Feb. 16, 1954 B. C. WEBSTER 2,669,649

SAFETY HOUSING FOR ELECTRICAL APPARATUS

Filed May 7, 1949

Fig.1.

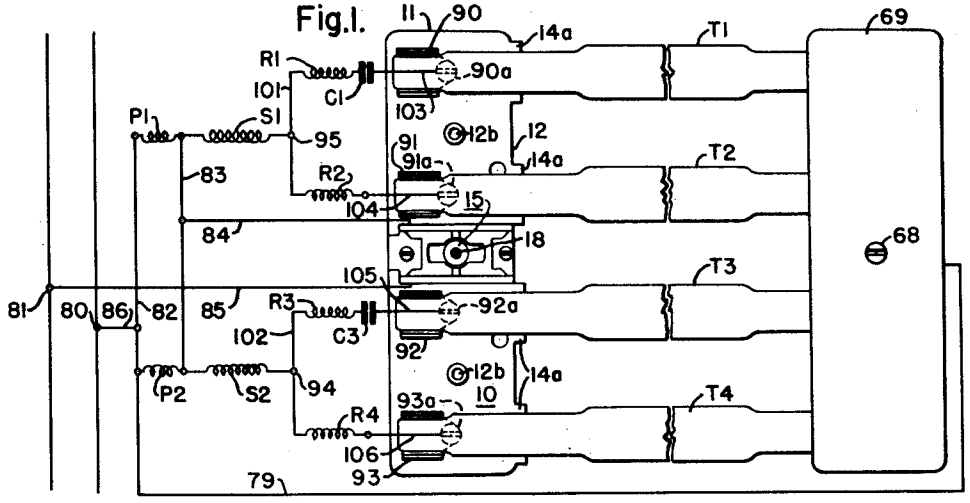


Fig.2.

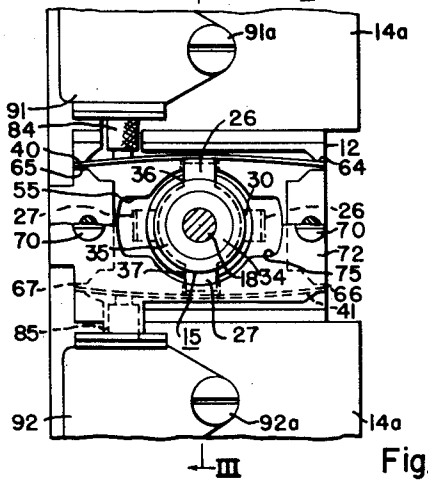


Fig.3.

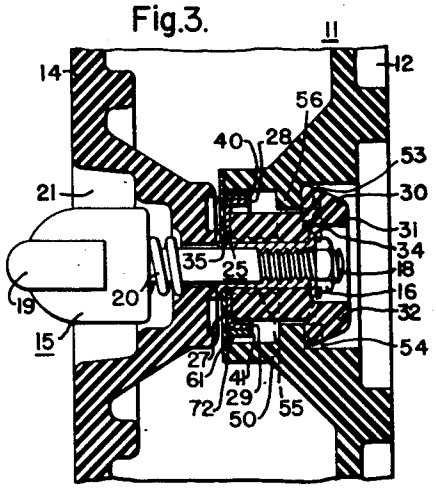
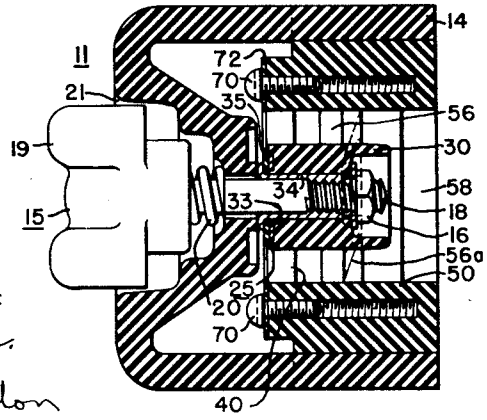


Fig.4.



WITNESSES:

N. F. Sussar.

G. T. Hatton

INVENTOR

Benjamin C. Webster.

