No. 720,951. PATENTED FEB. 17, 1903.

F. C. NEWELL.

ELECTRIC BRAKE.

APPLICATION FILED APR. 18, 1901. RENEWED DEC. 22, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

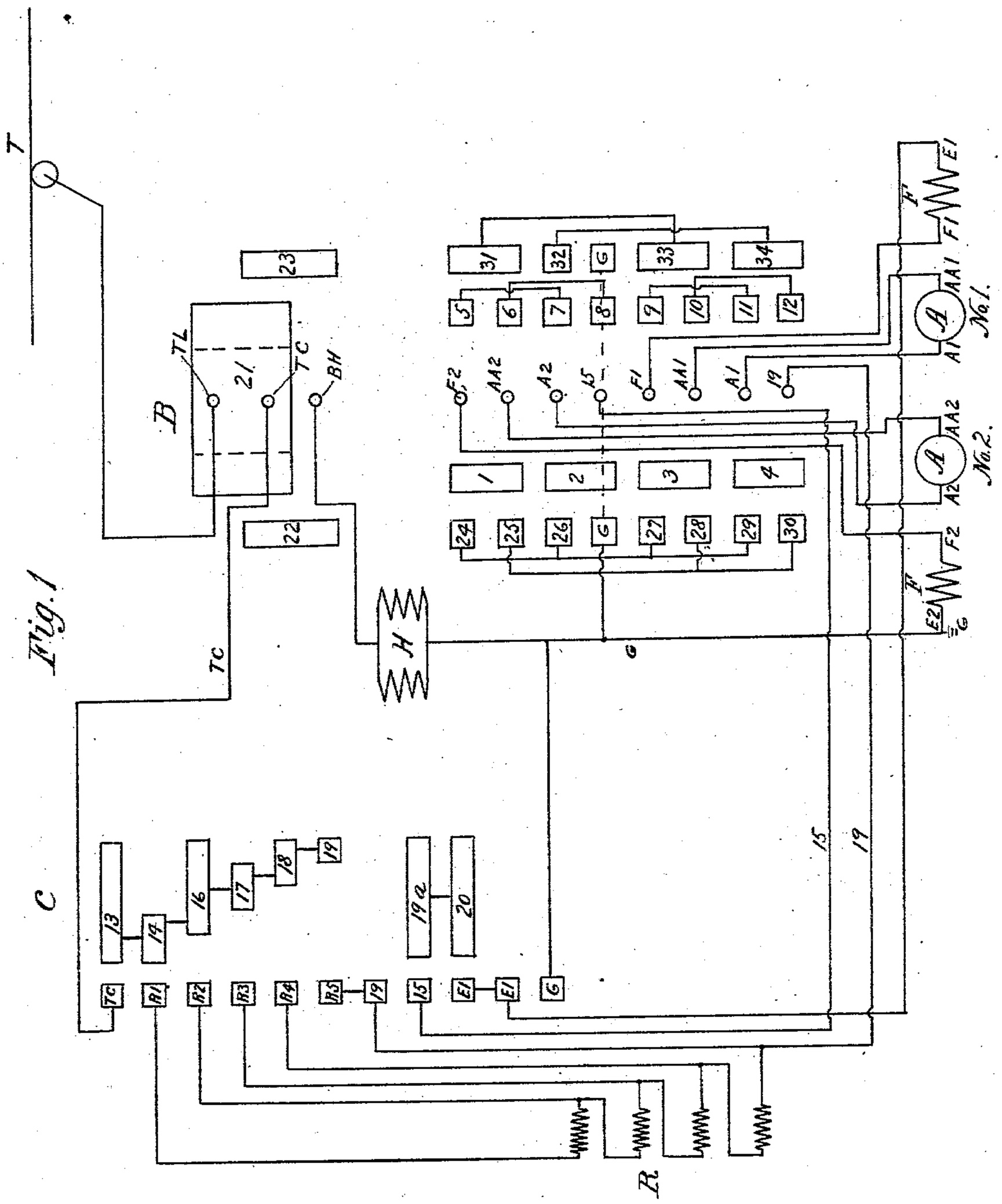

Fig. 1

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2

