

Nov. 15, 1932.

W. B. CHURCHER

1,887,883

ELECTRICAL SWITCH

Filed June 19, 1926

3 Sheets-Sheet 1

Fig. 1

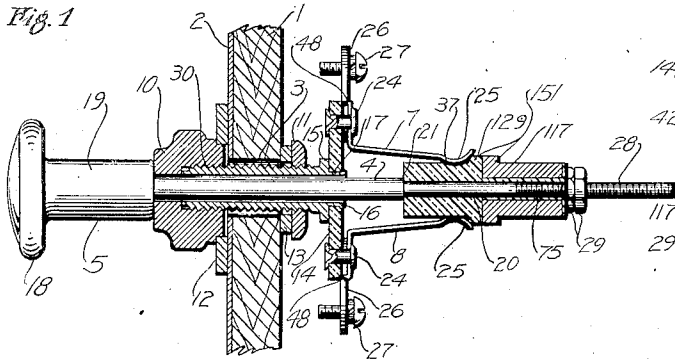


Fig. 2

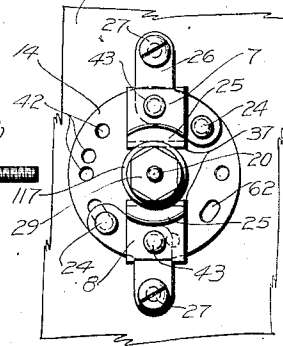


Fig. 3

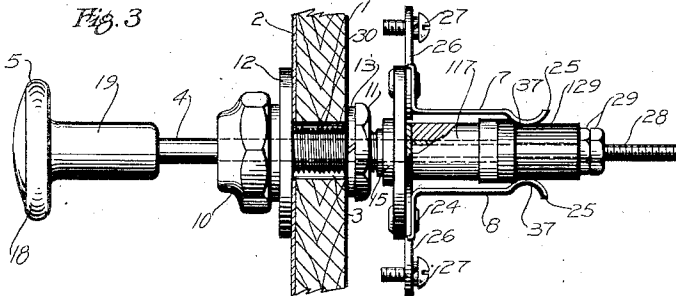


Fig. 4

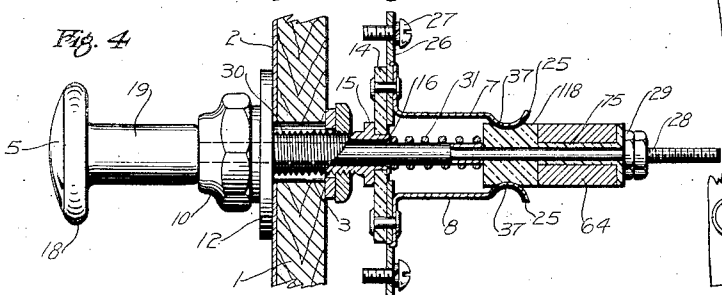


Fig. 6

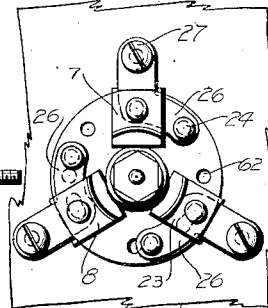


Fig. 5

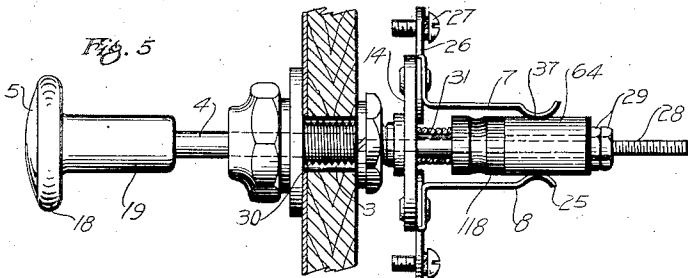
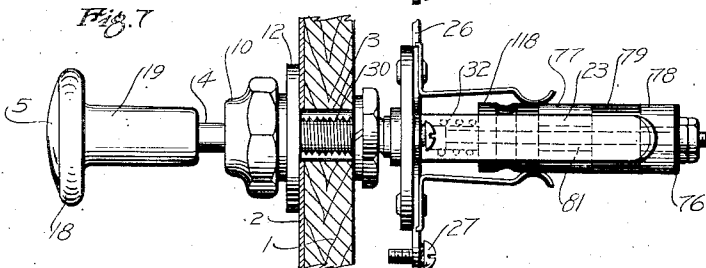


