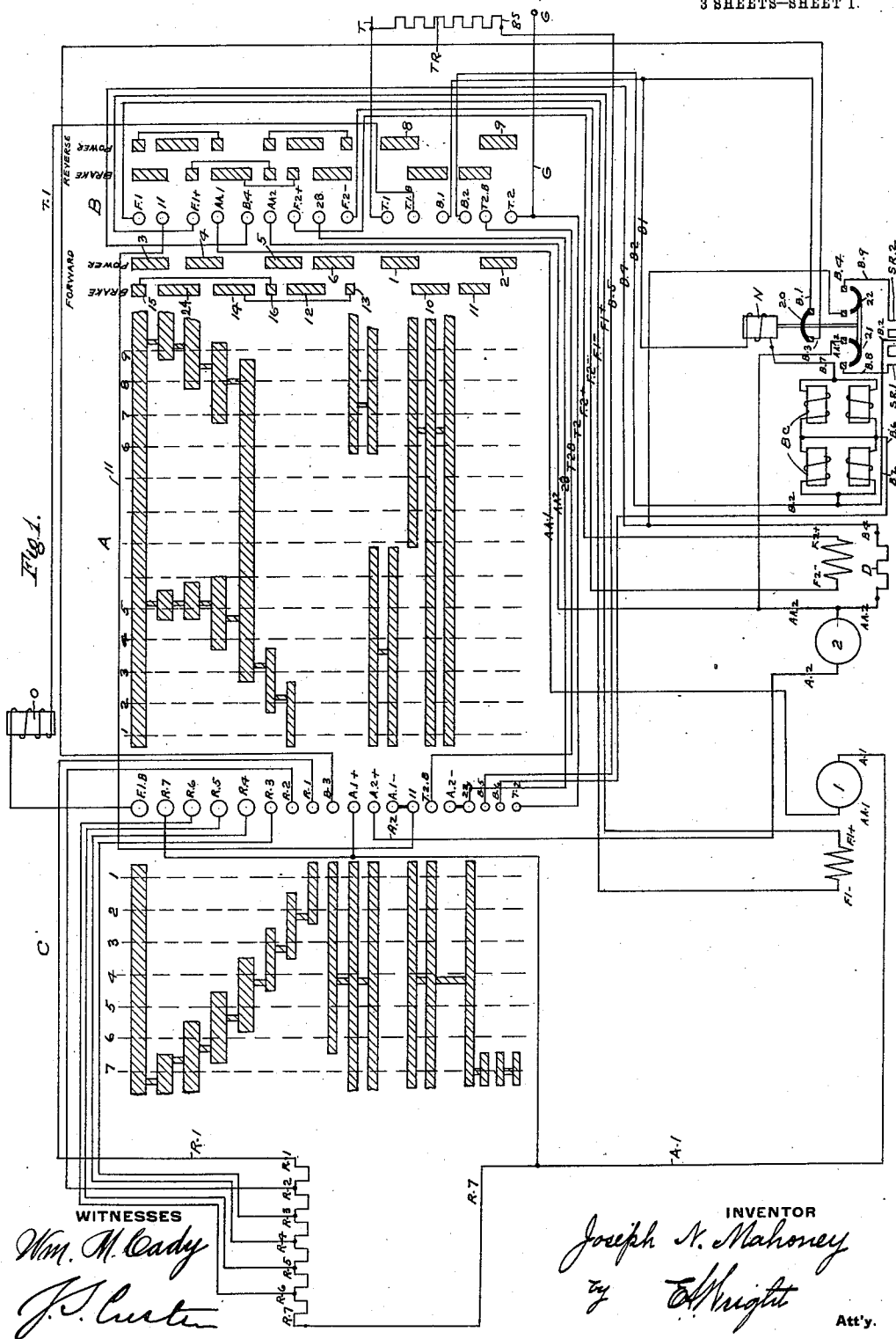


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ELECTRIC BRAKE.
APPLICATION FILED APR. 20, 1908.

1,012,878.

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3 SHEETS—SHEET 1.

