

May 16, 1967

E. H. YONKERS

3,320,377

HIGH VOLTAGE SWITCH DEVICE

Original Filed July 26, 1962

2 Sheets-Sheet 1

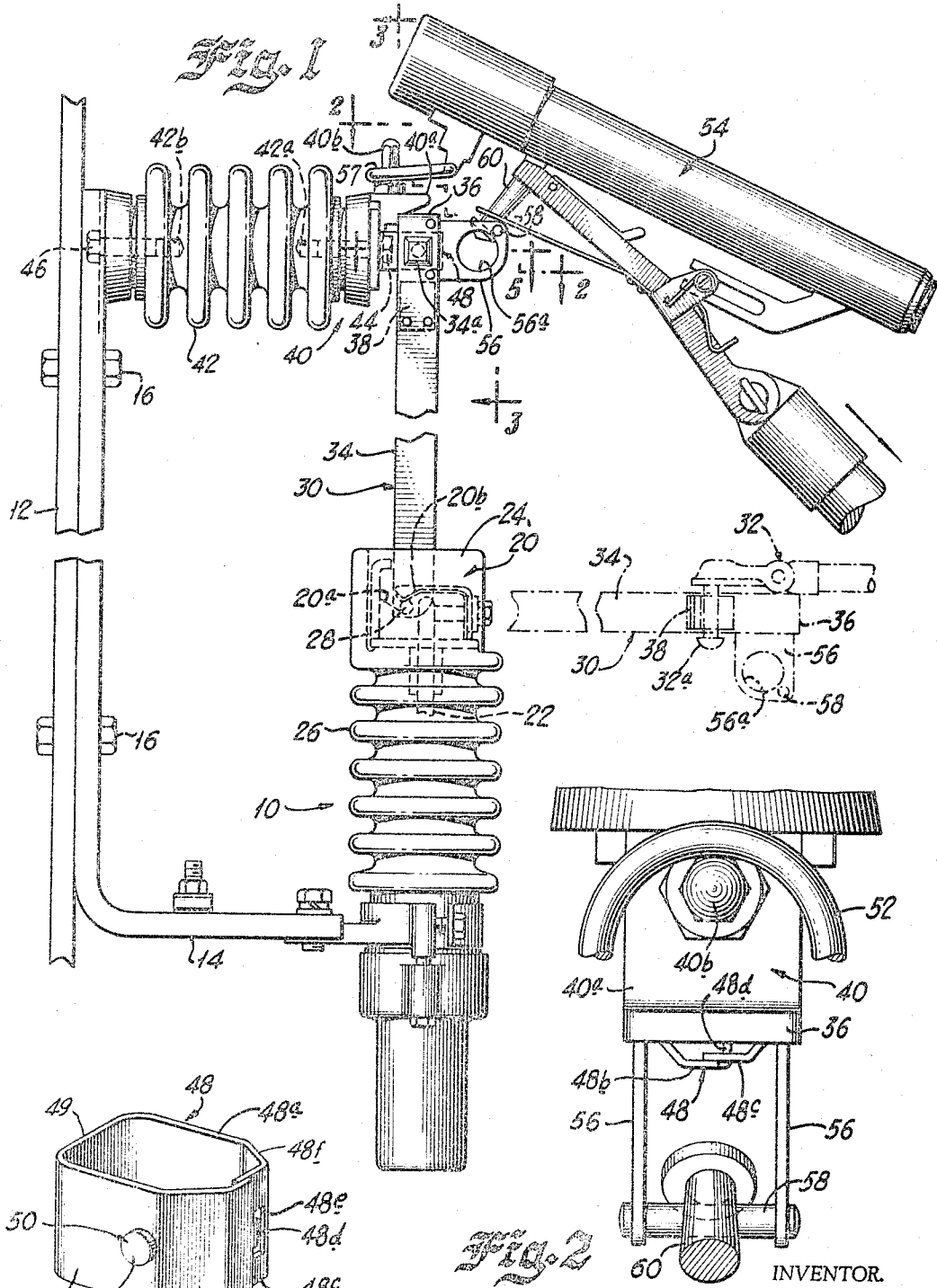


FIG. 2

FIG. 5

INVENTOR.
EDWARD H. YONKERS
BY *Mason, Kolchmanian,*
Rathburn & Wyss;
ATTORNEYS

May 16, 1967

E. H. YONKERS

3,320,377

HIGH VOLTAGE SWITCH DEVICE

Original Filed July 26, 1962

2 Sheets-Sheet 2

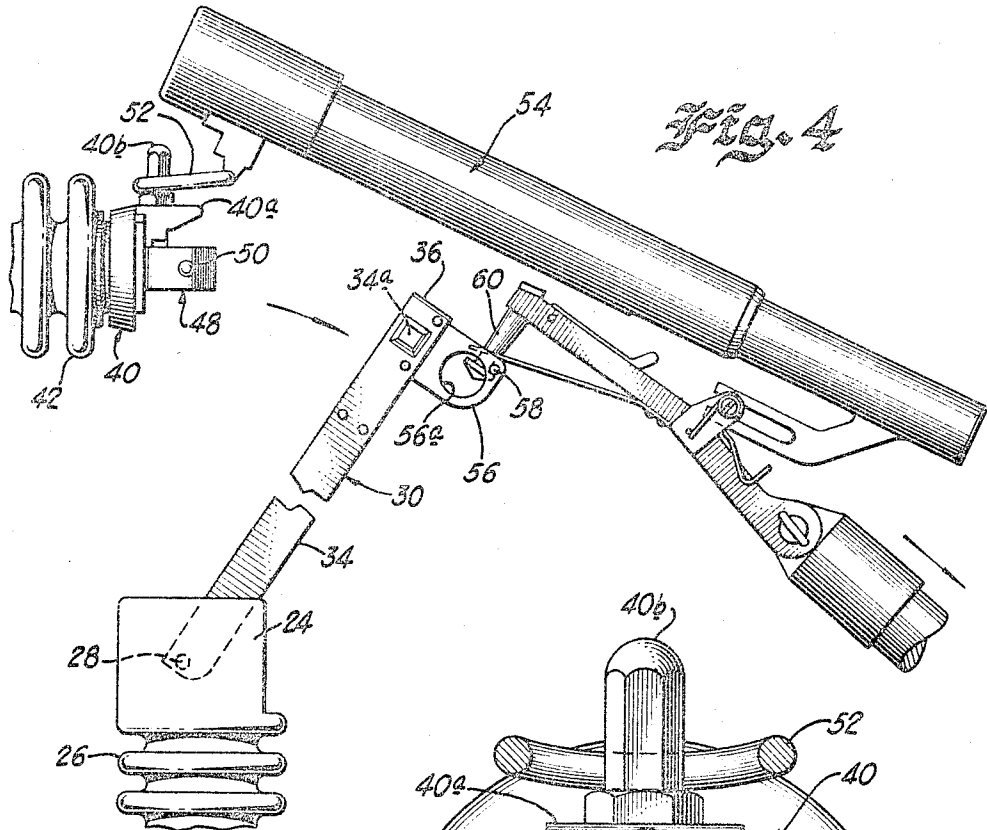


Fig. 4

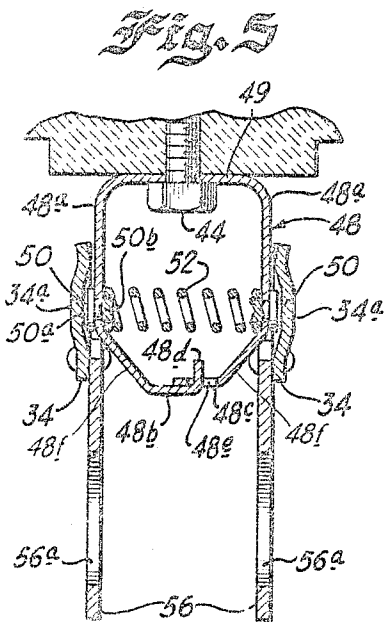


Fig. 5

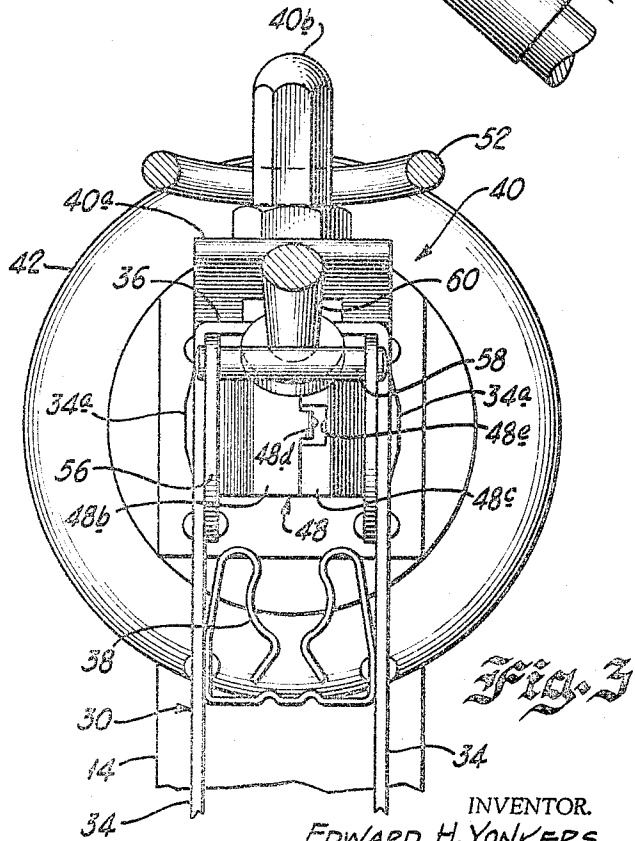


Fig. 3

INVENTOR.
EDWARD H. YONKERS
BY Mason, Kolchmanian,
Rathburn & Wyss;
ATTORNEYS.

1

3,320,377

HIGH VOLTAGE SWITCH DEVICE

Edward H. Yonkers, Glencoe, Ill., assignor to Joslyn Mfg. and Supply Co., Chicago, Ill., a corporation of Illinois

Original application July 26, 1962, Ser. No. 212,513, now Patent No. 3,172,979, dated Mar. 9, 1965. Divided and this application Nov. 6, 1964, Ser. No. 409,481
3 Claims. (Cl. 200—48)

