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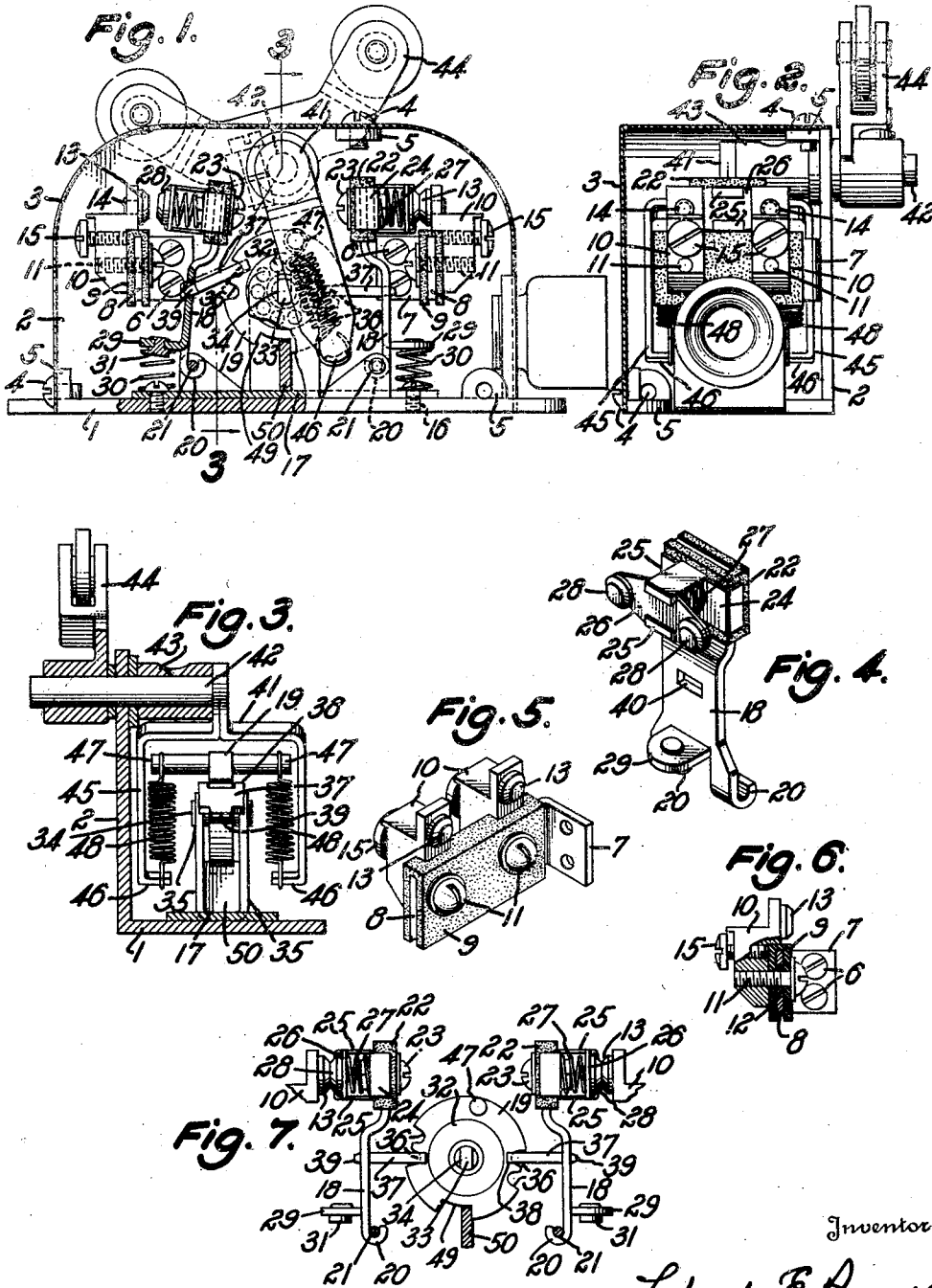
C. E. POWELL

2,239,624

ELECTRICAL SWITCH MECHANISM

Filed June 1, 1939

2 Sheets-Sheet 1



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April 22, 1941.

