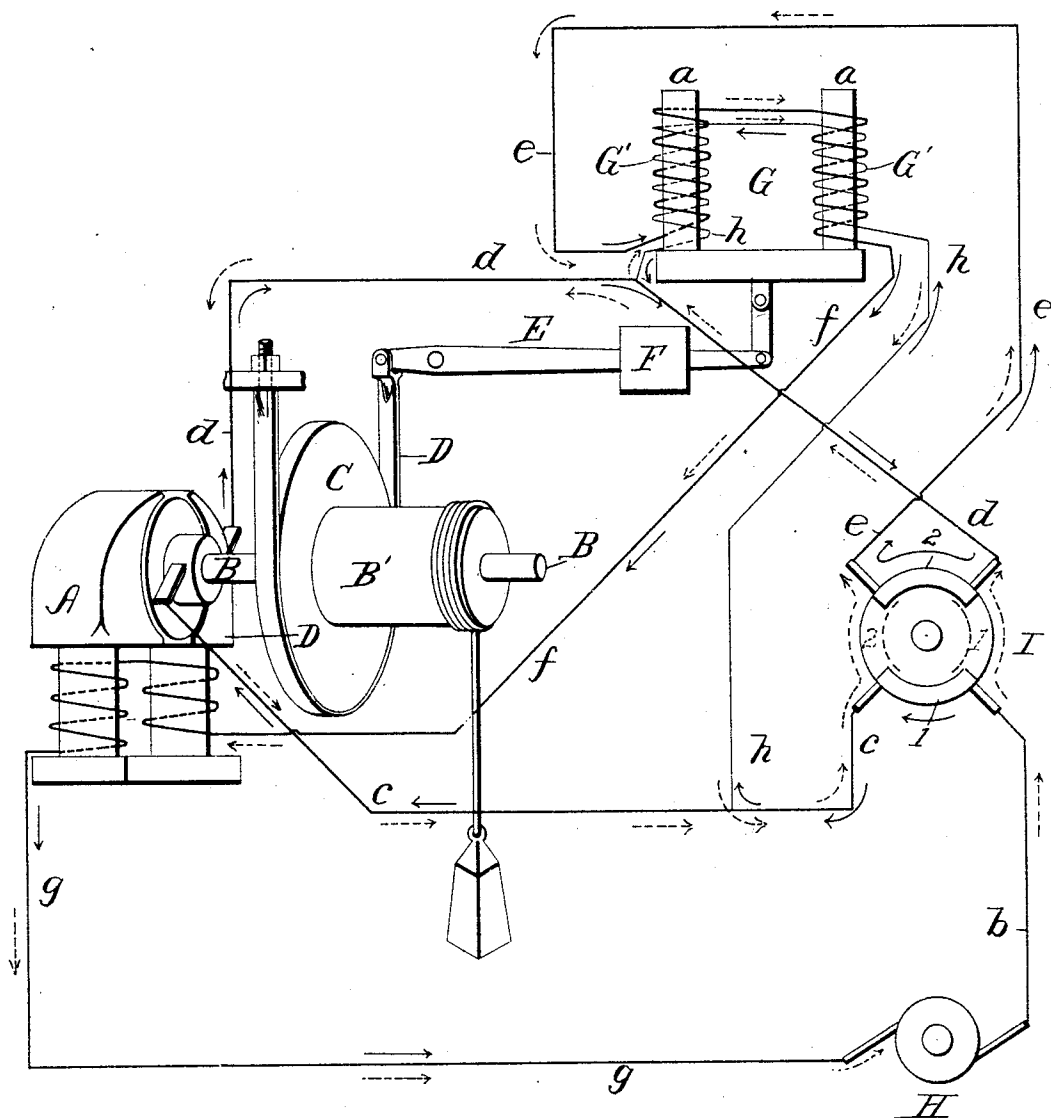


(No Model.)

A. J. SHAW.
ELECTRIC ELEVATOR BRAKE.

No. 515,256.

Patented Feb. 20, 1894.



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UNITED STATES PATENT OFFICE.

ALTON J. SHAW, OF MUSKEGON, MICHIGAN.

ELECTRIC ELEVATOR-BRAKE.

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To all whom it may concern:

Be it known that I, ALTON J. SHAW, a citizen of the United States, residing at Muskegon, in the county of Muskegon and State of Michigan, have invented certain new and useful Improvements in Hoisting Machinery, of which the following is a specification.

