Aug. 3, 1943. R. A. MILLERMASTER ET AL 2,325,697

ELECTRIC SWITCH

Filed Oct. 30, 1941 4 Sheets-Sheet 1

Fig. 1

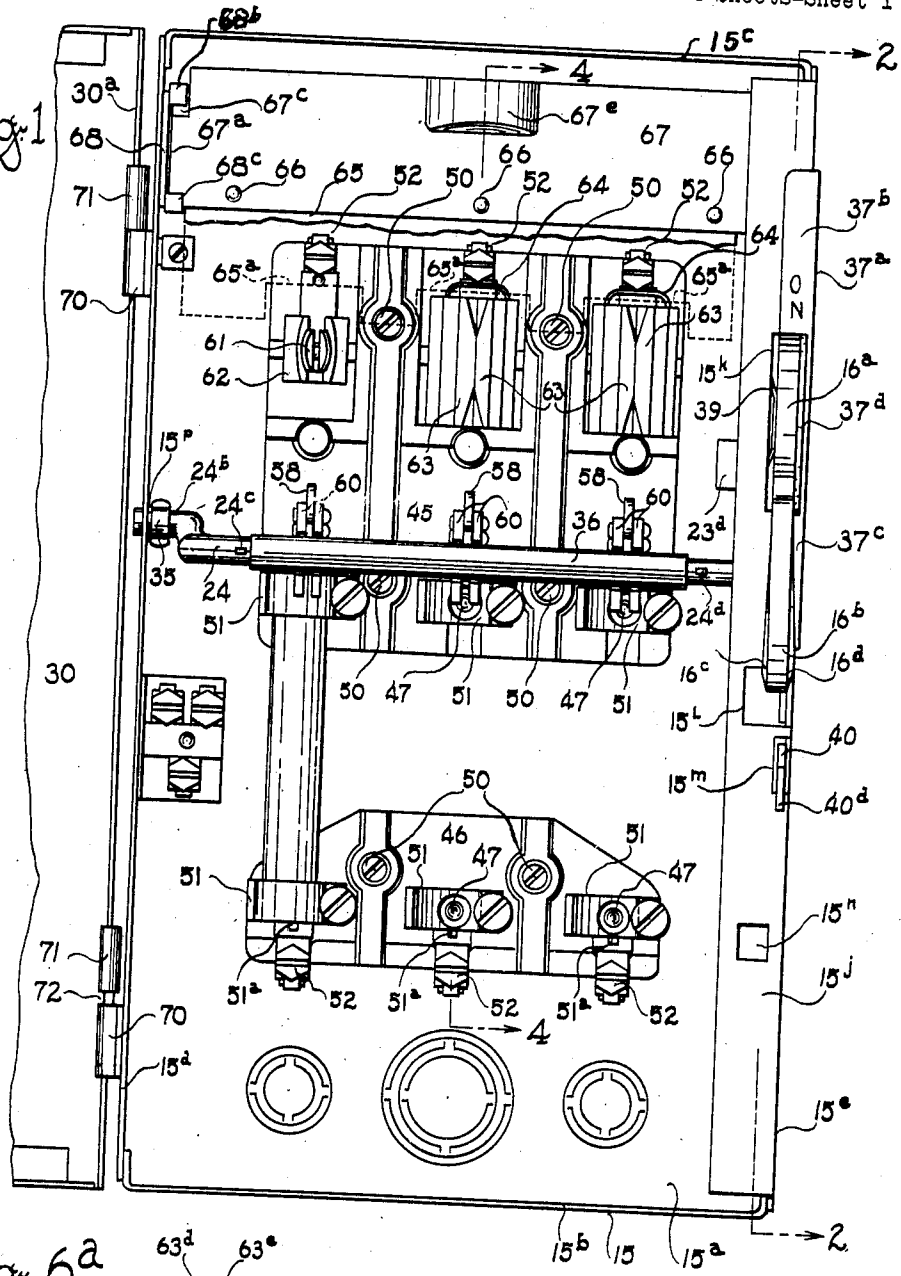
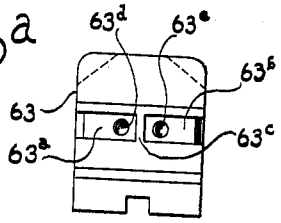


Fig. 6a



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Fig. 2

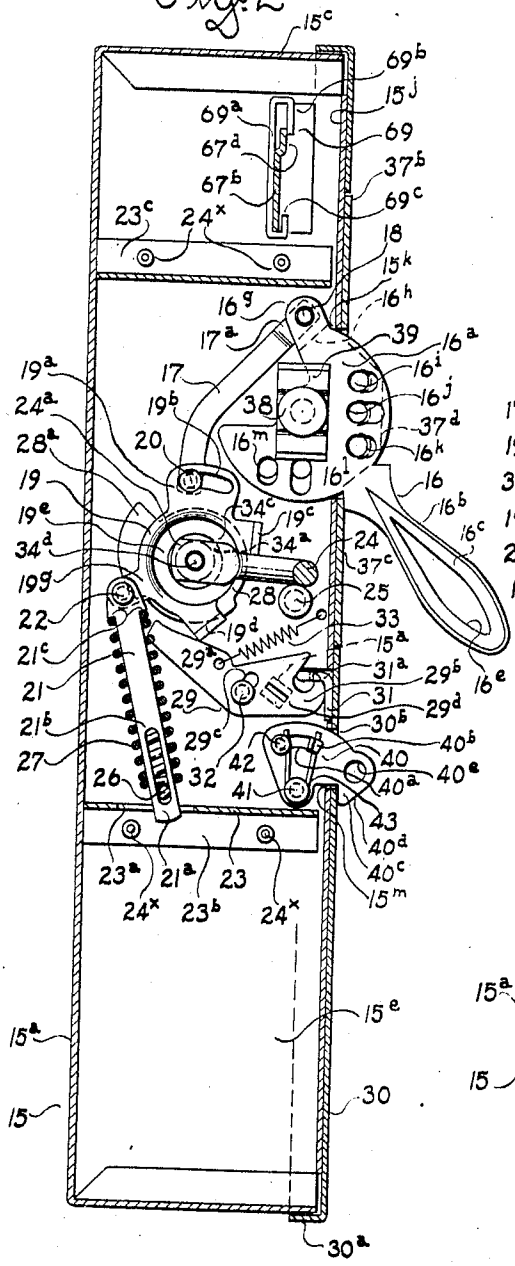
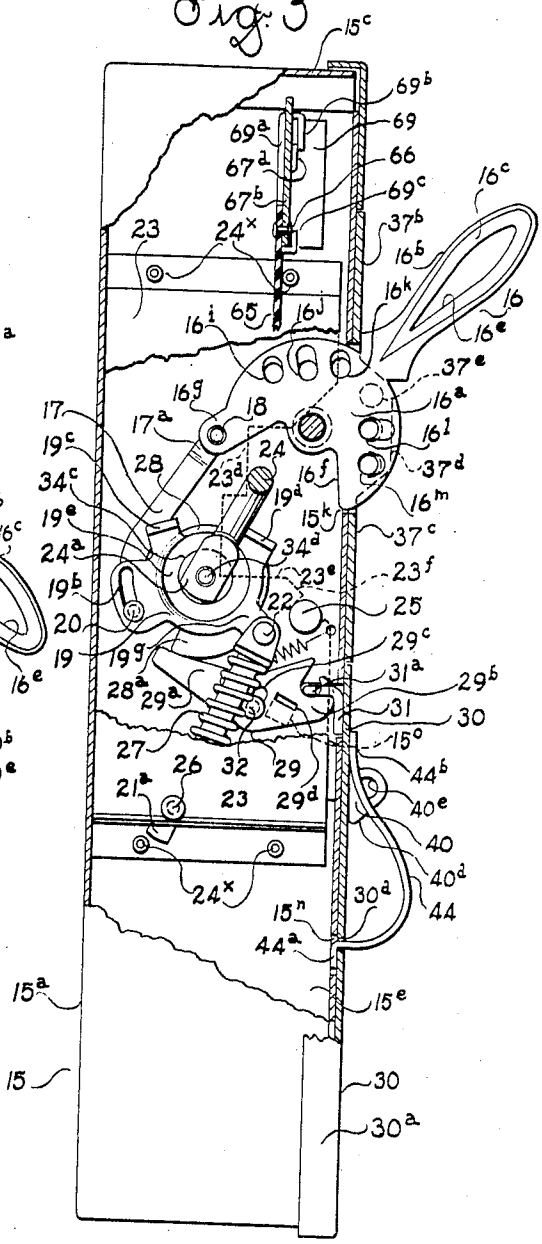