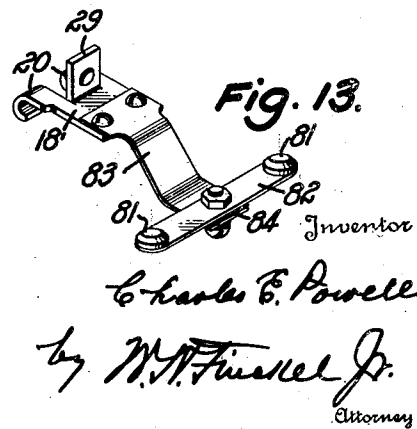
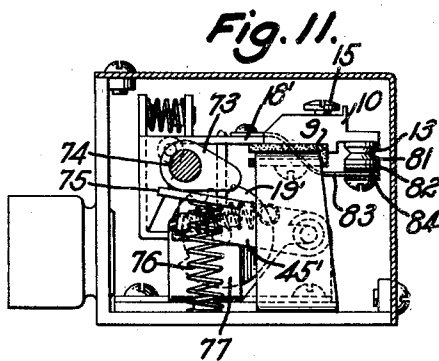
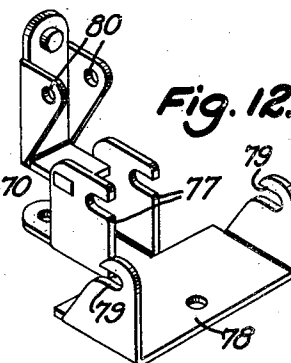
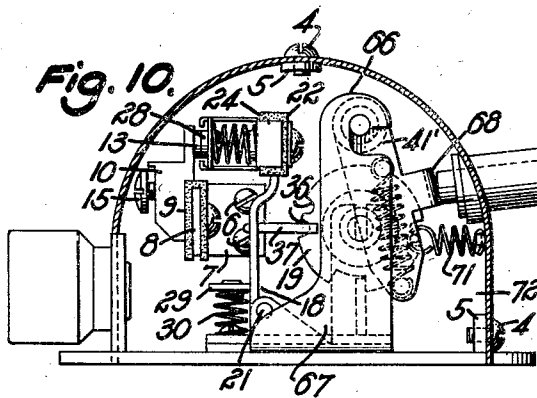
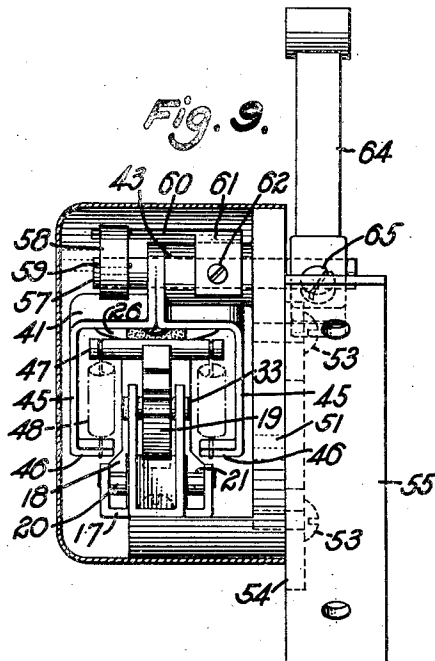
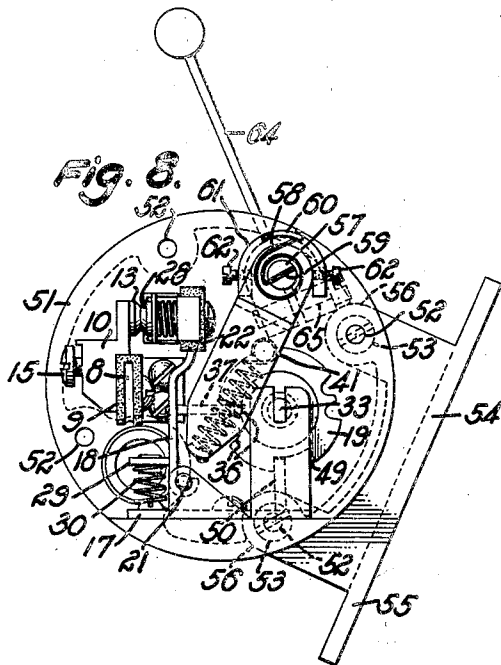
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,239,624

ELECTRICAL SWITCH MECHANISM

Charles E. Powell, Wadsworth, Ohio

Application June 1, 1939, Serial No. 276,375

7 Claims. (Cl. 200—6)

This invention relates to electrical switch mechanism, and it has special reference to switch mechanism designed primarily to supply the need for a contact making and breaking device of small current carrying capacity capable of being operated from on to off condition and of making a great many contacts at high speed with extreme accuracy of register of its contact elements and minimum wear on its parts, and which can be made so as to have small outside dimensions thus adapting it for installation for use in relatively limited space.

