No. 838,160. PATENTED DEC. 11, 1906

W. D. BALDWIN & A. SUNDH.

COMPOUND BRAKE FOR CARS.

APPLICATION FILED MAR. 7, 1905.

3 SHEETS—SHEET 1.

FIG. 1.

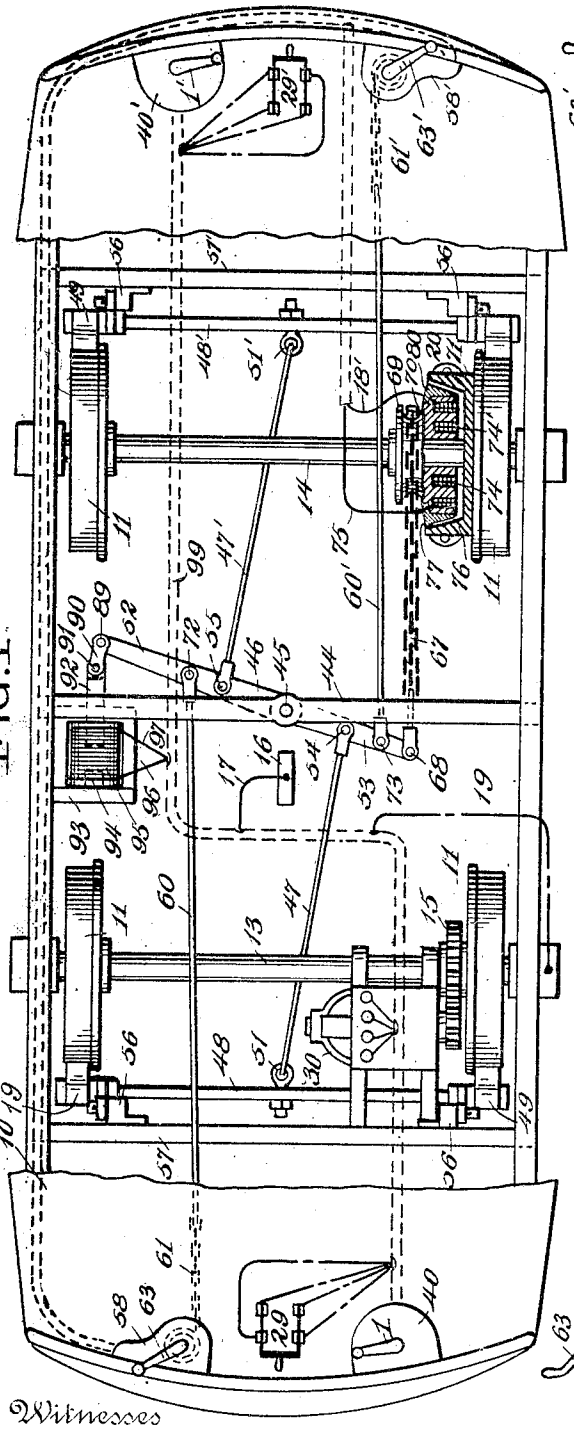
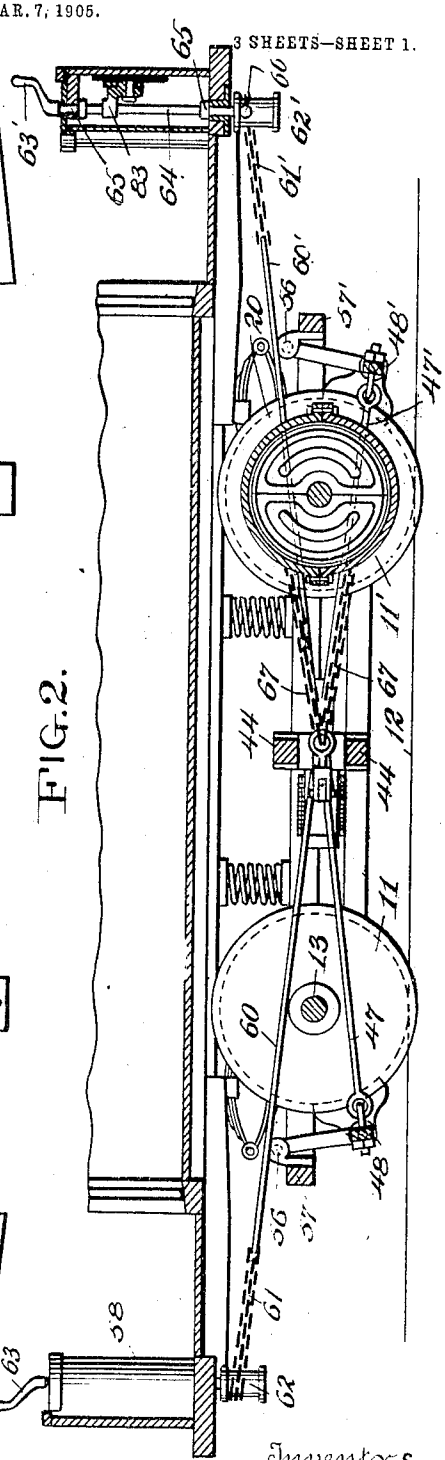


