W. C. MARSH.

CAR BRAKE.

APPLICATION FILED OCT. 14, 1908.

950,336.

Patented Feb. 22, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

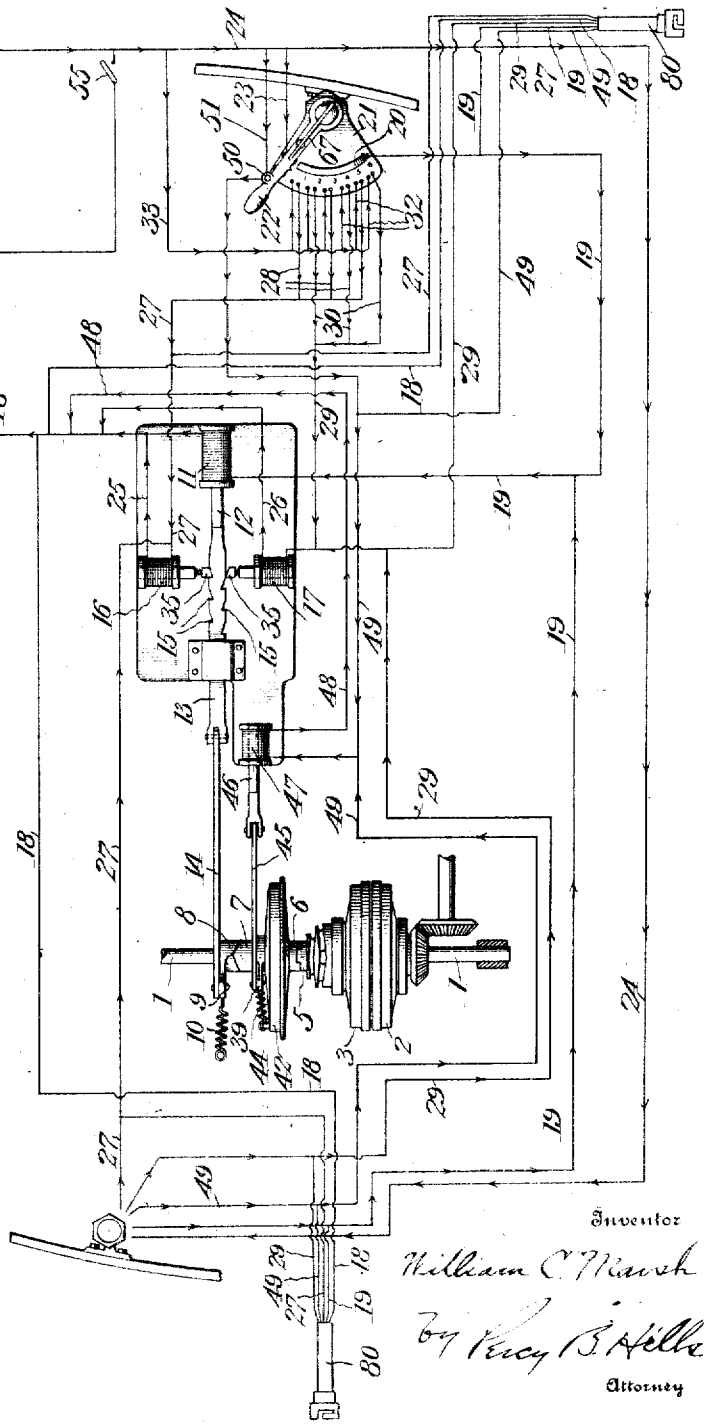
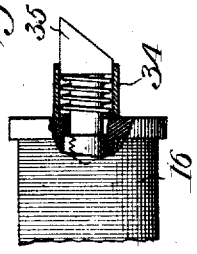


Fig. 6.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 2.

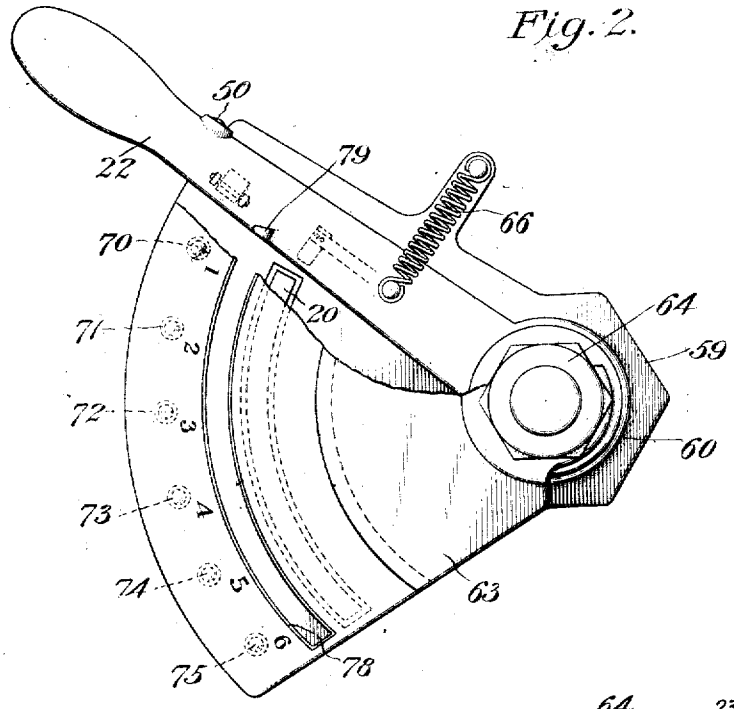

Fig. 3.

