T. E. BARNUM.

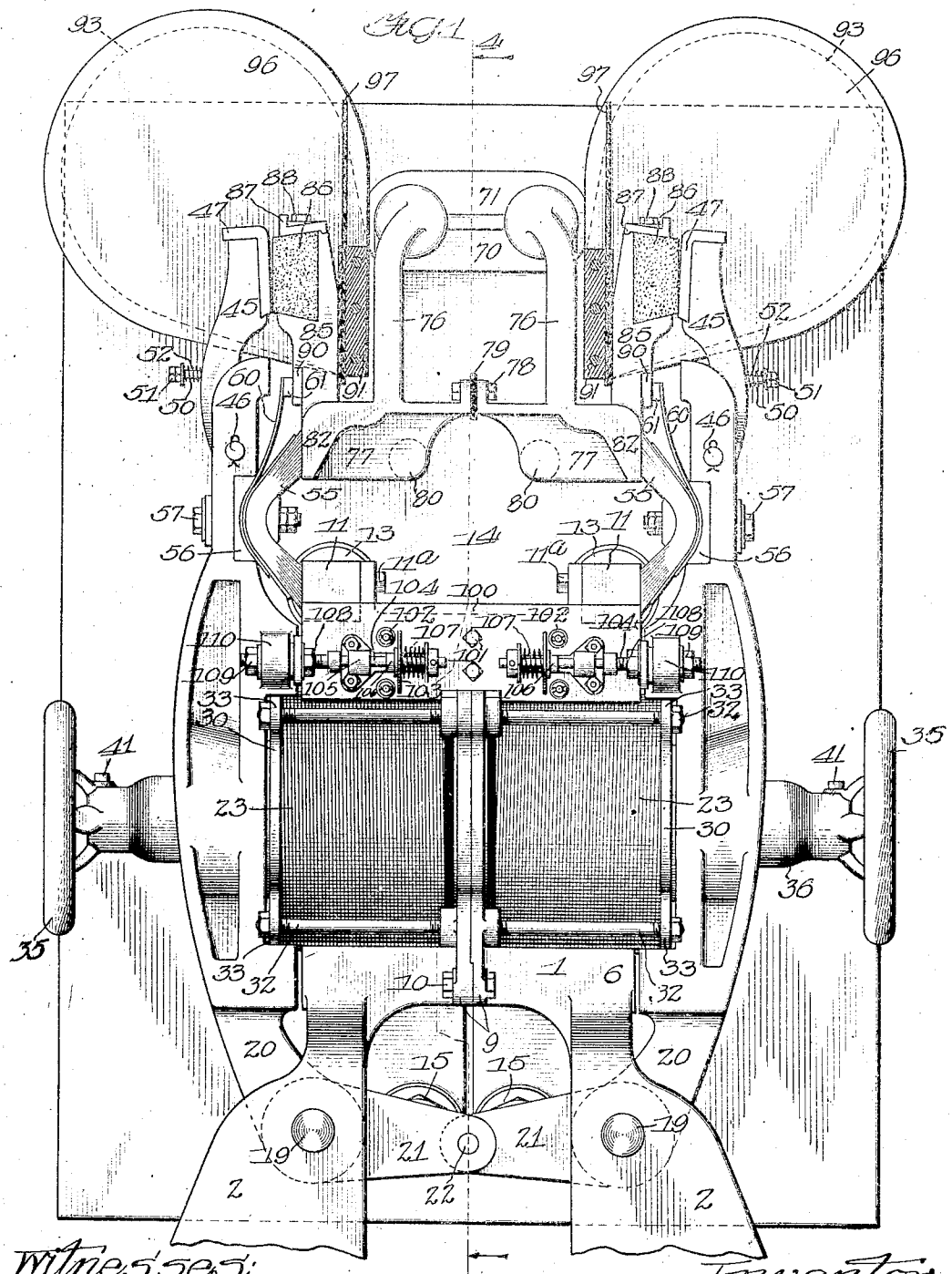
ELECTRIC SWITCH.

APPLICATION FILED JAN. 11, 1909.

**1,183,159.**

Patented May 16, 1916.

6 SHEETS—SHEET 1.




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ELECTRIC SWITCH.

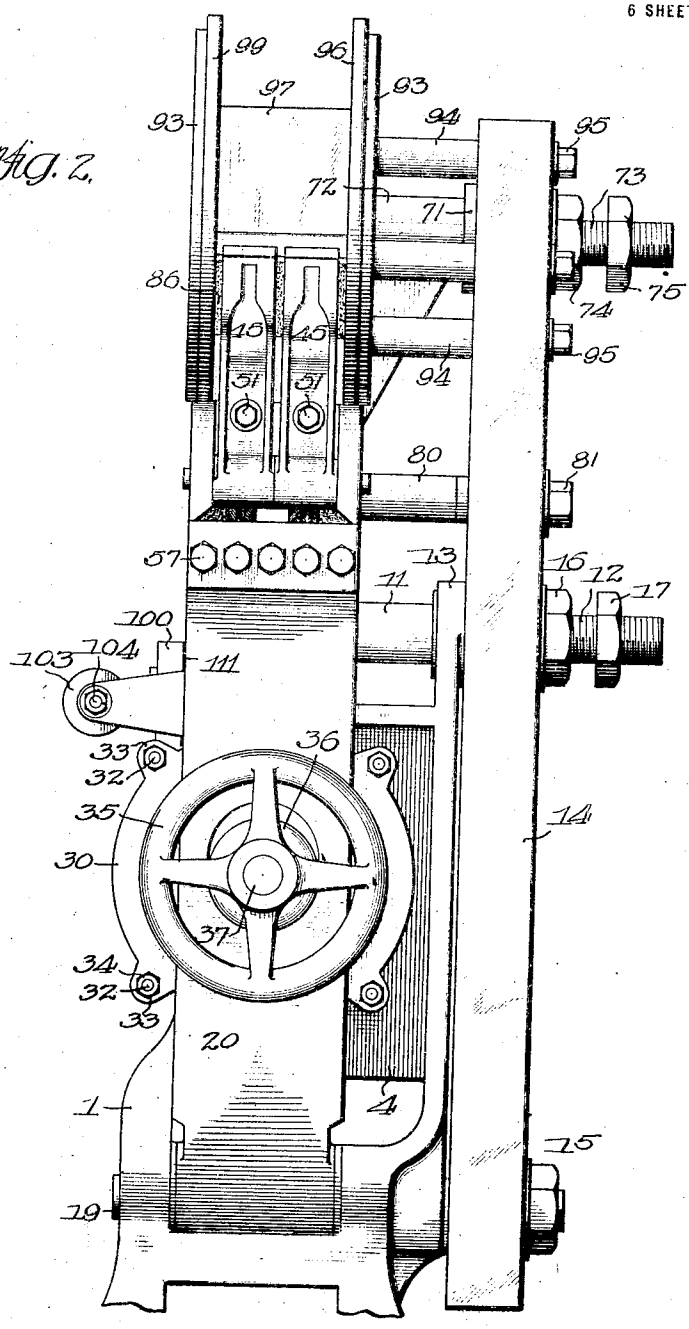
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6 SHEETS—SHEET 2.

