Feb. 29, 1944. A. W. KRIEGER 2,342,945

CIRCUIT BREAKER

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Fig. 1

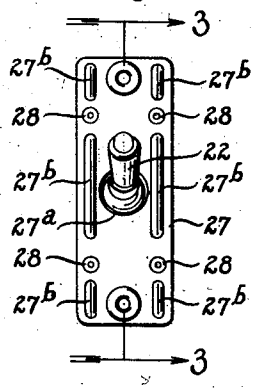


Fig. 2

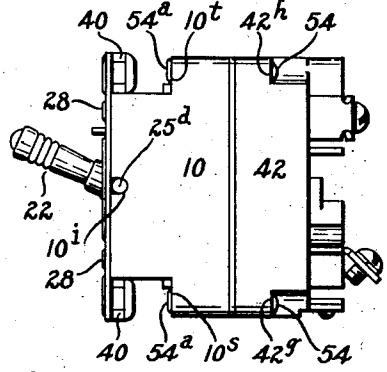
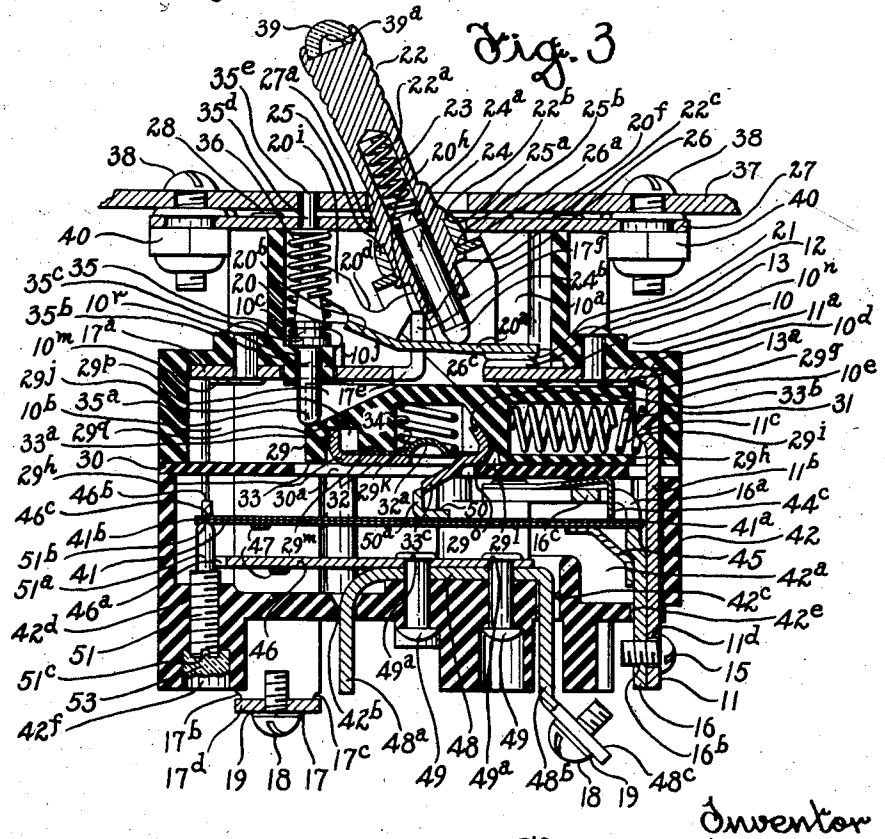


Fig. 3



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CIRCUIT BREAKER

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Fig. 4

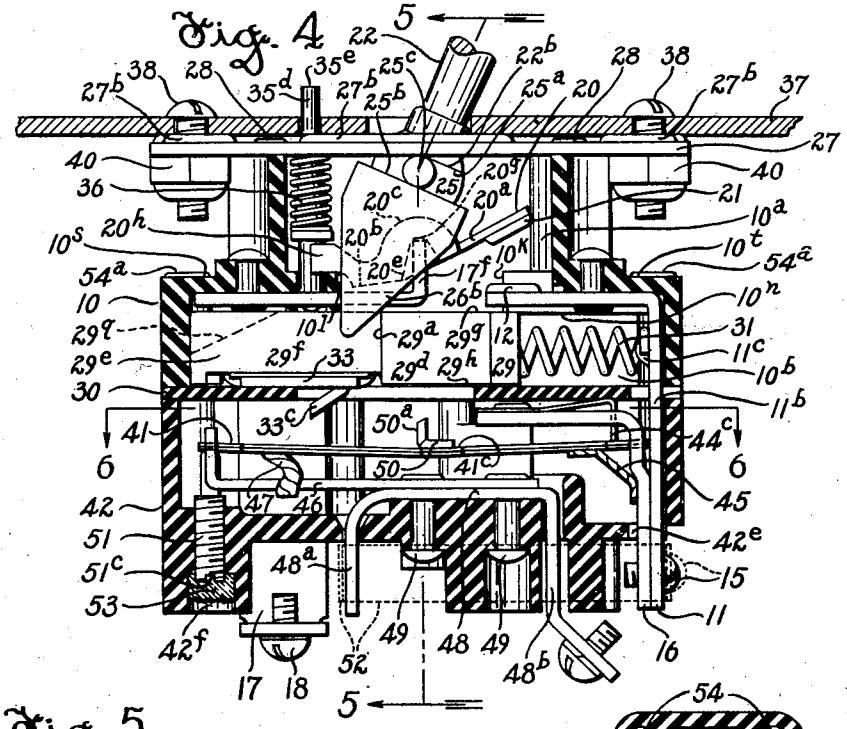


Fig. 5

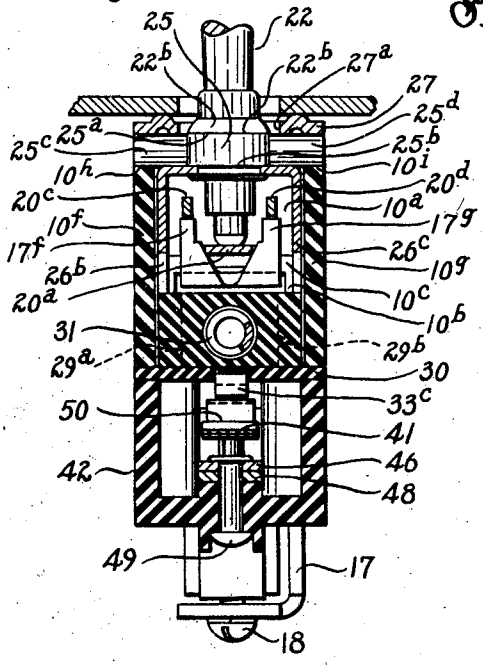
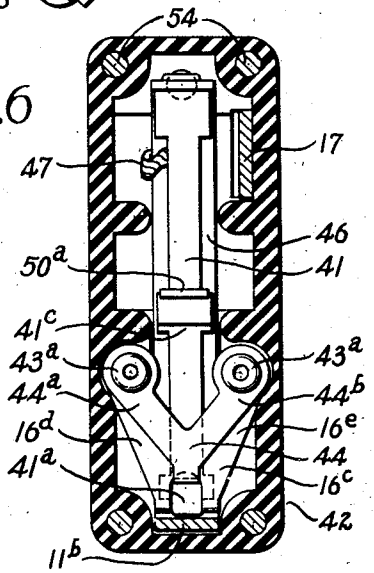


