Sept. 16, 1969 R. A. GREENWALL, JR., ET AL 3,467,922

MULTIPLE CIRCUIT ELECTRICAL SWITCHBOARD WITH CIRCUIT SELECTOR

Filed Jan. 18, 1968 3 Sheets-Sheet 1

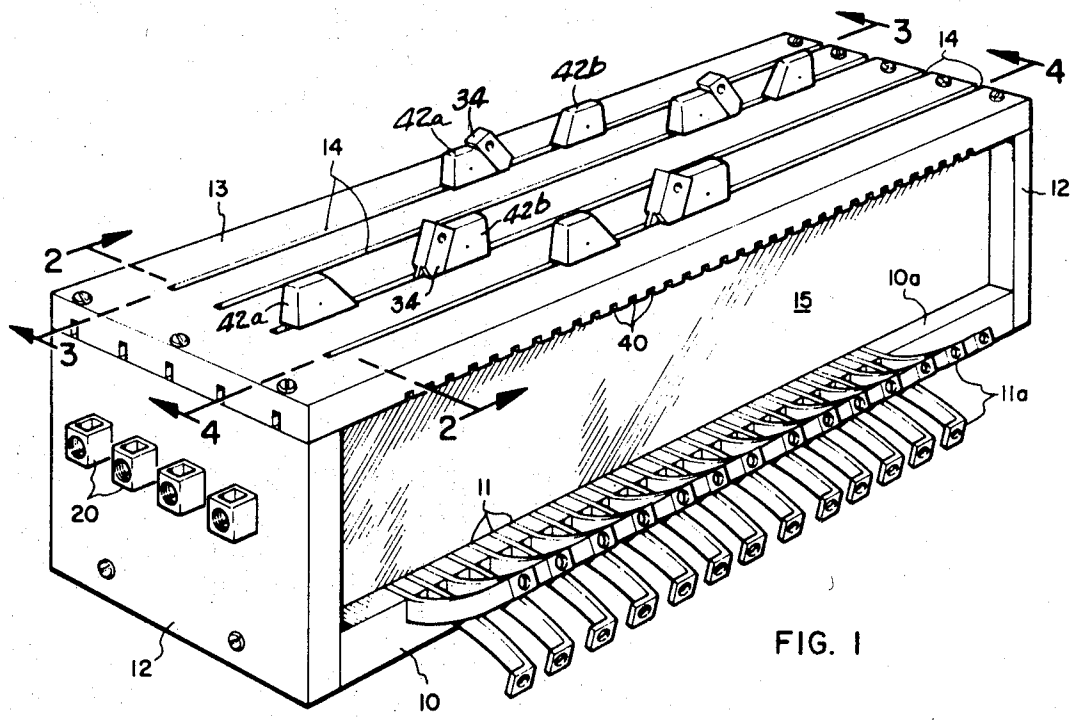


FIG. 1

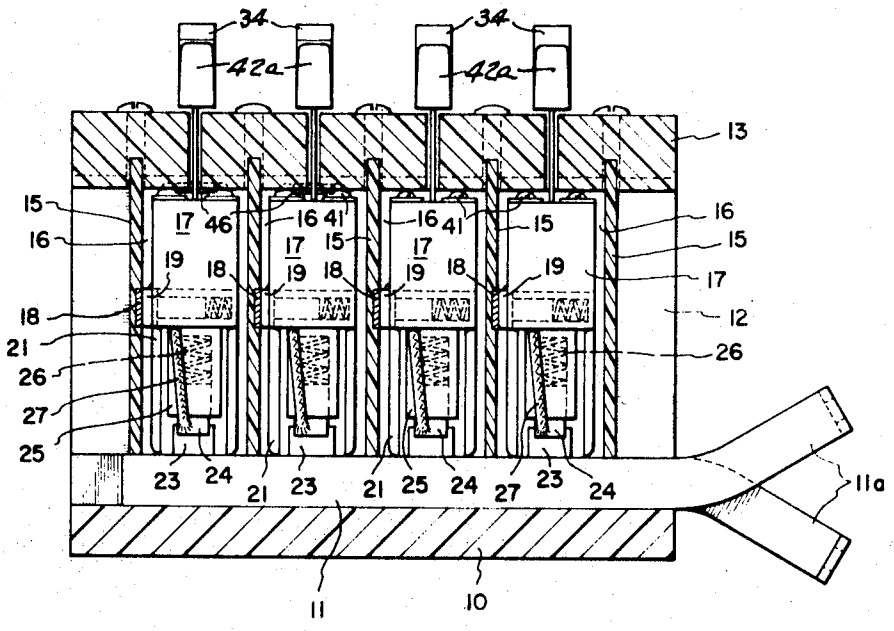


FIG. 2

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MULTIPLE CIRCUIT ELECTRICAL SWITCHBOARD WITH CIRCUIT SELECTOR

