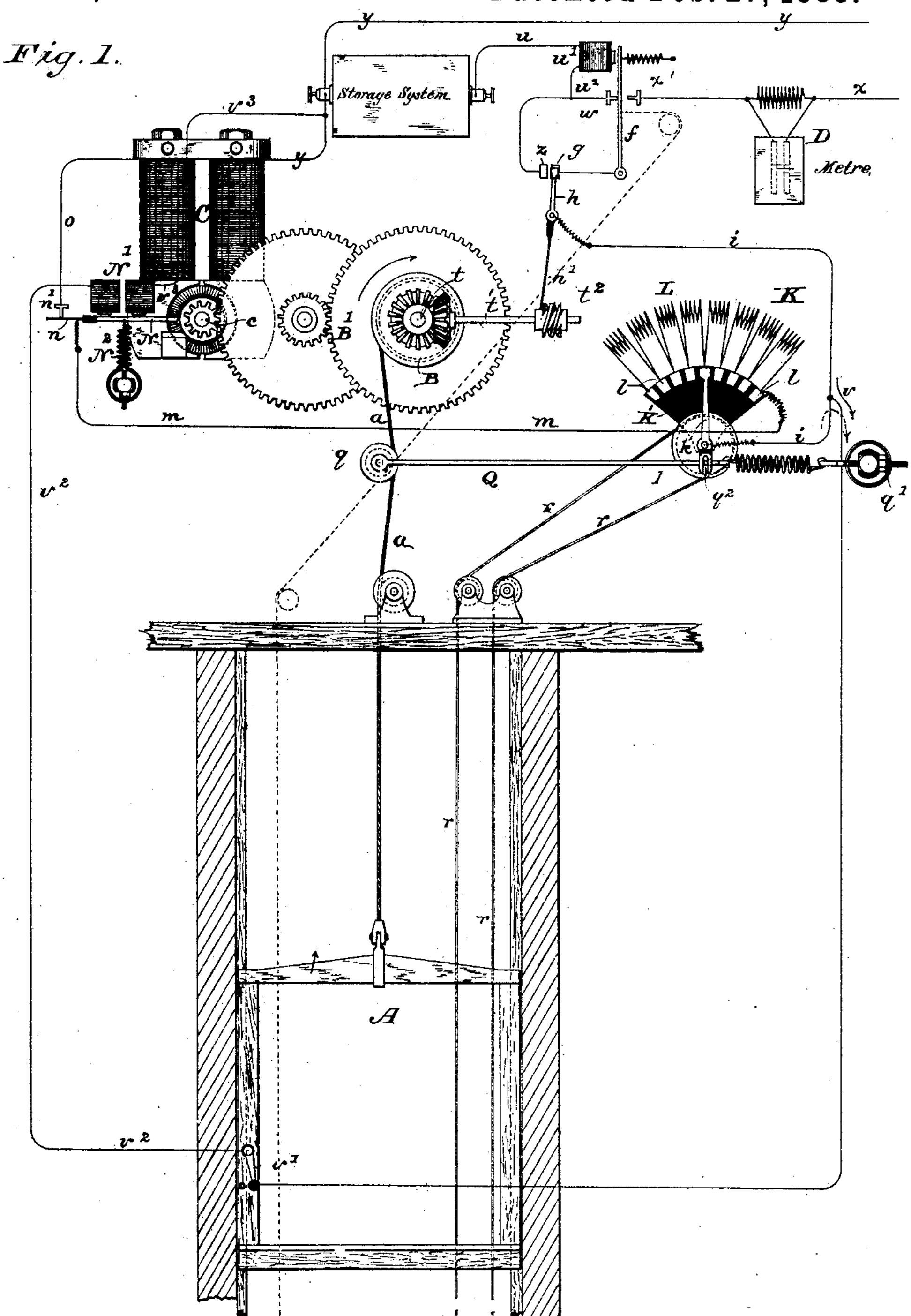
(No Model.) 2 Sheets—Sheet 1.

