

No. 883,059.

H. F. STARRETT.

PATENTED MAR. 24, 1908.

ELECTRICALLY OPERATED SWITCH.

APPLICATION FILED FEB. 7, 1902.

2 SHEETS—SHEET 1.

Fig. 2.

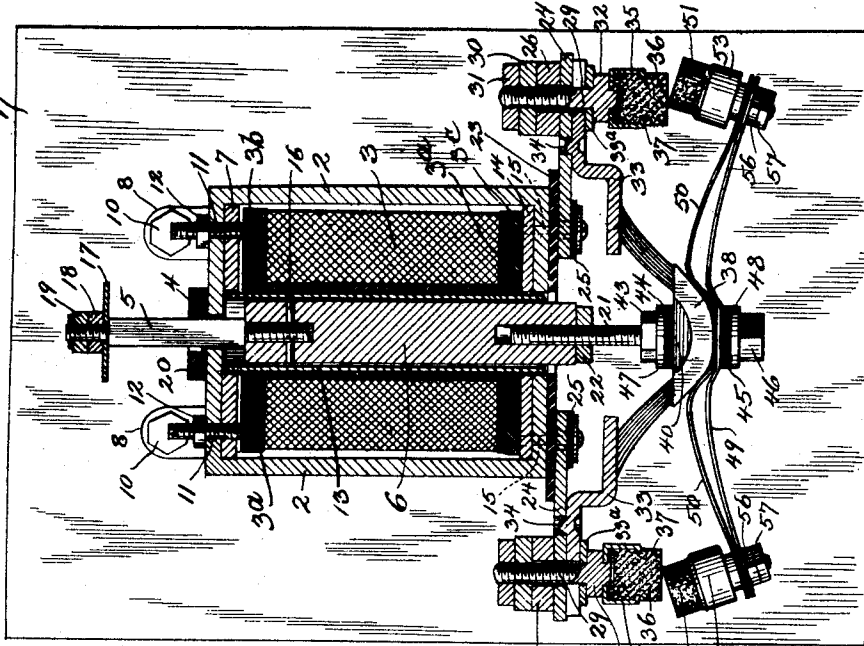
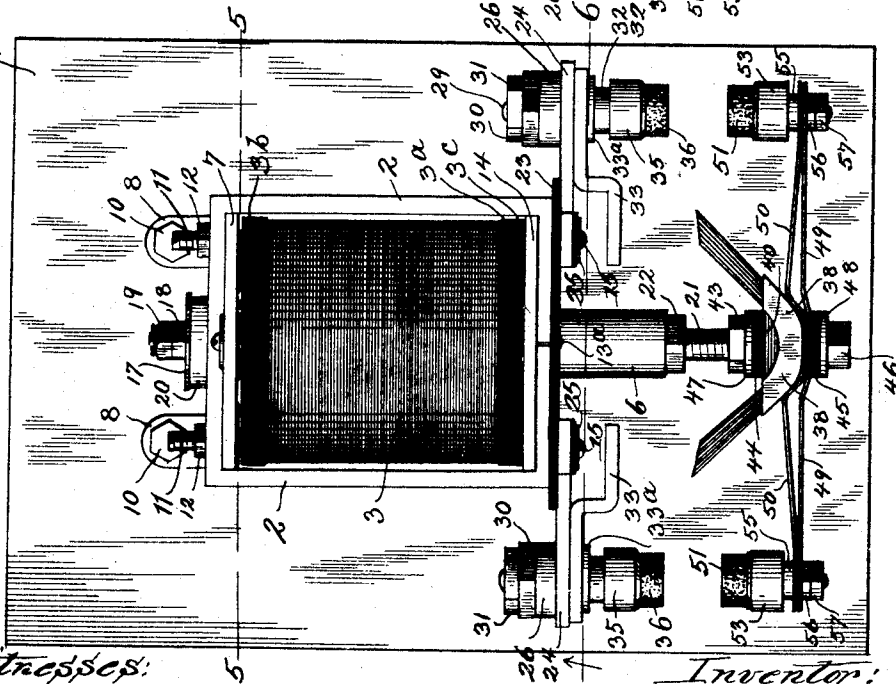


Fig. 1.



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2 SHEETS—SHEET 2.