Fig. 2.




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ELECTRIC SWITCH.

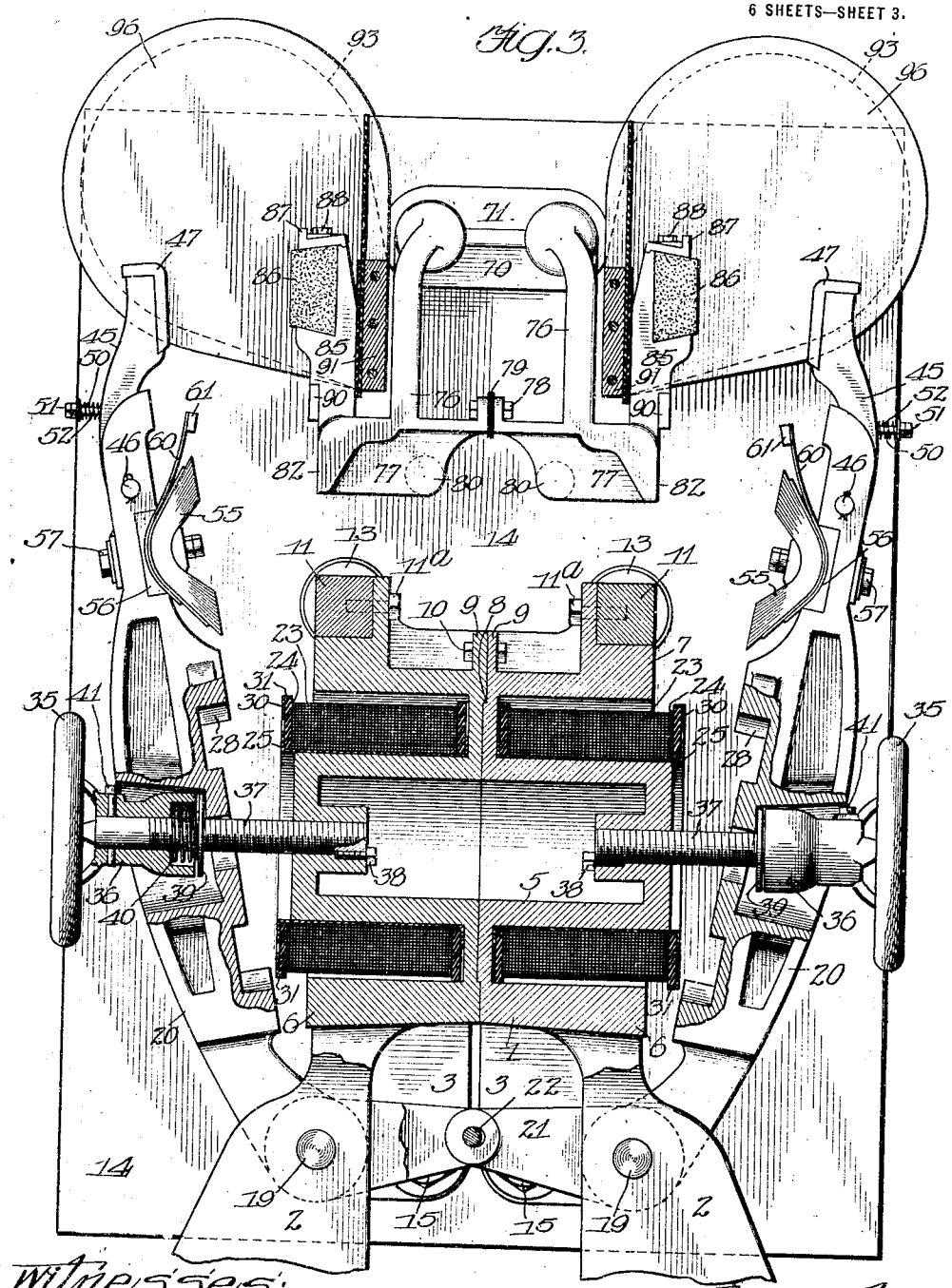
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6 SHEETS—SHEET 3.

Fig. 3.




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ELECTRIC SWITCH.