S. S. WHEELER.

ELECTRIC ELEVATOR.

No. 273,208. Patented Feb. 27, 1883.

Fig. 1.



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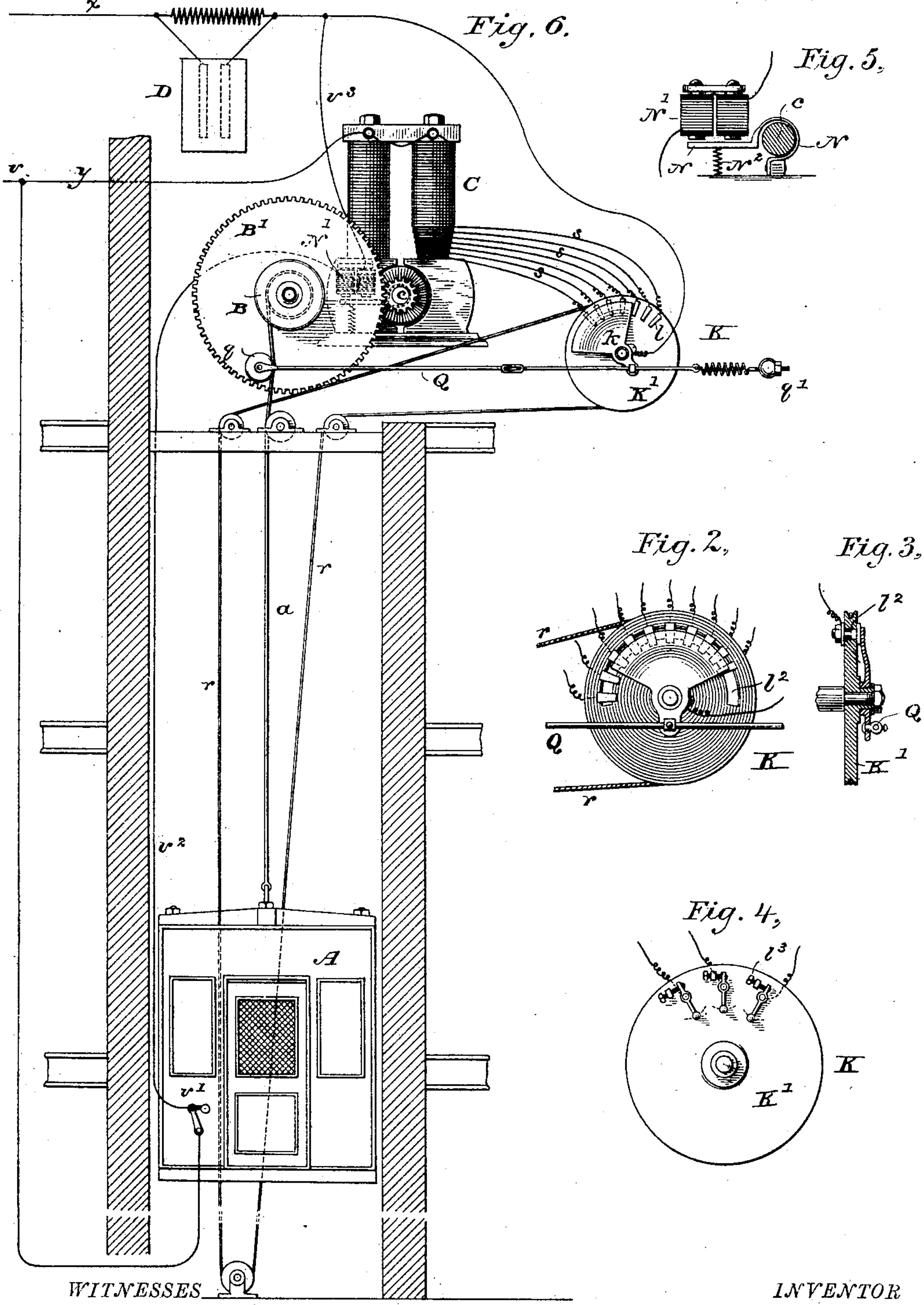

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UNITED STATES PATENT OFFICE.