Filed Jan. 18, 1968 3 Sheets-Sheet 2

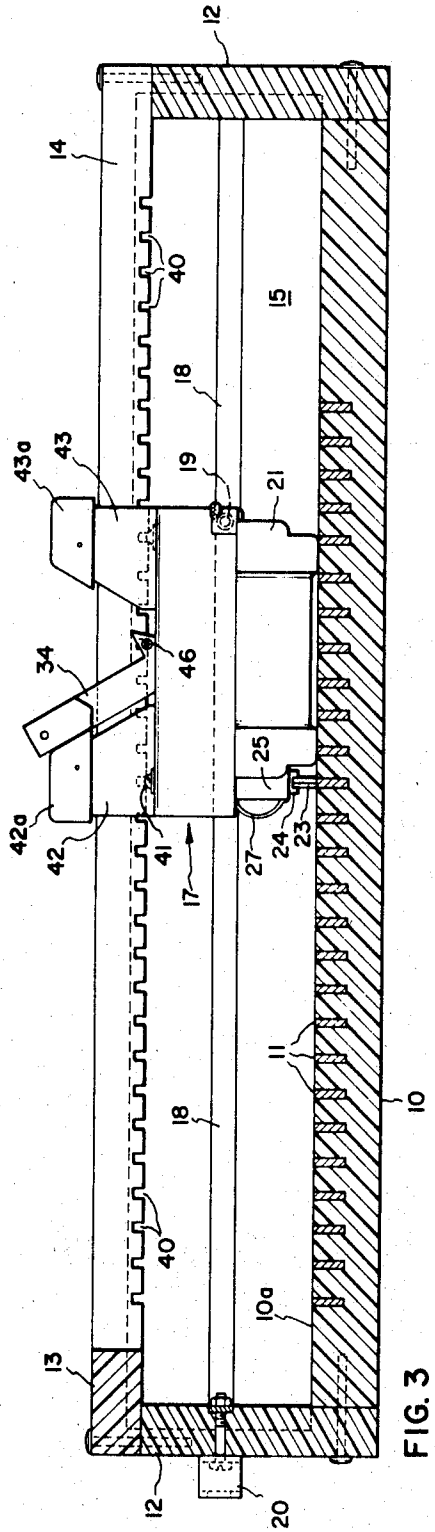


FIG. 3

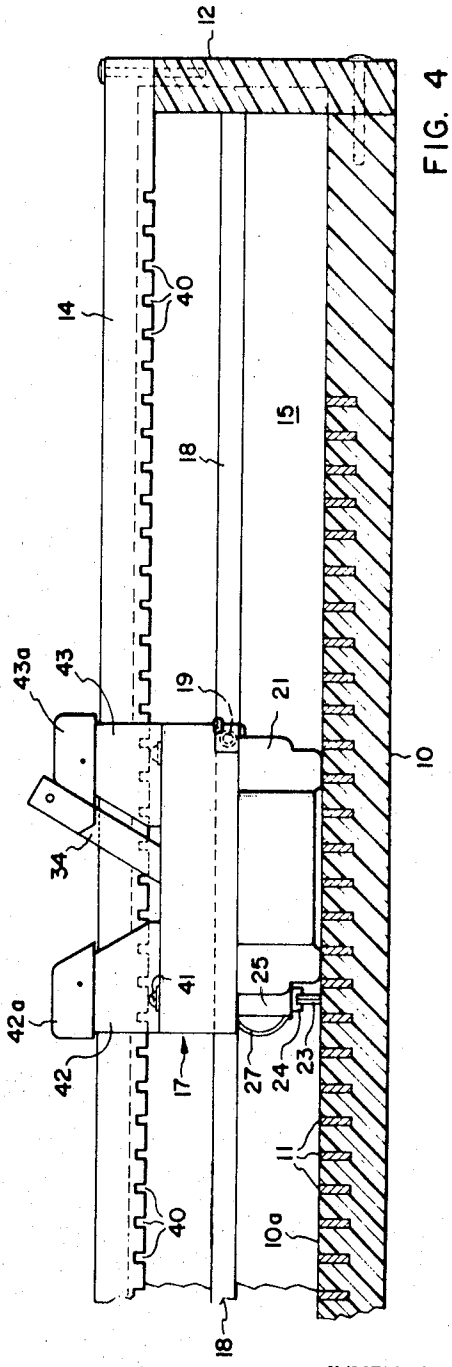


FIG. 4

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MULTIPLE CIRCUIT ELECTRICAL SWITCHBOARD WITH CIRCUIT SELECTOR