Fig. 3



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ELECTRIC SWITCH

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Fig. 4

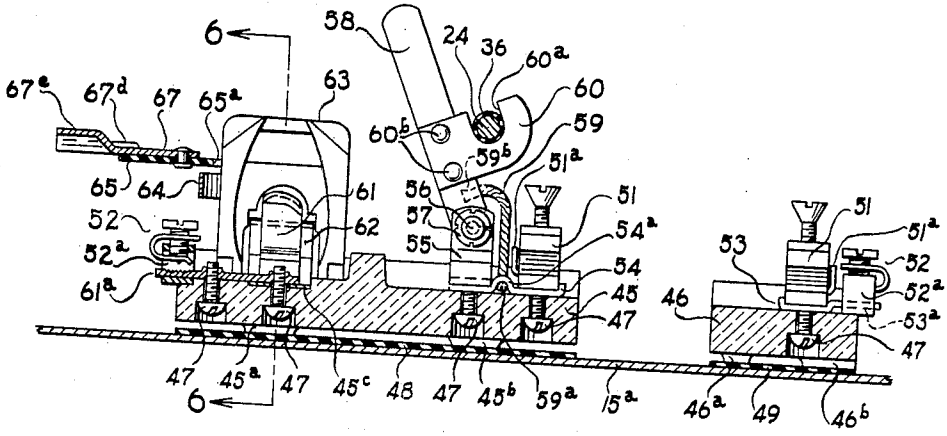


Fig. 5

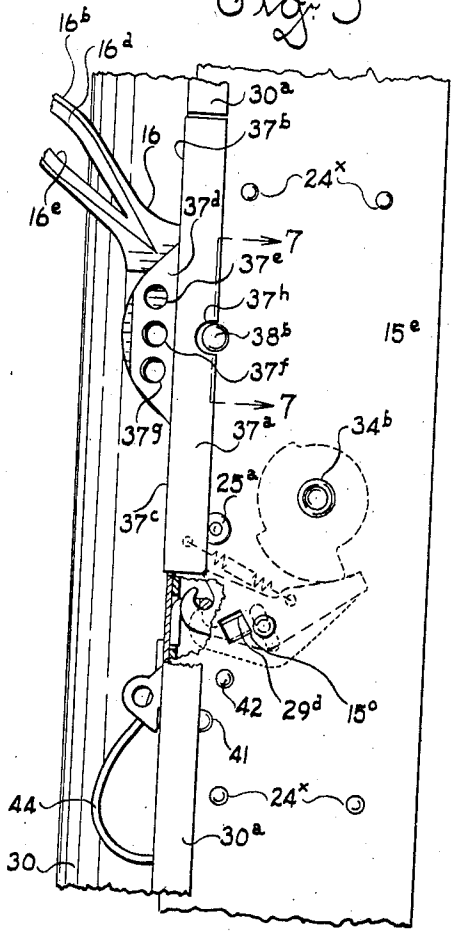


Fig. 6

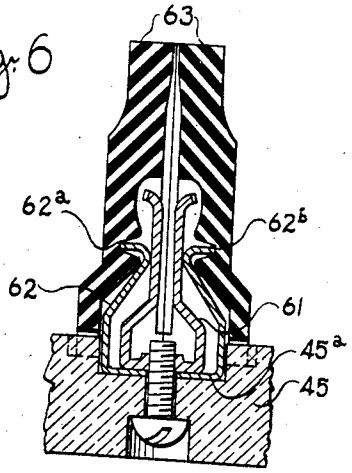
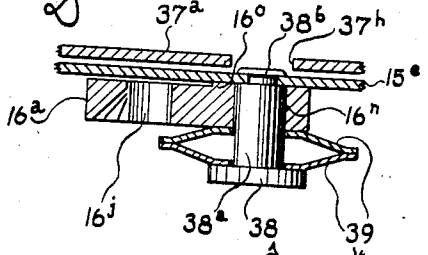


Fig. 7



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ELECTRIC SWITCH

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Fig. 8

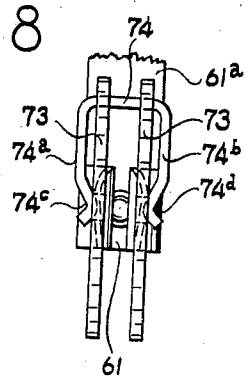


Fig. 9

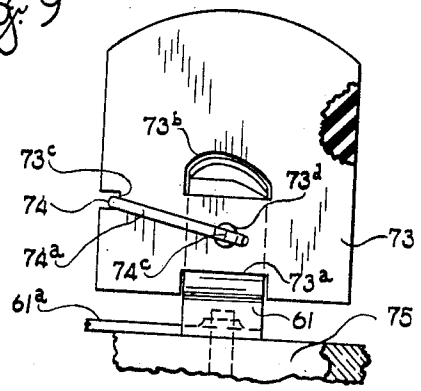


Fig. 10

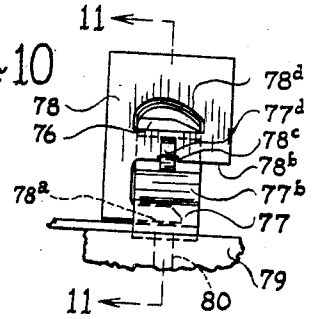


Fig. 11

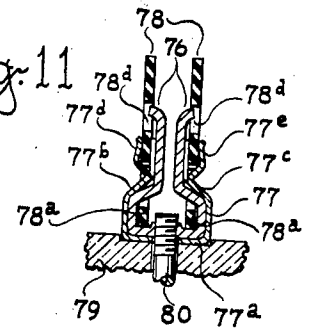


Fig. 12

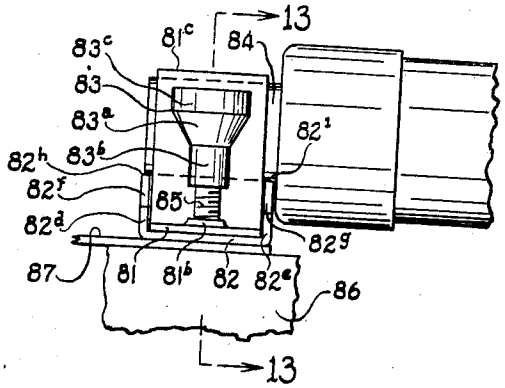


Fig. 13

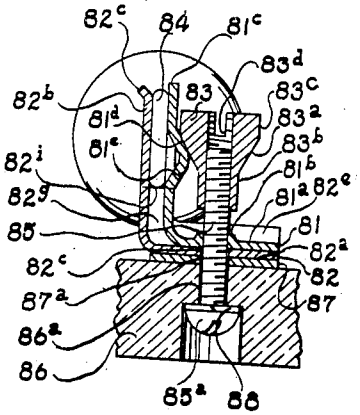
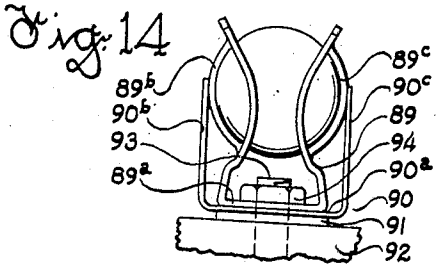


Fig. 14



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UNITED STATES PATENT OFFICE

2,325,697

ELECTRIC SWITCH

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Application October 30, 1941, Serial No. 417,106

8 Claims. (Cl. 200—50)

This invention relates to improvements in electric switches, and more particularly to improvements in electric switches, and more particularly to improvements in enclosed, snap make and break switches of the front-side operated type.