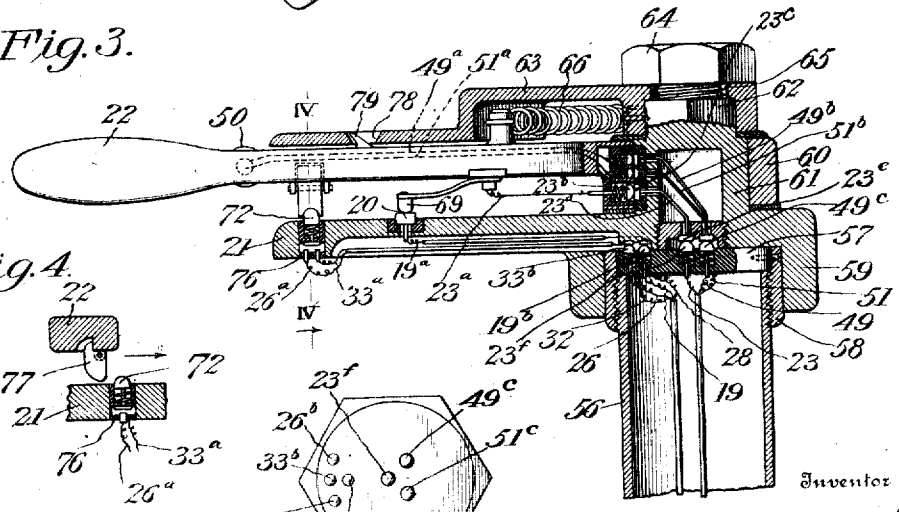

Fig. 4.

Fig. 5.

Witnesses

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3 SHEETS—SHEET 3.

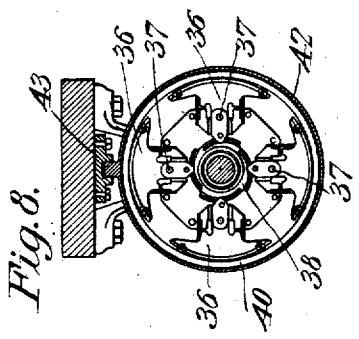

Fig. 8.

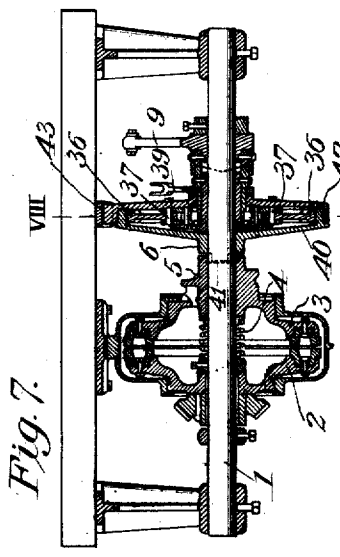

Fig. 7.