BY

Ralph L. Swingle

ATTORNEY

Patented Feb. 16, 1954

2,669,649

UNITED STATES PATENT OFFICE

2,669,649

SAFETY HOUSING FOR ELECTRICAL APPARATUS

Benjamin C. Webster, Southport, Conn., assignor to The Bryant Electric Company, Bridgeport, Conn., a corporation of Connecticut

Application May 7, 1949, Serial No. 91,888

9 Claims. (Cl. 240—11.4)

1

This invention relates to electrical circuits, and more especially concerns safety apparatus for use in the same.

An outstanding general object of this invention is the provision of reliable and effective apparatus for protecting against access to certain parts of an electrical circuit until those parts have been rendered safe to the touch.

A further object of the invention is that of providing a simple and practical safety switch and switch cover locking unit for electrical circuits, the switch components being well protected against giving off electrical shocks when fully exposed to the touch.

Another object of the invention is that of providing a safety unit suited for opening one electrical circuit with the effect of deadening another, and for preventing access to the latter circuit until the deadening operation is achieved.

A still further object of this invention is the provision of an electrical circuit controlled by a safety unit, the latter affording protection against access to certain parts in the circuit and for giving access after the circuit is cut off.

The present invention is of especial importance in the fluorescent lighting field, as where one or more gaseous electric discharge lamps of the fluorescent type are connected in suitable illuminating circuit with the output side of a stepup transformer. The lamps or tubes employed in fluorescent lighting systems, of course, are usually supported in sockets, or the like, and operate at a voltage which for example varies from a relatively low value where the tubes are of the hot cathode type, to a relatively high value in the event the tubes are adapted for lighting on cold cathodes without pre-heating.

A great number of the fluorescent lighting systems in the prior art have no reliable facility for preventing shocks, short-circuits, fire, or other hazards, incident upon exposure of parts which normally carry an electrical charge during replacement of the lamps. The usual control switches in these lighting circuits are of a kind which can easily be ignored, or left turned on with the thought that they are turned off, as during such operations as replacement of burned out tubes. The terminal portions, such as electrically conductive metal pins or caps of the fluorescent tubes, thus occasionally become exposed to the touch before full disconnection from their sockets is achieved. Likewise, a hazard exists in forcing the terminals of replacement tubes into live sockets, especially should connection into the energizing circuit be accomplished before shielding of the terminals against electrical shock or the like can be had. Then again, an open socket and exposed connections adjacent to the socket in one of these fluorescent lighting systems, sometimes give off shocks and afford other dangers well recognized as existing in exposed electrical parts which continue to carry a charge.

2

It is, accordingly, an object of this invention to provide a safety unit for fluorescent lighting systems, by which deadening of the secondary circuit of these systems is reliably assured before access can be had to certain normally charged components such as the lamp terminals and sockets for the purpose of replacing the lamp.

A still further object of the invention is that of providing fluorescent lighting systems, or other electrical systems of the character having a primary circuit and a secondary circuit, embodying circuit safety features.

The preceding objects and other objects of this invention will become more apparent upon consideration of the following description of a preferred embodiment thereof, when taken in connection with the attached drawing, in which:

Figure 1 is a diagrammatic view of a fluorescent lighting system including a safety switch unit in accordance with the invention, the unit appearing in plan view toward the lefthand side of the figure, with the cover omitted;

Figure 2 is an enlarged, fragmentary, plan view of the switch unit appearing in Figure 1, and with part of an interior cover plate broken away and with the switch being in circuit closing position;

Figure 3 is an enlarged sectional view taken substantially along the line III—III of Figure 2, and further representing the tube socket cover and controller knob of the switch unit; and

Figure 4 is an enlarged sectional view corresponding to Figure 3, taken substantially at right angles to the section of Figure 3.