Although the switch mechanism of the invention is, as stated, adapted primarily to small switches, it will be understood that it is not thus limited in its application.

One object of the invention is to provide a switch mechanism adapted to a variety of uses such as in combination with magnetic remote control counters, signals, machine tool controls, start and stop push buttons, float switches, pressure switches, and the like, where a quick make and break butt contact switch device capable of long life and rapid operation with absolute dependability is required.

An additional object of the invention is to provide a switch mechanism which requires slight pressure or a short stroke for its operation but which, even so, will change from on to off position, and vice versa with great rapidity and complete reliability.

Another object of the invention is to provide an electrical switch mechanism which may be of single pole single throw, double pole, or single pole two-way type, or a switch mechanism which when made of double pole type may readily, and without the use of tools, be transformed from a double pole single throw switch to a single pole single throw switch or a single pole double throw switch by a simple rearrangement of parts without disturbing or changing the mounting or any mechanical connections of the switch.

A further object of the invention is to provide an electrical switch mechanism which, though essentially the same in the mechanical arrangement of its parts, and in its mode of operation, may be made in various types, such for example as the single pole rotary type, the single pole push button type, the double pole transformable type hereinbefore referred to, a cam operated type, and conceivably other types, and which may be actuated by mechanical, electrical, pressure and other means to suit the requirements of various installations, but which, no matter what its type or mode of actuation, will render

efficient service when rapidly operated, and will be capable of extensive use without attention or adjustment, repair or replacement of parts.

Without limiting the adaptability of the switch mechanism of the invention, it may be said that in the forms shown in the drawings and hereinafter particularly described, the switch mechanism is especially designed for use in installations operating at 10 amperes 110 volts, 5 amperes 250 volts, and 1 ampere 500 volts, either alternating or direct current, non-inductive loads.

A still further object of the invention is to produce a switch mechanism capable of efficient operation wherein relatively light operating springs may be used, thus providing for more effective operation and longer life in that breakage and distortion of the springs is not apt to occur, and also providing for more satisfactory service in that repairs or replacements will rarely be necessary.

Still another object of the invention is to provide contact elements having relatively rugged mechanical characteristics and provided, where needed, with insulating means able to withstand the vibration and impact of a multiplicity of contacts without mechanical or electrical failure.

A still further object of the invention is to provide a switch mechanism the frame and operative parts of which are made of simple design and rugged wear-resisting materials, and preferably in the form of sheet metal stampings, thus reducing production cost to the minimum while at the same time insuring long life and freedom from defects or failures in service.

With the foregoing and other objects in view, as will appear hereinafter from the detailed description, the invention contemplates a snap switch provided with cooperating stationary and movable contact means, and means for operating the movable contact means including toggle mechanism comprising an oscillatable or shiftable member, link means providing a connection between such member and the movable contact means, and means for actuating said member including resilient means providing a snap action of said member substantially instantaneously from open switch position to closed switch position and vice versa, the link means being capable of adjustment with respect to the shiftable member to alter the character and operative timing of the switch mechanism. And the invention also contemplates various details of construction, assembly and operation of the mechanism, all as

will be explained hereinafter more fully and finally claimed.

In the accompanying drawings illustrating the invention, in the several figures of which like parts are similarly designated,

Figure 1 is a face view of one type of switch embodying the features of the invention, the cover and certain parts being shown in section in the interest of clearness.

Fig. 2 is a side view of the switch of Fig. 1, with the cover in section.

Fig. 3 is a section taken on the line 3—3 of Fig. 1.

Fig. 4 is a perspective view of the movable switch element assembly detached from its pivotal mounting.

Fig. 5 is a perspective view of the stationary switch element assembly detached from its mounting.

Fig. 6 is a sectional elevation illustrating the insulating means for the switch element assembly.

Fig. 7 is a fragmentary face view illustrating an adjustment of the means for operating the movable switch elements whereby the switch of Fig. 1 may be converted from one type of operation to another.

Fig. 8 is a face view of another type of switch embodying the features of the invention, with the cover removed.

Fig. 9 is a side view of the switch of Fig. 8 looking toward the left, with the cover shown in section.

Fig. 10 illustrates another type of switch embodying the features of the invention.