This invention relates to a cable terminal and switching device, and more particularly, to a switching device in which the switching element can be removed from the switch terminals while the terminals are energized. This application is a division of my copending United States patent application Ser. No. 212,513, filed July 26, 1962, which application is assigned to the same assignee as the present invention.

As a result of the recent trend toward the increasing use of underground cables to distribute electrical power in expanding residential areas, there is a growing need for safe, compact switch gears, particularly suited to switching and sectionalizing cable terminals at distribution voltage levels. One such terminating device is disclosed in copending United States patent application Ser. No. 142,562 filed Oct. 3, 1961, assigned to the same assignee as the present invention. In conjunction with the use of such terminating devices and underground high voltage cable distribution systems, it is necessary to provide a stepdown transformer to develop the low voltages for supply to residences and the like. These transformers are usually of the cabinet type mounted at ground level, and it is desirable that a switch be provided between cable terminals and the transformer terminals. Since it is not feasible to deenergize the distribution system and interrupt services on the entire system when installing new equipment or when performing routine maintenance operations, it is desirable that the latter switch be of a type which can be easily and safely installed or removed with the use of a hot line stick while the terminals are energized.

The present invention is an improvement over the cable terminal and switching device disclosed in the copending United States patent application Ser. No. 155,391, filed Nov. 28, 1961 and assigned to the same assignee as the present invention.

An object of the present invention is to provide a new and improved electrical switching device which can be used in conjunction with a cable terminating system as described in the copending application Ser. No. 142,562 identified above.

