No. 749,160. PATENTED JAN. 12, 1904.

C. W. BREEDLOVE & R. R. GRANT.

ELECTRICALLY OPERATED RAILWAY SWITCH.

APPLICATION FILED MAR. 25, 1903.

NO MODEL. 5 SHEETS—SHEET 1.

FIG. 1.

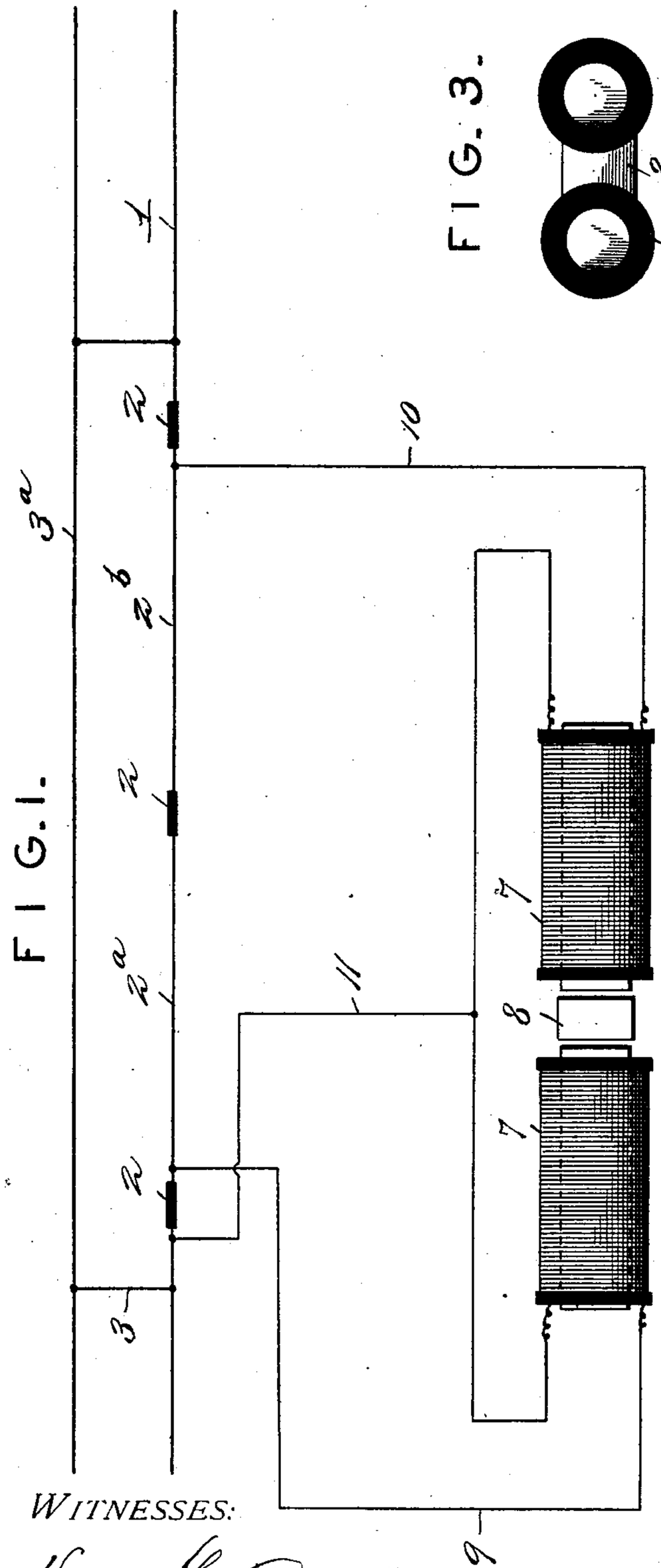

FIG. 3.

FIG. 2.

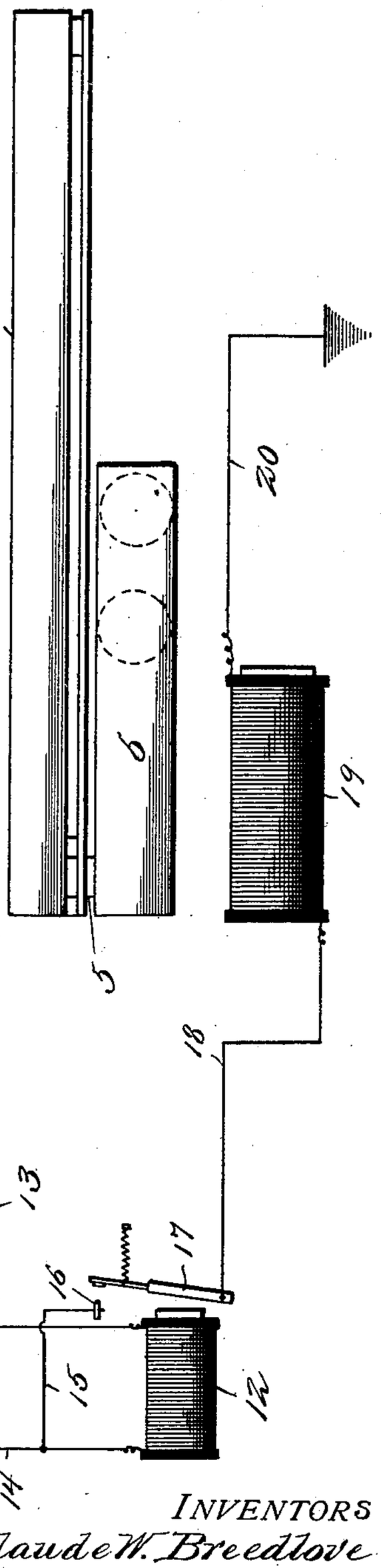

FIG. 4.

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NO MODEL. 5 SHEETS—SHEET 2.

FIG. 6.