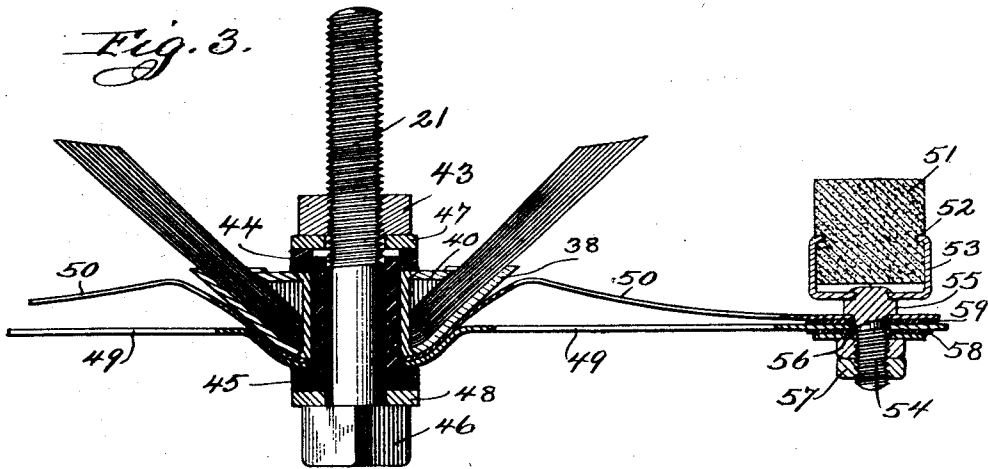


Fig. 4.

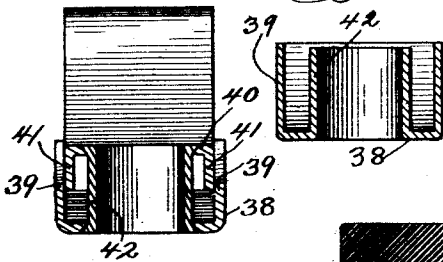


Fig. 9.

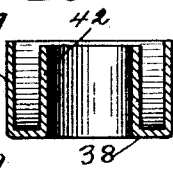


Fig. 5.

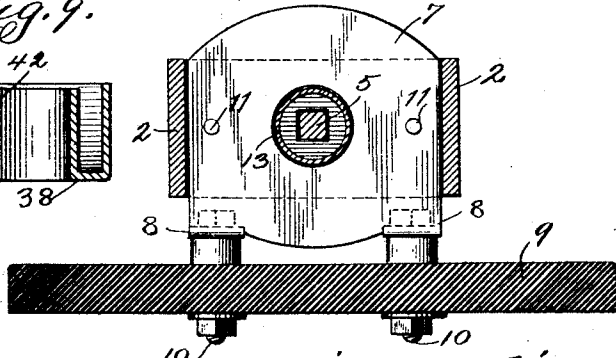


Fig. 6.

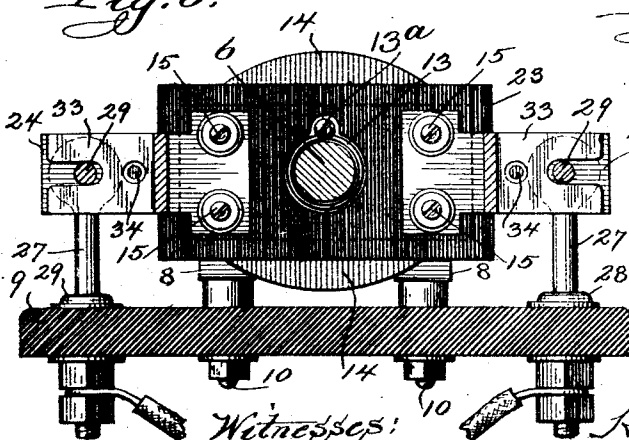
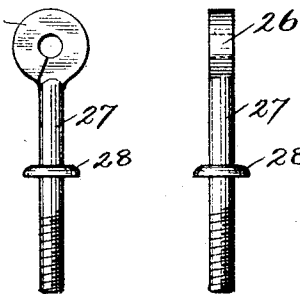


Fig. 7.

Fig. 8.



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UNITED STATES PATENT OFFICE.

