

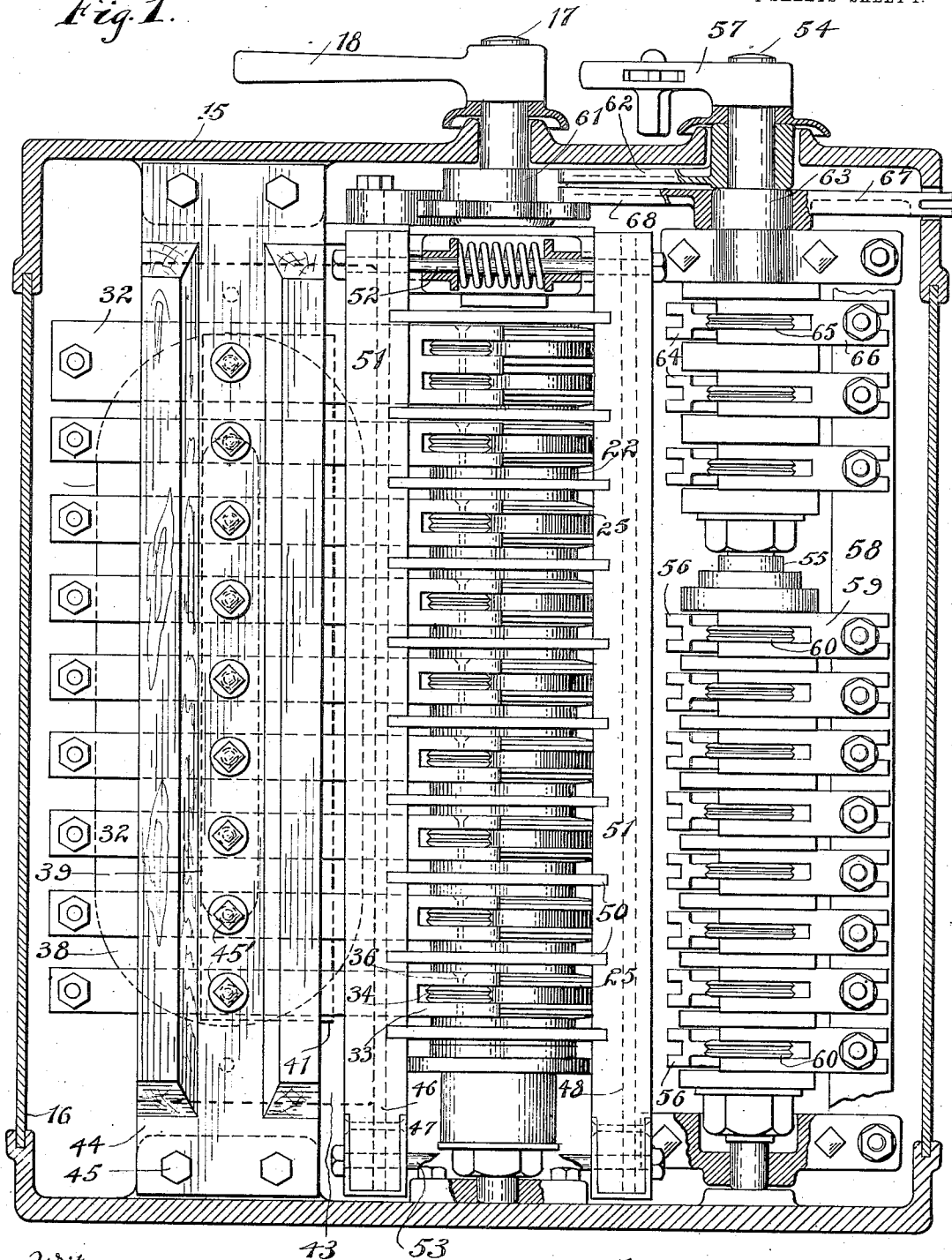
R. E. NOBLE & L. E. MITCHELL.
ELECTRIC SWITCH OR CONTROLLER.
APPLICATION FILED AUG. 12, 1908.

990,767.

Patented Apr. 25, 1911.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Milton F. Stein
Alv. Fenstermaker

Inventors.

Ralph E. Noble and Louise E. Mitchell.
By Glenn S. Noble.
Attorney.

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4 SHEETS—SHEET 2.