Fig. 7



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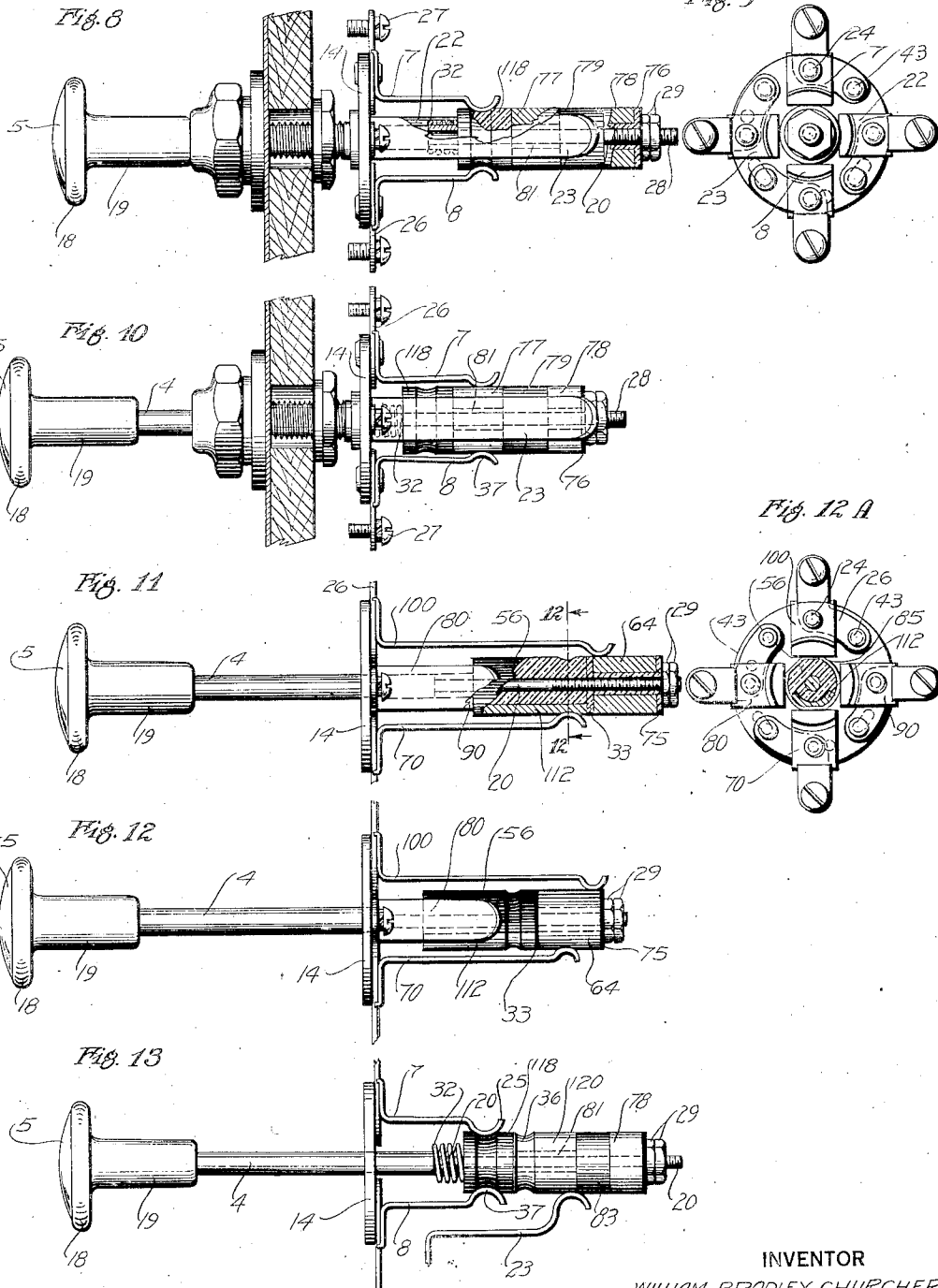
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3 Sheets-Sheet 2