In the particular embodiment of the invention disclosed in the accompanying drawing, a safety unit 10 is provided at the corresponding high voltage ends of a bank of fluorescent lighting tubes T1, T2, T3 and T4, for protecting against access to these ends when the tube energizing current is turned on. It is the housing 11 of the safety unit 10 which serves to enclose the tube ends. This housing, for example, includes a substantially rectangular base 12 and a relatively movable corresponding dome-shaped cover 14 for the base. Both the cover and base portions of the housing 11 illustratively are made of

an electrical insulating material such as any suitable resin, to protect against electrical shock. Cover 14 conveniently has at its inner side cut-out portions for receiving projections 14a on base 12, thus to orient the several portions to closed position and afford stable closure thereof. The base has openings 12b for receiving screws for mounting as to a ceiling or wall. As a further component of the safety unit 10, there is a circuit control switch 15 having features which will be more fully explained hereinafter. It will be observed that in order to replace a lamp it is necessary to remove cover 14 of unit 10.

The circuit controller portion of the control switch illustratively includes a shaft 18, which extends through a suitable opening in the cover 14 and externally of this cover carries a suitably affixed knob 19 for manual operation. Pressing on the underneath side of the knob 19 and against the outside surface of the cover 14 is a coil spring 20 of sufficient strength to urge apart the elements against which it presses. In this vicinity the cover conveniently has a depression 21, for receiving the inner portion of the knob 19 and concealing the spring 20 from outside view and thus contributing to neater general appearance of the safety unit 10. For added safety, the knob advantageously is of a material which is electrically non-conductive, such as an electrical-insulating synthetic resin.

That portion of the controller shaft 18 which is on the inside of the cover 14, is connected to operate a switch terminal contacting member of the controller unit as for example an annulus or washer-like member 25 having diametrically opposite rigid arms 26 and 27 turned down to provide contacts 28 and 29, respectively, at the outer ends of the arms. The switch terminal contacting member 25 is made of an electrically conductive material, illustratively copper. The arms 26 and 27 usually have about a 90° angle bend, thus to provide the contact portions 28 and 29.

Also mounted to rotate with the controller shaft 18 is a lock component 30, for selectively locking and unlocking the base 12 and cover 14 of the housing 11 with movement of the switch terminal contacting member 25 to and from electrically conducting position. The lock component 30 conveniently is of a substantially cylindrical shape having an axial bore, and diametrically opposite lugs 31 and 32 extending radially from one end of the main body thereof. This locking member usually is made of an electrically insulating material, as for example of a suitable synthetic resin or hard rubber, and conveniently forms a unit with the switch terminal contacting member 25, the latter being mounted in an annular groove 33 and radial grooves 36 and 37 in the end of the locking member remote from the radial lugs 31 and 32 and covered by the insulating washer 35. The annular groove 33 advantageously is between the inner and outer cylindrical surfaces of the locking member 30 so that the latter member can afford electrical insulation. The radial grooves 36 and 37 respectively receive the arms 26 and 27 of the switch terminal contacting member 25 and thus hold these arms and their respective contact portions 28 and 29 against rotation except as a unit with the locking member. An internally threaded bushing 34 extends through the axial bore of the locking member 30 and is cleated at one end against the lugged end of the latter member. The other end of the bushing 34 is spread to retain the insulating washer tightly in its covering position over the switch terminal contacting body 25, and accordingly prevents escape of this body from the annular groove 33 and radial grooves 36 and 37. Preferably the arms 26 and 27, as united to the locking member 30, are in about the same angular positions as the radial lugs 31 and 32.

The unit comprising the switch terminal contacting member 25 and the locking member 30, is mounted on the controller shaft 18 for rotation with the same. Bushing 34 conveniently fits onto that end of the shaft 18 which is inside the cover 14, and is internally threaded from one end to about mid-length, to accommodate threads on the shaft. The shaft threads terminate to afford a stop against one direction of relative rotation of the bushing 34, but leave enough of the shaft protruding to receive a lock nut 16, or the like, acting against relative rotation in the other direction.

At about the middle, for example, base 12 of the safety unit 10 has integral therewith, or attached thereto, a substantially rectangular or other suitably shaped casing having an upstanding wall 50 for confining the switch terminal contacting member 25 and locking member 30. Extending laterally from the inside surface of the wall 50, and illustratively somewhat above the principal top surface of the base 12, is an inwardly protruding locking portion 56 of the wall. This locking portion 56 defines an opening 55 which is substantially the same shape for example as the largest transverse section of the lugged end of the locking member 30 but somewhat larger than this section for clearance. The portion 56 illustratively is molded integral with the wall 50 and base 12.

