

March 31, 1964

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3,127,484

PUNCH CARD CONTROLLED SWITCH MECHANISMS

Filed April 19, 1962

2 Sheets-Sheet 1

Fig. 1.

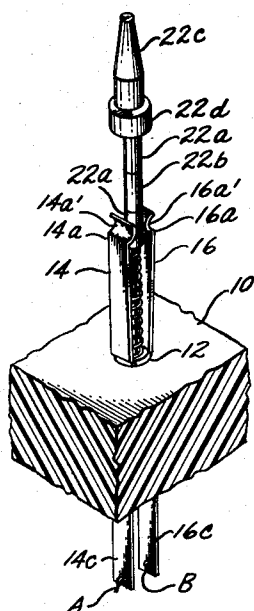


Fig. 2.

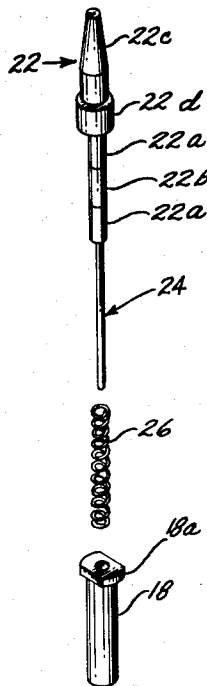


Fig. 3.

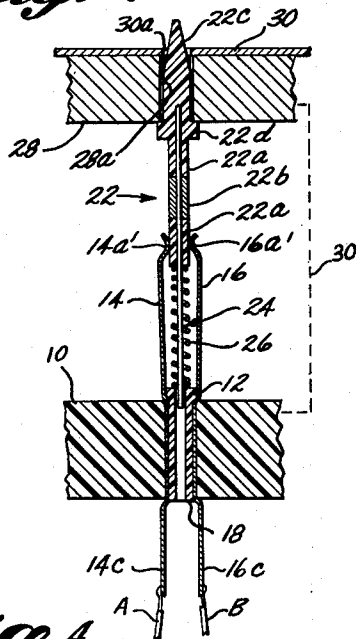


Fig. 4.

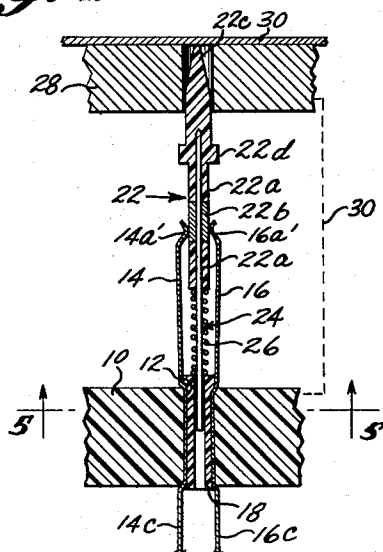
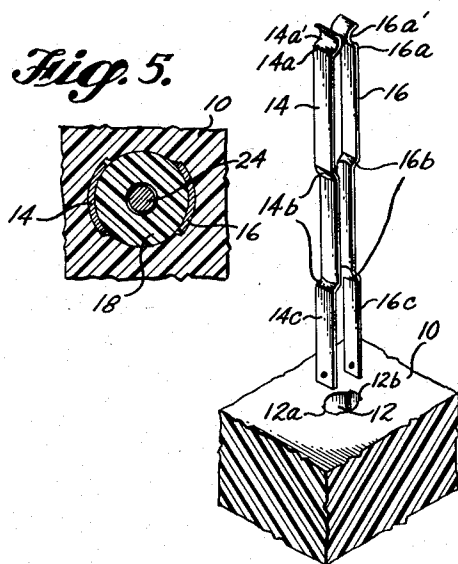


Fig. 5.



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Fig. 6.

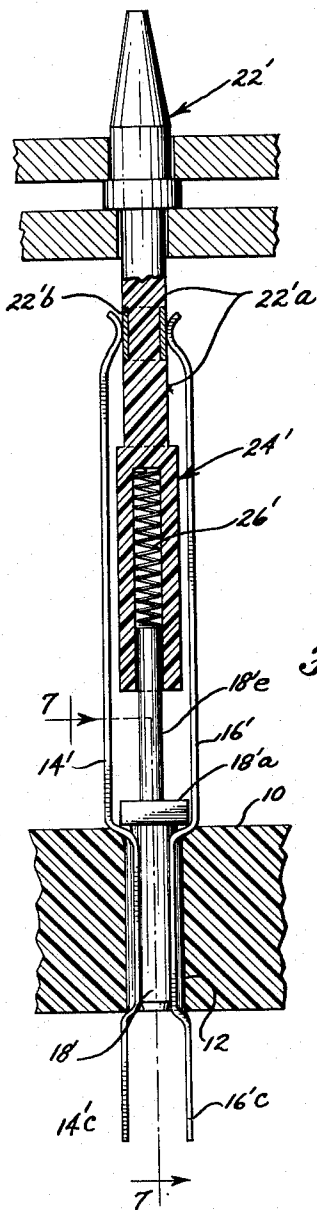


Fig. 8.