Fig. 11 illustrates a still further type of switch embodying the features of the invention.

Fig. 12 is a perspective view of a bracket assembly for mounting the parts of the movable switch element and the operating mechanism therefor illustrated in Fig. 11, and

Fig. 13 is a perspective view of the movable switch element detached from its mounting.

Referring to Figs. 1 to 6 inclusive, it will be seen that the switch illustrated is, with its parts arranged as shown, of the single pole double throw type, including a substantially L-shaped mounting element having a base 1 and back wall 2 and provided with a cover 3 enclosing the operative parts of the switch, the cover 3 being removably supported upon and secured to the mounting element by means of appropriately arranged screws 4 engaging ears 5.

Removably attached to the back wall 2 by screws or other appropriate fastening means 6 are angle brackets 7, the offstanding portions 8 of which (see particularly Figs. 5 and 6) are substantially enclosed by appropriately bent embracing strips of insulating material 9, against which bear the stationary contact and terminal carrying blocks 10, the attaching screws 11 of which pass through insulating sleeves 12 in the parts 8, so that the blocks 10 will be effectively insulated from the mounting element and from each other. The switch contacts 13 carried by the blocks 10 may have riveted or other appropriate connection 14 therewith, and the binding screws 15 are threaded thereinto in the customary manner.

Attached to the base 1 as by screws 16 or other appropriate fastening means is a suitably formed sheet metal bracket 17 designed to provide bearings and the like for the movable elements

of the switch mechanism, including the movable switch elements 18 and an operating disk 19.

Each of the movable switch elements 18 (see particularly Fig. 4) comprises an oscillatable arm provided with hook means 20 pivotally engaging a pivot pin 21 carried by ears of the bracket 17, and at its upper end is furnished with an insulating member 22 to which is affixed by a bolt, rivet or the like 23 a contact carrying element 24. This contact carrying element 24 is insulated from the switch element 18 in substantially the same manner as that described in connection with the stationary blocks 10 so that current will not pass from its contacts to the bracket 17 and the switch mounting element. The contact carrying element 24 is provided with similar L-shaped arms 25 between which is slidably positioned and guided a current carrying plate 26 backed up by an appropriately centered compression spring 27 and carrying the movable switch contacts 28.

Adjacent to its point of pivotal connection 21 each element 18 is provided with an offset lug 29 between which and the base of the bracket 17 is mounted a compression spring 30 tending normally to hold the switch contacts in open position and to maintain the pivotal connection between the parts 20 and 21. The springs 30 may be appropriately positioned by the heads of the screws or the like 16 and by centering means 31 carried by the lugs 29.

The operating disk 19 is provided with a ball bearing mounting 32 including a shaft 33 the ends 34 of which are slabbled off for slip engagement with bearing yokes 35 of the bracket 17. The periphery of the disk 19 is provided with diametrically opposite pairs of bearing points preferably formed as recesses or sockets 36 and seating in one or the other of the recesses of each pair, as will be hereinafter more fully explained, are link means 37 forked at one end 38 to embrace the sides of the disk 19 and provided with reduced lugs 39 at their other ends for engagement with appropriate slots 40 in the members 18, thus furnishing operating connection between the disk and the members 18 to provide for shifting of the movable switch contacts 28 from closed to open position and vice versa, the springs 30 serving to maintain operative engagement between the members 18, link means 37 and disk 19.

It will be apparent from the foregoing that oscillation of the disk 19 upon its bearing 32 will function to cause operation of the switch elements from closed to open position, and vice versa, by toggle action of the link means 37 with respect to the members 18 and disk 19, and inasmuch as the switch mechanism is, primarily, of the quick make and break or snap type, means must be provided for accomplishing this toggle action substantially instantaneously. Such mechanism is provided in accordance with the invention by means of a yoke-shaped lever 41 carried upon a shaft 42 arranged in suitable bearing means 43 affixed to the back wall 2 and carrying an actuating trip member 44 of any desired or approved type. The arms 45 of the yoke member 41 flank the disk 19 and are provided with spring attaching means 46 between which and the spring attaching members 47 carried by the disk 19 are mounted tension springs 48.