In the underneath side of the locking portion 56 and radiating from opening 55 are depressions 53 and 54 for holding the radial lugs 31 and 32. These depressions are effective to prevent rotation of the knob 19 and switch controller shaft 18 until, by manual operation, the knob and shaft are rotated and moved longitudinally against the action of coil spring 20 to free the lugs 31 and 32 of the depressions. The longitudinal movement and rotation of the lugs to desired extent, is facilitated for example by a space 58 within the wall 50 and immediately below the locking portion 56. Above the locking portion 56 and within the limits of the wall 50, there is a compartment 61 for receiving the switch terminal contacting member. On opposite sides of this compartment are terminal contacts 40 and 41 of the control switch 15. These terminal contacts are made of electrically conductive material, such for example as copper, or copper alloy, and preferably are in the form of thin flexible and resilient strips, each having both of their ends supported. In this connection the contact 40 has its ends fitting in grooves 64 and 65 in opposite sides of the casing wall 50, and the terminal 41 likewise is supported in grooves 66 and 67 of this wall. In the normal or open circuit position of the terminals 40 and 41, the lateral distance between these terminals is advantageously less than the distance across the switch terminal contacting member 25 measured from contact portion 28 to contact portion 29. With this arrangement, the terminals 40 and 41 are susceptible to being bowed apart by the switch terminal contacting member 25, with rotation of knob 19 and the controller shaft 18 for closing the switch 15. To

protect against electrical shock and also to retain the terminal blades 40 and 41 in their end supporting grooves, the switch 15 has an electrical insulating plate 72 or other suitable casing component over the terminals and across the top of wall 50. The plate 72 illustratively is held in place by lag bolts 73 threaded into the top edge of wall 50. There is an opening 75 in the plate 72 for ingress and egress of the locking member 30 and the switch terminal contacting member 25. This opening preferably is substantially in alignment with opening 55 and usually is of about the same size and shape (see Figure 2).

Assuming that the cover 14 along with the switch controller portion of the safety unit 10 are removed from the base 12, and that it is desired to close the switch 15, the following operations are in order: The cover 14 is seated on the base 12, with the base projections 14a receiving the cutout portions at the inner side of the cover. In achieving this operation, the knob 19 is given a turn should this be needed, to align the locking member 30 and the switch terminal contacting member for insertion through shaped opening 75 in the plate 72. As these latter elements are inserted, the locking member 30 passes on down into shaped opening 55 and blocks rotation of the knob 19 by reason of contacting the wall of this opening. During this time the switch contact arms 26 and 27 take a position (dotted line portion in Figure 2) between the switch terminals 40 and 41 and are out of electrical contact with the same as for example by being in substantially parallel relation to the terminal blades. Then, by pressing the knob 19 inward against the action of coil spring 20, the shaft 18 undergoes a longitudinal movement and the lugs 31 and 32 accordingly move clear of the underneath surface of locking portion 56 of the wall 50. It will be observed that the lower surface of locking portion 56 is sloped at 56a (Fig. 4) so that at this point, the knob 19 may be turned for rotating the shaft 18 and the locking member 30 so as to carry through for example about a 90° angle of rotation in a clockwise direction as viewed in Fig. 2, and lugs 31 and 32 will ride on the sloped surfaces 56a to cause longitudinal inward movement of shaft 18 to finally seat in the depressions 53 and 54 in the surfaces of locking portion 56. Coil spring 20 then is effective to arrest further rotation of the lugs. The cover 14 accordingly is locked to the base 12. A further important operation which occurs in giving the shaft 18 the necessary rotation to bring the lugs to the locking position just indicated, is the rotation of the switch terminal contacting member 25. The arms 26 and 27 in being fixed to the shaft 18, also undergo an angular displacement corresponding to that of the lugs and, accordingly, reach a lateral or bridging position with respect to the switch terminals 40 and 41, thus electrically interconnecting the same. In approaching this position, the switch contacts 28 and 29 of the arms tend to bow apart the terminals 40 and 41, thus assuring a good, firm electrical connection. It follows that the cover 14 and base 12 are safely locked together while the switch 15 is closed for conducting electricity. By continuing rotation of the knob 19, in the same direction the lugs 31 and 32 again ride on sloped surfaces 56a to move clear of the depressions 53 and 54 back to free exit position (dotted line position in Figure 2), leaving the switch terminals 40 and 41 electrically disconnected. The cover 14 then may be lifted from the base 12, at which time the switch terminal contacting member 25 is in suitable alignment with opening 75 for removal, as is the locking member 30 in alignment with openings 55 and 75. With the removal of cover 14, and the knob 19, shaft 18, switch contacting member 25 and locking member 30, all supported by the cover, the terminals 40 and 41 are protected against touch by the plate 72. The removed controller portions of the switch 15 are electrically dead.