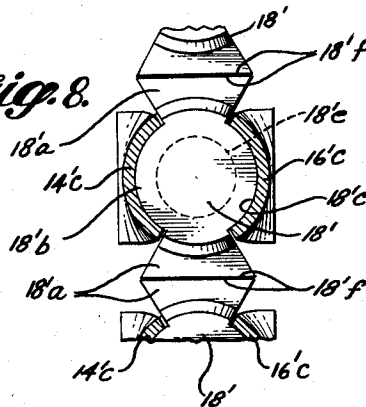
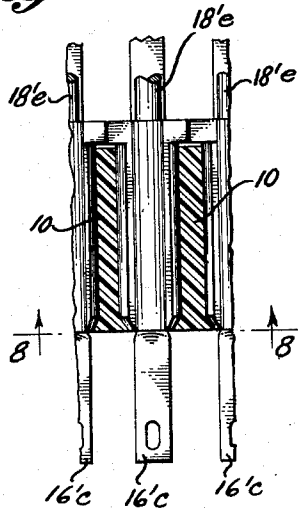


Fig. 7.



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**PUNCH CARD CONTROLLED SWITCH
MECHANISMS**

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Filed Apr. 19, 1962, Ser. No. 189,667
14 Claims. (Cl. 200—46)

This invention relates to electrical switch devices and has for its broad object the provision of a simple, reliable, easily accessible and compact panel-mounted switch preferably so constructed that its parts may be readily removed and replaced without disturbing or removing other similar switches mounted in the same switch array or matrix. The invention is herein illustratively described by reference to the presently preferred embodiment thereof; however, it will be recognized that certain modifications and changes therein with respect to details may be made without departing from the essential features involved. The present application is a continuation-in-part of Serial No. 172,160, filed February 9, 1962, now abandoned.

A further object hereof is to provide a simple and relatively inexpensive switch occupying minimum panel surface area so that a large number of these switches may be accommodated within a given area as, for example, in the case of punch card read-out devices, computer mechanisms, etc.

A further object is to provide such a switch device the panel-mounted contacts of which and the means for holding those contacts in the panel may be made removable from either side of the panel.

Another object is to provide a shuttle-type switch having low mechanical resistance to actuation so that a large number of them may be actuated simultaneously without undue effort or force requirement.

Still another object is a shuttle-type switch mechanism of improved construction from the standpoint of durability, reliability and versatility for use in a variety of applications especially wherein large arrays of similar switches are required in limited available space.

A specific object is to provide such a switch device in which the parts are reliably and positively interlocked in operative positions in the supporting panel without necessity of permanent embedment therein, nor of complex or expensive retaining elements secured to or forming part of the panel.

As herein disclosed, the improved switch device comprises in combination with an insulation panel or other insulative support having a hole therein, a pair of elongated resilient metal contact strips maintained extending through the hole in parallel relationship by a tubular insulative bushing removably lodged in the hole between the strips and serving as a guide for the shank portion of a switch shuttle which moves reciprocally in the space between the projecting switch-contact ends of the strips. Preferably the opposite ends of the strips also project from the panel and serve as soldering terminals.

In the preferred embodiment the shuttle reciprocates lengthwise and comprises a cylindrical head joined to the shank portion and having restricted conductive area thereon which is alternately engageable with and disengageable from the contact elements by such movement. A helical spring surrounding the shank reacts between the head and the end of the bushing urging the shuttle outwardly and into limiting position against a separate switch-actuating means comprising, for example, an opposing panel having an opening therein to receive the end of the shuttle and to move the shuttle against force of the helical spring. Preferably also the bushing has an enlarged head on one end which limits penetration of the

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bushing in the hole, and the bushing is frictionally fitted within the hole to be removable therefrom simply by pressing it outwardly.

These and other features, objects and advantages of the invention will become more fully evident from the following description thereof by reference to the accompanying drawings.