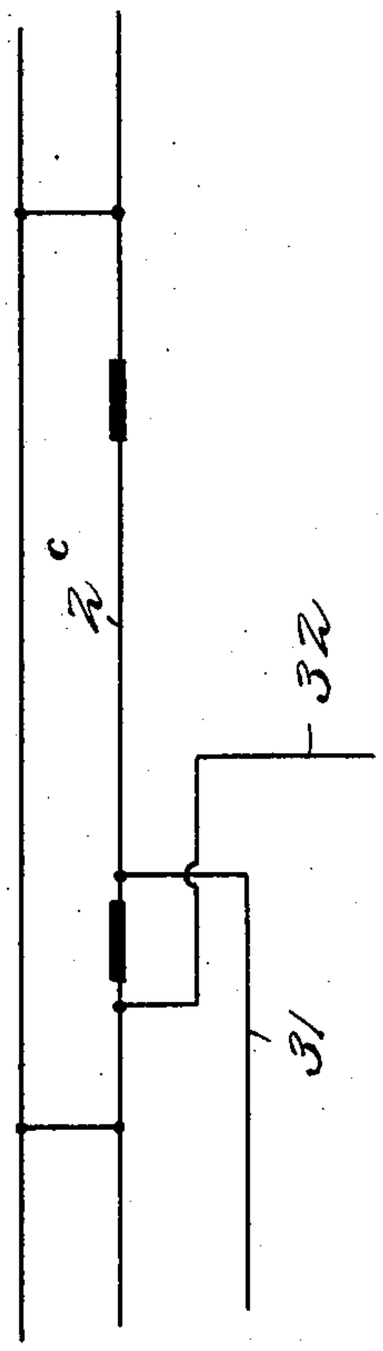


FIG. 7.

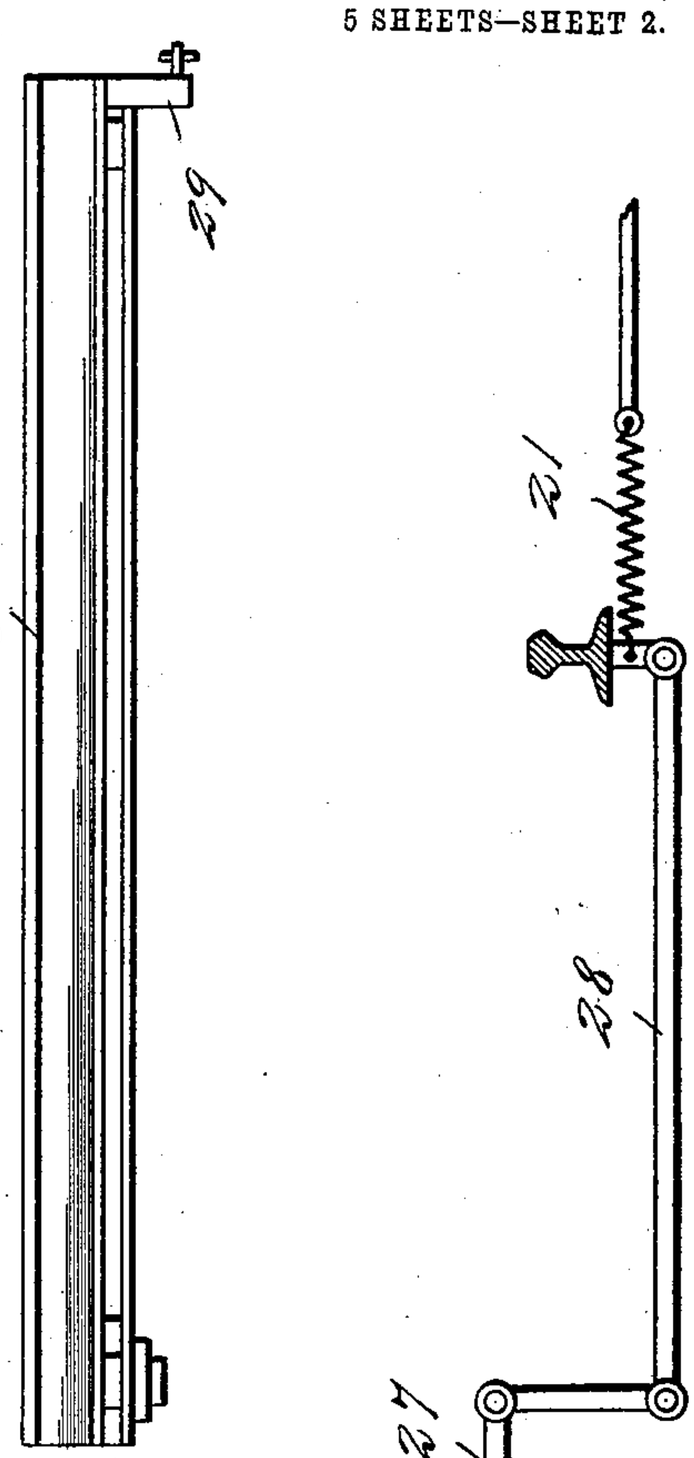
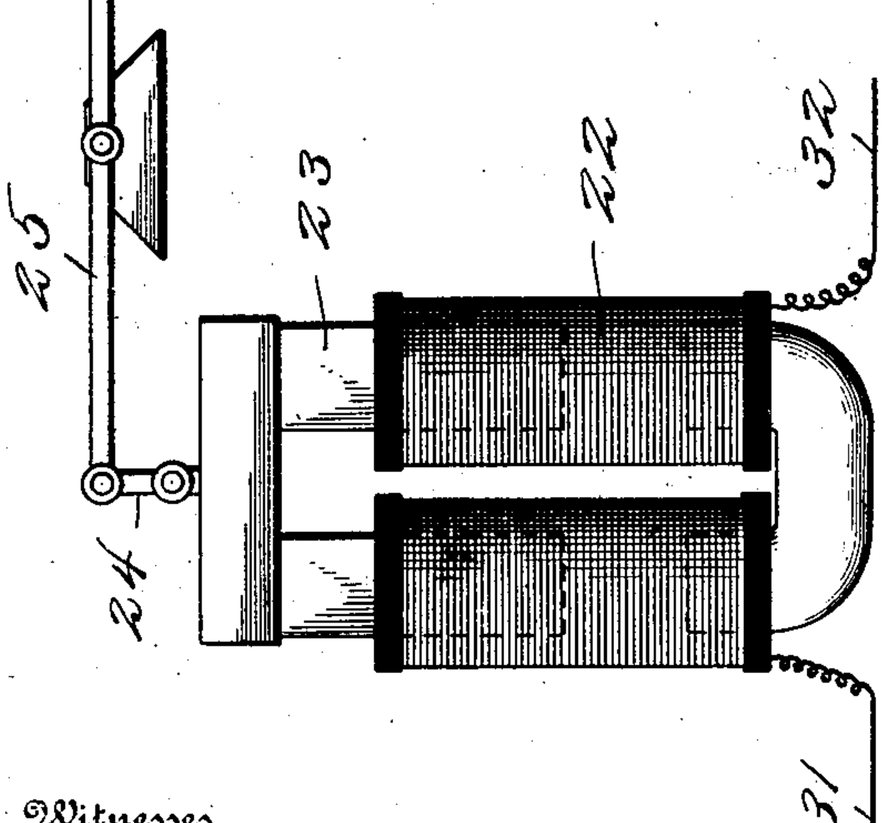


