

March 4, 1930.

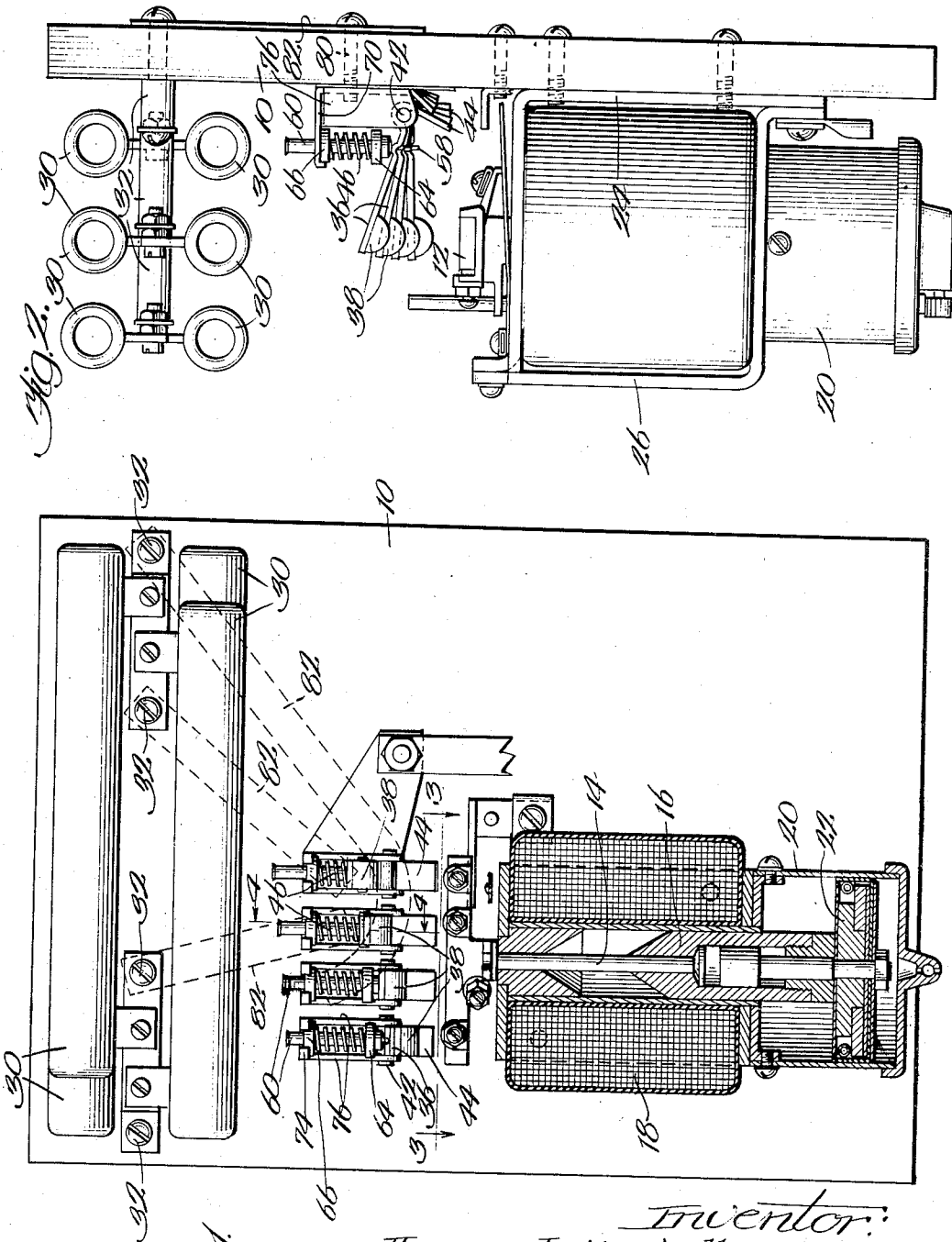
H. L. VAN VALKENBURG

1,749,200

ELECTRIC SWITCH

Filed April 27, 1925

2 Sheets-Sheet 1



Inventor:
 Hermon L. Van Valkenburg
 By Chever & Cox Attys.