FIGURE 1 is an isometric view of the improved switch device mounted in a segment of panel.

FIGURE 2 is an exploded isometric view of the same device.

FIGURE 3 is a longitudinal sectional view taken through the switch device and panel and showing an additional panel cooperating with the switch device as a means to actuate the same, the view showing the switch device in the "open" position.

FIGURE 4 is a view similar to FIGURE 3 with the switch device shown in the "closed" position.

FIGURE 5 is a transverse sectional view taken on line 5—5 in FIGURE 4.

FIGURE 6 is a view similar to FIGURE 3 showing a modification.

FIGURE 7 is a sectional view taken on line 7—7 in FIGURE 6.

FIGURE 8 is a sectional view taken on line 8—8 in FIGURE 7.

As illustrated in FIGURES 1 through 5, the novel switch mechanism comprises, in assembled relationship with the insulation panel 10 having a hole 12 therein, a pair of elongated integral one-piece resilient metal strips 14 and 16. These strips are removably received in the hole 12 and have contact ends 14a and 16a, respectively, which project outwardly therefrom. These projecting ends include portions 14a' and 16a' which are offset toward each other to form switch contact elements.

A tubular bushing 18 of insulative material is removably lodged in the hole and serves two functions. It serves as a locking means to maintain the strips in parallel relationship extending through and along mutually opposite sides of the hole 12. Also, it serves as a guide element for the switch shuttle to be described. As a locking means the bushing 18 could be removably lodged in the hole in different ways but it is preferred simply to have it held in place by friction so that it can be ejected by application of direct pressure longitudinally of the bushing. An enlarged head 18a on one end of the bushing serves as a stop limiting penetration of the bushing in the hole 12 by engagement of the head with the surface of the panel 10. Preferably the bushing and hole are cylindrical in form and the head which is nominally annular in form is flattened at opposite sides so that the flats are received between and bear against the two strips 14 and 16.

The hole 12 has grooves 12a and 12b extending along mutually opposite sides thereof, and the respective strips occupy these grooves and are maintained in them by the bushing 18. The groove bases are preferably arcuately formed on a circle which is concentric with the hole circle and the strips are similarly formed in cross section over the portion of their respective lengths lying in these grooves. Immediately outside the hole the strips are offset transversely away from each other as indicated at 14b for the strip 14 and at 16b for the strip 16 to provide positioning stops. By lodging the strips in the grooves 12a and 12b circumferential shifting of the strips is prevented as is canting in relation to the hole axis, and by providing the offsets 14b and 16b immediately adjacent the opposite faces of the panel 10, longitudinal shifting of the strips is prevented. Thus, with the strips installed as shown in the drawings and the plug or tubular bushing 18 inserted in the position illustrated, the strips 14 and 16

are positively locked against any relative motion or motion relative to the base support 10.

A switch shuttle comprising a head 22 and a shank 24 cooperates with the switch contact strips 14 and 16 to establish and interrupt electrical continuity between the contacts for switching purposes in accordance with the position of the shuttle. Preferably the shuttle shank 24 comprises a metal rod slidably received for guidance purposes within the bore of the tubular bushing 18. The head 22 is larger in cross section than the shank 24 and comprises rings of insulative material 22a and an intermediate ring of conductive material 22b formed compositely as a cylindrical member received slidably between the contact elements 14a' and 16a' of the respective trips 14 and 16. Longitudinal reciprocation of the shuttle 20 alternately places the surface of the conductive element 22b into and out of simultaneous contact with the strips in order to close and open the switch. Resilient bending force of the projecting ends of the strips 14 and 16 maintains the switch contact elements in firm surface-to-surface sliding contact with the cylindrical portion 22a, 22b of the shuttle head 22.

Preferably a helical spring 26 surrounding the shuttle guide rod 24 reacts between the end of the bushing 18 and the adjacent end of the shuttle head 22 and urges the shuttle normally outwardly into a switch-open position as established by a separate panel 28 or other suitable positioning means engaged by the shuttle head and limiting its outwardly projected position. An interconnection, designated 30, between the panels 28 and 10 establishes positional relationship between these two means and is of such a nature as to cause or permit relative motion therebetween in order to operate the switch.