Fig. 6



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CIRCUIT BREAKER

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Fig. 7

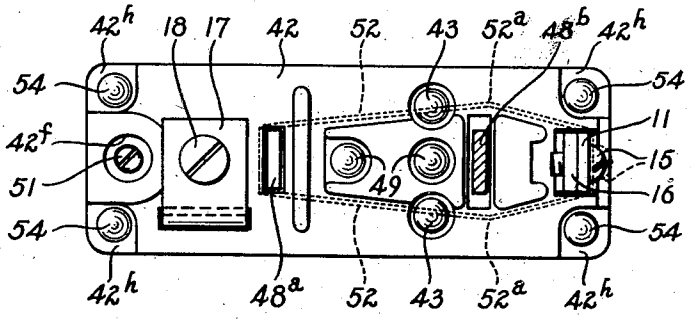


Fig. 8

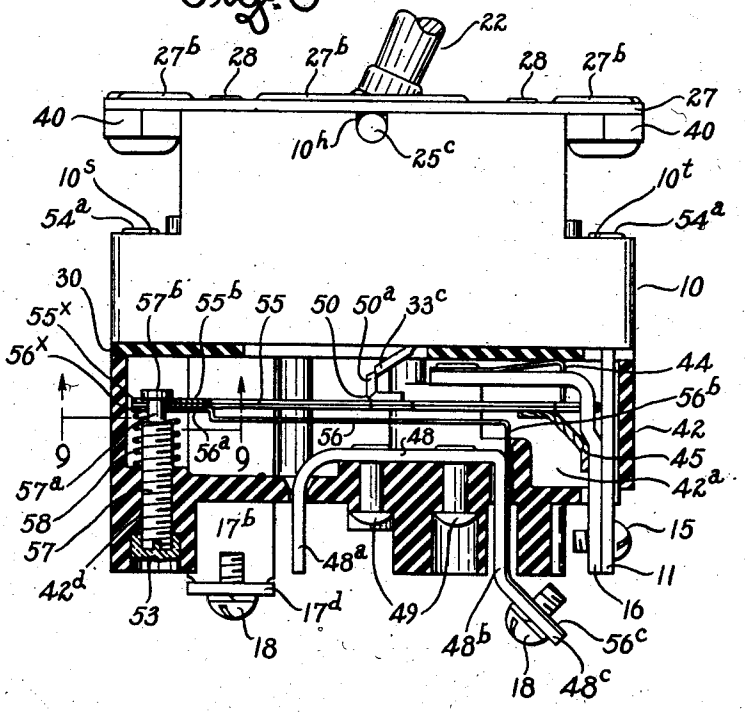
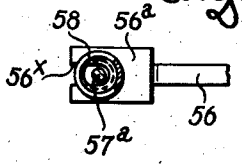


Fig. 9



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Patented Feb. 29, 1944

2,342,945

UNITED STATES PATENT OFFICE

2,342,945

CIRCUIT BREAKER

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Application September 7, 1942, Serial No. 457,542

28 Claims. (Cl. 200—116)

This invention relates to improvements in circuit breakers, and although not limited thereto the invention relates particularly to overload circuit breakers for airplanes and the like.

A primary object of the invention is to minimize the space requirements, and consequently the weight, of such a device, while insuring trustworthy operation thereof under all conditions.

Another object is to provide a manually controllable overload circuit breaker which is non-trip-free, to provide for attainment of an important and desirable result.

Another object is to provide a circuit breaker of the aforementioned character which will withstand severe vibration without accidental tripping thereof or arcing of its contacts.

Another object is to provide a circuit breaker which will perform in a normal manner under maximum flight altitude conditions.

Another object is to provide a circuit breaker which is substantially unaffected by variations in ambient temperature or pressure conditions.

Another object is to provide an overload circuit breaker the various parts of which are much smaller and more compactly arranged than those of circuit breakers of similar capacity heretofore known.

Another and more specific object is to provide an overload circuit breaker whose frontal area is the same as that of switches now standard for aircraft service.

Another object is to provide a manually controllable overload circuit breaker consisting of a group of elements most of which are common to such devices having a wide range of different capacities.

Another object is to minimize the number of different parts required to afford the desired range of variation in the circuit controlling capacities of such devices.

Another object is to provide a circuit breaker which may be manually closed and/or held closed regardless of overload conditions.

Another object is to provide a substantially dust-tight enclosure for the operating elements of such a circuit breaker.

Another object is to provide novel means for indicating the circuit controlling condition of the circuit breaker.

Another object is to provide novel means including a single manual lever for operating the switch mechanism and for simultaneously resetting the overload mechanism after tripping of the latter.

Another object is to provide a novel form of combined switching and resetting lever, and a novel form of pivoting means therefor.

Another object is to facilitate calibration and/or initial adjustment of such devices, and to maintain such adjustment.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate certain embodiments of the invention which will now be described; it being understood that the embodiments illustrated are susceptible of modification in respect of certain structural details thereof within the scope of the appended claims.

In the drawings,

Figure 1 is a top plan view, actual size, of a circuit breaker constructed in accordance with my invention.

Fig. 2 is a view thereof in side elevation.

Fig. 3 is an enlarged sectional view, on the line 3—3 of Fig. 1, in the direction of the arrows.

Fig. 4 is a view quite similar to Fig. 3, but showing in elevation the elements other than the insulating bases—the various parts being shown in the respective positions assumed thereby after automatic tripping of the switch to open position as an incident to an overload of predetermined value—the form and manner of attaching the shunting strips, when required, being shown in dotted lines.

Fig. 5 is a vertical sectional view, on the line 5—5 of Fig. 4.

Fig. 6 is a horizontal sectional view, on the line 6—6 of Fig. 5.

Fig. 7 is a bottom plan view of the device shown in Figs. 1 to 6—one of the terminal members being shown in section.

Fig. 8 is a view, partly in side elevation and partly in vertical section (with certain elements shown in elevation) of a slightly modified form of device for control of a circuit employing a current of relatively low value, and

Fig. 9 is a fragmentary view, in section on the line 9—9 of Fig. 8, showing the manner of supporting and affording adjustment of one end of the bimetallic member.

Referring first to that form of my invention shown in Figs. 1 to 7, the numeral 10 designates a base molded from any suitable insulating material—preferably "Bakelite." Base 10 is provided with a relatively deep but relatively short substantially rectangular recess 10^a which opens to the upper surface thereof, and with a relatively shallow but relatively long substantially rectangular recess 10^b which opens to the lower surface thereof; an approximately rectangular open-

ing 10c being formed between said recesses to provide a communicating passage. The upper wall of recess 10b is provided with a groove or channel 10d (Fig. 3) to snugly receive, in a substantially flush relation, the horizontal portion 11a of a member 11 formed of metal strip material, one end of portion 11a extending into alinement with opening 10c and having a tip 12, of fine silver or other suitable contact material, spot welded, brazed, or otherwise rigidly and permanently attached thereto.

Said upper wall of recess 10b and portion 11a of member 11 are provided with alined openings to receive the shank of a headed rivet 13, the end of which shank is upset, as shown at 13a, to rigidly secure member 11 in assembled position. The relatively longer vertical portion 11b of member 11 is preferably spaced slightly from the inner surface of the end wall 10e of recess 10b, said portion 11b extending downwardly to the point indicated in Fig. 3 for a purpose hereinafter described. Portion 11b is provided at the point indicated with an inwardly pressed or extruded boss 11c which is adapted to center one end of a coiled compression spring 31 which abuts against the inner surface of portion 11b. Portion 11b is provided near its lower end with a slot or substantially elliptical opening 11d, which is adapted to provide clearance for the shank of a screw 15 which serves to clamp said end to another metal member 16, as hereinafter described.

As shown in Fig. 3, the upper end wall of recess 10b is suitably recessed on the left-hand side of opening 10c to snugly receive the flat horizontal portion 17a of a punched and stamped sheet metal member 17, said member having a relatively long vertical portion 17b, which is notched on opposite side edges thereof adjacent to its lower end, as shown at 17b and 17c, the lower end portion 17d thereof being preferably bent inwardly at a right angle as shown (after final assembly of the parts). Portion 17d is provided with a tapped opening to receive, in an upward direction, the shank of a wiring terminal screw 18—a lock-washer 19 being preferably associated with the head of said screw, for a well known purpose.

