electrically coupled to the series contacts *e e e*, as shown. A brush *m*, carried by the lever F, is arranged to complete the circuit from positive contact-strip *a* to *e e e* or *f f f*, and a brush *n*, carried by the lever, is arranged to complete the circuit from strip *g h* to the negative strip or contact *b*. The strip *h* and series contacts *e e e* are in circuit, through connections *o p*, with one pole of the auxiliary or pilot motor, and strip *g* and series contacts *f f f* are in circuit, through connections *q r*, with the other pole of said pilot-motor. As shown, the positive and negative contact-strips *a b* extend the entire length of the support P, and circuit is made therefrom to either series *e e e* or *f f f* or to either strips *g h*, as the case may be, determined by the direction in which the lever F is rocked. The support P carries the top points *s t*, at which points the pilot-motor circuits are broken. The support P also carries a contact-strip V, arranged to reverse the direction of the pilot-motor current, as will be presently explained.

Suppose the lever F upon the car to be thrown to the right from the position thereof shown in Figs. 2 and 4. Until brush *m* bridges the space between strip *a* and the first of the series contacts *e* and the brush *n* bridges the space between strips *g* and *b*, the circuit will then be made as follows: from the main positive feed-wire through connection *c* to strip *a*, through brush *m* to and through the series contacts *e e e* and connections *o* and *p* to one pole of the pilot-motor, through the pilot-motor windings and connections *r* and *q* to strip *g*, through brush *n* to strip *b*, and thence through connection *d* to the negative line-wire. This will cause the pilot-motor G to be actuated at a speed determined by the amount of the resistance contained in the series connections of contacts *e e e* traversed by the current. By moving lever F so as to cut in or out the resistance in the series connections of *e e e* the speed of rotation of the pilot-motor is varied and controlled. Similarly by throwing the lever F to the left from the position shown in Fig. 4 current is made from stop *a* to the series contacts *f f f*, thence through connections *q r* to the opposite pole of the pilot-motor, through the pilot-motor windings, thence through the connections *p o* to strip *h*, through brush *n* to strip *b*, and thence through connection *d* to the negative line-wire, thereby reversing the direction of the pilot-motor-operating current, and hence reversing the pilot-motor, the speed of its reverse rotation being dependent upon the amount of resistance in the series connections of contacts *f f f* traversed by the current, and hence dependent upon the position of lever F. In either of the above cases actuation of the pilot-motor effects a movement of the arm M through gearing N and L.

I will now describe the connections and arrangement of parts of the contact-disk J and the various circuits controlled thereby and first with reference to the windings of the main hoisting-motor. It will be understood that the actuation of the main hoisting-motor may be effected by energizing the field and the speed of the motor may be varied by causing the field-energizing current to traverse field-windings arranged in series or auxiliary field-coils, all of which may be in live circuit at the moment the motor is started up and which produces in the field a sufficient number of lines of force to exert upon the motor-armature its initial or starting torque, and then successively cutting out these auxiliary or series field-coils in order to produce the necessary acceleration. Again, the motor field-circuit may include resistances or rheostats arranged in series, all of which are included in the live energizing-current at the moment of starting up of the motor and which may be successively cut out in order to produce the necessary acceleration of speed.

The principles of my invention are equally well adapted for use in connection with either system of motors, and therefore I have shown my invention as applied to a motor of the first above-described type, and I do not limit myself thereto.

