J. N. MAHONEY & W. M. AUSTIN.

ELECTRIC BRAKE.

997,458.

APPLICATION FILED AUG. 29, 1908.

Patented July 11, 1911.

4 SHEETS—SHEET 1.

Fig. 1.

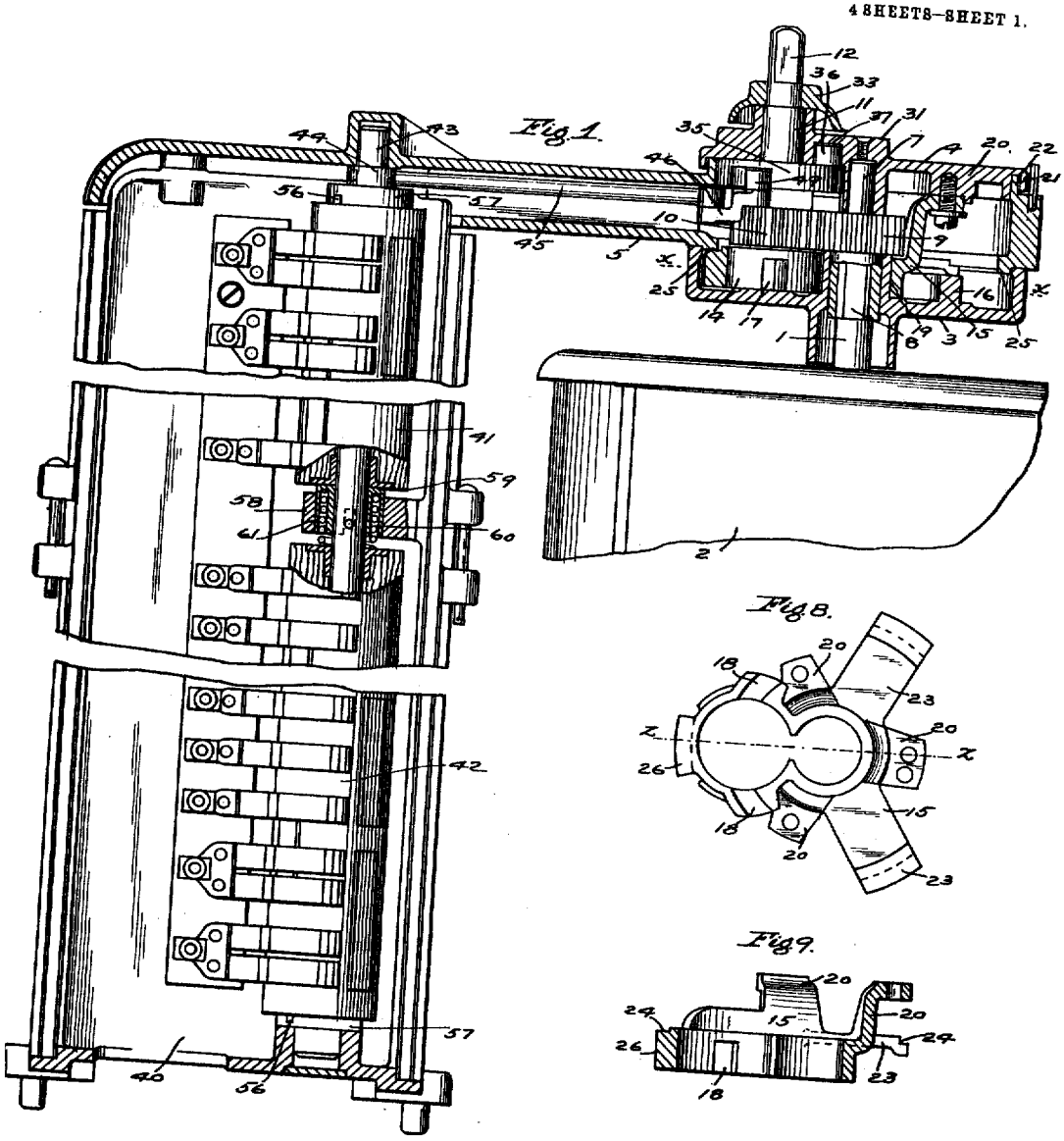

Fig 8.

Fig 9.

WITNESSES

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4 SHEETS—SHEET 2.

Fig 2.

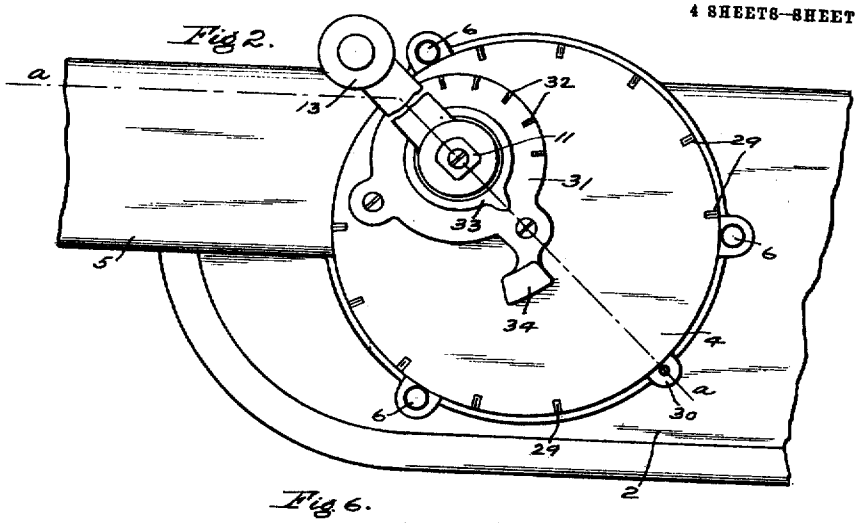


Fig 6.