Fig. 2

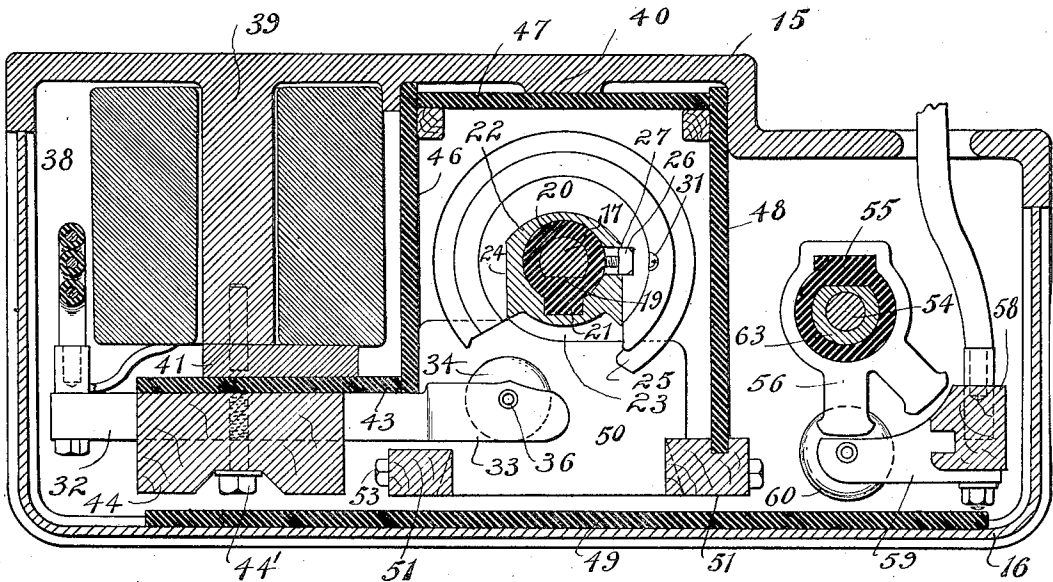


Fig. 3.

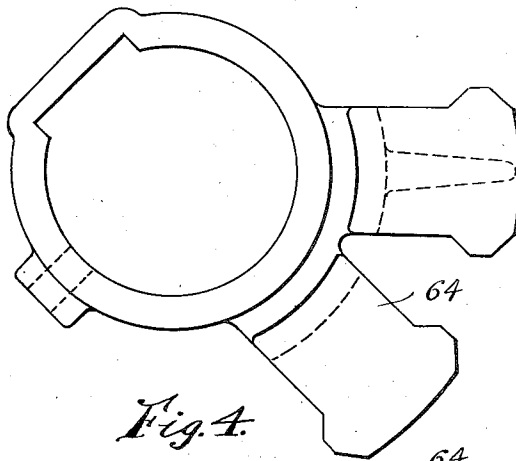


Fig. 4.

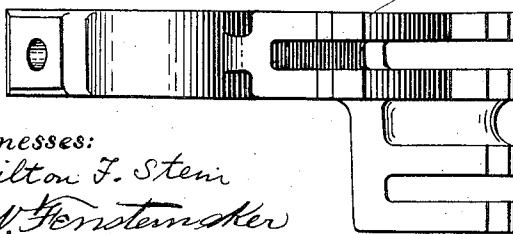
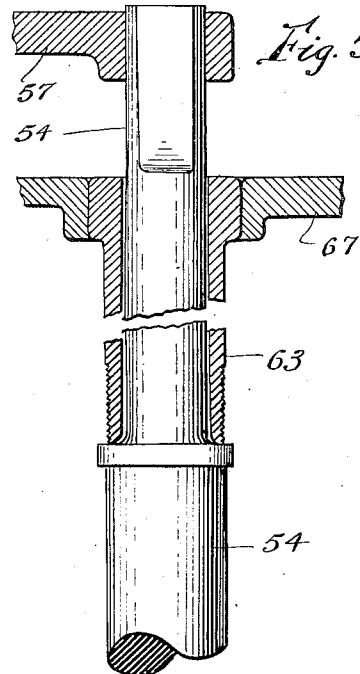