FIG. 5.



Witnesses

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NO MODEL. 5 SHEETS—SHEET 3.

FIG. 9

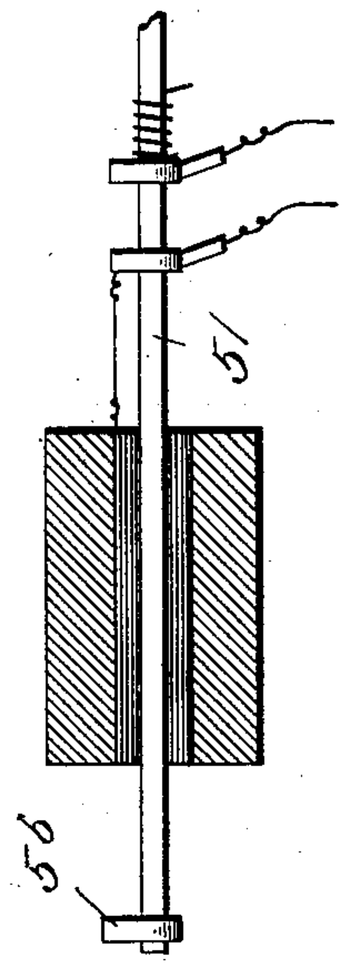
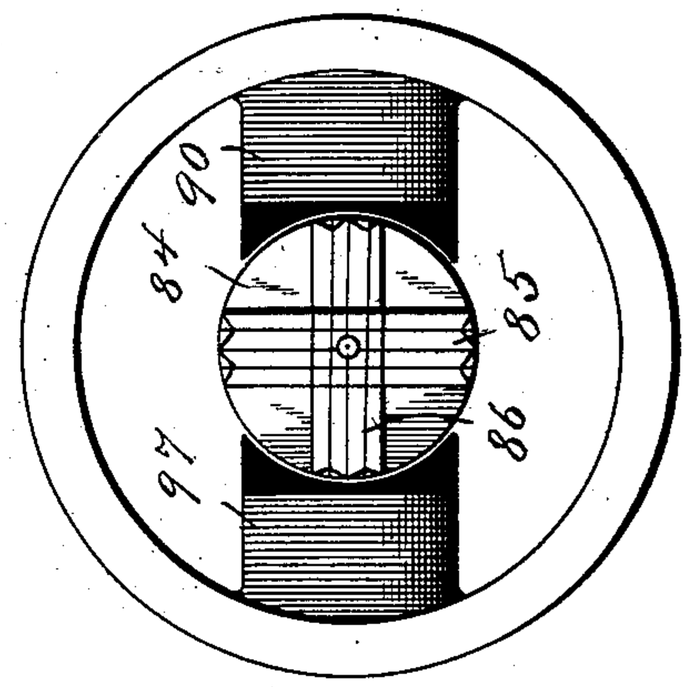


FIG. 17.