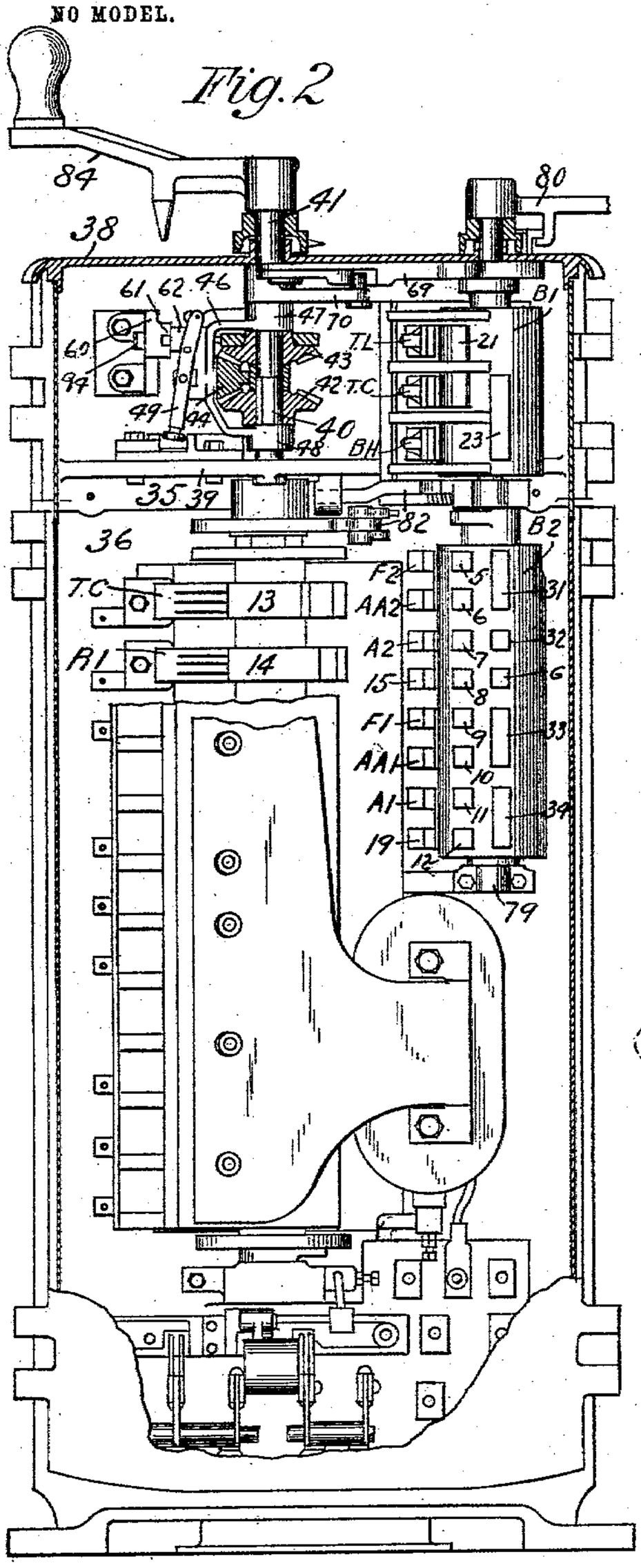


Fig. 3

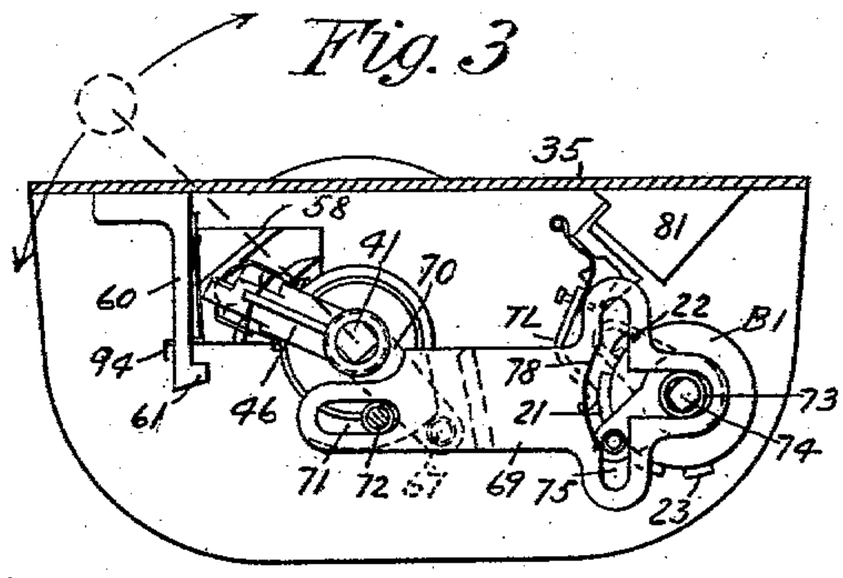


Fig. 4

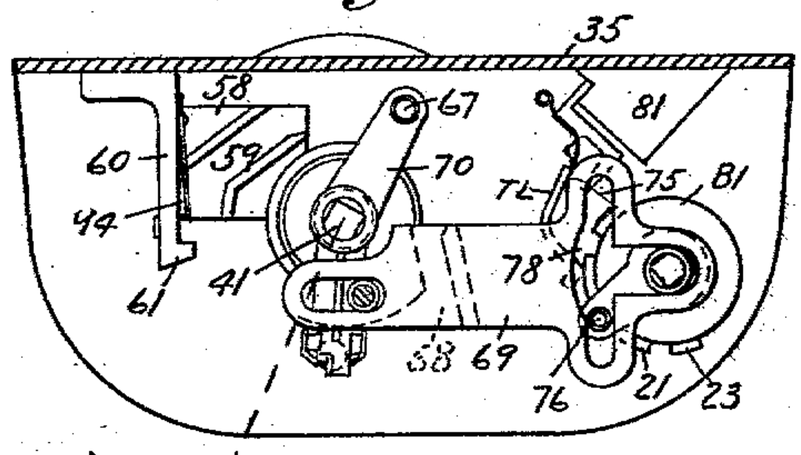


Fig. 5

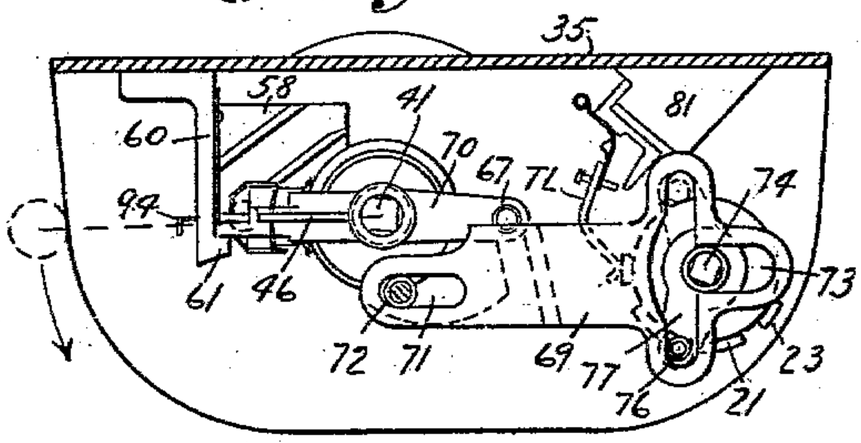
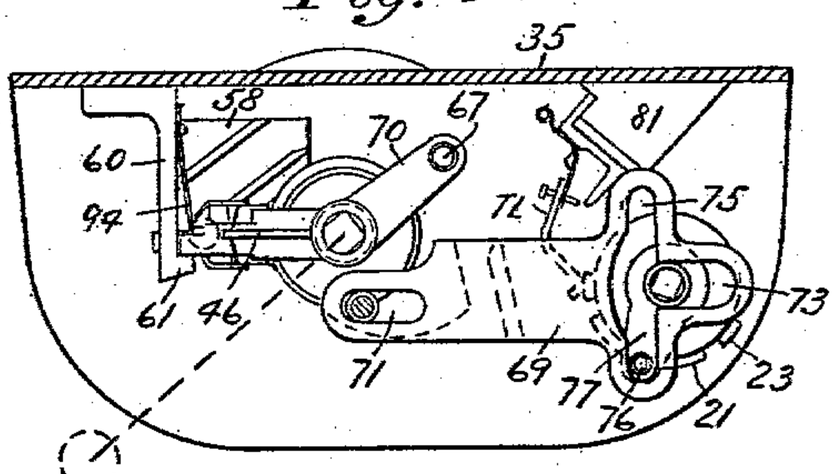