The portion 17a of member 17 projects into alinement with opening 10c and the inner end thereof is notched or bifurcated, as indicated at 17e; said bifurcated end being bent upwardly at a right angle to provide a pair of spaced fulcrum arms or studs 17f and 17g (Figs. 3, 4 and 5). Said fulcrum studs are preferably located in a vertical plane at the mid-length of recess 10c, and the same are adapted to form a pivotal support for a punched and stamped sheet metal contactor 20. Contactor 20 is preferably provided with a relatively long, flat arm 20a and a relatively short, flat arm 20b extending upwardly at an obtuse angle with respect thereto. The blank (not shown) from which contactor 20 is formed is provided on opposite sides thereof with integral extensions 20c and 20d (Figs. 3, 4 and 5); said extensions being respectively provided with outwardly pointed substantially triangular openings 20e and 20f, so that upon bending said extensions upwardly into parallel planes at right angles to arms 20a and 20b (within the areas of said bearings) the slightly rounded points 20g and 20h of said openings are adapted to act as downwardly opening bearings which seat against the respective upper ends of the fulcrum arms 17f and 17g. As will be noted, the fulcrum point of contactor 20 (Figs. 3 and 4) is in a plane slightly to the right of the point of juncture of the aforementioned arms 20a and 20b. This insures tilting of the contactor in one direction or the other as an incident to movement along arm 20a of the actuating element hereinafter described. Arm 20b acts as a rest for said element in the "off" position of the contactor, and insures against accidental movement of said element over the "dead" center.

As best illustrated in Fig. 5, arm 20a fits rather closely between the adjacent portions of arms 17f and 17g, whereby lateral displacement of the contactor is prevented. The rearwardly extending lugs 20h and 20i are adapted to seat against the bottom wall of recess 10 (Fig. 4) in the "off" position of the contactor thus limiting the throw of the latter in that direction. Arm 20a has welded or otherwise rigidly attached thereto a tip 21 corresponding to the tip 12 aforedescribed.

The operating means for contactor 20 comprises a metal lever 22 having a relatively long substantially cylindrical recess 22a opening to the lower end thereof. A coiled compression spring 23 is positioned within said recess, and a substantially cylindrical plunger 24, of any suitable insulating material, such as "Bakelite," is adapted to seat against said spring; plunger 24 preferably having a reduced upper end 24a adapted to telescope into one or more of the lower end coils of the spring, and the lower end 24b of said plunger being of rounded or convex form to facilitate movement thereof relatively to the contactor. Spring 23 at all times acts to bias plunger 24 outwardly from recess 22a, to provide a predetermined minimum degree of pressure of the plunger against the contactor.

Lever 22 is provided exteriorly thereof, at a point intermediate the length of recess 22a, with a downwardly facing annular shoulder 22b. A metal ring 25 is adapted to fit closely onto lever 22, said ring having a flat upper edge 25a adapted to seat against shoulder 22b and a flat lower edge 25b. A punched and stamped sheet metal member 26 of substantially inverted U-shape in vertical cross section has its perforated flat connecting portion 26a fitted onto lever 22, as shown, and seated against the lower edge 25b of said ring. An integral annular portion of lever 22 is upset over the inner surface of connecting portion 26a, as shown at 22c (Fig. 3) to rigidly and non-rotatably secure ring 25 and member 26 to lever 22, and to each other.

As shown in Figs. 4 and 5, ring 25 is provided with a pair of diametrically opposite integral lateral projections 25c and 25d of cylindrical form, said projections serving jointly as a pivot pin for lever 22. As shown in Figs. 2 and 5, the opposite side walls 10f and 10g of recess 10a are provided at the mid-length of the upper edges thereof with upwardly opening notches 10h and 10i, the bottom walls of which are preferably of arcuate form (see Fig. 2) to provide bearings for the respective projections 25c and 25d of ring 25. The depth of notches 10h and 10i is preferably slightly greater than the diameter of projections 25c and 25d to afford free rotation of the latter after attachment of the combined supporting and cover plate 27 formed of sheet metal, which serves to retain said projections within said bearing notches. Plate 27 is provided with a circular opening 27a which affords oscillating clearance for lever 22. As best illustrated in Fig. 3, opening 27a is of such a size, and lever 22 and ring 25 are so formed, as to provide for sub-

stantial closure of said opening in all positions of the lever.

Base 10 preferably has molded into its upper surface four metallic inserts, the hollow upwardly extending shanks of which are accommodated by a corresponding number of openings in said combined supporting and cover plate 27, said shanks being upset over said plate as shown at 28 in Figs. 1 to 4 to secure said parts in assembled relation.

The parallel downwardly extending arms 26b and 26c of member 26 are of substantially inverted triangular form, and the opposite angular edges of the same jointly are adapted to engage pairs of integral vertical abutment surfaces formed by, or as continuations of, the walls of opening 10c—certain of said abutments being shown at 10j, 10k and 10l in Figs. 3 and 4—to positively limit the throw of lever 22 in each direction. As shown in Figs. 3, 4 and 5, arms 26b and 26c extend downwardly through opening 10c into recess 10b, and the right-hand edges of said arms are adapted for cooperative engagement with alined vertical shoulders formed upon opposite sides of a member 29, molded from a suitable insulating material, such as "Bakelite"; one of said shoulders being shown at 29a in Fig. 4, and the width of each being indicated by the dotted lines at 29a and 29b in Fig. 5. Said shoulders (see 29a) are formed between a relatively wide right-hand portion 29c whose opposite flat sides (one of which is shown at 29d in Fig. 4) are freely slidable between the side walls of recess 10b, and a relatively narrower left-hand portion 29e whose opposite flat sides (one of which is shown at 29f in said figure) are freely slidable between the vertical walls of integral portions of base 10, one of said walls being shown at 10m in Fig. 3.

Member 29 is provided with upper and lower flat surfaces 29g and 29h (Figs. 3 and 4); the surface 29g being adapted to slidably engage the downwardly facing flat surfaces of a pair of spaced integral ledge portions formed upon the upper end wall of recess 10b, one of said surfaces being shown at 10n in Figs. 3 and 4. The lower surface 29h of member 29 is adapted to be positioned in a substantially flush relationship to the lower end of base 10 for sliding engagement thereof with a flat punched insulating plate 30, preferably formed of canvas- (or other fabric) reinforced "Bakelite."

Member 29 is provided with a substantially cylindrical recess 29i (Fig. 3) which is adapted to accommodate a relatively strong coiled compression spring 31, the outer end of which is adapted to surround the aforementioned boss 11c and engage the portion 11b of member 11, whereby spring 31 normally biases member 29 toward the left-hand extreme position thereof shown in Fig. 4, member 29 thus acting against the arms 26b and 26c associated with lever 22 to automatically throw the latter to effect circuit interrupting positioning of the switch contactor 20.

Member 29 is recessed at the lower surface of the narrow, left-hand, portion 29e thereof as shown at 29j, 29k and 29l in Fig. 3, and said surface is further countersunk or recessed, as indicated at 29m to accommodate a thin, punched and stamped sheet metal plate 32 and a relatively heavy punched and stamped sheet metal member 33. Plate 32 is provided with an upwardly extending substantially hemispherical boss 32a which fits into the lower end of a coiled compression spring 34 positioned within recess 29k. Member 33 is provided at the left-hand end thereof (Fig. 3) with a relatively narrow lug 33a which is adapted to be positioned within recess 29j, lug 33a being bent upwardly at substantially a right angle to the main body of member 33. Member 33 is provided at its right-hand end with a relatively narrow lug 33b which is bent to extend upwardly and inwardly at an acute angle to said main body portion, said angle corresponding to the angle of the end wall 29o of recess 29l. Member 33 has sheared from the main body thereof and bent downwardly therefrom at an acute angle a latching lug 33c. Plate 32 is notched at its opposite ends to accommodate the root portions of lugs 33a and 33b, whereby plate 32 and member 33 are restrained against lateral displacement with respect to each other.

Spring 34 thus acts to bias the main body portion of member 33 against the aforementioned plate 30 while biasing member 29 in an upward direction. Plate 30 is provided with a relatively long slot 30a (Fig. 3) to provide slidable clearance for lug 33c, which extends downwardly a predetermined distance therebelow.