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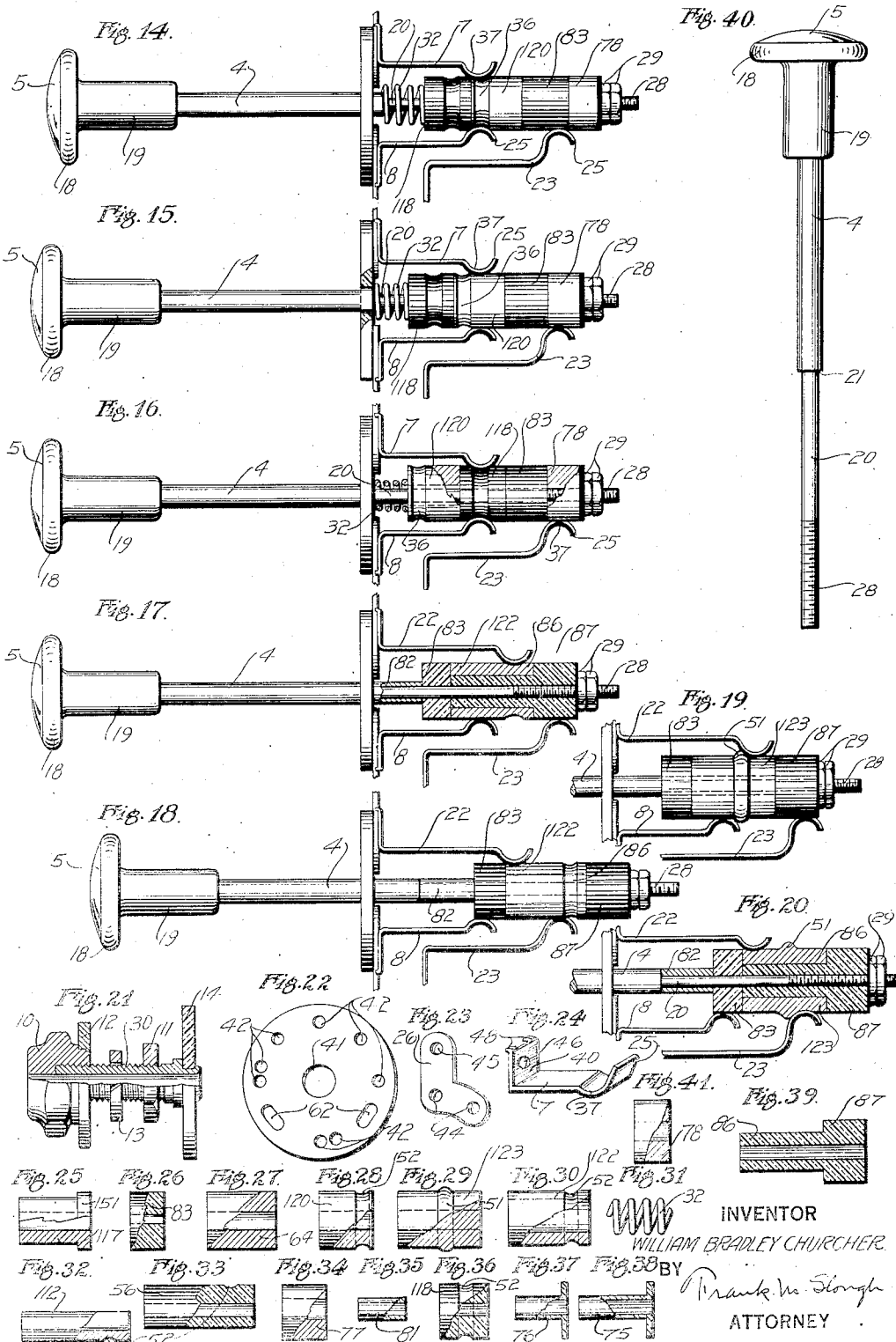
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UNITED STATES PATENT OFFICE

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ELECTRICAL SWITCH

Application filed June 19, 1926. Serial No. 117,140.

My invention relates to electrical switches and relates particularly to manually operable electrical switches as distinguished from automatic switches, and which are usually electro-magnetically operated.