A primary object of the invention is to generally improve the details of construction and assembly of the parts and the operation of switches of the aforementioned character.

Another object is to provide a simple bail-type operating element for the movable contacts of the switch—said operating element and the snap-actuating means therefor being supported by the metal housing or casing within the boundaries of the opposite side walls thereof, independently of the stationary and movable contact elements of the switch—a cooperative interlocking connection being provided between the bail-type operating element and the movable contact elements of the switch.

Another object is to provide novel and simple means for insuring adequate current controlling capacity of the switch.

Another object is to provide a novel form of hinge connection between the switch casing and the cover therefor, whereby the latter may be readily assembled or disassembled with respect to the former.

Another object is to provide improved means affording an interlocking connection between the snap operating mechanism and the casing cover, whereby normally, the cover cannot be opened while the switch is in "on" position, and the switch cannot be moved to its "on" position while the cover is open.

Another object is to provide novel, simple and inconspicuous means for rendering said interlocking connection ineffective, to provide for proper examination and testing of the switch parts when in use.

Another object is to provide a switch operating lever having a novel, non-arcuate arrangement of the openings in each of a plurality of groups—the casing having an associated part provided with openings for cooperation with certain or all openings of each group selectively, to accommodate the hasps of one or more padlocks; the arrangement being such that the padlock hasps may be applied only in the full "on" or full "off" position of the switch mechanism.

Another object is to provide improved and simplified arc-snuffing means for association with switches of the aforementioned character, whereby the current controlling capacity thereof is substantially increased.

Another object is to provide improved and simplified fuse clamps adapted for use with switches of the aforementioned character.

Another object is to provide novel means for insulating the live parts of the switch when the latter is in "off" position with the cover open.

Another object is to provide novel and simple means for insuring a good electrical connection between each oscillatable switch contactor and the terminal member associated therewith.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate a preferred embodiment of the invention, and modifications of certain structural details thereof; it being understood that the embodiment illustrated is susceptible of modification in respect of other structural details thereof without departing from the spirit and scope of the invention as defined by the appended claims.

In the drawings, Figure 1 is a top plan view of a three-pole, front-side operated safety switch of the fused type; the switch being shown in its "off" position with a fragment of the open cover—one of the arc snuffers and two of the fuses being omitted, and the insulating shield being broken away, for clarity of illustration of other parts of the switch.

Fig. 2 is a sectional view, on the line 2—2 of Fig. 1, with the cover closed.

Fig. 3 is a sectional view similar to Fig. 2, but with certain additional parts shown in elevation, and with the switch in its "on" position.

Fig. 4 is a fragmentary sectional view, on the line 4—4 of Fig. 1.

Fig. 5 is a fragmentary side elevational view of the switch in its "on" position—portions of the cover and casing being broken away, and portions of the interlocking elements being shown in full lines and in dotted lines.

Fig. 6 is a fragmentary sectional view, on the line 6—6 of Fig. 4.

Fig. 6a is a side elevational view of one of the two like molded insulating arc-snuffing elements shown in Fig. 6.

Fig. 7 is a fragmentary sectional view, on the line 7—7 of Fig. 5.

Fig. 8 is a top plan view of a stationary switch contact having a pair of flat, punched insulating arc snuffing elements retained in assembled relationship thereto by a spring clip.

Fig. 9 is a side elevational view of the device shown in Fig. 8, showing the manner in which the same is supported independently of the insulating base.

Fig. 10 is a side elevational view of a further modified form of arc snuffing device—the same being adapted for use in conjunction with a stationary switch contact having a metal reinforcing or back-up member of special form associated therewith.

Fig. 11 is a vertical sectional view, on the line 11—11 of Fig. 10.

Fig. 12 is a side elevational view of a novel form of clamp or support for the blade type terminal of a cartridge fuse—portions of the insulating supporting base and the fuse being broken away.

Fig. 13 is a vertical sectional view, on the line 13—13 of Fig. 12, and

Fig. 14 is an end elevational view of a clip for a fuse having ferrule type terminals—a resilient metal reinforcing or backing member being associated therewith.

Referring first to Figs. 1 to 7, inclusive, wherein is illustrated a switch of the aforementioned character having a rating of 60 amperes at 575 volts; Figs. 1 to 5 and 6a are drawn to one-half of full scale, and Figs. 6 and 7 are drawn to full scale. In these figures the numeral 15 designates the body portion of a sheet metal casing—said body portion having a bottom wall 15a, opposite end walls 15b and 15c, and opposite side walls 15d and 15e—certain or all of said walls being provided with suitable knockouts, as shown, for example, at 15g, 15h and 15i in said bottom wall 15a (Fig. 1). Said body portion 15 is preferably formed from a single punched sheet metal piece—the end walls 15b and 15c having inwardly bent flanges formed thereon as shown, against which the inner surfaces of the respective side walls 15d and 15e are adapted to abut—said side walls being spot-welded or otherwise rigidly and permanently attached to said end wall flanges.

Formed integrally with the side wall 15e and bent inwardly at a right angle thereto is a flange 15j—said flange having a plurality of openings, 15k, 15l, 15m and 15n, formed therein as an incident to blanking of the sheet metal member from which the body portion 15 is produced.

Opening 15k is of elongated rectangular contour, to accommodate and to provide oscillatory clearance for the flat, plate-like portion 16a, of arcuate contour, of a die-cast metal lever 16. The handle or hand-grip portion 16b of said lever is preferably of increasing thickness toward the outer end thereof, as shown at 16c and 16d in Fig. 1, to facilitate gripping thereof—said portions 16c and 16d being of convex form. Portion 16b is formed with an opening or cut-away portion 16e, to minimize the weight and to improve the appearance thereof, while also improving the functioning thereof as a hand-grip. Portion 16a of said lever is inserted downwardly through opening 15k—said portion having a segmental notch 16f formed therein to permit such downward insertion, to minimize the total weight or mass of the lever, and to provide proper clearance between the same and a lever 17 (see Fig. 2).

Portion 16a of said lever is provided with a perforated extension 16g, of reduced thickness as indicated in dotted lines at 16h in Fig. 2—the perforation in said extension being adapted to have alined therewith the perforation (not shown) in the laterally offset end portion 17a of the aforementioned lever 17; a headed rivet or pin 18 penetrating said perforations and having its shank end upset to pivotally connect said parts to each other. The other end of lever 17 has a pivotal lost motion driving connection with a punched and stamped sheet metal member 19—as by means of a pin 20 whose head overlies a portion of the extension 19a formed on member 19—the shank of which pin penetrates the arcuate slot 19b in said extension and is rigidly attached to said end of lever 17.

Member 19 is provided with an arm or extension 19g to which is pivotally connected one end of a plunger 21, as by means of a rivet or pin 22. The other end 21a of plunger 21 is afforded sliding and oscillatory clearance by a slot 23a (Fig. 2) formed in a sheet metal housing member 23 which substantially encloses all of the snap actuating elements of the switch. Member 23 has flanges 23b and 23c at opposite ends thereof, which are rigidly attached to side wall 15e, as by means of rivets 24x. As shown in Figs. 2 and 3, member 23 extends from the bottom wall 15a to a line spaced inwardly only slightly from the upper edge of said side wall 15e.