If desired, the panel 28 may comprise an apertured insulative or metal panel having a hole 28a therein which receives the tip portion 22c of the head 22. Such tip portion is tapered to be received in the hole 28a and has a flange enlargement 22d thereon which limits penetration of such tip portion in the hole 28a. A cover panel or strip 30 placed over the panel 28 may or may not have a hole 30a therein in registry with the hole 28a. Without such a hole 30a in registry with the hole 28a, the shuttle tip 22c is prevented from penetrating to the full depth in the hole 28a as shown in FIGURE 4 and the switch is maintained in the closed position assuming the positional relationship of all the panels as shown in FIGURE 4. However, with a hole 30a in registry with hole 28a the shuttle tip 22c is permitted to project to the full depth in hole 28a and the switch spring 26 urges the switch shuttle to the open position. Such a mechanism may represent, for example, a punch card controlled switch mechanism in which the sheet or strip 30 represents a punch card and the panel 28 represents a platen surface supporting the card in predetermined position relative to the insulative switch panel 10 so as to operate one or more switches selectively in accordance with the presence or absence of holes in the punch card in registry with holes in the panel 28, hence with the switch shuttles. A device of this type is disclosed in companion application Serial No. 174,882, filed February 21, 1962, in the names of Edward S. Baker and Arthur B. Lum and entitled "Punch Card Read-Out Device."

Preferably the ends of strips 14 and 16 opposite the contact ends also project from the insulative panel 10 and in this case are designated 14c and 16c, respectively. These serve as soldering terminals to which wires A and B may be joined to form an electrical circuit with associated apparatus (not shown).

It will be seen from the foregoing and from the drawings that the disclosed switch mechanism is installed in the panel 10 simply by slipping the conductive strips 14 and 16 into the hole 12 so that the portions intermediate the offsets 14b and 16b are lodged in the grooves 12a and 12b, respectively, whereupon the bushing 18 is pressed into the hole until its head 18b abuts the face of

the panel 10. Thereupon the shuttle is installed by inserting the shank 24 thereof into the tubular bushing with the helical spring 26 surrounding the shuttle. Because of the compactness of this switch device in a transverse dimension, a large number of similar devices may be installed in closely spaced rows and columns of holes in a panel 10 in a matrix or array useful in a variety of devices such as punch card registers or read-out devices, computers, etc. These switch devices are easily and quickly installed and removed independently of one another, both for initial assembly and for subsequent repair and replacement; however, they are highly durable and reliable in operation with low mechanical resistance to actuation.

In the modification shown in FIGURES 6 through 8, metal strips 14' and 16' are generally similar to their counterparts 14 and 16 of the first embodiment and are removably held in the hole 12 in base plate 10 by a locking element. In this embodiment the locking element comprises the generally cylindrical plug 18' having the enlargement stop 18'a on one end, but having longitudinal grooves 18'b and 18'c formed in opposite sides thereof which retain the metal strips. In addition the plug 18', instead of having a guide bore therein, has a guide rod 18'e projecting axially from one end thereof. The shank portion 24' of the shuttle in this case comprises a tubular skirt slidably receiving the post 18'e to guide the shuttle for longitudinal reciprocative movement. Spring 26' is lodged inside this guide skirt and reacts between the inner end wall thereof and the opposing end of the post 18'e. The shuttle insulative portions 22'a and conductive switch portion 22'b come alternately into contact with the metal strip switch contact elements as the shuttle reciprocates, as in the preceding embodiment.

In this modified embodiment both the shuttle and the plug are preferably molded of thermoplastic material. The enlargement stop 18'a on the end of the plug has two generally flat transversely directed faces 18'f. When the spacing between adjacent holes 12 in panel 10 is properly chosen the faces 18'f of the plugs received in such holes abut each other in substantial face to face contact and each plug thus prevents rotation of the other in its retaining hole in the base plate.

These and other aspects of the invention will be recognized from the foregoing description of the novel switch device in its presently preferred embodiment.

I claim as my invention:

1. A switch assembly comprising an insulative support having a hole therein, a pair of elongated conductive strips removably received in said hole and having ends projecting outwardly therefrom, switch contact elements carried by said projecting ends, means comprising an insulative tubular bushing removably lodged in said hole between said strips to maintain said strips in parallel relationship extending along mutually opposite sides of the hole, and an elongated shuttle having an elongated shank guided slidably in the tubular bushing and further having a head interposed slidably between said contact elements, including a switch conductor alternately engageable with and disengageable from said contact elements by lengthwise reciprocation of said shuttle.

2. The switch assembly defined in claim 1, wherein the ends of the strips opposite the first-mentioned ends also project from the support.

3. The switch assembly defined in claim 2, wherein at least a portion of the head comprises a substantially cylindrical form having conductive and nonconductive areas slidably engaged by the contact elements during reciprocation of the shuttle.