The manually operable electrical switches commonly employed for controlling the electrical circuits installed on automotive vehicles, such as motor busses, trucks, and the like, have been commonly of a number of different designs, depending upon the nature of the electrical circuit comprising such switch. For instance, it is common to provide one type of electrical switch to control the ignition circuit, another switch for controlling the circuit of the electric starter for the vehicle engine, and still other switches for controlling the lighting circuits. From the standpoint of the manufacture of the electrical equipment going into the vehicles, this practice has resulted in the necessity of manufacturing an exceedingly great number of switch parts assembled together to form different kinds of switches, and has resulted in the further requirement that supplies of switch parts be provided at service stations, and has generally resulted in a lack of economy in manufacturing the switches and servicing the vehicles upon which they are installed. Not only this, there is also a lack of economy in the installation of the switches on the vehicle, since different kinds of mountings are required for the different kinds of switches. Again, where a switch having a certain contact arrangement is once installed, whenever a switch having a different contact arrangement is required in its place, the first switch may be removed together with its characteristic mounting and another switch and mounting of different type installed in its place. Sometimes this is highly inconvenient and requires the use of special adapters for facilitating the mounting of the different switch type.

An object of my invention therefore, is to accomplish uniformity in switch mountings for the different functional purposes required by the nature of the different kinds of electrical circuits had upon the automotive vehicle.

Another object of my invention is to accom-

plish standardization of operating parts of the switches so that the same parts may be employed by the switches which control circuits of widely differing character.

Another object of my invention is to provide switch apparatus which may be easily assembled together in various combinations to accomplish varying switching functions as is desirable to meet the requirements of particular circuit conditions.

Another object of my invention is to provide switches of the above character in which the contact combinations may be altered after installation of the switch but without requiring a new switch in toto.

Other objects of my invention comprising the elimination of the above named disadvantages had in existing switch apparatus, and other objects, and the invention itself, will become more apparent as the following description of an embodiment of my invention progresses in which description reference will be had to the accompanying drawings forming a part of this specification.

In the drawings;

Fig. 1 shows a switch, largely in longitudinal medial section, embodying my invention;

Fig. 2 is an end elevation of the switch of Figs. 1, 3, 4 and 5;

Fig. 3 is a side elevation of the switch of Fig. 1 modified to secure a different contact characteristic;

Fig. 4 shows, largely in longitudinal medial section, the switch of Fig. 1 with a different electrical contact characteristic.

Fig. 5 shows the switch modified to have still other contact characteristics;

Fig. 6 is an end elevation of the switch of Figs. 13, 14 and 15;

Fig. 7 shows the switch modified to have still other contact characteristics with four radially disposed springs;

Fig. 8 shows the switch of Fig. 7 with four contact springs as in Fig. 7, but with a different relative positioning of its parts;

Fig. 9 is an end elevational view of Figs. 7, 8 and 10;

Fig. 10 is a view of the switch having a different electrical contact characteristic and with four contact springs radially disposed;

Figs. 11 and 12 show switches having different electrical contact characteristics and in which a rotation of the handle will accomplish additional switching function;

Fig. 12-A is a view of the switch 11, taken on the line 12-12 of Fig. 11;

Figs. 13 to 20, inclusive, are similar to Fig. 1, different electrical contact characteristics being illustrated, one contact spring of each being shown displaced from its actual position; and

Figs. 21 to 41, inclusive are views, some being shown partly in section, of the different parts which enter into the make-up of the different switch combinations above illustrated.

Referring now to the different figures of drawings, in all of which like parts are designated by like reference characters, and referring first to Fig. 1, wherein I illustrate a switch of the plunger type adaptable for use in an electrical circuit, such as the circuit controlling the magneto electrical system of an automotive engine, its function being to shunt circuit and to remove a shunt circuit from the magneto terminals, the switch being self-sustaining or "locking" in its two different operative positions. In referring to this and the other figures, reference may be had to the views of the parts entering into the switch assembly illustrated, each, per se, in one of the figures of Figs. 21 to 40, inclusive.