FIG. 2.



Witnesses
Walter C. Strang
Henry E. Foltz

Inventors
William D. Baldwin
August Sundh

By Attorneys
Brown & Darby

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Fig. 3.

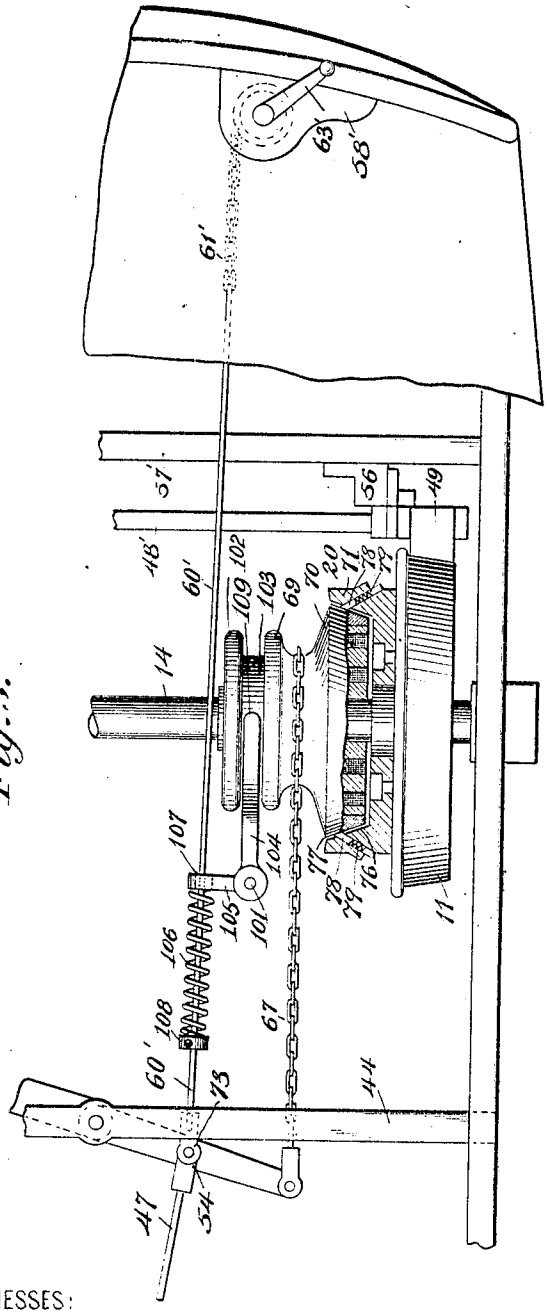
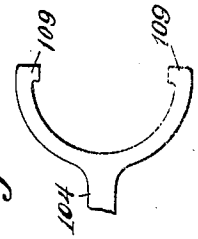


Fig. 3a.



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Walter C. Strang

Henry E. Kirby

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William D. Baldwin

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BY

Brown & Darby

ATTORNEYS

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3 SHEETS—SHEET 3.

