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Flynn et al.

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[54] **ELECTRICAL SWITCH**

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[73] Assignee: **Hampden Engineering Corporation,** East Longmeadow, Mass.

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[52] **U.S. Cl.** ..... **200/1 R,** 200/5 R, 200/15, 200/18

[51] **Int. Cl.**..... **H01h 21/40,** H01h 9/20, H01h 5/00

[58] **Field of Search**..... 200/1 R, 1 V, 4, 200/6 R, 11 R, 11 G, 14, 16, 17 R, 18, 63, 65, 66, 155, 156, 162, 163, 164 R, 5 R, 16 R, 15

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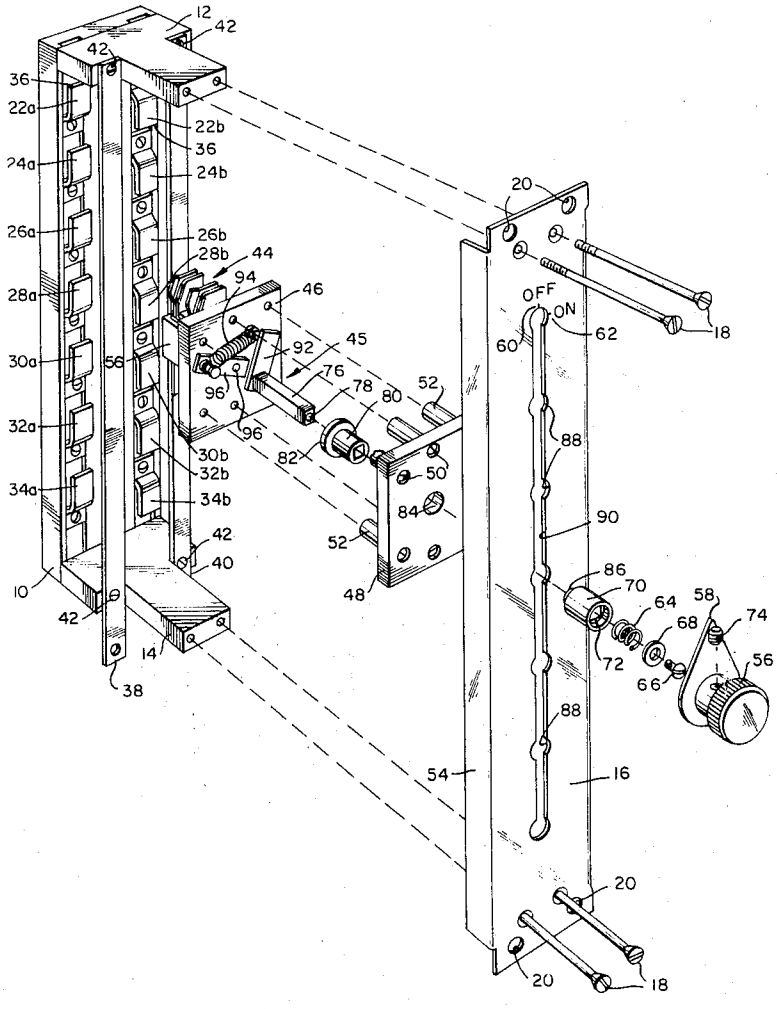
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Primary Examiner—J. R. Scott
Attorney—Theodore R. Paulding

[57] **ABSTRACT**

An electrical switch for selectively connecting a plurality of power supplies with a circuit, and comprising a series of pairs of blade-like contacts for power supply inputs and a pair of elongated bus bars for circuit output. A slotted face plate carries a slide which in turn supports a rotary contact assembly comprising wipers in a U-shaped configuration. The wipers engage the blade-like contacts and the bus bar to connect a selected power supply to the circuit on rotation of the contact assembly. A positive turning action on a control knob is required to overcome a tension spring and effect a snap-action closing operation of the rotary and fixed contacts. Further, the knob serves to lock the slide at each of the several switching stations, a positive linear knob movement being required for release of the locking action and movement between the stations, the knob being inoperable to close between stations.