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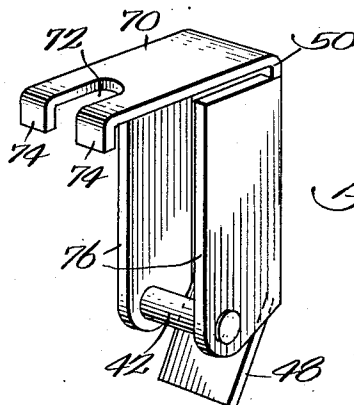
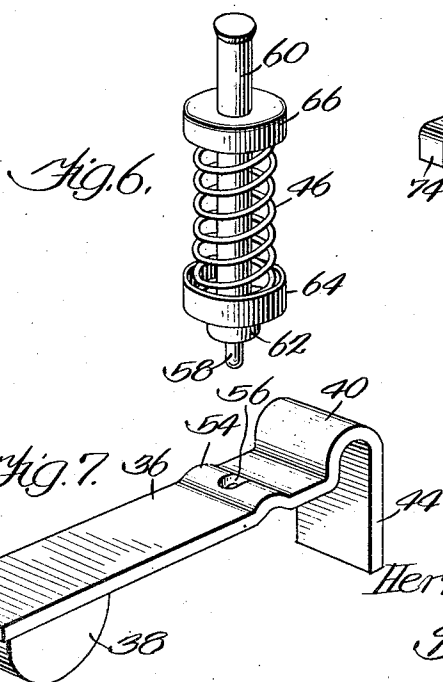
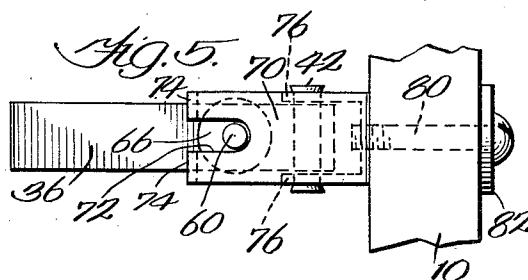
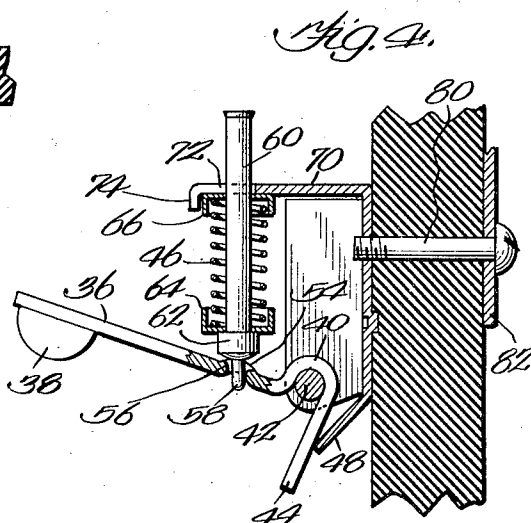
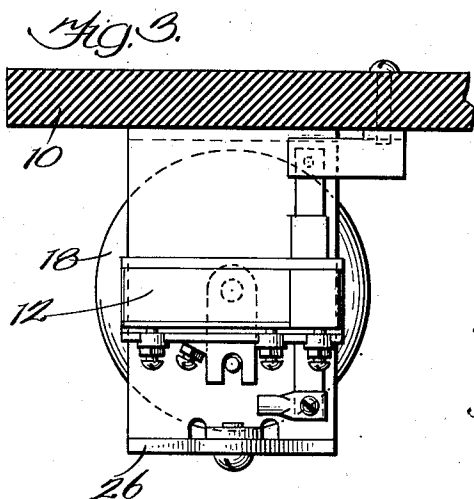
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ELECTRIC SWITCH

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

HERMON L. VAN VALKENBURG, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SQUARE D COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN

ELECTRIC SWITCH

Application filed April 27, 1925. Serial No. 25,993.

My invention relates to electric switches, and especially to switch fingers and their mountings. Switches of this general type are frequently used in starters for direct current motors, and for the sake of illustration I have chosen to illustrate the invention as embodied in a direct current motor starter. Such starters employ a plurality of fingers which are brought into action consecutively to cut out resistance as the motor accelerates. For various reasons these fingers become damaged and need to be replaced from time to time. An object of my invention is to provide a construction such that the fingers will be individually spring-pressed and will be secure in their position in the apparatus, but at the same time may be readily removed or replaced without the aid of tools of any kind. In other words, it is my purpose to provide switch fingers which may be removed or replaced individually with a minimum of effort and which will nevertheless maintain their position securely in the apparatus. Broadly speaking, this characteristic is not new, but my object is to provide an improved and simplified construction by which the general object may be attained. In apparatus embodying my invention the contact fingers may be taken out by merely lifting them off their fulcrums and pushing back the springs by which they are held seated.