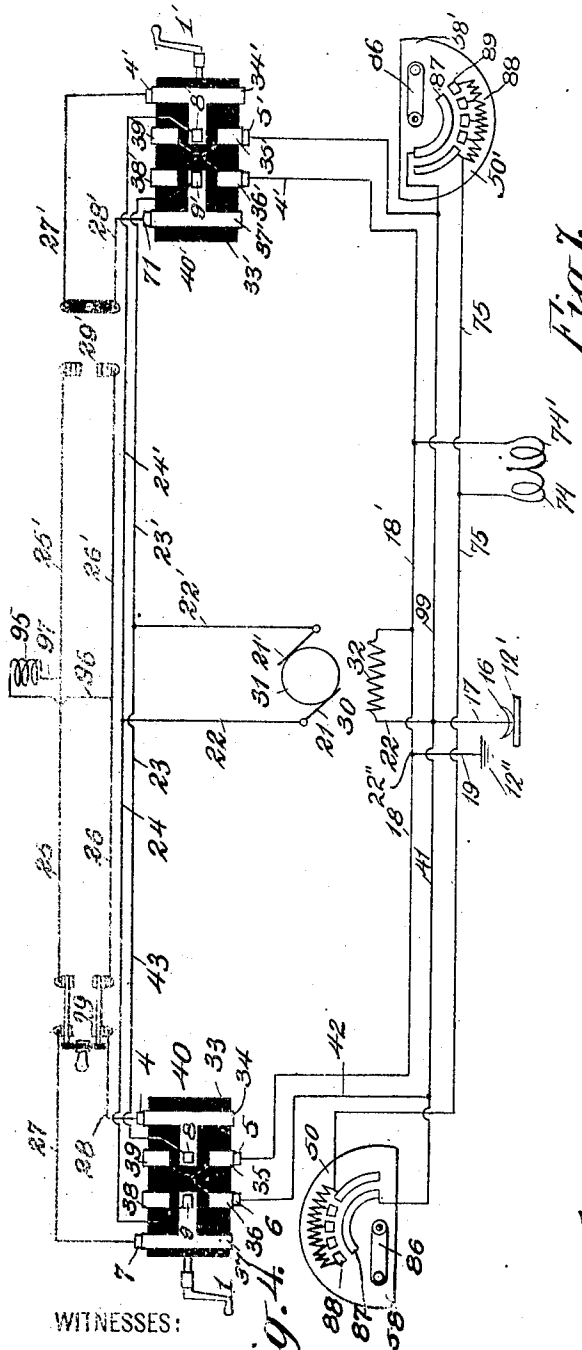

Fig. 4.

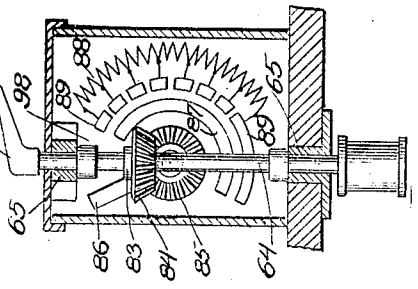

Fig. 7.

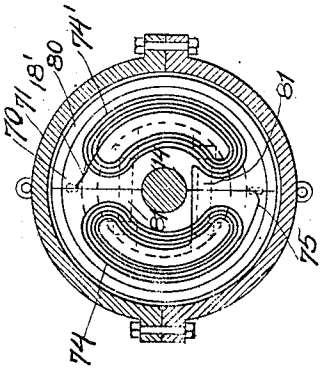

Fig. 6.

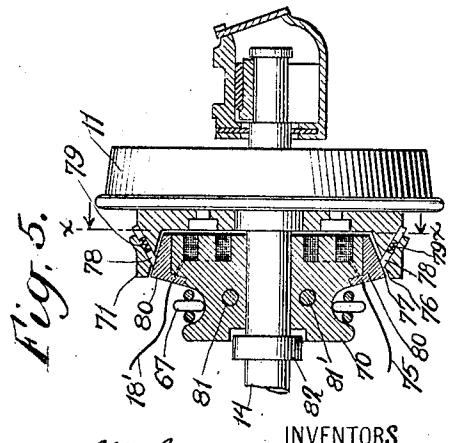

Fig. 5.

WITNESSES:

Walter C. Strang

Henry C. Kirby

INVENTORS

William D. Baldwin

August Sundh

BY

Brown & Darby.

ATTORNEYS

UNITED STATES PATENT OFFICE.

WILLIAM D. BALDWIN, OF NEW YORK, AND AUGUST SUNDH, OF YONKERS, NEW YORK.

COMPOUND BRAKE FOR CARS.