A further object of the present invention is to provide a new and improved electrical switching device in which the switching element can be easily and safely installed or removed with the use of a hot line stick while the switch terminals are energized.

Another object of the present invention is to provide a new and improved switching device which can be easily and quickly opened while under load using an auxiliary circuit interrupter with a minimum of manipulation of the interrupter and without arcing between the elements of the switching device.

Another object of the present invention is to provide a new and improved electrical switching element having

2

new and improved contact means on one terminal thereof for engaging contact means on a pivoting switching element in a manner to provide high current carrying capacity between the terminal and the switching element and to hold the switching element firmly in contact with the terminal yet allowing the switching element to be easily disengaged from the terminal when it is desired to open the switching device.

Another object of the present invention is to provide a new and improved electrical switching element having new and improved contact means on one terminal thereof for engaging contact means on a pivoting switching element and providing means for guiding the switching element into proper engagement as it is pivoted to close the switch.

Briefly, the foregoing and other objects of the present invention are accomplished by providing a switching device having first and second spaced apart terminals electrically connected by a removable switching element. The lower end of the switching element is mounted for pivotal movement upon the first terminal and can be removed completely therefrom if desired while the upper end of the element is adapted to contactingly engage contact means which are provided on the second terminal to complete the circuit between the two terminals when the switch device is closed and to move away from the contact means when the device is opened. The switching element comprises a pair of parallel, spaced apart confronting blade members each having an outward indentation on its inner surface near the upper end thereof for engagement with outwardly biased contact buttons of the contact means on the second terminal when the switch is closed. The contact means is constructed to form a closed loop having a central base portion secured to the body of the second terminal and a pair of spaced apart legs on which the contact buttons are mounted. Means are provided for biasing the legs and buttons outwardly to insure good electrical contact with the indentations on the adjacent blade members when the device is closed. Means are provided for limiting the outer biasing movement of the buttons when the device is open and forming a guide means to guide the switching element into proper contacting relation with the second terminal as the switch is closed.

Other objects and advantages of the present invention will become apparent from the following detailed description when taken in conjunction with the drawings in which:

FIG. 1 is a broken side elevational view of a switching device characterized by the features of the present invention showing the switch in the closed position and also showing an auxiliary circuit interrupter engaged with the switch in preparation for opening the switch. The switch is shown in the fully open position in dotted lines with a hot stick engaged therewith.

FIG. 2 is an enlarged, fragmentary, sectional view taken along a line corresponding substantially to the line 2—2 of FIG. 1;

FIG. 3 is an enlarged, fragmentary, sectional view taken along a line corresponding substantially to the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary, side elevational view similar to FIG. 1 but showing the switch in the open position

engaged with the auxiliary circuit interrupter after the circuit has been interrupted.

FIG. 5 is an enlarged, fragmentary, sectional view taken along a line substantially corresponding to the line 5-5 of FIG. 1; and

FIG. 6 is a perspective view showing the contact means of the upper terminal of the switching device of FIG. 1.

Referring now to the drawings, there is illustrated in FIG. 1 the upper portion of a cable terminating device 10 of the type disclosed in the previously mentioned copending application Ser. No. 142,562. The terminating device is secured to a wall 12 of an electrical switch box by a bracket 14 and by suitable fasteners 16. The bracket 14 also serves as a means for grounding the lower portion of the terminating device 10 to the switch box or frame on which the device is mounted. The stud and nut 18 may be utilized to ground other wires to the bracket 14.

The upper end of the terminating device 10 is provided with a terminal 20 of the type described in detail in the copending application Ser. No. 155,391 previously identified. The terminal 20 is connected to the end of a power cable 22 and, as is described in the copending application, is positioned in an upper recess 24 formed in an insulation housing 26 of the terminal device 10. The terminal is provided with a pin receiving open ended slot 20a and a spring retainer 20b for removably receiving a pin 28 at the lower end of a removable switching element 30. The pin 28 of the switching element 30 is inserted in the slot 20a and moved downward and forward past the retaining spring 20b which then biases the pin against the blind end of the slot 20a and allows the switching element 30 to be pivoted from the closed position shown in solid lines to the fully open position shown in dotted lines in FIG. 1. The pin 28 and the switching element 30 which carries it can be removed from the slot 20a by moving the switching element so that the pin moves upward and to the rear (as viewed in FIG. 1) past the retaining spring 20b and out the top of the open end of the slot.