Member 29 is provided at its left-hand end (Fig. 3) with an upwardly opening groove 29p having an angularly extending bottom wall 29q which acts as a cam surface for cooperation with the rounded lower end 35a of plunger 35, which is preferably composed of metal and machined to the form thereof best illustrated in Fig. 3. Thus the cylindrical lower end portion 35b of said plunger is slidable within a passage 10r formed in the wall between recesses 10a and 10b. Plunger 35 is provided with an annular flange 35c the lower surface of which acts to limit downward displacement of the plunger, and the upper surface of which acts as an abutment for the lower end of a coiled compression spring 36 which surrounds the plunger, the upper end of said spring being adapted to abut the inner surface of plate 27 to bias the plunger to the extreme lower position thereof shown in Fig. 3.

Plate 27 and a panel 37 (to which the circuit breaker is attached, as by means of a pair of screws or bolts 38, 38) are provided with alined openings to accommodate the reduced cylindrical upper end portion 35d of said plunger; the upper end surface 35e of portion 35d being preferably provided with a coating of paint or enamel (such as black, to correspond with the color of the outer surface of panel 37) to render the same invisible or inconspicuous in the normally retracted position of the plunger, and the upper end part of portion 35d being preferably provided with a coating of paint or enamel of a highly contrasting color (such as red) to render the same conspicuous when projected in the manner illustrated in Fig. 4. Portion 35d when thus projected serves to indicate that the switch mechanism has been tripped to circuit-interrupting position as an incident to the occurrence of an overload of predetermined value and/or of predetermined duration within the controlled circuit. The manner in which the cam surface 29q acts against the lower end of plunger 35 to project the latter is believed to be apparent from Figs. 3 and 4.

As shown in the various figures (see Fig. 1) plate 27 is provided with embossed upwardly projecting, interrupted rib portions along opposite sides thereof, as indicated at 27b, to seat against the inner surface of panel 37, thus providing clearance between said inner surface and the upset ends of shanks 28 aforementioned.

The switch operating lever 22 may have attached to its upper end a hollow transparent member 39 (Fig. 3) of glass or similar material, the inner surface of which is coated with luminous paint or a similar material, as indicated at 39a.

The plate 27 has rigidly and permanently attached thereto at opposite ends thereof a pair of so-called resilient nuts 40 of known form, said nuts being characterized by having fixed therewithin portions of fiber or a similar material, said fiber portions having untapped openings (not shown) therein the walls of which grip the shanks of bolts 38 when threaded into the metal portions of said nuts.

The means for latching member 29 in its retracted position against the bias of spring 31 (as shown in Fig. 3) comprises a bimetallic strip 41 of predetermined caliber which is supported within a recess 42a which opens to the upper end of the lower insulating base 42, which likewise preferably consists of molded "Bakelite." One end 41a (of reduced width) of strip 41 is adapted to seat against the upwardly facing edge or wall of an opening 16a (Fig. 3) formed in the aforementioned punched and stamped sheet metal member 16, the vertical portion of which is provided with a tapped opening 16b to accommodate the shank of screw 15 whereby members 11 and 16 are mechanically and electrically connected to each other. The portion 16c of member 16 is bent toward the left (Fig. 3) at substantially a right angle to the vertical portion thereof, and portion 16c is provided with a pair of integral arms 16d and 16e (Fig. 6) extending at a predetermined angle relatively to each other, said arms having openings formed therein to accommodate the hollow shanks of a pair of headed rivets 43 (see Fig. 7) which extend upwardly through openings provided in the bottom wall of recess 42a. Also as best illustrated in Fig. 6, a member 44 of highly resilient metal such as phosphor bronze, is superimposed upon the portion 16c of member 16, said member 44 having integral arms 44a and 44b the ends of which are likewise perforated to accommodate the shanks of rivets 43, said shanks being upset as shown at 43a in Fig. 6 to secure members 16 and 44 to base 42. Member 44 is provided with an integral lug 44c bent downwardly at substantially a right angle thereto, said lug 44c being adapted to penetrate opening 16a in member 16 and engage with a predetermined degree of pressure the upper surface of end portion 41a of said strip to hold the latter against said upwardly facing edge of opening 16a.

In practice a short length of multiple-strand wire 45, of copper or the like, has its respective ends spot-welded or otherwise rigidly attached to member 16 and to strip 41 to insure a good electrical connection therebetween. The other end 41b (of reduced width) of strip 41 is adapted to extend toward the left (Fig. 3) through an opening 46a formed in a metal member 46, one end portion 46b of member 46 being bent upwardly at substantially a right angle to the main body portion thereof, and the upper edge or end wall 46c of said opening being adapted to overlie said portion 41b of the bimetallic strip. A suitable length of multiple-strand copper wire 47 is spot-welded to strip 41 and to member 46 to insure a good electrical connection therebetween. The right-hand portion of member 46 (Figs. 3 and 4) overlies a metal member 48 of substantially inverted U-shape; members 46 and 48 having openings alined with openings formed in the bottom wall of recess 42a to accommodate the hollow shanks of headed rivets 49, 49, which shanks are upset as shown at 49a to rigidly secure said members to base 42. Said bottom wall of recess 42a is provided with an opening 42b through which the relatively short arm extends in a downward direction, and with an opening 42c to accommodate the relatively long arm 48b when in a straight condition. After securement of members 46 and 48 to base 42 the lower end portion 48c of arm 48b is preferably bent at a predetermined angle toward the right (as shown in Figs. 3 and 4), said portion 48c being provided with a tapped opening to accommodate the shank of a wiring terminal screw 18 like that associated with the aforementioned member 17.

Strip 41 has attached to the relatively wide intermediate portion 41c thereof (Figs. 4 and 6), as by spot-welding, the horizontal portion of a metal member 50, which is preferably formed of steel. Member 50 has a latch portion 50a bent upwardly at substantially a right angle thereto, the upper edge of portion 50a being beveled upwardly toward the right (Figs. 3 and 4) to serve as a cam to permit passage of portion 33c of member 33 thereover when member 29 is moved toward its right-hand extreme position from the position thereof shown in Fig. 4, to effect co-operative engagement of the latching lugs 33c and 50a upon manual release of lever 22 when the strip 41 is in its normal or relatively cool condition.

As shown in Fig. 3 there is preferably a predetermined normal degree of overlap between the lugs 33c and 50a when in latched relation, so that a sufficient degree of downward movement of lug 50a to effect disengagement thereof from lug 33c will occur within a predetermined period after the occurrence of the degree of overload in the circuit to which the breaker is adapted to respond. However, in practice it is desirable to provide for initially adjusting the device in a manner to preselect any one of a number of different time periods of response thereof to a given overload condition in the controlled circuit. Said means as shown preferably comprises a screw 51 adapted for cooperative threaded engagement with a threaded passage 42d in the bottom wall of recess 42a. Screw 51 has a reduced upper end portion 51a the rounded upper end 51b of which underlies the end portion 41b of strip 41 directly beneath the edge 46c of the opening in member 46. As will be understood, member 46 is resilient, and the arrangement is such that prior to assembling of screw 51, as shown in Fig. 3, the left-hand end of member 46 will be bowed or bent downwardly to some extent from the position thereof illustrated. It follows that the end portion 51b of the screw when driven to the point illustrated has caused a predetermined degree of upward bending of member 46, with a consequent clamping of end 41b of the strip between the screw end 51b and said edge 46c.

If it is desired to initially provide for an increased time period of response of the device to the predetermined overload condition, it is only necessary to drive the screw 51 upwardly to a greater extent within the threaded passage 42d, with consequent upward displacement of the left-hand end 41b of the bimetallic strip 41. This, of course, effects an upward displacement of lug 50a relatively to lug 33c, so that a longer time period will be required to effect disengagement of lug 50a from lug 33c under given overload conditions.