Fig. 5



Witnesses:
Milton F. Stein
A. W. Forstner

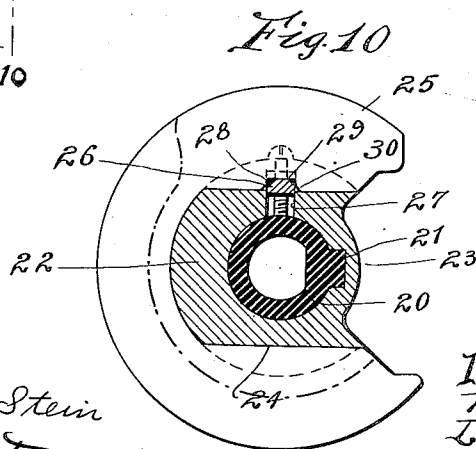
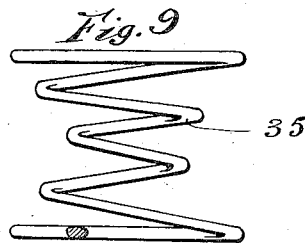
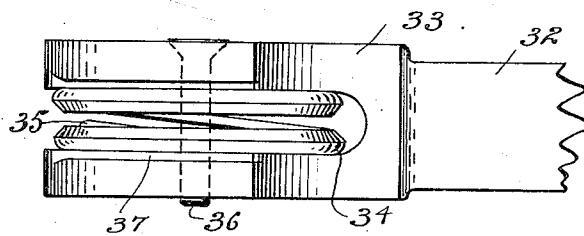
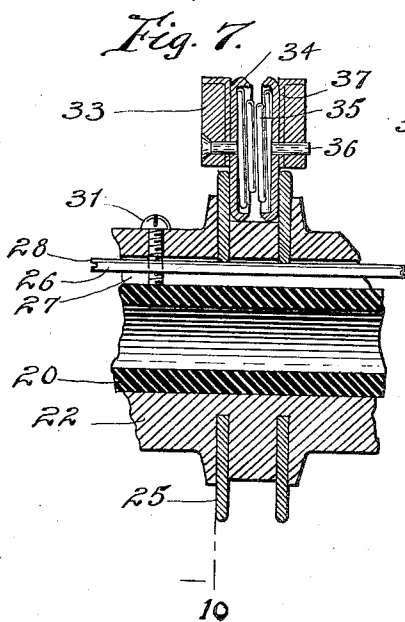
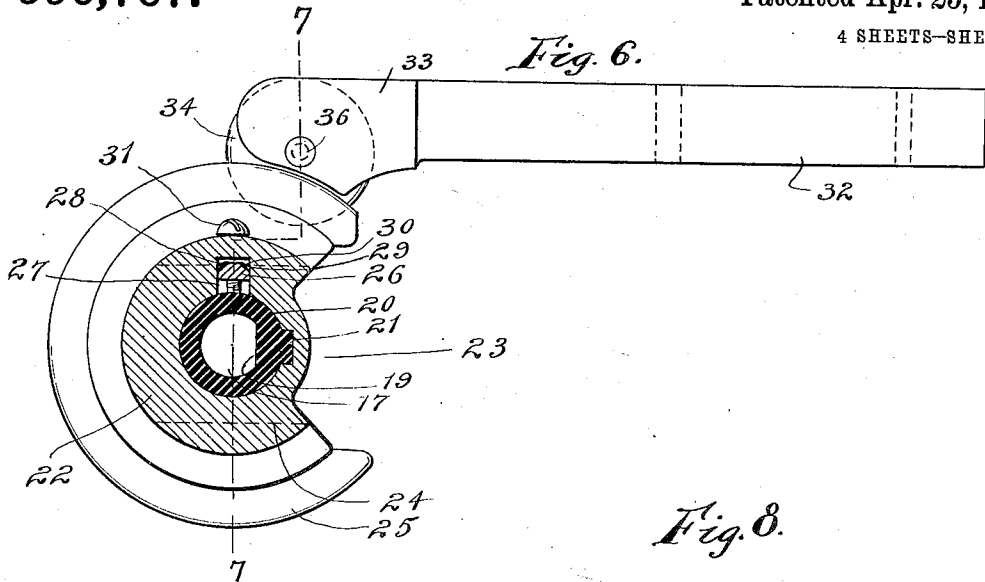
Inventors,
Ralph E. Noble & Louis E. Mitchell
By Glenn S. Noble
Attorney.

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4 SHEETS—SHEET 3.



Witnesses:
Milton L. Stein
All. Fenstermaker

Inventors,
Ralph E. Noble
Louis E. Mitchell
By Glenn S. Noble.
Attorney.

R. E. NOBLE & L. E. MITCHELL.
ELECTRIC SWITCH OR CONTROLLER.
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4 SHEETS—SHEET 4.