Now in applying the safety unit 10 to a fluorescent lighting system, it is advantageous to house the corresponding adjacent ends of the lighting tubes T1, T2, T3 and T4 within the housing 11 formed by the base 12 and cover 14. In the illustrative embodiment represented in Figure 1 of the accompanying drawing, the fluorescent lighting system includes a step-up transformer of which the energizing or primary windings P1 and P2 are connected at 80 and 81 in parallel to a line source of alternating current electrical supply. Beginning at junction 80 with the line supply, one of the parallel primary circuits includes leads 86 and 82, primary winding P1, leads 83 and 84, control switch 15 (and more particularly contact 40, switch terminal contacting body 25 and contact 41 thereof, see Figure 2) and lead 85 back to the line connection 81. The other parallel primary circuit includes leads 86 and 82, primary winding P2, leads 83 and 84, contact 40, switch terminal contacting body 25, contact 41, and lead 85 to connection 81.

The base of the safety unit 10 has mounted thereon, for shielding by the cover 14, a plurality of sockets or other suitable lampholders, such as electrically conductive clips 90, 91, 92, and 93, respectively receiving the adjacent terminal ends of tubes T1, T2, T3 and T4.

Secondary coils S1 and S2 of the transformer are, for example, in autotransformer connection across the coils P1 and P2, the tubes T1 and T2 accordingly being connected in parallel with coils P1 and S1. Thus, in the embodiment represented in Figure 1, an energized or transformer secondary circuit may be traced from the lefthand side of coil P1, through this coil and the secondary coil S1 to junction 95, thence along lead 101 to reactor R1 and condenser C1, lead 103 to lampholder terminal 90a, across the lamp T1 and thence along leads 79 and 82 back to the lefthand side of the coil P1. A circuit parallel to this is traceable from the lefthand side of the coil P1, through this coil and secondary S1 along lead 101 and through reactor R2 to terminal 91a of the lampholder 91, across the tube T2, and back along leads 79 and 82 to the lefthand side of coil P1. The reactors R1 and R2 conveniently serve to limit the current supply once the serially associated tubes T1 and T2 have become conductive. The condenser C1 effects phase displacement of the operating currents through tube T1 as compared with the current through T2, thus reducing stroboscopic effect in the emitted and blended light of the two tubes.

Similarly, tubes T3 and T4 are connected in parallel with coils P2 and S2. A circuit may be traced from the lefthand side of coil P2 (Figure 1) through this coil and secondary coil S2, junction 94, along lead 102, through reactor R3 and condenser C3, and along lead 105 to terminal 92a of the lampholder 92, thence across tube T3, and back over leads 79 and 82 to the lefthand side of coil P2. Coils P2 and S2 also are in circuit including lead 102, reactor R4, lead 106, terminal

93a of lampholder 93, tube T4 and leads 79 and 82 back to the coils. Reactors R3 and R4 limit the current in their respective circuits once the tubes T3 and T4 are energized. The condenser C3 effects phase displacement so as to reduce stroboscopic effect in the light emitted from tubes T2 and T4.