My invention consists in the combination with an electro-motor, or with such motor and machinery propelled thereby, of a brake and an electro-magnet for controlling said brake, said magnet having two windings, one in a shunt across the armature, whereby, when the current passes in one direction through the armature, the two windings act together to fully energize the brake magnet, and when the current passes in the reverse direction through the armature, one winding acts in opposition to the other, and the brake-controlling magnet is proportionately weakened.

The drawing is a diagrammatic perspective, illustrating the practical application of my invention to hoisting machinery, for which it is primarily designed.

In all cases where reversible electro-motors are employed for operating hoisting machinery, propelling cars and vehicles, and performing like work, the load is opposed to the motor in ascending, and acts with the motor in descending. From this it results that there is a tendency of the load to descend at a dangerous rate, unless special means be provided to regulate and control such descent. My invention is designed to meet this requirement, and to produce a brake which shall act automatically, withdrawing entirely when the load is moving or acting in opposition to the motor; which shall be only partially withdrawn when the load is descending or acting with the motor, whereby descent of the load is rendered steady and constant as to speed; and which shall be applied with full power when the load is at rest. To this end I provide a brake adapted to be automatically applied through the action of a weight, spring or equivalent means, but which is withdrawn to any required extent by an electro-magnet, the strength of which varies with the power and direction of the motor. The plan by which this result is attained may be best explained in connection with the drawing, in which A indicates a reversible electro-motor, the shaft or

arbor B of which is furnished with (or geared to) a hoisting drum B', and brake-wheel or disk C, as shown. A brake band D, or any common form of brake shoe, bears upon the brake wheel or disk C, against which it is pressed with suitable force by a lever E, provided with a counterweight F, or its equivalent, a spring. When the motor is at work turning drum B in a direction to lift the load, it is of course desirable that the brake be withdrawn, hence I provide an electro-magnet G, which, acting upon the weighted arm of lever E, lifts said lever and frees the brake wheel from the pressure of band or shoe D. The electro-magnet may be formed with stationary cores and act upon a soft iron armature carried by the lever E, but in practice I find it preferable to employ solenoid magnets, the movable, and preferably, soft iron cores *aa* of which are connected with the lever E. As is well known, the cores will be drawn into the magnet coils more or less, according to the strength of the current passing in given direction through the coils, hence by varying that strength, the movement of lever E and the consequent extent of withdrawal of the brake pressure may be varied and controlled as desired. This variation of the strength of effect by reversing the current in a portion of the winding of the brake-controlling magnet, so that while the aggregate amount of current passing may vary or may remain the same, it is divided between two coils which, during such reversal, act in opposition one to the other, and energize the magnet only to the extent of the difference in the two windings.

H indicates a source of electric energy, which may be a dynamo-generator, a battery, or any other convenient source of supply, and I indicates a reversing switch. The switch I is designed simultaneously to reverse the armature current of the motor A, and the current through one winding of the magnet G, but these functions may obviously be separated and performed independently by separate switches.

Referring again to the drawing, we may first trace out the circuits with the switch adjusted as in full lines or for lowering the load. Proceeding from the generator or source of energy, H, the current passes by conductor

b, to conducting section number 1 of the switch I, thence by conductor c to the lower commutator brush of the motor A, traversing the armature winding of said motor and
 5 going thence by the upper brush and conductor d to conducting section number 2 of the switch I, thence by conductor e to the magnet G, traversing the main coil thereof, thence by conductor f to the field coils of motor A,
 10 after traversing which it passes by conductor g back to the generator or source of supply. Branching off from the conductor c is a conductor h, which passes directly to the brake magnet and connects with or forms a second
 15 winding G', which will supplement or weaken the effect of the main winding as the current traverses it in the same or in reverse direction relatively to the current of the main winding. This secondary winding G' connects with conductor d at a point between
 20 the upper brush of the motor A and the brake magnet G, hence it follows that so much of the current as leaves conductor c by the branch h, is shunted around the armature and finds a path back to the generator by conductor d and the other conductors already mentioned as completing the circuit. The
 25 current being thus caused to pass about the coils of winding G' in a direction the reverse of that in which it traverses the main winding of magnet G, the main winding will be neutralized and the magnet weakened proportionately to the current thus shunted. The shunted current having only to pass
 30 through the winding G' of the brake magnet, said winding should be of finer wire than the main coils, in order that there may not be too great a diversion of the current from the armature, and that the winding G' may not be disproportionate to the work it is to perform. To whatever extent the winding G' neutralizes the main winding of brake-controlling magnet G, to just that same extent
 35 will the magnet be weakened and its power to withdraw the brake from wheel C be lessened; hence, as such neutralization occurs when the switch is set for lowering the load, the brake will be but partially withdrawn, and will hold the machinery against accidental
 40 over-speeding. Assuming now that the switch I be set to the position indicated by dotted lines, conducting section number 1 being at the right, the current will pass from generator to supply H by conductor b to conducting section number 1 of the switch,
 45 thence by conductor d to the upper commutator brush of motor A, thence through the armature winding and by the lower brush to conductor c, thence to conducting section number 2 of the reversing switch I, thence by conductor e to the main winding of brake-controlling magnet G, thence by conductor f to the field coils of the motor, which it traverses
 50 as before and whence it passes by conductor g back to the generator or source of supply H. It will be seen that under this arrangement, while the current is reversed through the