No. 838,160. Specification of Letters Patent. Patented Dec. 11, 1906.

Application filed March 7, 1905. Serial No. 248,873.

To all whom it may concern:

Be it known that we, WILLIAM D. BALDWIN, residing in the city of New York, county of New York, and AUGUST SUNDH, residing in Yonkers, county of Westchester, State of New York, citizens of the United States, have invented a Compound Brake for Cars, of which the following is a specification.

Our invention relates to brakes for cars, and particularly to brakes for cars electrically operated.

Our invention has for its object the provision of a brake for cars so constructed and arranged that it may be both manually and electrically operated from substantially the same point.

One of the advantages of our invention is that if the current should be interrupted to the electrical means for applying the brake—for instance, by the shoe on the third rail of an electrical railway not making contact or jumping said third rail—the manual means is at once operative to effectually apply the brake.

Our invention comprises manual and electrical means for applying a brake to a car operated from substantially the same point and further electrical means operative from the motor acting as a dynamo and coming into action after the first-named electrical means or manual means, or both, have operated.

Our invention is illustrated in the accompanying drawings, in which like characters of reference indicate like parts, and in which—

Figure 1 is a plan view of a railway-car with certain parts broken away and other parts in section to show the application of our invention to the bottom part of the car-body. Fig. 2 is a side elevation of the lower part of the car, showing our invention attached thereto. Fig. 3 represents a portion cut away from Fig. 1 and shows a modification. Fig. 3ª is a detail view of the same. Fig. 4 is a diagrammatic view showing a system of wiring applicable to an electrically-driven car and to the electrical means for operating our brake. Figs. 5, 6, and 7 are enlarged views of details hereinafter described.

Referring to Figs. 1 and 2, the reference-number 10 designates a railway-car, and 11 its wheels, one of which is fitted with an electromagnetic clutch 20, described hereinafter. The rails over which the car is adapted to run are designated by the number 12. 30 is the electric motor, shown connected to the axle 13 by suitable gearing 15. Two of the car-wheels 11 11 are rigidly secured to this axle, while the other two are similarly secured to the axle 14. 99 designates a conduit for carrying the wires. The electric motor 30 is arranged to be connected to and disconnected from a suitable source of electrical supply through a controller 40 or 40′. (Shown diagrammatically in Fig. 4.) The controllers may be of any suitable type and so, also, the wiring for the same. In Fig. 4 simple controllers and wiring for controlling the motor are shown; but we will not describe these in detail, as they specifically form no part of our invention. A brief description, however, is thought to be necessary in order to make clear the application of our invention thereto.

Referring now to Fig. 4, wherein 12′ represents a portion of the third rail and on which is adapted to slide the shoe 16, a wire 17 leads from shoe 16 to the shunt field 32 of the motor. The motor is herein shown shunt-wound for the sake of simplicity. Connected to the shunt field are the wires 18 and 18′, leading to the controllers 40 and 40′, respectively. Connected to the wire 18 at the point 22″ is a wire 19, grounded on the rails, as indicated at 12″. Thus a complete circuit is maintained through the shunt field 32 so long as the shoe 16 is on the third rail 12′. The motor-armature 31 is provided with brushes 21 and 21′, which through the wires 22 and 22′ are connected, respectively, to the wires 24 24′ and 23 23′, leading to the controllers 40 and 40′. Also connected to the controllers 40 and 40′ by the wires 27, 28, 27′, and 28′ are shown the double knife-switches 29 and 29′, that at the left being shown closed and that at the right open. The switches 29 and 29′ are connected with each other by the wires 25 25′ and 26 26′, one switch being placed at one end of the car and the other at the other end of the car near the controllers 40 and 40′, respectively, as shown in Fig. 1.

The controllers each comprise a series of fixed fingers or wipers adapted to make electrical contact with metallic strips shown mounted on an insulating-drum which is constructed to be rotated on its axis by means of a suitable handle. As the controllers are constructed alike, a description of the one at the left of Fig. 3 will suffice. The drum 33 is

snown made of insulation and as having the strips 34, 35, 36, 37, 38, and 39 mounted thereon. Bearing on 34, 35, 36, and 37, respectively, are the fixed fingers 4, 5, 6, and 7. Also bearing on the strips 34 and 37, at the central extensions thereof, are the stationary fingers 8 and 9. The strip 35 is electrically connected to the strip 38 and the strip 36 is electrically connected to the strip 39, as shown by the white dotted lines. The strips 38 36 and the extension of the strip 37 are circumferentially in line with each other and with the fingers 9 and 6. The strips 39 35 and the extension of the strip 34 are arranged in a similar manner with relation to the fingers 8 and 5. As shown in Fig. 4, the motor is electrically disconnected from the third rail.