Conversely, if it is desired to initially provide for a shorter period of response of the device to a given overload condition, it is only necessary to unthread the screw to the desired extent with respect to passage 42d whereby the lug 50a is lowered with respect to lug 33c, with a consequent reduction in the time required for the strip 41 to effect disengagement of lug 50a from lug 33c under said overload condition.

After the desired adjustment of screw 51 has been effected, I prefer to partially fill the countersink or recess 42f in which the kerfed end 51c thereof is located with a quantity of material 53, such as a porcelain type cement—to insure against accidental loosening of the screw—whereby the initial or factory adjustment of the device is maintained.

As shown in Figs. 3 and 4, an opening 42e is provided in the bottom wall of recess 42a to enable downward passage of the lower end portions of members 11 and 16 therethrough prior to assembly of screw 15.

From the foregoing description it will be apparent that, with the parts of the device in the relative positions thereof shown in Fig. 4 (wherein the strip 41 has responded to the predetermined overload condition to effect tripping of the switch to circuit interrupting position), the switch may nevertheless be immediately reclosed by manual operation of lever 22 to its left-hand extreme position shown in Fig. 1, and said switch may be maintained closed by manual retention of lever 22 in said extreme left-hand position notwithstanding continuance of such overload condition in the circuit.

This feature is of great practical importance and utility in respect of the use for which the device is intended, inasmuch as it provides for maintenance of a given device (such as a gun upon an airplane) in operation as long as possible; even though the operating motor is eventually burned out.

With the parts in the positions thereof shown in Fig. 4, but with the bimetallic strip 41 cooled sufficiently to permit return of lug 50a to a position wherein it will act to latch lug 33c, it is obvious that upon movement of lever 22 to its left-hand extreme position the switch will not only be closed, but upon coincident movement of member 29 to its extreme right-hand position (Fig. 3) lug 33c will cam or ride over lug 50a, and upon manual release of lever 22 lug 50a will coact with lug 33c to hold member 29 against the bias of spring 31, so that the switch will remain closed. With member 29 so restrained by lug 50a against the bias of spring 31, it is also obvious that the switch may be manually operated at will to open or closed position without in anywise affecting the latching connection between lugs 50a and 33c. However, upon the occurrence of the predetermined overload condition, lug 50a will be retracted downwardly by strip 41 to effect release of member 29 which will be moved by spring 31 to the left-hand position shown in Fig. 4, thus automatically effecting opening of the switch.

The devices hereinabove described are adapted for control of circuits having ratings of from 6 amperes to 50 amperes. For this purpose the bimetallic strip 41 may have any one of a number of different calibers to correspond to certain of the ampere ratings aforementioned. For other of the various ampere ratings either one or two shunting straps of the character shown in dotted lines at 52 in Figs. 4 and 7 may be employed. Said straps are preferably in the form of suitable lengths of resistance ribbon composed of "Advance" metal, which is obtainable commercially; the bent ends of each of said straps being spot-welded, brazed or otherwise rigidly and permanently attached to the member 11 and to the arm 48a of member 48, said straps being bent or bowed outwardly at 52a to afford ample electrical clearance between the same and arm 48b of member 48 (see Fig. 7).

Base 10 is preferably provided with ledges 10s and 10t offset downwardly from the upper surface thereof (Fig. 2), and base 42 is also preferably provided with ledges offset upwardly from the lower surface thereof, two of said ledges being shown at 42h in Fig. 2; said bases having alined passages at each of the four corners thereof communicating with said ledges, for the reception of headed rivets 54 the hollow shank ends of which are upset, as shown at 54a (Fig. 2) to rigidly and permanently secure said bases to each other.

In practice I prefer to combine the aforementioned parts numbered 16, 45, 41, 47, 46 and 48 as a sub-assembly, and to then insert the same as a unit into the recess 42a, the parts 46 and 48 being preferably rigidly connected to each other, as by spot-welding the same at a point between the alined openings therethrough which accommodate the shanks of rivets 49.

As will be apparent from the drawings, the various parts within the several recesses 10a, 10b and 42a are well protected against the entry of dust or other foreign matter.

The modified form of device illustrated in Figs. 8 and 9 is in most respects identical with that aforedescribed, and parts thereof corresponding to those in Figs. 1 to 7 having been designated by like numerals of reference. Thus, while I have shown the base 10 in side elevation, it is to be understood that the various parts associated therewith are identical with the corresponding parts aforedescribed. In Figs. 8 and 9, however, the metal member 46 and the multiple strand wire 47 are omitted, and a bimetallic strip 55 is substituted for the strip 41 aforedescribed. Strip 55 has spot-welded or otherwise rigidly attached to the lower surface of the left-hand end portion 55b thereof one end 56a of a relatively stiff strip or ribbon of a suitable resistance metal, such as the nickel-chromium alloy sold commercially under the trade name of "Nichrome." The main body portion 56 of said strip is offset downwardly to a slight extent to lie in a plane parallel to the bimetallic strip 55, to act as a heater for the latter. Strip 56 has a portion 56b bent downwardly at substantially a right angle to said main body portion thereof to lie against the arm 48b of member 48 and the end portion 48c of said arm, as shown at 56c. Portions 56c and 56b are preferably spot-welded or otherwise rigidly mechanically and electrically connected at one or more points to end 48c and arm portion 48b, respectively, of member 48; said portion 56c being provided with an opening (not shown) to afford clearance for the shank of screw 18.

The left-hand end portions 55b and 56a of the strips 55 and 56 are preferably provided jointly with an outwardly opening notch 55x, 56x, which is adapted to accommodate the reduced portion or neck 57a of an adjusting screw 57, screw 57 having an enlarged portion or flange 57b at the upper end thereof which overlies a portion of the end 55b of strip 55 to limit upward movement of said end. A coiled compression spring 58 surrounding screw 57 is interposed between end 56a of the heater strip 56 and the bottom wall of

recess 42a to bias the left-hand end of strip 55b against flange 57b. Screw 57 may be initially adjusted within passage 42d in the same manner as the aforedescribed screw 51 to predetermine the time period of response of the device to a given overload condition in the controlled circuit. A device like that disclosed in Fig. 8 is adapted for use in a low current carrying circuit, say, five amperes. The heater element 56 has the effect of modifying the operating characteristics of the strip 55 under given overload conditions, as will be readily understood by those skilled in the art.

I claim:

1. In an electro-thermally responsive overload circuit breaker, in combination, a switch biased to open position and adapted for manual movement to and retention in closed position at will, a normally flat bimetallic strip of predetermined length and caliber, means for connecting said strip in the circuit controlled by said switch to provide for influence of the former by the current condition in said circuit, a latch member rigidly attached to said strip intermediate the ends of the latter and projecting therefrom at substantially a right angle thereto to normally retain said switch in closed position when manually closed, means for fixedly supporting said strip at each end whereby the same is adapted to bow between its ends to effect retraction of said latch member under given conditions, the supporting means for one end of said strip comprising a stationarily supported screw manually adjustable to move said end of the strip to vary the normal plane of the latter whereby the normal position of said latch member is correspondingly varied to subject said latch member to adjustment of its critical range of movement by said metallic strip.

2. In an electro-thermally responsive overload circuit breaker, in combination, a bimetallic strip of predetermined caliber, means for connecting said strip in an electric circuit to provide for response thereof to a given overload condition in the circuit, a latch member attached to said strip intermediate the ends of the latter, means for supporting said strip at each end in a manner to insure against substantial endwise movement thereof in either direction, the supporting means for one end of said strip comprising a resilient metal member and a separately supported screw between which said end is interposed, said screw being manually adjustable to move said metal member and said end of the strip to vary the normal plane of the latter, whereby the initial position of said latch member is correspondingly varied to thereby predetermine the period of latch-tripping response of said bimetallic strip to a given overload condition, and means including one or more conducting metal straps included in the circuit in shunting relationship to said bimetallic strip, to thereby vary the value of the overload condition in said circuit to which said bimetallic strip is adapted to respond to trip said latch.