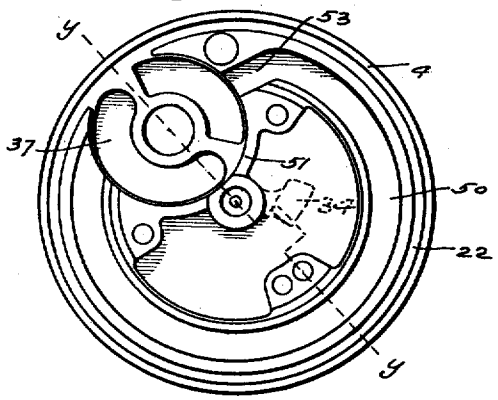
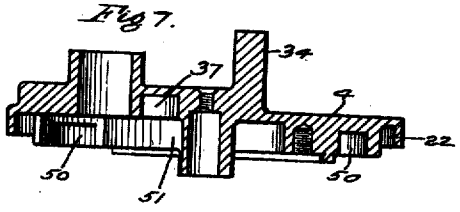


Fig 7.



WITNESSES

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4 SHEETS—SHEET 3.

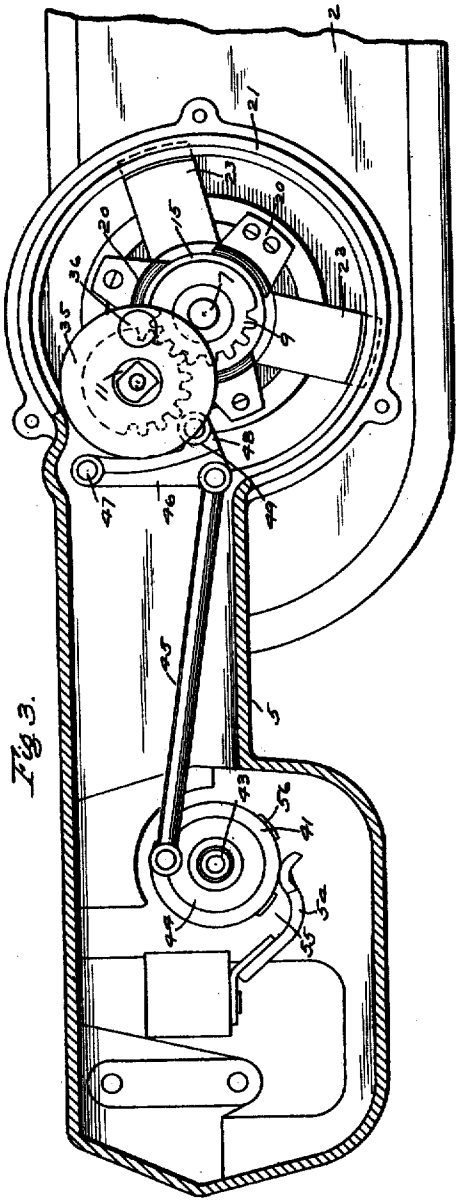

Fig. 3.

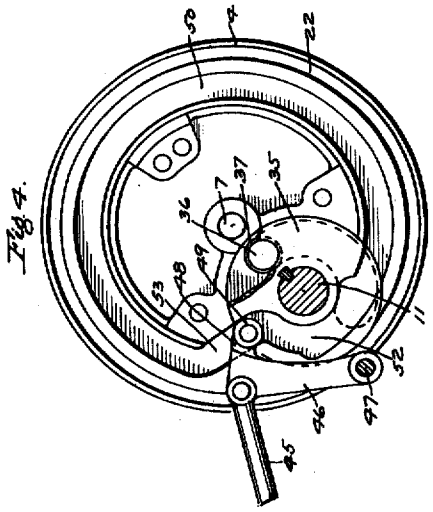

Fig. 4.

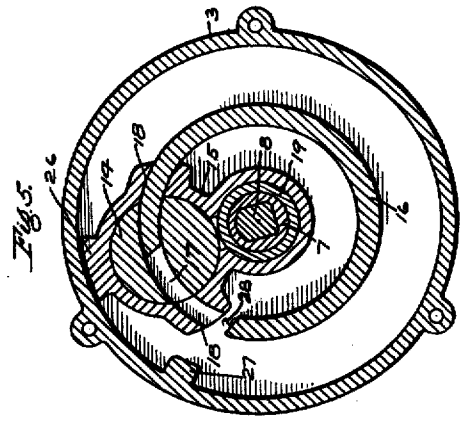

Fig. 5.