With the switch 29′ open and 29 closed the controller at the left if operated by means of the handle 1 will cause the motor to start in one direction or the other, depending upon which direction the handle is moved. Supposing the handle is turned in a clockwise direction, so that fingers 8 and 9 will respectively make contact with the strips 39 and 38, a circuit will be closed through the motor from the third rail 12′ to and through the shoe 16, wires 17 41 42, finger 6, strips 36 and 39, finger 8, wires 43 22′, brush 21′, armature 31, brush 21, wires 22 and 24, finger 9, strips 38 and 35, finger 5, wires 18 and 19, to the rails, which are connected to the negative terminal of the source of supply, the positive terminal being connected to the third rail. A complete circuit through the motor is thus established to revolve the same and propel the car in a certain direction. Upon moving the controller-handle counter-clockwise, so that contacts 8 and 9 make direct contact with the strips 35 and 36, respectively, it is obvious that the circuit through the motor will be reversed to revolve the same, and consequently move the car in a reverse direction. The controller as shown is therefore in reality only a reverser as thus far described.

The mechanical brake-rigging will now be described. Mounted on the truck at the bottom of the car-body is a double cross-piece 44, at substantially the central point of which is pivoted at 45 the double brake-lever 46, having the arms 52 and 53. To said arms at 54 and 55 are pivoted the rods 47 and 47′, respectively. These rods are suitably connected at 51 and 51′ to the brake-beams 48 and 48′, respectively. These brake-beams are suitably pivoted at 56 to the cross-beams 57 and 57′, which are also fixed to the truck. The brake-shoes 49 are mounted on the ends of the brake-beams 48 and 48′ and are normally held away from the peripheries of the wheels 11 in any suitable manner.

At each end of the car is mounted the brake-controlling means comprising a handle 63, adapted to be connected to the staff 64, constructed to rotate in the fixed bearings 65. Rigidly connected to the lower end of the staff 64 is a small drum 62 or 62′, to which is fastened at 66 a chain 61 or 61′, connected to the tie-rod 60 or 60′. The brake-controlling means are alike at both ends of the car, so that an operation of either or both will effectually set the brake-shoes 49. The tie-rods 60 and 60′ are pivoted at the points 72 and 73 to the arms 52 and 53 of the brake-lever 46. Suitably secured, as by means of a clevis, to one end of the brake-lever 46 at 68 are two chains 67 67, fastened at their other ends to the pulley 69, at the right-hand side thereof, as viewed in Fig. 2. This pulley 69 is rotatably mounted on the car-axle 14 and is rigidly secured to or made integral with the magnetic member or pole-piece 70 of the magnetic clutch 20. The other magnetic member of the clutch is designated by the reference-number 71 and is rigidly secured to one of the car-wheels 11. This member 71 serves as an armature for the electromagnet, whose coils are represented by the reference-numbers 74 74′. The member 71 is cup-shaped and has an annular inclined wearing-surface 76, which is adapted to make frictional engagement with the corresponding circumferential inclined surface 77 of the member 70.

The details of the magnetic clutch are shown in Figs. 5 and 6. The magnetic member 70 is mounted loosely on the axle 14 and has a small longitudinal movement thereon, which is limited in one direction by the collar 82 and in the other direction by the member 71, fixed to the axle 14. The magnetic member 70 is split diametrically and the halves secured together by the bolts 81 and 81′. The member 71 is similarly constructed. Embedded in the member 70 are two coils 74 and 74′, one in each half, the two coils being connected in series to wires 18′ and 75, as shown diagrammatically in Figs. 1 and 4 and in detail in Fig. 6.