SCHUYLER S. WHEELER, OF NEW YORK, N. Y.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 273,208, dated February 27, 1883.

Application filed December 30, 1882. (No model.)

To all whom it may concern:

Be it known that I, SCHUYLER S. WHEELER, a citizen of the United States, residing in the city and State of New York, have invented certain new and useful Improvements in Electric Elevators, of which the following is a specification.

In electric elevating apparatus, where matter is raised and lowered either vertically or at any angle of inclination, the gravitating power or force of the descending load, car, or mass has not been utilized and applied as part of the power required to perform the work being done; or the amount of power developed by the descent of the mass has not been applied to reduce the sum of the power received from the source of energy. Under my invention the power developed by the descending mass is utilized to reduce the sum of the power that would otherwise be required to do the work; or the amount of power used from the source of energy will be the sum of the power required to do the work (which power may be received from the source of energy) less the power developed by the descending mass, which may be returned to the source of energy, less, of course, the usual frictional losses. Under my organization, normally, the power of the motor is just sufficient to counteract the gravity of the parts of the apparatus, so that the apparatus remains at rest in whatever position it may be, and when the work to be done is increased or a greater mass or strain is thrown upon the motor the power of the motor is automatically proportionately increased, so that it still just sustains the parts of the apparatus, which remains at rest. When the work is to be performed, however, or the mass elevated, the power of the motor is further increased, as will hereinafter be described; or where the mass is to be lowered the power is decreased, so that the motor permits it to descend.

My invention consists in the novel methods of operation above outlined, and in certain novel apparatus for carrying it out; also, in certain improvements relating to the raising and lowering of the mass, the method of controlling, stopping, and starting the apparatus, and in certain other improvements, all of which are hereinafter set forth.

In the accompanying drawings, Figures 1 and 6 are diagrammatic sectional elevations, showing the manner of carrying out my invention. Figs. 2, 3, and 4 are detail views, showing the construction of one form of my improved controlling-switch; and Fig. 5 is a detail view of the brake mechanism.

In the drawings I have shown my invention organized in connection with a vertical elevator raised and lowered in an upright guide-way; but by the term "elevator" I wish to be understood as meaning any apparatus by which matter is transferred from one level to another.

In Figs. 1 and 6 the elevator-cage A, which travels in a suitable guide or frame, is suspended by a cable, *a*, from a drum or shaft, B, connected by suitable gearing, B′, with the revolving armature-carrying shaft *c* of a suitable electro-dynamic motor, C. This motor is connected with the poles of an electric generator, which may be placed at any desired distance. In the drawings I have considered the motor as connected in multiple arc in a system of electric distribution, in which a meter, D, is employed to keep an account of the electricity consumed by the user, as is well understood. The wires leading to the multiple-arc connection with the generator-circuits are marked *x* and *y* in the drawings.