Movement of the switching element 30 and the pin 28 thereof within the slot 20a of the terminal 20 is accomplished by hand (if the terminals are not energized) or, if the terminals are energized, by use of a hot line stick 32 as described in the aforementioned copending application Ser. No. 155,391. The switching element 30 is comprised of a pair of parallel switch blades 34 joined at their upper ends by an integrally formed end web 36 and at their lower end by the pin 28. A hot stick receiving spring clip 38 is positioned between the switch blades 34 to receive the headed pin 32a of the hot stick 32 when the stick is used to manipulate the switching element 30.

An upper or second terminal 40 is engaged by the upper end of the switching element 30 when the switch is closed. This terminal 40 is supported on a stand-off insulator 42 and is secured thereto by a cap screw 44 (FIG. 5) which is engaged in a threaded axial bore 42a in the outer end of the insulator. The insulator 42 is supported adjacent the upper end of the bracket 14 by means of a cap screw 46 threaded into an axial bore 42b at the inner end of the insulator.

In order to provide good electrical contact with the switching element 30 when it is closed, the upper terminal 40 is provided with a spring loaded contact member 48 shown in detail in FIGS. 5 and 6. This member 48 is formed from a strip of copper or other high conductive material which is bent to form a closed loop as illustrated. The loop is formed with a central base portion 49 which is secured to the main portion of the terminal 40 by the cap screw 44 and includes side legs 48a which carry contact buttons 50 preferably made of silver or other highly conductive material for insuring good electrical contact between the upper end of the switch-

ing element and the upper terminal 40. The buttons 50 are provided with outer rounded heads 50a and are retained in holes in the legs 48a by upsetting or center punching shank portions 50b of the buttons from the inside of the legs. The shank portions 50b serve as centering guides for the opposite ends of a coiled compression spring 52 which biases the legs 48a and buttons 50 outwardly to engage the respective blade members 34 of the switching element 30. The member 48 is also provided with inturned front leg portions 48b and 48c. The front leg portion 48b is provided with a tongue 48d which extends into a slot 48e provided in the leg portion 48c in order to permit the outer ends of the side legs 48a to flex inwardly against the force of the biasing spring 52 as the switch is opened and closed.

The biasing spring 52 exerts a continual force on the side legs 48a of the contact member 48 tending to move the contact buttons 50 carried thereby outwardly away from one another. The outward movement of the buttons away from one another is limited by the engagement with the blade members 34 of the switching element 30 when the switch is in the closed position and when in the open position, the tongue 48d engages the outer end of the slot 48e to limit the biasing movement. The front leg portions 48b and 48c of the contact member 48 are joined to the respective side legs 48a by means of angularly disposed portions 48f which additionally serve as guide members for guiding the blades 34 of the switching element 30 into proper alignment with the contact member 48 during closing of the switch.

The upper ends of the switch blades 34 are outwardly deformed slightly to form contact engaging recesses or indentations 34a which, as is best shown in FIG. 5, accommodate the rounded heads 50a of the buttons 50 when the switch is closed. The spring 52 is compressed when the switch is moved to the closed position and then forces the buttons 50 outwardly to seat in the recesses 34a, thereby retaining the switch in the closed position and also providing good electrical contact between the switching element and the upper terminal. It should also be noted from FIGS. 4 and 5 that the inner edges of the blades 34 adjacent the recesses 34a are bent slightly outward to aid in guiding the blades into proper engagement with the contact member 48 when the switch is closed. As is shown in FIG. 4, the terminal 40 is also provided with an outwardly extending lip 40a having an inclined lower surface which engages the end web 36 of the switching element 30 as it is closed. This lip 40a serves as a guide for the upper end of the switch element 30 during closing of the switch and insures that the pin 48 at the lower end of the switching element is seated against the blind end of the slot 20a in the terminal 20. Thus, when the switch is closed, the switching element 30 is held firmly between the terminals 20 and 40.