Fig. 12

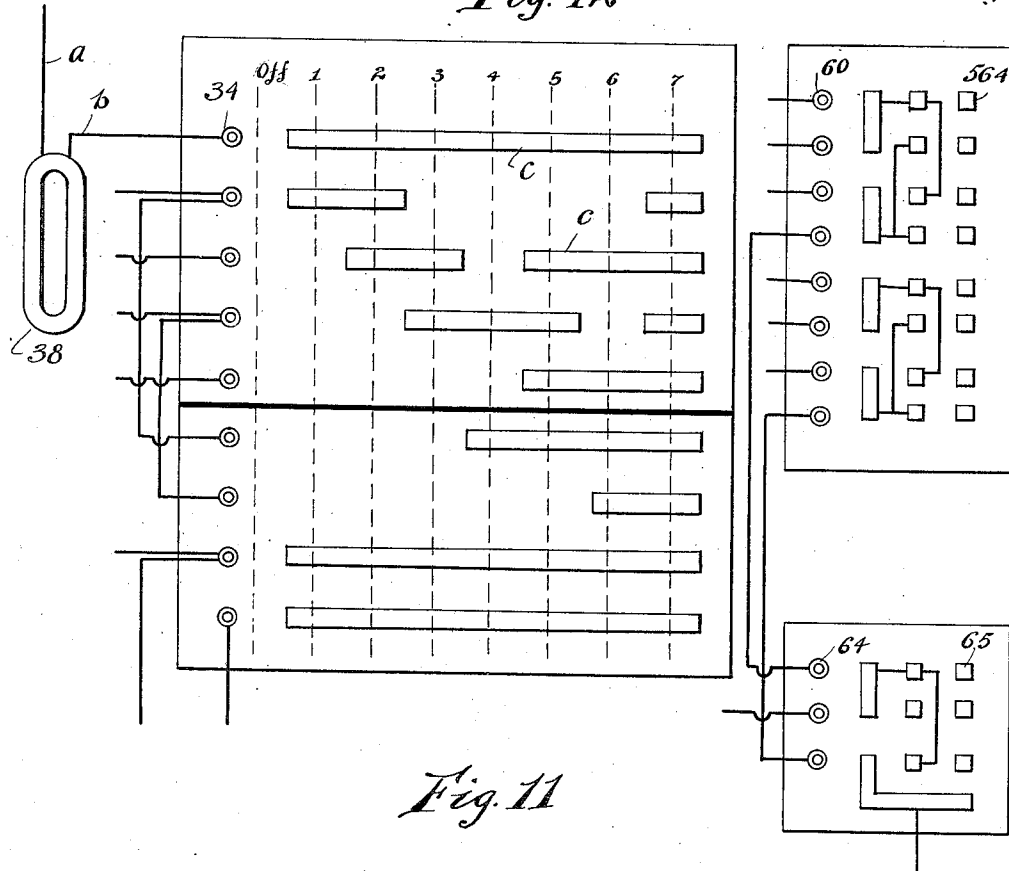
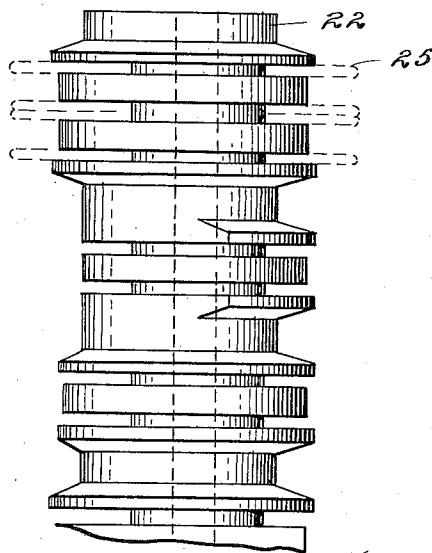


Fig. 11



Witnesses:
Milton F Stein
A. W. Vanstenuiter

Inventors:
Ralph E. Noble & Louis E. Mitchell
By Glenn S. Noble.
Attorney.

UNITED STATES PATENT OFFICE.

RALPH E. NOBLE AND LOUIS E. MITCHELL, OF CHICAGO, ILLINOIS, ASSIGNORS TO
MORGAN-GARDNER ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

ELECTRIC SWITCH OR CONTROLLER.

990,767.

Specification of Letters Patent. Patented Apr. 25, 1911.

Application filed August 12, 1908. Serial No. 448,193.

To all whom it may concern:

Be it known that we, RALPH E. NOBLE and LOUIS E. MITCHELL, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Switches or Controllers, of which the following is a specification.

This invention relates more particularly to regulators or controllers used in connection with electric cars or locomotives, although certain fundamental features thereof are also applicable to various types of electric switches and may also be used in other kinds of controllers.

The objects of the present invention are to improve the general construction and increase the efficiency and durability of such controllers or switches, to provide improved means for making and breaking the circuit connections, to provide an efficient and effective blow-out magnet device, and to combine the current-carrying fingers of the switch with pathways or circuits for the lines of force of the magnetic blow-out. We attain these objects, and such other advantages as will appear hereinafter, by means of the mechanism or apparatus shown in the accompanying drawings, in which—

Figure 1 is a front view, partially in section, of a controller embodying our improvements; Fig. 2 is a horizontal cross-section of the same; Figs. 3, 4 and 5 are details of the reversing and series-parallel switches; Fig. 6 is an enlarged view showing the wiper and cylinder of the regulating switch; Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6; Fig. 8 is an enlarged view of one of the contacts or wipers; Fig. 9 is a view of the coil spring used in connection with the wiper wheels or disks; Fig. 10 is a sectional view of the regulating switch cylinder, taken on the line 10—10 of Fig. 7; Fig. 11 is an enlarged side elevation of the main portion of the regulating switch cylinder; and Fig. 12 is a diagram illustrating the various switch connections.

As shown in these drawings, the present invention is illustrated as applied to a controller adapted for use in connection with cars or locomotives having two or more mo-

tors and combining in one casing a regulating switch, a reversing switch, and a switch for changing from series to parallel and vice versa.