Referring now to Fig. 1, which shows an organization differing in detail merely from that indicated in Fig. 6, the current from the source of electric energy comes in by the wire *x* past the meter D, which keeps a register or charge of the amount of current thus received. The meter, which is merely indicated in the drawings, is of the now well-known Edison type, and needs no special description. However, so far as my invention is concerned, other forms of meter may be used. The current passes from the meter D to the contact-stop *x′*, and then through the tongue *f*, (assuming at this time that the tongue is drawn over against its contact *x′* by its tension-spring,) thence to the contact *g*, and through the vibrating tongue *h* and wire *i* to a pivoted moving switch-arm, *k*, from this arm to one of a series of contacts, *l*, through one or more of the resistance-coils L and wire *m* to the tongue *n* on the brake-lever N, contact-stop *n′*, wire *o*, through the coils of the electromotor, and by wire *y* to the other pole of the source of electric energy. A branch or multiple-arc circuit of comparatively high resistance, in which the coils of the brake-magnets N′ are included, is thrown around the switch K and motor C. This circuit branches from the main line i at the point v, passes through a suitable switch, v', on the car or cage of the elevator, then by wire v^2 through the coils of the brake-magnets N′, and by wire v^3 back to the main line y. With the switch v' closed, so as to complete this branch circuit, as indicated in the drawings, a current of electricity will always pass through the brake-magnets N′ of sufficient strength to hold the brake-lever N up against the force of its spring N^2 and maintain the continuity of the main circuit between the contacts $n\,n'$, above mentioned.

The brake mechanism is illustrated particularly in Fig. 5, where it is shown as consisting of an elastic metal band or flat bar, N, which is bent part way around the shaft c of the motor. Its elongated end or arm constitutes the armature for the magnets N′. Normally the brake is drawn down by its spring N^2, so as to cause it to grip the shaft and stop the motor. When the branch circuit, however, is completed, the magnets N′ draw up the brake-arm N against the force of its spring and release the grip of the brake upon the motor-shaft. The special form of brake, however, is immaterial so long as it fulfills the requirements of the organization. With this branch circuit completed, therefore, as above described, the brake will be taken off the motor-shaft, the main-line circuit will be completed between the contacts n n', and the apparatus will be free to operate. Under these conditions it will be obvious that a current of electricity, coming in over the line x, as above described, and passing through the switch K and the coils of the motor, will actuate the motor, causing its shaft c to revolve and, through the gearing B′, wind the cable a on the hoisting-drum and elevate the cage.

I will now describe the manner of controlling the action of the elevator and of automatically adjusting the power of the motor to balance any weight that may be put on the cage. The switch K (illustrated in this figure) consists of a base or quadrant, K′, around the edge of which are placed a series of contacts, l, electrically connected by a series of resistance-coils, L, the contact and end of the coil at one side of the quadrant being electrically connected with the main-line wire m. The moving switch-arm k vibrates upon the center, from which the quadrant is struck, and is actuated in the following manner: A looped bar, Q, through which the lifting-cable a passes, is provided with a pulley, q, against which the cable works. The opposite end of the bar Q is connected by a coil-spring with an eye-rod, q', which passes through a stud, and can be adjusted by a nut, as shown in the drawings, to draw the pulley q against the lifting-cable and strain the cable out of a right line, as indicated in the drawings. A cross-pin, q^2, on the rod Q is straddled by the forked end of the switch-arm k, so that any endwise motion of the rod Q will rock the switch-arm on its pivot and cause it to pass over the face of the quadrant and make contact with the series of contact-points l. Of course the parts should be so proportioned that the arm k will not leave one contact l until it has made contact with the adjoining one, so that the circuit will not be broken. With this organization it will be obvious that an increased strain on the cable a, which will of course be proportional to the weight put in the car, will swing the switch-arm upon its pivot, and, cutting out one or more of the resistances L, will permit a greater current to pass, and will correspondingly increase the power of the motor, so that it will just sustain the car. In order, now, to further increase the power of the motor to elevate the car, the quadrant-base K′ of the switch is also pivoted upon the same center as the arm k, and is provided with a pulley over which an endless pull-rope r passes. This rope runs over suitable pulleys and through apertures in the elevator-cage, after the ordinary manner in elevators. The operator in the cage, by pulling upon this rope, can swing the quadrant K′ on its pivot, so as to throw in or out a greater or less resistance.