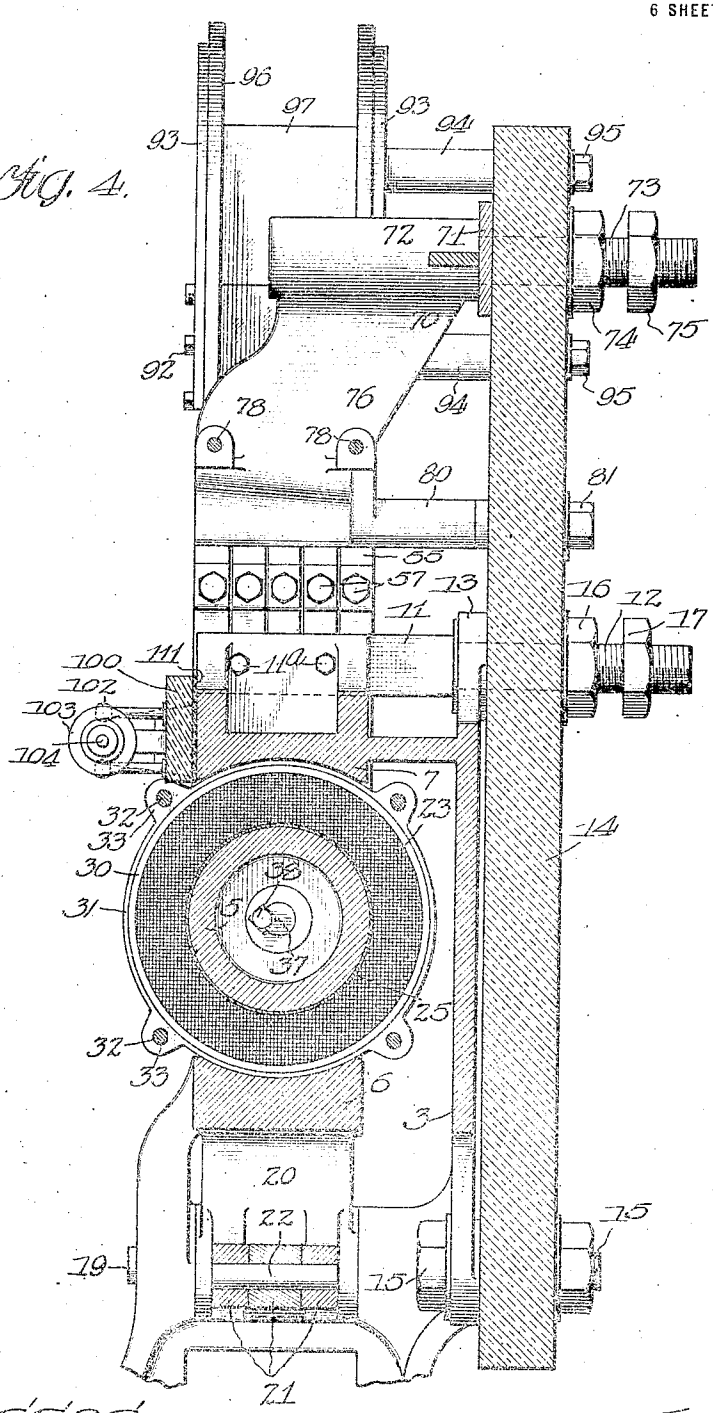
APPLICATION FILED JAN. 11, 1909.

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6 SHEETS—SHEET 4.

Fig. 4.




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ELECTRIC SWITCH.

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6 SHEETS—SHEET 5.

Fig. 5.

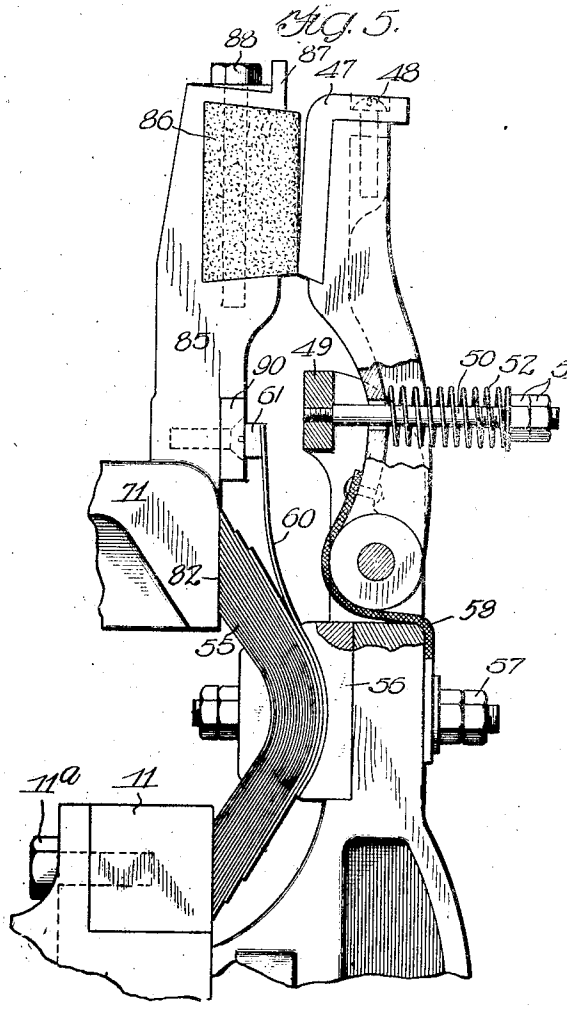



Fig. 6.

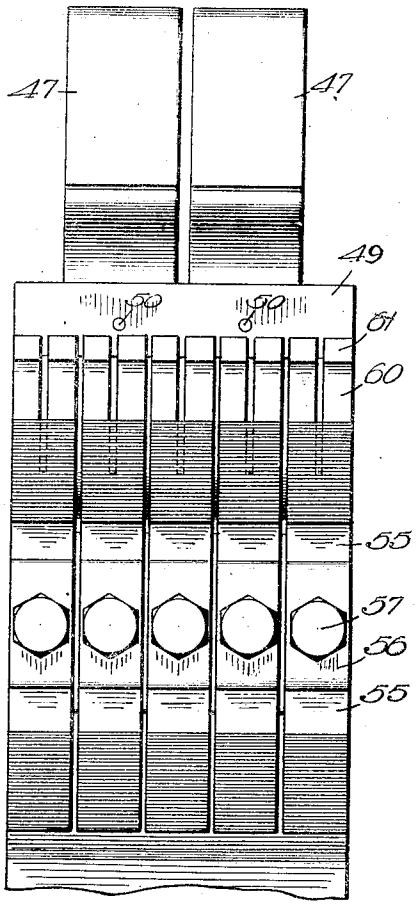
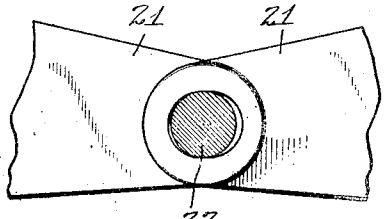



Fig. 7




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ELECTRIC SWITCH.