WITNESSES

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4 SHEETS—SHEET 4.

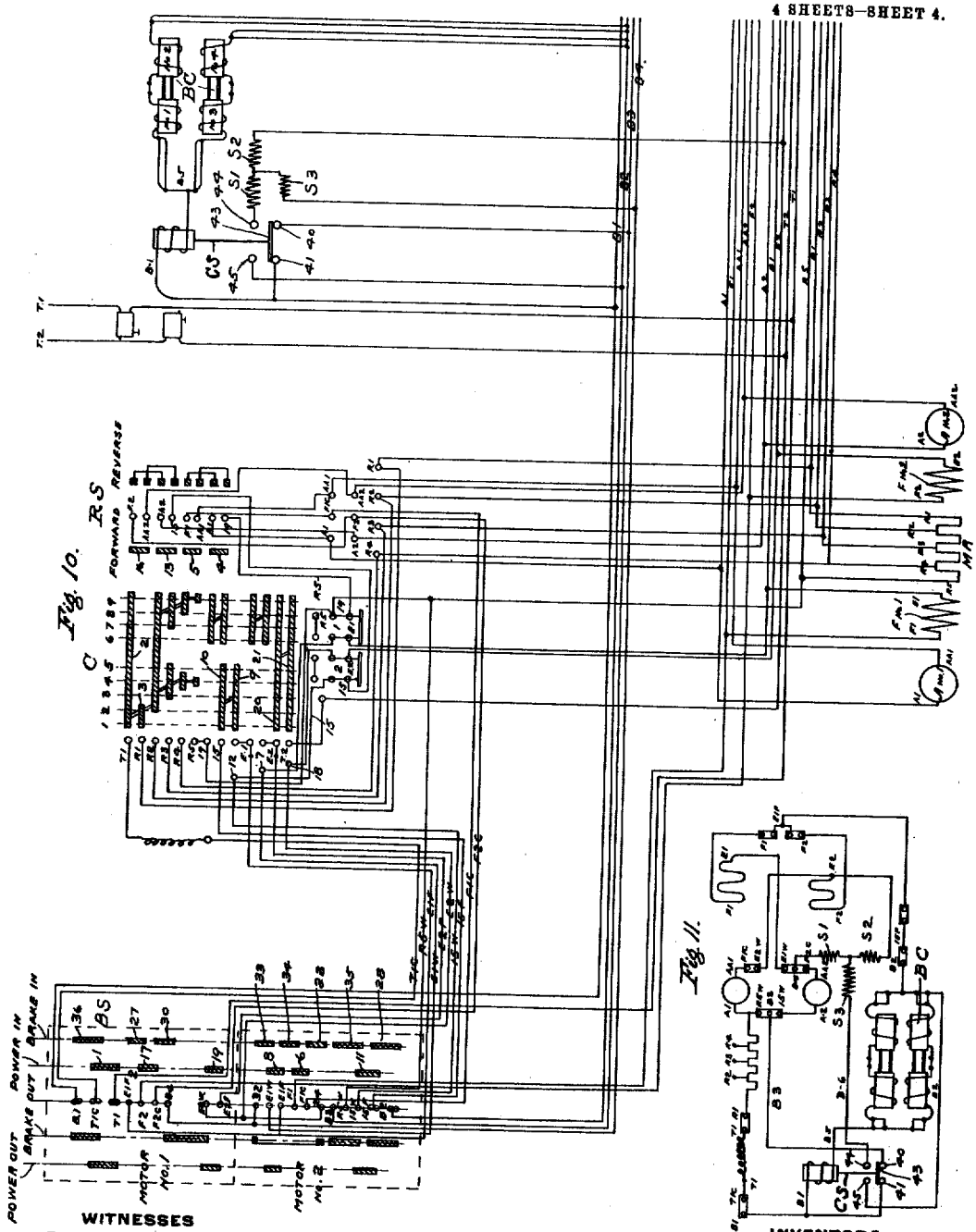

Fig. 10.

Fig. 11.

WITNESSES

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UNITED STATES PATENT OFFICE.

JOSEPH N. MAHONEY, OF WILKINSBURG, AND WALTER M. AUSTIN, OF SWISSVALE, PENNSYLVANIA, ASSIGNORS TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ELECTRIC BRAKE.

997,458. Specification of Letters Patent. **Patented July 11, 1911.**

Application filed August 29, 1908. Serial No. 450,860.

To all whom it may concern:

Be it known that we, JOSEPH N. MAHONEY and WALTER M. AUSTIN, citizens of the United States, residents of Wilkinsburg and Swissvale, respectively, 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 an apparatus of the type in which the running controller of an electrically propelled car is employed for both running and braking, the construction being such that upon movement of the controller handle in one direction from the neutral or off position the usual circuit combinations for propelling the car are set up while by moving the handle in the opposite direction from the off position the circuit connections for braking are made, the same set of contact points in the controller being utilized for both running and braking.

One object of the present invention is to provide an improved apparatus of the above character, of few parts, simple and compact in construction and which requires no change or alteration to be made in the controller to which it may be applied.

Another object is to provide electric connections to be employed with an apparatus of the above character and adapted to produce certain improved braking combinations of circuits whereby a more reliable and efficient brake is secured.

