No. 736,493. PATENTED AUG. 18, 1903.

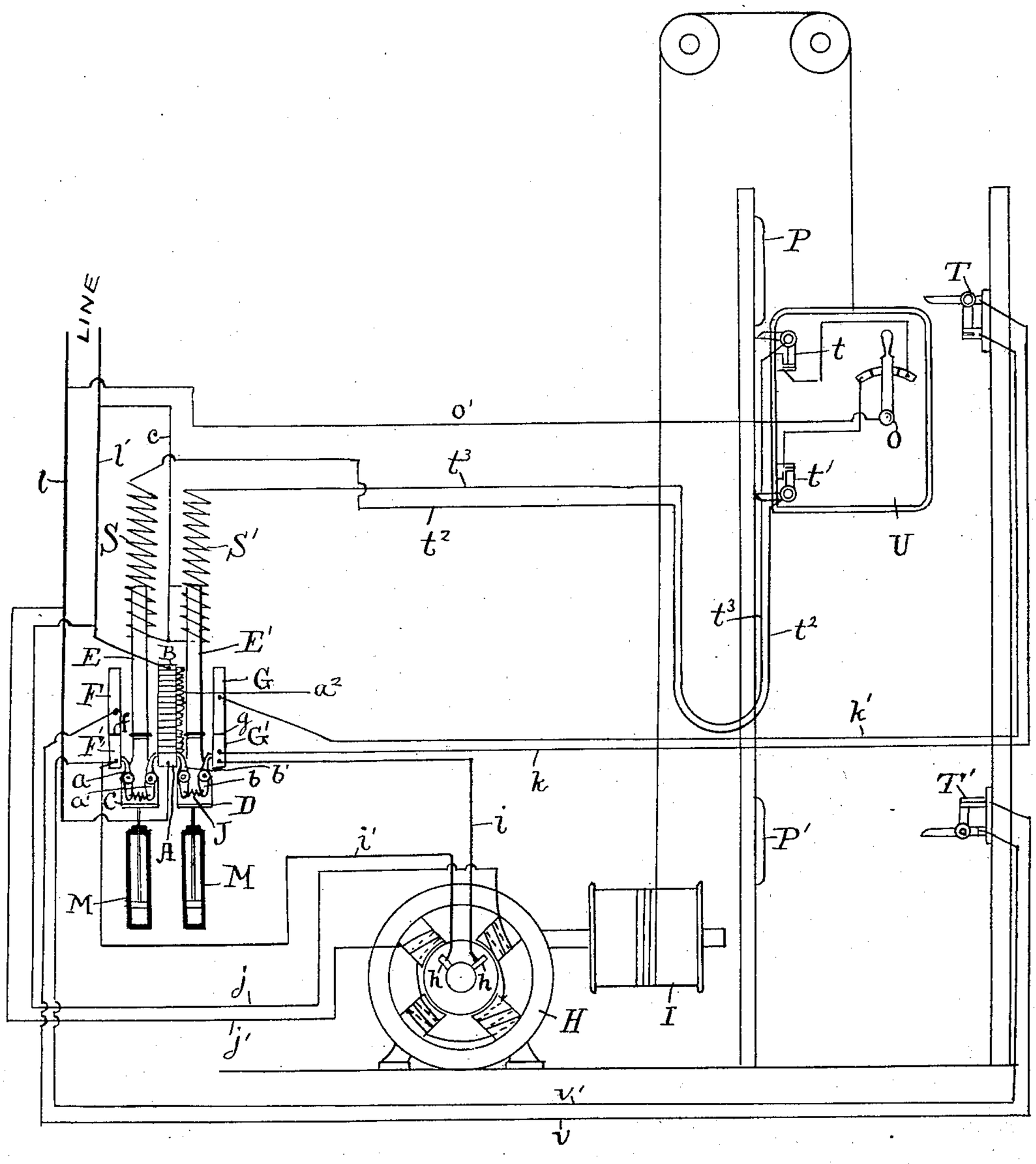
W. H. CHAPMAN.

CONTROLLER FOR ELECTRIC MOTORS.