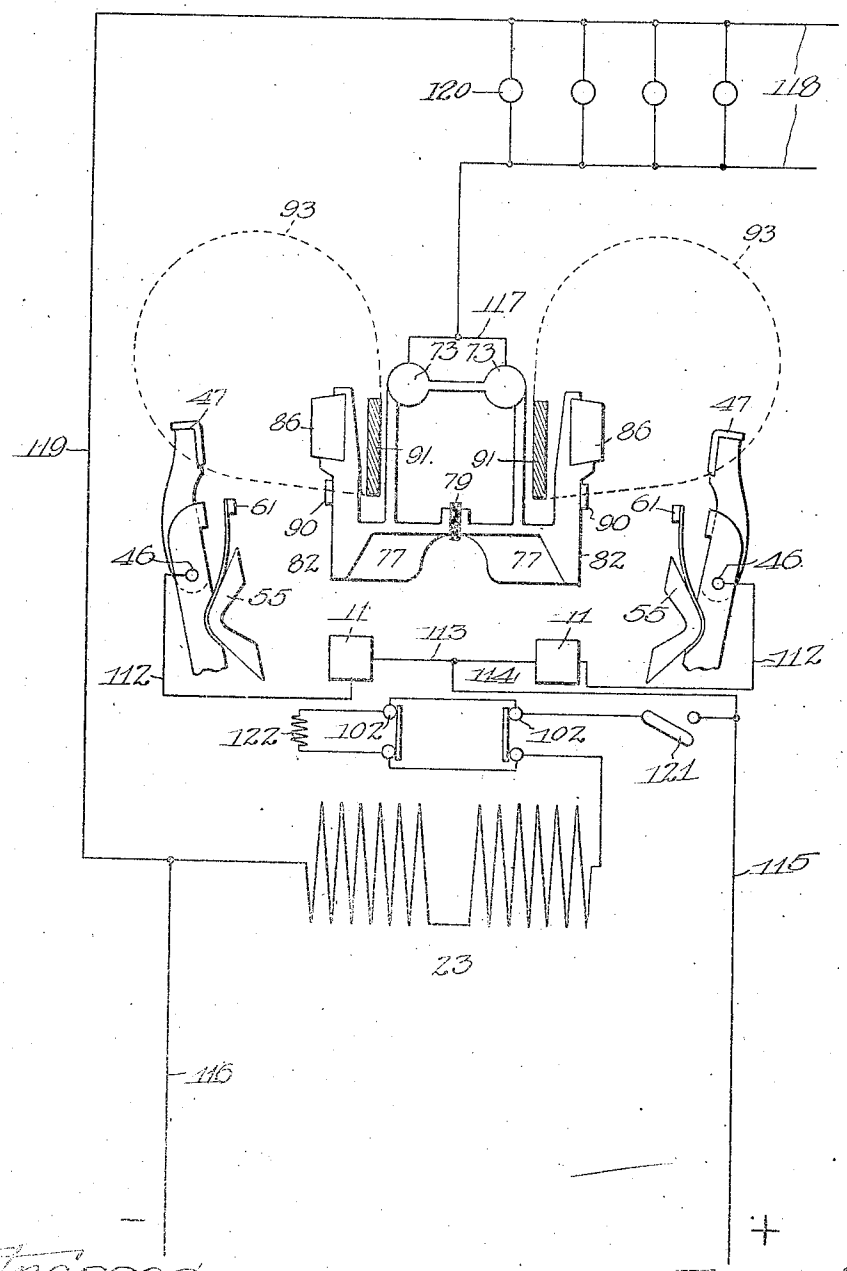
APPLICATION FILED JAN. 11, 1909.

1,183,159.

Patented May 16, 1916.

6 SHEETS—SHEET 6.

Fig. 8.




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# UNITED STATES PATENT OFFICE.

THOMAS E. BARNUM, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE CUTLER-HAMMER MFG. CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

## ELECTRIC SWITCH.

1,183,159. Specification of Letters Patent. Patented May 16, 1916.

Application filed January 11, 1908. Serial No. 471,751.

*To all whom it may concern:*

Be it known that I, THOMAS E. BARNUM, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Electric Switches, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in electric switches, and more particularly to those which are electro-magnetically operated.

My invention has for its object to provide an efficient and durable switch, particularly applicable for controlling circuits through which large currents are passed.

Other objects and advantages of my invention will be hereinafter set forth.

For the purpose of more fully disclosing the characteristic features of my invention, I shall describe the embodiment thereof, illustrated in the accompanying drawings, which device is one that I have worked out in practice. It should be understood that my invention is not limited to the particular construction illustrated, but is capable of various modifications.

The views in the accompanying drawings are as follows:

Figure 1 is a front elevation of the device; Fig. 2 is a side elevation of Fig. 1; Fig. 3 is a view similar to Fig. 1, showing parts of the device in section; Fig. 4 is a sectional view taken on line 4—4 of Fig. 1; Figs. 5, 6 and 7, are enlarged detail views of parts of the device, and Fig. 8 diagrammatically illustrates one circuit arrangement for this device.

The device illustrated is provided with a supporting frame 1, having suitable supporting members 2. For convenience of manufacture, I prefer to form the frame in two parts, which may be secured together in any suitable manner. The construction of the supporting frame is best illustrated in Figs. 2, 3 and 4. The two members of the frame are of substantially the same construction, and I shall, therefore, only describe one of the same in detail. Each member of the frame is preferably provided with a back portion 3 and a forwardly extending portion 4. The forwardly extending portion 4 is provided with a laterally extending cylindrical portion 5. Arranged below the cylindrical portion 5 is a lateral extension 6, while arranged above the cylindrical portion 5 is a lateral extension 7. The faces of the extensions 6 and 7, adjacent to the cylindrical portion 5, are preferably curved concentrically therewith.