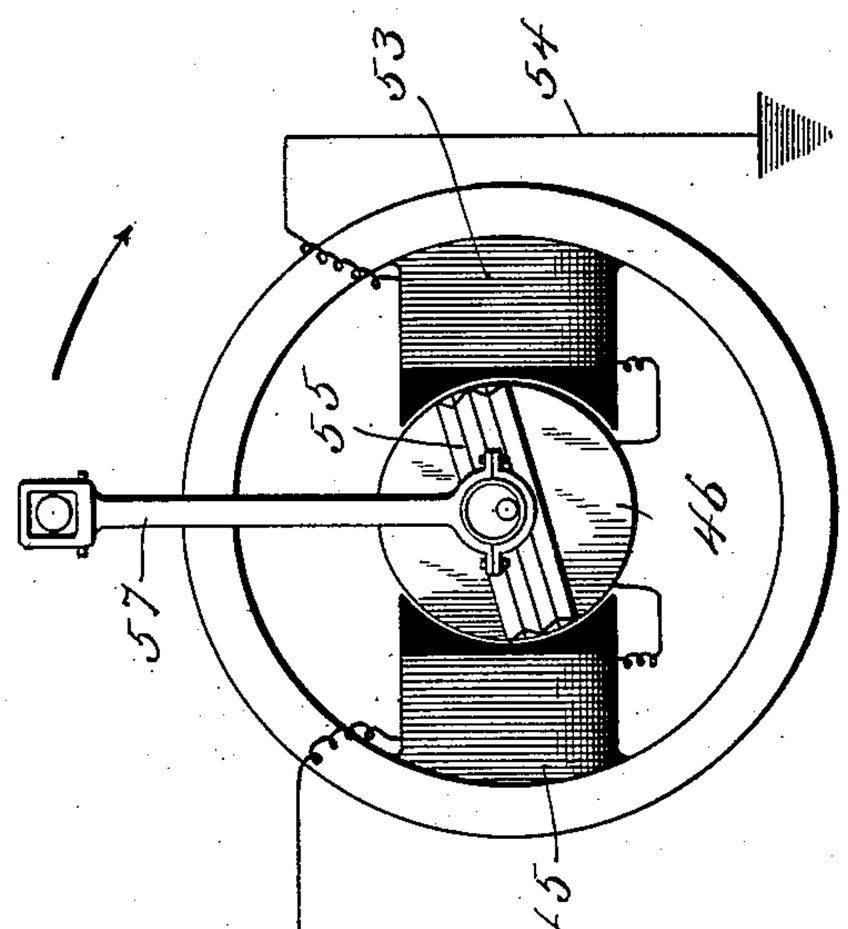


FIG. 8

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NO MODEL. 5 SHEETS—SHEET 4.

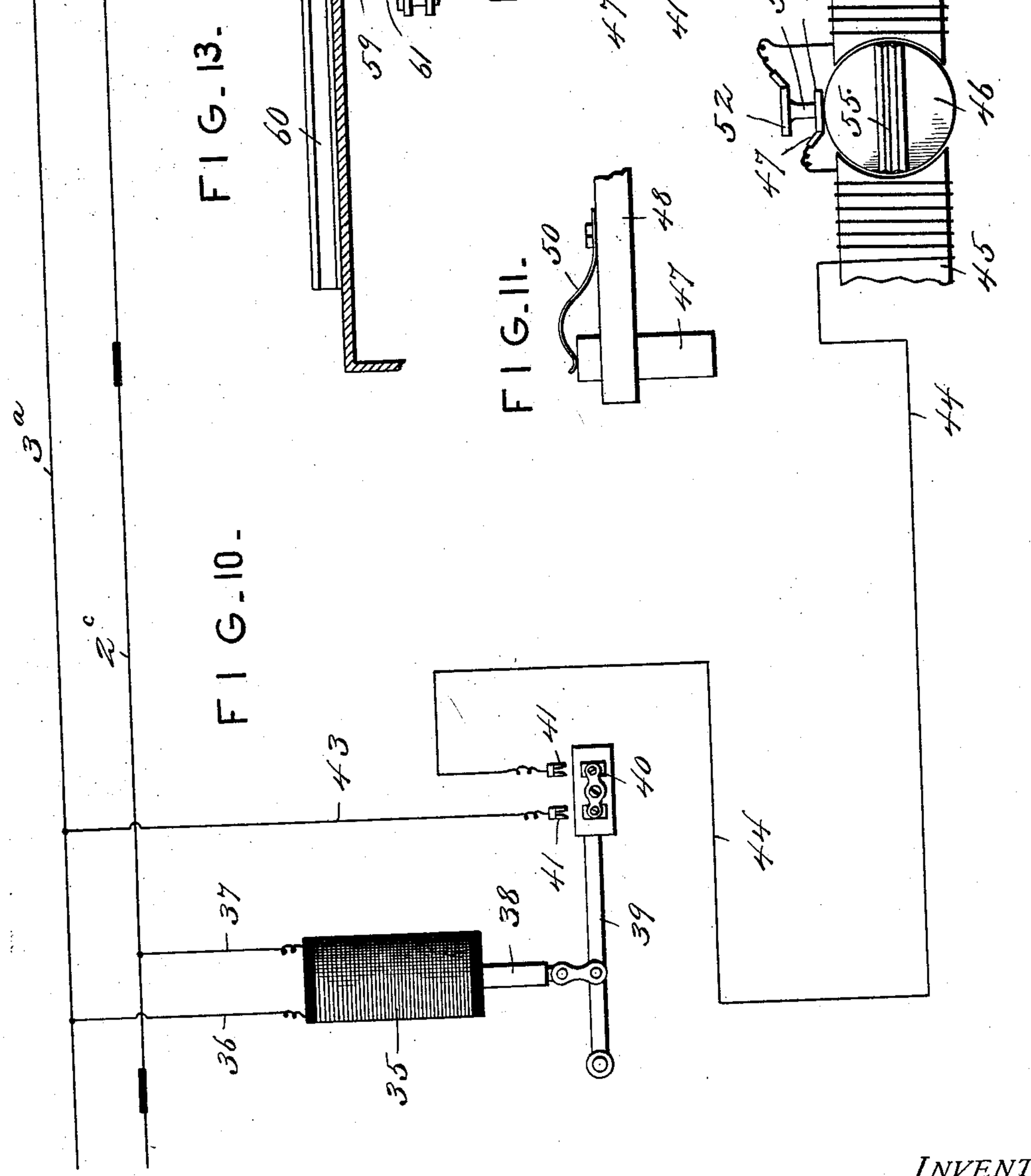

FIG. 10.

FIG. 11.

FIG. 12.

FIG. 13.

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ELECTRICALLY OPERATED RAILWAY SWITCH.

APPLICATION FILED MAR. 25, 1903.

NO MODEL. 5 SHEETS—SHEET 5.