APPLICATION FILED JAN. 9, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

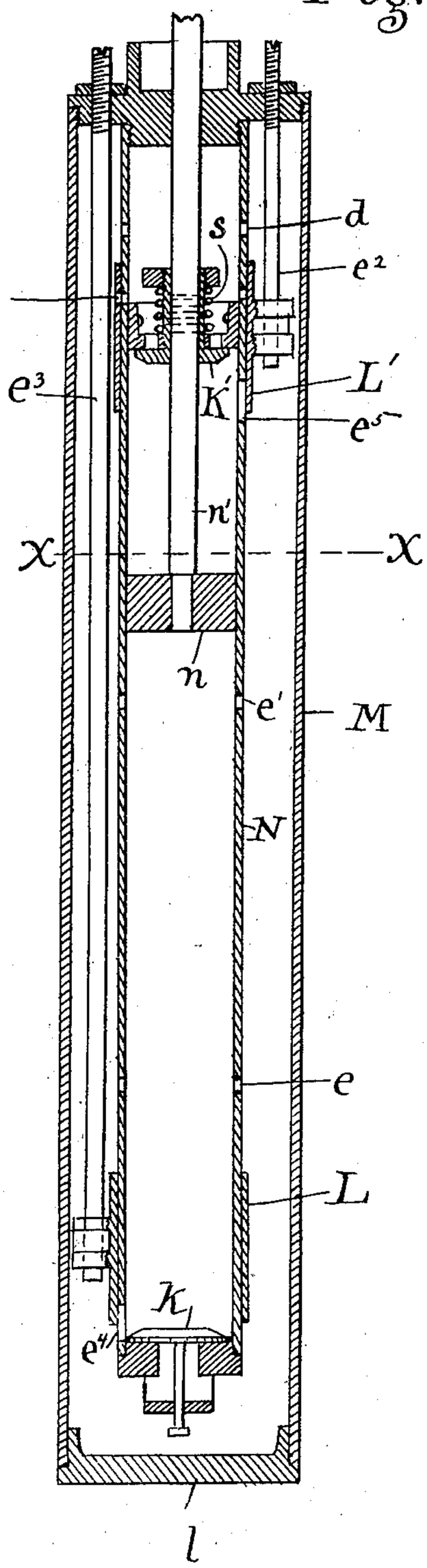
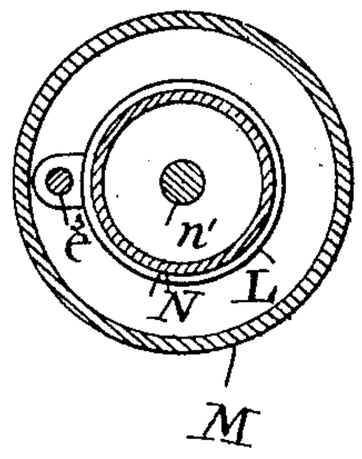


Fig. 3.



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No. 736,493. Patented August 18, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM HENRY CHAPMAN, OF PORTLAND, MAINE.

CONTROLLER FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 736,493, dated August 18, 1903.

Application filed January 9, 1903. Serial No. 138,332. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HENRY CHAPMAN, a citizen of the United States of America, and a resident of Portland, Cumberland county, State of Maine, have invented certain new and useful Improvements in Controllers for Electric Motors, of which the following is a specification.

My present invention relates to the control of an electric motor used for driving elevators or other work where the motor is required to be frequently started and stopped and reversed, and has for its object to provide a single device by which the motor may be started in either direction gradually or stopped forcibly, either one of these two functions being performed by one simple mechanical movement. I attain this object by arranging a series of contact-segments and of resistances and a pair of contact-sliders to move alternately over the same series of segments, the extreme segments of the series being connected, respectively, with the positive and the negative pole of the source of supply of the electric current.

I illustrate my invention by means of the accompanying drawings, in which—

Figure 1 is a diagrammatic view of an elevator-motor and controller constructed according to my invention. Fig. 2 is a vertical section through the dash-pot, and Fig. 3 is a cross-section on X X of Fig. 2.

In Fig. 1, U represents the elevator-car moving in vertical guides. I is the winding-drum. H is the motor, and l and l' are positive and negative portions of the line or source of electricity.

In the construction of my controller as here shown I make use of a vertically-arranged series of copper segments separated by mica segments in the usual manner, extending from A to B, A being the first segment of the series and B the last segment of the series, suitable resistances, as a^2, being inserted between the segments. One pole of the line is connected to the segment A and the other to the segment B. Contact-fingers are provided, which are adapted to slide along the series of segments A B, these fingers being electrically connected with the poles of the armature, as here shown.

C and D are cross-heads, on which are pivoted the contact-fingers a a' and b b'. To the lower end of each cross-head, but electrically insulated therefrom, is attached the piston-rod of a dash-pot M, and to the upper end of each cross-head, but electrically insulated therefrom, is attached an iron core E and E', extending into the solenoids S and S'.