10 Claims, 7 Drawing Figures



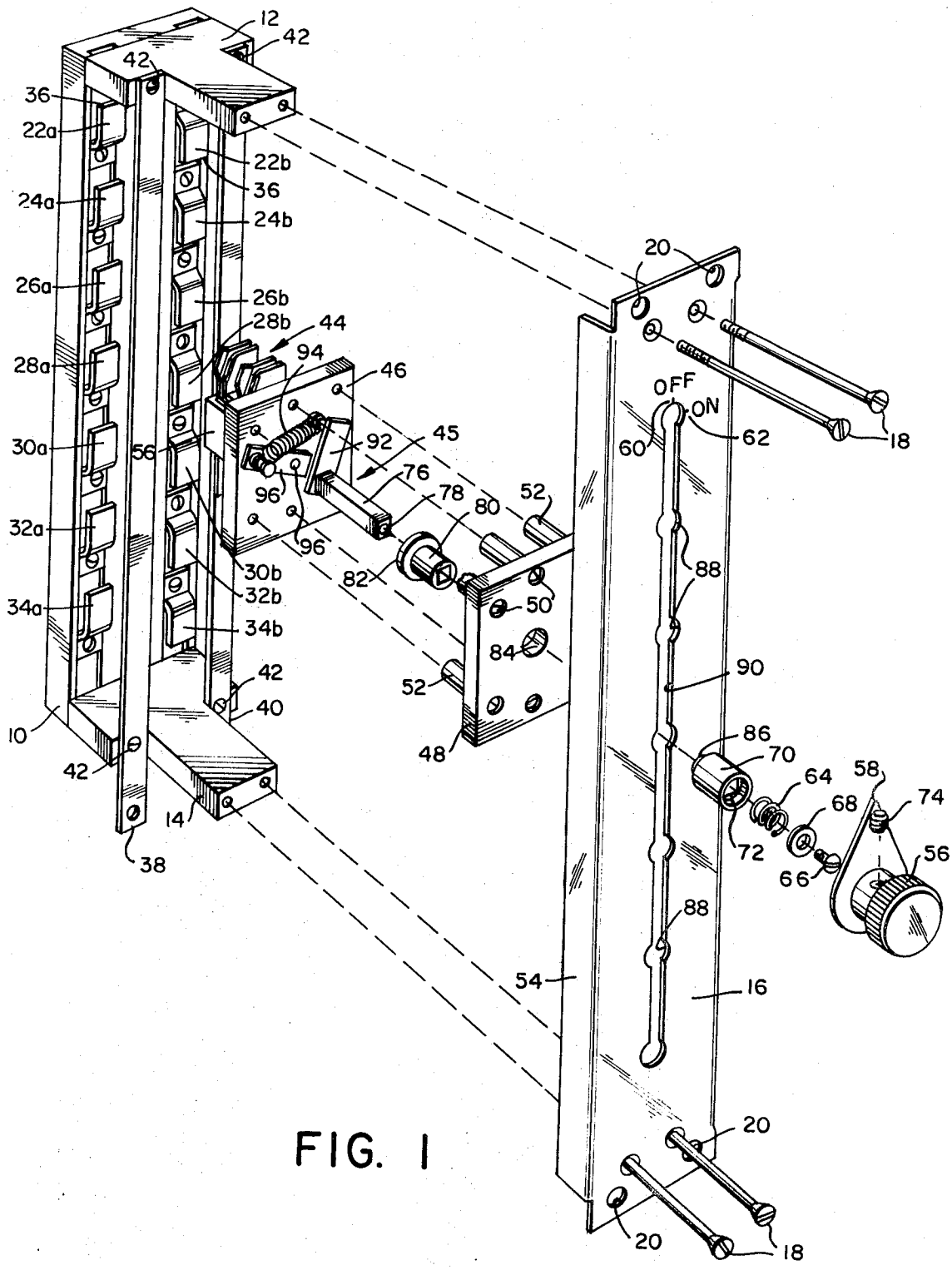

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OFF
ON
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FIG. 1