HENRY FLOYDE STARRETT, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE CUTLER-HAMMER MANUFACTURING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

ELECTRICALLY-OPERATED SWITCH.

No. 883,059.

Specification of Letters Patent.

Patented March 24, 1908.

Application filed February 7, 1902. Serial No. 93,028.

To all whom it may concern:

Be it known that I, HENRY FLOYDE STARRETT, citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Electrically-Operated 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 an electrically operated switch, and my object is to produce a switch in which the movable element is adapted to be controlled by a solenoid or similar electrical device, the features of my invention relating to various details of construction whereby a compact, efficient device results which may be economically constructed and which may be readily repaired as the parts thereof wear away with use.

I have illustrated my invention in the accompanying drawing in which:

Figure 1 is a view of the switch of my invention; Fig. 2 is a sectional view thereof; Fig. 3 is a sectional view of a portion of the movable contact; Fig. 4 is a sectional view through the device which holds the contact leaves together; Fig. 5 is a sectional view on line 5—5 Fig. 1; Fig. 6 is a sectional view on line 6—6 Fig. 1; Figs. 7 and 8 are detail views of one of the supporting and binding posts; Fig. 9 is a detail view of a modified form of the dished piece in which the contact leaves are secured.

Like letters refer to like parts in the several figures.

The frame, 2, which supports the actuating solenoid, 3, is formed from a strip or plate of ductile magnetic material provided at the lower end with a circular opening and at the upper end with an opening of non-circular or irregular cross section which in the present instance is a square hole. The material around this non-circular hole is preferably thrown up to form a collar, 4, to thereby form a longer guiding surface for the rod, 5, which is secured to the end of the core, 6, of the solenoid. A supporting plate, 7, is secured to the inner face of the end of the frame, 2, and is provided with downwardly and outwardly extending feet or lugs, 8, 8, which are adapted to be secured to the base plate, 9, by means of suitable bolts 10—10. The plate, 7, is riveted to the frame, 2, and the screws,

11, 11, which pass through holes in the end of the frame, 2, and which engage tapped holes in the plate 7 are employed to clamp the magnet coil spool in position. Nuts 12, 12, are adapted to be secured upon the outer ends of these screws to maintain the same in proper position. The plate, 7, is provided with a circular opening of larger size than the opening through the frame, 2, to accommodate the end of a brass tube, 13, the lower end of which passes through a similar circular opening in the lower end of the frame, 2. The tube, 13, is secured in position by means of a screw, 13^a, (Fig. 6), the head of which is adapted to abut against the end of said tube.

To the inner face of the frame, 2, at the lower end, is riveted a plate, 14, of circular contour. Between the end plates 7 and 14, the solenoid, 3, is adapted to be placed, the solenoid winding being mounted upon a suitable spool 3^a in a well known manner. The spool 3^a may be securely fixed in position by means of the screws 11—11, which may be moved downward to engage the end of the spool or a suitable header 3^b to clamp the same securely against the end plate, 14, or a similar header, 3^c. One or more of these headers may be used to compensate for variations in lengths of spools. The core, 6, of the solenoid is adapted to move within the tube, 13, and the guiding rod, 5, of square or non-circular cross section is provided at the lower end with a threaded shank adapted to engage a tapped hole in the upper end of the core, 6, the bar being securely fastened in position by means of the transverse pin, 16. The bar, 5, is guided by the square hole through the end of the frame, 2, and the collar, 4, affords a prolonged guiding surface. The upper end of the bar, 5, is threaded and a washer, 17, is mounted thereon, the upward movement of said washer on the rod 5 when the core 6 drops being limited by the position of the nuts, 18, 19. Upon the descent of the core, 6, the washer, 17, strikes the rubber buffer, 20. By adjusting the nuts, 18, and 19, along the threaded end of the rod, 5, the extent to which the core, 6, may descend can be regulated. The lower end of the core, 6, is provided with a tapped hole with which the threaded shank, 21, is adapted to engage, a nut, 22, being provided for securing the shank, 21, in the adjusted posi-

tion; to the lower end of the shank, 21, movable contacts are secured as hereinafter described.