The casing 15 is preferably made of cast iron to form a portion of the blow-out magnet field, and is provided with a removable cover 16. Centrally located within the casing is a regulating switch cylinder which coacts with certain contact fingers or devices for changing the relationship of the motors with the resistance. The regulating cylinder is provided with a shaft 17 mounted in suitable bearings in the casing 15 and having at its upper end a handle 18 for turning the same. The main portion of this shaft is flattened, as indicated at 19, to engage with an insulating sleeve 20 having a correspondingly shaped hole therein, so that the sleeve will turn with the shaft. This sleeve has a lateral projection 21 somewhat in the form of a key. The different portions of the cylinder proper 22 fit over this insulating sleeve and are provided with slots to engage with the projection 21. The cylinder 22 may be made in one or more sections, as desired, in order to make the various necessary connections, and, as indicated in Fig. 12, is made in two sections separated by an insulating disk. This cylinder varies in cross-section as indicated particularly in Figs. 6 and 10 but is preferably cut away along substantially its entire length, as indicated at 23, to leave an opening for the neutral or "off" position of the wipers, that is, when no current is passing through the switch. This cylinder is flattened or cut away on the sides at various points along its length, as indicated at 24, to receive the contact disks 25, which are preferably made of copper or other suitable material of high conductivity.

The disks 25, as particularly shown in Fig. 10, are provided with central openings corresponding in shape with the cross-section of the cylinder at the points of engagement, so that when the disks are slipped into position on the cylinder, they will be in substantial alinement and also uniformly positioned on the cylinder. In order to hold all of the disks on a given section of the cyl-

5 under in position, we have provided a novel
 form of fastening device which consists of a
 key 26 which slides in a slot 27 in the drum
 or cylinder 22. This key or feather is beveled
 at the outer corners as indicated at 28
 to engage with the slots 29 in the disks 25.
 These slots are also preferably beveled as
 indicated at 30, so that if the disks are not
 in exact alinement when the key is forced
 10 into locking position, it will enter the slots
 and thereby aline the disks. The key or
 feather 26 is moved in and out by means of
 one or more screws 31 passing through holes
 in the sides of the drum or cylinder 22 and
 15 engaging with threaded holes in the key, so
 that when the screws are turned in one direction,
 the key will be drawn away from the
 center or out into locking position where it
 engages with the disks 25 and locks them
 20 securely in position. When it is desired to
 remove the disks, or to insert the disks in
 position on the cylinder 22, the screws are
 turned in the opposite direction and are used
 to press the key 26 down to the bottom of
 25 the slot 27, when it will be disengaged from
 the disks. In order to bring the disks 25
 into close contact with the drum or cylinder
 22, the slot in the drum is made somewhat
 deeper than the slots in the disks, so that
 30 when the key 26 is forced outwardly by
 means of the screws 31, as shown in Fig. 10,
 it will bear against the disks and force them
 laterally so that the opposite inner sides of
 the disks will be drawn tightly against the
 35 corresponding faces of the cylinder. These
 disks may be made in any desired form to
 maintain contact with the wipers during
 any desired portion of rotation of the switch
 cylinder. For instance, as shown in full
 40 lines in Fig. 10, the disks may extend
 entirely around from the start to the off position;
 or, as indicated by the dotted line, may
 be cut away to maintain contact during a
 comparatively short portion of the movement
 45 of the cylinder. This is for the purpose
 of making and breaking various circuits
 in the motor connections. One of the most
 important features of this invention is the
 novel means provided for closing the
 50 circuits from the various terminal fingers,
 through these disks or through the switch
 cylinder, and for breaking or disrupting any
 arcs which may be formed between the
 wipers and the cylinder disks. For this
 55 purpose we provide a plurality of terminal
 connections or fingers 32 preferably made of
 iron or other suitable material adapted to
 carry an electric current and also to provide
 60 a pathway for the lines of force of the blow-
 out magnet. For the purpose of making
 contact between these fingers or bars and the
 disks 25, the bars or fingers are provided
 with forked ends 33 to receive the rotatable
 65 wheels or contact members 34 which make
 contact with the disks 25. The wheels 34