3. In an electro-thermally responsive overload circuit breaker, in combination, a manually operable switch mechanism biased to circuit interrupting position, a normally flat bimetallic strip of predetermined caliber included in the circuit controlled by said switch, a projecting latch member carried by said strip and cooperating with said switch when closed to normally hold the latter against said bias, normally fixed means at each end of said strip for supporting the same in a predetermined plane, said means at one end of the strip comprising a stationary screw manually adjustable to vary the normal plane of said strip and of said latch, to thereby require more or less bowing of said strip between the ends thereof for release of said switch, and said switch being adapted for movement to and retention in closed position at will independently of said latch member.

4. In an electro-thermally responsive overload circuit breaker, in combination, a manually operable switch mechanism normally biased to circuit interrupting position, a bimetallic strip of predetermined caliber included in the circuit controlled by said switch, a latch member carried by said strip and cooperating with said switch to normally hold the latter, when closed, in circuit completing position against said bias, normally fixed means at each end of said strip for supporting the same in a predetermined plane and in a manner to prevent substantial endwise movement thereof in either direction, said means at one end of the strip comprising a resilient metal member and a manually adjustable screw, said screw when manually adjusted being adapted to vary the initial plane of said strip and the corresponding initial position of said latch, to thereby vary the time element of response of said bimetallic strip for tripping of said switch under a given overload condition, and means comprising one or more conducting straps included in the circuit in shunting relationship to said bimetallic strip, to thereby vary the value of the overload condition in said circuit to which said bimetallic strip is adapted to respond to trip said latch.

5. In an electro-thermally responsive overload circuit breaker, in combination, a manual lever operated switch mechanism normally movable to and resiliently retained in either its circuit completing or circuit interrupting position according to the direction of movement of said lever, overpowering spring operated means associated with said switch mechanism and normally tending to bias the same to circuit interrupting position, a normally flat bimetallic strip of predetermined caliber included in the circuit controlled by said switch, a projecting latch member carried by said strip and cooperating with said spring operated means to normally render the latter ineffective to open the switch upon movement thereof to closed position, normally fixed means at each end of said strip for supporting the same in a predetermined plane and in a manner to prevent substantial endwise movement thereof in either direction, said means at one end of said strip comprising a resilient metal member and a manually adjustable member, said last mentioned member when manually adjusted being adapted to vary the initial plane of said strip and the corresponding initial position of said latch, to thereby vary the time element of response of said bimetallic strip for release of said spring operated means with consequent opening of said switch under a predetermined overload condition, and said manual lever being operable at will to retain said switch in circuit completing position independently of said latch member.

6. In an electro-thermally responsive overload circuit breaker, in combination, a manual lever operated switch mechanism normally movable to and resiliently retained in either its circuit completing or circuit interrupting position according to the direction of movement of said lever, overpowering spring operated means associated

with said switch mechanism and normally tending to bias the same to circuit interrupting position, a normally flat bimetallic strip of predetermined caliber included in the circuit controlled by said switch, a projecting latch member carried by said strip and cooperating with said spring operated means to normally render the latter ineffective to open the switch upon movement thereof to closed position, normally fixed means at each end of said strip for supporting the same in a predetermined plane and in a manner to prevent substantial endwise movement thereof in either direction, said means at one end of said strip comprising a resilient metal member and a manually adjustable member, said last mentioned member when manually adjusted being adapted to vary the initial plane of said strip and the corresponding initial position of said latch, to thereby vary the time element of response of said bimetallic strip for release of said spring operated means with consequent opening of said switch under a predetermined overload condition, and said lever being manually operable to effect and maintain completion of the controlled circuit regardless of said predetermined overload condition in the latter.

7. In an electro-thermally responsive overload circuit breaker, in combination, a manual lever operated switch mechanism normally movable to and resiliently retained in either its circuit completing or circuit interrupting position according to the direction of movement of said lever, overpowering spring operated means associated with said switch mechanism and normally tending to bias the same to circuit interrupting position, a bimetallic strip of predetermined caliber included in the circuit controlled by said switch, a latch member carried by said strip and cooperating with said spring operated means to normally render the latter ineffective to open the switch upon movement thereof to closed position, normally fixed means at each end of said strip for supporting the same in a predetermined plane and in a manner to prevent substantial endwise movement thereof in either direction, said means at one end of said strip comprising a resilient metal member and a manually adjustable screw, said screw when manually adjusted being adapted to vary the initial plane of said strip and the corresponding initial position of said latch, to thereby vary the time element of response of said bimetallic strip for release of said spring operated means with consequent opening of said switch under a predetermined overload condition, and means comprising at least one conducting metal strap arranged in shunt relationship to said bimetallic strip, to thereby vary the value of overload condition in said circuit to which said bimetallic strip is adapted to operatively respond.

8. In an electro-thermally responsive overload circuit breaker, in combination, a manual lever operated switch mechanism normally movable to and resiliently retained in either its circuit completing or circuit interrupting position according to the direction of movement of said lever, overpowering spring operated means associated with said switch mechanism and normally tending to bias the same to circuit interrupting position, a bimetallic strip of predetermined caliber included in the circuit controlled by said switch, a latch member carried by said strip and cooperating with said spring operated means to normally render the latter ineffective to open the switch upon movement thereof to closed position, normally fixed means at each end of said strip for supporting the same in a predetermined plane and in a manner to prevent substantial endwise movement thereof in either direction, said means at one end of said strip comprising a resilient metal member and a manually adjustable clamping screw, said screw when manually adjusted being adapted to vary the initial plane of said strip and the corresponding initial position of said latch, to thereby vary the time element of response of said bimetallic strip for release of said spring operated means with consequent opening of said switch under a predetermined overload condition, and means comprising a spring-retracted indicating element associated with said spring operated means and projected by the latter upon release thereof by action of said bimetallic strip, to thereby indicate attainment of said predetermined overload condition in the controlled circuit.

9. In an electro-thermally responsive overload circuit breaker, in combination, a manual lever operated switch mechanism normally movable to and resiliently retained in either its circuit completing or circuit interrupting position according to the direction of movement of said lever, overpowering spring operated means associated with said switch mechanism and normally tending to bias the same to circuit interrupting position, a bimetallic strip of predetermined caliber included in the circuit controlled by said switch, a latch member carried by said strip and cooperating with said spring operated means to normally render the latter ineffective to open the switch upon movement thereof to closed position, normally fixed means at each end of said strip for supporting the same in a predetermined plane and in a manner to prevent substantial endwise movement thereof in either direction, said means at one end of said strip comprising a resilient metal member and a manually adjustable clamping screw, said screw when manually adjusted being adapted to vary the initial plane of said strip and the corresponding initial position of said latch, to thereby vary the time element of response of said bimetallic strip for release of said spring operated means with consequent opening of said switch under a predetermined overload condition, means comprising a spring-retracted indicating element associated with said spring operated means and projected by the latter upon release thereof by action of said bimetallic strip, to thereby indicate attainment of said predetermined overload condition in the controlled circuit, said indicating element having an exposed end surface which is substantially invisible in its environment when retracted, and the same having an adjacent portion of highly contrasting color adapted to be exposed as an incident to projection thereof.

10. In a circuit breaker, in combination, a molded insulating base having recesses respectively opening to the upper and lower surfaces thereof with a communicating opening therebetween, a pair of sheet metal members rigidly secured flatwise to the upper end wall of the lower recess, each of said members having a portion thereof projecting into said opening, one of said portions being adapted to provide a stationary contact, the other portion being bifurcated and bent upwardly to provide a pair of spaced fulcrum arms located within the upper recess, a punched and stamped sheet metal contactor having a relatively long arm and a relatively short

arm arranged at an obtuse angle with respect to each other, said long arm being adapted for movement into or out of engagement with said contact, said contactor having outwardly pointed substantially triangular openings formed in opposite sides thereof, said sides being bent upwardly into substantially parallel relation within the respective areas of said openings to provide bearings for engagement with said fulcrum arms, said upper recess having a pair of alined upwardly opening bearing notches formed in the side walls thereof, a lever having lateral pivot extensions positioned within said notches in a substantially flush relationship to the upper surface of said base, a metal plate overlying the upper surface of said base and rigidly attached thereto to retain said pivot extensions within said bearings, said plate having an opening to provide oscillating clearance for said lever, and an insulating plunger spring biased outwardly from the recessed lower end of said lever to effect tilting movement of said contactor into or out of engagement with said contact upon movement of said lever in opposite directions respectively.