Another object is to provide a support for the contact fingers of special simplicity and effectiveness and one which will also promote the security with which the fingers will maintain their position on their fulcrum when in use.

Another object is to provide simple and effective means for retaining the guide pin and coil spring which act upon the contact fingers. Still another object is to provide a construction which will insure good electrical contact between the fingers and their support, thus making it possible to dispense with the auxiliary shunts or supplemental wires commonly used for the purpose. Still another object is to provide a construction which will afford each contact finger a wide range of movement about its fulcrum.

I accomplish my objects by the mechanism illustrated in the accompanying drawings in which

Figure 1 is a front view of my device in the form of a motor starter embodying the invention. In this view the electromagnetic coil and associated parts are shown chiefly in axial section.

Figure 2 is a side elevation looking toward the left in Figure 1.

Figure 3 is a sectional view on the line 3—3 Figure 1.

Figure 4 is a side elevation partly in section showing an individual contact finger and its mountings.

Figure 5 is a top plan view of the parts shown in Fig. 4.

Figure 6 is a perspective view of a coil spring and associated elements for backing up a contact finger.

Figure 7 is a perspective view of a contact finger.

Figure 8 is a perspective view of one of the brackets in which the fingers are supported.

Like numerals denote like parts throughout the several views.

In the form selected to illustrate the invention the parts are mounted on a panel 10 of insulating material. A movable contact bar 12 is arranged horizontally beneath the contact fingers and is controlled vertically by means of a rod 14 secured to a plunger 16 vertically movable within an electromagnetic coil 18. The upward movement is retarded by means of a dash pot which includes a piston 22 which cooperates with the plunger 16 and moves within a cylinder 20 containing oil or other retarding fluid. The coil and dash pot are secured to the panel by two cooperating brackets 24, 26. Above the contact fingers, which will presently be described, are resistance coils 30 which are secured to the panel 10 by suitable brackets 32.

As the parts thus far described are not of the essence of the present invention they need not be herein described in detail. Parts similar to them are shown in my prior Patent No. 1,266,642. It is sufficient for the present purpose to say that when the coil 18 is ener-

gized the contact bar 12 will be gradually elevated to engage the contact fingers successively.

Referring now to the parts more intimately concerned with the invention, the contact fingers 36 are here shown to be four in number, although the number may be varied without departing from the spirit of the invention. They are all alike, that is, of standard pattern, the purpose being to reduce the cost of manufacture and the number of parts which must be kept in stock for repair purposes. The configuration of these fingers is shown in perspective in Figure 7, each finger consisting of a comparatively straight arm or bar of suitable conductive material and provided at its outer or free end with a contact portion or contactor 38 adapted to cooperate with the contact bar 12 previously mentioned.

At its inner end each finger is recessed on its under side, it being desirable that the recess be deep enough to enable the finger to hold its seat firmly on its support. In the specific form shown each finger has a hook consisting of an arched portion 40 adapted to seat upon a fulcrum pin 42 and a tail 44 which projects below or forward from the plane of the finger and serves the dual purpose of insuring the position of the finger on the pin and that of a stop for limiting the movement of the finger under the action of the coiled compression spring 46 hereinafter again referred to. The tail 44 cooperates with a stationary arm 48 forming part of the supporting bracket 50. Between its ends each finger has a hump 54 having an aperture 56 in the middle which accommodates the reduced lower end 58 of the pin 60 which assists in yieldingly holding the contact fingers in position. This may be said to constitute a pin and socket connection between the guide pin and the finger. A head 62 is formed near the lower end of the pin and serves as an abutment against which the hump 54 bears and also as a collar or shoulder for supporting the cap 64 on which the lower end of the spring 46 seats. A similar cap 66 seats upon the top of the spring, these caps being apertured to permit the pin 60 to slide freely through them. It is desirable that each pin 60 be peened or riveted over at the top to prevent the upper cap from coming off. This makes a unit construction, that is, each spring and its associated parts kept together and can be handled as a unit.

The hump 54 above mentioned, on which the pin bears, is located nearer the fulcrum pin 42 than it is to the other end of the finger. By thus bringing the pressure of the spring near the fulcrum point the pressure of the finger upon the fulcrum is increased to such an extent that the usual auxiliary shunt or connecting wire is unnecessary. The use of such a wire is shown in my aforesaid patent.