Fig. 6



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 7

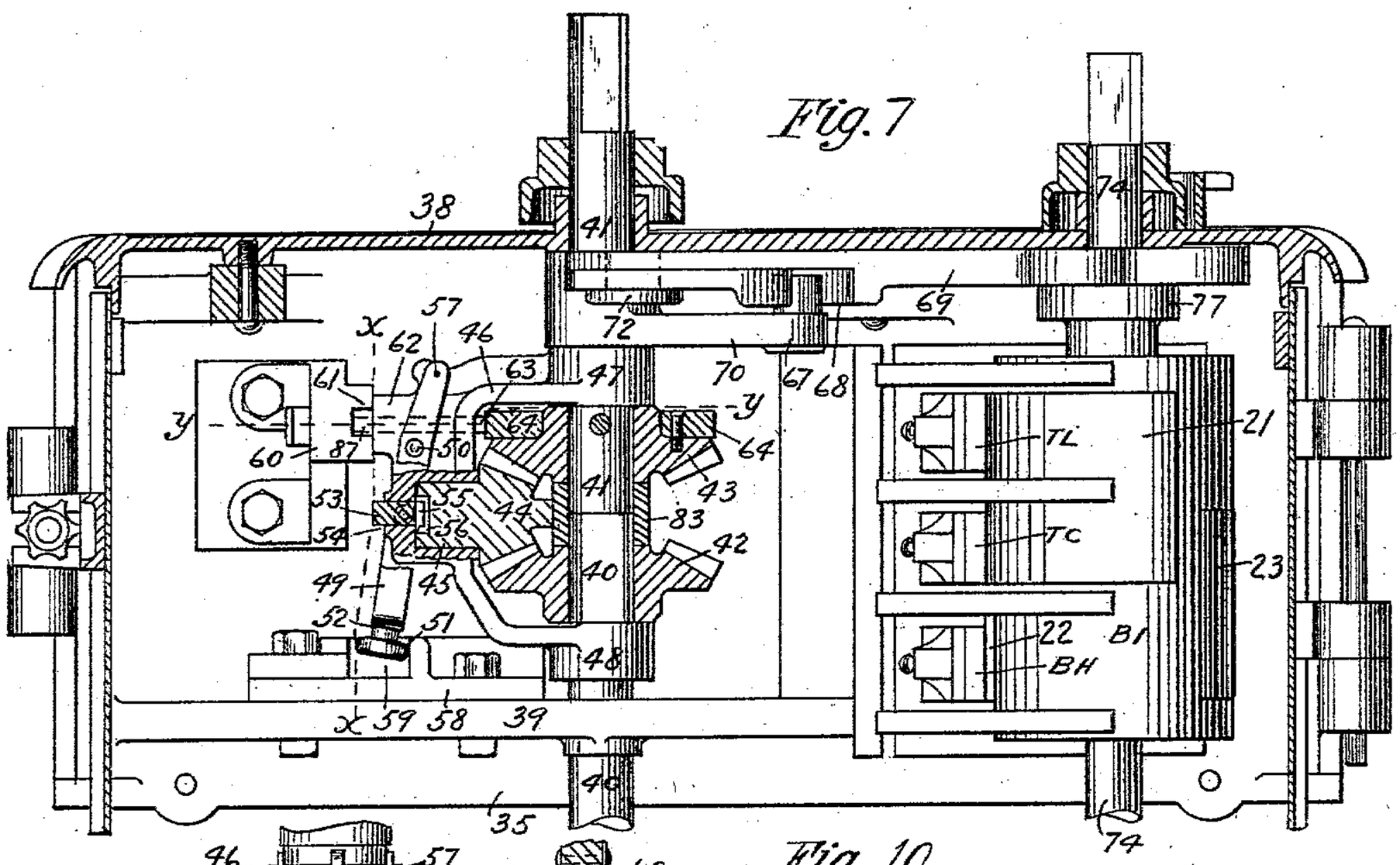


Fig. 9

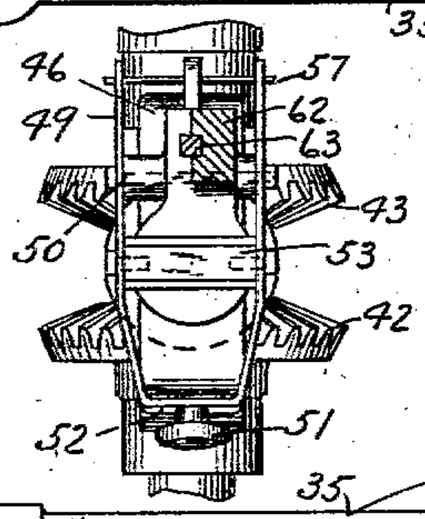


Fig. 10

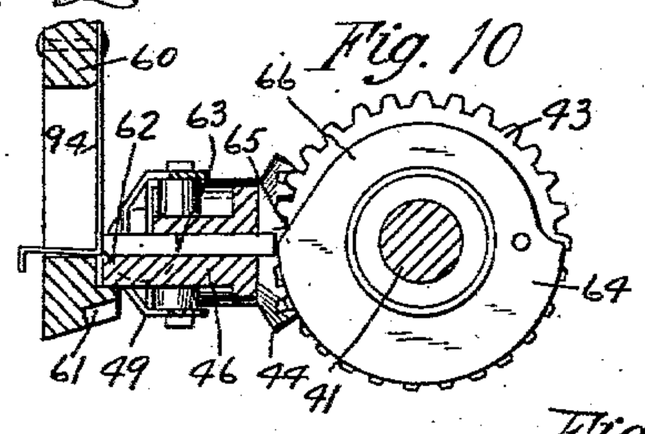


Fig. 11

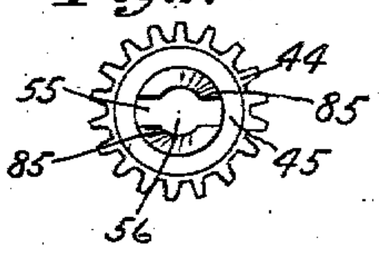
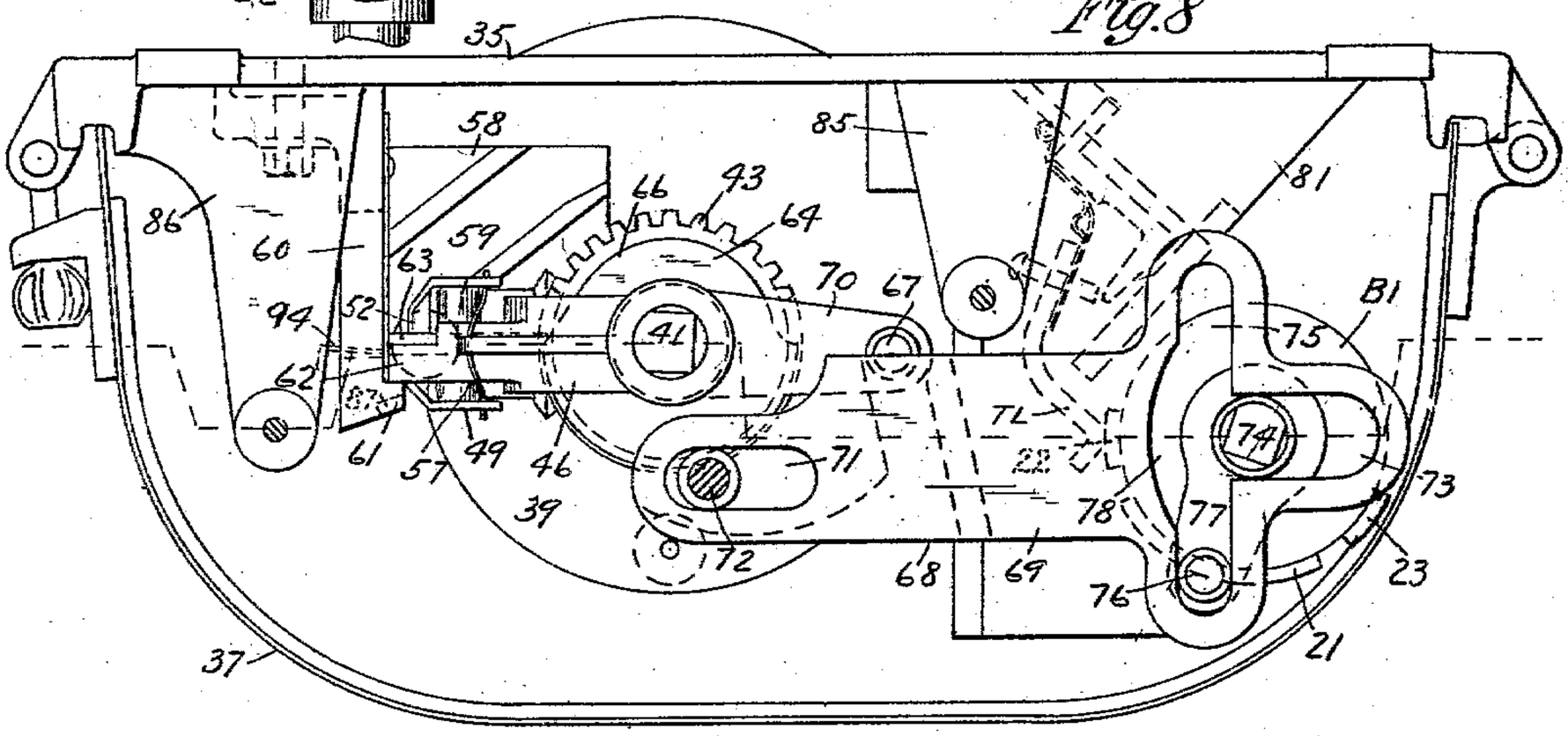


Fig. 8



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UNITED STATES PATENT OFFICE.

FRANK CLARENCE NEWELL, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ELECTRIC BRAKE.

SPECIFICATION forming part of Letters Patent No. 720,951, dated February 17, 1903.

Application filed April 18, 1901. Renewed December 22, 1902. Serial No. 136,243. (No model.)

To all whom it may concern:

Be it known that I, FRANK CLARENCE NEWELL, a citizen of the United States, residing at Wilkinsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Electric Brakes, of which improvement the following is a specification.

My invention relates to electric brakes for railway-cars, and has for its object to provide means by which a running-controller of an electrically-propelled car may be converted into a combined running and braking controller, in which the handle is moved in one direction from its neutral position for running and in the opposite direction from that position for braking, but at the same time utilizing the same contact-points on the controller for both running and braking.

Heretofore braking-controllers have been constructed with two sets of contact-points—one set for the running-circuit and the other set for the braking-circuit—with a handle adapted to be moved in opposite directions from its forward or neutral point for controlling the respective circuits; but such a construction is complicated and expensive, owing to the large number of contact-points required on the switch or controller and the limited space available for such a large number of contacts. It has also been proposed to connect a separate brake-switch in the circuits, whereby after the brake-switch is thrown the running-controller may be used to control the brake-circuit with the same contact-points and the same movement of the handle as in running; but such a construction is open to the objection that it requires an extra handle to be operated by the motorman and also that the handle of the running-controller is moved in the same direction for both running and braking, so that in case of an emergency or moment of excitement the motorman is liable to seize the wrong handle or to operate the handle of the running-controller without throwing the brake-switch. In all cases it is desirable that there should be but one handle to be operated to control the power in running and braking, so that the motorman will always have one hand free to apply the hand-brake when necessary.