are arranged in pairs in the forks 33 and are
 held apart by means of peculiarly shaped
 coiled springs 35, shown extended in Fig. 9.
 The wheels 34 are preferably recessed to receive
 these double conical springs which are
 70 made in this form so that in case any become
 broken, they will still retain their spring
 action, without falling out from the space
 between the wheels. These wheels are
 75 mounted on pins or axles 36 passing through
 the forks 33. In order to insure a good electrical
 connection between the wheels 34,
 which are ordinarily made of copper, and
 the iron bars 32, we provide copper lining
 80 plates 37 which are flanged at the top to
 engage with the edges of the forks 33, the
 flanges being soldered or fastened to the
 edges, leaving the main portions of the
 plates free, so that they may be sprung in
 85 slightly to insure good contact between
 themselves and the wheels 34. These wheels
 34 are slightly beveled around the outer
 edges, so that they will pass in between two
 adjacent disks 25, as indicated in Figs. 6 and
 90 7, the space between said disks being slightly
 smaller than the normal distance between
 the outer faces of the wheels, so that when
 the contact is made between these disks and
 the coating wheels, the spring 35 will press
 95 the wheels into close contact with the disks.
 It will be readily seen from Fig. 6 that when
 the cylinder 22 is turned to bring the opening
 23 in line with the wheels 34, there will
 be no contact between the wheels and the
 100 disks. Then, when the cylinder is turned,
 the disks will pass into engagement with the
 respective wiper wheels, thereby closing the
 circuit between the cylinder and the terminal
 fingers. On account of the rolling movement
 105 between the disks and the wheels or
 wipers, the tendency will be to maintain
 good contact surfaces, and, should any slight
 raise or spots be formed on the wheels, the
 wheels will be turned when they come in
 110 contact with the ends of the disks until clean
 contact surfaces are presented. On account
 of this rolling contact, a much larger contact
 surface is available than was possible in
 using the old method of sliding contacts.
 115 The terminal fingers or bars 32 are further
 utilized in connection with the blow-out
 device, as will now be explained.

At the side of the regulating switch is
 mounted a magnet 38, having its core 39
 120 made integral with or connected with the
 back of the casing 15, so that the back of
 the casing will form, as it were, one of the
 arms of the magnet or a pathway for the
 magnetic lines of force. In order to concentrate
 125 these lines of force adjacent to the
 regulating switch, the back of the casing
 is provided with a projection 40 at the rear
 of the switch, as indicated in Fig. 2. At the
 front of the core 39 is secured a core piece 41
 130 extending somewhat over the coils 42. Over

this metallic or iron plate is placed an insulating plate 43 on which are placed the iron or metallic conducting fingers 32. These fingers are held in position by means of a bar or strip 44, having grooves cut therein to receive the fingers, this bar being held by means of screws 45. The fingers 32 are also held by means of screws 45', which pass through enlarged or elongated holes in the strip and are threaded to engage with the fingers which may be adjusted longitudinally within the limits of the enlarged holes. This bar or strip 44 is preferably made of wood, but may be made of any suitable non-conducting material.

When the contact part of one of the disks 25 is cut away so that any circuit may be broken at any desired point, as above suggested, the adjacent raised portions of the iron of the cylinder are also preferably cut away as indicated in Fig. 11, so that the air gap between said cylinder and the end of the corresponding finger 32 will be increased. This will concentrate the lines of magnetic force on the fingers through which circuits remain closed, thereby strengthening the magnet fields and more effectually disrupting or blowing out any arcs which may be formed when the next circuits are broken. This is of considerable advantage, as, ordinarily, after all of the contacts have been made and when the first circuit is broken, the current is divided and there is not apt to be a large arc formed; then, as the circuits are successively broken, the current in the remaining ones is increased, but on account of the cutting away of the iron, the magnetism is correspondingly increased until the last circuit is broken, thereby giving a successively increasing magnetic field for disrupting any arcs which may be formed as the circuits are successively broken.

The regulating switch cylinder is substantially inclosed on three sides by means of insulating plates 46, 47 and 48, and the inner front portion of the cover 16 is also lined with a corresponding plate 49, this being for protection against any arcs which may be formed at the contact points. Insulating plates 50 are also interposed between the contact ends of the fingers 32 and extend in adjacent to the cylinder 22 for the purpose of preventing any arcs from jumping across from one set of contact wheels to an adjacent set or to the adjacent contact disks, and for the further purpose of assisting in disrupting or breaking any arcs. It will also be noted that these plates lie sufficiently close to the forked ends 33 to prevent the displacement of the pins or axles 36 after the parts have been assembled, so that these pins do not need to be fastened in position. The insulating plates 50 connect with the other protecting plates around the cylinder and are held and locked in po-

sition by means of vertical strips 51 preferably made of wood or other suitable insulating material, these strips being provided with dove-tailed grooves to receive the plates 50 and longitudinal grooves to receive the side plates. These strips are held together by means of removable bolts or locking devices 52 and 53, so that when the strips are removed, the other parts are released and may be readily disconnected.