Member 23 is provided in its upper edge intermediate the length thereof with an approximately rectangular notch, indicated in dotted lines at 23e in Fig. 3, to provide clearance for that end portion of a bail member 24 which is associated with the snap actuating mechanism; member 23 having a lug 23d (Figs. 1 and 3) formed integrally with the lower edge of said notch 23e to limit oscillatory movement of bail 24 in a direction to effect closure of the switch. Oscillatory movement of said bail member 24 in the reverse direction is limited by a pin 25 (Figs. 2 and 3) which has one end thereof riveted to the side wall 15e, as shown at 25a in Fig. 5—the other end of said pin being adapted to seat in an opening or notch formed in member 23 adjacent to the upper edge thereof—said upper edge being cut away, as indicated in dotted lines at 23f in Fig. 3, to permit abutment of bail member 24 against said pin 25.

Plunger 21 is provided with a slot 21b which is adapted to accommodate the shank of a pin 26 which penetrates alined openings in side wall 15e and member 23 and is headed at each end thereof to retain the same in position. Pin 26 thus acts to permit both reciprocatory and oscillatory movement of plunger 21 with respect to slot 23a (Fig. 2).

Plunger 21 is surrounded by a relatively heavy compression spring 27, one end of which abuts pin 26 and the other end of which abuts shoulders 21c formed on said plunger; wherefore spring 27 acts to effect snap movement of member 19 to one or the other of its extreme positions, respectively shown in Figs. 2 and 3. Member 19 is provided with a pair of angularly spaced integral lugs 19c and 19d, bent inwardly at substantially right angles to the plane of the major portion thereof, and adapted for alternate engagement with bail member 24 to correspondingly bias the latter to one or the other of its extreme positions (Figs. 2 and 3).

Member 19 has an inwardly offset, flat, circular portion 19e which is spot-welded or otherwise rigidly secured, in a predetermined rotary or angular relationship, to a flat sheet metal cam member 28, the latter having a main cam portion 28a adapted for cooperation with the tail portion 29a of a latch member 29 to normally provide for locking the casing cover 30 in closed position when the switch is closed. Cover 30 has spot welded or otherwise rigidly attached to the inner surface thereof a sheet metal member 31—the latter having a right angled inwardly extending perforated lug portion 31a for cooperation with the latch end 29b of member 29, in a well known manner.

Member 29 is pivotally attached to the side wall 15e, as by means of a headed rivet or pin 32, the shank of which is accommodated by a slot 29c, as shown in Figs. 2 and 3. A coiled tension spring 33 has one end attached to side wall 15e and the other end attached to member 29, in the manner illustrated in Figs. 2 and 3, whereby member 29 is biased to the position illustrated in Fig. 2 by closure of cover 30, when the switch is open; whereas the cam portion 28a of member 28 acts upon member 29, and against the bias of spring 33, to effect locking of cover 30 in closed position upon closure of the switch, as shown in Fig. 3.

In order to provide for manual release of the cover interlock afforded by member 29 when the switch is closed, said member is preferably provided with a substantially rectangular opening or slot 29d (adapted to accommodate the end of a screwdriver or similar tool), the side wall 15e being provided with a registering opening or slot 15o of substantially the same length as slot 29d but of substantially greater width than the latter, as shown in full lines in Fig. 5 and in dotted lines in Figs. 2 and 3. With reference to Fig. 3, it is to be understood that upon insertion of a screwdriver into slot 29d from the exterior of the casing the screwdriver may be rotated or pressed downwardly to effect bodily lateral and downward movement of member 29 to effect disengagement of hook portion 29b of member 29 from lug 31a—the point of engagement of tail portion 29a with cam portion 28a forming a fulcrum for such movement, and the slot 29c being arranged at the proper angle to permit such movement of member 29 relatively to pivot pin 32.

The rigidly connected members 19 and 28 are pivotally supported as by means of a metal member having an intermediate shank portion, represented by the circular dotted line 34a in Fig. 2, which freely penetrates alined openings in said members, and an adjacent end shank portion of reduced diameter which penetrates an opening of corresponding size in side wall 15e and is upset over the outer surface of the latter, as shown at 34b in Fig. 5. Said pivotal supporting member is provided with a disk-like head or flange 34c (Figs. 2 and 3) which overlies a part of the flat portion 19e of member 19 to retain the latter and member 28 in pivotally assembled relation to side wall 15e. Located centrally of head 34c, and formed integrally therewith, is a substantially cylindrical stud portion 34d, which is adapted to act as a pivotal support for the flattened and perforated end portion 24a of bail member 24 (Figs. 2 and 3).

In assembling bail member 24 with respect to the main portion 15 of the casing, the straight left-hand end portion 24b thereof is extended or projected outwardly a substantial distance beyond the side wall 15d through a suitable bearing opening 15p (Fig. 1) provided in the latter. This permits the pivot opening provided in the other, or flattened, end 24a of the bail member to be brought into registry with the stud portion 34d (Figs. 2 and 3), whereupon the bail member may be moved bodily toward the right (Fig. 1) to provide proper pivotal engagement of bail end 24a with stud 34d while maintaining proper pivotal engagement of the end 24b thereof with the pivot opening 15p in side wall 15d. In practice a resilient sheet metal clip 35 (Fig. 1) of greater than semicircular length or area is then snapped onto the end portion 24b of said bail member, interiorly of the casing, to retain the right-hand end 24a in pivotal engagement with said stud 34d.

Prior to forming of bail member 24 a preformed seamless tube 36 (Fig. 1) of suitable insulating material, such as impregnated and wound sheet fiber, is loosely slid thereonto—said bail member being then "pinched," or otherwise slightly deformed, as shown at 24c and 24d, to prevent substantial endwise displacement of tube 36 in either direction. As hereinafter described in detail, tube 6 is adapted for cooperative driving engagement with the walls of open slots formed in insulating members which are in turn rigidly attached to the movable contactors of the switch.

As best illustrated in Figs. 1 and 5, there is rigidly attached to the side wall 15e, as by spot welding, a metal member having a portion 37a corresponding in width to the width of the flange 30a of cover member 30—said member having integral portions 37b and 37c bent inwardly at a right angle to portion 37a, and an integral intermediate portion 37d slightly offset inwardly from and extending upwardly in a plane parallel to said portion 37a. Portion 37d (Fig. 5) is provided with three equally spaced circular openings 37e, 37f and 37g, which are arranged in a straight line as shown. When lever 16 is in the position shown in Fig. 2 (corresponding to "off" positioning of the switch mechanism) the openings 16i, 16j and 16k in portion 16a of said lever are respectively adapted to register with said openings 37e, 37f and 37g in portion 37d (Fig. 5); whereby (as indicated in Fig. 2) from one to three workmen or operators may apply and lock the hasps of their individual padlocks, to positively lock the switch against closure pending removal of all of said padlocks. As aforementioned, the openings 16i, 16j and 16k are arranged in a straight line to jointly aline with the openings 37e, 37f and 37g only when lever 16 is in its lower extreme position shown in Fig. 2.

Portion 16a of lever 16 is further provided with a pair of openings 16l and 16m, which are likewise arranged in a straight line for cooperation jointly with the respective openings 37f, 37g (Fig. 5) when lever 16 is in its upper extreme position (Figs. 3 and 5) corresponding to "on" position of the switch mechanism. With particular reference to Fig. 3, it should be noted that the arrangement of parts is preferably such that handle portion 16b may be moved downwardly to a sufficient degree to permit the opening 16k to register with opening 37e, without in anywise affecting the full "on" positioning of the switch mechanism. This result may be attained by reason of the lost motion afforded between the walls of the slot 19b in member 19 and the pin 20 attached to lever 17. From the foregoing it is apparent that a single operator may apply a padlock to retain the switch in "on" position pending removal of such padlock—while insuring against simultaneous locking of the switch in "on" position by any other operator. The advantages of this novel arrangement, from the viewpoint of safety, are believed to be apparent.