My invention consists in means whereby the same contact-points on the controller may be used for braking as for running, while at the same time the controller-handle is adapted to be moved in opposite directions from its "off" or neutral position for regulating the current in the running and braking circuits, respectively.

It also consists in a construction adapted to be applied to a running-controller to turn the controller-shaft in the same direction when the handle is turned in either direction from its neutral position.

My invention further consists in an improved form of combined brake-switch and reversing-switch adapted in certain positions to connect the line-current with the controller for running either forward or backward and in other positions to cut off the line connection and connect up the motors to act as generators in a local brake-circuit with the controller for braking when the car is moving in either direction.

It also consists in means whereby the brake-switch is automatically thrown by the controller-handle when it is moved over its neutral position; and my invention further consists in certain combinations and arrangement of parts, all as hereinafter more fully set forth.

In the accompanying drawings, which illustrate an embodiment of my invention, Figure 1 is a diagram showing the contact-points of the brake-switch and the controller and the circuits as used in running and braking. Fig. 2 is a front view of the interior of a running-controller, showing my improvements applied thereto, the beveled gearing being shown in section and some of the parts of the controller being broken away to more clearly show the contact-points. Fig. 3 is a top plan view of the controller with the cover or cap plate removed and showing the position of the parts when the controller-handle is in the neutral position. Fig. 4 is a similar view showing the position of the parts when the controller-handle has been turned to the right in the di-

rection for running to about the point at which the motors would be connected up in parallel if a series-parallel controller is used. Fig. 5 is a similar view showing the position of the parts when the controller-handle has been turned to the left from its neutral position in the direction for braking to the first point where the brake-switch is thrown. Fig. 6 is a similar view showing the position of the parts when the handle has been moved still farther toward the left, where the braking-circuit is connected up with the resistance. Fig. 7 is a front view, partly in elevation and partly in section, of the upper part of the controller, showing my improved construction on a larger scale. Fig. 8 is a plan view of the construction shown in Fig. 7, the cover-plate being removed. Fig. 9 is a vertical section taken on the line $x\,x$ of Fig. 7. Fig. 10 is a horizontal section taken on the line $y\,y$ of Fig. 7; and Fig. 11 is an end view of the beveled pinion, showing the clutch-face of the hub.

Referring to Fig. 1 of the drawings, C represents the contact-points of the controller-cylinder, and B the combined brake-switch and reversing-switch, which takes the place of the ordinary reversing-switch and is provided with four series of contact-points, the two inside series 1 to 4 and 5 to 12 serving as the ordinary contact-points of the reversing-switch and the two outside series 24 to 30 and 31 to 34 adapted to connect up the motors in parallel to act as generators by the momentum of the car when running in either direction. The upper part of the brake-switch is also provided with three additional stationary contact-fingers and three contact-points 21, 22, and 23, which are mounted on the same shaft with the other contact-points and arranged in line therewith. The additional terminal points or contact-fingers are connected as follows: TL to the trolley at T, TC to its corresponding terminal point on the controller C, and BH to the brake-magnets H and the ground-wire. The course of the current for the different circuits may now be traced, supposing the brake-switch to be moved to its running position, in which the contact-points 1, 2, 3, and 4 will be in contact with the motor-terminals F^2 AA^2, &c., and the controller in its first notch on the running side, in which position the controller-bars 13 and 14 make contact with the terminal points TC and R′, respectively. The current then flows through the trolley T to terminal TL and bar 21 on the brake-switch, through lead TC to contact-bars 13 and 14 on the controller, through lead R′, resistance R, lead 19, contact-bar 4 on the brake and reversing switch B, lead A′, armature A of No. 1 motor, lead AA′, contact-bar 3 on the brake and reversing switch, lead F′ through field F of No. 1 motor, lead E′ to contact-bars 20 and 19^a on the controller, lead 15 to contact-bar 2 on the brake and reversing switch, lead A^2 to armature A of No. 2 motor, lead AA^2 to contact-bar 1 on the brake and reversing switch, lead F^2 through the field of No. 2 motor, and lead E^2 to the ground. Further movements of the controller in the same direction serve to cut out resistance as the bars 14, 16, 17, 18, and 19 successively make contacts with the terminals R^2, R^3, R^4, and R^5, respectively. In case a series-parallel controller is used still further movement in this direction would connect up the motors in parallel; but it is not necessary to illustrate this connection, as it is a well-known form of controller and well understood by all skilled in the art. When it is desired to run backward, the controller being in its neutral position, the brake and reversing switch is thrown to its other intermediate position, in which the contact-points 5 to 12 are in line with and make contact with the motor-terminals F^2 AA^2, &c. It will be noticed that the contact-bar 21 on the brake and reversing switch is large enough to be in contact with the terminals TL and TC when this switch is in either one of its intermediate positions, and in this way the terminal TC on the controller is always connected with the trolley when the brake and reversing switch is in position for running either forward or backward or is in its neutral position. If desirable, two separate contact-bars, as indicated in dotted lines, may be used; but I prefer the former construction, as it prevents arcing at the brake-switch in case of leakage.

When running backward, the circuits are the same as in running forward, except that the direction of the current through the armatures is reversed by means of the cross connections between the contact-points 5 and 7, 6 and 8, 9 and 11, and 10 and 12 on the brake and reversing switch, as will be readily understood by all familiar with the art.