In the face of contact-disk J, I arrange the contact strips and rings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11. The contact-strips 1, 8, and 11 comprise concentrically-arranged rings. The commutator K carries the insulated rings r', r^2, r^3, r^4, r^5, r^6, r^7, r^8, r^9, r^{10}, and r^{11}, which are respectively connected electrically to the contact strips and rings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11. Ring r' is included in circuit with the main positive wire X and ring r^8 is included in circuit through connections *y d* with the main negative wire, and therefore rings 1 and 8 respectively constitute the main positive and negative contacts of contact-ring J. The rings r^2, r^3, r^4, r^5, r^6, and r^7 are respectively included in the circuits of the auxiliary series field-coils of the main hoisting-motor. It will be observed that the contacts are arranged on opposite sides of a neutral point, but that corresponding contacts 4, 7, 9, and 10 are arranged on each side of said neutral point and the members of each pair are electrically connected to each other. Now suppose the pilot-motor has been actuated, as above described, to effect a rocking of the arm M in the direction indicated by the arrow in Fig. 4, the following operation results: The brush a', carried by said arm, bridges the space between and couples up ring 1 and contact 2, the brush a^2, carried by said arm, bridges the space between contacts 7 and 8 and between 10 and 8, and brush a^3 bridges the space between contacts 9 and 11. Circuits are thereby made as follows: from the main positive line-wire X to ring r' of the commutator, thence to contact-ring 1 on the

contact-disk J, thence to brush a' to contact 2, thence to ring r^2 of the commutator, thence through all of the series windings or all the resistances in the hoisting-motor field-circuit or armature-circuit 1, according to the type of motor, thence to ring r^7 of the commutator, thence to contact 7 of the contact-disk J, through brush a^2, to ring 8, which is the negative ring of said disk, thence to ring r^8 of the commutator, and thence out to the negative line-wire through connections $y\,d$. The hoisting-motor is thereupon thrown into action and this causes a rotation of the ring J in the same direction in which the arm M is traveling. If the speed of travel of arm M coincides with the speed of rotation of disk J, the motor A continues at a uniform speed. If it is desired to increase or diminish the speed of the motor A, the relative speeds of arm M and disk J are varied. This may be effected by varying the speed of the pilot-motor G, which controls the speed of travel of arm M. If the speed of travel of pilot-motor G, and hence also of arm M, is increased, as above explained, so that said arm travels at a greater speed than disk J, said arm will gain on said disk until finally brush a' passes contact 2, and consequently cuts in or out the resistance in the field-circuit or armature-circuit of motor A, or cuts out the field series coils of said motor controlled by contact 2, as above explained, and cuts in contact 3 by the brush a' bridging the space between ring 1 and the said contact 3. This results in an acceleration of speed of the motor A, and hence also of the contact-disk J, through the cutting in or out of additional resistance or auxiliary coils in the motor-field circuit included in circuit with said contact. This action is repeated at each acceleration of speed of the arm M, which speed is controlled from the car through the small pilot-motor G. In the same manner when arm M is thrown to the right from the position thereof shown in Fig. 4, circuit is made from ring 1 to contact 5, thence to ring r^5, thence in an opposite direction through the motor field-coils from that above described, thence to ring r^4 to contact 4, thence through brush a^2 to negative ring 8, and thence out, thereby reversing the direction of rotation of motor A, and by varying the relative speed of arm M and disk J the speed of the motor A is varied and controlled.

From the foregoing it will be seen that as long as the speed of travel of arm M coincides with the speed of rotation of disk J the motor A is operating at a uniform speed and that by varying the relative speed of said arm and disk the speed of the main motor is correspondingly varied. It will also be seen that in case of overloading, resulting in a decrease of speed of the motor A, the arm M automatically cuts in or out the necessary field coils or resistances to increase the speed. The apparatus is therefore automatic and self-adjusting and is effectively controlled by a very small current, sufficient only to actuate the small pilot-motor G, which has but a light duty to perform—namely, to operate arm M.

When it is desired to stop the motor A, the operator on the car suitably moves lever F to a position where the circuits of the motor G are broken, thereby arresting said motor, and hence arresting arm M. As the motor A continues in action the disk J continues to rotate relatively to the now stationarily-held arm M, and hence automatically cuts in or out the necessary circuits of the field of motor A, and hence brings said motor to rest, with the arm M occupying a central or neutral position with respect to the contacts 2, 3, and 4 on the one hand and 5, 6, and 7 on the other.