The series of segments A to B are clamped into a suitable frame, (not shown,) and metal contact-strips F F' and G G' are arranged vertically on either side of the segments A B and parallel with the series of segments. On one side of the segments A B the contact-strips G and G' form a single strip, the lower portion G', which is here shown as shorter than the upper portion, being insulated from it. The two parts of the strip are, however, electrically connected, as hereinafter shown. On the opposite side the contact-strips F and F' are arranged in like manner. The cross-head D moves between the segments A B and the contact-strips G G' and carries the fingers b and b', which press, respectively, against the segments A B and the contact-strips G and G'. The cross-head C in like manner moves between the segments A B and the contact-strips F F', carrying the contact-fingers a and a'. Springs, as J, keep the contact-fingers pressed with equal force against the contact-strips and against the segments. Each dash-pot (shown in detail in Figs. 2 and 3) is composed of an inner tube N and an outer tube M and a piston n, fitting the inner tube. At the lower end of the inner tube is a valve K, opening upward and normally kept on its seat by gravity, and near the upper end of the inner tube is a valve K', opening downward, but kept normally on its seat by a spring s. Through the walls of the inner tube are several openings or ports. One port, e^4, located at the bottom, may be closed more or less by the adjustable sleeve L, controlled by the rod e^3, and one port, e^5, near the top and just below the valve K', may be closed more or less by the adjustable sleeve L', controlled by the rod e^2. Above the valve K' are ports d, always open. About one-quarter way along the tube from the bottom are ports e e, always open, (except as the piston closes them in passing,) and at about two-thirds the way along the tube from the bottom are ports e', always open, (except as the

piston closes them in passing.) The two tubes of the dash-pot being filled with oil, it will be seen that a movement of the piston upward from the bottom may take place freely until the ports e' are reached, the oil passing out through the ports e and e' and up through valve K. The valve K opens upward and relieves any pressure that may exist; but when the ports e' are reached the piston is retarded by an amount depending on the adjustment of the sleeve L', closing more or less of the port e^5 just below the valve K'. This valve is kept closed by its spring and also by the upward pressure of the piston on the oil, and the piston can only move as it forces oil out through the portion of the port that is open. When the piston is descending, it has free movement until it reaches the ports e, since the oil flows out through ports e and e' and in through the ports d and e^5, and then during the rest of its descent it can only move as fast as it can force oil out through the portion of the lower port e^4 not covered by the sleeve L. Thus the piston is retarded during the last one-third of its movement upward and during the last one-fourth of its movement downward, but is otherwise practically unretarded in its movements. As herein shown, the series of segments A to B is connected to two sets of resistances, the series being divided into two portions. One set starts at the bottom segment and has low resistances from step to step at first, but gradually increases from step to step until at about one-fourth way along the series it becomes very great or even infinite for each step, and then after a few steps of very high or infinite resistance it gradually decreases again until at the upper end of the series the resistance is quite small. A common arrangement for a ten-horse-power motor, for instance, is to have the steps near the extreme of the series amount to about five one-hundredths ohm per step, while those near the point of maximum are sometimes brought to infinity.

Means are provided for automatically stopping the elevator-car when it reaches the top and bottom of its travel. For this purpose I provide two safety-switches T T', which are normally closed, and when closed the switch T' makes the two contact-strips G G' practically one piece, its two parts being connected by lines k and k'. The switch T' makes the two contact-strips F F' practically one piece through the connecting-wires v and v'. As a further means of preventing accident I make use of limit-switches t and t' in the elevator-car. These switches are normally closed and in series with the controlling-switch O in the circuit of the solenoids S S' and through connecting-wires o', t^2, and t^3. The solenoid-circuit is divided into two parts. One part includes the lever of the switch O and the right-hand segment of this switch, the limit-switch t, and solenoid S, while the other part includes the lever of the switch O and the left-hand segment of this switch, the limit-switch t', and solenoid S', and only one of these branches can be closed at a time, so as to have a current through it. The field of the motor is connected with the line by wires j and j'. The contact-strip F F' is connected to one armature-terminal of the motor through line i', and the contact-strip G G' is connected to the other armature-terminal of the motor through the line i. Normally, then, both armature-terminals are in connection with the segment A, one through strip G' and fingers $b\,b'$ in cross-head D and the other through strip F' and fingers $a\,a'$ of cross-head C. If now the switch O be turned to the right, the solenoid S' will receive a current, pulling up the core E and cross-head D. As soon as the fingers $b\,b'$ have passed the point of infinite resistance along the series of segments they place the strip G' G in connection with the upper pole of the line through the resistance intervening between the point of contact of the fingers and the segment B, and this resistance is gradually cut out until when the fingers arrive at segment B full connection is established between contact-strips G G' and the upper pole of the line. The armature-circuit is then complete with no resistance in, and it will then revolve at its maximum power so long as switch O is kept in the same position or until the elevator-car reaches the limit of its course, where the safety-switch t is opened by striking a stop P in the wellway. When the solenoid S' loses its current, either by the opening of switch t or by the turning of switch O, the core E and cross-head D drop by gravity rapidly until it reaches a point about one-fourth from the bottom, where the dash-pot retards it and where also a local circuit is completed, including the armature of the motor, the contact-strip G', fingers $b\,b'$, and whatever resistance there is between the segment A and the point of contact of fingers b' with the series of segments, and through this local circuit there is a current established by reason of the momentum of the moving parts making the motor act as a generator, and when the cross-head D has arrived at the bottom and fingers $b\,b'$ are in contact with the bottom segment it removes all resistance from this local circuit, and if the motor has not already come to a stop before this point is reached there is a most powerful tendency to bring it to a stop by reason of the complete short-circuiting of the armature at this point. Thus a powerful braking action is applied and applied by gradual steps as the cross-head approaches the bottom. Now if the switch O is turned to the left the solenoid S is energized, pulling up the core E and cross-head C with fingers $a\,a'$, thus bringing the contact-strip F gradually into connection with the upper pole of the line, while the other cross-head, D, and fingers $b\,b'$ remain at the bottom pole of the line. Thus a current is admitted to the armature in the reverse direction, causing it to