In the particular form of controller herein shown, which may be termed a series and parallel controller, there are arranged in the casing adjacent to the regulating switch, a reversing switch and a series parallel switch. As these switches are operated only at the times when the current is cut off, no blow-out magnet is necessary, therefore a smaller construction is available. A shaft 54 is mounted in suitable bearings in the casing 15 and carries at its lower end a sleeve 55 of insulating material which in turn carries wipers or contacts 56 for the reversing switch. These contacts may be connected in any desired manner for making the necessary circuits. The shaft 54 is turned by means of a handle 57, or in any other desired manner. A bar 58 of wood or other suitable insulating material is mounted adjacent to the shaft 54 and carries a plurality of contact terminals or fingers 59 having contact wheels, or rotatable contact devices 60, of the same construction as the devices described in connection with the regulating switch, the arrangement preferably being such, that these contact wheels, which are not subject to arcing or sparking, may be used, if necessary, to replace a defective wheel in the regulating switch, in case any of such become sufficiently worn or injured that they will not operate properly under the repeated action of the regulating switch. The rotatable contacts 60 engage with slots in the fingers or wipers 56 and press against the inner sides of these slots, as described in connection with the regulating cylinder. As there are only two positions for the reversing switch, the wipers 56 only need to be in the form of narrow fingers, as indicated in Fig. 3, instead of disks, as required in the regulating switch.

Any suitable interlocking device, such as indicated by the disk 61 on the shaft 17 and the coacting arms 62 on the shaft 54, may be used for interlocking these shafts so that the reversing switch can only be operated when the regulating switch is in off position and so that the regulating switch cannot be operated except when the reversing switch is in proper position; but the particular interlocking mechanism shown herein forms no part of the present invention.

On the upper portion of the shaft 54 is mounted a sleeve 63, which carries contacts

or wipers 64 for the series-parallel switch. These wipers, which are shown in detail in Figs. 3 and 4, coact with rotatable contact devices 65 mounted in fingers 66 secured to the bar 58, and operate substantially the same as the reversing switch just described. The cylinder 63 is provided with a handle 67 for turning the same, this handle also being provided with an arm 68 which interlocks with the disk 61 so that the series-parallel switch can only be operated when the regulating switch is at off position and so that the regulating switch cannot be operated except when the series-parallel switch is in proper position to close the desired circuits.

As above suggested, the drawings and description herein presuppose the use of two or more motors, and a resistance arranged in any desired manner for regulating or assisting in the regulation of the motors. For convenience in understanding the electrical connections which may be used with our improved controller, we have indicated in Fig. 12 one arrangement of the different switches, in which the left-hand portion of the figure indicates the regulating switch; the upper right-hand portion, the reversing switch; and the lower right-hand portion, the series-parallel switch. The current passes from the trolley through the wire *a*, then through the blow-out magnet 38, then through suitable connections, designated by *b*, to the first wiper or contact wheels 34. As this first connection always carries the full current, it is provided with a double set of contact wheels, as indicated at the top of Fig. 1. The cylinder contacts or disks 25 are represented in this figure by the elongated rectangles *c-c*. The arrangement is such that when these disks make contact with the wheels 34, as indicated diagrammatically in this figure, different amounts of resistance will be cut in or cut out, as desired, for the regulation of the motors; but as the particular system used forms no part of the present invention, further description is not necessary. The contact wheels 60 of the reversing cylinder and the various connections between the wipers 64 are indicated in the upper right-hand portion of the drawing, with the connections leading to the series and parallel switch shown beneath. The arrangement of the wipers 64 and the contact wheels 65 of this latter switch are also indicated diagrammatically.

Having thus described our invention, which we do not wish to limit to the exact construction or arrangement of parts herein shown and described, what we claim and desire to secure by Letters Patent is:

1. An electric switch having a unitary non-yielding, rigidly mounted, current-carrying contact device or finger, a blow-out mag-

net for said switch, said contact device or finger also serving to carry the lines of force of said blow-out magnet.

2. As a new article of manufacture, a combined electric switch and blow-out magnet having a rigidly mounted, non-yielding integrally formed pole-piece serving as one of the current-carrying members of said switch.

3. A combined electric switch and blow-out magnet in which movable contact members make contact with contacts on relatively stationary, unitary rigidly mounted, current-carrying members, said stationary members also serving as pole-pieces of the blow-out magnet.

4. In an electric device, the combination of a movable circuit making and breaking member, non-yielding, rigidly mounted, current carrying contact devices coacting with said member, and a magnet common to all of said contact devices, one pole piece of said magnet being arranged adjacent to the contact making and breaking member, said contact devices also serving as the opposite pole pieces of said magnet.

5. The combination in an electric controller, of a switch having a plurality of contacts, with a blow-out magnet having a plurality of pole pieces extending from a common core to points adjacent to the several circuit breaking points, said pole pieces also serving as electric connections for the switch said switch having a body portion forming a part of the magnetic circuit, parts of such body portion being cut away so that the magnetic field adjacent to the switch contacts which are closed will be increased as the other switch contacts are successively opened.

6. A contact member for an electric switch, comprising a substantially cylindrical body having slots therein, contact disks fitting in said slots, and means for holding said disks in position.

7. A contact member for an electric switch, comprising a body portion provided with slots, contact disks having central openings with parallel sides and adapted to fit in said slots, and a key for holding said disks in position.