Lever 16 is pivotally supported upon the inner surface of casing wall 15e as by means of a pin the head of which is designated by numeral 38 (Figs. 2 and 7); said pin having a relatively long intermediate shank portion 38a of relatively large diameter which is adapted to freely penetrate a correspondingly shaped opening 16n (Fig. 7) in portion 16a of said lever; said pin also having a reduced end or shank portion which penetrates an opening of corresponding size in wall 15e, and is upset over the outer surface of the latter, as shown at 38b in Fig. 7. As shown in Figs. 5 and 7 the portion 37a of the aforementioned metal

member is provided with a notch 37h which provides access to said reduced shank end of pin 38, for upsetting thereof, after portion 37a of said member has been attached to the casing. Also, as best illustrated in Fig. 7, a pair of like bowed spring metal strip members 39, 39 are arranged with their end portions engaged—the intermediate portions thereof being perforated to accommodate the shank portion 38a of pin 38. Said springs are jointly interposed between the head of pin 38 and the portion 16a of lever 16 under a predetermined degree of compression—whereby the central raised portion or projection 16c (Fig. 7) is biased into bearing engagement with the inner surface of wall 15e. The upper edges of springs 39 are located adjacent to the lower surface of flange 15j (see Fig. 2) to prevent rotary displacement of the former. As shown in Figs. 1 to 3, the space between portions 37b and 37c of the aforementioned metal member cooperates with the opening 15k in flange 15j to afford oscillatory clearance for portion 16a of lever 16.

A manually releasable cover latch 40 is pivoted to side wall 15e as by means of a pin 41 (Figs. 2 and 5) riveted to the latter. Member 40 is provided with an arcuate slot 40a (Fig. 2) which accommodates the shank of a headed rivet 42 attached to wall 15e; the lower end of said slot cooperating with pin 41 to limit the degree of upward movement of latch member 40. Member 40 is provided at the other end of slot 40a with an integral lug or hook 40b (Fig. 2) which is adapted to be engaged by one arm of a coiled torsion or hairpin-type spring 43; said spring being provided with at least one coil intermediate its ends and surrounding pin 41. The other arm of spring 43 is normally engaged under a predetermined degree of stress with the pin 42—wherefore latch member 40 is biased to its normal or latching position shown in Figs. 1 to 3. As shown, member 40 has an end portion 40c (Figs. 1 and 2) adapted to project outwardly through opening 15m and the alined opening 30b in cover 30 and overlying the outer surface of the latter to retain the same in closed position.

Cover 30 is provided with a finger-hold or handle formed of a metal strip 44 (Figs. 3 and 5) one end of which is bent, as shown at 44a in Fig. 3, for insertion through an opening 30d in said cover and adapted to lie flatwise against the inner surface of said cover—being spot welded or otherwise rigidly attached thereto. The other end 44b (Fig. 3) of member 44 is spot welded or otherwise rigidly attached to the outer surface of cover 30 at a point adjacent to but inwardly of the opening 30b (Fig. 2). The opening 15n in flange 15j (Figs. 1 and 3) is adapted to accommodate said end 44a of member 44. As best illustrated in Fig. 3, handle 44 and latch 40 are so arranged as to facilitate opening of cover 30 by one hand; the index finger of the right hand being insertable inwardly through the loop formed by member 44, and the thumb of the same hand being free to effect pivoted movement of latch 40 to a position wherein the same permits free outward or opening movement of cover 30. Latch 40 is provided with the usual cam surface 40d to facilitate closing movement of cover 30; and with an opening 40e to accommodate the hasp of a padlock to prevent cover releasing movement thereof.

The switch disclosed herein is of the fused type (see Figs. 1 and 5); and to minimize the cost and weight thereof we prefer to employ a relatively large molded insulating base 45, adapted to support the switch proper and one group of fuse clamps, and a relatively small molded insulating base 46 properly alined therewith and spaced therefrom to support the other group of fuse clamps and their associated wiring terminals. It is to be understood that if desired a single insulating base of proper size may be employed. The various metal parts of the switch structure and the fuse clamps are attached to bases 45 and 46 by screws or bolts 47 the heads of which are located in countersunk recesses in the lower surfaces of said bases. Said bases are each provided with a multiplicity of feet or projections (certain of which are shown at 45a, 45b and 46a, 46b in Fig. 4) to space the body portions of said bases a substantial distance upwardly from the bottom wall 15a of the casing. In practice relatively thin flat, punched insulating plates 48 and 49 are interposed between said insulating bases and said bottom wall 15a, to insure against accidental grounding of any of the live parts of the switch in the event of loosening of any of the screws 47. If desired, the heads of screws 47 may be waxed in, to provide an additional safeguard. As shown in Fig. 1 the bases 45 and 46 are removably attached to bottom wall 15a, as by means of screws 50—the shanks of which penetrate openings in the bases, alined with the feet 45a, 45b and 46a, respectively, and corresponding openings in plates 48 and 49. Said screws 50 take into tapped openings (not shown) in bottom wall 15a.

The fuse clamps 51 illustrated in Figs. 1 and 4 are preferably of the character disclosed in the patent of R. A. Millermaster, No. 2,194,667, dated March 26, 1940—to which reference may be had for a detailed description of the construction and operation thereof—said fuse clamps being particularly adapted for use in conjunction with cartridge fuses having terminals of the ferrule type.

The solderless wiring terminals 52 shown in Figs. 1 and 4 are of the character disclosed in the patent of R. A. Millermaster, No. 2,193,202, dated March 12, 1940—to which reference may be had for a detailed description of the construction and operation thereof. As best illustrated in Fig. 4, the screws 47 associated with base 46 each freely penetrate an opening (not shown) in a bus member 53 of any suitable metal, such as copper, and take into a tapped opening in the base portion of the fuse clamp 51 (see Fig. 1); the stop members 51a being spot welded or otherwise rigidly secured to said fuse clamps 51. If desired, the stop members (corresponding to 51a hereof) may be removably associated with clamps 51 in a manner similar to that disclosed in said Patent No. 2,194,667—in which event the screws 47 will preferably freely penetrate passages formed in clamps 51 and take into nuts (not shown) positioned above the washer portions of the stop members. As shown in Fig. 4 hereof, each bus member 53 has an upwardly offset portion 53a of reduced width intermediate its length to provide sets of spaced shoulders to accommodate and prevent endwise movement of the tubular element 52a of the associated wiring terminal device.

As shown in Fig. 4, each fuse clamp 51 on base 45 is secured in position by its associated screw 47, and in good electrically conducting relationship to one end portion of a bus member 54 of copper or the like; a second screw 47 being adapted to secure to base 45, in good electrically conducting relationship to the other end of bus member 54, a metal member 55, which acts in

conjunction with a pivot pin 56 and a spring washer 57, to provide a pivotal support for one of the three movable contactors 58 of the switch. Also as shown in Fig. 4 each bus member is bent or deformed at a point intermediate its ends to provide a downwardly opening groove 54a which is adapted to accommodate one end 59a of a multiple strand flexible conductor wire or pigtail 59—said end 59a being spot welded, or otherwise rigidly and permanently secured within groove 54a. The other end of wire 59 is spot welded or otherwise rigidly secured to the associated movable contactor 58 as indicated in dotted lines at 59b.

Each contactor 58 as shown has attached thereto on opposite sides thereof a pair of like flat, punched insulating elements 60, 60, as by means of a pair of rivets 60b, 60b. It is to be understood that for switches of smaller size and lower current controlling capacity only one element corresponding to element 60 need be attached to each contactor—and only one of the rivets 60b need be employed, if the insulating plate is provided with one or more suitable openings, and if each contactor is provided with a corresponding number of extruded bosses or projections to interlock with such openings.

Each plate 60 is provided with a forwardly opening notch 60a of U-shape or contour—said notches being jointly adapted for cooperation with the insulating tube 36 and the bail member 24 surrounded by the latter. The arc of movement of bail 24 is so related to the arc of movement of plates 60 as to insure proper driving engagement of the former with the latter in all positions.