By reference particularly to Fig. 1, it will be seen that the spring attaching means 47 will normally assume a position past dead center with

respect to the shaft 33 of the disk 19 and, hence, when the trip means 44 are actuated the arms 45 of the yoke member 41 will be swung across the axis of shaft 33 and hence their spring connecting ends 46 will put such tension upon the springs 48 as to cause the spring attaching means 47, and with them the disk 19, to instantaneously snap over center to the opposite past dead center position. The limits of oscillation of the disk 19 in response to the influence of the springs 48 are defined by an appropriate notch 49 the faces of which alternately cooperate with a stop 50 carried by the bracket 17 in fixed relation to the axis of oscillation of the disk.

It will be obvious that the counteracting forces exerted by the springs 48 between their points of connection 46 and 47 with the arms 45 of the yoke 41 and disk 19 will operate to hold the shaft 34 upon which the disk finds its bearing seated in the yoke members 35 of the bracket 17.

From the foregoing, it will be apparent that a switch of the type illustrated in Figs. 1 to 7 inclusive may be made to operate as a single pole double throw switch, when its parts are in the positions of adjustment illustrated in Fig. 1, or as a double pole single throw switch when its parts are in the position of adjustment illustrated in Fig. 7, or that by completely removing one of the movable switch elements 18 and its actuating toggle link 37, the switch may be made to operate as a single pole single throw switch. All of these modifications of operative characteristics of the switch are made possible by its structural details and mode of assembly. In other words, having reference particularly to Figs. 1 and 7, if the toggle link 37 at the left is moved from the upper recess or socket 36 of the disk 19 to the lower recess or socket, as shown in Fig. 7, oscillation of the disk will result in simultaneous closing and opening movement of both movable switch elements 18. Moreover, if the link 37 at the left is maintained in the position illustrated in Fig. 7, and the link 37 at the right is moved into the lower recess or socket of the disk 19, the timing of opening and closing movement of the switch elements 18 may be reversed from that of the adjustment of parts as illustrated in Fig. 1.

It will be apparent that adjustment of the toggle links 37 as just described, may be accomplished without the use of tools after the cover 2 is removed, it being necessary merely to hold the respective switch element 18 with its contact elements 20 hard against the fixed contact elements 13 so that the spring 27 is sufficiently compressed to permit movement of the disk adjacent end of the toggle link 37 from one notch to the other. Such manipulation of the switch element 18 causes a compression of the spring 27 in excess of that occurring during normal functioning of the switch, and therefore during such normal functioning there is no chance for the link 37 to escape from the slot 40 of the switch element 18 and the engaged recess or socket 36 of the disk 19.

Furthermore, it is possible, without the use of tools, to disconnect the movable switch elements 18 from their pivot bearings upon the pivot pins 21 merely by depressing them against the springs 30 until their hook elements 20 are released from the pivot pins 21, and thereafter these switch elements and their springs 30 and toggle links 37 may be lifted out of the switch assembly.

Moreover, the disk 19 may also be disassembled without the use of tools, simply by lifting its shaft

33 out of engagement with its yoke-like supporting members 35, tension sufficient for this purpose being put upon the springs 48.

The type of switch illustrated in Fig. 9, although embodying substantially the same fixed and movable switch elements and operating mechanism therefor as described in connection with Fig. 1, is of greater adaptability than the latter in that its mechanism may be assembled within a more confined space and the contour of the switch may be circular, as shown. Preferably the circular mounting element or housing 51 may be provided with a plurality of equally spaced circumferentially arranged openings 52 preferably tapped for cooperation with attaching screws or the like 53 for mounting bracket 54 having an off-standing attaching flange 55. This mounting bracket 54 has a pair of ears 56 with which the screws 53 cooperate, and it will be apparent that these screws, may be engaged with any two circumferentially adjacent openings 52, and thus the bracket is susceptible of being mounted with respect to the housing in any one of four positions circumferentially thereof. Moreover, the bracket may be mounted either as illustrated, with its flange 55 extending away from the housing, or it may be reversely mounted with its flange extending toward the housing. The flexibility of the manner in which the mounting bracket 54 may be associated with the housing 51 of the switch makes possible mounting of the switch with respect to a supporting member in a variety of positions to adapt it to many conceivable conditions of use.

Furthermore, if the switch cover, or the housing, is provided with a revolving cam attaching means (not shown) the switch may be coupled to any rotating element on a machine and thus be mounted to make and break electrical contact once during each revolution of such element, as will be apparent from the following description of the operative parts of the switch mechanism of these figures of the drawings (Figs. 8 and 9).