8. A contact member for an electric switch, comprising a body portion having slots formed therein with substantially parallel bottoms, contact disks having central openings with parallel sides engaging with said body member, keyways formed in said body member and in said disks, a key fitting in said keyways, and screws passing through said body member and engaging with said key, the arrangement being such that when the screws are tightened the key will be drawn outward to engage with said disks.

9. A contact member for an electric

switch, comprising a substantially cylindrical body portion, grooves formed in said body portion, contact disks having central openings with parallel sides and fitting in said grooves, keyways formed in said cylindrical portion and in said disks, a beveled key in the keyway of said cylinder, screws passing through the walls of said cylinder and engaging with said key, the arrangement being such that when the screws are tightened the key will be forced outward to engage with the keyways in the disks and align said disks on the cylinder, and when the screws are turned in the opposite direction they may be used to press the key down to release said disks.

10. A contact member for an electric switch, comprising a fork, wheels mounted in said fork, and a spring for holding said wheels in normally separated position.

11. A contact member for an electric switch, comprising a pair of contact wheels, a spring for holding said wheels in normally separated position, and a bearing for supporting said wheels.

12. A contact device for an electric switch, comprising a suitable support, beveled wheels slidably mounted in said support, and a suitable conical spring for holding said wheels normally apart.

13. A contact device for an electric switch, comprising a forked current carrying member, lining plates of higher conductivity secured in said fork, a pin through said fork, contact wheels mounted on said pin and bearing against said lining plates, and a coiled spring between said wheels.

14. In an electric switch, the combination of a rotatable cylinder provided with contact disks, stationary current carrying fingers mounted adjacent to said cylinder, and contact wheels mounted in said fingers the sides of said wheels engaging with the sides of said contact disks, substantially as described.

15. In an electric switch, the combination of a rotatable cylinder provided with contact disks, a stationary current carrying device arranged adjacent to said cylinder, a pair of contact wheels mounted in said device for making contact with the disks of said cylinder, and a spring for holding said wheels in contact with said disks the arrangement being such that the sides of said contact wheels engage with the sides of said disks.

16. In an electric switch, the combination of a rotatable cylinder, contact disks arranged in pairs on said cylinder, current carrying fingers mounted adjacent to said cylinder, pairs of wheels in said fingers, for making contact with the pairs of disks on said cylinder, and springs for holding said wheels in contact with said disks.

17. In an electric apparatus, the combina-

tion of a casing, a shaft mounted in said casing, an insulating sleeve on said shaft, cylinder sections provided with contacts, mounted in said casing, a magnet mounted in said casing and having one of its poles formed by one of the walls of said casing, a projection in said casing, adjacent to the cylinder, a plurality of contact devices forming the opposite pole of said magnet and adapted to make electrical connections with the contacts on said cylinder at points approximately opposite from the projection in said casing.

18. In an electrical device, the combination of a casing, a cylinder provided with contacts mounted in said casing, means for turning said cylinder, a blow-out magnet mounted in said casing, a plurality of pole pieces extending from the core of said magnet to points adjacent to the points of contact, and rotary contact devices having lateral faces adapted to engage with the lateral faces of said contacts on said cylinder to complete the circuits between said pole pieces and said cylinder.

19. In an electric controller, the combination of a casing having one side forming one of the poles of a magnet, a magnet mounted in said casing, a contact cylinder mounted in said casing, means for making contact with said cylinder to make and break electric circuits, pole pieces from said magnet, extending to points adjacent to the contact points of the switch, longitudinal non-combustible insulating plates arranged around said cylinder to form an open-sided box, longitudinal strips engaging with the edges of two of said plates and having lateral grooves therein, and lateral insulating members fitting in said grooves and extending in between the contact making and breaking points, the arrangement being such that the lines of magnetic force from the pole piece of said magnet will pass through said cylinder and across the points of contact.

20. In an electric controller, the combination of a casing, a combined regulating switch and magnetic blow-out mounted in said casing, a shaft mounted in said casing, wipers mounted on said shaft, a plurality of rotary contacts adapted to engage with said wipers to form a reversing switch, means for turning said shaft, a sleeve mounted on said shaft, a plurality of wipers mounted on said sleeve, rotary contacts adapted to engage with said wipers to form a third switch for changing the motors from series to parallel or vice versa, and means connecting between said sleeve and the shaft of the regulating switch for preventing the turning of either said shaft or said sleeve, except when the other is in predetermined position.

21. In an electric controller, the combination of a casing, a combined regulating

switch and magnetic blow-out arranged in said casing, insulating plates mounted in said casing for protection against arcs formed at the points of contact, a reversing switch
5 mounted in said casing, a third switch in said casing for changing the connections between the motors, said switches being provided with interchangeable, rotatable, spring-pressed contact devices for making contacts with the movable switch contact 10 members, substantially as described.

RALPH E. NOBLE.

LOUIS E. MITCHELL.

Witnesses:

B. P. TRACY,

R. WISEMAN.