In order to provide for opening of the switch under load by using an auxiliary circuit interrupter, the upper terminal 40 is provided with an upwardly extending, centrally located, vertical stud 40b which is adapted to be engaged by the upper contact ring 52 of an auxiliary circuit interrupter 54. The switching element 30 is provided with a pair of parallel spaced ring members 56 which are respectively attached to the upper ends of the switch blades 34. The ring members 56 are formed of flat plate and are provided with large circular openings 56a in order to accommodate the headed pin 32a of the hot line stick 32 when it is used to open or close or otherwise manipulate the switching element. The use of the hot stick for manipulating the switching element 30 is fully described in the copending application Ser. No. 155,391 and reference should be had to this application for a complete understanding of this operation. A spacer pin 58 is provided between the rings 56 adjacent their upper outer corners. The pin 58 stiffens the ring

members 56 to prevent bending and also serves as an engagement surface on which the contact pin or prong 60 of the auxiliary circuit interrupter is engaged.

In order to open the switch when current is flowing through switching element 30 without arcing between the contact member 48 and the switching element, the auxiliary circuit interrupter 54 is placed in the position shown in FIG. 1 with the upper contact ring 52 in engagement with the stud 40b and the contact pin 60 in engagement with the spacer pin 58 thereby providing a shunt path for current flow through the auxiliary interrupter. The handle of the interrupter is then pulled in the direction indicated by the arrows to pivot the switching element 30 in a clockwise direction about the pin 28 thus breaking contact between the upper end of the switching element and the upper terminal 40. Little or no arcing occurs during this breaking of contact since the current is flowing through the auxiliary interrupter. As soon as the contact between the switching element 30 and the contact member 48 is broken, continued pull on the handle of the auxiliary circuit interrupter 54 toward the position shown in FIG. 4 breaks the circuit in the auxiliary circuit interrupter, and the arc developed in the interrupter is extinguished therein. The contact ring 52 can now be disengaged from the stud 40a without arcing since there is no current flowing through the auxiliary interrupter and the switching element 30 can be allowed to pivot to the position shown in dotted lines in FIG. 1 whereupon the circuit interrupter may be disengaged entirely.

If it is then desired to remove the switching element 30 from the lower terminal 20 while it is still energized, the hot stick 32 can be utilized in the manner described in the copending application Ser. No. 155,391. After such removal the switch can be closed and locked to prevent unauthorized access to the switch or to prevent inadvertent contact with the energized terminals. It should be noted that by providing a removable switching element, a much smaller switch box or cabinet can be utilized than is possible without such an element. When it is desired to close the switch, the hot stick can be again utilized to insert the switching element 30 into the terminal 20 and to then pivot the switching element to the closed position.

The auxiliary circuit breaker 54 can be of the commercially available type having a fixed upper contact means such as a ring or loop for engagement with a fixed switch terminal and a relatively movable lower contact means for engaging the movable switch element or fuse of the switch. Moreover, it should be noted that the unique positioning of the stud 40b and the pin 58 in relation to each other allows the circuit breaker to be easily and positively engaged with the switch with a minimum of manipulation by merely placing the ring 52 over the stud 40b and engaging the contact pin 60 over the spacer pin 58 between the ring members 56. There is no necessity for twisting or rotating the auxiliary interrupter in order to engage it or to further twist or rotate it in order to open the circuit. The direction of pull on the handle is relatively constant and there is no need for a swivel jointed arrangement on the auxiliary circuit breaker in order to operate applicant's switching device. The direction of pull and movement of the handle of the auxiliary interrupter during engagement with and opening of the switch is substantially in a single plane which is aligned with the plane of movement of the pivoting switching element 30. Thus, the present invention provides a cable terminal and switching device which has a removable switching element, yet, still is capable of carrying high current loads, and also is capable of being easily and safely opened under load by use of a conventional auxiliary circuit interrupter with a minimum of manipulation. Because of these advantages the switching device can be utilized with high voltages and current and can be safely operated by an interrupter in relatively confined areas.