It may sometimes be desired to arrest the motor A quickly. In order to effect this result, instead of merely arresting the action of the pilot-motor, and hence of the arm M, said motor and arm may be reversed, thereby causing said arm M to travel in the opposite direction to that in which disk J is revolving, and hence more quickly cutting in or out the field-circuits of the motor through which the action of the motor is controlled. This may be accomplished in whichever direction the motors G or A have been previously traveling by rocking lever F to make connection between contacts a and v. From the last-mentioned contact the circuit leads through connection b' to ring r^{11} of the commutator, thence through connection b^2 to ring 11 on disk J. Suppose arm M has been thrown to the left from its neutral position. Then the above circuit would be continued from ring 11, through brush a^3 to contact 9, thence to ring r^9, through connection b^3, and thence through connection b^4 to one pole of the motor G, thence through connection b^5 to ring r^{10}, through connection b^6 to contact 10 on disk J, thence through brush a^2 to negative contact-ring 8, and thence out through the remainder of the circuit from said ring, as hereinabove described. On the other hand, suppose the arm M to have been thrown to the right, then the above course would be merely reversed, thereby rotating the pilot-motor in the opposite direction, and hence, in either case, in a direction opposite to that in which it has been previously rotating, thereby reversing the direction in which the brush-carrying arm M has been traveling, and consequently effecting a rapid stoppage of the hoisting-motor.

The principle of operation of the electrical apparatus above described can be equally well embodied in hydraulic-elevator construction, and to illustrate the generic character of the broad principle involved I have shown in Fig. 3 a form of apparatus showing my invention as applied to hydraulic elevators, and wherein 25 designates the cylinder, 26 the cross-head, carrying the usual traveling sheave, and 27 the change or control valve. A connection 28, preferably a sprocket-chain,

is connected at the two ends thereof to the cross-head 26, and hence said sprocket-chain or connection travels with the cross-head. This sprocket-chain or connection 28 is arranged to engage and drive a sprocket or other suitable gear 29, on the shaft of which is arranged a suitable gear 31, adapted to receive an endless sprocket-chain or connection 30, arranged to lead from said sprocket 31 to and around a suitable guide-pulley or projection 32, carried by the stem 33 of control-valve 27, thence around a guide 34, thence around a suitably-arranged sprocket-gear 35, thence around a second guide-pulley or projection 36 on the stem 33 of the control-valve 27, thence around a guide-pulley 37, and finally back to sprocket-gear 31. A sprocket or other suitable gear 38 is mounted on the same shaft with gear 35 and is driven by any suitable driving connection 39 from a pilot-motor 40, which motor may be of any desirable type and is to be controlled from the car. It will be understood by referring to Fig. 3 that the guides or projections 32 36 upon the stem 33 of the control-valve 27 are arranged adjacent to each other and that both the portions of connection 30 extending from guide 34 to gear 31 and from gear-pulley 35 to guide 37 pass through the space between said guides or projections 32 36. From this construction it will be seen that so long as motor 40 and the cross-head 26 operate in the same direction and at the same speed the control-valve 27 is held stationary; but if any variations in the relative speeds of said motor and cross-head are made then the control-valve 27 will be shifted in one direction or the other, according to whether motor 40 is traveling faster or slower than cross-head 26. The operation by which this result is effected may be illustrated in the following manner: Suppose the cross-head 26 and motor 40 to be traveling in the directions respectively indicated by the arrows and at the same speed. As is evident, under these conditions the valve 27 is held stationary. Now suppose the operator on the car stops or arrests the action of the motor 40. The result will be that the connection 30 will be locked against further movement at the gear 35 in case motor 40 is stopped, or the travel of said connection will be impeded and retarded at that point. The continued movement of the cross-head 26, however, will cause the portion of connection 30 lying between gear 31 and guide 34 to straighten out, and to an equal extent that portion of said connection lying between pulley 31, guide 37, and pulley 35 will be paid out, thereby effecting a movement of the valve-stem 33 in the direction of the arrow, and hence a shifting of valve 27, by which the travel of the cross-head 26 is controlled and regulated. In a similar manner the parts operate in the opposite direction, thereby controlling the speed and action of the hoisting-motor according as the speed of the pilot-motor 40 is varied, and as said motor may be conveniently arranged under the constant control of the operator on the car in any well-known and convenient manner the control of the hoisting-motor is made easy, simple, and efficient.