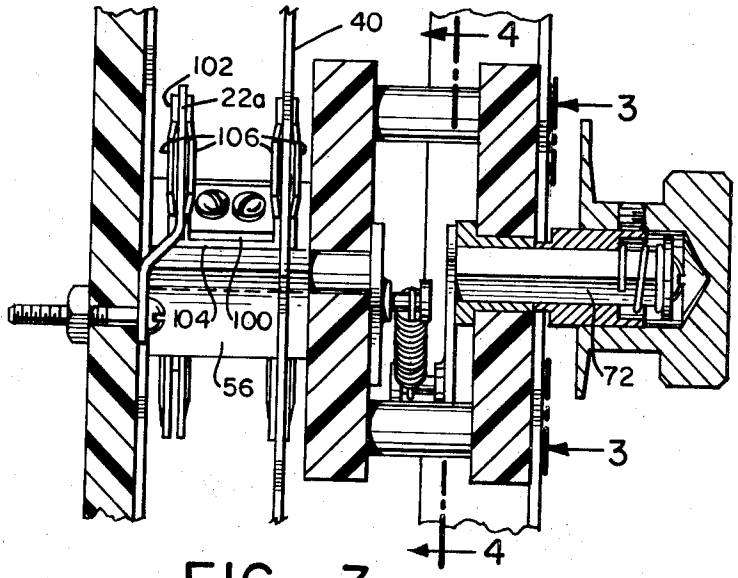


FIG. 2

FIG. 3

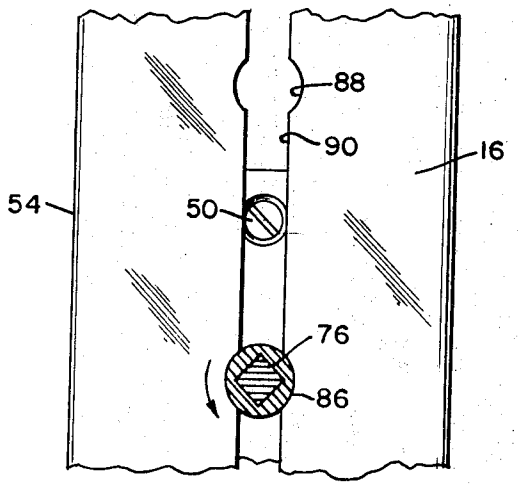
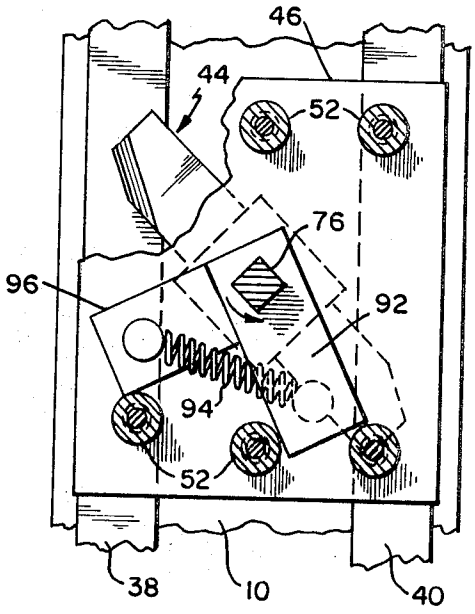