Upon the outer face of the frame, 2, at the lower end, a plate or layer, 23, of insulating material is adapted to rest, and against the outer face of this insulating plate, the ends of the bridge pieces, 24, 24, are adapted to rest, the said bridge pieces, being secured in position by means of the screws, 15, 15, the said screws being insulated from the bridge plates, 24, by means of suitable insulating washers, 25, 25. The outer ends of the bridge plates, 24 are secured respectively to the posts, 26, 26, which serve the double function of supporting posts and binding posts. These posts are shown in detail in Figs. 7 and 8 and it will be noted that the post is provided with a shank, 27, of circular cross section having the lower end threaded and provided with a collar or shoulder, 28. The upper end is bent about a mandrel to form an eye, and the material surrounding this eye is flattened in the rectangular cross section to provide flat faces whereby the bridge plates may be secured thereto to afford firm mechanical and electrical contact. The threaded ends of the post 26 are adapted to pass through holes provided in the base plate, 9, and the posts are secured in position by means of nuts screwing upon the threaded ends thereof. These nuts also serve to bind the circuit conductors in position whereby the posts may serve as binding posts to conduct the current to the switch contacts. Holes are provided in the outer ends of the bridge plates, 24, adapted to register with the eyes in the posts, 26, and studs or shanks, 29, are adapted to pass through said holes and eyes, nuts 30 and 31 being secured upon the ends of said shanks to secure the same in position. The shanks, 29, carry shoulders or collars 32, against which a washer, 33^a is adapted to rest, and between the washers, 33^a and the bridge plates, 24, the renewable contacts, 33 are adapted to be clamped. These contact pieces are in the form of plates having the contact ends offset and provided at the opposite ends with slots adapted to permit the said contacts to be readily inserted between the washers, 33^a and the bridge plates, 24. Each of the contact pieces is provided with a lateral projection, 34, adapted to register with a hole in the plate, whereby the contact piece is secured in position and is prevented from turning upon the shank, 29. When it is desired to remove the renewable contact piece, 33, the nuts, 30, 31, may be loosened and the contact piece, 33, may then be readily removed from position. Similarly, in assembling, the slot in the end of the contact piece enables the same to be readily inserted between the washer and the bridge plate, after which the nuts may be screwed down to

clamp the renewable contact pieces in position. The contact ends of the contact pieces are offset to carry the same away from the heads of the screws, 15, 15. Instead, however, of offsetting the contact pieces, it is apparent that the bridge pieces may be suitably formed to provide this space between the heads of the screws and the contact ends of the contact pieces.

Upon the end of the shank 29, a cup, 35 is provided said cup having a central aperture through which the end of the shank, 29, extends, the same being burred over to secure the cup to the shank. Within the cup, a carbon block, 36, is inserted, the said block, being provided with a peripheral groove or channel, and the lip, 37, at the edge of the cup, 35, is forced into this groove to securely maintain the carbon block in position. The carbon block and its supporting shank thus constitute a unitary assembled structure which may be placed upon the market as an article of manufacture and the carbons of the switch as they wear away with use, may thus be readily replaced at slight cost. The renewable contacts, 33, can likewise be placed upon the market as separate articles and these contacts may be similarly replaced as the old ones wear away. The lower end of the shank, 21, supported on the core, 6, carries the movable contact which is in the form of a plurality of copper leaves secured together at the middle and having the ends free and adapted to engage the contact pieces, 33, when the solenoid is energized. In order to secure these contact leaves together, I provide a stamping, 38, which is dished, that is, it is provided with a bottom, the longitudinal cross section of which is circular, while the transverse section is rectangular and upwardly extending flanges, 39—39 are formed upon the bottom. A flanged cap, 40, is provided having downwardly extended flanges, 41, 41 the lower edges of which are curved and parallel to the bottom of the dished piece, 38. A tube, 42, extends through openings provided in the dished piece and in the cap and the ends of this tube are burred over to thereby secure the cap and the dished piece together, and to thus clamp the leaves between the bottom of the dished piece and the edges of the flanges of the cap. Instead of providing a separate tube, 42, the tube may be formed integral with the dished piece, as shown in Fig. 9. The contact leaves and their support as thus formed constitute a unitary device which may be placed upon the market as an article of manufacture whereby the contact leaves, as the same wear away with use may be readily replaced. The shank, 21, is adapted to pass through the opening provided through the support for the leaves, and carries upon the end a head, 46. By means of the nut, 43, the leaf support may be clamped in position.