It is to be observed that one terminal of these coils is connected to the rails over which the car travels—that is, the coil 74′ is connected to the ground 12″ through wires 18′ and 19. The peripheral portion of the member 70 is provided with a magnetic ring of good wearing material. Arranged to bear on said rings are the graphite brushes 78 78, kept continuously in contact with the ring 80 by means of the springs 79 79. These brushes keep the peripheral surface 77 of the ring 80 lubricated, thus preventing cutting between this ring and the member 71. The ring 80 can be easily removed and replaced, however. Securely mounted on the staff 64 is a hub 83 of a bevel-gear 84, which meshes with another bevel-gear 85, herein shown as placed at right angles thereto. To the gear 85 is secured a metallic arm 86, adapted to make electrical contact with the segment 87 and contacts 89 when the brake-handle 63 is re-

volved in a clockwise direction. The last contact 89 is made longer than the others, and the segment 87 is extended to correspond therewith, so that after all the resistance 88 is cut out, as hereinafter explained, the brake-handle 63 can be moved farther to hold the brake applied without breaking the circuit to the magnetic clutch.

Mounted in a frame 93 on the lower part of the car-body between the wheels on the side opposite to that of the magnetic clutch 20 and so as to be adjacent the mechanical brake-rigging is a solenoid 95. This solenoid is provided with a fixed core 94, projecting a short distance into the solenoid, as shown in Fig. 1, and also with a movable core 92, which is pivoted at 91 to a link 90. This link 90 is pivoted at 89 to the arm 52 of the brake-lever 46. The solenoid 95 is connected by wires 96 and 97 with the wires 25 25′ and 26 26′, as shown in Fig. 4.

The operation of the invention will now be fully described. Let it be assumed that the current from the motor has been turned off and that the car is running by reason of its momentum and it is desired to bring the car to a gradual and quick stop. The circuits and connections will then be as indicated in Fig. 4. The relation between the variable rheostat 98 and the mechanical means for actuating one of the brakes is such that the arm 86 makes electrical connection between the segment 87 and the contacts 89 before the brake-shoes 49 are manually applied to the wheels 11. Therefore after the current has been turned off from the motor and the handle 63 has been turned in a clockwise direction a circuit is closed by the arm 86 from the third rail 12′ to and through the wires 17 and 99, segment 87, said arm 86, first contact 89, all of the resistance 88, wire 75, coils 74 and 74′, wires 18′ and 19, to the source of current-supply. Thus a small amount of current is admitted to the coils of the magnetic clutch, which is consequently energized, and the member 70 is drawn toward the member 71. The tendency will then be for the member 70 to share the rotation of the axle 14 by reason of the frictional engagement of the surfaces 77 and 76. As the arm 86 is moved farther in its arc of movement more of the resistance 88 is cut out, and hence more current is admitted to the coils of the clutch. As the current is thus gradually admitted, the magnetization of the magnetic clutch increases until the attraction between members 70 and 71, and consequently the frictional engagement between the surfaces 77 and 76, is at a maximum, when all the resistance 88 is cut out. The electromagnetic clutch 20 is therefore in reality an electromechanical brake electrically actuated and controlled by the rheostat. The chains 67 being connected to the pulley 69, one of them will be drawn so as to move the arm 53 toward the right, the pulling force on the chain being increased as the magnetization of the clutch increases. As the lever 46 is rocked on the pivot 45 the brake-shoes 49 will be applied through the rods 47 and 47′ with increasing force. The magnetic clutch can be operated from either end of the car, the rheostats being connected in parallel. As soon as the controller was placed in the position shown in Fig. 4 the coil 95 was connected in series with the brushes of the motor. The motor-armature continuing to revolve while the car is moving by its own momentum through the gearing will cause a current to be generated, which current passes through the coil 95. The circuit through the coil 95 may be traced from the brush 21, to and through the wire 24, finger 9, strip 37, finger 7, wire 27, one blade of switch 29, wire 25, coil 95, wire 26, the other blade of switch 29, wire 28, finger 4, strip 34, finger 8, wires 23 and 22′, and brush 21′, back to the armature. The motor thus acting as a dynamo will in combination with the circuit just traced act as a dynamic brake and to energize said coil 95; but this coil 95 is so constructed that it will not have sufficient strength to operate the brake-rigging to effectually apply the shoes 49 while the core 92 is in a certain predetermined position, but as the brakes-shoes are applied through the magnetic clutch the core 92 is moved farther into the field of the coil 95. After a certain movement of this core the coil acts to effectively assist in applying the brake-shoes and hold the same in place. As the car slows down, however, the current through this coil is gradually reduced to zero when the car has come to a stop, the current through the magnetic clutch continuing until the handle 63 is moved to its initial position.