Still another object of our invention is to provide an improved mechanism of the above nature for utilizing a running controller as a combined running and braking controller which is positive in its operation and which is not liable to get out of order, even under rough usage.

In the accompanying drawings; Figure 1 is a vertical section on the line *a*—*a* of Fig. 2 of our improved mechanism for converting a controller into a combined running and braking controller, shown applied to an ordinary running controller, the brake switch being shown in elevation with the cover plate removed; Fig. 2 a top plan view of the above construction, the brake switch not being shown; Fig. 3 a top plan view thereof including the brake switch, the controller dial plate being removed and the casing extension to the brake switch being shown in a horizontal section; Fig. 4 an inverted plan view of the controller dial plate showing a portion of the mechanism for operating the brake switch; Fig. 5 a horizontal section on line *x*—*x* of Fig. 1; Fig. 6 an inverted plan view of the controller dial plate or upper casing section; Fig. 7 a section thereof on line *y*—*y* of Fig. 6; Fig. 8 an inverted plan view of the spider which positions and guides certain of the parts; Fig. 9 a section thereof on the line *z*—*z* of Fig. 8; Fig. 10 a diagrammatic view showing a development of the circuits and electric connections employed with the combined running and braking controller; and Fig. 11 a schematic diagram of the braking combination of circuits set up in the first braking position.

The improved braking attachment is shown in Fig. 1 of the drawings applied to the operating shaft 1 of an ordinary running controller 2 and preferably comprises a casing made up of a lower stationary section 3, an upper movable section 4, and an intermediate section 5 suitably secured to the lower section 3 by means of bolts 6. A stub shaft 7 provided with a socket adapted to fit over the usual handle end 8 of the controller shaft 1 is journaled in the lower section 3 of the casing and also in the upper section 4 and is provided intermediately of the journals with a gear 9 adapted to mesh with a gear 10 secured on an operating shaft 11 having a key end 12 to which the usual controller handle 13 may be applied. The operating shaft 11 is journaled in the upper section 4 and carries on its lower extremity a disk 14, having a bearing in a spider 15. Concentric with the controller shaft 1, the casing section 3 carries an interiorly arranged upwardly projecting rib 16 and the disk 14 is provided with an arc shaped channel 17 adapted to fit over the rib 16, as shown in Fig. 5, so that the operating shaft 11 and the disk 14 may be rotated about the controller shaft as a center, the rib 16 engaging within the channel 17. The spider 15 is provided with outwardly extending portions on opposite sides of the block 14 in which are channels 18 adapted to register with the rib 16 in the movement of the parts. Centrally the lower section 3 is provided with an upstanding sleeve 19 upon which

the spider 15 is rotatably mounted, the spider being provided with radial bracket arms 20 adapted to be secured to the upper section 4, so that the upper section 4, the spider 15 and the operating shaft 11 may turn as a unit about the controller shaft 1. The intermediate section 5 is provided with a circular flange 21 which is adapted to engage with a channel or groove 22 in the upper section to guide the same in its movement. The spider 15 is also provided with radial arms 23 having upper peripheral recesses 24 adapted to engage with a projecting peripheral ledge 25 carried by the intermediate section 5, to serve as a guiding means for the spider. A recess 24 is also provided on a lug 26 arranged in the radial line through the axis of the controller and operating shafts and this lug extends downwardly so as to engage a stop lug 27 located interiorly and near the periphery of the lower section 3, in order to limit the movement of the spider 15 and the connected parts in one direction from the off position. A portion of the rib 16 is cut away to form an opening 28 of sufficient extent to permit of the disengagement of the disk 14 from the rib 16 and the free movement of said disk about its own axis. This opening 28 is so located, that when the controller handle is in its neutral or off position, the disk is positioned in said opening, and the stop lug 27 is located to engage the lug 26 in the same position, so that upon further movement of the controller handle after the lugs 26 and 27 engage, the block 14 is free to turn in the opening 28, while the spider and the parts connected thereto are held.

The rotatable top section 4 is provided with peripheral notches 29, and the stationary section 5 with a pin 30, so that the movement of the controller for running will be indicated by the relative positions of the notches and the pin. Around the operating shaft 11 a raised portion 31 is provided on the casing section 4, on which are peripheral notches 32 for indicating the braking positions, a pointer 33 being provided on the operating shaft 11. The casing section 4 may also be provided with a stop lug 34 for engaging the controller handle 13 to prevent the movement of same beyond the desired braking positions.