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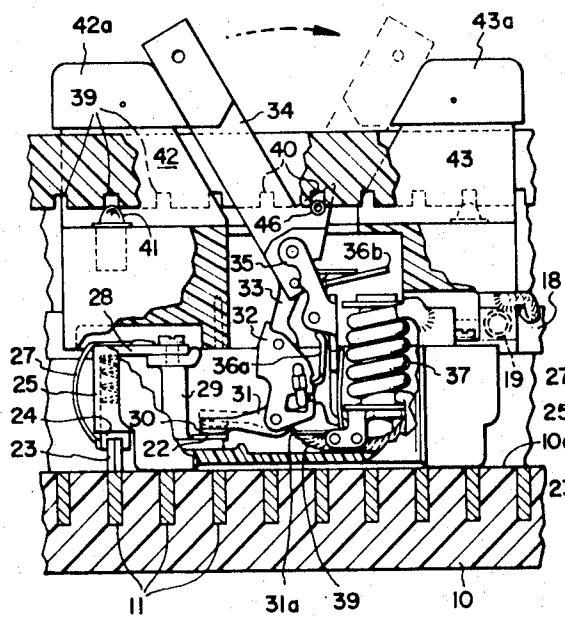


FIG. 5

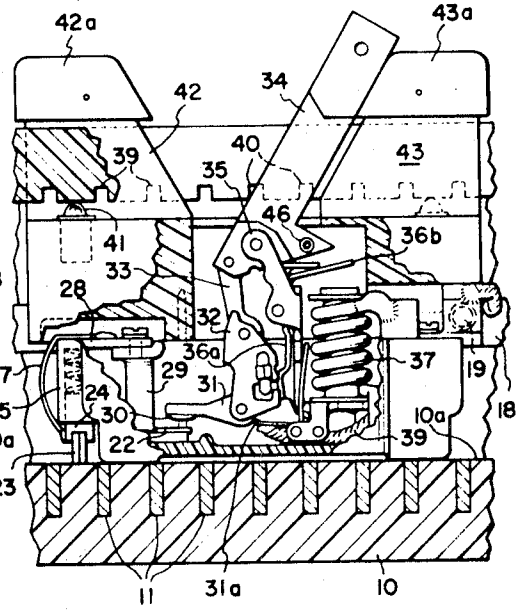


FIG. 6

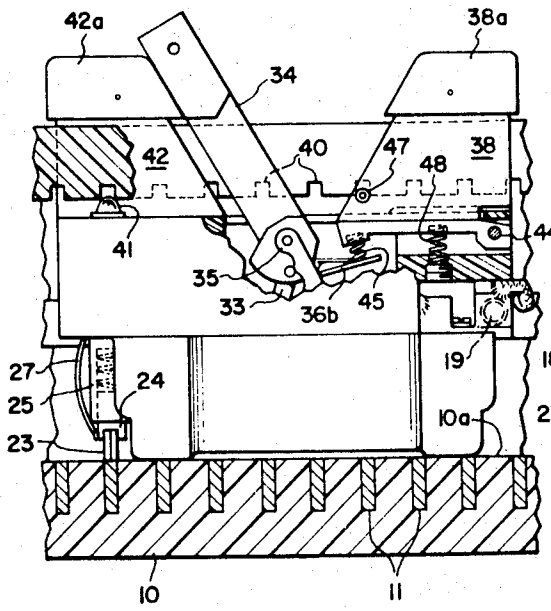


FIG. 7

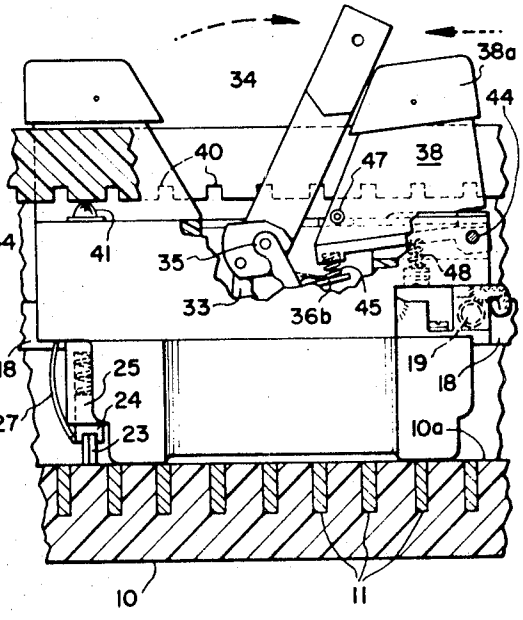


FIG. 8

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United States Patent Office 3,467,922 Patented Sept. 16, 1969