The action of stopping the hoisting-motor 25 may be hastened and accelerated by reversing the action of the pilot-motor 40 in the same manner as above described with reference to the electrical embodiment of my invention.

Any suitable arrangement of apparatus may be provided for automatically arresting the action of the main motor at the extreme limits of travel thereof when used for elevator purposes; but as such a construction and arrangement is well known and understood in the art and forms no part of the present invention I have not shown any particular arrangement therefor. In the case of the electrical apparatus above described I have indicated in Fig. 1 how this result may be accomplished—namely, by screw-threading the projecting end 50 of the shaft of drum B and mounting thereon a traveling nut 51, arranged to operate in connection with suitable contacts, as indicated at 52 52, to automatically cut the pilot-motor out of action at the extreme limits of its movement, as will be readily understood by persons skilled in the art.

Many variations and changes may be made in the details of construction and arrangement of parts, and the principles of my invention may be involved in a wide variety of specific forms of apparatus and still fall within the spirit and scope of my invention. I do not desire, therefore, to be limited or restricted to the exact form and details of construction shown; but,

Having now explained the nature and object of my invention and an operative form and arrangement of apparatus embodying the same, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent of the United States, is—

1. The combination with a main motor, of an auxiliary motor, means for controlling said auxiliary motor, and means operated by the joint action of the speed of said main and auxiliary motors for controlling said main motor; as and for the purpose set forth.

2. The combination with a main motor, of an auxiliary motor, means for independently controlling said auxiliary motor, and connections whereby said main motor is controlled by the joint action of the speed of said auxiliary and main motor; as and for the purpose set forth.

3. The combination with a main motor, controlling means therefor, and connections between said main motor and its controlling means, of an auxiliary motor, means for independently controlling the same, and means actuated by said auxiliary motor whereby said connections between said main motor and its controlling means are governed and controlled; as and for the purpose set forth.

4. In an electric elevator, a main motor,

means actuated thereby for controlling the circuits of said motor, an auxiliary motor, and means actuated thereby for controlling said circuit-controlling means; as and for the purpose set forth.

5. In an electric elevator, a main motor, means actuated thereby for controlling the circuits of said motor, an auxiliary motor, means actuated thereby for controlling said circuit-controlling means, and means for controlling said auxiliary motor from the car; as and for the purpose set forth.

6. In an electric elevator, a main motor, means actuated thereby for controlling the circuits of said motor an auxiliary motor, means actuated thereby for governing said circuit-controlling means, and means for independently and electrically controlling said auxiliary motor from the car; as and for the purpose set forth.

7. The combination with a main motor, of an auxiliary motor, means for controlling the latter, and means actuated by variations in speed of said motors for controlling said main motor; as and for the purpose set forth.

8. In an elevator apparatus, a main hoisting-motor, an auxiliary or pilot motor, and means actuated by variations in the relative speeds of said motors for controlling said main motor, and means for controlling the speed of said auxiliary motor from the car; as and for the purpose set forth.

9. In an electric elevator, a hoisting-motor, an auxiliary or pilot motor, means actuated by variations in the respective speeds of said motors for controlling the main-motor circuits, and means for electrically controlling the speed of said pilot-motor from the car; as and for the purpose set forth.

10. In an electric elevator, a main hoisting-motor, a movable contact-carrying device actuated thereby, an auxiliary or pilot motor, means for controlling the same from the car, and means actuated by said pilot-motor arranged to operate in conjunction with said movable contact-carrying device for controlling the main-motor circuits; as and for the purpose set forth.