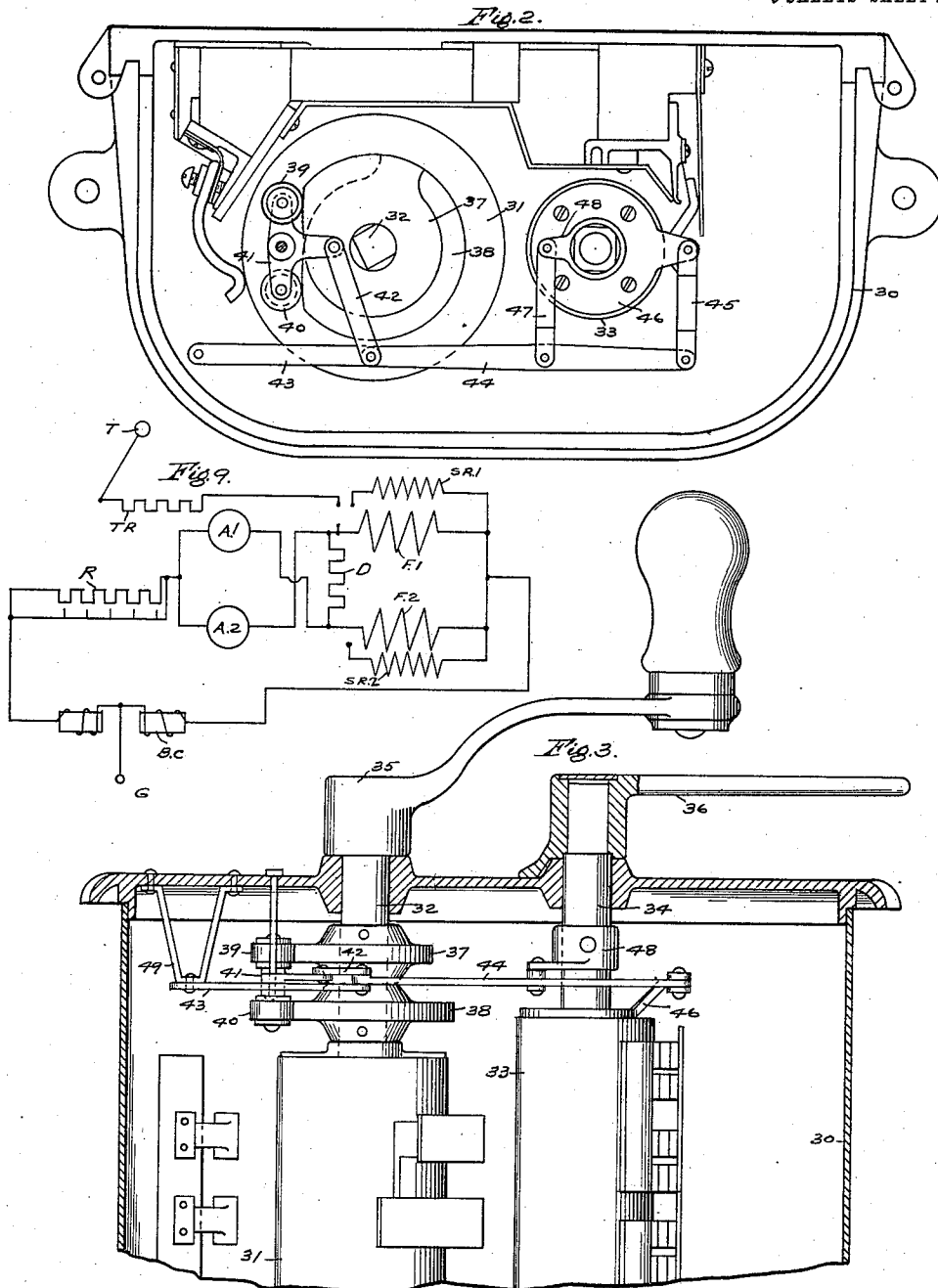


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WITNESSES
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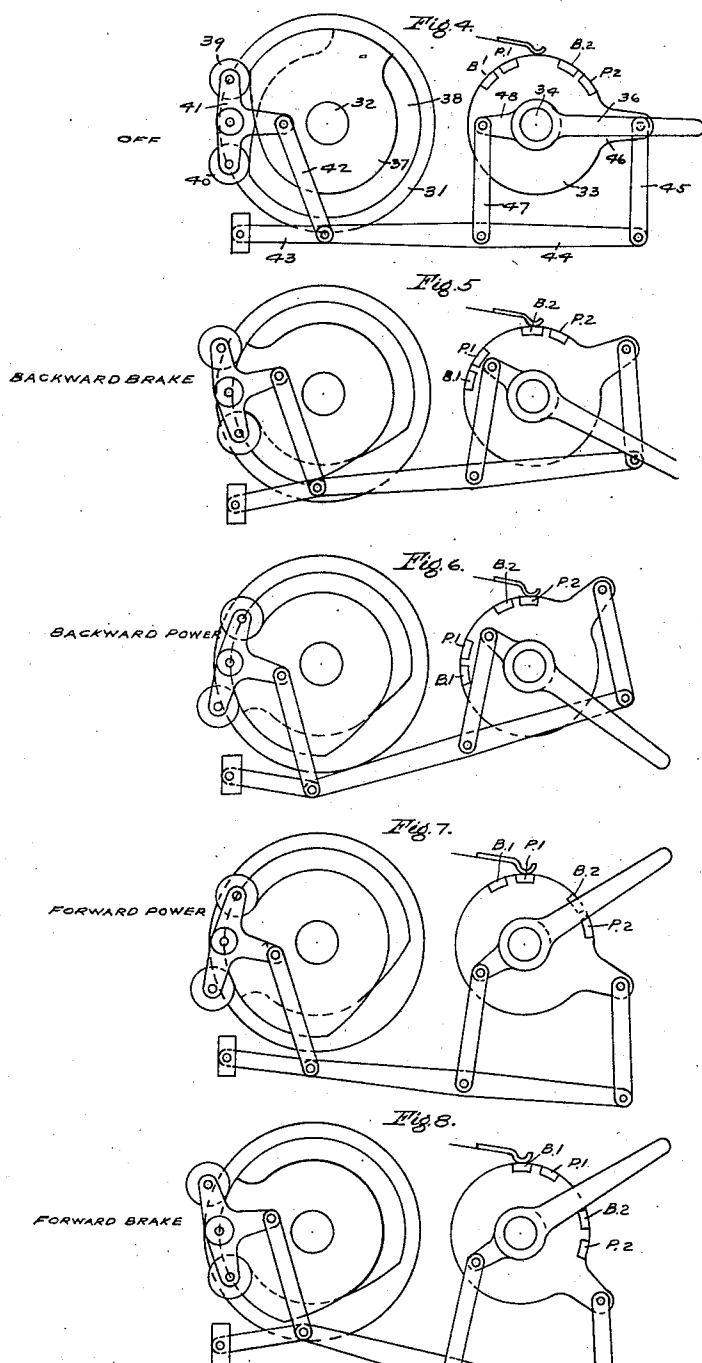
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Joseph N. Mahoney
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WITNESSES

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INVENTOR

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UNITED STATES PATENT OFFICE.

JOSEPH N. MAHONEY, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ELECTRIC BRAKE.

1,012,878.

Specification of Letters Patent.

Patented Dec. 26, 1911.

Application filed April 20, 1908. Serial No. 428,164.

To all whom it may concern:

Be it known that I, JOSEPH N. MAHONEY, a citizen of the United States, residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Electric Brakes, of which the following is a specification.

This invention relates to electric brakes, and more particularly to that type of brake wherein the propelling motors of the car are adapted to be connected up to act as generators to supply electric current for operating the brakes, as now extensively employed in electric traction service.

One object of my invention is to provide an improved combined running and braking controller of simplified construction.

Another object is to provide an improved form of combined brake and reversing switch.

Another object is to provide improved means for automatically actuating the brake and reverse switch by the movement of the controller handle from a power position to a position for applying the brakes or vice versa.

Another feature of my improvements relates to a combined controller of the above type adapted to make the electrical connections and circuits for effecting certain improved braking combinations whereby a more positive and reliable brake is obtained.