3,467,922

MULTIPLE CIRCUIT ELECTRICAL SWITCHBOARD WITH CIRCUIT SELECTOR

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Filed Jan. 18, 1968, Ser. No. 698,811
Int. Cl. H01h 9/20
U.S. Cl. 335—161 16 Claims

ABSTRACT OF THE DISCLOSURE

A movable switching unit which carries an electrical contact adapted for making and breaking contact, selectively, with any one of a series of stationary, electrical, load contacts during such times as the unit has protectively disconnected the electrical supply circuit operating through the switchboard. Following the "making" with any selected load contact, the unit provides for reconnecting the supply circuit through a circuit breaker arrangement, which is preferably and advantageously carried by the unit as a part of switch mechanism provided by such unit for controlling electrical supply. The stationary, load contacts are preferably flush with the working surface of the switchboard, positional indexing of the switching unit being provided by a detent arrangement sharing indexing components with keeper components of latch mechanism, which is provided for locking the switching unit in any selected "make" position. The switching unit is optionally but preferably constructed for triggering the supply switch mechanism and the latch mechanism to their break and release positions, respectively, by means of a handle that is provided primarily so the user can easily grasp and move the unit from position to position relative to the stationary, load contacts.

BACKGROUND OF THE INVENTION

Field.—The invention relates to electrical switchboards providing multiple load circuit connections and means for individually closing the circuits from time to time on a selective basis. It is particularly concerned with such switchboards that utilize a movable switching unit carrying an electrical contact for "make" and "break," individually, with a series of stationary contacts belonging to the multiple load circuit connections, respectively, and along which the switching unit is adapted to be moved.

State of the art.—United States Patent No. 2,796,473 of June 18,1957 (Re. 24,586, Jan. 13, 1959), to Ariel R. Davis, discloses an electric switchboard of the particular type concerned that has gone into extensive use for controlling the dimming of theatrical stage lights. A series of stationary, load contacts are individually recessed in an insulating base to provide respective, superimposed spark-quenching chambers; a movable switching unit, carrying a resiliently-urged electrical contact adapted to reach into the respective spark-quenching chambers and "make" and "break" with the individual load contacts therein, is tiltably mounted for sliding along the insulating base so as to avoid making electrical contact with load contacts it must cross in traveling to a selected load contact of the series. Arcing danger from the making and breaking of electrical contacts is minimized by the spark-quenching chambers, and such chambers serve the additional function of positionally indexing the switchboard.

Recent improvements have been made to the Ariel Davis switchboard. These are disclosed in copending applications of Robert A. Greenwall, Jr., Ser. Nos. 619,227 and 619,350, filed Feb. 28, 1967, and Feb. 28, 1967, and entitled "Improved Switching Means for Electrical Switchboards" and "Electric Switchboard Improvements," respectively.

In the first of these copending applications, the switchboard is largely similar to the Ariel Davis switchboard, but utilizes a movable switch unit in the form of a carriage that rolls along the surface of the insulating base and indexes by reason of a slight drop of the roller into each recess as it travels along the series of recessed, stationary, load contacts. Moreover, the carriage is formed as a lever, fulcrumed by the roller, so the movable contact may be conveniently lifted from the surface of the insulating base to facilitate movement across the load contacts in traveling from "break" with one to "make" with another. In this arrangement, it is still prudent to utilize spark-quenching chambers, even though some other indexing means be provided.

In the second of these copending applications, the switchboard is again largely similar to the Ariel Davis switchboard, but utilizes "strap-like" electrical conductor elements of rectangular cross-section placed on edge as stationary, load contacts of bus bar formation in order to increase the capacity of the switchboard to handle considerably higher electrical values. As specifically shown, these bus bars are recessed into the insulating base to provide spark-quenching chambers in accordance with accepted practice.