As best illustrated in Figs. 4 and 6, each stationary contact 61 is of the well-known constricted U-shape in transverse cross section (Fig. 6) to accommodate the free end of its associated switch contactor 58; the contact having formed integrally therewith the bus portion 61a (Fig. 4) to accommodate the solderless wiring terminal device 52 aforedescribed—and a pair of screws 47 being employed, as shown to retain each contact and bus portion in assembled position. Interposed between the lower end of each contact 61 and the bottom wall of a recess 45c in the upper surface of base 45 is a combined reinforcing and interlocking member 62, likewise formed to constricted U-shape (Fig. 6) from suitable resilient sheet metal, such as steel. The arms of each member 62 are so shaped that the upper end portions thereof normally engage the arms of their associated contact 61 with a predetermined degree of pressure, as an incident to assembly of said parts with respect to the base. The resiliency of the arms of member 62 acts to assist in exerting the desired degree of pressure of the arms of the contact 61 against a contactor 58 inserted therebetween, and further insure return of the arms of the contact to the desired normal position upon withdrawal of the contactor. The arms of each member 62 are further provided with outwardly extending upper end portions 62a and 62b (Fig. 6) which serve as interlocking connections between the same and a pair of like molded insulating arc-snuffing members 63, 63 (Figs. 4, 6 and 6a).

Members 63, 63 are in general quite similar both structurally and functionally to the corresponding element disclosed in the patent to R. A. Millermaster, No. 2,090,764, dated August 24, 1937—to which reference may be had. Members 63, 63 act to substantially fully enclose their associated stationary contact, while permitting snap movement of the contactor 58 into and out of engagement with the latter. As shown in Fig. 6a each member 63 is provided with a pair of endwise alined groove 63a and 63b extending inwardly from opposite edges thereof to a centrally located ridge or abutment 63c, which limits the degree of telescoping onto a pair of said members 63 of a sheet metal spring clip 64 (Figs. 1 and 4), said clip acting to retain members 63 in assembled relation to their respective contact while permitting separation of said members by the contactor during circuit closing movement of the latter. Grooves 63a and 63b are provided at points adjacent to their inner ends with approximately hemispherical recesses 63d and 63e (Fig. 6a) either of which is adapted to accommodate a correspondingly shaped boss (not shown) formed on the inner surface of each arm of clip 64. With the arrangement herein illustrated the clips 64 may be relatively shorter than those employed in the device of said Patent No. 2,090,764; and, in addition, the connecting portion of each U-shaped clip is spaced a substantial distance rearwardly of the associated pair of members 63 (see Figs. 1 and 4) to insure proper self adjusting movement of the latter by the contactor without any possibility of positive interference or resistance by any portion of the clip 64.

It is to be understood that the line terminals of the switch are those shown at the upper end of Fig. 1 and at the left-hand end of Fig. 4; and, for cooperation with the arc-snuffing insulating elements 63, we prefer to provide a removable insulating cover or plate 65—thus affording a substantially dead-front arrangement for the live parts when the switch is "off" with the cover open. The forward edge of plate 65 is preferably of the contour best illustrated in dotted lines in Fig. 1—the same being provided with three notches 65a to accommodate the several arc-snuffing devices aforedescribed.

Plate 65 is attached, as by means of a plurality of rivets 66, to a punched and stamped sheet metal plate 67—the latter having opposite end portions 67a and 67b of reduced width which are adapted to seat upon the horizontal or shelf portions (see 69a, Figs. 2 and 3) of a pair of sheet metal brackets 68 and 69; the vertical portions of which brackets are spot welded or otherwise rigidly secured to the respective side walls 15d and 15e. The shelf portions of brackets 68 and 69 are respectively provided with opposed bent or hooked ends 68b, 68c and 69b, 69c (Figs. 1 to 3)—the ends 68b and 69b being relatively higher than hooks 68c and 69c. Plate ends 67a and 67b are respectively provided with partially sheared and upwardly offset lugs 67c and 67d, which fit rather closely beneath the hooks 68c and 69c (as illustrated in Figs. 2 and 3).

Plate 67 is assembled with respect to said brackets by tilting the same, to permit free sliding movement of lugs 67c and 67d beneath hooks 68b and 69b, whereupon the plate ends may be seated upon the horizontal portions or shelves (see 69a, Figs. 2 and 3), and said plate ends may then be slid in the opposite direction, to fit within hooks 68c and 69c (see Figs. 2 and 3). The insulating plate 65 will thus be held in proper covering relationship to the line terminals of the switch. In removing plate 67 (with its attaching insulating plate 65) from said supporting brackets, the former is first slid upwardly (Figs. 2 and 3) to clear hooks 68c and 69c and then tilted outwardly and withdrawn from engagement with hooks 68b and 69b, as will be obvious.

The cover 30 is removably hinged to casing 15 in the novel manner illustrated in Fig. 1. Thus in practice a pair of sheet metal hinge members 70, 70 are spot welded or otherwise rigidly attached to the outer surface of the side wall 15d of the casing at points such as those illustrated; and a second pair of sheet metal hinge members 71, 71 are spot welded or otherwise rigidly attached to the inner surface of the flange 30a of cover member 30. All of the four hinge members may be of identical form—but the hinge members 70, 70 each have rigidly secured therewithin (as by spot welding, brazing or the like) and projecting upwardly therefrom a hinge pintle—one of which is shown at 72. The hinge pintles preferably project like distances upwardly from members 70, 70—but, due to the relative positions of hinge members 70, 70 and 71, 71, the upper hinge member 71 will first be brought downwardly to telescope onto and slightly engage the pintle carried by the upper hinge member 70—whereupon the lower hinge member 71 may be readily alined manually with the hinge pintle 72 carried by the lower hinge member 70. The advantages of the hinging mechanism for the removable cover 30 will be at once apparent to those skilled in this art—since the inherent difficulty of manually effecting simultaneous alinement of a plurality of cover hinges with a corresponding number of hinge pintles is well known—and is especially troublesome where a casing cover of relatively large size or weight is involved. A similar result might be obtained by spacing both hinge members 70, 70 so as to be engaged by the respective members 71, 71 when the cover is assembled to the casing—provided that one of the hinge pintles (preferably the upper one) is made to project upwardly a substantially greater distance than the lower pintle. It is believed, however, that the appearance of the cover hinging arrangement illustrated is somewhat better than that last described, in which the end portion of one of the hinge pintles will be exposed.

As shown in Figs. 1 and 4, plate 67 may have a raised portion 67e formed thereon by a stamping operation—said portion 67e serving as a finger abutment to facilitate sliding of plate 67 within brackets 68 and 69 toward the end wall 15c of the casing, and subsequent tilting of said plate as aforedescribed to permit removal thereof from said brackets.

The switch aforedescribed preferably embodies as a whole the ornamental design disclosed and claimed in Design Patent No. 126,465, granted April 8, 1941, to Millermaster and Stevens.

In Figs. 8 and 9 there is illustrated a simpler and less expensive arc-snuffing device which is adapted for use in conjunction with a combined stationary switch contact 61 and integral bus portion 61a like that aforedescribed. The device comprises essentially a pair of like flat, punched insulating plates 73, 73, of impregnated fiber or the like, preferably having high heat resisting characteristics. Each plate is preferably provided at its lower edge with a substantially rectangular notch 73a (Fig. 9) to accommodate the upwardly and inwardly angled intermediate portion of one arm of the contact, and with an approximately semi-elliptical opening 73b to accommodate the flared upper end portion of such arm of the contact. Each plate 73 is also provided, at the side thereof remote from the hinge point of the switch contactor (not shown in Figs. 8 and 9), with a rectangular notch 73c, and with a substantially circular opening 73d located between the aforementioned notch 73a and opening 73b.