Fig. 3 represents a modification of our invention in which the electromagnetic brake may be applied manually by the operation of the same handle from which the brake-shoes are manually applied. To accomplish this result, we secure to the pulley 69 a circumferentially-grooved collar, the groove being designated by the reference-number 103. Pivotally mounted on the truck at point 101 is a bell-crank lever having one of its arms 104 forked and provided with inwardly-projecting lugs 109, which fit loosely in the groove 103. A detailed view of the forked arm is shown in Fig. 3ª. The other arm 105 of the lever is provided near its end with a longitudinally-extending slot 107, through which passes the rod 60′. On this rod at 108 is a collar normally rigid with the rod 60′, but adapted to be loosened and moved along the same to adjust the tension of the long spring 106. This spring is placed on the rod 60′ between the arm 105 and the fixed collar 108 and is so adjusted that normally it exerts no pressure whatever to move

the arm 105 toward the right, and consequently the clutch member 70. When the handle 63′ is operated, however, to close the circuit to the electromagnetic clutch and to increase the current strength therein, the chain 61′ is wound on the drum 62′ and the rod 60′, with its collar 108, is pulled toward the right. This operation may act to throw the magnetic members of the clutch into closer and more effective relation with each other or it may place the parts in such position that upon further movement of the brake-lever after the clutch has been fully energized the clutch-brake may be held in braking position or the effect thereof increased. It is therefore seen from the foregoing that should the magnetic clutch become inoperative—as, for instance, by reason of lack of current in its coils from some cause—the brake can be applied mechanically by the same handle that operates the rheostat which controls the magnetic clutch. Furthermore, the braking effect is increased by the operation of the core 92 and parts connected therewith, depending on the speed of the car.

It is obvious that in going upgrade the coil 95 could not be used alone to hold the car after stopping and for the same reason the magnetic clutch used alone or therewith would not hold the car on an upgrade should the current-supply be cut off from the coils of the magnetic clutch. On a downgrade the dynamic brake and coil 95 with its movable core would be operative to keep the car from going at a dangerous speed; but its circuit may become deranged and on any grade or on a level the electrical braking means may become inoperative due to a derangement of circuits or lack of current. We therefore provide a means for operating either one or both of the aforementioned brakes manually in case of emergency, the said brake or brakes being actuated or applied from the same handle by which the current to the magnetic clutch is controlled, so that no time shall be lost. So long as the magnetic clutch operates properly very little power is necessary to manually operate the handle 63—that is, only sufficient power to operate the rheostat and keep the chain 61′ taut is required to set or apply the brakes. After the brakes are applied the handle is in such position that should the electromechanical brake give way the brakes directly applied to the car-wheels may be kept set or again brought into effective operation manually by a small further movement of this handle, or at any time by means of the brake-handle both brakes may be controlled and the brake which is mechanically applied held set or its action increased independently of the electrical means for operating the magnetic clutch.

We have herein disclosed one form with a modification of our invention; but we do not wish to be limited thereto, as various changes may be made in the details of construction and arrangement of parts without departing from the spirit and scope of said invention.

What we do claim as our invention, and desire to protect by Letters Patent, is—

1. The combination with a motor connected to operate as a momentum-driven generator, of an electroreceptive device in circuit therewith, a brake, actuating means for applying said brake, electromagnetic apparatus for operating said actuating means, manual means for assisting in the operation of said actuating means, and means connected to said actuating means and controlled by said electroreceptive device for holding said brake applied or increasing the action thereof independently of said manual means.

2. The combination with an electrodynamic brake comprising a motor-armature, of an electroresponsive device in circuit therewith, an additional brake, actuating means for applying said additional brake, electromagnetic apparatus for operating said actuating means, manual means for assisting in the operation of said actuating means, and mechanism connecting said actuating means and electroresponsive device, the aforesaid parts being so constructed and arranged that after the manual application of said additional brake said electroresponsive device shall hold the same applied or increase the action thereof.