armature, it remains unchanged through the main winding of the brake magnet G and through the field coils of the motor A, hence
 70 the motor will turn in a reversed direction, but the main coils will act as before in the brake magnet. It will also be observed that under this adjustment of the switch I, the current first reaches conductor h at a point between
 75 the upper commutator brush of motor A and the brake controlling magnet G, and dividing at that point, a portion traverses the winding G' of magnet G in a direction opposite to that in which it previously traveled, and the same
 80 as that in which it traverses the main winding of said magnet. It therefore follows that both windings act to energize the magnet, which consequently acts with full power and completely withdraws the brake. The arrangement thus set forth gives very delicate
 85 and accurate control of the motor and load, because with decrease of counter electro-motive force, the current through the series coil or main winding of the brake magnet, tending to withdraw the brake, decreases, and the
 90 current through the shunt coil or winding of said magnet, tending to weaken the magnet, increases, so that a very small change in speed makes a great difference in the pressure of the brake.

The driven machinery represented is merely illustrative, and stands for any and all machinery requiring to be propelled by power. It is of course understood that the field current instead of the armature current may be reversed to reverse the direction of rotation of the motor, and in such case the neutralizing coil will be placed in shunt around the field; or in other words, it is to be placed in
 100 the reversible portion of the circuit, and the main coil is to be in that portion of the circuit through which the direction of the current is constant. Such variation is, therefore, comprehended within my invention. Complete interruption of the circuit of course permits the full application of the brake to hold the load at any point.

The apparatus is perfectly self-regulating, because the load descends at a speed dependent upon the weight of the load and upon the power applied to or through the armature. The descent is opposed or resisted by the pressure of the brake, as regulated or controlled by the solenoid or brake magnet. As
 115 the speed increases from zero to the limit permitted by the controlling devices, a counter-electro-motive force is set up, which lessens the flow of current through the circuit. Decrease of current causes weakening or partial de-energization of the solenoid or brake-magnet, and such weakening permits the brake to exert a greater pressure upon the brake drum, thereby retarding the rotation of the driven machinery and of the armature,
 120 and consequently the descent of the load. This decrease of speed lessens or suppresses the counter-electro-motive force and causes the several effects above stated to be pro-

duced in the reverse order. While these operations or effects occur successively, the intervals between them are inappreciable, and the rate of descent is constant after reaching the predetermined limit.

Having thus described my invention, what I claim is—

1. In combination with a reversible electro-motor, a brake, and an electro-magnet for controlling said brake, said magnet having two coils or windings, one in the constant portion of the circuit and the other in a portion wherein the current is reversed in reversing the motor.

2. In combination with an electro-motor, a brake, an electro-magnet for controlling said brake, having two windings, and means for directing the current through the two coils in the same direction when the motor is turning one way and in opposite directions when the motor is turning the reverse way.

3. In combination with an electro-motor and brake, a differential electro-magnet for controlling said brake, and means for controlling the flow of current through the windings of the differential magnet, substantially as described.

4. In combination with an electro-motor as A, and machinery as B' driven thereby, a

brake wheel or disk as C, a brake as D, an electro-magnet as G, provided with two independent coils or windings, and a switch as I, adapted to reverse the motor and also to reverse the current through one coil or winding of the brake-controlling magnet.

5. The herein described method of controlling electrically-propelled machinery, provided with a differential brake-controlling magnet, which consists in shunting a portion of the current around the motor armature and through one winding of the brake-controlling magnet, in different directions, according to the direction in which the motor is turning.

6. The herein described method of controlling electrically propelled machinery, having a brake and a differential magnet for controlling said brake, which consists in reversing the direction of the current through a portion of the brake magnet coils and thereby varying the strength of the magnet and its consequent effect upon the brake.

In witness whereof I hereunto set my hand in the presence of two witnesses.

ALTON J. SHAW.

Witnesses:

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