While the present invention has been described in connection with particular embodiments thereof, it will be understood that those skilled in the art may make many changes and modifications without departing from the true spirit and scope of the invention and accordingly all such changes and modifications which fall within the true spirit and scope of this invention are intended to be covered in the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An electrical switching device comprising first and second spaced apart terminals and a switching element having one end pivotally mounted on said first terminal and movable in a plane to engage its opposite end with said second terminal when in a closed position and to be disengaged from said second terminal when in an open position, said switching element comprising a pair of parallel spaced confronting blade members, said blade members defining opposed recesses on their confronting faces, and contact means on said second terminal disposed to lie between and engageable with said recesses of said blade members when said switching element is in a closed position, said contact means including a closed loop of strip material formed with a central base at one end secured to said second terminal, a pair of spaced apart leg members extending from said base between and closely confronting inner surfaces of respective ones of said blade members and end members formed at the other end of said loop, a pair of contact buttons, one button carried on each of the respective legs and each button having an enlarged head extending outwardly of the leg to contact and seat within a recess of a respective blade member and biasing means extending between said legs and axially aligned with said buttons for normally biasing said legs outwardly apart from one another.

2. An electrical switching device comprising first and second spaced apart terminals and a switching element having one end pivotally mounted on said first terminal and movable in a plane to engage its opposite end with said second terminal when in a closed position and to be disengaged from said second terminal when in an open position, said switching element comprising a pair of parallel spaced confronting blade members, said blade members defining opposed recesses on their confronting faces, and contact means on said second terminal disposed to lie between and engageable with said recesses of said blade members when said switching element is in a closed position, said contact means including a closed loop of strip material formed with a central base at one end secured to said second terminal, a pair of spaced apart leg members extending from said base between and closely confronting inner surfaces of respective ones of said blade members and end members formed at the other end of said loop, a pair of contact buttons, one button carried on each of the respective legs and each button having an enlarged head extending outwardly of the leg to contact and seat within a recess of a respective blade member and biasing means extending between said legs and axially aligned with said button for normally biasing said legs outwardly apart from one another, one of said end members including an inwardly extending tongue and the other defining a tongue receiving slot, said tongue and slot cooperating to limit the outward movement of said legs from one another when said switch is opened.

3. An electrical switching device comprising first and second spaced apart terminals and a switching element having one end pivotally mounted on said first terminal and movable in a plane to engage its opposite end with said second terminal when in a closed position and to be disengaged from said second terminal when in an open position, said switching element comprising a pair of parallel spaced confronting blade members, said blade members defining opposed recesses on their confronting

7

faces, and contact means on said second terminal disposed to lie between and engageable with said recesses of said blade members when said switching element is in a closed position, said contact means including a closed loop of strip material formed with a central base at one end secured to said second terminal, a pair of spaced apart leg members extending from said base between and closely confronting inner surfaces of respective ones of said blade members and end members formed at the other end of said loop, a pair of contact buttons, one button carried on each of the respective legs and each button having an enlarged head extending outwardly of the leg to contact and seat within a recess of a respective blade member and biasing means extending between said legs and axially aligned with said button for normally biasing said legs

5

10

15

8

outwardly apart from one another, said loop including switch element guiding portions joining respective legs to respective ones of said end members, said guiding portions disposed to extend inwardly from said legs toward one another.

References Cited by the Examiner

UNITED STATES PATENTS

2,200,509	5/1940	Lindae	-----	200—162
2,226,385	12/1940	Ramsey	-----	200—162

ROBERT K. SCHAEFER, *Primary Examiner.*

R. S. MACON, *Assistant Examiner.*