If the car is to ascend with a load, the quadrant may be swung by means of the pull-rope r to cut out some of the resistance in the circuit, and increase the supply of current to the motor until the desired speed of ascent is attained. When the car has risen to the desired point the power of the motor can in like manner be reduced so as just to balance the weight of the load, when the car will of course remain stationary. When the car is descending the operator manipulates the rope r to throw in an increased resistance until the motor becomes too weak to sustain the car, when it will commence to descend. The descent of the car drives the motor-shaft b in the opposite direction and transforms it into a dynamo-electric machine or generator of electricity, and I utilize the current thus generated for the purpose outlined at the beginning of this specification.

The action of the motor and the manner of controlling the descent of the cage are hereinafter described. I will also defer the description of that part of my system relating to the utilization of the current generated by the descent of the cage until I have further described my organization of apparatus illustrated in Figs. 2, 3, 4, and 6.

In Fig. 6 the general arrangement of the parts indicated by similar letters is the same as that just described in connection with Fig. 1, except the difference in the construction of the switch and the manner of increasing and decreasing the power of the motor. In this figure the base K′ of the switch is provided with a series of contacts, l, to which are connected a series of wires, s, which are wound together, or multiply, around the stationary magnets of the motor, as clearly indicated in the drawings. The switch-arm k is shown as a rocking quadrant, and is connected up in circuit and operated in the same manner as shown in Fig. 1. The base K′ of the switch is also operated by a pull-rope passing through the elevator-cage, as just described. The brake-magnets are connected up in branch circuit in the same manner as in Fig. 1, as will appear on tracing the circuit by means of the letters $v\ v'\ v^2$. The strain of the cable a upon the rod Q operates to swing the switch-arm k and throw in a greater or less number of circuits s, which pass around the magnets of the motor, and thus increase or decrease the power of the motor, according to the weight in the cage, to which the strain of the cable is of course proportional.

In Fig. 2 the contacts l are carried by short bolts, which may be moved in a slot, l^2, in the base of the switch, and clamped at any desired point by means of set-nuts. By this means the contacts—of which there may be any suitable number, and of which there may be more than are indicated in the drawings—may be adjusted toward or from each other. Another arrangement for accomplishing the adjustment of the contacts is shown in Fig. 4, where the contacts l form the ends of pivoted levers, which may be adjusted by thumb-screws l^3. These details, however, may of course be varied, the broad principle of the invention being in no way dependent upon them. The purpose of having the contacts movable is that by experimentally adjusting them the apparatus may be brought to just the condition desired without difficulty. The adjustment of the rod Q serves a similar purpose, and both means may be used together. A like adjustment of the contacts l may be provided in the organization shown in Fig. 1. Under the organization shown in this figure, 6, the too rapid descent of the car is prevented by manipulating the pull-rope and causing a greater current to pass through the stationary magnets of the motor, so that its speed of descent, as well as ascent, can be perfectly controlled.

I have illustrated two ways of the same nature of utilizing the electricity generated in the motor C by the descent of the cage, which drives it in an opposite direction and changes it into a dynamic generator of electricity. In Fig. 1 I have shown what I consider the most effectual and practical manner of utilizing the electric energy thus developed. In this organization I make use of a storage system in the following manner: The cage of the elevator is represented as ascending and the rope a being wound upon the drum B. A beveled gear, t, on the end of the drum-shaft gears with a corresponding bevel on a counter-shaft, t'. This shaft carries a section of worm, t^2, which controls the elongated spring end h' of the vibrating tongue h. With the elevator ascending and the gearing moving in the direction indicated by the arrows this worm operates to press the spring-extension h' over to the left and cause the tongue h to rest against the contact-point g.