In practice I prefer to construct the two members of the frame so that they will interfit, as shown at 8, Fig. 3. The two members of the frame may be secured together in any suitable manner. As shown in Figs. 1 and 3, the forwardly projecting portions of the frame are provided with ears 9 through which pass bolts 10. The bolts 10 thus secure the two members of the frame together. At its upper end, and on opposite sides thereof, the frame 1 is recessed to receive contact blocks 11, which are preferably rectangular in cross-section and formed of brass. The contact blocks 11 may be of any suitable length, and are preferably secured to the frame 1 by bolts 11ª. The contact blocks 11 are preferably provided with screw-threaded stems 12, which pass through ears 13 provided on the supporting frame. Secured to the back of the supporting frame is an insulating panel 14, formed of any suitable material. The panel 14 is secured to the lower part of the frame by bolts 15, and to the upper part of the frame by the stems 12 of the contact blocks 11. The stems 12 carry nuts 16, adapted to bear against the back of the insulating panel. As will be hereinafter explained, the stems of the contact blocks form binding posts and are, therefore, provided with binding nuts 17. Fulcrumed on pins 19, which pass through the base of the supporting frame, are a pair of contact arms 20. The arms 20 are preferably provided with angularly disposed tail pieces 21, the ends of which are preferably arranged to overlap and interfit, as shown in Fig. 4. Extending through the overlapping ends of the tail pieces 21 of the contact arms is a pin 22. The apertures in the tail piece 21, through which the pin 22 extends, are preferably slightly elongated to permit the contact arms to be moved inwardly. This arrangement provides means for limiting the outward movement of the contact arms and insures movement of the contact arms simultaneously. The contact arms 20 are

adapted to be drawn inwardly by electromagnets 23, mounted on the cylindrical portions 5 of the frame, said cylindrical portions forming the cores of said magnets. The magnets are preferably wound on insulating spools 24, of any preferred type, and in practice I prefer to interpose metallic bushings 25 between the insulating spools and the cylindrical portions 5 of the supporting frame. The bushings are preferably provided at their ends with annular flanges for engaging the ends of the insulating spools. As shown, the ends of the magnets 23 project beyond the ends of the cylindrical portions 5 of the frame, and I therefore preferably form annular recesses 28 in the contact arms 20 for receiving the ends of the magnets to permit the arms to be drawn inwardly sufficiently to engage and seal with the ends of the cylindrical portions 5 and the extensions 6 and 7.

With the arrangement thus far described, I have found, in practice, that upon the closure of the circuits of the magnets 23, the arms 20 are quickly drawn inwardly, but rebound and fall backward almost immediately. This I have found is due to the fact that when the circuits of the magnets are closed the current therethrough does not rise to its full strength immediately on account of the retarding effect of self induction, and consequently the magnets are not sufficiently energized to retain the arms in closed position. This difficulty I have found can be overcome by reducing the gap in the magnetic circuit of each magnet so that its magnetic flux will not seek the path through the arm 20 until after the current through the magnet has attained nearly its full value and a strong magnetic field has been developed. This result can be secured in a simple and efficient manner by placing an iron ring 30 at the outer end of each magnet. With this arrangement it will be seen that when the circuits of the magnets are first closed, the magnetic flux will pass through the iron rings instead of through arms 20 inasmuch as the paths through the rings are shorter. Thus the arms are not drawn inwardly until the current through the magnets attains nearly its full strength and the cores are strongly magnetized. When the arms are finally drawn inwardly they will be firmly held in closed position. The rings are preferably formed with annular flanges 31, adapted to surround the ends of the insulating spools upon which the magnets are wound. The rings 30 are held in place by means of rods 32. One end of each of the rods 32 is screwed into the frame, while the other end passes through an ear 33 provided on the rings 30. Nuts 34 are then screwed onto the ends of the rods 32 to hold the rings in place.

In practice I prefer to provide means for manually operating the contact arms in the event the magnets fail to operate. Of course, various means may be provided for this purpose. The means which I have shown for accomplishing this purpose, comprise a pair of hand wheels 35, the hubs 36 thereof being threaded onto screw-threaded rods 37 projecting from the ends of the cylindrical portions 5 of the frame and extending through suitable apertures provided in the contact arms. The rods 37 are preferably screw-threaded into the ends of the cylindrical portions 5 and are prevented from turning by means of screws 38. The arms 20 are preferably recessed to receive the hubs 36 of the hand wheels. Interposed between the arms 20 and the ends of the hubs 36 are disks 39, which bear against coil springs 40 surrounding the rods 37, and set into suitable recesses provided in the ends of the hub. For locking the hand wheels against rotation, when not in use, I provide locking pins 41, which pass through the hubs 36 and the rods 37. It will thus be seen that by removing the pins 41 the hand wheels may be turned on the rods 37 to force the contact arms inwardly. As before stated, these hand wheels are provided merely for the purpose of operating the arms 20 should the magnets, for any reason, fail to operate.

At their upper extremities the arms 20 are preferably bifurcated to receive arcing contact arms 45, which are fulcrumed on pins 46 passing through the bifurcated portions thereof. In practice any desired number of arcing contact arms may be mounted on each of the contact arms 20. In the device illustrated I have shown two of such devices provided on each contact arm. The arcing contact arms are provided at their upper ends with arcing contacts 47, of any desired type. The contacts 47, which I have shown, comprise angle plates, having one end therof beveled or inclined and fitting into correspondingly shaped notches in the arms 45. The contacts are secured to the arms by means of screws 48, (Fig. 5). The bifurcated portions of the arms 20 are preferably connected by a cross piece 49. Projecting from the cross piece 49, and extending through suitable apertures provided in the contact arms, are rods 50, the ends of which are preferably screw-threaded and carry nuts 51. Surrounding the rods 50, and interposed between the arcing contact arms and the nuts 51, are coil springs 52, which tend to force the arcing contact arms inwardly against the cross pieces 49. The pressure of the springs 52 may be regulated by adjusting the nuts 51 on the rods 50.