Referring now particularly to Fig. 1, at 1, I show a support for the switch which may be the dash board of an automotive vehicle, such as a motor bus, and which board may have a metallic facing 2, being perforated likewise at 3, to effect the mounting of the switch mechanism to be described on the dash or instrument board, as the portion of the dash upon which these switches are mounted is sometimes called. The switch proper comprises four primary parts, these being now briefly designated as a supporting mount 30, an operating rod 4 provided with a handle 5, movable electrical contact pieces, one being shown at 117, Fig. 1, and switch contact springs, as illustrated at 7 and 8 therein. The mount is carried by the instrument board, being rigidly secured thereto by virtue of clamping nuts 10 and 11 and intermediately disposed washers 12 and 13, the mount carrying at its flanged end an insulating plate 13, between a shoulder formed by an end face of the mount flange 15 and the headed end flange portion 16, of the reduced end 17, of the mount disposed between the flanges 15 and 16; the insulating plate 14 being centrally perforated and fitted over the portion 17 of the mount and secured in place by the forming of the flange 16 by expandingly heading over the outer edge thereof. The mount 30, has a central bore through which the rod 4 may axially be reciprocated and which loosely fits within the bore. The

handle 5 has a flanged head 18 and a stem portion 19, the end of which is adapted to engage with the end face of the clamping nut 10, which is suitably enlarged and formed to form a stop for the handle when the handle is pushed inwardly to operate the switch.

The rod 4 is reduced in diameter in its end portion 20, thus providing a shoulder 21 at the junction of the reduced end with the larger rod portion. The springs, such as 7 and 8, and such as 22 and 23, Figs. 8 and 10, especially, are carried on the insulating plate 14, each of the springs being secured to the insulating plate by screws, or, as illustrated, by rivets 24, the springs being disposed 90° apart on the annular plate 14, with their contact ends 25 extending inwardly, resiliently, toward the longitudinal axis of the reduced end 20 of the operating rod 4. A terminal 26 is provided for each contact spring and a binding post electrical connecting screw 27 is screw threaded through the terminal 26 for each spring for the purpose of making electrical contact between circuit conductors and the different contact springs. The reduced end 20 of the rod 4 is threaded, as shown, at 28, clamping nuts 29 being adapted to be threaded onto the threads thereof to clamp one or more of the tubular elements illustrated in Figs. 25 to 39, inclusive, these being telescoped over the reduced end 20 of the rod, an end 1, resting against the shoulder 21 thereof, and an opposite end 1, coming into contact with the inner face of the inner clamping nuts 29, whereby the interposed tubular elements of the specified figures are securely clamped in positions on the rod in the desired way requisite for accomplishing different electrical contact functions. At 75 is shown a tubular insulator collar having a flanged outer end against which the clamping nuts 29 abut in retaining the tubular elements, referred to on the reduced end 20, of the operating rod 4.

The switches illustrated in Figs. 1 to 20, inclusive, comprising varying arrangements of cooperative contact springs, which are illustrated as being two in number in some cases, such as Figs. 1 to 5, inclusive, other cases are illustrated as comprising additional springs 22, and/or 23, Figs. 7 and 13 or a different case is illustrated comprising other springs 70, 80, 90 and 100, Figs. 11 and 12, are, by such variations, adapted to accomplish different switching functions.

For instance, Fig. 1 is adaptable for use to control a magneto ignition circuit of an automotive vehicle, the plunger rod 4 having locking "on" and "off" positions, wherein the contact springs 7 and 8 are insulated each from the other and from the rod 4 in one position, and wherein the springs and rod are interconnected in the other position. Fig. 3 likewise contains an insulating tubular element 129, Fig. 28, and a metallic tubular

element 117, preferably exactly like that of the contact element 129, except for its electrical conducting properties resulting from its different composition, the two tubular elements are in transposed positions on the rod.

With this exception, the switches of the other figures will be more readily understood, some of them, like Figure 4, being provided with a spring 31 constantly exerting an effort sufficient to restore the switch parts to the positions illustrated in Fig. 4, and in which normal position the contact springs 7 and 8 are alone insulated, each from the other and from the rod, and other of the switches, Fig. 13, comprising a shorter spring 32 interposed between an end tubular insulator element, such as 118, and the flange 16. In Fig. 7, the spring 32 is only effective after the rod 4 has been withdrawn to a predetermined amount. An annular flanged insulator ring 76, is inserted over the reduced portion 20 of the rod 4 over which is placed a metallic cylindrical contact member 28 abutting against the insulator member 118.

Fig. 4 illustrates a switch adapted to close a circuit in the circuit of the starting relay for an electrical starting motor for an automotive engine, being automatically reciprocable by virtue of the compression of the spring 31 to relay releasing position, as illustrated. Fig. 5 illustrates the varying switch position of the switch of Fig. 4.