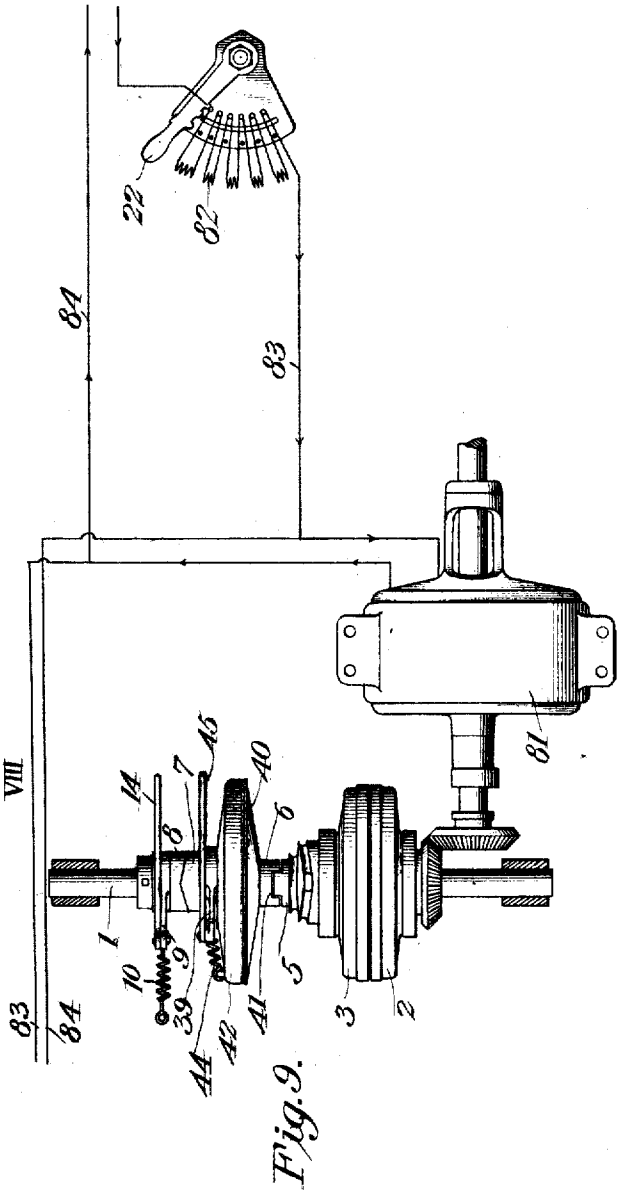

Fig. 9.

Witnesses

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UNITED STATES PATENT OFFICE.

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CAR-BRAKE.

950,336. Specification of Letters Patent. Patented Feb. 22, 1910.

Application filed October 14, 1908. Serial No. 457,644.

To all whom it may concern:

Be it known that I, WILLIAM C. MARSH, a citizen of the United States, residing at Dunkirk, in the county of Chautauqua, State of New York, have invented new and useful Improvements in Car-Brakes, of which the following is a specification.

My invention relates to car brakes wherein the same are applied by friction means driven either from the car axle or by an electric motor, and has for its primary object to provide an electrical control therefor whereby the same may be applied and locked through a lever under the control of the operator, and may then be either released or their force of application increased or diminished, as may be desired.

A further object of my invention, where the friction means is driven by an electric motor, is to normally supply a minimum current to said motor, and to automatically increase or diminish the same in proportion to the degree of application of said friction means to the brake, a common operating means accomplishing this result.

Still another object of my invention is to provide for simultaneously operating the various electrical controlling devices in a plurality of cars coupled together from a common controlling means in one of the cars.

These objects I accomplish in the manner and by the means hereinafter more definitely pointed out and claimed, reference being had to the accompanying drawings, in which:

Figure 1 is a diagrammatic view of my improved system as applied to a car. Fig. 2 is a top plan view of the controlling lever and its parts, the same being shown partly broken away. Fig. 3 is a vertical sectional view through said controlling lever and its supporting post. Fig. 4 is a detail sectional view on the line IV—IV, Fig. 3. Fig. 5 is a top plan view of the supporting post for the controlling lever, the latter and its parts being removed. Fig. 6 is an enlarged detail view, partly broken away, of one of the auxiliary solenoids. Fig. 7 is a detail vertical sectional view of the transverse shaft and the friction disks and brake mechanism carried thereby. Fig. 8 is a transverse sectional view on the line VIII—VIII, Fig. 7. Fig. 9 is a view similar to Fig. 1, illustrating a modified construction.

Similar numerals of reference denote corresponding parts in the several views.

In Letters Patent No. 896,063, granted to me August 11, 1908, and No. 896,649, granted to me August 18, 1908, there is disclosed a braking mechanism for cars wherein is employed a transverse shaft, upon which is mounted to freely rotate thereon a friction disk that is constantly rotated from the car axle when the latter is in motion; said shaft also having freely mounted thereon a second friction disk having a spiral groove therein of peculiar shape in which to wind a cable connected with the brake shoe mechanism for applying the latter. This second friction disk is movable longitudinally of said shaft to bring it into and out of frictional contact with the friction disk rotated from the car axle.

It is one object of my present invention to provide electrically operated mechanism for applying and releasing this braking mechanism.

In the said drawings, referring more particularly to Fig. 1, the reference numeral 1 denotes the transverse shaft mounted beneath the car body, the same carrying the two friction disks 2 and 3, all hereinbefore referred to. The friction disk 3 is slidable to and from the friction disk 2, being normally forced away by the coiled spring 4, and its hub 5 is keyed to rotate with the hub 6 of a clutch hereinafter to be described. The said clutch is bodily movable longitudinally of shaft 1, and is forced toward the friction member 2 by a cam surface 7 operated by the partial rotation of cam hub 8 which is rotated by lever 9 and retracted by spring 10.