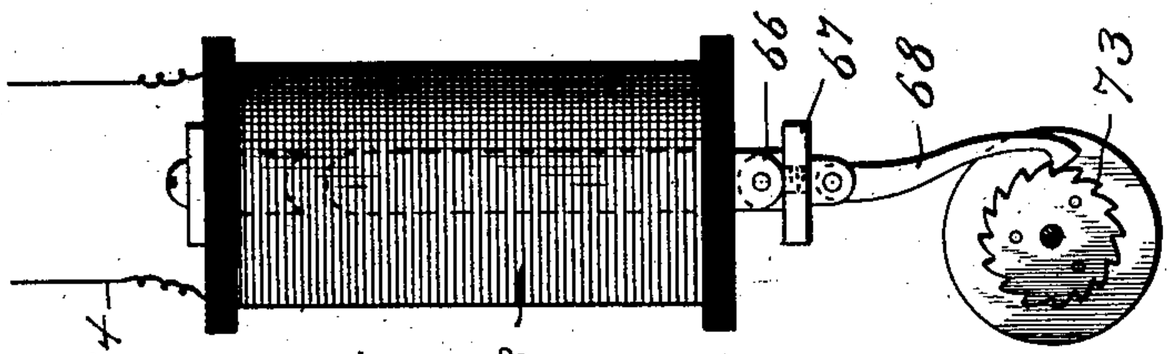

FIG. 15.

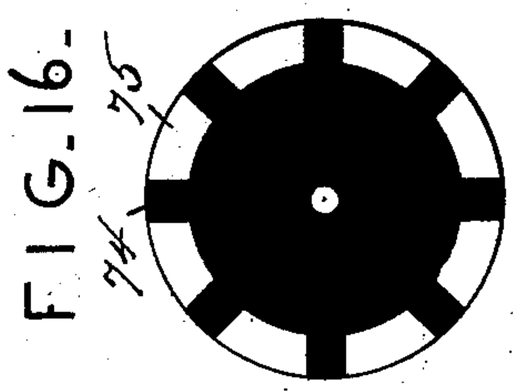

FIG. 16.

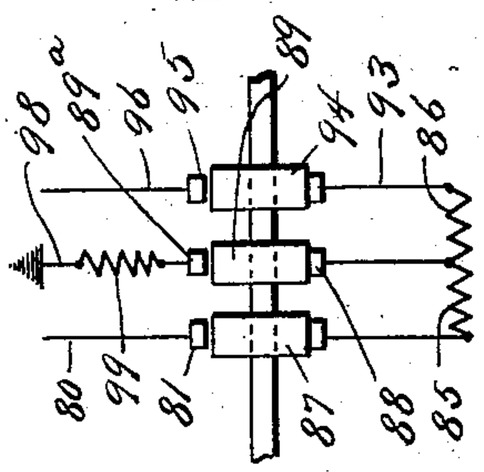

FIG. 18.

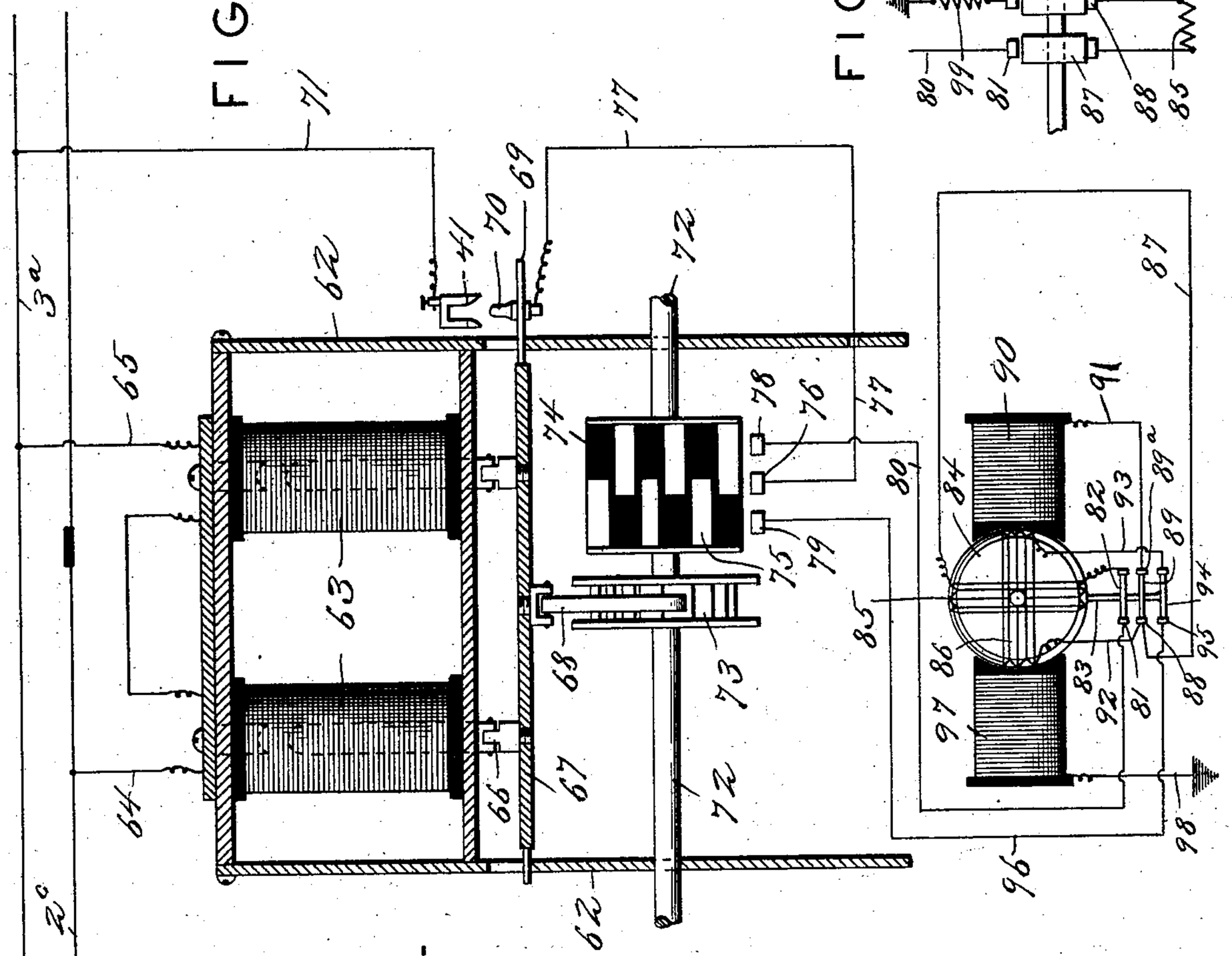

FIG. 14.