11. In a circuit breaker, in combination, a molded insulating base having recesses respectively opening to the upper and lower surfaces thereof with a communicating opening therebetween, a pair of sheet metal members rigidly secured flatwise to the upper end wall of the lower recess, each of said members having a portion thereof projecting into said opening, one of said portions being adapted to provide a stationary contact, the other portion being bifurcated and bent upwardly to provide a pair of spaced fulcrum arms located within the upper recess, a punched and stamped sheet metal contactor having a relatively long arm and a relatively short arm arranged at an obtuse upward angle with respect to each other, said long arm being adapted for movement into or out of engagement with said contact, said contactor having outwardly pointed substantially triangular openings formed in opposite sides thereof, said sides being bent upwardly into substantially parallel relation within the respective areas of said openings to provide bearings for engagement with said fulcrum arms, said upper recess having a pair of alined upwardly opening bearing notches formed in the side walls thereof, a lever having lateral pivot extensions positioned within said notches in a substantially flush relationship to the upper surface of said base, a metal plate overlying the upper surface of said base and rigidly attached thereto to retain said pivot extensions within said bearings, said plate having an opening to provide oscillating clearance for said lever, an insulating plunger spring biased outwardly from the recessed lower end of said lever to effect tilting movement of said contactor into or out of engagement with said contact upon movement of said lever in opposite directions respectively, one of said first mentioned sheet metal members having a wiring terminal element formed integrally therewith, and the other of said members being electrically connected to a second wiring terminal element through the medium of an electrothermally responsive overload member associated with said device.

12. A metal switch lever having a relatively long substantially cylindrical recess opening to the lower end thereof, a coiled compression spring positioned within said recess, a substantially cylindrical insulating plunger whose upper end is normally engaged under pressure with said spring whereby the lower end of said plunger is biased outwardly from said recess, said lever having an exterior, downwardly facing, annular shoulder formed thereon intermediate the length of said recess, a metal ring the upper edge of which is adapted to seat against said shoulder, an integral annular portion upon the exterior of said lever being upset to underlie the lower edge of said ring whereby the latter is retained in assembled position, and said ring having diametrically opposite integral lateral extensions of substantially cylindrical form adapted for pivotal engagement with bearings formed in a suitable support, whereby said lever is limited to oscillatory movement in a single plane.

13. A metal switch lever having a relatively long substantially cylindrical recess opening to the lower end thereof, a coiled compression spring positioned within said recess, a substantially cylindrical insulating plunger whose upper end is normally engaged under pressure with said spring whereby the lower end of said plunger is biased outwardly from said recess, said lever having an exterior, downwardly facing, annular shoulder formed thereon intermediate the length of said recess, a metal ring the upper edge of which is adapted to seat against said shoulder, a punched and stamped sheet metal member of substantially inverted U-shape, the connecting portion of said U being perforated to accommodate said lever whereby the outer surface of the former is adapted to seat against the lower edge of said ring, an integral annular portion upon the exterior of said lever being upset to underlie the lower surface of said connecting portion of the U whereby the latter and said ring are retained in assembled relation to said lever, and said ring having diametrically opposite integral lateral extensions adapted for pivotal engagement with a suitable support.

14. A metal switch lever having a relatively long substantially cylindrical recess opening to the lower end thereof, a coiled compression spring positioned within said recess, a substantially cylindrical insulating plunger whose upper end is normally engaged under pressure with said spring whereby the lower end of said plunger is biased outwardly from said recess, said lever having an exterior, downwardly facing, annular shoulder formed thereon intermediate the length of said recess, a metal ring the upper edge of which is adapted to seat against said shoulder, a punched and stamped sheet metal member of substantially inverted U-shape, the connecting portion of said U being perforated to accommodate said lever whereby the outer surface of the former is adapted to seat against the lower edge of said ring, an integral annular portion upon the exterior of said lever being upset to underlie the lower surface of said connecting portion of the U whereby the latter and said ring are retained in assembled relation to said lever, said ring having diametrically opposite integral lateral extensions adapted for pivotal engagement with a suitable support, the arms of said U-shaped member being of downwardly pointed triangular contour, one side edge of each arm being adapted for joint engagement with a spring biased element of an electro-thermally responsive overload device, and both side edges of the respective arms being adapted to jointly engage cooperating shoulders formed upon a suitable support to positively limit the pivotal movement of said lever in each direction.

15. In an overload circuit breaker, in combination, a molded insulating base having a recess formed therein and opening to the upper and lower ends thereof, a switch mechanism positioned within the upper end portion of said recess and including a manually operable lever pivotally supported with respect thereto and projecting upwardly therebeyond, said switch mechanism comprising a stationary contact and a contactor tiltable into and out of engagement therewith, said lever providing for such tilting of said contactor at will, a molded insulating member slidably mounted within the lower end portion of said recess, a coiled compression spring interposed between said member and a side wall of said recess to bias said member toward a given extreme position, a lug carried by said lever and engageable by said member for normal movement by the latter to a position wherein said contactor is disengaged, a latch element associated with said member and projecting downwardly therefrom, a second molded insulating base underlying said base first mentioned and having a recess opening to the upper end thereof, a bimetallic electro-thermally responsive member positioned within said last mentioned recess and having means for connecting the same in circuit with said contact and said contactor upon engagement thereof, a latch element carried by said bimetallic member and adapted to normally engage and hold said first mentioned latch element and said insulating member upon movement of the latter against its bias by said lever to a position corresponding to engagement of said contactor with said contact, and said bimetallic member being movable automatically under given overload conditions to effect disengagement of said second latch element from the first to permit movement of said insulating member under its bias to effect corresponding movement of said lever, with consequent disengagement of said contactor from said contact.

16. In an overload circuit breaker, in combination, a molded insulating base having a recess formed therein and opening to the upper and lower ends thereof, a switch mechanism positioned within the upper end portion of said recess and including a manually operable lever pivotally supported with respect thereto and projecting upwardly therebeyond, said switch mechanism comprising a stationary contact and a contactor tiltable into and out of engagement therewith, said lever providing for such tilting of said contactor at will, a molded insulating member slidably mounted within the lower end portion of said recess, a coiled compression spring interposed between said member and a side wall of said recess to bias said member toward a given extreme position, a lug carried by said lever and engageable by said member for normal movement by the latter to a position wherein said contactor is disengaged, a latch element associated with said member and projecting downwardly therefrom, a second molded insulating base underlying said base first mentioned and having a recess opening to the upper end thereof, a bimetallic electro-thermally responsive member positioned within said last mentioned recess and having means for connecting the same in circuit with said contact and said contactor upon engagement thereof, a latch element carried by said bimetallic member and adapted to normally engage and hold said first mentioned latch element and said insulating member upon movement of the latter against its bias by said lever to a position corresponding to engagement of said contactor with said contact, said bimetallic member being movable automatically under given overload conditions to effect disengagement of said second latch element from the first to permit movement of said insulating member under its bias to effect corresponding movement of said lever, with consequent disengagement of said contactor from said contact, a pair of wiring terminal elements positioned at the lower end of said second base, means providing an electrical connection between one of said terminal elements and said switch mechanism, and means providing an electrical connection between the other terminal element and said bimetallic member.