Washers 44, 45, of insulating material and metallic washers 47 48 are preferably inserted between the head and the nut as illustrated.

5 Clamped between the washer 45 and the dished piece, 38, is a spring support, 49 and a contact leaf 50. Upon the opposite ends of the spring, 49, carbon contacts are supported; these contacts each comprise a carbon block, 51, provided with a peripheral groove into which the lipped end, 52, of the cup, 53 is adapted to extend, the cup being secured to the end of a threaded shank, 54, in the manner described in connection with the carbon contact 36. The shank 54 carries a collar or shoulder, 55, between which and the nuts, 56, 57, the spring, 49, and leaf, 50, are adapted to be clamped. In order to limit the current flowing through the spring, 49, insulating washers, 58, 59, are placed upon opposite faces of said spring, 49, whereby the current passing to the carbon contacts will mainly flow through the leaf, 50, while the spring, 49 will be comparatively free of flowing current. The carbon, 51 and its support constitute an assembled unitary structure which may be readily placed upon the market as a replaceable element of the switch.

30 The operation of the switch is as follows: When the actuating solenoid is deenergized, the parts occupy the position shown in Fig. 1. When an actuating current traverses the solenoid, the core, 6, is raised and the carbon contacts, 36, 51, are first closed together, and subsequently the leaf contacts engage the contact pieces, 33, to complete the circuit closing operation. When the solenoid is deenergized, the core 6, falls by gravity and the leaf contacts are first separated from the contact pieces, 33, and finally the carbon contacts are separated, whereby the arc produced by the breaking of the circuit is confined to the carbon contacts. The distance through which the solenoid, 6, is adapted to travel, may be adjusted by means of the nuts, 18 and 19, at the upper end of the guiding rod, 5. By means of the threaded shank 21, and locking nut, 22, the position of the movable contacts relatively to the core may be adjusted as desired.

In assembling the mechanism of the switch the posts, 26, 26, may be placed in position and the electrical conductors upon the back of the base plate may be secured thereto prior to the assembling of the rest of the mechanism. This feature is of great advantage, particularly where there are a number of switches to be mounted upon a single base plate. The posts for all of the switches may be mounted upon the board at the factory and the electrical connections between the posts, which are usually placed upon the back of the board, may be likewise made at the factory. The base board with all of the

electrical connections thus completed, may then be shipped to the place of installation and the remaining mechanism of the switches may be independently shipped, whereby danger of breakage or disarrangement of the parts may be effectively provided against. Upon the arrival of the apparatus at the place of installation, the base board may be mounted in position and after it has thus been placed in the desired location, the switch elements may be placed in position. The switch elements may then be readily mounted by securing the ends of the bridge pieces to the posts and by securing the legs at the upper end of the frame to the base plate. The solenoid spool may be readily placed in position by removing the screw 13^a, and withdrawing the tube, inserting the spool in position between the end pieces, replacing the tube, 13 and screw, 13^a, and then by means of the screws, 11, 11, clamping the spool in position.

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

1. In an electrically operated switch, the combination with a frame adapted to contain a magnet coil and surround said coil upon its sides and ends, of a supporting plate secured to the upper part of said frame, outwardly turned lugs formed upon said plate, a suitable base to which said lugs are adapted to be secured, insulated bridging plates secured to the lower part of said frame, contact plates secured to said bridging plates and electrically conductive posts mounted on said base and secured to said bridging plates; to support said frame, substantially as described.

2. In an electrically operated switch, the combination with a rectangular frame of ductile and magnetic material, surrounding a magnet coil, of a supporting plate secured to the upper part of said frame and having outwardly extending lugs, a suitable base to which said lugs are adapted to be secured, insulated bridging plates secured to the lower part of said frame, contact plates secured to said bridging plates and electrically conductive posts mounted on said base and secured to said bridging plates; to support the frame, substantially as described.