It will be seen that with the channel 17 in the disk 14 engaging the rib 16, the disk and thereby the operating shaft 11 and gear 10 are securely locked against rotative movement about the axis of the operating shaft and so the intermeshing gears 9 and 10 form a rigid connection from controller shaft 1 to the operating shaft 11 and the controller handle 13, whereby movement of said handle turns the controller shaft as though applied directly to same. When the parts are in the position in which the disk 14 registers with the opening 28, the disk may be turned about the axis of the operating shaft 11 and in this case the movement of the controller handle rotates the gear 10 on its own axis and thereby the gear 9 and the controller shaft 11 are rotated in the direction opposite that of the controller handle. The location of the stop lug 27 with respect to the lug 26 is such that they engage in the off position of the parts, while in the same position the disk 14 registers with the opening 28. Secured to the operating shaft 11 above the gear 10 is a disk 35, carrying on its upper face a pin 36 for engaging a groove 37 cut in the under face of the casing section 4, as more clearly shown in Fig. 6. The movement of the operating shaft 11 and connected parts about its own axis is thus limited, and the extent of the groove 37 is such that in moving the controller handle to the right the pin 36 engages the end of the groove 37 when the channel 17 in the disk 14 is in alinement with the rib 16. In this manner even where the disk 14 registers with the opening 28, the channel 17 is maintained in proper position to engage the rib 16 as the parts move to the right.

In the further construction of our invention we provide a brake switch, the one illustrated being designed for a two motor equipment and comprising drums 41 and 42 mounted on a shaft 43 and suitably inclosed in a casing 40. The casing 40 is secured at the top to a hollow extending portion of the casing section 5 within which a connecting rod 45 operates. A rocker arm 44 is secured to the upper portion of the shaft 43 and is pivotally connected to one end of the rod 45. The opposite end of said rod is pivotally connected to a lever 46 pivotally mounted on a pin 47 secured to the casing section 5. The lever 46 is provided with an arm 48 on the end of which a roller 49 is carried. The roller 49 extends upwardly and works in a cam groove 50 cut in the under face of the casing section 4. This groove is concentric with the controller shaft except for a portion 53, which turns inwardly, as shown. The disk 35 fits in a recess in the under face of the casing section 4 and is provided with an irregular channel 52 adapted to aline with the channel 50 when the disk is in its fixed position with respect to the section 4. In the off position, the relation of parts is such that the roller 49 is at the extreme inner part of the groove 53 and the drums 41 and 42 are maintained by the connecting rod 45 in the position shown in Fig. 3, in which the contact fingers 54 are intermediate the running contacts 55 and the braking contacts 56. As before stated, in this position the lug 26 rests against the stop lug 27 and the disk 14 registers with the opening 28. If it is desired to propel the car, the controller handle is turned to

the right. The groove 17 then passes over the rib 16 and thus locks the gears 9 and 10 from relative movement so that the controller shaft is turned about its axis directly. During the same movement, the roller 49 is forced outwardly by the groove portion 53 into the groove 50 and the brake switch drums are thereby turned so that the contact fingers 54 engage the running contacts 55 and the proper circuit connections are made for running. The controller handle may then be turned through the various running positions as desired, the same being indicated by the movement of the dial plate 4 and the notches 29 with respect to the pin 30. If it is desired to apply the brakes, the controller handle being in the off position, the handle is moved to the left, but since the movement of the parts in this direction is prevented by the engagement of the lug 26 with the stop lug 27, and the disk 14 being free to turn on its own axis, it will be seen that the gear 10 is now rotated and thereby rotates the gear 9 in a direction opposite to that of the gear 10 and handle 13 but in the same direction as in running. During the preliminary movement of the handle and shaft 11 to the left, the groove 52 in the disk 35 is so arranged as to force the roller 49 still farther inwardly and thereby through the connecting rod 45 turn the drums 41 and 42 so that the contact fingers 54 engage the contact points 56 for setting up the combination of circuits for braking. Continued movement of the controller handle to the left brings the pointer 33 to the first of the braking notches 32 and thereafter the desired braking effect may be obtained in the usual manner by rotating the controller handle to its various braking positions as indicated on the disk 31. It will now be seen that with the above described construction the operating parts are positively locked together so that when the parts are in a running position, the brakes cannot be applied without returning the handle to off position and moving same in the opposite direction, and likewise when in a braking position the parts must first be returned to off position before going to the running notches, at the same time the brake switch is automatically shifted, as the controller handle passes through the neutral point, to the proper position according to the direction of movement of the handle.

Another feature of our improvements relates to improved means for cutting out one of a plurality of motors of a car, and for this purpose the drums 41 and 42 are loosely mounted on the shaft 43 and are provided at the respective opposite outer ends with transverse keys 56 adapted to engage in corresponding recesses cut in disks 57 secured to the shaft 43. Intermediate the drums 41 and 42 an arm 58 carried by the casing 40 surrounds the shaft 43, and mounted in said arm is a loose sleeve 59. Said sleeve is provided with a cylindrical recess 60, within which is mounted a coil spring 61. One end of the spring bears against one of the drums and the loose sleeve 59 is forced by the spring into yielding engagement with the end of the other drum. It will now be apparent that the drums are yieldingly maintained with the keys 56 locked in the disks 57, but when it is desired to cut out one of the motors, the corresponding drum may be grasped by the hands and moved inwardly against the resistance of the spring 61 so that the key 56 of the drum is disengaged from its recess and the drum can then be turned around 180 degrees and the key 56 allowed to drop back into its recess. The motor connected to that particular drum is thus cut out and the apparatus may be operated with the remaining motors in the usual manner.

Having now described the mechanical features of our improvements, the electric connections and circuits employed for setting up the improved braking combinations will be taken up.