WITNESSES:

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No. 749,160. Patented January 12, 1904.

UNITED STATES PATENT OFFICE.

CLAUDE W. BREEDLOVE AND RUDOLPH R. GRANT, OF BERKLEY, VIRGINIA.

ELECTRICALLY-OPERATED RAILWAY-SWITCH.

SPECIFICATION forming part of Letters Patent No. 749,160, dated January 12, 1904.

Application filed March 25, 1903. Serial No. 149,568. (No model.)

To all whom it may concern:

Be it known that we, CLAUDE W. BREEDLOVE and RUDOLPH R. GRANT, citizens of the United States, residing at Berkley, in the county of Norfolk and State of Virginia, have invented new and useful Improvements in Electrically-Operated Railway-Switches, of which the following is a specification.

Our invention relates to new and useful improvements in electrically-operated railway-switches; and its object is to provide means whereby a switch-tongue may be readily shifted in a desired direction by the proper manipulation of the lever of an ordinary electrical controller employed upon cars propelled by electricity.

The invention consists in the novel construction and combination of parts hereinafter more fully described and claimed, and illustrated in the accompanying drawings, showing the preferred form of our invention, and in which—

Figure 1 is a diagrammatical view of a trolley and its feed-wire and showing the electrical connections between said trolley and the tongue-operating magnets of the apparatus. Fig. 2 is an elevation of the switch-tongue and the casing thereof, within which is arranged the operating-magnets. Fig. 3 is an end elevation of one of the magnets used for operating the switch-tongue. Fig. 4 is a diagrammatical view of a modified form of apparatus which is adapted to be employed where conditions do not permit the placing of the trolley under ground. Fig. 5 is an elevation of a solenoid adapted to be arranged upon a span-pole and which operates a series of rods and levers, whereby the switch-tougue may be shifted in one direction. Fig. 6 is a diagrammatical view of the trolley and feed wire and showing the manner in which the wires of the solenoid are connected thereto. Fig. 7 is a side elevation of a switch-tongue adapted to be used in connection with this form of apparatus. Fig. 8 is a diagrammatical view of another modified form of switch-shifting apparatus in which a rotary armature is employed and adapted to be operated when its magnets are energized so as to shift the switch-tongue. Fig. 9 is a longitudinal section through the armature, showing the eccentric, commutators, and brushes. Fig. 10 is a diagrammatical view of said modified form of apparatus, showing the electrical connections between the circuit-closing magnets and the feed and trolley wires and also showing diagrammatically the connections between said wires and the switch-operating armature. Fig. 11 is a detail view of one of the brushes of the commutator connected to the rotary armature. Fig. 12 is a detail view of one of the contacts of the electric switch used in this modified form of apparatus. Fig. 13 is a side elevation of the switch-tongue and showing the arm thereof which is adapted to be connected to the eccentric of the armature. Fig. 14 is a diagrammatical view of a further modification in which by the proper manipulation of the controller of an electric car the switch-tongue may be shifted in either direction desired. Fig. 15 is a side elevation of the commutator-operating magnets used in connection with this modification and showing the pawl and ratchet operated by said magnets. Fig. 16 is an end elevation of the commutator used in connection with this modification with its end plate removed. Fig. 17 is an end elevation of the magnets and switch-operating armature used in connection with this modified form, the eccentric upon the arm of the shaft of the armature being removed; and Fig. 18 is a diagrammatical view showing the course of a current of electricity through the switch-operating armature, its magnets, commutators, and brushes.

Referring to the figures by numerals of reference, 1 is a trolley-wire having, preferably, three circuit-breakers 2 arranged thereon. Connecting-wires 3 serve to conduct electricity from the feed-wire 3^a to those portions of the trolley which are not insulated by the circuit-breakers 2. The switch-tongue 4 is provided with a depending lug 5, which extends into a suitable casing 6, within which are arranged oppositely-disposed magnets 7, having an armature 8 arranged therebetween which is connected to the lug 5. Wires 9 and 10 extend from the insulated portions of the trolley-wire to the two sets of magnets, respectively, and

another wire 11 extends from a point adjacent to one of the connecting-wires 3 down to each set of magnets 7. With this arrangement of magnets and wires it is obvious that when a trolley-car is to go, for example, to the right the trolley, as soon as it reaches the insulated portion 2^a of the trolley-wire will draw the electric current through the wire 11 and wire 9 and energize the magnet included in said circuit, thereby shifting the switch in the desired direction. Before the trolley reaches the insulated portion 2^b of the trolley-wire the current is shut off from the motor of the car and said car permitted to coast until the insulated portion 2^b is passed. It will be understood that this operation can be reversed when it is desired to shift the switch-tongue in the opposite direction, it being merely necessary to coast over the insulated portion 2^a and turn on the current to the motor when the trolley reaches the insulated portion 2^b.

When for any reason it is impossible to place wires 9, 10, and 11 under ground, thereby endangering the perfect insulation of the system, a small magnet 12, having a few coils of wire thereon, can be placed within a suitable casing upon a span-pole and said magnet connected to one of the insulated portions of the trolley-wire by means of a wire 13 and to said wire at a point adjacent to a connecting-wire 3 by means of a wire 14. A branch wire 15 extends from wire 14 to a contact 16, and an armature 17 is electrically connected, by means of a wire 18, to a magnet 19, heavily wound with small wire and arranged adjacent to the switch-tongue and adapted to operate the same. A wire 20 serves to conduct the current from this magnet 19 to the ground. By employing an apparatus of this character it is only necessary to use one insulated portion 2^c upon the trolley-wire, and the car upon reaching the same will draw the current through wires 14 and 13 and magnet 12 and cause armature 17 to close the circuit between wires 15 and 18. The magnet 19 will thus be energized and attract the switch-tongue to it, and as said tongue when used with an apparatus of this character has a coiled spring 21 connected thereto it is obvious that this spring will return the same to normal position after the car has passed off of the insulated portion 2^c.