3. In an electrically operated switch, the combination with a rectangular frame adapted to accommodate a magnet coil, of a reciprocating plunger for said coil, stationary contacts mounted with said frame upon opposite sides of said plunger, a bridging member for electrically connecting said contacts carried upon one end of said plunger, and an extended member of non-circular cross section carried upon the opposite end thereof and extending through a correspondingly shaped aperture in said frame, whereby rotary movement of said plunger is prevented.

4. In an electrically operated switch, the combination with a rectangular frame adapted to accommodate a magnet coil, the upper part of said frame having a non-circular aperture, of an extending member carried by the armature of said magnet and adapted to fit and be guided by said aperture, the metal of the frame being formed up about said aperture to provide a collar for a longer bearing for said member, a lateral projection upon said member and a resilient buffer surrounding said collar; substantially as described.
5. In an electrically operated switch, the combination with a solenoid magnet, of a rectangular frame of magnetic material adapted to be included in the magnetic circuit, a reciprocating core for said magnet, stationary contacts mounted with said frame upon opposite sides of said core, a bridging member for electrically connecting said contacts carried upon one end of said core, and an extended member of non-magnetic material and non-circular cross section carried upon the opposite end thereof and extending through a correspondingly shaped aperture in said frame whereby rotary movement of said core is prevented.
6. In an electrically operated switch, the combination with a rectangular frame adapted to accommodate a solenoid magnet and closely fitting the same, the upper part of said frame passing across the end of the magnet having a non-circular aperture therein, of a core for the solenoid having an upward extension shaped correspondingly to and passing through said aperture, whereby rotary movement of said core is prevented, means associated with said extension to limit the downward travel of the core, and switch contacts carried upon the lower end of said core.
7. In an electrically operated switch, the combination with a rectangular frame adapted to accommodate a solenoid magnet and being included in its magnetic circuit, the upper part of said frame having a non-circular aperture therein, of a plunger core for the magnet, a part carried upon the upper ends of said core and adapted to pass through said aperture whereby rotary movement of said core is prevented, adjustable means carried upon said part to limit and adjust the downward travel of the plunger, and switch contacts carried upon the lower end of said core.
8. In an electrically operated switch, the combination with a frame adapted to accommodate the magnet coil, bridging plates secured to the end of the frame and supporting posts mounted upon a suitable base and secured to the ends of the bridging pieces to support the frame, substantially as described.
9. In an electrically operated switch, the combination with a frame adapted to accommodate a magnet coil, outwardly extending bridging plates secured to and insulated from the end of said frame, switch terminals carried by said plates, supporting posts secured to the outwardly extending ends of said plates, and means for connecting the conductors with the said posts, substantially as described.
10. In an electrically operated switch, the combination with a frame adapted to accommodate a magnet coil, outwardly extending bridging pieces insulated from and secured to the end of said frame, removable switch contacts carried by said pieces, a base supporting posts mounted on said base and secured to the outwardly extending ends of said bridging plates, and means for connecting the conductors with said posts, substantially as described.
11. In an electrically operated switch, the combination with a frame adapted to accommodate a magnet coil, bridging plates secured to the end of said frame, removable contact plates secured to said bridging plates and having contact ends, supporting posts mounted on a suitable base, and clamping means to secure said plates together and to the posts, substantially as described.
12. In an electrically operated switch, the combination with a frame adapted to support an operating magnet, of bridging plates secured to said frame, separate contact plates, supporting posts mounted upon the base of the switch, and a stud or bolt passing through each bridging plate, post, and corresponding contact plate to clamp them together, substantially as described.
13. In an electrically operated switch, the combination with a supporting plate having a plurality of apertures therein, a contact plate mounted on said supporting plate and having a projection adapted to enter one of said apertures and a clamping stud extending through another of said apertures and the contact plate to firmly clamp them together, substantially as described.
14. In an electrically operated switch, the combination with a supporting plate, of a removable contact plate mounted on said supporting plate, a slot formed in said contact plate, a stud passing through said slot and through the supporting plate and adapted to clamp the two plates together, and other means to prevent said contact plate from rotating, whereby upon loosening the stud the contact plate may be readily removed, substantially as described.
15. In an electrically operated switch, the combination with a supporting plate having a plurality of apertures therein, a contact plate having a projection adapted to enter one of said apertures and a slot adapted to align with another of said apertures, a stud

passing through the slot and said alining aperture to clamp said parts together; substantially as described.