SUMMARY OF THE INVENTION

A principal purpose in the making of the present invention was to eliminate switchboard arcing at the multiple, stationary, load contacts, rather than to quench the usual sparks. This was accomplished by providing a movable switching unit embodying switch mechanism for closing and opening the electrical supply circuit through the switchboard and by integrating such switch mechanism with latch mechanism that serves to lock the switching unit in a selected indexed position, against transitional movement along the series of load contacts, during "make" with any given load contact. The arrangement is such that only by actuating the switch mechanism to open the electrical supply circuit is the latch mechanism unlocked to permit such transitional movement. Accordingly, there can be no "make" or "break" of the switching unit with any of the multiple, load contacts while the supply circuit is hot; no arcing can occur when the "make" or "break" is carried out with the supply circuit cold.

Another purpose was to incorporate circuit breaker protection in the switchboard, so currents of higher amperage can be safely handled. By the aforedescribed switching arrangement, it was found possible to incorporate a standard, overload, circuit breaker in the switching unit as a component of the supply switch mechanism and to thereby achieve the desired safety protection inexpensively and in an unobtrusive and compact manner. In fact, it was found possible to utilize a commercially available toggle switch and circuit breaker combination, with only minor additions to provide both latch and shielded switch mechanisms, as well as overload protection. This is a great manufacturing advantage for a relatively small enterprise, and, in itself, constitutes a special feature of the invention.

In the utilization of such commercially available switch and circuit breaker combination, both indexing and latching of the switching unit are conveniently carried out by the provision of a series of keeper slots in the underside of the usual top of the switchboard, the individual slots corresponding in position with the positions of the individual, load contacts. The toggle switch arm, provided for moving a movable contact of the supply switch mechanism to "make" and "break" positions relative to a stationary contact thereof, extends through an elongate

slot in the switchboard top in accordance with switching-unit mounting of the prior practice, and for latching purposes, may be provided, immediately below the switchboard top, with a laterally-extending latch pin that enters a keeper slot when the switch arm is tripped to "make" position following travel of the switching unit to a selected load circuit position. In this arrangement, indexing is provided by a spring-loaded detent finger carried by the switching unit to ride against the slotted undersurface of the switchboard top and to coact with the individual slots thereof in respective "make" positions of the movable switching unit.

A bus bar arrangement conforming to that disclosed by the afore-referred-to copending application Ser. No. 619,350 is preferably utilized here for the stationary, load contacts, but it is no longer necessary nor advantageous to recess the individual "strap-like" bus bars below the working surface of the insulating base; rather, the bus bars are preferably flush with such surface and the switching contact of the movable switching unit is preferably spring-pressed against such surface so as to ride thereagainst in its movement from one bus bar to another.

Although the latch pin may be incorporated in the toggle switch arm as previously indicated, it is preferred to construct the switching unit for triggering by means of one of a pair of handles provided for convenient grasping by a user for moving the unit back and forth to a selected load circuit position in the switchboard. Thus, one of such handles may be formed and pivoted to rock as a lever, with the work arm of the lever extending over the trip arm of the circuit breaker and carrying the latch pin, so as to trip the main switch when the lever is pushed down and, at the same time, unlocking the switching unit for transitional movement, a spring being provided to reset the triggering arrangement in the selected new "make" position, while, at the same time, locking the switching unit in that position.

The invention is preferably and most conveniently incorporated in a multiple circuit electrical switchboard constructed with several switch units arranged for rectilinear reciprocation across a rectilinear series of transversely positioned, electrical conductors serving as stationary contacts for multiple, load circuits, the switchboard of the invention conforming in this respect with the prior switchboards referred to above, but it will be clear to those skilled in the art that the generic concepts disclosed herein can be applied to other types of multiple circuit electrical switchboards, without departing from the invention particularly pointed out and described in the claims. Also, various aspects of the invention can be incorporated in switchboards of the type shown in the afore-referred-to copending application Ser. No. 619,227.

DESCRIPTION OF THE DRAWINGS

There are illustrated in the attached drawings specific constructions of multiple switchboards representing what are presently contemplated as the best modes of carrying out the invention in actual practice.

In the drawings:

FIG. 1 is a pictorial view looking toward one corner and the top of a typical switchboard of the invention having four movable switching units, two of which in the foreground are in unlocked, open circuit positions awaiting movement to selected load circuit "make" positions, and the remaining two of which in the background are already in locked, closed circuit or "make" positions;

FIG. 2, an enlarged vertical section taken along the line 2—2 of FIG. 1;

FIG. 3, a longitudinal section taken along the line 3—3 of FIG. 1;

FIG. 4, a similar longitudinal section taken along the line 4—4 of FIG. 1;

FIG. 5, an enlarged fragmentary view partially in vertical section of the closed and locked, movable switching unit shown in FIG. 3;

FIG. 6, a similar view of the open and unlocked, movable switching unit shown in FIG. 4;

FIG. 7, a view corresponding to that of FIG. 5, but showing an embodiment equipped with a triggering handle; and

FIG. 8, a view corresponding to that of FIG. 6, but showing the embodiment of FIG. 7.