A substantially U-shaped resilient metal clip, preferably formed of spring wire, has its connecting portion 74 positioned within the notches 73c of the pair of plates 73—and the arms 74a and 74b extend downwardly at a slight angle to overlie the openings 73d in the respective plates 73. The ends of said arms are provided with substantially V-shaped inward bends, as shown at 74c and 74d for resilient interlocking engagement with the walls of openings 73d, to yieldably and removably retain the arc-snuffing elements in assembled relation to the contact; it being noted that clip 74 does not directly engage the stationary contact.

As will be noted, a metal reinforcing clip like the clip 62 heretofore described is not employed in the device of Figs. 8 and 9. However, as will be apparent, the wire clip 74 inherently has a predetermined reinforcing effect upon the arms of the contact 61, by reason of the pressure applied by the former upon the plates 73. As will be apparent from consideration of Figs. 8 and 9, the plates 73 afford a definite cooling and snuffing effect upon any arcs drawn as an incident to separation of the contactor from the contact. The numeral 75 in Fig. 9 designates a fragment of a suitable insulating supporting base for the switch parts.

In Figs. 10 and 11 there is disclosed a further modified form of arc-snuffing device, wherein a stationary contact member 76 (which may be like the contact 61 aforedescribed) has associated therewith a reinforcing or backing member 77 of any suitable resilient metal, such as steel. Member 77 has a connecting portion 77a underlying contact 76 and upwardly extending arms 77b and 77c which quite closely conform with the shape or contour of the contact arms throughout the major portion of the length of the latter, as shown in dotted lines in Fig. 10 and in full lines in Fig. 11. Each arm 77b and 77c is provided intermediate the width thereof with a pair of parallel shear lines extending inwardly from the upper edge thereof to provide resilient tongues which are bent to extend laterally and then upwardly, in the manner best illustrated in Fig. 11.

A pair of like flat, punched insulating plates 78, 78 (of the form best illustrated in Fig. 10) are attachable by a simple yieldable interlocking connection thereof with contact 76 and member 77. As will be apparent from consideration of Fig. 10, each plate 78 may be placed in assembled position by inserting the lower or hooked end 78a thereof within the free space provided at the lower end of each arm of the contact; the lower edge 78b of the upper rectangular portion of the plate being then pressed downwardly between the respective tongue 77d or 77e and the upper end of the respective arm 77b or 77c of member 77—each edge 78b being provided with a small downwardly opening rectangular notch 78c to facilitate proper assembling movement of the plate, and to assist in preventing subsequent accidental displacement thereof. Each plate 78 is also provided with a substantially semi-elliptical opening 78d to accommodate the outwardly flared upper end of its associated contact arm, and to further assist in preventing accidental displacement of said plate, as will be apparent from consideration of Figs. 10 and 11. Contact 76 may

be attached to a suitable insulating base 79, as by means of a screw or bolt 80. Plates 78 may be readily removed from assembled position for purposes of inspection or replacement, as will be apparent.

In Figs. 12 and 13 there is illustrated a novel and simple form of fuse clamp adapted for use in conjunction with fuses having blade-type terminals. Said clamp comprises a pair of elements 81 and 82 respectively stamped from blanks punched from copper strips of different widths. The horizontal portion 81a of element 81 is provided with an upwardly extruded and tapped opening 81b—the substantially vertical portion 81c of said element having a pair of upper relatively widely spaced parallel vertical slits and a pair of lower relatively narrowly spaced parallel vertical slits, with transverse slits connecting the former with the latter. The material between said pairs of slits is then bent outwardly, as shown in Fig. 13 to provide a relatively wide downwardly angled cam surface 81d and a relatively narrow upwardly angled strut or reinforcing portion 81e formed integrally therewith. Said cam surface 81d is preferably of concave form (not shown) in horizontal cross section, whereby the same is adapted to closely fit and guide the adjacent portion of a conical cam surface 83a formed upon an operating nut 83 of the form illustrated.

Element 82 has a horizontal portion 82a underlying portion 81a of element 81 and projecting laterally therebeyond to a predetermined point, where it merges with the vertical portion 82b, which extends upwardly in substantially parallel relation to portion 81c—the upper end of portion 82b being preferably flared, as shown at 82c to facilitate insertion of the blade-type terminal 84 of a fuse between portions 81c and 82b. Said horizontal portion 82a is preferably provided with an opening 82c (Fig. 13) affording clearance for the shank of a bolt 85 which extends upwardly through a clearance passage 86a in an insulating base 86, and through a clearance opening 87a in a bus member 87 or the like, and takes into the aforementioned tapped opening 81b in portion 81a; a lock washer 88 being preferably interposed between the head 85a of said bolt and base 86 to prevent accidental loosening of the bolt. The shank 85 extends upwardly a relatively great distance beyond portion 81a for cooperation with the aforementioned adjustable cam nut 83—the latter having an internally threaded downward extension 83b to insure a sufficient area of threaded engagement with shank 85; and said nut having a cylindrical upper end portion 83c provided with a kerf 83d to accommodate a screwdriver or other operating or adjusting tool.

As shown, element 82 is provided with integral flange portions which extend upwardly from the horizontal portion, as indicated at 82d and 82e, and inwardly from the vertical portion 82b, as indicated at 82f and 82g—the upper edges 82h and 82i of the latter serving as stops to limit the degree of downward insertion of a blade terminal 84 between portions 81c and 82b. Also, as will be readily understood, said integrally connected flange portions 82d, 82f and 82e, 82g serve to substantially reinforce and rigidify the member 82 and to resist outward bending of the vertical portion 82b thereof as an incident to clamping action of portion 81c against a blade terminal upon downward adjustment of nut 83. In practice the horizontal portion 81a of element 81 is spot welded or otherwise rigidly secured to horizontal portion 82a of element 82 (preferably adjacent to the right-hand end of said elements, Fig. 13) to insure maintenance of said elements 81 and 82 in properly assembled relationship and of unit form prior to mounting thereof upon base 86. A similar result could, of course, be obtained by shaping elements 81 and 82 as integrally connected parts of a single metal blank and then bending or reflexing the parts, at the point of connection thereof, to the relative positions shown in Figs. 12 and 13. The arrangement just described has the disadvantage that a substantial amount of scrap would result from formation of the part corresponding to element 81 illustrated.

In Fig. 14 there is illustrated a clip 89 for ferrule type fuse terminals, the base portion 89a of which overlies the flat connecting portion 90a of a resilient metal reinforcing member 90 of substantially rectangular U-shape. Member 90 is preferably formed from a strip of phosphor bronze or similar metal of strength and resiliency and good electrical conductivity—although steel may be employed if desired. The arms 90b and 90c may be employed if desired. The arms 90b and 90c of member 90 extend upwardly and engage with a predetermined degree of initial pressure the respective arms 89b and 89c of the fuse clip—such degree of pressure being substantially increased upon spreading of arms 89b and 89c as an incident to insertion of a ferrule-type terminal therebetween. Member 90 as shown is superimposed upon a bus member 81 or the like, and said parts are attached to a suitable insulating base 92, as by means of a bolt 93, the shank of which takes into a nut 94.

We claim:

1. A front-side operated safety switch comprising a sheet metal housing having bottom, side and end walls and a hinged cover, quick make and break mechanism comprising elements supported upon the inner surface of one side wall of said housing and including a pivoted handle projecting upwardly beyond the upper edge of said side wall, a bail member having a straight end portion insertable outwardly a substantial distance beyond the opposite side wall of said housing through a bearing opening in the latter, the opposite end portion of said bail member having a bearing opening formed therein and one element of said quick make and break mechanism having a stud for cooperation with said last mentioned bearing opening upon endwise bodily movement of said bail member in a reverse direction, associated means to retain said bail member in assembled position, a switch unit comprising an insulating base having at least one set of stationary and movable contacts attached thereto, each movable contact being pivotally supported upon said base, and the same having a notched insulating plate attached thereto for hooked engagement with the intermediate portion of said bail member for operation by the latter into and out of engagement with its associated stationary contact, said insulating base with its attached switch contacts being insertable into and removable from said housing independently of said bail member.