FIG. 4



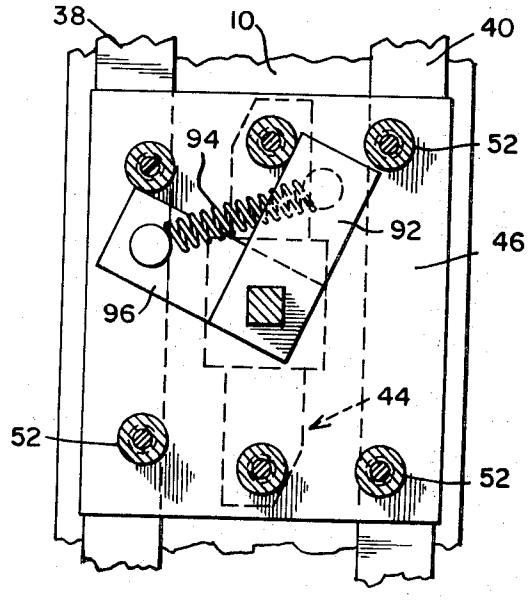


FIG. 5

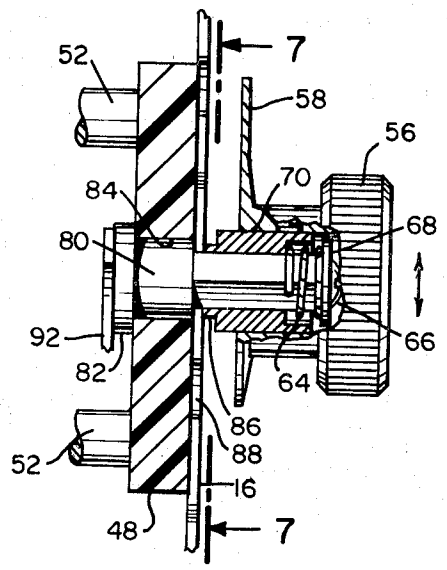

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FIG. 6

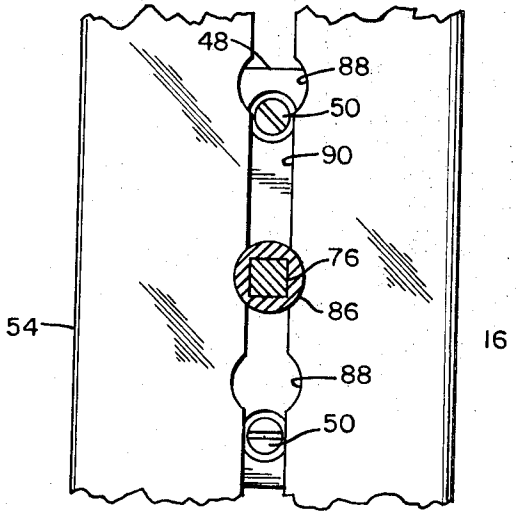

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FIG. 7

ELECTRICAL SWITCH

BACKGROUND OF INVENTION

It has been a conventional practice to employ patch cords in laboratory panels and other environments for selectively connecting electrical power supplies with branch circuits and the like and incorrect connections are of course some times encountered with dire results. Switching devices have been provided in the past for substitute use in these environments, but have not been entirely satisfactory, such devices also being subject to incorrect connection and other disadvantages.

SUMMARY OF THE INVENTION

It is the object of the present invention to provide an electrical switch for selectively connecting a plurality of power supplies or the like with a circuit and wherein a positive action is required for effecting individual connections with provision against inadvertent connection between desired or selected switching stations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 of the drawings is an exploded perspective view illustrating the switch of the present invention.

FIG. 2 is an enlarged fragmentary sectional view through the switch of the present invention.

FIG. 3 is a fragmentary sectional view taken generally as indicated at 3—3 in FIG. 2.

FIG. 4 is a fragmentary sectional view taken generally as indicated at 4—4 in FIG. 2, and showing a movable contact in a closed position.

FIG. 5 is a fragmentary sectional view taken generally as indicated at 5—5 in FIG. 2, and showing the movable contact in an opened position.

FIG. 6 is a fragmentary section similar to FIG. 2 but showing a control knob in a second position.

FIG. 7 is a fragmentary section taken generally as indicated at 7—7 in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring particularly to FIG. 1, it will be observed that the switch of the present invention comprises a frame formed with a rear plate 10, upper and lower end plates or spacers 12, 14 and a front or face plate 16. The rear and end plates are preferably of insulating material and the face plate 16 may be attached to the end plates by means of suitable screws 18, 18 at upper and lower end portions. The front or face plate 16 may be of metallic construction and provided with suitable openings such as 20, 20 at end portions for connection with a laboratory panel or the like.