DETAILED DESCRIPTION OF ILLUSTRATED EMBODIMENTS

In the specific form illustrated, the switchboard comprises an insulating base **10** of elongate, rectangular configuration having a series of electrical bus bars **11** recessed therein transversely of and flush with the working surface **10***a* thereof. Such bus bars have terminals **11***a* separated from one another in accordance with the disclosure of copending application Ser. No. 619,350 for connection with respective load circuits, such as individual dimmer circuits for stage lights as illustrated and explained in the aforementioned Ariel Davis U.S. Patent No. 2,796,473 (Re. 24,586).

Means for mounting and for guiding the travel of movable switching units are provided in the form of a superstructure comprising opposite end walls, each designated **12**, and a top wall **13** having a series of parallel longitudinal slots **14** therein. A series of parallel, longitudinal partition walls **15**, rabbeted into the top wall, see FIG. 2, divide the switchboard into separate, parallel, longitudinal compartments **16**, into which respective movable switching units **17** are fitted for back and forth sliding movement along rectilinear paths established by the slots **14**. All of the walls are of insulating material, such as a thermoset resin.

As in previous switchboards of the type concerned, each compartment **16** is provided with an elongate rail, here taking the form of an electrically conductive strip **18** recessed in and extending along the length of a partition wall **15**, for enabling a spring-urged electrical contact **19** of the corresponding switching unit **17** to make continuous electrical connection with an external power lead (attached to a terminal **20**) as such unit travels.

In the illustrated construction, each of the movable switching units **17** comprises switch mechanism and associated overload circuit-breaker means protectively encased in a sliding carriage **21**, FIGS. 3 and 4, having walls of a suitable electrical insulating material. It is highly advantageous and a feature of the invention that individual, overload, circuit-breaker means be incorporated in the switching means as a component part thereof, but it should be understood that other features of the invention can be utilized without such overload protective feature if desired.

As shown, see FIGS. 5 and 6, the switch mechanism is a standard commercial type manufactured and sold by Heinemann Electric Co., Trenton, N.J., under U.S. Patent No. 2,200,109, identified as Catalog No. 0911, Circuit Breaker, 1-pole unit, 120 v. AC, issue FW–14, modified somewhat for the present purposes. As modified, such switch mechanism comprises a stationary, switch contact **22** electrically connected to a load circuit contact **23**, which is carried by and depends from the bottom of the carriage **21** for movement therewith and for "make" and "break" with selected bus bars **11** serving as stationary load circuit contacts.

Such movable load circuit contact **23** is affixed to the lower end of an electrically conductive stem **24** that is slidably mounted in an electrically conductive guidebox **25** and is continually urged downwardly against the working surface **10***a* of insulating base **10** by a spring **26**, see FIG. 2. To insure positive conduction of electricity, a flexible, braided wire conductor **27** connects stem **24** with a bar **28** that, with post **29**, electrically connects

stationary switch contact **22** with guidebox **25**, see FIGS. 5 and 6.

The switch mechanism further comprises a movable switch contact **30** carried by toggle switch linkage components **31**, **32**, and **33**, which are attached to and operated by a switch handle **34** that projects through and slides along a corresponding slot **14**. Such switch handle is pivoted between a pair of spaced bracket arms **35** for back and forth movement to throw contact **30** into "make" and "break" positions relative to stationary switch contact **22**, see FIGS. 5 and 6, respectively.

Link **31** is spring-biased at **31***a* for automatically throwing the switch into "break" position when the long dependent arm **36***a* of a spring-biased trip lever **36** is actuated by downward movement of the normally raised, short lever arm **36***b* thereof.

The switch mechanism is preferably constructed with the lever arm **36***b* forming an armature for an electromagnet coil **37**, as illustrated in FIGS. 5 and 6, in which case such lever arm and coil serve as components of overload circuit-breaker means. However, as shown in the embodiment of FIGS. 7 and 8, a manual trip lever **38** may be provided for independently tripping the switch through lever arm **36***b* whether or not overload circuit-breaker means are provided.