Mounted on the under side of the car body is a solenoid 11, whose core 12 is extended into a bar 13, connected to lever 9 by a link 14, and provided with alternately disposed notches 15 on its opposite sides. Disposed at a right angle to the solenoid 11 and on opposite sides of the toothed bar 13 are the similar auxiliary solenoids 16 and 17. The circuits for said solenoids may be traced as follows: A wire 18 leading from one side of the line operating the car leads to solenoid 11, while from the said solenoid leads wire 19 that is branched to extend to the opposite ends of the car. By referring to the diagrammatic detail of the controlling mechanism at the right of Fig. 1 it will be seen that the wire 19 is connected to an elongated contact plate 20 mounted on the segment base plate 21, and that the con-

trolling lever 22 is connected by wire 23 with the wire 24 leading to the other side of the line current source. The contact plate 20, however, terminates just short of the lever 22 when the latter is in its normal inactive position, so that the circuit through solenoid 11 is completed only when lever 22 is moved from its normal inactive position, but continues until said lever is returned to its inactive position. The solenoids 16 and 17 are connected with line wire 18 by the wires 25 and 26, while on its other side the solenoid 16 is connected by branched wire 27 leading to both ends of the car, with wires 28 leading to a series of double contacts in the plate 21. Similarly the other side of solenoid 17 is connected by a branched wire 29 with a series of wires 30 leading to a series of double contacts similar to the contacts to which the wires 28 lead in the plate 21, said two series of contacts being arranged alternately in said plate, the contacts of wires 28 being numbered 1, 3 and 5 on said plate, while the contacts of wires 30 are numbered 2, 4 and 6. Leading from each of the other members of said contacts is a wire 32 connecting with a common wire 33 leading to the line wire 24.

From this description of the circuits it will be seen that none of the circuits through the solenoids 11, 16 and 17 will be closed while the lever 22 is in its normal inactive position shown, and that the spring 10 will, through lever 9, link 14 and bar 13, draw the core 12 of said solenoid to its outermost position shown in Fig. 1, the cores of solenoids 16 and 17 being also retained in their outermost positions by springs 34 so that their heads 35 will be forced into contact with bar 13 and the head 35 of solenoid 16 will engage the first notch 15 in said bar. Now, when the lever 22 is initially moved from its normal position contact will be at once made with plate 20, which will close the circuit through solenoid 11, thus operating on its core 12 to draw it within said solenoid, which movement is prevented by engagement of head 35 of solenoid 16 with the first of the notches 15 in bar 13. But as the lever 22 is moved farther the double contact at No. 1 on plate 21 is closed, as hereinafter described, by said lever, which closes the circuit through solenoid 16, thus retracting its core and releasing bar 13, which permits the core 12 and said bar to move inward until the next notch on the opposite side of said bar 13 is engaged by the head 35 of solenoid 17. A further movement of lever 22 will now break the circuit at No. 1 and then close the circuit at No. 2, which results in deënergizing solenoid 16 and energizing solenoid 17, which in like manner permits the inward movement of core 12 another step until head 35 of solenoid 16 engages the third of the notches on bar 13. Thus the continued movement of lever 22 will alternately energize and deënergize the solenoids 16 and 17, and permit a step by step movement to core 12 and bar 13 under the continued energizing of solenoid 11. This step by step movement will be imparted to lever 9, through link 14, and the cam hub 8, rotating with said lever 9, will, by its contact with cam surface 7, move the parts bodily on shaft 1 toward friction disk 2, so that contact is made between said disks 2 and 3 and the motion of the former imparted to the latter to wind the brake shoe operating cable thereon in the manner described in my Letters Patent hereinbefore referred to. In said Letters Patent I have disclosed a means for retaining the disk 3 in its wound position, which retains brakes set, and yet permits the friction disks 2 and 3 to be released from their frictional contact with each other. In the present structure, however, I have substituted for said holding mechanism a construction of pivoted radially movable gripping shoes disclosed in certain applications for Letters Patent filed by me February 11, 1908, Serial No. 415,429, and September 3, 1908, Serial No. 451,520, wherein, as shown in Figs. 7 and 8 of the present structure, a series of radially movable brake shoes 36 is provided, the same being pivoted at 37, and being controlled in their radial movement by a cam ring 38 which is in turn operated by a lever 39. Said shoes are projected against a braking surface 40 which is keyed at 41 to rotate with the friction disk 3, so that, when said braking surface is engaged and held by said brake shoes 36, said friction disk 3 will also be retained. The said brake shoes 36 are connected with the member 42 which is in turn held against rotation on the shaft 1 by its engagement with a bracket 43 fixed to the under side of the car body, which at the same time permits the necessary slight bodily movement of the parts on the shaft 1, due to the cam 8 when the friction disks 2 and 3 are brought into operative engagement.

Connected with lever 39 on one side is a coiled spring 44, which normally maintains said lever and its cam ring 38 in position to project the brake shoes 36 into clutching engagement with the braking surface 40, while on its other side said lever 39 has connected thereto a link 45, which is in turn connected to the core 46 of a solenoid 47 fixed to the car frame. The circuit for said solenoid is as follows: Extending from one side thereof is the wire 48 which leads to the line wire 18, while from the other side extends the branched wire 49 which leads to a normally open circuit closing button 50 on the operating lever 22, from which leads a wire 51 connected to line wire 24 on the other side of the source of power.