As will be apparent from a further inspection of Figs. 8 and 9, the operative parts of the fixed and movable switch elements, and the toggle and snap action operating means therefor, have been given the same reference characters as those applied to similar parts appearing in Figs. 1 to 7 inclusive. However, the switch mechanism of Figs. 8 and 9 is of the single pole single throw type and is adapted normally to be held in either open or closed circuit condition. This is accomplished by providing the shaft 57 with which the yoke member 41 oscillates with a coiled spring 58 one end of which may be engaged in a notch 59 in the end of the shaft and its other end bearing against an arm 60 attached to a yoke-shaped bracket 61 angularly adjustable upon the bearing member 43, its adjustment being fixed by binding screws 62. Thus the tension upon the spring 58 may be varied in accordance with power of the springs 48. The operating lever 64 is adjustably mounted upon the shaft 57 by means of a split hub and clamping screw 65, and it may be angularly arranged with respect to the shaft in any position necessary to accommodate the switch to its conditions of installation with respect to the part by which the lever 64 may be actuated.

Thus, when the toggle mechanism has been actuated by the snap action means under the influence of the lever 64 to open the switch, the

spring 58 will return the parts to closed switch position.

The switch illustrated in Fig. 10 is of the single pole single throw type adapted for push button operation, and the parts of the mechanism there- of which correspond in nature and function to those illustrated in Figs. 1 to 7 inclusive have been given similar reference characters.

In this switch mechanism the arms 66 of a bracket 67 detachably and pivotally support the yoke member 41', and this yoke member has an abutment member 68 providing means against which the shank 69 of a push button 70 bears. A return spring 71 is connected between the housing 72 and the yoke 41'. Thus, when the push button 70 is moved inwardly the snap action toggle mechanism will be actuated to open the switch, and when the push button is released the spring 71 will automatically return the parts to initial closed switch position.

It will be obvious that by adjusting the toggle link 37 of the switches of both Figs. 8 and 10 from one notch 36 of the disk 19 to the other, the characteristics of operation of the two switches may be reversed. In other words, instead of being normally in closed switch position, they may be normally in open switch position.

The switch illustrated in Fig. 11 is modified somewhat from those hereinbefore described, and is so designed that its mechanism may be enclosed within a smaller casing or housing than the others. Moreover, its construction is somewhat simplified and cheapened but without sacrificing any of the efficient operative characteristics of the other switches. In this type of switch a cam 73 mounted upon a shaft 74 to which an actuating member (not shown) is attached, bears against a step 75 provided on one of the arms 45' of the yoke member of the snap action mechanism. The opposite face of this step 75 bears against a return spring 76. The disk 19' may have a plain bearing, instead of a ball bearing, in hook-shaped arms 77 of a bracket 78 (Fig. 12) and this bracket 78 also furnishes bearings 79 for the arms 45' of the yoke member, and bearings 80 for the pivot pin of the movable switch element 18'. This movable switch element 18' (Fig. 13) instead of being provided with the mounting means 24, 25, 26, 27 of Figs. 1 to 10 inclusive, has its contact elements 81 mounted upon a current carrying bar 82 affixed to a spring arm 83 between which and the bar 82 suitable insulation 84 is interposed.

The switch of Fig. 11 is of the single pole single throw type and with its parts in the adjustment illustrated, is normally in closed switch condition. However, as in the case of the switches of Figs. 8 and 10, this switch also may be adjusted to be normally in open switch condition.

All of the insulated parts of the switch mechanism may, after assembly, be appropriately coated with a suitable lacquer and baked, if desired, thus providing not only for more effective insulation but tending to greater security of assembly.

It will be apparent that the switch mechanism of the invention is of the quick make and break butt contact type, and that it will be positively on or off for any appropriate motion past dead center of the operating yoke member of the snap action mechanism. Moreover, due to the resilient mounting of the movable contact elements 28 and 81 there will be adequate similar contact

pressure between the fixed and movable contact elements regardless of the amount of motion imparted to the operating lever to actuate the snap action mechanism. This does away with the possibility of having a titting or weak contact with the accompanying heating and burning of the contact elements even at light loads or under conditions of operation where the motion of the machine to which the switch is attached is very slow, or where such motion is stopped just at the point of actuation of the switch mechanism.

It will be noted, furthermore, that the switch mechanism of the invention embodies in its operative characteristics the feature of positively maintaining or locking the contacts in the on or contact-making position in such manner that no amount of pressure acting directly against the contact bar can force it back, nor will any amount of vibration loosen the contact.