In forward running when it is desired to apply the brakes the controller is brought to its neutral position, and the brake and reversing switch is thrown from its first or forward running position to its forward braking position, in which the outside series of contact-points 22 and 24 to 30 are in line with and make contact with the lead-terminals or stationary fingers TC F^2, &c. This operates to cut off the motors from line-circuit and to connect them up to act as generators in a local circuit with the controller and the brake-magnets. The controller then being moved to its first position, in which the bars 13 and 14 make contact with the fingers TC and R′, respectively, the current in the brake-circuit may be traced as follows: from the armature of No. 1 motor through lead A′ to contact-bars 29 and 27 on the brake and reversing switch, lead F′ through field F of No. 1 motor, lead E′ to contact-bars 19^a and 20 on the controller, lead 15 to contact-bar G on the brake and reversing switch, to the ground-wire, through the brake-magmets H, the terminal BH to the contact-bar 22 on the brake and reversing switch, through lead TC to con-

tact-bars 13 and 14 on the controller, lead R′ through resistance R, lead 19 to contact-bars 30 and 28 on the brake and reversing switch, and lead AA′ back to the armature of No. 1 motor. At the same time as the motors are connected up in parallel the current from the armature of No. 2 motor flows through lead A^2 to contact-bars 26 and 24 on the brake and reversing switch, lead F^2 through field F of No. 2 motor, lead E^2 to the ground-wire, where it joins the current from No. 1 motor and flows through the brake-magnets, controller resistance, and lead 19 to contact-bar 30 and by cross connection to contact-bar 25 on the brake and reversing switch, and through lead AA^2 to the armature of No. 2 motor. The armature of each motor is connected to the fields of both motors by the equalizing connections between the contact-bars on the brake and reversing switch. Further movement of the controller in the same direction will operate to cut out resistance and regulate the current in the brake-circuit.

To apply the brakes when running backward, the controller is brought to its neutral position and the brake and reversing switch shifted from its second intermediate position to its second outer position, in which the contact-bars 23 and 31 to 34 make contact with the terminal points of the switch. The controller is then moved to its first position, and as the armatures are then revolving in the opposite direction from that of forward running the current flows from the armature of No. 1 motor through lead AA′ to contact-bar 33 of the brake and reversing switch, lead F′ through field F of No. 1 motor, lead E′ to contact-bars 20 and 19^a on the controller, lead 15 to contact-bar G and to the ground-wire, through brake-magnets H to contact-bar 23 on the brake and reversing switch, lead TC to contact-bars 13 and 14 on the controller, lead R′ through the resistance R, lead 19 to contact-bar 34, and lead A′ to the armature of No. 1 motor. From No. 2 motor the current flows by lead AA^2 to contact-bar 31 on the brake and reversing switch, lead F^2 through the field of No. 2 motor, lead E^2 to the ground-wire, where it joins the current from No. 1 motor to lead 19 and contact-bar 34 on the brake and reversing switch, then by cross connection to contact-bar 32 and lead A^2 back to the armature of No. 2 motor. There is also a cross connection between the contact-bars 31 and 33, which serves as the equalizer for the motor-generators. The resistance in the braking-circuit may then be regulated by further movement of the controller, as before described.

I have described the circuit connections between the controller and brake and reversing switch at one end of the car and the motors; but it is to be understood that the circuits are extended to the other end of the car, which is also provided with a duplicate controller and brake and reversing switch.

In order that the brake-switch may be thrown automatically by the movement of the controller-handle as it moves over its neutral position and that a further movement of the handle in the direction for braking may operate the controller-shaft in the opposite direction over the same positions as in running, I have devised the construction shown on Sheets 2 and 3 of the drawings, which will now be described. This construction is adapted to be applied directly to the top of an ordinary running-controller and involves no change therein except the removal of the cover-plate and the reversing-switch cylinder.

The casing or frame of the extension-top is composed of a cast-iron back plate 35, adapted to be securely bolted to the top of the back plate 36 of the ordinary running-controller frame, a curved front plate 37, hinged to the back plate, and a cover 38, so that the finished appearance of the improved controller is substantially the same as the ordinary running-controller, except that the height is slightly increased. A lower plate or flange 39 is secured to or cast integral with the back plate 35 and is provided with a circular opening adapted to fit over the upper end of the controller-shaft 40, while the cover-plate 38 has a corresponding opening in line therewith for the stub-shaft 41. On the upper end of the controller-shaft is keyed the beveled gear-wheel 42, the corresponding beveled gear-wheel 43 being rigidly secured on the lower end of the stub-shaft 41. Between the beveled gears is located the beveled pinion 44, adapted to mesh with the bevel-gears and having its hub 45 bearing in the yoke 46, which in turn has an upper bearing at 47 on the stub-shaft and a lower bearing at 48 on the controller-shaft 40. A collar 83 is placed on the shaft between the beveled gears and serves as an abutment for the pinion 44. The bifurcated clutch-operating lever 49 is pivoted at 50 on the yoke and has one arm on each side thereof, the arms being joined at their lower ends by a cross-piece 52, on which is pivoted the roller 51. The clutch-bar 53 is secured between the arms of the lever 49 and is adapted to be moved in a slotted opening 54 in the yoke, which opening communicates with the bearing of the pinion 44. A rectangular recess 55 is cut in the inner face of the hub of the pinion and is adapted to register at each revolution of the pinion with the slotted opening in the yoke and with the clutch-bar 53, so that when the pinion is in this position the clutch-bar may be moved into the rectangular recess 55 and lock the pinion 44 against rotation. The inner face of the hub of the pinion may be bored out in the center, as indicated at 56, and the opposite edges of the clutch-face of the pinion may be slightly beveled off to facilitate the operation of the clutch, as indicated at 85 in Fig. 11. A spring 57 is interposed between the yoke and the upper ends of the lever-arms, which spring tends to move the lever to the position to throw in the clutch. On

the lower bracket or plate 39 is secured a casting 58, having upwardly-projecting flanges forming a groove 59, in which the roller 51 of the clutch-operating lever is adapted to move. The shape of the groove-flanges is such that the clutch-lever is operated to throw the clutch-bar in and out at the proper time when the yoke 46 is swung around on the axis of the controller-shaft, as more fully described hereinafter. A bracket 60 is secured to the back plate 35 and is provided with a notched end forming a stop 61, which is adapted to be engaged by a projection 62 of the yoke 46 when the same is swung around to certain positions. In a longitudinal opening through the yoke is located the slidable bar 63, which at one end bears against the face of the cam 64 on the gear-wheel 43. This cam may be secured to the shaft or to the gear-wheel or may be integral with the gear-wheel. The bar 63 extends through the projection 62 of the yoke and when the yoke is in the position shown in Fig. 8 bears against the latch-spring 94, which is secured in a slotted opening or recess in the bracket 60. As shown in Fig. 8, the projection 62 of the yoke rests against the stop 61, thus preventing further movement of the yoke to the left; but the high point 65 of the cam has moved the bar 63 outward, compressing the spring-latch 94 into its recess and leaving the yoke free to swing toward the right. If now the cam be turned so that its low point 66 bears against the end of the bar 63, the spring-latch will force the bar inward and move out beyond the face of the projection 62, and the yoke will then be securely held against rotation in either direction, as shown in Fig. 6.