In operation the solenoid 47 is normally deënergized by the break in the circuit at the button 50, and the brake shoes 36 are applied to breaking surface 40 by the action of spring 44 on lever 39. But when the operator grasps the handle of lever 22 to operate the same, he will, by pressing said button 50, as hereinafter described, close said circuit and energize solenoid 47, which will result in drawing lever 39 toward said solenoid and against the tension of spring 44, whereby cam ring 38 will be rotated and the brake shoes 36 retracted to permit their release from the braking surface 40. As this action takes place before the lever 22 is moved to energize solenoid 11, the friction disk 3 is free to be rotated by its contact with friction disk 2 when lever 9 and cam 8 are subsequently operated through the movement of lever 22 and the energizing of solenoids 11, 16 and 17, as hereinbefore described. When the car brakes have been applied with the desired force, they may be retained thus applied by simply releasing button 50, which breaks the circuit to solenoid 47, thereby releasing lever 39 and permitting its return to its initial braking position under the tension of spring 44, which will at once again apply the brake shoes 36 to braking surface 40 and thus retain said braking surface and the set friction disk 3 in the position to which it has been moved by its frictional contact with friction disk 2. The lever 22 may then be released to return automatically to its initial position, as hereinafter described, and the car brakes will remain set until the button 50 is again pressed to close the circuit through solenoid 47 and thus release the braking surface 40, which will permit the same and friction disk 3 to return to their initial unbraking positions. In fact, as the lever 22 is adapted to automatically return to its initial position when released, as hereinafter described, the removal of the operator's hand from said lever will simultaneously apply the brake shoes 36 and move the friction disks 2 and 3 from contact, thereby preventing undue wear on the latter and yet retaining the car brakes in their set position.

When the car brakes have been applied and locked, say to the extent of the No. 3 position of the lever 22, and it is desired to apply them to a greater degree, the same may be accomplished by moving the lever 22 again to the No. 3 position, but without pressing the button 50. Upon then pressing the button, the brake shoes 36 will be released, but the disk 3 will be retained in its position by the frictional contact with disk 2, and a further movement of lever 22, say to the No. 4 position, with button 50 still pressed, will increase the frictional contact and still further rotate disk 3 to tighten the car brakes, which fresh position can then be maintained by again releasing button 50 and thus applying brake shoes 36. So, also, to reduce the brake pressure, when set to, say, the No. 3 position, to that of the No. 2 position, the lever 22 is moved to the No. 2 position without pressing button 50, and then by pressing said button the disk 3 is released by brake shoes 36, and will at once rotate reversely until held by the disk 2 at the tension of the No. 2 position, where it may then be retained by releasing button 50.

It is intended that the source of current supply for this mechanism shall be the line current that operates the car, but should there be an interruption of said circuit, as by a slipping of the trolley, I have provided an emergency source of current supply by means of a storage battery 52 connected with the line wires 18 and 24 through wires 53 and 54, a switch 55 being interposed in one of said wires to normally break the circuit. Said switch may be located in any position convenient to the operator, as, for instance, on the base plate 21 or on the lever 22. Or, if desired, said battery 52 may be constantly in circuit, so that it will automatically supply current when the line circuit is broken.

I have shown in Figs. 2, 3, 4 and 5 a practical mechanism for operating the circuits to apply and release the car brakes, of which the following is a description. At each end of the car I provide a hollow post 56, having fixed in its upper end a flat plate 57, retained in place by a collar 58 that is in screw threaded engagement with the top of said post 56 and is angular in its exterior configuration. Removably fitted upon this collar 58 is the lever 22 and its parts constructed as follows: A hub 59 angularly recessed to fit over collar 58 without turning has fixed thereto, or formed integral therewith, the base plate 21, the inner apertured end 60 of said lever 22 rotatably fitting on the reduced upper extension 61 of hub 59, and lying above said base plate 21. Also mounted upon a still further reduced and angled portion 62 of hub 59 is a top plate 63, shaped like plate 21 and overlying lever 22 and said plate 21, all of said parts being retained in position by a nut 64 on the upper threaded end 65 of hub 59. To normally maintain the lever 22 in the inactive position shown in Fig. 2, I employ a spring of any suitable construction, such as the coiled spring 66, or a flat spring 67 shown in Fig. 1. The circuits controlled by said lever are as follows: Mounted in the base plate 21 is the extended contact plate 20 which will underlie lever 22 at all times except when the latter is in its inactive position. Said plate is connected to wire 19^a which leads to a spring contact 19^b in plate 57, to which wire 19 is connected. On the under side of lever 22 is a spring contact 60 connected with a wire 23^a

which leads to a spring contact 23^b in the end 60 of lever 22 that is in turn in engagement with an elongated contact 23^c in the extension 61 of hub 59, said elongation of contact 23^c completing the circuit at that point, no matter to what position lever 22 may be turned. A wire 23^d leads from contact 23^c to contact 23^e that contacts with spring contact 23^f, to which wire 23 is connected, whereby the circuit through solenoid 11 is completed as soon as lever 22 is moved.