4. The switch assembly defined in claim 3, wherein the head is cross-sectionally larger than the shank and the switch assembly further includes a helical spring encircling the shank and reacting between said bushing and the head, and wherein the bushing has a stop element projecting

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transversely from one end thereof limiting penetration of the bushing in the hole.

5. The switch assembly defined in claim 1, wherein the bushing is frictionally fitted to the hole in the support and wherein the hole is of cylindrical form with longitudinally extending grooves in opposite sides thereof which receive the respective strips, thereby to hold the strips against circumferential shifting around the hole.

6. The switch assembly defined in claim 5, wherein the conductive strips project from both ends of the hole in the support and each strip includes a portion offset transversely away from the other strip immediately adjacent the respective ends of the hole thereby to prevent longitudinal shifting of the strips.

7. A switch assembly comprising an insulation panel having a hole therein, a pair of elongated integral one-piece resilient metal strips removably received in said hole and having ends projecting outwardly therefrom with portions offset toward each other to form switch contact elements carried by said projecting ends, locking means removably lodged in said hole between said strips to maintain said strips in parallel relationship extending along mutually opposite sides of the hole, and an elongated shuttle having an elongated shank in slidable engagement with the locking means and further having a head interposed slidably between said contact elements, including a switch conductor alternately engageable with and disengageable from said contact elements by reciprocative movement of said shuttle.

8. The switch assembly defined in claim 7, wherein the locking means comprises a tubular bushing frictionally fitted to the hole in the support and wherein the hole is of cylindrical form with longitudinally extending grooves in opposite sides thereof which receive the respective strips, thereby to hold the strips against circumferential shifting around the hole.

9. The switch assembly defined in claim 8, wherein the bushing has an enlargement at one end limiting its penetration in the hole, the strips project from both ends of the hole in the support and each strip includes a portion offset transversely away from the other strip immediately adjacent the respective ends of the hole thereby to prevent longitudinal shifting of the strips.

10. A switch assembly comprising an insulation panel having a hole therein, a pair of elongated conductive strips removably received in said hole and having ends projecting outwardly therefrom, switch contact elements carried by said projecting ends, means comprising an insulative tubular bushing removably lodged in said hole between said strips to maintain said strips in parallel relationship extending along mutually opposite sides of the hole, an elongated shuttle having an elongated shank guided slidably in the tubular bushing and further having a head interposed slidably between said contact elements, including a

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switch conductor alternately engageable with and disengageable from said contact elements by lengthwise reciprocation of said shuttle, spring means surrounding said shank and reacting outwardly on the shuttle from the insulation panel, and means spaced outwardly from the panel and engageable by the shuttle to limit outward displacement thereof effected by said spring means.

11. A switch assembly comprising an insulative support having a hole therein, a pair of elongated conductive strips received in said hole and having ends projecting outwardly therefrom, switch contact elements carried by said projecting ends, means comprising an insulative tubular bushing lodged in said hole between said strips to maintain said strips in parallel relationship extending along mutually opposite sides of the hole, and an elongated shuttle having an elongated shank in slidable engagement with the tubular bushing and further having a head interposed slidably between said contact elements, including a switch conductor alternatively engageable with and disengageable from said contact elements by lengthwise reciprocation of said shuttle.

12. A switch assembly comprising an insulation panel having a hole therein, a pair of elongated resilient metal strips removably received in said hole and having ends projecting outwardly therefrom with portions offset toward each other to form switch contact elements, a generally cylindrical locking element removably lodged in said hole and having a generally cylindrical peripheral wall fitted to the wall of said hole, one of said walls having parallel grooves extending lengthwise along opposite sides thereof in which grooves the respective metal strips are retentively held in generally parallel relationship, thereby to maintain said strips against circumferential shifting about the hole, and an elongated shuttle interposed between said contact elements and slidable reciprocatively lengthwise axially of said hole, said shuttle having a conductive portion and an insulative portion alternatively engageable with the contact elements, said locking element having guide means and said shuttle having cooperable guide means engaged therewith for guiding said shuttle to permit such reciprocation thereof.

13. The switch assembly defined in claim 12, wherein the locking element has an enlargement on one end thereof limiting penetration in the hole, and the respective walls are fitted for frictional retentive engagement therebetween.

14. The switch assembly defined in claim 12, wherein the metal strips have portions immediately outside the ends of the hole which are laterally offset from the portions thereof retained in the hole, thereby to prevent longitudinal shifting of the metal strips.

No references cited.