Another advantage of this construction in which the spring bears so closely to the fulcrum is that it permits the finger to have a wide range of movement.

The bracket 50 previously mentioned has an arm 70 which projects forward from the top and is bifurcated at the outer end, having a slot 72 which accommodates pin 60. Flanges 74 depend from the outer bifurcated ends of the arm and these retain the upper cap 66 in place and prevent the pin from sliding out through the open end of the slot.

The bracket 50 is shown in a design which affords simplicity of manufacture and efficiency in holding the parts assembled. In addition to the stop arm 48 and upper arm 70 previously described the bracket has two forward projecting wings 76 which are arranged vertically and form a support for the fulcrum pin 42. These wings are spaced apart sufficiently to freely accommodate the contact finger between them, but at the same time prevent much lateral play. These wings also protect the fingers against any blow from the side which might tend to dislodge the finger from the fulcrum on which it rides. In other words the bracket practically constitutes a housing and by preference is formed of a single piece of sheet metal. Each bracket is secured to the insulating panel 10 by a screw 80 which passes through the panel and at the outer end makes electric contact with a strap 82. These straps are connected to the different resistance coils 30 and operate in the usual manner.

In accordance with common practice the switch fingers normally stand at different elevations, and this is accomplished in my apparatus by bending the stop arms 48 to different angles as clearly illustrated in Figure 2.

The operation will now be readily understood. After the parts have been assembled as illustrated in Figures 1 and 2, if the coil 18 is energized the plunger 16 will be caused to rise gradually under the retarding influence of the dash pot and bring the contact bar 12 first into engagement with the lowermost contact finger and then successively in contact with the adjacent fingers, thus to cut out the resistance offered by the coils 30. If it is desired to replace one of the contact fingers all that is necessary is to lift the finger upward sufficiently to permit the tail 44 to clear the fulcrum pin 42. The spring device which includes the spring 46, pin 60 and associated parts may be lifted out of contact with the finger or the finger may be lowered away from the spring device, for it will be noted that said device makes one-way engagement contact with the finger, merely resting upon it and not being in any way fastened to it. The spring device simply makes end contact with the back of the finger at one end, and the under side of arm 70 at the other end, and

consequently the spring device may be removed from the bracket by merely lowering it away from the latter after the finger has been removed. There is no danger of the parts becoming disassembled because there is a pin and socket connection between the guide pin 60 and the finger, and similar engagement between the upper cap 66 and the upper horizontal arm 70. The upper cap normally prevents the pin from sliding out of slot 72 but the spring device may be readily taken out even though the contact finger is present, for by lowering the cap 66 sufficiently to clear the lower end of the flanges 74 the pin 60 may be slid out of slot 72. Thus it will be evident that the device is extremely simple in construction, and no nuts, screws or cotter pins need be removed as a prerequisite to taking the elements apart.

I do not herein claim the form of bracket by which the solenoid 18 is supported, as this forms the subject of a separate application filed by me on the 27th day of May, 1925, Serial No. 33,095.

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

1. An electric switch having an electrically energized stationary support and a contact finger, one having an open concavity and the other a portion projecting into it, whereby the finger is pivotally supported, may be lifted off, and is energized, the front side of the finger making contact with the fulcrum and having a main contact surface, an abutment fixed relatively to the fulcrum, a spring engaging the finger between its ends for urging it forward toward acting position and to maintain it seated on the fulcrum, and a tail at the inner end of the finger, for engaging the abutment to limit the forward movement of the finger about its fulcrum.

2. An electric switch having a cylindrical fulcrum, a contact finger in the form of a hook the tail of which extends substantially at right angles to the length of the finger, well beyond the fulcrum, the end of the finger opposite to the hooked end having a contact surface on the front side and the hooked end having a concavity on its front side adjacent to the tail of the hook, said concavity facing forward and being of a diameter fully as great as the diameter of the fulcrum whereby the finger may be lifted off, a spring acting upon the finger between its ends for pressing the finger forward toward the fulcrum and toward the part to be electrically contacted, and a stationary abutment for the outer surface of the tail of the finger for limiting the extent to which the finger may be moved forward by the spring.