Referring in detail to Fig. 7, the mounting of which is similar in construction to the mounting illustrated in the foregoing figures, except that the switch illustrated in Fig. 7 is provided with a short coil spring 32 coiled about the operating rod 4 and interposed between the reduced upset portion 16 of the mounting 30 and a tubular insulator element 118. Also the contact and insulator portion carried by the operating rod are different and comprise a metallic contact cylindrical member 77 and 78, a cylindrical insulator member 79, insulator bushing 81 and an annularly flanged insulator member 76, the latter of which having a cylindrical extension over which the contact metallic element 78 is placed, all of which are retained contiguous to each other as illustrated, by the clamping nuts 29. Additional spring contact arms, such as 23, are employed.

Fig. 9 illustrates an end elevation of my switch illustrated in Figs. 7, 8 and 10, wherein I employ four contact spring arms 7, 8, 22 and 23. The same insulator plate 14, employed in the other embodiments of my invention is also employed in this embodiment. Elongated slots 62 and holes 42 are provided in the plate adjacent the periphery thereof for the reception of rivets 24 and 43, by which the binding terminal and the spring contact arms 7, 8, 22 and 23 are secured to the insulator plate 14 in any of the desired positions, depending upon the number of binding

terminals and spring contact arms employed in the particular switch. I contemplate using preferably from two to four of such contact spring arms.

Figs. 8 and 10 illustrate the varying switch positions of the switch of Fig. 7.

Fig. 8 illustrates a switch capable of performing the same functions in connection with a magneto ignition and starting relay circuits, the magneto ignition circuit to be operative, requiring that the springs 7 and 8, or at least one of them, rest against an insulating contact tube, as illustrated, during starting and intermediate switch positions.

The switch of Figs. 11, 12 and 12-A, having a special rotative operative movement, will require some additional explanation than that had in the foregoing. This switch comprises a metallic contact segment peripherally disposed, illustrated at 112, and embraced in part by an insulating portion 56, from between the ends of which the metallic portion projects forming a flattened insulating contact cylinder portion. This insulating contact portion is provided for the purpose of insulating the contact or armature spring 70 from electrical circuit with the rod 4, and other contact springs whenever it is desired to "turn off" the headlights, or other electro-responsive devices controlled by the switch.

In Fig. 11 the switch is in the "off" position with the contact spring 70, resting on the metallic segment portion 112 and springs 80 and 90 insulated from contact with the insulating portion 56. Spring 100 is insulated in this position from contact with the metal contact member 64 which is placed over the cylindrical portion of the insulator member 75, which in turn is inserted over the end of the rod 20, the inner end of which abuts against an insulating washer 33 inserted between the portions 56 and 64 and retained in assembled position by the clamping nuts 29. However, when the handle 18 is revolved 90 degrees, so that the armature spring 70 is in contact with either the spring 80 or 90, an electrical connection will be established through the metallic contact 112, the one contact spring 80, being for the purpose of conducting current to effect, for instance, the "bright" or "far ahead" lighting of a filament, and the contact spring 90, for instance, is adaptable to conduct current to a filament for the "dim" or "near by" lighting function. These springs may be connected, respectively, to the two filaments provided in a "tilt-ray" headlight lamp bulb to selectively effect the operation of the one or the other of the filaments.

Fig. 12-A comprises four contact springs 70, 80, 90 and 100, the contact spring 70, being used as the intermediate or armature spring and when resting against the flattened surface of the metallic portion 56, is fully insulated from the contact springs 80 and/or

90, being in the normal "off" position and being independent of the longitudinal position taken by the switch contact 112 by a reciprocatory axial movement of the rod 4. Fig. 12 illustrates Fig. 11 in its "pulled out" position in which is shown the armature spring 70 advanced to a position on the metallic contact portion 64 forming a contact with spring 100, which is adaptable to conduct current to a filament for the "parking" lamp, and/or other lamps of this nature.

Fig. 13 illustrates a switch adapted to have its contact spring 23 in the starting relay circuit, make contact with a metallic tubular element of a form similar to the insulating element, Fig. 26, when the switch handle is in full withdrawn position, Fig. 15, and which will restore to an intermediate position, Fig. 14, wherein both the springs 7 and 8 make contact with the intermediate metallic contact piece 120, the curved tip 37 of the spring 7 resting within the groove 36 of the contact piece 120 to insure that a battery ignition circuit may be closed through the spring 7 when the switch is in its starting and also in its intermediate position.