Secured to the contact arms 20, below the arcing contact members, are a plurality of main contacts 55. Any number of these contacts may be provided. In practice I

prefer to form the main contacts of a plurality of laminations adapted to be secured in suitable holders 56 and to the contact arms 20 by means of bolts 57. The laminated main contacts 55 are so arranged that their lower extremities will engage the contact blocks 11 carried by the supporting frame. Extending upwardly from the main contacts 55 are a series of spring fingers 60, each provided at its end with a contact or contacts 61. The auxiliary contact members 60 may be conveniently secured in the main contact holders. The arcing contacts, the auxiliary contacts and the main contacts, are so arranged that when the arms 20 are moved inwardly said contacts will successfully engage their respective stationary contacts in the order named. The arcing contact arms are electrically connected to the arms 20 by flexible conductors 58.

The stationary contacts which are adapted to be engaged by the upper ends of the main contact and the arcing contacts, are carried by a frame 70, which may be of any desired construction. As shown, the frame 70 is provided with a back portion 71, adapted to bear against the front of the insulating panel. Projecting forwardly from the portion 71 are a pair of substantially parallel extensions 72, which have rearwardly projecting screw-threaded stems 73, extending through suitable orifices provided in the insulating panel. The stems 73 serve as means for securing the frame 70 to the insulating panel and carry nuts 74, adapted to be turned to draw the frame firmly against the panel. As will be hereinafter explained, the stems 73 form binding posts and are, therefore, provided with nuts 75. Extending downwardly from the extensions 72 are arms 76, provided at their ends with enlarged portions 77, which are secured together by bolts 78, but separated by a strip of insulating material 79. The purpose of insulating the portions 77 from one another will be hereinafter explained. Each of the portions 76 is provided with a rearward extension 80, having a screw-threaded portion passing through the insulating panel and carrying a nut 81, adapted to be turned against the back of the insulating panel. This arrangement provides additional means for securing the frame to the insulating panel. In practice I prefer to provide the portions 77 of the frame with contact surfaces 82, adapted to be engaged by the upper ends of the main contacts carried by the arms 20. Extending upwardly from the portions 77, and preferably formed integrally therewith, are carbon contact holders 85. The contact holders 85 are constructed to receive carbon contact blocks 86, which may be retained therein by suitable clamping plates 87 secured in place by bolts 88. The carbon contact blocks 86 are arranged to be engaged by the arcing contacts 47 carried by the contact arms 20. The contact holders 85 are also provided with contacts 90 adapted to be engaged by the auxiliary contacts 61 carried by the contact arms 20.

For disrupting the arcs produced by the arcing contacts, I provide blow-out devices having iron cores 91 arranged between the arms 76 of the frame 70 and the arcing contact holders 85. Secured to the ends of the cores 91 by screws 92, and arranged on opposite sides of the carbon contact blocks 86, are pole pieces having polar faces 93. The blow-out devices are supported by means of extensions 94, having screw-threaded portions passing through the insulating panel and secured therein by nuts 95. Arranged between the polar faces are insulating chutes or barriers 96, having a portion 97 disposed between the cores 91 and the carbon contact holders 85. With this arrangement it will be seen that the cores of the blow-out devices are surrounded on three sides by portions of the frame 70. As will be hereinafter explained, the current passing through the frame 70 magnetizes the cores of the blow-out devices and hence no special blow-out coils are required.

As shown in Figs. 1, 2 and 4, I may provide auxiliary switches adapted to be actuated by the contact members when moved inwardly. These switches may be of any desired form. As illustrated, they are mounted on an insulating panel 100, secured to the supporting frame above the magnets 23 by means of bolts 101. Suitably secured to the panel 100, and projecting outwardly therefrom, are two pairs of contact studs 102 adapted to be bridged by the contact disk 103. The contact disks are loosely mounted on rods 104, which are slidably mounted in brackets 105 secured to the insulating panel. Rigidly mounted on the rods 104 are collars 106, against which the contacts are arranged to be pressed by coil springs 107. The springs 107 surround the rods 104 and bear against the end of the brackets 105, thereby normally holding the contact disks against their respective sets of contact studs. The disks 103 are arranged to be disengaged from their contact by studs 108, carried by the contact members and arranged to engage and press the rods 104 inwardly when the contact members are moved inwardly. As illustrated, the studs 108 are screw-threaded and are adjustably secured by nuts 109 to ears 110 provided on the contact members. In practice, the contact studs and the bolts for securing the brackets, are arranged to pass through the insulating panel and I, therefore, prefer to interpose a layer of insulating material 111 between said panel and the supporting frame to prevent short circuits.