3. An electric switch having a plurality of contact fingers in the form of a hook, means for fulcruming said fingers about a common axis, means acting upon the fingers between

their ends in a direction to urge them toward the fulcrum, the tail at the hooked end of the finger also projecting in a forward direction well beyond the fulcrum, and a stationary abutment having a plurality of arms arranged side by side opposite to the individual fingers, in position to engage the outer side of the tails thereof, the fingers being of uniform configuration and the arms being bent at different angles whereby the fingers will normally stand at different angles.

4. An electric switch having a cylindrical fulcrum, a contact finger having a wide mouth concavity seating upon said fulcrum whereby the finger may be lifted off from it, a stationary arm, and an assembled pin and coiled spring interposed between the arm and the finger, said spring urging the finger toward its fulcrum and detachably engaging with the arm and the finger whereby the spring device may be lifted out as a unit, and when removed permits the finger to be lifted off its fulcrum.

5. An electrical switch having a cylindrical current carrying fulcrum, a contact finger having a wide mouth concavity seating upon the fulcrum whereby the finger may be lifted away from it for detachment, the acting surface of the contact finger being on the forward side, and the concavity facing forward, a stationary arm behind the finger and spaced from it, and a single, self-contained freely removable compression spring interposed between the arm and the finger and making one-way engagement contact with each of them, whereby the spring may be lifted out of the assembly and the finger may be lifted off the fulcrum when the spring is removed.

6. An electric switch having a contact finger with a contact surface on the front at one end and a wide-mouth concavity facing the front at the other end, a cylindrical fulcrum on which the concavity seats, a bracket in the form of a housing, said bracket having forward projecting, vertically arranged wings for supporting the fulcrum and guarding the finger from the sides, an arm projecting forward over said wings, a spring interposed between the top of the finger and the under side of the arm, and a removable self-contained unitary spring device making one-way engagement contact with the back of the finger and with the under side of the arm and held in place solely by them whereby the spring device can be lifted out of the assembly and the finger may be lifted off the fulcrum.

7. An electric switch having a stationary arm, a fulcrum a contact finger pivotally mounted on it, and a unitary, self-contained spring device interposed between the arm and the finger for holding the latter seated upon the fulcrum, said spring device comprising a pin, a helical compression spring surrounding it, the spring being anchored at one end

to the pin and at the other end free to slide relatively to it, and means for preventing the free end of the spring from slipping past the free end of the pin.

5 8. An electric switch having a stationary fulcrum, a contact finger having a wide-mouth concavity on the forward side, seating upon the fulcrum whereby it may be lifted off from it, a stationary arm behind the
10 fulcrum, and a self-contained, unitary, compressive spring device interposed between the arm and the finger for pressing the finger forward toward acting position and pressing it firmly against the fulcrum, said spring device
15 comprising a pin, a helical compression spring surrounding it, the spring being anchored at one end to the pin and at the other end free to slide relatively to it, and means for preventing the free end of the spring from
20 slipping past the free end of the pin.

9. An electric switch having a stationary fulcrum, a contact finger pivoted thereon, a stationary abutment, and a spring device interposed between the abutment and the finger
25 for urging said contact finger in a forward direction, said spring device comprising a pin making one way engagement contact with said finger and passing slidably through said abutment, a coiled spring surrounding the
30 pin and anchored to it at one end, a cap engaging the other end of the spring, the cap being slidable along the pin and adapted to engage the abutment, and means at the end of the pin farthest from the contact finger
35 for preventing the cap from slipping over the end of it, all the equipment of the pin lying on the same side of the contact finger whereby the spring device is self-contained and removable as a unit.

40 10. An electric switch having a lift-out contact finger, at one end of which a concavity is formed which opens toward the front, the other end of the finger having a contact-making surface on the front, a cylindrical current-carrying fulcrum on which the concave
45 portion of the finger seats, a single, loose, detachable spring acting upon the finger between its ends for urging it forward toward acting position and for urging the concave
50 portion toward the fulcrum to keep it seated and obtain good electrical contact whereby the fulcrum may be the sole source of electrical energy, the concavity having an opening of sufficient diameter to permit the finger to be
55 lifted off the fulcrum, and means for electrically energizing the fulcrum.