run the other way, and it continues so to run until switch O is turned to off position or until switch t' is opened by striking the stop P' at the bottom of the wellway. When this occurs, the solenoid S loses its power, and core E, with cross-head C, drops to the bottom and establishes the local circuit and finally the short circuit of the armature, as before. If from any disarrangement the cross-heads C or D should remain at the top and not drop beyond the point where switches t or t' are opened, one of the switches T and T' would also be opened, and this would open the armature-circuit and cut off the power.

I claim—

1. In a controller for electric motors, the combination of a series of segments connected with suitable resistances, each terminal segment of said series being connected with one pole of the line, a pair of movable contact-fingers adapted to slide independently along said segments from one end of the series toward the other end, each of said contact-fingers being connected to one armature-terminal of the motor and means for sliding said fingers on said segments.

2. In a controller for electric motors, the combination of a series of segments connected with suitable resistances, each terminal segment of said series being connected with one pole of the line, a pair of contact-fingers adapted to slide independently along said series of segments from one end toward the other, each of said contact-fingers being connected with one armature-terminal of the motor, a solenoid for moving each of said fingers and a switch for controlling the solenoid-circuits.

3. In a controller for electric motors the combination of a series of segments having each terminal segment connected with one pole of the line, resistances interposed between said segments, said resistances increasing rapidly and to a high degree from the lower end of the series to a point intermediate to the ends and thence dropping suddenly and then decreasing gradually to the upper end of the series, a pair of contact-fingers adapted to slide independently on said series of segments from one end toward the other, each of said contact-segments being connected to one armature-terminal of the motor and means for sliding said fingers on said segments.

4. In a controller for electric motors, the combination of a series of segments connected by suitable resistances, each terminal segment of said series being connected with one pole of the line, a pair of contact-strips parallel with said series of segments, two pairs of independently-movable contact-fingers adapted to move longitudinally of said strips and segments, one finger of each pair being adapted to slide on said segments and one on one of said strips, each of said strips being connected with one armature-terminal of the motor, and means for moving said pairs of fingers.

5. In a controller for electric elevator-motors, the combination of a series of segments connected by suitable resistances, each terminal segment of said series being connected with one pole of the line, a pair of contact-strips parallel with said series of segments, each strip being separated by insulation into two parts, a safety-switch adapted to be thrown by the movement of the elevator-car, the two parts of said switch being connected with the two parts of one of said contact-strips, two independently-movable pairs of contact-fingers adapted to move longitudinally of said strips and said segments, one finger of each pair being adapted to slide on said segments and one on one of said strips, each of said strips being connected to one of the armature-terminals of the motor and means for moving the pairs of fingers.

6. In a controller for electric elevator-motors, the combination of a series of segments connected by suitable resistances, each terminal segment of said series being connected with one pole of the line, a pair of contact-fingers adapted to slide independently along said series of segments from one end toward the other, each of said fingers being connected with one armature-terminal of the motor, a solenoid for moving each of said fingers, a switch for controlling each solenoid-circuit and an automatic switch in each of the solenoid-circuits adapted to be thrown by the motion of the car to break the circuit.

7. In a controller for electric elevator-motors, the combination of a series of segments having each terminal segment connected with one pole of the line, resistances interposed between said segments, said resistances increasing rapidly and to a high degree from the lower end of the series to a point intermediate the ends and thence dropping suddenly and then decreasing gradually to the upper end of the series, a pair of contact-strips parallel with said series of segments and divided by insulation into two parts, a safety-switch so located as to be thrown by the movement of the car, the two parts of said switch being connected with the two parts of one of said contact-strips and each of said contact-strips being connected with one terminal of the motor, two independently-movable pairs of contact-fingers adapted to move longitudinally of said strips and segments, one of the fingers of each pair being adapted to slide on said segment and one on said contact-strips and means for moving said pairs of fingers.

Signed at Portland, Maine, this 5th day of January, 1903.

WILLIAM HENRY CHAPMAN.

Witnesses:
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