On the stub-shaft 41, beneath the cover-plate 38, is mounted the crank-arm 70, having at its outer end an upwardly-projecting pin 67, adapted to extend into a recess or groove 68 in the slide bar or plate 69. This plate is provided with a guide-slot 71, through which passes a large headed pin 72, secured to the under side of the cover 38 for sustaining and guiding the slide-plate 69 as it is reciprocated by the movement of the crank-pin 67 in the cam-shaped slot 68. The other end of the slide-plate has an elongated opening 73 for the shaft 74 of the brake and reversing switch and a transverse slot 75 for the pin 76 of the crank-arm 77, which is secured on the shaft 74 beneath the slide-plate 69. The transverse slot 75 has an arc-shaped portion 78 cut out of one side, the purpose of which will appear hereinafter.

The cylinders B′ and B^2 of the combined brake and reversing switch are mounted on the same continuous shaft 74, which extends from the usual lower bearing 79 up through the cover-plate and is provided with the usual handle 80. The lower cylinder B^2 is the same as the ordinary reversing-switch cylinder with the two additional rows of contact-bars, as shown in Figs. 1 and 2. The upper cylinder B′ is provided with the contact-bars 21, 22, and 23, while the additional stationary terminals or fingers TL, TC, and BH are supported on a triangular block 81, secured to the back plate 35, suitable insulation being provided for the contacts.

The usual interlocking mechanism 82 between the controller-shaft and the shaft of the reversing-switch is retained, so that the brake and reversing switch can only be moved when the controller is in its neutral position.

The cover 38 may be secured to the brackets 86 and 87, and the controller is provided with the usual handle, 84.

When the handle is turned around to its extreme position on the running side, the yoke strikes against the outer side of the stop 61, in which there is a small recess 87 for the end of the bar 63.

The operation of my improved controller complete is as follows: The controller-handle 84 being in the neutral position, as shown in Fig. 3, the pin 67 of the crank 70 is at the end of the cam-shaped groove 68. The slide-bar 69 is in its left-hand position, so that the pin 76 of crank 77 is just at the end of the arc-shaped portion of the slot 75, and the brake and reversing switch is in position for forward running. When in this position, it will be noticed that the reversing-switch can be thrown by hand in the usual way without interfering with any of the other parts of the mechanism, as the locking device between the shafts is released and the pin 76 merely travels through the arc-shaped portion 78 of the slot 75 without moving the slide-plate 69. In the neutral position the roller 51 holds the clutch-operating lever in its outer position and the clutch-bar 53 out of the recess in the face of the hub of the pinion 44, so that the pinion is free to turn. If now the controller-handle is moved toward the right for running, the stub-shaft 41 turns the beveled gear-wheel 43 and pinion 44; but the gear-wheel 42 remains stationary for the moment, as the resistance of the controller against rotation is greater than that of the yoke 46 about the axis of the shaft. The yoke then swings around in the same direction as the controller-handle, and the roller 51, bearing against the outer side of the groove 59, forces the clutch-bar 53 into the recess 55 of the hub of the pinion 44, locking the same against rotation, so that further movement of the controller-handle produces a corresponding movement of the controller-shaft 40, and the two shafts are locked together as one integral shaft. This result is effected during the movement of the controller-handle from its neutral point to its first running position, and the contact-bars 13 and 14 then make contact with the terminal points TC and R′. The electrical resistance may then be cut out and in and the current regulated in the usual way. During this operation the spring 57 holds the clutch-bar and pinion locked together, and the pin 67 is out of the groove 68, so that the slide-bar 69 is

not moved. To stop the car, the controller-handle is brought back to its neutral position, which movement releases the clutch by means of the roller 51 bearing against the inner side of the groove 59 and throwing out the clutch-lever. Further movement of the controller-handle toward the left for braking operates to swing the yoke around on the axis of the shaft until the projection 62 strikes against the stop 61, the pinion 44 rolling on the gear-wheel 42, which for the time being remains stationary. At the same time the pin 67 passes through the cam-groove 68 and moves the slide-bar 69 to its right-hand position, throwing the brake and reversing switch to one of its outer positions for braking, as indicated in Fig. 5. In this position the high point 65 of the cam 64 forces the bar 63 against the latch-spring 94 and compresses the same into its recess in the bracket 60. It will be noticed that the movement thus far on the braking side has not moved the controller-shaft from its neutral position, so that the current is still cut off, and the only effect of the first movement is to throw the brake-switch and bring the yoke against the stop. Further movement of the controller-handle toward the braking side rotates the beveled gear 42 and the controller-shaft 40 in the opposite direction—that is, in the same direction and over the same points as in running—since the yoke is now held stationary against the stop. At the same time the high point of the cam 64 moves away from the bar 63, releasing the latch-spring 94, which now springs out beyond the face of projection 62 of the yoke and holds the yoke stationary against rotation in either direction, as indicated in Fig. 6, so that the controller-handle may be moved back and forth on the braking side to cut the resistance out or in, as desired. The reverse movement of the handle to the position shown in Fig. 5 brings the controller-shaft 40 to its neutral position, and the cam 64 forces out the bar 63, compressing the latch-spring, so that the yoke is free to swing around on the axis of the shaft as the handle is moved from the position shown in Fig. 5 to its neutral position. (Shown in Fig. 1.) During the movement at this point the controller-shaft remains in its neutral position, while the brake and reversing switch is thrown in one direction or the other, according to the direction of movement of the controller-handle. For braking when running backward the operation is the same, except that the crank-pin 76 of the brake and reversing switch is at the other end of the arc 78 and moves in the opposite end of the slot 77, as indicated in dotted lines, Figs. 3 and 5. By this construction it will be observed that it is only necessary to move the brake-switch one point from one of its intermediate positions to its corresponding outer position for braking in running either forward or backward.