The electromagnet coil **37** is connected in the power supply circuit **39**, between movable switch contact **30** and contact **19**, and becomes energized sufficiently upon overload in the circuit to pull armature **36***b* downwardly and trip the switch to "break" the contacts **22** and **30** thereof. The contacts are similarly broken in the absence of overload if the switch is tripped by the pushing down of lever **38** to depress armature **36***b* in the embodiment of FIGS. 7 and 8. This arrangement can be used even if overload coil **37** is not present, as may be the case in switchboards handling low electrical values, e.g., twenty amps and below.

For indexing the movable switching units **17** relative to the individual, stationary, load circuit contacts provided by the bus bars **11**, the undersurface of top wall **13** is grooved transversely of its length to provide a series of recesses **40** corresponding in numbers and position with the bus bars, and the carriage **21** of each unit **17** is provided with a spring urged detent finger **41** for coaction with such recesses.

In order to easily slide the switching units **17** back and fourth on the working surface **10***a* of the insulating base **10**, considering the presence of the detent indexing arrangement and both the downward thrust and upward reaction of the springs **26**, each of the units **17** is provided with a pair of handles **42** and **43**. In the embodiment of FIGS. 7 and 8, the lever **38** is formed and serves as one of these handles, corresponding to handle **43**. As shown, these handles are flat plates extending upwardly through the correponding slot **14** in top wall **13**, capped by elongate knobs, **42***a*, **43***a*, and **38***a*, respectively, that are easily grasped and that can be conveniently marked with circuit-identifying indicia on their flat tops.

It should be noted that, in the embodiment of FIGS. 7 and 8, the flat plate lever **38** is fulcrummed by a pivot pin **44** at the outer lower corner, and that a coil spring **45** is interposed between the opposite lower corner and armature **36***b*, the distance between these representing the work arm of the lever and the handle provided by such lever furnishing means whereby the switch may be easily tripped to "break" its contact **30** relative to its contact **22**.

For individually locking the respective movable switch units **17** against transitional movement along insulating base **10** at such times as their respective sets of switch contacts **22** and **30** are in "make" positions, latch means are provided. The series of indexing recesses or grooves **40** advantageously serve as latch keepers, and pins **46**, mounted in and projecting from either one or both sides of the respective switch handles **34**, serve as latch bolts, the pin or pins of each switch unit entering a groove recess **40**, as shown in FIG. 5, when its switch mechanism is thrown into "make" position and being retracted from such groove recess, as shown in FIG. 6, when such mechanism is thrown into "break" position.

In the embodiment of FIGS. 7 and 8, the latch bolt pin or pins, **47**, are mounted in the work arm of the lever **38**, rather than in the switch handle **34**, the lever **38** being normally urged upwardly by a spring **48**. In this connection, it should be noted that spring **45** is of such strength as to depress armature **36***b* sufficiently early in the movement of lever **38** to trip the switch mechanism to "break" position before the latch is unlocked, thereby positively protecting against switchboard arcing, i.e., arcing when the movable load circuit contact **23** is moved away from or toward a stationary load circuit contact **11**.

It should be noted that, in both embodiments of the movable switching unit, the switch handle **34** is prevented from actually closing the switch when the unit is in an unindexed position. In the embodiment of FIGS. 5 and 6, this is accomplished by reason of the fact that latch pin or pins **46** abut against the lands between indexing grooves **40** and prevent complete throw of the switch handle, while, in the embodiment of FIGS. 7 and 8, latch pin or pins **47** in lever **38** similarly abut the lands between indexing grooves, so that the work arm of such lever continues to compress spring **45** and to exert tripping force on armature **36***b*.

It should also be noted that, although the movable switching unit of FIGS. 7 and 8 is positively locked against transitional movement until lever **38** is actuated, the movable switching unit of FIGS. 5 and 6 is only locked against free and easy transitional movement. The application of pushing or pulling force to handle knobs **42***a* and/or **43***a* will automatically throw switch handle **34** from switch closing position to switch opening position as latch pin or pins **46** are being forced from latching position in the keeper slot **42** by the resulting transitional movement of the switching unit.

Although it has been convenient to designate the series of stationary contacts as "load" contacts adapted for connection with respective "load" circuits and to designate the contacts of the switch mechanism of the movable switching unit as "electrical supply" contacts, it should be understood that the source of electric power and the load or loads concerned may be located anywhere in the complete electrical circuitry controlled by the "electrical supply" switch and the "load" contacts.

Whereas this invention is here illustrated and described in detail from the standpoint of presently preferred specific embodiments thereof, it is to be realized that various changes may be made within the generic preview of the disclosure without departing from the claimed subject matter.