Fig. 10 illustrates a development of a running controller C having a reverse switch RS and a brake switch BS with the various circuits to the motors and the brake magnet coils. Upon turning the controller handle to the first running position, as indicated by the dotted line 1 in Fig. 10, the reversing switch being in its forward position and the brake switch having been automatically shifted in this movement, as before described, so that the movable contact bars indicated by "Power in" engage the fixed contacts, and starting for convenience with the leading in trolley, the course of the current is through the trolley lead T1 to contact point T1 in brake switch BS by bar 1 to lead T1C and thence to point T1 on running controller C and through bars 2 and 3 to point R1, by lead R1 to main resistance MR and through the main resistance to lead R5 to point 19 in the reverse switch RS and thence by bar 4 to point A1 and through lead A1 to armature A No. 1 of motor No. 1, through armature to lead AA1 and thence to point AA1 in reverse switch and by bar 5 to point F1, through lead F1C to point F1C in BS and by bar 6 to lead F1 and thence through field F No. 1 of motor No. 1 to lead E1 and thence to a connection 7 in the controller C, which is connected to lead E1W going to point E1W in BS. Point E1W is connected by bar 8 to point E1F and thence through lead E1F to point E1 in controller C and thence by bars 9 and 10 to point 15, through lead 15F to point 15F in BS, through bar 11 to point 15W and thence by lead 15W to a connecting point 12 in the controller C, thence

by lead 15 to point 15 in RS and by bar 13 to point A2, thence through lead A2 to armature A No. 2 of motor No. 2 from which the current flows through lead AA2 to point AA2 in RS, by bar 16 to point F2 through lead F2C to point F2C in BS, by bar 17 to point F2 and thence through lead F2 to field F No. 2 of motor No. 2 thence through lead E2 to connecting point 18 in controller C to lead E2W and point E2W in BS, by bar 19 to point E2F and through lead E2F to point E2 in controller C by bars 20 and 21 to point T2 and thence to the return trolley lead or ground T2. It will thus be seen that the movement of the controller handle to the first running position connects up the motors in series with the full main resistance in the usual manner and by moving the handle through the positions 1 to 5 inclusive the resistance may be gradually cut out. Positions 6 to 9 serve to connect up the motors in parallel relation as will be understood without further tracing of the circuits.

If it is desired to apply the brakes the controller handle is turned from its off position in the reverse direction to that for running, as hereinbefore explained, by which movement the brake switch BS is rotated so that the set of bars indicated at the "brake in" position engage the stationary contact points, the reverse switch being in its forward position, and the drum of the controller having been rotated to its first position the following combination of circuits will be set up; starting at the AA1 terminal of armature A No. 1 the current flow is through lead AA1 to point AA1 in RS by bar 5 to point F1 through lead F1C to point F1C in BS and by bar 23 to point 24 which connects with point E2W. Thence the current flows through lead E2W to connecting point 18 in controller C and thence by lead E2 to field F No. 2 of motor No. 2. It will thus be seen that the armature of motor No. 1 is cross connected to the field of motor No. 2. From the field F No. 2 the circuit is traced through lead F2 to point F2 in BS and by bar 27 to point E1F2 which is connected to point E1F and also to lead E1F. Following first the connection through point E1F, it is found that bar 34 in BS connects same to point F1 which connects to field F No. 1 through lead F1, thence circuit is traced through lead E1 to point 7 in controller C, lead E1W to point E1W in BS, by bar 33 to point 32, to point B4, and thence by bar 30 to point F2C and lead F2C, to point F2 in RS and by bar 16 to point AA2 thence through lead AA2 to armature A No. 2 of motor No. 2, by lead A2 to point A2 in RS by bar 13 to point 15 and through lead 15 to point 12 in controller C, thence by lead 15W to point 15W in BS, and point 15W is connected by bar 35 to point R5W, lead R5W to point 19 in RS, by bar 4 to point A1 and thence by lead A1 to armature A No. 1 of motor No. 1. A closed circuit loop is thus formed including the two armatures of the motors each one of which is cross connected to the field of the other motor. Following the circuit through lead E1F to point E1 in controller C, it is found that point E1 is connected by bars 9 and 10 to point 15 which follows lead 15F to point 15F in BS by bar 28 to point B2 through lead B2 to one terminal of the brake magnet coil BC. The opposite terminal of the brake magnet coil BC is connected to the coil of the regulating switch device CS and thence the circuit is through lead B1 to point B1 in BS, by bar 36 to point T1C, lead T1C to point T1 in controller C, by bars 2 and 3 to point R1 by lead R1 to main resistance MR, through main resistance to lead R5 and thence to point 19 in RS by bar 4 to point A1 and through lead A1 to armature A No. 1 of motor No. 1. A local brake circuit is thus formed with the motor generator loop and including the brake magnet coils.