In Fig. 5 we have shown a solenoid 22, which may be connected to a span-pole, the armature 23 of which is fastened by means of a link 24 to a lever 25. The opposite end of this lever is connected by means of a rod 26 to a bell-crank lever 27, which may be arranged under ground and connected by a rod 28 to a lug 29, depending from the switch-tongue 30. The spring 21 serves to hold this tongue normally in one position, and when it is desired to shift the tongue to its other position it is merely necessary to direct the current to the motor of the car when the trolley of said car reaches the insulated portion 2^c of the trolley-wire. The current will then promptly pass through wires 31 and 32 to the magnets and cause the operation of the levers 25 and 27. When the normal position of the switch is such as not to require changing, it is merely necessary to coast over the insulated portion 2^c.

In lieu of the series of levers and rods employed in the mechanism illustrated in Fig. 5 a current of electricity can be directed to a rotary armature which is adapted to shift the switch-tongue in one direction. We have illustrated this form of device in Figs. 8 to 12, in which 33 is a span-pole, to which a casing 34 is connected. Arranged within this casing is a solenoid 35, which is electrically connected, by means of a wire 36, to the feed-wire 3^a and to the insulated portion 2^c of the trolley by means of a wire 37. The armature 38 of this magnet is connected to a lever 39, having electrically-connected pins 40 at one end thereof, which are adapted when the magnet is energized to be drawn upward between spring-arms 41, which project from plugs 42. One of these plugs is connected to the feed-wire 3^a by means of a wire 43, while the other is connected by a wire 44 to a magnet 45, having a rotary armature 46. A brush 47, preferably formed of carbon and slidably mounted in an arm 48, is electrically connected to the magnet 45 and is held in contact with a commutator 49 by means of a spring 50. This commutator is mounted upon the shaft 51 of the armature 46, and a second commutator 52 is arranged on said shaft and has a brush similar to the brush 47, which is electrically connected to a magnet 53, arranged at the other side of the armature 46 and having a wire 54 for conducting the current to the ground. A wire coil 55 extends across the armature. The shaft 51 is shown diagrammatically in Fig. 10; but in Fig. 9 we show the proper position of the same in relation to the armature. By referring to said figure and Fig. 8 it will be seen that an eccentric 56 is secured to the shaft and has a pitman 57 mounted thereon. This pitman is connected in any suitable manner to an arm 58, extending laterally from a stem 59, formed upon the lower surface of one end of a switch-tongue 60, as shown in Fig. 13. When a car reaches the insulated portion 2^c and draws a current thereto, it is obvious that solenoid 35 will be energized and draw the pins 40 upward. This will close the circuit through wires 43 and 44, and the current will cause the armature 46 to rotate a one-half revolution, and thereby shift the switch in the desired direction. As soon as the insulated portion 2^c is passed the coiled spring 61 upon stem 59 will turn the switch-tongue 60 to normal position.

It will of course be understood that with

the constructions herein described in which a spring is utilized for throwing the switch-tongue in one direction it is necessary for the car to coast for a certain distance if it is not desired to shift the switch electrically. This feature will be found objectionable where the switch is approached upon an upgrade, and it is therefore necessary in such cases to provide mechanism such as illustrated in Figs. 14 to 18. By referring to said figures it will be seen that we provide a casing 62, having solenoids 63 therein, connected to the insulated portion 2^c of the trolley-wire by means of a wire 64 and to the feed-wire 3^a by means of a wire 65. The armatures 66 of the solenoids are pivoted to a strip 67, slidably mounted within the casing and having a pawl 68 pivoted thereto. An extension 69 is arranged at one end of the strip 67 and has a plug 70 extending upward therefrom. This plug is adapted to be brought in position between the arms 41 of a contact constructed substantially similar to the one illustrated in Fig. 12, and this contact is connected to the feed-wire 3^a by a wire 71.

A shaft 72 is journaled within the casing at a point below strip 67 and has a ratchet-wheel 73 secured thereto and adapted to be engaged by pawl 68. A commutator 74 is also secured to this shaft and is formed of insulating material and provided in its periphery with a series of oppositely-extending alternately-arranged contact-plates 75, which are insulated from each other. The inner ends of these plates overlap and are all adapted to contact successively with a brush 76, connected to the plug 70 by means of a wire 77. Brushes 78 and 79 are arranged at opposite sides of brush 76 and are adapted to contact with alternate plates 75. One of these brushes, 78, is electrically connected, by means of a wire 80, to a brush 81, which bears upon a commutator 82, arranged on the shaft 83 of a rotary armature 84. Coils 85 and 86 are arranged on this armature at right angles to each other, and one of these coils, 85, is electrically connected to the commutator 82. The opposite end of this coil is connected to a wire 87, which serves to conduct a current of electricity to a brush 88, mounted on shaft 83 and bearing upon a commutator 89, which is electrically connected to a brush 89^a, which is connected to a magnet 90 by a wire 91. The brush 88 is also electrically connected to one end of coil 86 by a wire 92, and the other end of said coil is electrically connected by a wire 93 to a commutator 94, arranged on shaft 83. This commutator has a brush 95, which is connected to brush 79 by a wire 96. A magnet 97 is arranged at the side of the armature 84 removed from magnet 90 and is connected to the ground by means of a wire 98. With this apparatus when it is desired to shift the switch the current is directed to the motor of the car as soon as said car reaches the insulated portion 2^c of the trolley. Electricity is thus drawn from feed-wire 3^a through wires 65 and 64, thereby energizing the solenoids 63 and causing them to retract their armatures. Strip 67 will be drawn upward and plug 70 brought into contact with the arms 41, and thereby electrically connect the wires 71 and 77. As the brush 76 is at all times in contact with one of the plates 75, it is obvious that said plate will also be electrically connected with the feed-wire 3^a. When the strip 67 moves upward, it will draw pawl 68 therewith and cause the ratchet-wheel 76 to rotate, thereby bringing a plate 75 into contact with one of the brushes 78 and 79. If brush 79 is contacted by said plate, a circuit will be promptly established between wires 77 and 96 to brush 95 through the commutator 94, wire 93, coil 86, wire 92, commutator 89, wire 91, the magnets and the field 99 therebetween to the ground-wire 98. This will cause a one-half revolution of the armature 84 in one direction, and the pitman 57, mounted upon the eccentric 56 upon the shaft of said armature, will be drawn so as to operate the switch-tongue. The plug 70 and the pawl 68 will be held in raised position as long as the current continues uninterrupted through the motor of the car. If the switch-tongue when first moved, as above described, is not brought to the proper position, the current within the car can be broken momentarily to permit strip 67 to fall into its normal position, and when said current is again established through the car the commutator 74 will be partially rotated for a second time and bring a contact-plate 75 into electrical connection with the brush 78. This will establish a circuit from the wire 77 through wire 80, brush 81, commutator 82, coil 85, wire 87, commutator 89, wire 91, magnets 90 and 97, through the field 99 and wire 98. A half-revolution of the armature in the opposite direction is thus produced, and the switch-tongue is caused to move back to its initial position.