We claim:

1. In a multiple circuit, electrical switchboard with circuit selector, which switchboard is provided with an insulating base presenting a series of spaced, stationary, electrical contacts adapted for connection with respective electrical load circuits, and provided, further, with means for mounting and for guiding the travel of a movable switching unit along said series of contacts, and with means for making continuous electrical connection of said unit with an external power source as said unit travels, a movable switching unit comprising

a carriage for travel along said series of stationary contacts;

a load circuit contact carried by said carriage for "make" and "break" with selected stationary load circuit contacts; and

a switch mechanism in said carriage for opening and closing the electrical supply circuit, said switch mechanism having a switch contact electrically con-

nected with said means for making continuous connection with an external power source, switch contact electrically connected with said load circuit contact, and means for "making" and "breaking" said switch mechanism contacts.

2. An electrical switchboard according to claim 1, wherein the means for "making" and "breaking" the switch mechanism contacts include overload circuit-breaker means.

3. An electrical switchboard according to claim 2, wherein toggle switch components provide the means for "making" and "breaking" the switch mechanism contacts.

4. An electrical switchboard according to claim 3, wherein the overload circuit breaker means is connected in circuit with the specified one switch mechanism contact and the toggle switch mechanism is arranged to move that one contact into its "break" position when a load circuit being serviced by the switchboard is overloaded.

5. An electrical switchboard according to claim 4, wherein the overload circuit breaker means includes an electromagnet having an armature, the toggle mechanism is spring-loaded for moving the one contact into "break" position and includes tripping mechanism therefor, and the said armature is arranged to actuate said tripping mechanism when it is itself actuated by said electromagnet.

6. An electrical switchboard according to claim 5, wherein the movable switching unit additionally includes manually operable means for actuating the tripping mechanism, said means comprising a lever fulcrumed in said carriage and having a power arm in the form of a handle and a work arm adapted to actuate the armature.

7. An electrical switchboard according to claim 6, wherein there are additionally provided latch means for locking the movable switching unit in any given load circuit "make" position with respect to the series of stationary contacts, said latch means including structure fixed in position relative to the insulating base and presenting a series of recesses corresponding in number and position with the stationary load circuit contacts of the series of said contacts in the insulating base, said recesses serving as latch keepers; and a latch bolt element on the work arm of the lever arranged to enter one of said recesses when the switch mechanism contacts are in their "make" positions and to be retracted therefrom when the power arm of the lever is operated to actuate the armature.

8. An electrical switchboard according to claim 7, wherein the movable switching unit is additionally provided with a detent finger that bears against the recessed latch structure and coacts with the recesses thereof to provide indexing means for said switchboard.

9. An electrical switchboard according to claim 8, wherein the carriage comprises walls of insulating material protectively encasing the switching mechanism contacts and overload circuit breaker means of the movable switching unit.

10. An electrical switchboard according to claim 1, wherein there are additionally included latch means in operative association with the switch mechanism of the movable switching unit for locking said unit in any selected load-circuit "make" position thereof.

11. An electrical switchboard according to claim 10, wherein the means for "making" and "breaking" the switch mechanism contacts include overload circuit-breaker means; the movable switching unit includes manually operable means for "breaking" the switch mechanism contacts through said circuit-breaker means; and the latch means includes a locking component carried by said manually operable means.

12. An electrical switchboard according to claim 10, including structure fixed in position relative to the insulating base and presenting a series of recesses corresponding in number and position with the stationary load circuit contacts of the series of said contacts in the insulating base, said recesses serving as latch keepers, the locking component carried by the manually operable means being a latch bolt.

13. An electrical switchboard according to claim 12, wherein toggle switch components provide the means for "making" and "breaking" the switch mechanism contacts and include a manually operable switch lever, the latch means including a latch bolt carried by said switch lever in position to enter one of latch keeper recesses when the switch lever is in switch-closing position and to be retracted therefrom when said switch lever is in switch-opening position.

14. An electrical switchboard according to claim 13, wherein the movable switching unit is additionally provided with a detent finger that bears against the recessed latch structure and coacts with the recesses thereof to provide indexing means for said switchboard.

15. An electrical switchboard according to claim 1, wherein the stationary electrical contacts are bus bars recessed into the insulating base flush with the working surface thereof, and resilient means are provided for continuously urging the load circuit contact, that is carried by the carriage, against said working surface of the insulating base.

16. An electrical switchboard according to claim 1, wherein the carriage comprises walls of insulating material protectively encasing the switching mechanism contacts.

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HAROLD BROOME, Assistant Examiner

U.S. Cl. X.R.

200—16, 18