A switch bar 43 controlled by the regulating switch device CS is adapted in one position to connect points 40 and 41 leading respectively to the leads B3 and B1, so that a short circuit path around the brake resistance is formed at certain times. The switch bar 43 is also adapted in another position to connect points 44 and 45, the point 45 being connected to lead B2 and the point 44 being connected to a series of resistance units S1, S2, and S3, the resistance S3 being connected to lead B4 and leading to a point intermediate the resistances S1 and S2 and the resistance S2 being connected to lead E2. By this means a shunt resistance is inserted around each field in the upper closed position of the switch bar 43, the resistance S1 being the shunt for the field of motor No. 1 and the resistance S2 for the field of motor No. 2 in connection with the common resistance S3.

The circuit connections being as described above, when the controller is first thrown to a braking position, the solenoid coil of the regulating switch device CS has practically no current flowing through it, so that the switch bar 43 remains in its lower position connecting the points 40 and 41, and as the points 44 and 45 are disconnected, the shunt resistances around the fields are cut out for the moment and the motors are acting as generators to supply current to the brake circuit with the short circuit path closed by the regulating switch device. It follows that the current is permitted to build up rapidly in the brake coils and thereby cause the quick movement of the brake shoes to the rails. As soon as the current reaches a predetermined strength according to the adjust-

ment of the regulating switch device CS, the coil thereof operates to disconnect the switch points 40 and 41 and to connect the switch points 44 and 45. This movement cuts in the shunt resistances around the motor fields and opens the short circuit branch of the brake circuit, so that the path of the current is then through the main resistance MR. The normal braking circuit is then produced for the first brake notch and the braking effect may thereafter be increased as desired by moving the controller handle to the successive braking positions which correspond with the running positions 1 to 5 on the controller C, the amount of resistance MR being varied, as will be readily understood.

By connecting up the shunt resistances S1 and S2 as hereinbefore described, in case either motor circuit becomes broken, the other motor will still be available to generate current; for example, if the field circuit of motor No. 1 is broken, then a circuit still exists from the armature of motor No. 2 through the resistances S1 and S2 and thence through the field F No. 2, so that current is generated by one armature and its own field and thus the braking effect of one motor generator will still be provided.

By cross connecting the armature of one motor with the field of the other motor the current output of the motors is equalized, as any tendency of one armature to generate current at a greater or less rate than the other is compensated for by reason of a corresponding strengthening or weakening of the field of the other motor.

In moving one of the drums in the brake switch so as to cut out a motor, the circuit of that particular motor is opened and the proper connections are made by contact bars so that the other motor may operate alone. The bars which connect in the movement of the cut out drum between the brake and power positions with the fixed contact points are shown in the diagram of the brake switch as "Brake out" and "Power out" respectively.

It will now be seen that by the movement of a single controller handle the circuits may be made either for propelling the car or for applying the brakes and that when the handle is set to any position the parts are securely locked, so that it is impossible to make a change in the connections without returning the handle to off position and moving same in the opposite direction. It will also be noted that the braking attachment is adapted to be applied to a running controller without altering the mechanical construction thereof, the only change being as to the electrical connections and wiring.

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

1. In an electric brake mechanism, the combination with a running controller provided with an operating handle having two axes of rotation, of means for operating the controller upon movement of the handle about either axis of rotation.

2. In an electric brake mechanism, the combination with a running controller provided with an operating handle having two axes of rotation, of means for operating the controller upon rotation of the handle about one axis in one direction and about the other axis in the opposite direction.

3. In an electric brake mechanism, a running controller having a handle adapted to be moved in one direction about one axis of rotation from its neutral position for running and in the opposite direction about another axis of rotation for braking.

4. In an electric brake mechanism, the combination with a running controller having a handle adapted to be moved in one direction about one axis of rotation from its neutral position for running and in the opposite direction about another axis of rotation for braking, of means for moving the controller in the same direction upon movement of the handle in either direction.

5. In an electric brake mechanism, the combination with a running controller comprising a set of movable contacts, a set of fixed contacts, and an operating handle having two axes of rotation, of means for operating the movable contacts over the fixed contacts in the same direction upon movement of the handle in one direction about one axis for running and in the opposite direction about the other axis for braking.

6. In an electric brake mechanism, the combination with a running controller having a main shaft and an operating handle therefor carried by an auxiliary shaft and adapted at one time to rotate about the axis of the main shaft and at another time about the axis of the auxiliary shaft, of means operatively connecting the main and auxiliary shafts and locking mechanism for preventing rotative movement of the handle about one axis upon its movement about the other axis.

7. In an electric brake mechanism, the combination with a running controller having a main shaft, an auxiliary shaft operatively connected to the main shaft, and a handle mounted on the auxiliary shaft and adapted to rotate about the axis of the main shaft at one time and the axis of the auxiliary shaft at another time, of means rigid with the auxiliary shaft having a slot, and a projecting rib carried by the controller for engaging said slot in the movement of the handle about the axis of the main shaft to lock said handle against rotation about the axis of the auxiliary shaft.

8. In an electric brake mechanism, the

combination with a running controller having a main shaft, of a braking attachment comprising a gear adapted to operate with the main shaft, an auxiliary shaft carrying a handle and a gear adapted to mesh with the first gear, of means for locking the auxiliary shaft and the second gear against movement about the axis of the auxiliary shaft upon movement of the handle in one direction about the axis of the main shaft and means for holding the auxiliary shaft from movement about the main shaft upon movement of the handle in the opposite direction.