In accordance with the invention, a plurality of fixed contacts are provided and arranged at switching stations, at least two of the latter being provided. As shown, seven switching stations are provided and two contacts are spaced apart in a pair arrangement at each switching station. Thus, left and right-hand contacts 22*a*, 22*b* are mounted on the rear plate 10 at a first or uppermost switching station 22, left and right-hand contacts 24*a*, 24*b* at the next switching station 24, etc. through the seventh switching station 34. The fixed contacts 22*a*, 22*b* through 34*a*, 34*b* may vary widely in form but in accordance with the presently preferred practice, contacts of a blade-like type are provided and are offset forwardly from the rear plate 10 with small connector bolts extending rearwardly through the

plate, FIG. 2, for connection with a power supply or the like. Each blade 22*a* through 34*b* has an exposed edge portion and said edge portions are arranged oppositely in each pair of contacts. That is, a free or extending edge or end portion of each blade 22*a*–34*b* is exposed for ready engagement with a contact to be described below and said free or extending end portions 36, 36 are directed oppositely whereby readily to be engaged in a rotary motion by opposite end portions of a movable contact.

Additional fixed contacts may of course be provided in accordance with the invention and such contacts are shown at 38, 40 in the form of left and right-hand bus bars mounted forwardly of the contacts 22*a*–34*b* on the end plates 12, 14 by means of small screws 42, 42. At a lower end portion, the bus bars 38, 40 extend downwardly beyond the end plate 14 for connection with a branch laboratory circuit or the like. Thus, seven AC and/or DC power supplies may be connected selectively with a branch circuit.

Further in accordance with the present invention, a movable contact or contact assembly as indicated at 44 is provided for movement between first and second positions respectively engaging and disengaging the fixed contacts 22*a*–34*b* and the bus bars 38, 40. The movable contact or contact assembly 44 is mounted on a carrier which preferably takes the form of a slide 45 having a rear plate 46 and a front plate 48 each of insulating material. The front and rear plates are secured together in spaced relationship by appropriate screws 50, 50 extending through spacer rods 52, 52. Short, elongated marginal flanges 54, 54 extend vertically along the front or face plate 16 and slidably receive the front plate 48 of the slide for vertical movement to and between the aforesaid seven switching stations 22–34. An insulating contact block 56 mounted rearwardly of the rear slide plate 46 engages a rear surface of the latter and preferably engages a front surface of the rear frame or plate 10 as best illustrated in FIG. 2. Thus, the slide is constrained between the front plate 16 and the rear plate 10 of the switch assembly for vertical sliding movement under manual direction or manipulation.

A manually operable means for effecting sliding movement of the carrier or slide 45 and also for moving the contact or contact assembly 44 between its said first and second positions, may take the form of a control knob 56. As best shown in FIG. 1, the control knob 56 preferably includes an indicator or pointer 58 operatively associated with off and on marks 60, 62, the latter appearing at an upper portion of the front plate 16. A small compression spring 64 disposed within the knob 56 has an associated screw and washer 66, 68 for retaining the same within a sleeve 70 and in engagement with an internal sleeve shoulder 72. The screw 74 secures the complete knob assembly to a stem 76 as best illustrated in FIG. 2.

Stem 76, which may be regarded as a part of the knob or knob assembly, preferably takes a square cross-sectional configuration and includes a threaded opening 78 for receiving the screw 66. A second sleeve 80 having a square opening therethrough receives the stem 76 and has an annular flange at 82 for abutment against the rear surface of the front plate 16 of the switch frame. An opening 84 in the front plate 48 of the slide receives the sleeve 80.

As will be apparent, the sleeves 70 and 80 can be assembled on opposite sides of the plate 16 with a rear

portion **86** of reduced diameter on the sleeve **70** entered in enlarged portions **88, 88** in an enlongated slot **90** in the front plate **16.** The said portion **86** has a second and cylindrical cross-sectional configuration with respect to the stem **76.** The slot **90** in the plate **16** extends vertically and seven enlarged portions **88** corresponding to the seven switching stations are provided. Preferably, and as shown, the both diametrically reduced portion **86** and the enlargements **88** take a cylindrical or circular configuration while the slot **90** is of a linear or straight-wall configuration.