With the parts of the apparatus in the positions shown, the power for driving the electric motor is derived from a storage system indicated in the drawings. It is therefore assumed that the storage system has been previously charged by a descent of the elevator-cage and is now working the motor. One pole of the storage system is connected to the wire y, leading from the source of electric energy, while the circuit from the opposite pole passes through a wire, u, coil of a magnet, u', wire u^2, and then branches, one branch leading to the contact-stop w and the other to the contact-stop z. The tongue f is drawn over by the magnet u', so as to break contact with the main-line stop x' and make contact with the stop w, so that with the tongue h thrown over against the stop g the circuit will be completed from the storage system through the wire $u\ u^2$, stop w, tongue f, and so on to the motor, wire y, and opposite pole of the storage system, as described in connection with the running of the main-line circuit. The bias or tension of the tongue f is such that whenever the power of the electricity from the storage system is insufficient to work the elevator the tongue f will go over against its contact x', and the current will then be taken from the main line over the meter D. As long, however, as the current is sufficient the parts will remain in the position indicated in the drawings, and the electricity from the storage system which has been charged by the descent of the cage will work the elevator, and no electricity will be received over the main line, and the meter will therefore not register. When the elevator is descending the motion of the worm t^2 will be reversed, and the tongue h will be thrown over against its contact z, so that the electricity which is now generated by the reverse motion of the motor will pass by the wire i, tongue h, contact z, &c., into the storage system. The effect of the current in the coil of the magnet u' is to draw the tongue f against the contact w, thus breaking the main-line circuit and placing the parts in condition for the motor to be operated by the electricity from the storage system on the next lift. The contacts z and g are such that the tongue h will not leave one until contact is made with the other; otherwise the circuit would be broken when the worm reversed the tongue h, and the tongue f would go over against its contact x', and might not be brought back by the magnet u'. By this organization of circuit and apparatus I am enabled to utilize the electric energy generated by the descent of the mass, and when the supply of the electricity thus generated is not sufficient to do the work the main-line current is automatically thrown in. Of course, where the elevator is carrying unequal loads, an adjustment of the tongue f which would cause it to fall over against the contact x' when the power fell below a certain limit would, perhaps, not be sufficient to insure the operation of the apparatus in all cases, for a load too great to be lifted might be taken on and delay would be caused. A supplementary pull-rope extending from the vibrating tongue f through the elevator-cage, as shown in dotted lines, could be so arranged that the tongue could be thrown over positively against the contact x' whenever desired, and the current for actuating the motor be taken from the main line past the meter. The descent of the cage under this organization is controlled in the following manner: In dynamo-electric machines the decrease of resistance in the circuit of the machine gives a greater capacity to the machine and calls for an increased power to drive it. When the cage is descending the motor is driven as a dynamo, and the current thus generated is passed into the storage system and the main-line connection is broken at x'. There is no current, therefore, from the main line which can be controlled to counteract and overcome the reverse action of the motor and regulate the descent of the cage; but the operator in the cage, by working the rope r, may cut out several or all of the resistances L, and thus give the dynamo such a capacity that the force of the descent of the cage is not sufficient to overcome it. The descent may therefore be perfectly controlled.

In both organizations shown in Figs. 1 and 6, when the apparatus is not working the switch v' in the cage is moved so as to interrupt the brake-circuit and permit the lever N, acting by the force of its spring, to grip the motor-shaft and lock all the parts firmly. The movement of the brake-lever N interrupts the main-line circuit at n n' and takes the power off the motor. When the switch v' is closed and the apparatus is working or ready for working, there must at all times be a current through the brake-circuit in the same direction to constantly hold up the brake-lever and always maintain the continuity of the main circuit at the points n n', whether the car is ascending or descending, and whether the current, in ascending, is taken from the storage system or from the line x. This I accomplish by placing the brake-magnets in a branch circuit around the motor or dynamo C. The current from either the storage system or line x, when the car is ascending, will pass to the motor, as before described, and of course the current in the branch or brake circuit will be in the same direction, or that indicated by the solid arrow. There will be no failure in this current, as the circuit is never broken at the contacts z g. When the car is descending and the armature of the motor is driven in an opposite direction from that in which it rotated as a motor, and the machine becomes an electric generator, the current generated of course runs in an opposite direction to the current which drove the motor. The branch or brake circuit still, therefore, takes its current at the point v, and it is still in the direction of the arrow. There is therefore never any interruption of the current in this circuit, and the brake-lever is not released unless the switch v' is moved. The operation is the same under the arrangement shown in Fig. 6.