In the accompanying drawings; Figure 1 is a diagram illustrating the development of a preferred form of my combined controller and braking and reversing switch; Fig. 2 a top plan view of a combined controller showing my improvements applied thereto, the top cover plate being removed; Fig. 3 a side elevation of the upper portion of the above controller with the casing removed; Figs. 4 to 8 inclusive, diagrams illustrating the relative positions of the controller and the brake and reverse switch in off, full backward braking, full backward power, full forward power, and full forward braking positions respectively; and Fig. 9 a diagram illustrating the braking combination of circuits formed in the first braking position of the controller.

In carrying out my invention I employ a single controller drum having one set of

contact bars for power and another set for braking, as shown in Fig. 1, the controller handle being moved in one direction from a neutral position for power connections and in the opposite direction for braking. When the controller handle is moved to its first power position and assuming that the brake and reversing switch is in its forward power position, the circuits will be as follows: from trolley T, through contacts in brake switch B and connecting bar 1 to lead T¹, through blow-out coil O to point in controller and thence by connecting bars in the power section A to point and lead R², thence by lead R² through the resistance R to terminal A¹ of armature of motor No. 1, thence by lead A A¹ to point in brake switch B and through connecting bar 4 to lead F¹⁺ and thence through field of motor No. 1 to lead F¹⁻, point in brake switch, through bar 3 to lead 11 and point in controller, through bar in power section A to lead A², armature motor No. 2, lead A A², bar 5 in brake switch to lead F²⁺, field of motor No. 2, lead F²⁻, bar 6 in brake switch to lead 22 and thence to point in controller and through bars in power section A to lead T^{2B}, to bar 2 in brake switch B and thence by lead G to ground. The motors are now connected up in series and further movements of the controller serve to first cut out resistance and then finally connect up the motors in parallel in the usual manner. To run the car backward, the controller being in the neutral position, the brake and reversing switch is thrown to the power reverse position, as indicated on the drawing. The connecting bars therein then reverse the direction of current through the armatures, the trolley and ground connections being maintained by bars 8 and 9 respectively, as will be understood.

If it is desired to apply the brakes while running forward, the controller is turned to neutral position and the brake and reversing switch is thrown to the forward brake position. The controller is then moved in its opposite direction to the first braking position in which the current flow may be traced as follows: Current flows from both motor armatures through leads A¹ and A² to points in controller, which are connected by bars in the braking section C of the controller and thence through a common lead

R', resistance R, lead R¹ to point R¹ in controller, through connecting bars in brake section C to point T^{1B}, thence through lead T¹ to point T^{1B} in brake and reversing switch B, by connecting bar 10 to lead B¹ and thence through coil N of a regulating device and brake magnet coils B C, to lead B², point B² in brake and reverse switch B, through connecting bar 11 to lead T^{2B} and thence to point T^{2B} in controller, the circuit then dividing, one branch being through bars in brake section of controller to lead 23, bar 12 in brake and reverse switch to lead F²⁺ and field motor No. 2, and thence by lead F²⁻ in switch B, by connected bars 13 and 14 to lead A A¹ and armatures of motor No. 1, the other branch being through lead 11 to point 11 in switch B, bar 24 to point F¹⁺, lead F¹⁺ through the field of motor No. 1, lead F¹⁻ to point F¹ in B, to bar 15 and thence to bar 16, to point A A², lead A A² to armature of motor No. 2. It will thus be seen that the motors are now connected up in a closed circuit to act as generators, and supply current in parallel relation to a common circuit containing a variable resistance and the brake magnet coils, the armature of each motor being cross connected to the field of the other motor.

In addition to the above electrical connections, the regulating coil N in the local brake circuit controls a series of switches, of which 21 and 22 govern respectively shunt resistances S R¹ and S R², a common terminal of said resistances being connected by lead B² to the common connection between the field terminals F¹⁺ and F²⁺ while the other terminal of resistance S R¹ is connected through switch 21 and lead A A² to the other terminal of field of motor No. 1 and the other terminal of resistance S R² is connected through switch 22, lead B⁴, bar 14 in brake and reverse switch to lead A A¹ and the other terminal of motor No. 2. The switch 20 controls a short circuit around the resistance R, and is closed so long as the current flowing through the coil N is less than a predetermined amount.