Referring now particularly to FIGS. **3** and **5,** it will be observed that the rear portion **86** of the sleeve **70** is of such diameter as to rotatably enter the enlarged portions **88** of the slot **90.** The square stem **76** is slidable vertically within the slot **90** when aligned therewith but when the said stem is rotated to the position of FIG. **3** within an enlarged slot portion **88,** the said stem is incapable of moving vertically within the slot **90.** The portion **86** is in no event capable of movement along the slot **90.** As will be seen, the movable contact or contact assembly **44** is arranged relative to the stem **76** so as to maintain the said contact in a dead or open position when the stem **76** enters the slot **90** for movement between enlargements **88** or switching stations. Thus, it is impossible to inadvertently engage the said movable contact **44** with the contacts **22***a*–**34***b*. Such engagement can occur only at the switching stations and only on positive over-riding manual manipulation of the control knob **56.** The small compression spring **64** operates against the internal shoulder **72** whereby to retain the control knob **56** in an inner or rear position as shown in FIG. **2** when the knob and associated slide are located at a switching station with the reduced diametrical portion **86** entered in an enlargement **88** of the slot **90.** Thus, the knob and slide are releasably locked at a switching station and the knob may be urged linearly outwardly or forwardly as shown in FIG. **6** to withdraw the portion **86** from the enlarged slot portion **88** whereupon the knob and slide may be moved vertically with the stem **76** in a dead position and traveling vertically in the slot **90** as illustrated in FIG. **7.** Thus, inadvertent vertical movement of the knob and slide between switching stations is positively avoided.

Operation of the movable contact or contact assembly

Operation of the movable contact or contact assembly **44** is preferably effected with a snap action for rapid engagement and disengagement of the movable and fixed contacts as is desirable particularly in the case of a DC power supply. Thus, the stem **76** has a connected over-center arm **92** and an associated tension spring **94** has one end thereof connected to a free-end portion of the arm **92** and an opposite end thereof connected to a second or operating arm **96.** The arm **96** carries a small pivot pin **98** which extends through the rear slide plate **46** and rotates the aforementioned contact block **56.** As best illustrated in FIGS. **4** and **5,** the arm **92** may be rotated angularly by the knob **56** and the stem **76** to a closed contact position wherein the arm extends approximately at 5 o'clock and to an open contact position wherein the arm **92** extends approximately at 1 o'clock. In the closed contact position of FIG. **4,** the spring **94,** the arm **92** and the arm **96,** in an over-center operation, swing the contact or contact assembly **44** in a counter-clockwise direction and a snap-action into engagement with the aforementioned fixed contacts **22***a*–**34***b* and thus the bus bars **38, 40.** Similarly, with the arm **92** in the 1 o'clock position of FIG. **5,** the over-center operation of the said arm, the spring **94** and the arm **96** effect a snap-action movement of the contact to the vertical or open position.

As will be apparent, the spring **94** serves a dual purpose in effecting snap-action contact engaging and disengaging movement as a biasing means requiring a positive over-riding manipulation of the control knob to effect engagement or disengagement of the movable contact with a fixed contact. Thus, inadvertent engagement or disengagement of switching elements is avoided.

The particular form of the contact or contact assembly **44** may vary widely within the scope of the present invention, but preferably, and as shown, a pair of U-shaped contacts or wiper arms **100** and **102** are provided on opposite sides of the contact block **56.** An inner U-shaped contact **100** has an insulating member **104** disposed between a body portion thereof and an outer contact member **102.** The free or leg portions of the contact members or wiper arms engage the fixed contacts **22***a*–**34***b* and the bus bars **38, 40.** More specifically, rear or inner legs of the members **100, 102** slidingly engage and wipe a fixed contact such as **22***a* in FIG. **2.** Similarly, outer or front legs of the arms **100** and **102** slidingly engage and wipe the bus bars as in the case of the bus bar **40** in FIG. **2.** The leading edges of the legs of the contacts or wiper arms **100** and **102** are preferably bent slightly so as to be inclined outwardly and to form a mouth section as at **106, 106** for ease of entry of the fixed contacts or bus bars. Further, the spacing between the legs of the wiper arms **100** and **102** is preferably slightly less than the thickness of the fixed contacts and that of the bus bars to provide for firm frictional wiping or sliding action during engagement and disengagement of the movable and fixed contacts.