Located in sockets in the base plate 21 is a plurality of, say, six circuit-closing spring-retracted buttons 70, 71, 72, 73, 74 and 75, beneath each of which in an insulating plate 76 are fixed the terminals of two wires. The section in Figs. 3 and 4 passes through the button 72, and its terminals 26^a and 33^a lead to contacts which are in engagement with spring contacts 26^b and 33^b in plate 57, and to which are connected, respectively, the wires 26 and 32, whereby the depression of button 72 will close the circuit through solenoid 16. It will be understood that the terminals leading from the alternate buttons 70 and 74 are similarly connected to wires 26^a and 33^a, or lead to the contacts 26^b and 33^b, so that the depression of any of said buttons will energize solenoid 16. In a similar manner the buttons 71, 73 and 75 are provided with terminals connected to the contacts 28^c and 33^b, which in turn lead to wires 28 and 32, so that the depression of any one of said buttons 71, 73 or 75 will close the circuit through solenoid 17. Pivoted to the under side of lever 22 is a trigger 77 so constructed and pivoted that it will maintain its projected position when resisted while the lever is moved away from its initial position, but will yield on its pivot to resistance in the opposite direction. This results in a successive depression of buttons 70 to 75 as said trigger contacts therewith in the movement of lever 22 away from its initial position, but in a yielding of said trigger during the return movement of said lever whereby none of said circuits will be closed during said return movement.

The circuit closing push button 50 in lever 22 is of any usual construction and is adapted to remain normally open. Wires 49^a and 51^a lead from the terminals thereof to contacts in the part 60 of lever 22 similar to contact 23^b, while from elongated contacts in the extension 61 similar to contact 23^c lead wires 49^b and 51^b, which in turn contact with contacts 49^c and 51^c in the plate 57, to which are connected, respectively, the wires 49 and 51, whereby the closing of button 50 will energize solenoid 47.

The top plate 63 is preferably provided with a slot 78 in which moves a pointer 79 on the lever 22, which serves to indicate the position of said lever with respect to the buttons 70 to 75, suitable numerals from 1 to 6 on the top plate 63 indicating the position of said underlying buttons.

An important feature of my invention is its adaptability for use with a plurality of cars coupled in a train, whereby the brakes on each car will be simultaneously controlled by the operator on the motor car, and may be applied and released simultaneously, just as the air brake is operated. This I accomplish by providing each car with the system shown in Fig. 1. Now, by connecting the wires 18, 19, 27, 29 and 49 in each car in series with said wires on the motor car, by means of a common plug 80 receiving said five circuits insulated from each other but positioned to register each with its corresponding wire in a similar plug on the adjoining car, and by providing one suitable circuit closing cap piece for each car, except the motor car that will be fitted on either of the posts 56 of each car, so as to close the circuits in said car through 19^b and 23^f, through 26^b and 33^b, through 29^c and 33^b, and through 49^c and 51^c, respectively, the various circuit closing operations performed through the lever 22 on the motor car will be simultaneously performed on each car of the train, and the brakes on each car simultaneously applied or released.

It will be understood that the lever 22 and its top piece 63 and base piece 21 are adapted to be removed together from a post 56 at one end of the car, and to be applied to the post 56 at the other end of said car, or to a similar post on any other car, in a manner similar to the use of the ordinary controller lever now in common use on electric cars for controlling the current to the car motor. It will also be understood that, in order to prevent accidental short circuiting of the current through any of the contacts in the top plate 57 of any post 56 when not in use, as well as to protect said contacts, I will provide a suitable removable cap for covering the same, but which will have an interior surface of insulating material.

In Fig. 9 I have shown a slightly modified construction, wherein the friction disk 2, instead of being operated from the car axle, as in my Letters Patent No. 896,063 and 896,649, hereinbefore referred to, is operated by an electric motor 81 which is constantly driven from the line circuit. In order, however, to prevent unnecessary use of current in operating the same, I provide a rheostat 82 which is controlled step by step through the lever 22 to throw in additional power as said lever is moved from its initial position. By this means so long as said lever is in its normal inactive position a constant but minimum supply of current will be furnished to the motor 81, through wires 83 and 84, but as said lever is moved to apply the friction disk 3 to friction disk 2 the step by step cutting out of the coils of the rheostat 82,

which will be timed to take place successively just before the buttons 70 to 75 are pressed, will successively increase the supply of current to motor 81 to enable it to supply the necessary power. And this control of the power to the motor 81 in each one of a train of connected cars may be had by extending the wires 83 and 84 through the couplings 80, and by cutting out the rheostat 82 in each car except the controlling car, which latter may be accomplished through the circuit closing cap piece used to close the other circuits hereinbefore described.