The effect of safety unit 10 on the fluorescent lighting system just described, is to close the parallel primary circuits of the windings P1 and P2 by means of the switch 15 so long as the locking member 30 locks together the cover 14 and base 12. Under these conditions, the cover 14 not only prevents access to live parts of the switch itself, but also to such components as the lampholders 90, 91, 92 and 93, including their terminals, and the ends of tubes T1, T2, T3 and T4 supported therein. When the cover 14 is unlocked by rotation of knob 19, the switch 15, and more particularly the switch terminal contacting member 25 of the controller, opens the transformer primary energizing circuits of the fluorescent lighting system, and the secondary or energized circuits including the lamps T1, T2, T3 and T4 are rendered electrically dead. Upon removal of the cover 14 from the base 12, as for example to replace one of the lamps therefore, any components of the secondary circuits may be safely touched without danger of electrical shock or short-circuit. The terminal contacts 40 and 41 connected in the primary circuits of the transformer are the only parts in unit 10 which may be energized when cover 14 is removed, but these are at a relatively low potential, and are not readily accessible in view of being housed within the insulating wall 59 and beneath the insulating plate 72.

At the other ends of tubes T1, T2, T3 and T4 remote from the safety unit 10, is a suitable enclosure 69, for closing off these tube ends and such related parts as their supporting sockets, or other suitable holders and the electrical connections needed in this vicinity for giving the tube operating circuits described above. A fastener 68 such as for holding together a base and cover of the enclosure 69, advantageously is not moved to open the enclosure until after operation of knob 19 to open the unit 10. If desired, the enclosure 69 may be replaced by another unit 10 for added safety.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it is desired that the invention be not limited to this particular structure, inasmuch as it will be obvious to persons skilled in the art that many modifications and changes may be made in this particular structure without departing from the broad spirit and scope of this invention. Accordingly, it is desired that the invention be interpreted as broadly as possible and that it be limited only as required by the prior art.

I claim as my invention:

1. An electrical safety unit, comprising, a housing having relatively movable portions for admitting access to the inside thereof; an electrical switch inside said housing and including relatively movable contacts respectively supported by said relatively movable housing portions for coming apart with the same, one of said contacts being mounted for movement relative to its housing portion, manually operable means for said one contact operative from outside said housing for effecting opening and closing of the switch by movement relative to said housing portions with said housing portions closed; and locking means for preventing access to the inside of said housing while the switch is closed.

2. An electrical safety unit, comprising, a housing having relatively movable portions for admitting access to the inside thereof; an electrical switch inside said housing and including spaced contacts and a movable bridging contact respectively supported by said relatively movable housing portions for coming apart with the same, said bridging contact being operative from outside said housing for selectively affording a bridge across said spaced contacts with said housing portions closed; and locking means operative with said bridging contact for preventing access to the inside of said housing while the switch is closed.

3. An electrical safety unit, comprising, a housing having relatively movable portions for admitting access to the inside thereof; an electrical switch inside said housing and including relatively movable contacts respectively supported by said relatively movable housing portions for coming apart with the same, one of said contacts being mounted for movement relative to its housing portion, manually operable means for said one contact operative from outside said housing for opening and closing the switch by movement relative to said housing portions with said housing portions closed; and locking means cooperative with said one contact for locking the latter at switch closing position and for preventing access to the inside of said housing while the switch is closed.

4. An electrical safety unit, comprising, a housing having relatively movable portions for admitting access to the inside thereof; an electrical switch inside said housing and including laterally spaced flexible terminal strips supported at the ends thereof to one of said housing portions, and a terminal bridging member rotatably supported by another of said housing portions and operable by a controller from the outside thereof, for rotation between said terminals for connecting and disconnecting the same when the housing is closed; and a lock operative with said controller for preventing access to the inside of said housing while the switch is closed and for giving access when the switch is open.

5. An electrical safety unit, comprising, a housing having relatively movable portions for admitting access to the inside thereof; an electrical switch inside said housing and including, a circuit controller supported through the wall of one of said housing portions and having a bridging contact portion inside said wall for rotation by operation from the outside, and spaced contacts within a casing supported inside another of said housing portions, said casing having an access opening for admitting said bridging contact portion of the controller; and a lock for closing said housing against access, comprising, a locking portion within said contact casing below the access opening thereof, and a lugged component fixed for movement with said controller through said access opening for rotation to underneath said locking portion with rotation of said bridging contact portion to closed position of the switch.

