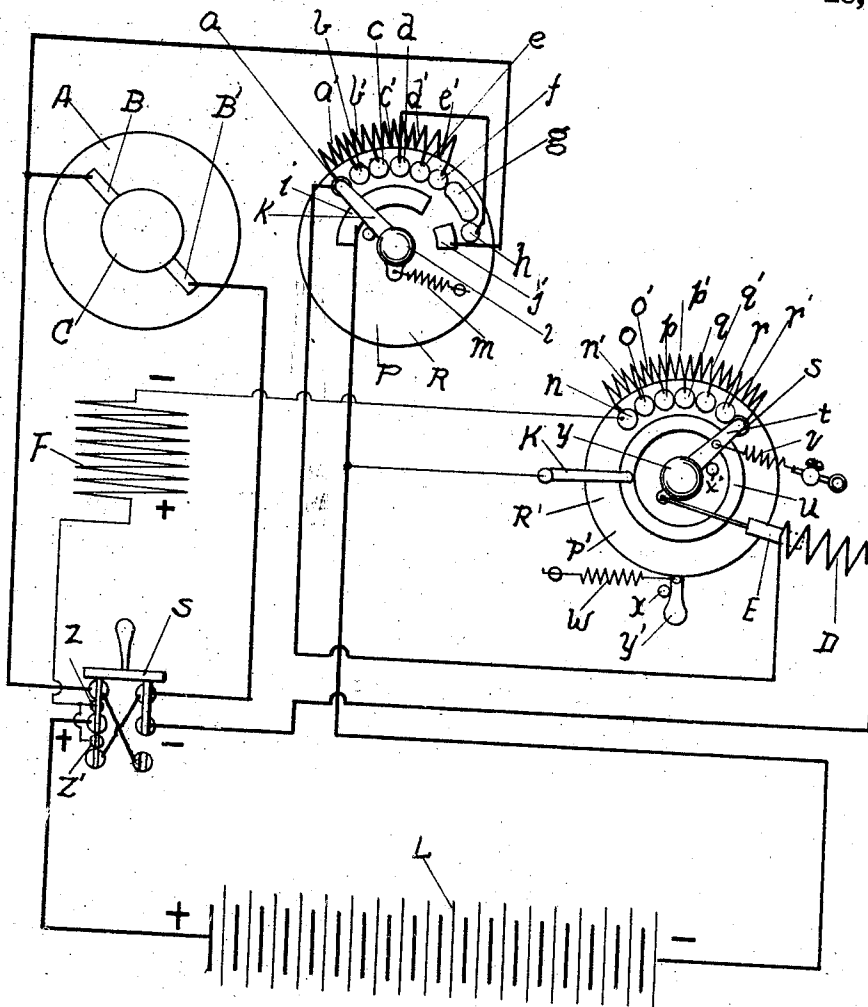


H. E. DEY.
METHOD OF CONTROL FOR ELECTRIC MOTORS.
APPLICATION FILED AUG. 13, 1919.

1,383,081.

Patented June 28, 1921.



INVENTOR

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METHOD OF CONTROL FOR ELECTRIC MOTORS.

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Specification of Letters Patent.

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Application filed August 13, 1919. Serial No. 317,141.

To all whom it may concern:

Be it known that I, HARRY EUGENE DEY, a citizen of the United States, and a resident of Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Methods of Control for Electric Motors, of which the following is a specification.

This invention is more specifically intended for electrically driven vehicles, such as automobiles and street cars, but may be used in other lines, as elevators, etc.

Referring to the accompanying drawings, which are in diagrammatic form and, for convenience in illustrating, are shown as operated by hand, instead of by foot as would be preferable in practice: A, is the armature of the motor to be controlled; B, and B', are its brushes resting upon its commutator C; F, is the field magnet coil; S, is a reversing switch; R, is a rheostat inserted in the armature circuit, and R', is a rheostat in series with the field winding.

The armature rheostat R, is provided with the resistances a' , b' , c' , d' , and e' , and their contact buttons a , b , c , d , e , and f , also the neutral, or dead button g , and button h , which is connected to button d . The arm k , serves to carry the current from the plate sectors i , and j , to the contact buttons. A spring m , is attached to the arm k , and anchored to the base plate P; its office being to draw the arm to the position where all resistance is cut out. A handle 1, provides manual control of the arm k .

The field rheostat R', has a set of resistances n' , o' , p' , q' , and r' , and their corresponding contact buttons n , o , p , q , r , and s ; also the ring u , and contact arm t . Spring v , which is anchored external to the rheostat, draws the arm t , to the position of highest resistance; the solenoid coil D, which is also statically mounted, is connected in series with the armature circuit, and acts upon its core E, to pull the arm t , against the spring v , to the position of no resistance; the base plate P', of rheostat R', is arranged to rotate upon its center, and is held in its normal position against the stop x , by the spring w , which is anchored to a stationary part; the handles y , and y' , are for controlling the movements of the plate P', and arm t , by manual power.