11. In an electric elevator, a main hoisting-motor, a disk carrying contacts for controlling the motor-circuits and adapted to be rotated by said motor, an auxiliary motor, an arm carrying brushes adapted to be actuated by said auxiliary motor, and brushes arranged to operate in conjunction with the contacts on said disk for controlling the motor-circuits; as and for the purpose set forth.

12. In an electric elevator, a main hoisting-motor, a rotary disk actuated thereby and carrying the terminal contacts of the motor-circuits, an auxiliary motor, means for controlling the same from the car and brushes actuated thereby, arranged to operate in conjunction with said terminal contacts for controlling the main-motor circuits; as and for the purpose set forth.

13. In an electric elevator, a main hoisting-motor, a rotary disk actuated thereby and carrying terminal contacts of the motor-circuits, a commutator, arranged to act in unison with said disk to give the proper lead to said circuits, an auxiliary motor, an arm arranged adjacent to said disk and adapted to complete the circuit through said terminal contacts, said arm arranged to be actuated by said auxiliary motor, and means for controlling the auxiliary motor from the car; as and for the purpose set forth.

14. In an electric elevator, a main hoisting-motor, circuits therefor a rotary contact-carrying device actuated by said motor, a brush-carrying arm mounted for independent movement adjacent to and in connection with said contact-carrying device, an independent motor arranged to control said arm, whereby said arm may be moved to make the main-motor circuits, and means whereby the travel of said arm may be reversed without reversing said main motor; as and for the purpose set forth.

15. In an electric elevator, a main hoisting-motor, movable contacts actuated thereby, said contacts being included in the motor-circuits, a brush-carrying arm, arranged when moved from a neutral position, to make the motor-circuit, whereby said motor is placed in operation and said contacts are moved, means for controlling the movements of said arm, whereby the speed of the motor is controlled, and means for reversing the movement of said arm without reversing said motor, whereby said motor is quickly arrested; as and for the purpose set forth.

16. In an electric elevator, a motor, movable contacts actuated thereby, said contacts being included in the motor-circuits, a brush-carrying arm arranged to occupy a neutral position relative to said contacts when said arm and motor are out of action, means for independently moving said arm, said means being controllable from the car, whereby contacts are made in either direction to start and reverse said motor; as and for the purpose set forth.

17. In an electric elevator, a motor, movable contacts actuated thereby, said contacts being included in the motor-circuits, a brush-carrying arm arranged to occupy a neutral position relative to said contacts when said arm and motor are out of action, means for independently moving said arm in either direction, whereby the motor-circuits are all made to actuate the motor in either direction, as desired, the arrangement being such that the direction of movement of said arm and contacts is coincident, means for varying the relative speed of said contacts and arm, whereby the speed of the motor is varied, and means for independently reversing the direction of movement of the arm, whereby the motor may be quickly arrested; as and for the purpose set forth.

18. The combination with a main motor, of an auxiliary motor, and connections actuated

by the joint action of said motors for reversing said auxiliary motor, whereby both of said motors are rapidly brought to rest; as and for the purpose set forth.

19. In an electric elevator the combination with an electric motor, circuits therefor, of an auxiliary circuit, means for controlling said auxiliary circuit from the car, and means whereby a variation in the auxiliary circuit will produce a corresponding variation in the motor-circuits, as and for the purpose set forth.

20. In an electric elevator the combination with a series motor, and circuits therefor, of auxiliary circuits, means for controlling said auxiliary circuits from the car and means whereby a variation in the auxiliary circuit will produce a corresponding variation in the series-motor circuit, as and for the purpose set forth.

In witness whereof I have hereunto set my hand this 3d day of February, 1896.

HAROLD ROWNTREE.

Witnesses:
S. E. DARBY,
M. I. CAVANAGH.