If preferred, instead of constantly driving the friction disk 2 by the motor 81, I may arrange a normally broken contact on lever 22 and base plate 21, which will be closed upon the slightest movement of said lever 22 and will remain closed so long as lever 22 is turned from its inactive position. By this means the motor 81 will be energized only while the brakes are being applied, and with this construction the rheostat 82 may or may not be employed.

An important advantage obtained by controlling the movement of the core 12 of the solenoid 11 through the solenoids 16 and 17 is that the application of the friction disks will be uniform under any variation of the current supply. Thus, no matter what may be the strength of the line current, a movement of lever 22 to say the No. 1 position will permit the core 12 of solenoid 11 to move only far enough to bring the head 35 of solenoid 17 into engagement with the first notch 15 on that side of bar 13, whereupon said movement will be positively checked. And this is true no matter to what position the lever 22 is moved, the result being that under any varying condition of current supply the operator will obtain an application of the brakes dependent upon the movement of lever 22 which will be unvarying in power.

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

1. In a car brake, the combination with means for frictionally applying the brakes, of a solenoid for applying said friction means, and separate electric means for controlling the movement of the solenoid core.

2. In a car brake, the combination with means for frictionally applying the brakes, of a main solenoid for applying said friction means, and separate solenoids for alternately checking the movement of the core of the main solenoid in applying said friction means.

3. In a car brake, the combination with means for frictionally applying the brakes, of a main solenoid for applying said friction means, separate solenoids for alternately checking the movement of the core of said main solenoid in applying said friction means, and a lever for controlling the circuits to said solenoids.

4. In a car brake, the combination with means for frictionally applying the brakes, of a main solenoid for applying said friction means, separate auxiliary solenoids for alternately checking the movement of the core of said main solenoid in applying said friction means, and a circuit controlling lever for said solenoids adapted when moved from its initial position to maintain closed the main solenoid circuit and in its movement to alternately close and open the auxiliary solenoid circuit.

5. In a car brake, the combination with a friction brake setting mechanism comprising a member rotated by a source of power and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, of a main solenoid for moving said members into contact with each other, and auxiliary solenoids for controlling the movement of the core of said main solenoid in its operation of said members.

6. In a car brake, the combination with a friction brake setting mechanism comprising a member rotated by a source of power and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, of a main solenoid for moving said members into contact with each other, and auxiliary solenoids adapted to be alternately energized to effect a step by step control of the movement of the main solenoid core in its operation of said members.

7. In a car brake, the combination with means for frictionally applying the brakes, and means for controlling said friction means, of a clutch for maintaining the brakes in any applied position, and electrically controlled means for maintaining the clutch in its unlocked position.

8. In a car brake, the combination with means for frictionally applying the brakes, and means for controlling said friction means, of an automatically locking clutch for maintaining the brakes in any applied position, and electrically controlled means for unlocking the clutch and maintaining it in its unlocked position.

9. In a car brake, the combination with a friction brake setting mechanism comprising a member rotated by a source of power and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, and means for moving said members into contact with each other, of an automatically locking clutch for maintaining said freely rotatable member in any position to which it may be moved by its frictional contact with the power rotated member, and means for unlocking the clutch and maintaining it in its unlocked position.

10. In a car brake, the combination with a friction brake setting mechanism comprising a member rotated by a source of power and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, and means for moving said members into contact with each other, of an automatically locking clutch for maintaining said freely rotatable member in any position to which it may be moved by its frictional contact with the power rotated member, and electrically controlled means for unlocking the clutch and maintaining it in its unlocked position.

11. In a car brake, the combination with a friction brake setting mechanism comprising a member rotated by a source of power and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, and means for moving said members into contact with each other, of an automatically locking clutch for maintaining said freely rotatable member in any position to which it may be moved by its frictional contact with the power rotated member, and a solenoid adapted when energized to unlock said clutch and maintain it in its unlocked position.

12. In a car brake, the combination with a friction brake setting mechanism comprising a member rotated by a source of power and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, and means for moving said members into contact with each other, of an automatically locking clutch for maintaining said freely rotatable member in any position to which it may be moved by its frictional contact with the power rotated member, a solenoid adapted when energized to unlock said clutch and maintain it in its unlocked position, a normally open circuit for said solenoid, and means within control of the operator for closing said circuit.

13. In a car brake, the combination with means for frictionally applying the brakes, of a main solenoid for applying said frictional means, separate auxiliary solenoids for alternately checking the movement of the core of the main solenoid in applying said friction means, a clutch adapted when applied to maintain said brake applying means in their applied position, and a solenoid for controlling said clutch.

14. In a car brake, the combination with means for frictionally applying the brakes, of a main solenoid for applying said frictional means, separate auxiliary solenoids for alternately checking the movement of the core of the main solenoid in applying said friction means, a clutch adapted when applied to maintain said brake applying means in their applied position, a solenoid for controlling said clutch, and a common lever carrying the circuits of all of said solenoids.