In Fig. 8, which diagrammatically illustrates one circuit arrangement for the switch, I have shown the switch in a schematic way. The supporting frame and the switch arms having been omitted in this view, I have shown the arcing contacts 47, electrically connected to the main contact blocks 11 by conductors 112. The contact blocks 11 are shown to be electrically connected by a conductor 113, which in turn is connected by conductor 114 to main line 115 of the supply circuit. The binding posts 73 of the frame 70 are electrically connected by a conductor 117, which in turn is connected to one side of a translating circuit 118. The opposite side of the translating circuit is connected by conductor 119 to main line 116. Any suitable translating devices 120 may be connected in the translating circuit. As shown, the windings 23, for operating the main contact arms, are connected in series across the supply circuit. It should be understood, however, that the windings may be connected in circuit in any desired manner. For controlling the circuits of the windings 23, a switch 121 may be provided, and for reducing the flow of current through the windings, after the contact arms have been drawn inwardly, a resistance 122 may be connected in circuit therewith. The resistance 122 is arranged to be normally short circuited by the auxiliary switches. With the switch 121 open, no current will flow through the windings 23 and consequently the contact arms will be in their open position. Therefore no current will flow through the translating devices. Assuming now that the switch 121 is closed, circuit will be closed through the windings 23. This circuit may be traced from main line 115 through switch 121 through the auxiliary switches and the winding 23 to main line 116. It will thus be seen that the resistance 122 is excluded from circuit. As soon as the magnets 23 become fully energized the contact arms are drawn inwardly, causing the arcing contacts, the auxiliary contacts and the main contacts to engage their respective stationary contacts in the order named. As soon as the arcing contacts engage the carbon contacts, circuit is closed from main line 115 by conductor 114 to conductor 113, thence dividingly through the contact arms and the arcing contacts to the carbon contacts on opposite sides of the frame 70, and thence through the translating devices to main line 116. Owing to the peculiar shape of the frame 70, and to the insulation, the current flowing, when only the arcing contacts are closed, is forced to take tortuous paths around three sides of the cores of the blow-out devices. This results in magnetizing the cores of the blow-out devices and causing the blow-out devices to disrupt any arcs formed between the arcing contacts. When the contact arms are drawn to their innermost positions the main contact brushes will bridge the main contacts 11 and 82. Of course, as soon as the main contacts are closed, little or no current will flow through portions 85 of the frame 70. However, when the arms 20 move outwardly, the main contact brushes will leave their respective contacts before the arcing contacts are separated, and, therefore, the cores of the blow-out devices will be magnetized in ample time to extinguish the arcs formed between the arcing contacts as they are separated. When the switch arms 20 reach their closed position the auxiliary switches are opened, thereby inserting the resistance 122 in circuit with the windings of the magnets 23. This results in decreasing the flow of current through the magnets to an amount just sufficient to cause said magnets to retain the contact arms in closed position.

As already set forth, the construction which I disclose provides two paths for the current passing therethrough, and consequently the arcing between each set of arcing contacts is reduced. It should be understood, however, that my invention is not limited to this arrangement, as one contact arm might be sufficient.

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

1. In an electric switch, the combination with a magnet frame having at its base means for supporting the same in a vertical position, horizontally disposed electromagnets mounted upon opposite sides of said magnet frame in axial alinement, switch arms pivoted upon opposite sides of said magnet frame contiguous to its base to be actuated by said electromagnets and contacts carried by said magnet frame to be engaged by said switch arms.

2. In an electric switch, the combination with a magnet frame having at its base means for supporting the same in a vertical position, horizontally disposed electromagnets mounted upon opposite sides of said magnet frame in substantially axial alinement, switch arms pivoted on opposite sides of said magnet frame contiguous to its base to be actuated by said electromagnets, an insulating panel secured to and supported by said magnet frame and a set of contacts to be engaged by each of said switch arms, certain of said contacts being mounted directly upon the magnet frame and others upon said insulating panel.

3. In an electric switch, the combination with a vertically disposed self-supporting magnet frame, of an electromagnet carried thereby, a vertically arranged switch member pivoted to said magnet frame and arranged to be actuated by said electromagnet,

and a hand wheel having means associated therewith for actuating said switch member.

4. In an electric switch, the combination with a magnet frame provided at its base with means for supporting the same in a vertical position, said magnet frame having a horizontally disposed cylindrical portion, an electromagnet mounted upon said cylindrical portion of said frame, pole pieces for said electromagnet projecting from said magnet frame above and below said cylindrical portion and disposed in a parallel relation thereto and a vertically disposed switch arm fulcrumed to said magnet frame and constituting an armature for said electromagnet, said switch arm when attracted by said electromagnet coöperating with said pole pieces to complete magnetic circuits for said electromagnet.

5. In an electric switch, the combination with a magnet frame having a cylindrical portion and projecting portions arranged substantially parallel to the axis of said cylindrical portion, an electromagnet mounted on the cylindrical portion of said frame, a switch arm fulcrumed to said magnet frame and arranged to be actuated by said magnet, said switch arm and said projecting portions of the frame being adapted to complete magnetic circuits for said magnet, a screw-threaded rod projecting from the cylindrical portion of said frame and extending through said switch arm, and a hand wheel having an internally screw-threaded hub fitting onto said rod, said hand wheel being adapted to be turned to actuate said switch arm.

6. In an electric switch, in combination, a movable contact member, a stationary contact holder carrying a main contact and an arcing contact arranged to be engaged by said switch member, and a magnetic blow-out device, said contact holder being constructed to form a tortuous conducting path about the core of said blow-out device.

7. In an electric switch, in combination, a movable contact member, a stationary contact holder provided with a contact adapted to be engaged by said contact member, and a magnetic blow-out device having a core fitting between portions of said contact holder, the contact on said holder being so located as to cause the current passing therethrough to also pass through the portions of said holder surrounding said core.

8. In an electric switch, the combination with a movable contact member, of a stationary contact holder provided with a contact adapted to be engaged by said contact member, said contact holder having substantially parallel conducting portions electrically connected at one end, and a magnetic blow-out device having a core disposed between the parallel portions of said holder, the contact on said holder being so arranged as to cause the current passing therethrough to pass through the parallel portions of said holder in series.

9. In an electromagnetic apparatus, a magnetizable member, a winding therefor having a substantial amount of self-induction, a second magnetizable member, means for mounting the latter for free movement toward and away from the first named member, and means providing a magnetic circuit shunting said movable member of such relatively lower reluctance as to permit the passage of magnetic flux sufficient to prevent the attraction of said movable member until the current in the magnetizing winding rises to substantially its full value.

10. In an electric switch, in combination, a magnet frame, an electromagnet having a core attached to said frame, said frame having projections extending substantially parallel to the axis of the magnet core, a contact member adapted to be actuated by said magnet and forming the armature thereof, and a magnetic ring arranged at the end of said magnet for diverting the magnetic flux of said magnet from said contact member until said magnet becomes substantially fully energized.