A safety resistance D is interposed across the armature leads, and a ground connection is provided intermediate the two sets of brake magnet coils for a purpose hereinafter appearing.

When the above braking combination is first set up the flow of current through the regulator coil N is insufficient to cause the actuation of the switches, so that the short circuit switch 20 remains closed and the shunt switches 21 and 22 remain open. The fields of the motors are thus permitted to build up rapidly and, as the resistance R is now short circuited, a considerable rush of current is supplied to the brake coils, which rapidly forces the brake shoes into engagement with the rails or other friction

engaging surfaces. As soon as the current generated attains a certain degree of strength the coil N is thereby caused to actuate the switches so as to cut in the shunt resistances around the fields of the motors and the resistance R in the brake circuit. The cross connection of the motor fields and armatures serves to equalize the output of each motor and the safety resistance D is for the purpose of completing the circuit of one motor through its own armature and field in case the circuit of the other motor becomes broken, the course of the current then obtaining being apparent from an inspection of the diagram shown in Fig. 9. By moving the controller handle around to its different braking positions from 1 to 6 inclusive, the resistance R in circuit may be diminished and the braking force correspondingly increased, as will be clearly understood. In the last braking position, No. 7, electrical connections are made so as to supply current from the trolley to the brake circuit, through the trolley resistance, thus, should the speed of the car be insufficient to generate current enough to hold the brakes applied or when it is desired to hold the brakes on with the car at a standstill, as on a grade for example, trolley current is supplied to the brake magnets and the brakes are held applied.

According to another feature of my improvements means are provided for operating the brake and reverse drum automatically, by the movement of the controller. For this purpose I preferably employ the construction illustrated in Figs. 2 and 3, the usual controller casing 30 being provided, containing the controller drum 31, mounted on shaft 32, and the brake and reversing drum 33, mounted on shaft 34, the main controller shaft 32 being operated by the usual handle 35 and the brake and reverse shaft 34 by the handle 36. Cams 37 and 38 are mounted on the controller shaft 32, and the respective peripheries of the cams are engaged by rollers 39 and 40 which are mounted on opposite sides of a pivotally mounted T head 41. The third arm of the T is pivotally connected by a link 42 with links 43 and 44, the link 43 having its opposite end secured to a fixed pivot held in the bracket 49 and the link 44 being pivotally connected to a link 45 which is also pivotally connected to a plate 46, secured to the top of the brake and reversing drum 33. At a point on the link 44, intermediate the links 42 and 45, a link 47 is pivotally secured, the opposite end thereof being pivotally attached to a rocker arm 48 mounted on the brake and reversing shaft 34.

As shown in Fig. 1 and Figs. 4 to 8 inclusive, the brake and reversing drum is provided with four sets of connecting bars-132

as follows: forward brake, B^1 , forward power, P^1 , reverse or backward brake, B^2 , and reverse or backward power, P^2 .

The shaft 34 is loose in the brake and reversing drum, so that in operating the brake and reverse handle 36, the drum 33 is moved through the links 47, 44 and 45, and it will be apparent that said handle may thus be independently operated to shift the drum 33 to its various positions in the usual manner. In addition, by means of the link connections to the cam mechanism on the controller drum the brake and reversing drum is operated by the movement of the controller handle in passing over its neutral position from a power position to a braking position or vice versa.

The usual interlocking mechanism may be employed so that the brake and reversing switch handle can only be operated with the controller handle in the off or neutral position, and the controller handle cannot be operated unless the brake and reversing switch is first moved to one of its operating positions. In running forward the brake and reversing switch is first moved to forward position with the contacts P^1 in contact with the fingers, the controller being then operated in the usual manner, or in running backward the brake and reversing switch is moved to the position in which the contacts P^2 are in engagement with the fingers. Considering the brake and reversing switch in a forward running position, if it is desired to apply the brakes, the controller handle is turned in the opposite direction from that employed for running. In passing over the neutral position, the cam plates are so arranged that the roller arm 41 is rotated from its position shown in Fig. 7 to the position shown in Fig. 8. This causes the link member 42 to pull up and turn the link 44 about the link 47 as a fulcrum, the same being held by its connection with the arm 48 which exerts sufficient resistance to movement for that purpose. The link 45 therefore turns the drum 33 about its shaft and causes the contacts B^1 to engage with the contact fingers. The desired connections are thus made for braking and by the further movement of the controller the various braking combinations are set up in the usual manner. If the controller handle is turned back through its neutral position to a running position the reverse movement of the parts is caused and it is apparent that the brake and reversing switch will be turned to the forward running position. The same operation is effected in running backward, the parts being in the position shown in Fig. 6, and in turning to the braking position the brake and reversing drum is shifted to the position shown in Fig. 5.