15. In a car brake, the combination with means for frictionally applying the brakes, of a main solenoid for applying said frictional means, separate auxiliary solenoids for alternately checking the movement of the core of the main solenoid in applying said friction means, a clutch adapted when applied to maintain said brake applying means in their applied position, a solenoid for controlling said clutch, and a common lever carrying normally open circuits of all of said solenoids.

16. In a car brake, the combination with means for frictionally applying the brakes, of a main solenoid for applying said frictional means, separate auxiliary solenoids for alternately checking the movement of the core of the main solenoid in applying said friction means, a clutch adapted when applied to maintain said brake applying means in their applied position, a solenoid for controlling said clutch, and a common lever carrying normally open circuits of all of said solenoids, and adapted by its movement from normal position to operatively close and open the circuits of the friction brake applying and controlling solenoids.

17. In a car brake, the combination with means for frictionally applying the brakes, of means for electrically operating said friction means, and means for varying the supply of current to said electric means proportionately to the degree of application of said friction means.

18. In a car brake, the combination with means for frictionally applying the brakes, of means for electrically controlling said friction means, means for electrically operating said friction means, and means for varying the supply of current to said electric operating means proportionately to the degree of application of said friction means.

19. In a car brake, the combination with means for frictionally applying the brakes, of means for electrically controlling said friction means, means for electrically operating said friction means, means for varying the supply of current to said electric operating means, and a common control for said electric controlling and supplying means operating to vary the supply of current to said supplying means in proportion to the degree of application of said controlling means.

20. In a car brake, the combination with a friction brake setting mechanism comprising an electric motor, a member continuously rotated by said motor, and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, of means for variably moving said members into contact with each other and for pro-

portionately varying the supply of current to said motor in accordance with the degree of application of said friction members to each other.

21. In a car brake, the combination with a friction brake setting mechanism comprising an electric motor, a member continuously rotated by said motor, and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, of electric means for variably moving said members into contact with each other and for proportionately varying the supply of current to said motor in accordance with the degree of application of said friction members to each other.

22. In a car brake, the combination with a friction brake setting mechanism comprising an electric motor, a member continuously rotated by said motor, and a freely rotatable member connected to the brakes, said members being adjustable relatively to each other, and electric means for variably moving said members into contact with each other, of a common controlling lever adapted in its movement to control the variable electrically operated contact between said friction members and to simultaneously vary the supply of current to said motor in proportion to the degree of application of said friction members.

23. In a car brake, the combination with a plurality of cars, means on each car for frictionally applying the brakes thereon, electric means on each car for variably operating said friction means, and means on each car for electrically controlling said friction means, of a common means on one car for simultaneously controlling said electric controlling means on all the cars and for varying the supply of current to said electric operating means on each car proportionately to the degree of application of said friction means.

24. In a car brake, the combination with a plurality of cars, means on each car for frictionally applying the brakes thereon, electric means on each car for variably operating said friction means, means on each car for electrically controlling said friction means, means on each car for locking said friction means when applied, and means on each car for electrically controlling said locking means, of a common means on one of said cars for simultaneously controlling said electric controlling and locking means on all the cars and for varying the supply of current to said electric operating means on each car proportionately to the degree of application of said friction means.

25. In a device of the character described, the combination with a car brake, of a main solenoid, connections between its core and said brake embodying a bar having notches therein alternately disposed on opposite sides thereof, and oppositely disposed auxiliary solenoids having spring projected cores adapted when said solenoids are deënergized to be projected against said bar in the path of said notches to retain said bar against movement toward said main solenoid, and means for first constantly energizing said main solenoid and then alternately energizing said auxiliary solenoids at will to permit a step by step movement to said bar under the energized action of said main solenoid to variably apply the brake.

26. In a device of the character described, the combination with a car brake, of a main solenoid, connections between its core and said brake embodying a bar having notches therein alternately disposed on opposite sides thereof, and oppositely disposed auxiliary solenoids having spring projected cores adapted when said solenoids are deënergized to be projected against said bar in the path of said notches to retain said bar against movement toward said main solenoid, and a common means for first constantly energizing said main solenoid and then alternately energizing said auxiliary solenoids at will to permit a step by step movement to said bar under the energized action of said main solenoid to variably apply the brake.

27. In a car brake, the combination with means for applying the brake, of means for controlling said application embodying means initially energized in excess of the requirements, and means for controlling the movement of said energized means.

28. In a car brake, the combination with means for applying the brakes, of electrical means for controlling said application embodying means initially energized in excess of the requirements, and means for controlling the movement of said energized means.

29. In a car brake, the combination with means for applying the brakes, of electrical means for controlling said application, embodying a solenoid initially energized in excess of the requirements, and means for controlling the movement of the core thereof.

30. In a car brake, the combination with means for applying the brakes, of electrical means for controlling said application embodying a solenoid initially energized in excess of the requirements, and separate solenoids for alternately checking the movement of the core of the main solenoid.

In testimony whereof, I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM C. MARSH.

Witnesses:
FRED J. REED,
J. L. HUBBURT.