While I have shown my invention applied to the ordinary form of series-parallel controller, it is to be understood that it is not limited to this construction, but may be used with other forms of controllers.

Other specific construction may also be used for reversing the movement of the controller-switch and for automatically throwing the brake-switch without departing from my invention, and the brake-switch may also be operated by hand, if desired.

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

1. In an electric brake mechanism, the combination with a running-controller having a handle adapted to be moved in one direction from its neutral or off position for running and in the opposite direction for braking, of mechanism operated by said handle for causing the movable contact-bars of the controller to move in the same direction from the off position when the controller-handle is moved in either direction from said position.

2. In an electric brake mechanism, the combination with a running-controller having a handle adapted to be moved in one direction from its neutral position for running and in the opposite direction for braking, of means for moving the controller in the same direction as the handle on the running side and in the opposite direction from the handle on the braking side.

3. In an electric brake mechanism, the combination with a running-controller having a handle adapted to be moved in one direction from its neutral position for running and in the opposite direction for braking, of means for clutching the handle to the controller-shaft on the running side and means for rotating the shaft in the opposite direction from the handle on the braking side.

4. In an electric brake mechanism, the combination with a running-controller having a handle adapted to be moved in one direction from its neutral position for running and 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.

5. In an electric brake mechanism, the combination with a running-controller, of means for moving the same contact-bars of the controller-switch over the same set of contact-points when the controller-handle is moved in either direction from its neutral position, and switch connections adapted to be operated, when the controller-handle is in its neutral position, to cut off the current from the line and to connect up the motors and the controller in a local brake-circuit.

6. In an electric brake mechanism, the combination with a running-controller, of means for moving the same contact-bars of the controller-switch over the same set of contact-points when the controller-handle is moved in either direction from its neutral position, and switch connections adapted to be automatically operated by the controller-handle

in passing over its neutral position to cut out the line-circuit and to connect up the motors to act as generators in a local brake-circuit.

7. In an electric brake mechanism, the combination with a running-controller having a handle adapted to be moved in one direction from its neutral position for running and in the opposite direction for braking, and means for moving the same contact-bars of the controller over the same set of contact-points for both running and braking, of a brake-switch adapted to be thrown automatically when the controller-handle passes over its neutral position.

8. In an electric brake mechanism, the combination with a running-controller having means for utilizing the same set of movable and fixed contact-points for both running and braking, of a combined brake and reversing switch having positions for running forward and backward respectively and two other positions for braking, the running-controller being connected into the brake-circuit and adapted to control the resistance therein.

9. In an electric brake mechanism, the combination with a running-controller having a handle adapted to be moved in one direction from its off position for running and in the opposite direction for braking, but utilizing the same set of fixed and movable contact-points for both running and braking, of a combined brake and reversing switch adapted by a single movement from either its forward or backward running position to cut out the line-circuit and to connect up the controller in a local brake-circuit with the motors acting as generators.

10. In an electric brake mechanism, a combined brake and reversing switch including the terminal points of the leads to the line, to the controller and to the brake-magnets, and having two intermediate series of contact-bars for forward and backward running respectively, and two outer series of contact-bars adapted to cut off the motors from the line and to connect them up in a circuit with the brake-magnets for forward and backward braking respectively.

11. In an electric brake mechanism, an attachment for running-controllers comprising a reversing-gear and a clutch device adapted to be applied to the controller-shaft whereby the shaft may be rotated in the same direction as the handle or in the opposite direction thereto.

12. In an electric brake mechanism, an attachment for running-controllers, comprising a reversing-gear adapted to be inserted between the controller-shaft and the handle, a clutch for locking the reversing-gear when the handle is moved in one direction from its neutral position, and means for releasing the clutch when the handle is moved in the opposite direction from its neutral position.

13. In an electric brake mechanism, an attachment for running-controllers comprising a beveled reversing-gear adapted to be inserted between the controller-shaft and the handle, a yoke mounted on the axis of the shaft for carrying the pinion of the reversing-gear, a clutch for locking the pinion against rotation in the yoke when the handle is moved in one direction from its neutral position, means for releasing the clutch, and a stop for preventing rotation of the yoke when the handle is moved in the opposite direction.

14. In an electric brake mechanism, an attachment for running-controllers comprising a beveled reversing-gear adapted to be inserted between the controller-shaft and the handle, a yoke mounted on the axis of the shaft for carrying the pinion of the reversing-gear, a clutch for locking the pinion against rotation in the yoke when the handle is operated on the running side, means for releasing the clutch, a stop and a latch device for holding the yoke stationary when the handle is operated on the braking side.

15. In an electric brake mechanism, an attachment for running-controllers, comprising a beveled reversing-gear adapted to be inserted between the controller-shaft and the handle, a yoke for carrying the pinion of the reversing-gear, a clutch for locking the pinion, means for releasing the clutch, a stop and a latch device for holding the yoke stationary in a certain position, and a cam for operating the latch.

16. In an electric brake mechanism, the combination of a running-controller, a brake-switch, a slide-bar having a slot, a crank-arm on the shaft of the brake-switch for engaging said slot, and means actuated by the handle of the running-controller when passing its off position for reciprocating said slide-bar.

17. In an electric brake mechanism, the combination of a running-controller, a brake-switch, a slide-bar having a slot and a cam groove or surface, an arm on the shaft of the brake-switch provided with a pin engaging said slot, and a crank arm or cam operated by the handle of the running-controller for engaging said cam-groove to reciprocate said slide-bar.

18. In an electric brake mechanism, the combination of a running-controller, a combined brake and reversing switch, a slide-bar having a slot one side of which is in the form of an arc, a crank-arm on the shaft of the brake-switch for engaging said slot, and means operated by the handle of the running-controller for reciprocating said slide-bar.

In testimony whereof I have hereunto set my hand.

FRANK CLARENCE NEWELL.

Witnesses:

R. F. EMERY,

JAS. B. MACDONALD.