Referring to Fig. 13, wherein a coiled spring 32 is employed and adapted to be coiled about the reduced portion 20, and the operating rod 4; this spring 32 remains free in the intermediate and off positions and is only compressed against the insulator tubular element 118 when in the starting position, snapping back to intermediate position again as the handle 18 is released.

A metallic tubular contact element 120 having an annular groove 36, the rod 20 and insulated therefrom by the insulator bushing 81, an insulator tubular element 83, and metallic contact tubular element 78 are then telescoped over the rod 20 and retained thereon by virtue of the clamping nuts 29. Figs. 14 and 15 illustrate a switch capable of performing the functions of the switch of Fig. 13 in various contacting positions.

In Fig. 16, I have reversed the order of the various tubular contact end insulator elements. The metallic contact element 120 is first placed on the rod 20 followed by the insulator elements 118 and 83, the metallic contact element 78 being applied lastly all retained in the position illustrated by the clamping nuts 29.

Fig. 17 illustrates a switch comprising preferably three contact spring arms 7, 8 and 23, and tubular elements such as the tubular insulating element 83, metallic contact piece 122 telescoped over the reduced portion 86 of an insulator piece 87, is capable of being set to an intermediate and two opposite extreme positions, the same being adaptable for use in connection with the headlight circuits of an automobile, wherein connection is made through the tubular metallic contact piece, such as the one illustrated at 122 from a

spring 22 to either a spring 8 or 23, the springs 8 or 23 each leading to the headlight filaments, the one contact spring 8 being for the purpose of conducting current to effect, for instance, the "bright" or "far-ahead" lighting of a filament, and the contact spring 23, for instance, adaptable to convey current to a filament for the "dim" or "near-by" lighting function. These springs may be connected, respectively, to the two filaments provided in a "tilt-ray" headlight lamp bulb to selectively effect the operation of the one or the other of the filaments.

Fig. 18 illustrates a different operative position for closing different electric circuits from that of Fig. 17.

Figs. 19 and 20 differ from Figs. 17 and 18 in that the metallic tubular contact element 123 differs from contact element 122 being provided with an annular projection 51 over which the contact spring arms snap and is also slightly thicker than the same.

By referring to the different figures illustrating the tubular elements, Fig. 21 shows the mount assembly comprising the tubular mount 30, the insulating disk 14, washer 12, clamping nuts 10 and 11, and washer 12, clamping nuts 10 and 11, and washer 13, all in axial alignment.

The tubular elements, illustrated in Figs. 25 to 39, inclusive, may be as illustrated for each of insulating or metallic material, and it is to be understood that according to the requirements of the switching function to be performed, the composition of these tubular elements would depend, so as to make them insulating or electrical current conducting. Some of these are provided with annular projections 51, and flanges 151, which the contact portion 37 of the springs may override, and others have peripheral grooves 52 adapted to center the plunger rod by the pressure of the contact portion 37 of the spring fitting into the grooves. The functions of these elements will be readily understood by reference to the above description and the drawings illustrating the different switches.

Fig. 22 is a view of the insulating plate having a central opening 41, and a series of circular perforations 42 and elongated perforations 62 arranged in a circle about the central opening, being in pairs suitable for the reception of the rivets 43, which pass through the springs, such as shown at 7 and 8, the terminals 26 and the plate 13. The terminal itself, 26, is illustrated in Fig. 23, being an L-shaped stamping having perforations at its ends and middle for the reception of the rivets 43 in the openings 44, the opening 45 being threaded for the reception of the terminal screw 27. The contact springs 7, 8, 22, 23, 70, 80, 90 and 100 are as illustrated at 7, Fig. 24, wherein the spring is shown as comprising an angularly disposed base 40 centrally perforated at 46

and having projecting end flanges 48 and a spring portion. The spring portion has its end transversely curved to form a contact portion 37.

It is to be noted that preferably in all switch constructions, I so arrange the springs that the deflecting efforts exerted thereby upon the rod 4 will be balanced,—i. e., a deflecting effort exerted by one or more of the springs in a given direction will be opposed by an equal and opposite deflecting effort by one or more other springs. Thus in Figs. 8, 9 and 10, I show two long and two short springs, each spring of a pair being equal in length and arranged oppositely to the other spring of the pair, and in Figs. 6 and 13, where three springs are used, the thickness of the springs will be so chosen relative to their lengths that from each of the three directions there will be exerted toward the axis of the rod 4 a deflecting effort equal to the deflecting effort of each of the other springs.