It will thus be seen that a simple mechanism is provided whereby it is only necessary for the motorman to operate a single handle in order to apply the brakes, thus obviating the danger of throwing the brake and reversing switch to a wrong position as well as allowing the motorman a free hand with which to operate the hand brakes when desired.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In an electric brake, the combination with a power and braking controller having one set of movable contacts for power and another set for braking, of a brake and reversing switch having positions in which connections are made for respectively running forward and backward and for braking forward and backward.

2. In an electric brake, the combination with a power and braking controller having one set of movable contacts for power and another set for braking, of a brake and reversing switch having four positions adapted to make connections for running forward, running backward, braking forward and braking backward, the running positions being alternated with respect to the braking positions.

3. In an electric brake, the combination with a power and braking controller having one set of movable contacts for power and another set for braking, of a brake and reversing switch having four positions in which connections are made for respectively running forward, running backward, braking forward, and braking backward, a running position being located on one side and a braking position on the other side of the neutral position of said switch.

4. The combination with a controller having separate sets of contacts for power and for braking respectively, of a brake and reversing switch having positions for running forward and backward and two other positions for braking and means operating upon movement of the controller for actuating said brake and reversing switch.

5. The combination with a controller having separate sets of contacts for power and for braking, of a brake and reversing switch having positions for running forward and backward respectively and two other positions for braking and means operating upon movement of the braking controller over its neutral position for shifting said brake and reversing switch.

6. In an electric brake mechanism, the combination with a running and braking controller having contact bars for running located on one side of a neutral position thereof and contact bars for braking located on the opposite side of said neutral position, of a brake and reversing switch hav-

ing forward positions for running and for
braking and backward positions for running
and braking and means operated by the
movement of the controller in passing over
the neutral position for shifting said brake
and reversing switch from a power to a
braking position.

7. In an electric brake mechanism, the
combination with a controller and a brake
switch, of a rocker arm adapted to be re-
ciprocated by the movement of said con-
troller and a lever device operatively con-
nected to said rocker arm and the brake
switch to thereby impart reciprocatory
movement to said brake switch.

8. In an electric brake mechanism, the
combination with a controller and a brake
switch, of a rocker arm, a cam device for
reciprocating said rocker arm, and a lever
mechanism operatively connected to said
brake switch, and adapted to be reciproc-
ated by said rocker arm for actuating said
brake switch.

9. The combination with a combined run-
ning and braking controller and a brake
switch, of a connecting mechanism operated
by the movement of said controller for
actuating said brake switch and manually
operated means for also actuating the
switch through said connecting mechanism.

10. In an electric brake, the combination
with two motors, of a controller drum hav-
ing one set of contacts for running and
another set for braking, the latter set of
contacts being adapted to connect up the
propelling motors to act as generators for
a local brake circuit with the armature of
each motor cross connected to the field of the
other motor.

11. In an electric brake mechanism, the
combination with a plurality of motors for
propelling the vehicle, of a combined run-
ning and braking controller having separ-
ate running and braking contacts, the
braking contacts being adapted to connect
up the motors to act as generators in a
circuit having the armature of one motor
cross connected to the field of the other
motor and having a resistance connection
interposed between the motor armatures and
the motor fields so as to complete a local
circuit for one motor upon failure of the
other motor circuit.

In testimony whereof I have hereunto
set my hand.

JOSEPH N. MAHONEY.

Witnesses:

R. F. EMERY,
Wm. M. CODY.