6. An electrical safety unit, comprising, a housing having relatively movable portions for admitting access to the inside thereof; an electrical switch inside said housing and including, a shaft through the wall of one of said housing portions and carrying an operating knob on the

outside and a switch terminal-closing portion inside for unitary longitudinal movement and rotation relative to the supporting housing portion, and terminals in a casing which is supported inside another of said housing portions, said casing having a shaped access opening through the casing thereof for admitting said terminal-closing portion at one rotative position thereof; and a lock for closing said housing portions against access including, a locking component fixed on said shaft and shaped to fit through said shaped opening at said one rotative position for subsequent rotation to position corresponding to terminal-connecting position of the terminal-closing portion, a corresponding locking portion within said casing for flanking said shaped locking component during rotation of the latter and affording an interlock with the same against rotation at its position corresponding to terminal-connecting position of said terminal-connecting portion, and a spring biasing said shaft longitudinally toward the outside of said housing and thus urging said shaped locking component retractibly into interlocking relation with the corresponding locking portion.

7. An electrical safety unit for transformer-operated gaseous electric discharge lighting systems, comprising, in combination, a closed housing having relatively movable portions for admitting access to the inside thereof; at least one lampholder within said housing for receiving transformer secondary current supply and the end of a gaseous electric discharge lamp, an opening in said housing of a size to receive one end of a gaseous electric discharge device for engagement with said holder; an electrical switch inside said housing and including, separate terminals for transformer primary circuit connection, and controller means respectively supported by said relatively movable housing portions for coming apart with the same, said controller means being permanently movably mounted in and extending through its housing portion so as to be operative from outside said housing for effecting electrical connection and disconnection of said switch terminals with the housing portions closed; and locking means for preventing access to the inside of said housing while said switch is closed.

8. Supporting means for gaseous electric discharge lamps comprising, spaced hollow supporting housings each having openings for receiving the corresponding end of a lamp, said housing being spaced apart a distance considerably less than the length of a lamp to be supported thereby so that a substantial portion of each end of the lamp extends into the respective housing when supported thereby, one of said housings having relatively movable portions for admitting access to the inside thereof; at least one lampholder within said housing for receiving transformer secondary current supply and the end of a gaseous electric discharge lamp and being spaced from its corresponding housing opening; an electrical switch inside said housing and including, separate terminals for transformer primary circuit connection, and controller means respectively supported by said relatively movable housing portions for coming apart with the same, said controller means being operative from outside said housing for effecting electrical connection and disconnection of said switch terminals with the housing portions closed; and locking means for preventing access to the inside of said housing while said switch is closed.

9. Supporting means for gaseous electric discharge lamps comprising, a hollow housing having at least one opening of a size to closely surround the glass envelope of a lamp with the adjacent end and terminal of the lamp completely received within the housing, said housing having relatively movable portions for admitting access to the inside thereof, an electrical switch and contact means for engaging a lamp terminal in said housing, said contact means being spaced from said housing opening, a circuit controller supported through the wall of one of said housing portions and having a non-circular shaped contact bridging portion inside said wall for rotation by operation from the outside, and said switch including spaced encased contacts supported inside another of said housing portions and having a noncircular shaped access opening into the casing thereof for admitting said contact bridging portion of the controller at one rotative position of the latter for subsequent rotation to switch closing position where said contact bridging portion of the controller cannot escape through said casing opening.

BENJAMIN C. WEBSTER.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
978,841	Buckton	Dec. 20, 1910
1,629,089	Beckmann	May 17, 1927
1,675,837	Beckmann	July 3, 1928
1,731,417	Hartwig	Oct. 15, 1929
2,042,680	Pontis	June 2, 1936
2,127,473	Sacco	Aug. 16, 1938
2,313,983	Yost	Mar. 16, 1943
2,401,555	De Reamer	June 4, 1946
2,406,104	Ranney	Aug. 20, 1946
2,430,336	Hathaway	Nov. 4, 1947
2,434,576	McShane et al.	Jan. 13, 1948
2,449,820	Seaman	Sept. 21, 1948

FOREIGN PATENTS

Number	Country	Date
244,851	Great Britain	Dec. 31, 1925
333,551	Great Britain	Aug. 11, 1930
393,721	Great Britain	June 15, 1933
597,173	Great Britain	Jan. 20, 1948