11. In an electric switch, in combination, two contact members, electromagnetic means tending to operate the same in opposite directions independently of one another and interlocking means for said members insuring operation thereof in unison.

12. In an electric switch, in combination, two contact members, electromagnetic means tending to operate the same in opposite directions and independently of one another, manual operating means for said members and interlocking means for said members insuring operation thereof in unison.

13. In an electric switch, in combination, a magnet frame, electromagnets mounted thereon, a pair of contact members movable in opposite directions and adapted to be actuated by said magnets, said contact members being interlocked to move in unison, a pair of stationary contacts carried by said magnet frame, and a stationary contact holder provided with a pair of contacts, each of said contact members being adapted to electrically connect one of said contacts on said magnet frame to one of the contacts carried by said contact holder.

14. In an electric switch, in combination, a magnet frame provided with a forwardly extending portion provided on opposite sides with laterally extending cylindrical portions, electromagnets mounted on the cylindrical portions of said frame, and a pair of contact members pivoted on opposite sides of said magnet frame and movable in opposite directions, said contact members being adapted to be actuated by said magnets.

15. In an electric switch, in combination, a magnet frame provided with a forwardly extending portion provided on opposite sides with laterally extending cylindrical portions, electromagnets mounted on the cylindrical portions of said frame, and a pair of contact members pivoted to said magnet frame and movable in opposite directions, said contact members being adapted to be actuated by said magnets, and projections on said magnet frame adapted to be engaged by said contact members to complete magnetic circuits for said magnets.

16. In an electric switch, in combination, a magnet frame provided with a forwardly extending portion provided on opposite sides with laterally extending cylindrical portions, electromagnets mounted on the cylindrical portions of said frame and a pair of contact members pivoted to said magnet frame and movable in opposite directions, said contact members being adapted to be actuated by said magnets, screw-threaded rods projecting from the cylindrical portions of said magnet frame and extending through said contact members, and hand wheels having internally screw-threaded hubs fitting onto said rods, said hand wheels being adapted to be rotated to actuate said contact members.

17. In an electric switch, in combination, a magnet frame formed in two parts, each part having a forwardly extending portion carrying a laterally extending cylindrical portion and lateral extensions arranged substantially parallel to the axis of the cylindrical portion, said parts being adapted to be secured together so that said extensions will project in opposite directions, electromagnets mounted on said magnet frame, and a pair of contact members pivoted to said frame and adapted to be actuated by said magnets.

18. In an electric switch, in combination, a pair of contact members movable in opposite directions and interlocked to move in unison, electromagnets for actuating said contact members, said contact members forming the armature of said magnets, and means for diverting the magnet fluxes of said magnets from said contact members until said magnets become substantially fully energized.

19. In an electric switch, in combination, a pair of contact members, movable in opposite directions and interlocked to move in unison, electromagnets for actuating the same, said contact members forming the armature of said magnets, and a magnetic ring provided at the end of each magnet adjacent to its corresponding contact member for diverting the magnetic fluxes of said magnets from said contact members until said magnets become substantially fully energized.

20. In an electric switch, in combination, a pair of contact members movable in opposite directions, a stationary contact holder provided on opposite sides with contacts arranged to be engaged by said contact members, magnetic blow-out devices having pole pieces disposed on opposite sides of the contacts on said holder, said holder being constructed to provide tortuous conducting paths around the cores of said blow-out devices.

21. In an electric switch, in combination, a stationary contact holder provided on opposite sides with substantially U-shaped portions, having contacts arranged thereon, a pair of contact members movable in opposite directions and adapted to engage the contacts on said holders, and a pair of magnetic blow-out devices having cores fitting into the U-shaped portions of said contact holder, the contacts on said holder being so arranged as to cause a flow of current through the U-shaped portions of said holder.

22. In an electric switch, the combination with a magnet frame provided at its base with means for supporting the same in a vertical position, a pair of electromagnets mounted upon said frame on opposite sides thereof, a pair of switch members pivoted upon opposite sides of said frame to be actuated by said magnets, and two sets of coöperating contacts, each of said switch members when actuated engaging and bridging one of said sets of contacts.

23. In an electric switch, the combination with a magnet frame of electromagnets carried by said frame, switch members on opposite sides of said frame forming armatures for said electromagnets, stationary contacts to be engaged by said switch arms when attracted by said magnets, said switch arms being electrically connected and said stationary contacts being electrically connected and an interlock between said switch members insuring simultaneous operation thereof.

24. In an electric switch, in combination, a magnet frame having at its base means for supporting the same in a vertical position, horizontally disposed electromagnets mounted upon opposite sides of said frame in substantially axial alinement, electrically connected switch arms pivoted to said frame on opposite sides thereof and constituting armatures for said electromagnets, electrically connected contacts to be engaged by said switch arms when attracted by said electromagnets and an interlock between said switch arms insuring synchronous operation thereof.

25. In an electric switch, in combination, a magnet frame having on opposite sides of an intermediate portion cylindrical projections in substantially axial alinement, electromagnetic windings mounted on said cylin-

drical portions and switch arms at opposite sides of said frame to be actuated by said windings.

26. In an electric switch, in combination, a magnet frame provided on opposite sides of an intermediate portion with the oppositely extending cylindrical portions arranged in substantially axial alinement and with projections from said intermediate portion extending substantially parallel to said cylindrical portions, electromagnetic windings mounted upon said cylindrical portions and switch members at opposite sides of said frame to be actuated by said electromagnetic windings.

27. In combination, a magnetic frame provided at its base with means for supporting the same in a vertical position, said frame being formed in longitudinal sections secured together, laterally extending cylindrical portions provided on said sections in substantially axial alinement, electromagnetic windings mounted on said cylindrical portions and switch arms fulcrumed on opposite sides of said frame to be actuated by said electromagnetic windings.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

THOS. E. BARNUM.

Witnesses:
FRANK H. HUBBARD,
SHEPLER W. FITZGERALD.