Although the switch mechanism of the invention has been particularly disclosed as including an oscillatable disk 19 as the shiftable member of the snap action toggle mechanism, it is conceivable that a reciprocative member might be substituted therefor and the adjustable link means associated with such reciprocative member in the same manner as that disclosed in connection with an oscillatable disk. Also, other changes and modifications may be made in the mechanism without departing from the spirit of the invention and the scope of the following claims.

What I claim is:

1. In electrical switch mechanism, a fixed switch element and a movable switch element carrying appropriate contacts and arranged in current making and breaking association, and relatively shiftable means for moving said movable switch element from open to closed position and vice versa, said shiftable means including an oscillatable member and means interposed between and bearing upon said movable switch element and oscillatable member respectively and thereby operatively connecting said oscillatable member with said movable switch element, the bearing for said interposed connecting means upon said oscillatable member providing for two optional points of connection of said means and member, so that when the oscillatable means is in one position and the connecting means are engaged with one bearing point thereon the switch contacts will be closed, and when the oscillatable member is in the same position and the connecting means are engaged with the other bearing point thereon the switch contacts will be open.

2. In electrical switch mechanism, a fixed switch element and a movable switch element carrying appropriate contacts and arranged in current making and breaking association, and relatively shiftable means for moving said movable switch element from open to closed position and vice versa, said shiftable means including a member movable with respect to the movable switch element and a link interposed between and bearing upon said movable switch element and movable member and optionally engageable with one or the other of two bearing points upon said movable member and thereby adjustable with respect to the latter so that when the shiftable member is in one position and the link engaged with one of said bearing points the switch contacts will be closed, and when the shiftable element is in the same position and the link en-

gaged with the other bearing point the switch contacts will be open.

3. In electrical switch mechanism, a fixed switch element and a movable switch element carrying appropriate contacts and arranged in current making and breaking association, and relatively shiftable means for moving said movable switch element from open to closed position and vice versa, said shiftable means including an oscillatable member provided with circumferentially spaced socket means, a link member interposed between the oscillatable switch element and movable member and having one end optionally seated in one or the other of the socket means, whereby when the oscillatable member is in one position and the link member is seated in one of the socket means the switch contacts will be closed, and when the oscillatable member is in the same position and the link member is seated in the other of the socket means the switch contacts will be open.

4. In electrical switch mechanism, two fixed switch elements and two movable switch elements carrying complemental contact members and arranged in pairs in spaced relation, and means for simultaneously operating both pairs of elements, comprising a shiftable member arranged between said pairs, link means interposed between and bearing upon said shiftable member and each of the movable switch elements, each of said link means having provided for it on said shiftable member a pair of bearing points with either one or the other of which it is optionally engageable, so that with the shiftable member in one position a change of connection of the link means from one bearing point to the other will result in closing of its respective switch contacts if open, or vice versa, whereby appropriate adjustment of the link means with respect to said bearing points will make possible closing and opening of both sets of contacts simultaneously, or closing of one set of contacts while the other set is open.

5. In electrical switch mechanism, two fixed switch elements and two movable switch elements arranged in pairs in spaced relation, and

means for simultaneously operating both pairs of elements, comprising an oscillatable member interposed between the movable switch elements, said oscillatable member provided with substantially diametrically spaced pairs of relatively separated points of connection with link means interposed between said oscillatable member and the movable switch elements, each of said link means being adjustable from one connection point of its pair of same to the other, whereby to change the type of switching operation of the switch mechanism from single pole double throw to double pole single throw and vice versa.

6. In electrical switch mechanism, a fixed switch element and a movable switch element, snap action means including a shiftable member, means interposed between and bearing upon said shiftable member and movable element and operative to move said movable element to open or closed switch position in response to shifting movement of said shiftable member, said shiftable member being provided with two points of bearing for optional engagement by said interposed means, whereby with the shiftable member in one position shifting of engagement of the interposed means from one bearing point to the other will result in a change from open to closed switch position and vice versa.

7. In electrical switch mechanism, a fixed switch element and a movable switch element, snap action toggle means including a shiftable member, link means interposed between and bearing upon said shiftable member and movable element and operative to move said movable element to open or closed switch position in response to snap action shifting of said shiftable member, said shiftable member provided with a pair of spaced notches either one of which may provide a bearing point for engagement with said link means, whereby with the shiftable member in one position shifting of engagement of the interposed means from one bearing point to the other will result in a change from open to closed switch position and vice versa.

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