While I may depart from this preferred construction, I find that by so balancing the deflecting effort of each spring, the switch will be capable of being reciprocated with a minimum of effort, since the friction in the bearings thereof will be minimized and since also unequal wear would take place on one or the other side of the bearings were the arrangement an unbalanced one.

Having thus described my invention in certain embodiments, I am aware that numerous and extensive departures may be made from the embodiments herein illustrated and described but without departing from the spirit of my invention.

I claim:

1. In an electric switch construction, a support, a face plate provided with a central perforation secured to the support, a plunger reciprocally mounted in the support and extending through the perforation, a handle at one end of the plunger for reciprocally moving it, an electric switch element provided with conducting surfaces and insulating surfaces supported on the rod and reciprocable therewith, the face plate being provided with a plurality of pairs of primary and secondary perforations, the primary perforations being disposed in a circle around the central perforation, the secondary perforations also being disposed in a circle around the central perforation, said pairs of perforations being positionally distributed on the face plate to provide even numbers and odd numbers of said pairs of perforations symmetrically disposed around said central perforation, a plurality of resilient electric contacts each supported at a portion thereof on the face plate and at a free portion thereof adapted to resiliently successively engage the conducting and insulating surfaces of the switch element when the same is reciprocated, means for effecting rigid association of the

contacts with the face plate comprising a pair of spaced binding elements associated with each contact and extending into a corresponding pair of said perforations in the face plate to prevent movement of the unsupported end of each contact relative to the face plate in directions transversely of the plunger or rotatably about either binding element of the pair.

2. In an electric switch construction, a support, a face plate provided with a central perforation secured to the support, a plunger reciprocally mounted in the support and extending through the perforation, a handle at one end of the plunger for reciprocally moving it, an electric switch element provided with conducting surfaces and insulating surfaces supported on the rod and reciprocable therewith, the face plate being provided with a plurality of pairs of primary and secondary perforations, the primary perforations being disposed in a circle around the central perforation, the secondary perforations also being disposed in a circle around the central perforation, said pairs of perforations being positionally distributed on the face plate to provide even numbers and odd numbers of said pairs of perforations symmetrically disposed around said central perforation, a plurality of resilient electric contacts each supported at a portion thereof on the face plate and at a free portion thereof adapted to resiliently successively engage the conducting and insulating surfaces of the switch element when the same is reciprocated, means for effecting rigid support of each contact on the face plate comprising a pair of rivets associated with each contact and extending through a corresponding pair of said perforations in the face plate to prevent shifting of the contacts on the face plate in directions transversely of the plunger or rotatably about either of the rivets of the pair.

3. In an electrical switch, a plunger rod therefor having a handle knob at one end, its other end being threaded, said rod being of reduced diameter in its portion adjacent the threaded end to provide an intermediate shoulder, an apertured face plate through the aperture of which the rod is adapted to reciprocate, electrical contact springs supported on the side of the face plate opposite the knob and having contact portions at their free ends which are disposed adjacent the rod, a plurality of differently formed annular elements comprising electric current conducting and electrical insulating elements adapted to be placed over the threaded end of the rod in axial alignment with their peripheral portions engageable with the contact portions of the springs, and a nut adapted to be threaded onto the end of the rod to clamp said annular elements in place thereon, said elements being of generally cylindrical form,

one of said elements comprising a pair of segments, one of said segments being an insulating segment, the other segment being a current conducting segment, said elements comprising an insulating element disposed
5 longitudinally of the said composite segmental element.

4. In an electrical switch, a plunger rod therefor having a handle knob at one end, contact elements carried on the other end of the rod and contact springs engageable with the lateral surfaces of the said elements, insulating elements disposed intermediate the contact elements, said contact elements and said insulating elements being so disposed longitudinally and circumferentially of the rod, relative to said contact springs, as to be separably engageable by at least one of said springs upon longitudinal and/or rotative movement of the plunger rod, a transverse face plate provided with a perforation through which the rod extends and the contact springs being mounted thereon and extending therefrom in the direction opposite to the handle knob.

In testimony whereof I hereunto affix my signature this 4th day of June, 1926.

WILLIAM B. CHURCHER.