16. A contact terminal for electric switches comprising a metal cup, a carbon block carried in said cup and having a recess formed therein, parts formed in said cup and projecting into said recess for securing the same therein, and means for fastening said cup in its support; substantially as described.

17. A contact terminal for electric switches comprising a carbon block having a circumferential groove formed therein, a metallic cup in which said block is carried, the metal of said cup being depressed into said groove, and means for securing said cup to its support, substantially as described.

18. A contact terminal for electric switches, comprising a carbon block having a circumferential groove, a metallic cup in which said block is carried, the edge of said cup being turned into said groove so as to firmly secure the block in position therein, and a shank connected with the cup to support the same and electrically connect it in circuit, substantially as described.

19. As a new article of manufacture, a contact piece for electrical devices, consisting of a dished member curved in longitudinal cross section, a cap having flanges formed integral therewith, a plurality of superimposed leaves disposed between said dished member and said cap, and means for retaining said cap in engagement with said dished member whereby said leaves are supported in a curved form and a unitary structure is produced, substantially as described.

20. As a new article of manufacture, a contact piece for electrical devices, consisting of a dished member of curved longitudinal cross section and rectilinear transverse cross section, a cap having downwardly extending flanges, the lower edges of which are curved parallel to the bottom of said dished member, a plurality of superimposed leaves disposed between said dished member and said cap and a tube extending through said leaves and suitably attached to said dished member and said cap whereby said leaves are held in a curved form and a unitary structure is produced, substantially as described.

21. In a removable contact member for electric switches, the combination with a plurality of leaves of conducting material, a dished piece adapted to receive said leaves upon one side, a second piece for forcing said leaves into contact with the concave side of said dished piece, and a tube extending through an aperture in said leaves and serving to secure said pieces together, substantially as described.

22. A contact member for electric switches comprising a plurality of superimposed leaves, a dished member having flanges said member being adapted to receive said leaves

between the flanges, a cap to force said leaves into the dished portion of said member between the flanges, said cap having flanges conforming to the curve of said leaves when pressed home and adapted to bear against them, and means to permanently clamp said parts together, whereby they may be handled as a whole, substantially as described.

23. In an electrically operated switch, an integral contact member comprising a plurality of superimposed leaves, plates upon either side of said leaves clamping them together and in curved form whereby a unitary structure is produced, said leaves and plates having an aperture extending through the same, and a part carried by the switch extending through said aperture to secure the said contact member thereto, whereby the member may as a whole be readily removed, substantially as described.

24. In an electrically operated switch, the combination with switch terminals, of a solenoid, a reciprocating core for said solenoid, a bridging contact switch member carried upon said core and adapted to complete the circuit through said switch terminals, a supporting spring also carried upon said core, carbon terminals carried upon the ends of said supporting spring, and a current carrying leaf electrically connecting said carbon terminals, substantially as described.

25. In an electrically operated switch, the combination with switching terminals, of a solenoid, a reciprocating core therefor, a bridging contact switch member movable with said core and adapted to complete the circuit through the switch terminals, a supporting spring also carried upon said core, carbon contacts carried upon the ends of said supporting spring and a current carrying leaf electrically connecting said carbon contacts, substantially as described.

26. In an electrically operated switch, the combination with a reciprocating part, of a bridging contact switch member carried upon said part and adapted to complete the circuit through the switch terminals, a leaf spring support also carried upon said part, contact cups carried upon the ends of said support, carbon blocks mounted in said cups, a contact leaf extending between said cups, threaded shanks secured to said cups and extending through the ends of said spring support and the contact leaf, and nuts adapted to be screwed upon said shanks to secure the parts together, substantially as described.

27. In an electrically operated switch, a frame of magnetic material forming part of the magnetic circuit thereof, switch contact parts rigidly attached to said frame, but insulated therefrom, a supporting base, said switch being secured to said base by means cooperating with said contact parts, substantially as described.

28. In an electrically operated switch, a

frame of magnetic material forming part of
the magnetic circuit thereof, switch contact
parts attached rigidly to said frame, but insulated therefrom, a supporting base, said
5 switch being in part secured to said base by
means cooperating with said contact parts,
substantially as described.

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

H. FLOYDE STARRETT.

Witnesses:

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