9. In an electric brake mechanism, the combination with a running controller having a handle adapted to operate about one axis in one direction from its neutral position for running and about another axis in the opposite direction for braking, of means for moving the same contact bars of the controller switch over the same set of contact points for both running and braking, a brake switch having a set of contacts for running and a set for braking, and means operated by the handle in passing over the neutral position for automatically shifting the brake switch from one set of contacts to the other.

10. In a combined braking and running controller mechanism, the combination with a controller switch comprising a plurality of drums provided with contact points for controlling the circuits of corresponding motors, of means for locking the drums in their normal operating position adapted to permit the shifting of one of the drums from its normal operating position to cut the corresponding motor out of action.

11. In an electric brake mechanism, the combination with a running controller and a brake switch comprising a plurality of drums provided with contact points for controlling the circuits to corresponding motors, of a yielding resistance means for normally maintaining the drums locked in the relative position for operating, and adapted to permit one of the drums to be unlocked and turned so as to lock in another position to cut the corresponding motor out of action.

12. In an electric brake mechanism, the combination with a running controller, of a combined braking and running attachment adapted to be applied as a unit to the operating shaft of the running controller and comprising a brake switch, means operated by the movement of the controller handle in one direction for setting up the running combination of circuits in the brake switch and in the opposite direction for setting up the braking combination of circuits, and mechanism for utilizing the same set of contacts in the controller for both running and braking.

13. In an electric brake mechanism, the combination with a running controller having means for utilizing the same set of movable and fixed contacts for both running and braking, of a brake switch adapted to connect up the motors to act as generators in a local brake circuit and means having electrical connections in a braking position for producing a temporary initial rush of current in the brake circuit.

14. In an electric brake mechanism, the combination with a running controller having means for utilizing the same set of movable and fixed contacts for both running and braking, of a brake switch adapted to connect up two motors to act as generators in a local brake circuit and electric connections whereby in braking the armature of one motor is cross connected to the field of the other motor.

15. In an electric brake mechanism, the combination with a running controller having means for utilizing the same set of movable and fixed contacts for both running and braking, of a brake switch adapted to connect up two motors to act as generators in a local brake circuit, electric connections whereby in braking the armature of each motor is cross connected to the field of the other motor, and a resistance interposed between said cross connections.

16. In an electric brake mechanism, the combination with a running controller having means for utilizing the same set of movable and fixed contacts for both running and braking, of a brake switch adapted to connect up the motors to act as generators in a local brake circuit, an electric switch controlling device having switches for controlling shunt resistances connected around the fields of the motors and a switch for controlling a short circuit around a resistance connected up in the local brake circuit.

17. An electric switch mechanism, comprising a running controller having means for utilizing the same set of movable and fixed contacts for both running and braking, a brake switch adapted to connect up the motors to act as generators in a local brake circuit, a switch controlling device for controlling shunt resistances around the motor fields and a short circuit around a resistance in the local brake circuit, and electric connections whereby at first upon movement of the controller handle to a position for braking, the short circuit is closed around the local brake circuit resistance and the shunt resistance circuits are open, the switch controlling device being adapted to then open the short circuit and close the shunt circuits around the motor fields.

18. In an electric brake mechanism, the combination with a running controller provided with an operating handle, of an attachment operated by the movement of the handle in either direction for turning the

controller in the same direction, comprising an operating connection interposed between the handle and the controller and a tongue and coöperating groove mechanism for locking said operating connection.

19. In an electric brake mechanism, the combination with a running controller provided with an operating handle, of an attachment operated by the movement of the handle in either direction for turning the controller in the same direction, comprising a gear adapted to rotate on its axis to turn the controller upon movement of the handle in one direction and a tongue mounted in a groove for locking said gear to permit the controller to be turned upon movement of the handle in the opposite direction.

20. In an electric brake mechanism, the combination with a running controller and an operating handle therefor, of a gear interposed between the handle and the controller and a tongue operating in a groove for locking said gear to form a rigid connection from the handle to the controller, said tongue and groove having a relative position in which the gear is free to turn about its axis to operate said running controller.

21. In an electric brake mechanism, the combination with a running controller provided with an operating handle, a reversing gear operatively connected to said handle and the controller, a tongue adapted to engage in a slot associated with said gear to lock the same and thereby form a rigid operating connection between the handle and the controller, said tongue being cut away at one point to permit the rotation of the gear about its axis so as to turn the controller in a direction opposite to that of the handle.

22. The combination with two motors adapted to be driven by the momentum of the car to act as generators in a local brake circuit, of a controller having contact points for cross connecting the field of one motor with the armature of the other motor and for connecting up a shunt resistance around each motor field, the shunt resistance circuit being adapted to complete a local circuit for one motor field and armature upon failure of the other motor circuit.

23. In an electric brake mechanism, the combination with a running controller provided with an operating handle having its axis eccentric to an axis of rotation, of means for operating the controller upon movement of said handle about said axis of rotation.

In testimony whereof we have hereunto set our hands.

JOSEPH N. MAHONEY.
WALTER M. AUSTIN.

Witnesses:
WM. M. CADY,
A. M. CLEMENTS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."