3. The combination with a motor connected to operate as a momentum-driven generator, of an electro-receptive device in circuit therewith, a brake, electromechanical means for applying said brake, and means controlled by said electroreceptive device and connected to said electromechanical means for holding the brake applied or increasing the action thereof.

4. The combination with a brake, of actuating means for applying the same, electric means for operating said actuating means, an electrodynamic brake, an electroresponsive device in circuit therewith and connected to said actuating means for holding the first-named brake applied or increasing the action thereof independently of said electric means.

5. The combination with a motor connected to operate as a momentum-driven generator, of an electroresponsive device in circuit therewith, a brake, mechanical actuating means for applying said brake, an additional brake, electric means for applying said additional brake and connected to operate said actuating means, means for controlling said electric means, mechanical means for operating said actuating means to hold the first-named brake applied or increasing the action thereof, a handle for operating said controlling means and said mechanical oper-

ating means, and means connecting said electroresponsive device and actuating means to also hold said first-named brake applied.

6. The combination with a motor connected to operate as a momentum-driven generator, of an electroresponsive device in circuit therewith, a plurality of brakes, electromechanical means for applying said brakes, and means controlled by said electroresponsive device for holding one of said brakes applied or increasing the action thereof.

7. The combination with a brake, of electromagnetic means for applying the same, an additional brake, and mechanism for applying the same, connections between such mechanism and a device driven by the electromagnetic brake for also applying said first-named brake, a manual device connected to the aforesaid mechanism and also controlling the circuit of the electromagnetic means, and an electrodynamic brake.

8. The combination with a clutch-brake, of electromagnetic means for applying the same, means for lubricating said brake, a manual device carrying a circuit-closer for controlling the electromagnetic means, an additional brake, mechanism for applying the same and independent connections between said mechanism for applying the additional brake and the manual device and also from the aforesaid mechanism connected to and driven by the electromagnetic means.

9. The combination with a vehicle and a brake therefor, of a movable arm connected to the said brake for applying it, and connections between such movable arm and three independent actuating means, namely, a manual means, a means driven by the movement of the vehicle, and an electroresponsive device in the circuit of an electrodynamic brake.

10. The combination with a vehicle and a brake therefor, of a movable brake-arm for applying said brake, and connections between such movable arm and three independent actuating means, namely; a manual means, a magnetic clutch connected with one of the wheels of the vehicle, and an electromagnet comprising a solenoid and a movable core, said solenoid being connected in the circuit of an electrodynamic brake.

11. The combination with a motor, of an electromagnet in a normally open circuit with the motor-armature, a brake, electromechanical means for applying said brake, a connection between said electromagnet and said electromechanical means, and an electric switch for cutting off the current-supply from the motor-armature and closing the same upon itself through said electromagnet.

12. The combination with a brake, of actuating devices for applying the same, electric apparatus for operating said actuating means, an electrodynamic brake, an electromagnetic device in circuit therewith and connected to act on said actuating means to hold said first-named brake applied or increasing the effect thereof independently of said electric apparatus.

13. The combination with a motor, of an electromagnet comprising a solenoid and a movable core, a brake, mechanical actuating means for applying the brake, an electromagnetic clutch-brake, connections between said clutch-brake and said actuating means, a rheostat for controlling said clutch, a handle for operating said rheostat, connections between said handle and said mechanical actuating means, and circuits and connections including the usual car-controller for connecting the armature in a local circuit through said electromagnet.

14. The combination with a motor, of electromagnetic apparatus connected thereto, a mechanical brake, manual means for applying said brake, electrical means for applying said brake, and connections between said mechanical brake and said electromagnetic apparatus to permit the latter to hold said brake applied or increase the action thereof.

15. The combination with a motor connected to operate as a momentum-driven generator, of electromagnetic apparatus connected thereto, a mechanical brake, an electrical brake, means coacting with said electrical brake for applying said mechanical brake, a controlling device for said electrical brake, mechanical connections for actuating said mechanical brake, a single handle for operating said controlling device and actuating said mechanical connections to apply both of said brakes, and means operated by the aforesaid electromagnetic apparatus for holding said mechanical brake applied or increasing the action thereof independently of said handle and its connections or the electrical brake.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

WILLIAM D. BALDWIN.
AUGUST SUNDH.

Witnesses:
CHARLES M. NISSEN,
THOS. M. LOGAN