The circuits are as follows:

Beginning at the positive end of the bat-

tery L, the wire leads to the left side of the pole changing switch S; thence to either one of the armature brushes B, and B', according to the position of the switch; the field is also connected to the circuit at this point by means of the contact clips z , and z' ; after passing through the armature the current is led back to the switch, and thence to the solenoid coil D; passing through the coil it continues to the contact button a , on rheostat R; thence through the arm k , to the sector i , and then by wire to the negative terminal of the battery; the branch leading to the field continues through the latter and its connecting wire to the contact button n , of rheostat R'; thence consecutively through the resistances, contact arm t , flat ring u , and collecting brush K, which connects with the negative wire from the battery. The motor brush B, is connected to the sector j , of rheostat R, which results in short circuiting the armature through the resistances a' , b' and c' when contacts h , and j , are bridged by the arm k .

The method of operation is as follows:

It is the intention to substitute a foot lever for the handle 1, of rheostat R, shown in the drawing, and to operate it in a manner similar to that of the clutch in a gasoline car. By means of the foot lever the arm k , is first pressed over to the neutral position at g ; the circuit is then closed at the switch S, and the pressure at the pedal lightened, allowing the arm k to travel over the resistance contacts until all resistance is cut out at contact a ; the machine then running at full normal speed. A pressure of the foot inserts resistance to any amount desired, producing the effect of a slipping clutch; at the position g , the circuit is broken, which is equivalent to an open clutch; a further movement to the contact h , short circuits the motor through the resistances a' , b' , and c' , causing the motor to act as a brake. While not shown on the drawing, it will readily be understood that a further movement of the foot lever can be made to apply mechanical brakes, as is the practice with many makes of gas cars.

The field winding is of the shunt type, of a comparatively low resistance, perhaps one fifth of what would ordinarily be adopted for a given voltage. The resistance of the rheostat R', is designed so as to make the combined resistances of the field and said rheo-

stat equal to a normal field resistance, or even higher. The spring *v*, of rheostat *R'*, cuts in resistance, while the pull of the solenoid *D*, serves to cut it out as the load increases; thus producing the overload characteristics of a series type motor from a plain shunt wound machine, without losing the regenerative and braking features of the latter. It has the added advantage over the series motor that the torque curve can be made of any form desired; concave, convex, wavy or straight line, according to the design and arrangement of the field resistances; for normal loads the torque and speed can be made to conform to that obtained from a lightly compounded shunt machine, but as the overload danger point is reached the resistances may be rapidly lowered with consequent heavy increase in torque, slowing up in speed and reduction of sparking. Another feature of this invention is that on descending grades the car automatically slows up as the incline increases, by reason of the fact that the motor is of the shunt type and the counter electro-motive-force becomes greater than the voltage of the battery, thus reversing the direction of flow of the current and charging the battery from the power that would otherwise be wasted by friction on the brakes, and producing an effect upon the solenoid similar to that resulting from up grades, causing a slowing of speed due to increased field strength. This also applies to the motor when braking, the short circuited current acting upon the solenoid in a similar manner. If desired, however, the automatic control can be neutralized by manual control. This is accomplished by causing the base *P'*, to follow up the contact arm by means of the handle *y'*; the automatic remaining in operative condition from any point at which the hand control may be held, as their action is entirely independent of one another. By varying the pull of the spring *v*, by means of an adjusting screw, a wide range of load capacity and speed regulation can be obtained without changing the motor windings. This feature is valuable for fitting cars to operate to their best advantage in different sections of the country, or for heavy and light work.

The reversing switch *S*, is of the well known pole changing type, acting upon the armature of the motor. It is provided with two additional contact clips *z*, and *z'*, that serve to cut in and out the field circuit with the closing and opening of the main circuit.

I intend that the word solenoid shall include any electrical mechanism.

I claim—

1. A control for electric motors which comprises a source of electrical supply; an electric motor of the shunt type having a comparatively low resistance field winding; a rheostat for the field circuit having movable contact arm and baseplate elements; a spring attached to said contact arm and anchored to a fixed object, to insert resistance; an armature circuit; a solenoid mounted in a fixed position, connected in series with the armature circuit, and pulling in opposition to said spring, and means of manual control of the two elements.
2. A control for electric motors which comprises a source of electrical supply; an electric motor of the shunt type, provided with a low resistance field winding; a rheostat for the field circuit having movable contact arm and base plate elements; a spring attached to one of said elements and anchored to a fixed object, to insert resistance; an armature circuit; a solenoid mounted in a fixed position and connected in series with said armature circuit and pulling in opposition to said spring; a spring attached to the other element of said rheostat having a fixed anchorage and a tension in a direction to cut out resistance, and means for manual control of the two elements.
3. A control for electric motors which comprises a source of electrical supply; an electric motor of the shunt type, provided with a low resistance field winding; a rheostat for the armature circuit; a spring for retaining the arm of the rheostat in the no resistance position; means for manually overcoming the pull of the spring; a rheostat for the field circuit having movable contact arm and base plate elements; a spring attached to one of said elements and anchored to a fixed object, to insert resistance; a solenoid mounted in a fixed position, connected in series with the armature circuit, and pulling in opposition to said spring; a spring attached to the other element of the rheostat in said field circuit, having a fixed anchorage and a tension in a direction to cut out resistance; and means for manual control of the two elements of said field rheostat.

HARRY EUGENE DEY.

Witnesses:

MARY E. DEY,
W. P. PREBLE.