2. A front-side operated safety switch comprising a sheet metal housing having bottom, side and end walls and a hinged cover, quick make and break mechanism comprising elements supported upon the inner surface of one side

wall of said housing and including a pivoted handle projecting upwardly beyond the upper edge of said side wall, a bail member having a straight end portion insertable outwardly a substance distance beyond the opposite side wall of said housing through a bearing opening in the latter, the opposite end portion of said bail member having a bearing opening formed therein and one element of said mechanism having a stud for cooperation with said last mentioned bearing opening upon endwise bodily movement of said bail member in a reverse direction, a spring collar adapted to fit upon said straight end portion of said bail member within the housing to retain the same in assembled posiiton, a switch unit comprising an insulating base having at least one set of stationary and movable contacts attached thereto, each movable contact being gpivotally supported upon said base, the same having a notched insulating plate attached thereto for hooked engagement with the intermediate portion of said bail member for operation by the latter into and out of engagement with its associated stationary contact, said insulating base with its attached switch contacts being insertable into and removable from said housing independently of said bail member, and said quick make and break mechanism and said cover having cooperating interlocking elements to normally insure against opening of said cover when said switch is in closed position and to also normally insure against closure of said switch when said cover is in other than its closed position.

3. A front-side operated safety switch comprising a sheet metal housing having bottom, side and end walls and a hinged cover, quick make and break mechanism comprising elements supported upon the inner surface of one side wall of said housing and including a pivoted handle projecting upwardly beyond the upper edge of said side wall, a bail member having a straight end portion insertable outwardly a substantial distance beyond the opposite side wall of said housing through a bearing opening in the latter, the opposite end portion of said bail member having a bearing opening formed therein and said side wall having a stud attached thereto and projecting inwardly therefrom for cooperation with said last mentioned bearing opening upon endwise bodily movement of said bail member in a reverse direction, means associated with said straight end portion of said bail member within the housing to retain the same in assembled position, a switch unit comprising an insulating base having at least one set of stationary and movable contacts attached thereto, each movable contact being pivotally supported upon said base, the same having a notched insulating plate attached thereto for hooked engagement with the intermediate portion of said bail member for operation by the latter into and out of engagement with its associated stationary contact, said insulating base with its attached switch contacts being insertable into and removable from said housing independently of said bail member, said quick make and break mechanism and said cover having cooperating interlocking elements to normally insure against opening of said cover when said switch is in closed position and to also normally insure against closure of said switch when said cover is in other than its closed position, and associated means accessible from the exterior of said housing for temporarily rendering said interlocking elements ineffective.

4. A front-side operated safety switch comprising a sheet metal housing having bottom, side and end walls and a hinged cover, quick make and break mechanism comprising elements supported upon the inner surface of one side wall of said housing and including a pivoted handle projecting upwardly beyond the upper edge of said side walls, a bail member having a straight end portion insertable outwardly a substantial distance beyond the opposite side wall of said housing through a bearing opening in the latter, the opposite end portion of said bail member having a bearing opening formed therein and one of said elements having a stud for cooperation with said last mentioned bearing opening upon endwise bodily movement of said bail member in a reverse direction, associated means to retain said bail member in assembled position, a switch unit comprising an insulating base having at least one set of stationary and movable contacts attached thereto, each movable contact being pivotally supported upon said base, the same having a notched insulating plate attached thereto for hooked engagement with the intermediate portion of said bail member for operation by the latter into and out of engagement with its associated stationary contact, said insulating base with its attached switch contacts being insertable into and removable from said housing independently of said bail member, said quick make and break mechanism and said cover having cooperating interlocking elements to normally insure against opening of said cover when said switch is in closed position and to also normally insure against closure of said switch when said cover is in other than its closed position, associated means accessible from the exterior of said housing for temporarily rendering said interlocking elements ineffective, said handle having an enlarged flat portion provided with two groups of openings, the openings of each group being arranged in a straight line and the lines of said groups being at substantially right angles to each other, said housing having a part positioned in parallel relation to the enlarged portion of said handle, and said part having a plurality of openings formed therein and arranged in a straight line, the arrangement being such that said groups of openings are respectively alined with certain or all of the plurality of openings in said part in the respective extreme positions of said handle, said openings when alined providing for positively locking the switch and cover in predetermined positions by use of one or more padlocks.

5. In an electric switch, in combination, a metal casing, an operating lever pivotally supported relatively to said casing, said lever having an enlarged portion of flat, segmental form adjacent to the point of pivotal support thereof, said enlarged portion having two groups of openings formed therein, the openings in each group being arranged in a straight line, and a metal member carried by said casing and arranged in parallel relation to said enlarged portion of said lever, said member having a plurality of openings formed therein and arranged in a straight line, the arrangement being such that the aforementioned groups of openings arranged in straight lines are selectively adapted to register jointly with certaian or all of the openings in said member only in the respective extreme "on" or "off" positions of said lever.

6. In an electric switch, in combination, a metal casing, an operating lever pivotally supported relatively to said casing, said lever having an enlarged portion of flat, segmental form adjacent to the point of pivotal support thereof, said enlarged portion having two groups of openings formed therein, the openings in each group being arranged in a straight line, a metal member carried by said casing and arranged in parallel relation to said enlarged portion of said lever, said member having a plurality of openings formed therein and arranged in a straight line, the arrangement being such that the aforementioned groups of openings arranged in straight lines are selectively adapted to register jointly with certain or all of the openings in said member only in the respective extreme "on" or "off" positions of said lever, and said lever being movable from its extreme "on" position to throw the corresponding group of openings in the flat portion thereof out of registry with all of the openings in said metal member and to bring only one of the openings of the other group into registry with one of the openings in said metal member, to thereby provide for locking said lever in an "on" position by a single padlock while preventing attachment of an additional padlock or padlocks.

7. In a front-side operated safety switch of the snap make and break type, in combination, a sheet metal housing having bottom, side and end walls and a movable cover, a die-cast metal operating lever pivotally supported upon the inner surface of one side wall of said housing, said lever having an enlarged portion of relatively thick, flat, segmental form adjacent to the point of pivotal support thereof, said enlarged portion having two groups of openings formed therein, the openings in each group being arranged in a straight line and said lines being arranged at substantially a right angle to each other, and a metal member carried by said side wall of the housing and arranged in parallel relation to said enlarged flat portion of said lever, said member having a plurality of openings formed therein and arranged in a straight line substantially parallel to the upper portion of said side wall, the openings arranged in a straight line in one of said groups being adapted to register with all of the openings in said member in one angular position of said lever, and the openings arranged in a straight line in the other of said groups being adapted to register with certain of the openings in said member in another angular position of said lever.

8. In a front-side operated safety switch of the snap make and break type, in combination, a sheet metal housing having bottom, side and end walls and a movable cover, a die-cast metal operating lever pivotally supported upon the inner surface of one side wall of said housing, said lever having an enlarged portion of relatively thick, flat, segmental form adjacent to the point of pivotal support thereof, said enlarged portion having two groups of openings formed therein, the openings in each group being arranged in a straight line and said lines being arranged at substantially a right angle to each other, a metal member carried by said side wall of the housing and arranged in parallel relation to said enlarged flat portion of said lever, said member having a plurality of openings formed therein and arranged in a straight line substantially parallel to the upper portion of said side wall, the openings arranged in a straight line in one of said groups being adapted to register with all of the openings in said member in one angular position of said lever, and the openings arranged in a straight line in the other of said groups being adapted to register with certain of the openings in said member in another angular position of said lever, and said lever being movable from one of said angular positions thereof to throw the corresponding group of openings in the flat portion thereof out of registry with all of the openings in said metal member and to bring only one of the openings in the other group into registry with one of the openings in said metal member.

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