In the organization indicated in Fig. 6 I purpose driving the current of electricity generated by the descent of the cage back to the source of supply. The effect of this will be to cause the meter to register in the opposite direction, or, in other words, to make it deduct from its account of electricity used the amount of the electricity thus sent back. The effect of thus forcing back a current of electricity upon a system of distribution in which the consumers are connected up in multiple arc—as, for instance, in the Edison electric-light system—will not be a disturbing one, for the reason that the dynamos or generators of electricity at the central station of such a system are automatically governed to regulate the supply of electricity to the demand within certain limits, and to maintain a uniform volume in the working circuits, so that if the effect of forcing the current derived from the descent of the mass back to the dynamo or generator at the central station is to increase the sum of the current in the distributing-lines, the generator at the central station would compensate for this increase by producing less electricity; or if the effect is to overcome or counteract the electro-motive force of the electricity in the multiple circuit in which the elevating apparatus is connected the generator at the central station will automatically compensate for such a condition, and there would be no disturbances on the lines.

While the two methods which I have described of utilizing the current generated by the descent of the mass differ in some respects, they are, broadly considered, substantially the same. The generation of available energy or the creation of chemical potential in a storage system represents the performance of a certain amount of work and the expenditure of a certain amount of energy which is applied to the reduction of the sum of the power that would be otherwise required from the distributing system to run the elevator, and forcing the current back into the distributing system and causing the meter to register in a reverse direction is also an expenditure of energy which acts to reduce the sum of the power actually received from the source of energy to perform the work to be done, and, making allowance for differences in apparatus, the amount of electricity indicated by the meter as having been used in the two organizations illustrated in Figs. 1 and 6 should be the same, assuming that the same weight has been raised and lowered.

I have now fully described my invention, and as the various points are specifically set forth and claimed hereinafter, a further recapitulation is deemed unnecessary.

It should be distinctly understood that, so far as the leading features of my invention are concerned, the apparatus shown and described may be varied and modified without departing from the invention, the primary features of which are exhibited by the operations performed and the results accomplished, rather than by the special organizations of apparatus, although much of such apparatus is novel, and is herein claimed.

The right to hereafter file other applications for any subject-matter that may have been claimed and the claims erased in the prosecution of this application, or for any subject-matter herein described, illustrated, or indicated, but not claimed, is distinctly reserved.

I claim as my invention—

1. The combination, substantially as set forth, of the main-line or generator circuit, an electric motor placed therein, a car, cage, or vehicle which is hoisted by the motor when the motor is driven in one direction, but which in descending drives the motor in the opposite direction, thus changing it into an electric generator, and mechanism under the control of the attendant in the car for increasing or decreasing the electric capacity of the motor-circuit, so as to thereby increase or decrease the resistance of the motor to being thus driven by the descending car, whereby the speed of descent of the car may be regulated, as described.

2. The combination of the main-line or generator wires, the electric motor placed therein, the car, cage, or vehicle for raising and lowering matter, mechanism for automatically increasing or decreasing the power of the motor in proportion to the weight placed upon the car for the purpose set forth, and mechanism to further increase or decrease the power of the motor, at the will of the operator, to raise or lower the car.

3. The combination of the main-line or generator wires, the electric motor placed therein, the car, cage, or vehicle to be raised or lowered by the motor, the switch having the moving base and moving switch-arm, means for automatically moving the switch-arm to vary the power of the motor, as set forth, to automatically increase or decrease the power of the motor proportionately to the weight thrown upon the car, and means under the control of the operator for moving the base of the switch to further increase or decrease the power of the motor to raise or lower the car.