In the foregoing description we have shown the preferred form of our invention; but we do not limit ourselves thereto, as we are aware that modifications may be made therein without departing from the spirit or sacrificing the advantages thereof, and we therefore reserve the right to make such changes as fairly fall within the scope of our invention.

Having thus described the invention, what is claimed as new is—

1. In an electrically-operated switch, the combination with a trolley-wire having an insulated portion and a feed-wire electrically connected to the trolley-wire at opposite sides of the insulated portion; of a magnet electrically connected to the feed-wire and the insulated portion of the trolley-wire, a contact electrically connected with the feed-wire, an armature to the magnet adapted to bear upon said contact when the magnet is energized, a rotary armature, magnets therefor, a switch-

tongue, and means connecting said tongue and the rotary armature for transmitting motion to the tongue.

2. In an electrically-operated switch, the combination with a trolley-wire having an insulated portion and a feed-wire connected to the trolley-wire at opposite sides of the insulated portion; of a rotary armature, magnets therefor electrically connected with the feed-wire, a circuit-closer within said connection and connected with the feed-wire and the insulated portion of the trolley-wire, an eccentric connected to and revoluble with the armature, a pitman upon the eccentric, a switch-tongue, and means connecting the tongue and pitman whereby a reciprocating motion may be imparted to the tongue by the armature.

3. In an electrically-operated switch, the combination with a trolley-wire having an insulated portion; of a feed-wire connected to said trolley-wire at opposite sides of said portion, an armature, magnets at opposite sides thereof, electrical connections between the magnets and the ground and feed wire, respectively, said armature being adapted to make a one-half revolution when the magnets are energized, an electrically-operated circuit-closer intermediate the feed-wire and magnets and electrically connected to said feed-wire and the insulated portion of the trolley-wire, an eccentric connected to and revoluble with the armature, a pitman mounted thereon, and a switch-tongue connected to and adapted to be operated by the pitman.

4. In an electrically-operated switch, the combination with a trolley-wire having an insulated portion and a feed-wire connected to the trolley-wire at opposite sides of said insulated portion; of a circuit-closer connected to the feed-wire and the insulated portion, a commutator, means for simultaneously rotating said commutator and closing the circuit, alternately-arranged overlapping conducting-plates upon the commutator, a brush for all of said plates adapted to be electrically connected to the feed-wire by the circuit-closer, a rotary armature adapted to be partially rotated in either direction, a switch-tongue connected to and operated thereby, and means for conducting a current through the commutator to either side of the armature.

5. In an electrically-operated switch, the combination with a switch-tongue; of a rotary armature having coils at right angles to each other and adapted to partially rotate, means connecting the armature and tongue whereby the tongue may be shifted by said armature, magnets to the armature, a commutator, a trolley-wire having an insulated portion, a feed-wire connected to the trolley-wire at opposite sides of the insulated portion, an electrical connection between the feed-wire and commutator, a circuit-closer within said connection connected with the feed-wire and the insulated portion, and means operated by the circuit-closer for rotating the commutator whereby a current may be directed into either coil of the armature.

6. In an electrically-operated switch, the combination with a trolley-wire having an insulated portion and a feed-wire connected to the trolley-wire at opposite sides of said portion; of a magnet electrically connected with the feed-wire and the insulated portion, an armature to the magnet, a contact electrically connected to the feed-wire, a plug connected to the armature adapted to bear upon the contact, a rotary shaft, a commutator thereon, a ratchet-wheel revoluble with the commutator, and a pawl connected to the armature and engaging the ratchet-wheel.

7. In an electrically-operated switch, the combination with a trolley-wire having an insulated portion and a feed-wire connected to the trolley-wire at opposite sides of said insulated portion; of a magnet electrically connected to the feed-wire and the insulated portion, an armature, a shaft, a commutator secured to and revoluble with the shaft and having oppositely-extending overlapping conductor-plates in the periphery thereof, a ratchet-wheel revoluble with the commutator, and a pawl connected to the armature and engaging the ratchet-wheel.

8. In an electrically-operated switch, the combination with magnets and a rotary armature therebetween having coils at right angles to each other; of commutators revoluble with said armature, electrical connections between one of the commutators and both coils, electrical connections between said coils and the other commutator respectively, a feed-wire, and electrically-operated means for directing a current from the feed-wire to either coil of the armature.

In testimony whereof we affix our signatures in presence of two witnesses.

CLAUDE W. BREEDLOVE.
RUDOLPH R. GRANT.

Witnesses:
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S. W. CHILDRESS.