11. An electric switch having a loose, detachable contact finger with a contact surface on the front at one end and a wide-mouth
30 concavity facing the front at the other end, a cylindrical fulcrum on which the concavity seats, means for electrically energizing said fulcrum, a bracket in the form of a housing, said bracket having forward projecting, vertically arranged wings for supporting the

fulcrum and guarding the finger from the sides, an arm projecting forward over said wings, a spring interposed between the top of the finger and the under side of the arm, and a loose, detachable self-contained unitary
70 spring device making one-way engagement contact with the back of the finger and with the under side of the arm whereby the spring device can be lifted out of the assembly and the finger may be lifted off the fulcrum,
75 without unfastening any fastening devices.

12. An electric switch having a support, a contact finger pivoted upon said support, a guide pin bearing upon the back of the finger and having a pin and socket connection therewith, a spring for urging the pin toward the
80 finger, and an arm rigid with said support and overlying the top of the spring, said arm being bifurcated for accommodating the pin and having a flange at the outer end of the
85 bifurcations for retaining the spring.

13. An electric switch having a stationary support and a contact finger, one having an open cavity and the other a projection extending into it, whereby the finger is pivotally supported, and is freely liftable from the
90 support, means for urging the finger toward said support and forward toward acting position, and a tail at the inner end of the finger adapted to engage said support for limiting
95 the forward movement of the finger, the tail extending forward and approximately at right angles to the body of the finger for guarding against accidental displacement of the finger from its support.
100

14. A switch having an electrically energized support and a contact finger, one having an open cavity and the other having a projection seating therein whereby the finger is freely removable from its support and pivotally supported thereby, and a single spring
105 urging the finger toward acting position and also toward its support whereby to insure good electrical contact with said support, said pivotal connection forming the current carrying connection between the finger and its support.
110

15. A switch having an electrically energized support and a detachable contact finger, one having an open cavity and the other having
115 a projection pivotally seated therein whereby the finger is freely removable from its support, and a single spring pressing against the contact finger adjacent its pivotal mounting to force the finger firmly into engagement with its support to insure good electrical contact with said support, said spring also being constructed and arranged to force the finger into acting position, said
120 pivotal connection forming the current carrying connection between the finger and its support.
125

16. An electrical switch having a cylindrical fulcrum, means for electrically energizing it, a contact finger having a wide mouthed
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concavity seating upon said fulcrum whereby the finger may be freely lifted off its fulcrum, a stationary arm, a coil compression spring detachably interposed between the arm and the finger for urging the finger towards its fulcrum and permitting the quick detachability of the contact finger from its finger.

be withdrawn from assembled position between the arm and finger by depressing the spring and withdrawing the device from the switch assembly.

In witness whereof, I have hereunto subscribed my name.

HERMON L. VAN VALKENBURG.

17. An electric switch having a fulcrum, a contact finger pivotally mounted upon said fulcrum, an arm spaced from the fulcrum, and a unitary spring pressed pin device arranged to operate between the arm and finger to normally urge the contact finger about its fulcrum, said device having opposed ends detachably socketed in the arm and finger, respectively, whereby the same may be freely assembled in operative position between said arm and finger without disassembling the elements of the spring device.

18. An electric switching device having a fulcrum, a contact finger pivotally mounted upon said fulcrum and having a socket spaced from the fulcrum, an arm spaced from the fulcrum, and a resilient finger actuating means comprising a pin formed with a pintle at one end for fitting in the finger socket and an abutment adjacent the pintle providing a spring seat and a spring encircling the pin and having one end taking against the abutment, said finger actuating means being detachably interposed between the contact finger and the arm with the pintle arranged in the socket and the spring compressed between the arm and the abutment whereby the finger actuating means may be readily assembled in place by merely compressing the spring and without necessitating the disassembly of any of the switch elements.

19. In an electric switch assembly having a fulcrum, a contact finger pivotally mounted to said fulcrum and provided with a socket formed therein, adjacent said fulcrum, a stationary arm spaced from the fulcrum and a finger actuating spring and pin device mounted between the finger and the arm, and arranged to normally urge the finger in one direction about the fulcrum, said device making detachable one way engagement with the stationary arm at one end and being removably arranged at its opposite end in said socket whereby the said device may be withdrawn from assembled position by depressing the spring and withdrawing the device from the arm and finger.

20. In an electric switch assembly having a fulcrum, a contact finger pivotally mounted upon said fulcrum and comprising a strip of sheet metal having a portion wrapped about the fulcrum to provide the pivotal connection therewith, a spring device interposed between the finger and the arm for pressing the finger in one direction about its fulcrum, said spring device making detachable one way engagement with the arm and the finger whereby the spring device may

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