4. The combination, substantially as set forth, of the main-line or generator wires, the electric motor placed therein, the car, cage, or vehicle to be raised and lowered by the motor, switch mechanism for automatically increasing or decreasing the power of the motor proportionately to the weight thrown upon it for the purpose set forth, means for adjusting such switch mechanism, and switch mechanism under the control of the operator for further increasing or decreasing the power of the motor to raise or lower the car.

5. The combination of an electric circuit and the two-part switch, each part of which is independently movable, a series of contacts on one part of the switch, over which the other part of the switch moves, and means for increasing or decreasing the capacity of the electric circuit in response to the movement of either part of the switch.

6. The two-part switch, consisting of the pivoted moving base carrying a series of contacts, and mechanism for adjusting them toward or from each other, and the pivoted moving switch-arm.

7. The combination of the main-line or generator circuit, the electric motor placed therein, the car, cage, or vehicle which is raised by the motor, mechanism for varying and controlling the power of the motor to elevate the car or permit it to descend, and an electric circuit and apparatus for receiving the electric current generated by the reversal of the motor when it is driven by the descending car, and subsequently applying it to reduce the sum of the power that would otherwise be required to perform the work.

8. The combination of the main-line or generator circuit, the electric motor placed therein, a car, cage, or vehicle which is raised by the motor, and which in its descent reverses the motor, brake apparatus, and a branch circuit thrown around the motor, in which circuit the coils of the brake-controlling magnets are placed, for the purpose set forth.

9. The combination of the main-line or generator wires, the electric motor placed therein, the car, cage, or vehicle to be raised and lowered by the motor, mechanism for varying the power of the motor to raise or lower the car, an electric circuit or apparatus for receiving the electric current generated by the reversal of the motor when it is driven by the descending car, and brake apparatus, the controlling-magnets of which are placed in a branch circuit thrown around the motor or generator.

10. The combination of the main-line or generator wires, the electric motor placed therein, the car, cage, or vehicle to be raised and lowered by the motor, mechanism for controlling the power of the motor to raise the car or permit it to descend, a storage system and its circuit running through the motor, contacts and means for operating them, which complete the circuit from the motor or generator to the storage system when the car is descending, circuit-connections by which the electric energy thus created is used to partly elevate the car on the next lift, and means for breaking the storage-system circuit and completing the main-line circuit through the motor when the capacity of the current from the storage system falls below the power required to elevate the car.

11. The combination of the main-line or generator wires, the electric motor placed therein, the car, cage, or vehicle to be raised and lowered by the motor, mechanism for controlling the power of the motor to raise the car or permit it to descend, a storage system and its circuit running through the motor, contacts and means for operating them, which complete the circuit from the motor or generator to the

storage system when the car is descending, circuit-connections by which the electric energy thus created is used to partly elevate the car on the next lift, means for breaking the storage-system circuit and completing the main-line circuit through the motor when the capacity of the current from the storage system falls below the power required to elevate the car, and a branch circuit in which the brake-controlling magnets are placed, thrown around the motor, for the purpose set forth.

12. The combination of the main-line or generator wires, the electric motor placed therein, the car and cable, the hoisting-drum driven by the motor, mechanism for controlling the power of the motor, and the bar or rod Q, on which the strain of the cable is exerted, which operates the controlling mechanism and automatically increases or decreases the power of the motor proportionately to the strain upon the cable.

13. The combination of the main-line or generator wires, the electric motor placed therein, the car and cable, the hoisting-drum driven by the motor, mechanism for controlling the power of the motor, the bar or rod Q, on which the strain of the cable is exerted, which operates the controlling mechanism and automatically increases or decreases the power of the motor proportionately to the strain upon the cable, and means for adjusting the rod.

In testimony whereof I have hereunto subscribed my name.

SCHUYLER S. WHEELER.

Witnesses:
W. L. CANDEE,
WM. A. SKINKLE.