From the foregoing, it will be apparent that an improved electrical switch assembly has been provided. Inadvertent operation of the switch effecting rotation of the movable contact assembly is prevented by the aforementioned spring **94.** Positive over-riding manipulation of the knob is required in effecting the over-center operation so that an operator is fully aware of his action in engaging or disengaging contacts at a selected switching station. The operator is further prevented from moving the slide from one switching station to another through inadvertent action and instead he must first draw the knob forwardly or outwardly in a conscious effort before effecting sliding movement from one switching station to another. Further, there is no possibility of inadvertent engagement of contacts between stations, the contact assembly **44** being maintained in the open or dead condition as illustrated in FIG. **5** during movement of the slide between stations. Still further, a desirable snap-action engagement and disengagement of contacts is provided at each switching station.

We claim:

1. An electrical switch comprising a frame, a plurality of fixed contacts arranged in series on said frame to provide at least two switching stations, at least one movable contact having first and second rotary positions respectively in and out of engagement with an adjacent one of said fixed contacts, a carrier mounted on said frame and slidably movable between said switching stations, said carrier supporting said movable contact

for selective contact movement between said first and second rotary positions adjacent a fixed contact at each of said stations, exposed manually operable rotatable means on said carrier for selectively moving said movable contact between its said first and second rotary positions, means on said carrier biasing said movable contact toward its said second rotary position and requiring positive overriding pressure on said manually operable means to move said contact to its said first rotary position, and releasable locking means connected with said manually operable means and between said frame and carrier and operable automatically to lock said carrier against sliding at each of said switching stations, said manually operable means also being movable axially and said locking means being releasable for movement of said carrier between said switching stations only on positive overriding axial manipulation of said manually operable means with said contact in its said second rotary position.

2. An electrical switch as set forth in claim **1** wherein said locking means is further operable between said switching stations to maintain said movable contact in its said second position.

3. An electrical switch as set forth in claim **2** wherein a snap-action device is included between said movable contact and said manually operable means, said device serving to effect engagement and disengagement of said movable and fixed contacts in a snap action on movement of said manually operable means.

4. An electrical switch as set forth in claim **3** wherein said fixed contacts are arranged in spaced pairs and comprise a series of contact pairs with at least one spaced pair of contacts at each of said switching stations, and wherein said movable contact is of a rotary type with opposite end portions engageable respectively in said first position with the contacts of a spaced pair.

5. An electrical switch as set forth in claim **4** wherein each of said fixed contacts comprises a blade having an exposed edge portion, the contacts of each pair having said exposed edge portions facing in generally opposite directions, and wherein said rotary contact comprises at least one wiper blade engageable at opposite end portions in frictional sliding motion respectively with said exposed edge portions of a pair of fixed contacts.

6. An electrical switch as set forth in claim **5** wherein said rotary contact comprises at least two wiper arms having end portions spaced to engage resiliently in a sliding motion and to wipe opposite sides of a fixed contact at its said exposed edge portion.

7. An electrical switch as set forth in claim **6** wherein a wiper arm block is provided on said carrier and supports a pair of generally U-shaped wiper arms on opposite sides thereof, one leg of each of said U-shaped wiper arms being positioned for engagement with a fixed contact as aforesaid, and wherein at least two additional contacts are provided and positioned for engagement respectively with the other legs of said U-shaped wiper arms.

8. An electrical switch as set forth in claim **7** wherein said snap-action device comprises a tension spring and an associated over-center arm angularly movable in opposite directions by said manually operable means to effect the aforesaid rotary contact movement.

9. An electrical switch as set forth in claim **8** wherein said manually operable means comprises a control knob adapted for rotary and limited linear movement, wherein a slotted switch face plate is provided with slot enlargements aligned respectively with said switching stations, and wherein said carrier comprises a slide movable along said face plate and supporting said rotary contact and control knob, said control knob having an adjacent first and second cross-sectional configurations, the former of which permits rotary knob movement as aforesaid only at said slot enlargements, linear knob movement as aforesaid serving selectively to register said first and second cross-sectional configurations with said slot.

10. An electrical switch as set forth in claim **9** wherein a biasing spring is provided for restraining said control knob with its said first cross-sectional configuration in registry with said slot.

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