17. In a manually controllable, non-free tripping, overload circuit breaker, in combination, a molded insulating base having a recess formed therein and opening to the upper end thereof and a relatively longer recess formed therein and opening to the lower end thereof with a communicating passage formed therebetween, a switch mechanism positioned within said upper recess and including a manually operable lever pivotally supported with respect thereto and projecting upwardly therefrom, said switch mechanism comprising a stationary contact and a pivoted contactor movable into and out of engagement therewith, said lever having a spring-biased plunger carried thereby to effect such movements of said contactor at will upon corresponding movements of said lever, a molded insulating member slidable within said lower recess, a coiled compression spring interposed between said member and a side wall of said recess to bias said member toward a given extreme position, said member having a recess formed therein and opening to the lower surface thereof, a metal member positioned upon the lower surface of said insulating member and interlocked against lateral movement relatively thereto, a coiled compression spring within said last mentioned recess to afford a downward bias upon said metal member, a lug formed integrally with said metal member and projecting downwardly therefrom, a thin, flat insulating plate underlying said base, said plate having a relatively long slot formed therein to provide clearance for said lug, a second molded insulating base underlying said plate and having a recess opening to its upper end, a bimetallic electro-thermally responsive member positioned within said last mentioned recess and having means for connecting the same in circuit with said contact and said contactor upon engagement thereof, a latch element carried by said bimetallic member and adapted to normally engage and hold said first mentioned latch element and said insulating member upon movement of the latter against its bias by said lever to a position corresponding to engagement of said contactor with said contact, said bimetallic member being bendable automatically under given overload conditions to effect disengagement of said second latch element from the first to permit movement of said insulating member under its bias to effect corresponding movement of said lever, with consequent disengagement of said contactor from said contact, and common means for rigidly and permanently connecting said insulating bases and said plate in assembled relationship to each other.

18. In a manually controllable, non-free-tripping, overload circuit breaker, in combination, a molded insulating base having a recess formed

therein and opening to the upper end thereof and a relatively longer recess formed therein and opening to the lower end thereof with a communicating passage formed therebetween, a switch mechanism positioned within said upper recess and including a manually operable lever pivotally supported with respect thereto and projecting upwardly therefrom, said switch mechanism comprising a stationary contact and a pivoted contactor movable into and out of engagement therewith, said lever having a spring-biased plunger carried thereby to effect such movements of said contactor at will upon corresponding movements of said lever, a molded insulating member slidable within said lower recess, a coiled compression spring interposed between said member and a side wall of said recess to bias said member toward a given extreme position, said member having a recess formed therein and opening to the lower surface thereof, a metal member positioned upon the lower surface of said insulating member and interlocked against lateral movement relatively thereto, a coiled compression spring within said last mentioned recess to afford a downward bias upon said metal member, a lug formed integrally with said metal member and projecting downwardly therefrom, a thin, flat insulating plate underlying said base, said plate having a relatively long slot formed therein to provide clearance for said lug, a second molded insulating base underlying said plate and having a recess opening to its upper end, a bimetallic electro-thermally responsive member positioned within said last mentioned recess and having means for connecting the same in circuit with said contact and said contactor upon engagement thereof, a latch element carried by said bimetallic member and adapted to normally engage and hold said first mentioned latch element and said insulating member upon movement of the latter against its bias by said lever to a position corresponding to engagement of said contactor with said contact, said bimetallic member being bendable automatically under given overload conditions to effect disengagement of said second latch element from the first to permit movement of said insulating member under its bias to effect corresponding movement of said lever, with consequent disengagement of said contactor from said contact, common means for rigidly and permanently connecting said insulating bases and said plate in assembled relationship to each other, a pair of wiring terminals positioned at the lower surface of said second base within the contour of the latter, one of said terminals being directly connected electrically with a part of said switch mechanism, and means including said bimetallic element providing an electrical connection between the other terminal and another part of said switch mechanism.

19. In a manually operable, non-free-tripping, overload circuit breaker for aircraft service, in combination, an upper molded insulating base having recesses opening respectively to the upper and lower surfaces thereof with an opening therebetween, a switch mechanism positioned within the first mentioned recess, said mechanism including a manually operable lever projecting above said base, said lever having a pair of spaced parallel lugs extending downwardly therefrom through said opening, a molded insulating member slidable within the second mentioned recess, a coiled spring associated with said insulating member to normally bias the latter toward one extreme position in the recess, said insulating member having shoulders and said lever lugs being engageable with said shoulders to effect movement of said insulating member toward its opposite extreme position against said bias, as an incident to manual movement of said lever in one direction, said insulating member having a latching lug projecting downwardly therefrom, a second molded insulating base having a recess opening to the upper surface thereof, an electro-thermally responsive overload member positioned within said last mentioned recess and having a latching lug normally engaged with said first mentioned latching lug in the last mentioned position of said insulating member, said switch when closed affording a circuit through said overload member, and the latter when subjected to a predetermined overload being adapted to release said insulating member to thereby effect automatic opening of the switch.

20. In a manually operable, non-free-tripping, overload circuit breaker for aircraft service, in combination, an upper molded insulating base having recesses opening respectively to the upper and lower surfaces thereof with an opening therebetween, a switch mechanism positioned within the first mentioned recess, said mechanism including a manually operable lever projecting above said base, said lever having a pair of spaced parallel lugs extending downwardly therefrom through said opening, a molded insulating member slidable within the second mentioned recess, a coiled spring associated with said insulating member to normally bias the latter toward one extreme position in the recess, said insulating member having shoulders and said lever lugs being engageable with said shoulders to effect movement of said insulating member toward its opposite extreme position against said bias, as an incident to manual movement of said lever in one direction, said insulating member having a latching lug projecting downwardly therefrom, a second molded insulating base having a recess opening to the upper surface thereof, an electro-thermally responsive overload member positioned within said last mentioned recess and having a latching lug normally overlappingly engaged with said first mentioned latching lug in the last mentioned position of said insulating member, said switch when closed affording a circuit through said overload member, the latter when subjected to a predetermined overload being adapted to release said insulating member to thereby effect automatic opening of the switch, and said switch being manually operable to open or closed position by said lever independently of said overload member after initial resetting of said insulating member.

21. In a manually operable, non-free-tripping, overload circuit breaker for aircraft service, in combination, an upper molded insulating base having recesses opening respectively to the upper and lower surfaces thereof with an opening therebetween, a switch mechanism positioned within the first mentioned recess, said mechanism including a manually operable lever projecting above said base, said lever having a pair of spaced parallel lugs extending downwardly therefrom through said opening, a molded insulating member slidable within the second mentioned recess, a coiled spring associated with said insulating member to normally bias the latter toward one extreme position in the recess, said insulating member having shoulders and said lever lugs being engageable with said shoulders to effect movement of said insulating member toward its

opposite extreme position against said bias, as an incident to manual movement of said lever in one direction, said insulating member having a latching lug projecting downwardly therefrom, a second molded insulating base having a recess opening to the upper surface thereof, an electrothermally responsive overload member positioned within said last mentioned recess and having a latching lug normally overlappingly engaged with said first mentioned latching lug in the last mentioned position of said insulating member, said switch when closed affording a circuit through said overload member, the latter when subjected to a predetermined overload being adapted to release said insulating member to thereby effect automatic opening of the switch, and manually adjustable means associated with said second base and said overload member to vary the degree of overlapping engagement of said latching lugs with each other, whereby the time period of response of the device to a given overload condition is predetermined.

22. In a manually operable, non-free-tripping, overload circuit breaker for aircraft service, in combination, an upper molded insulating base having recesses opening respectively to the upper and lower surfaces thereof with an opening therebetween, a switch mechanism positioned within the first mentioned recess, said mechanism including a manually operable lever projecting above said base, said lever having a pair of spaced parallel lugs extending downwardly therefrom through said opening, a molded insulating member slidable within the second mentioned recess, a coiled spring associated with said insulating member to normally bias the latter toward one extreme position in the recess, said insulating member having shoulders and said lever lugs being engageable with said shoulders to effect movement of said insulating member toward its opposite extreme position against said bias, as an incident to manual movement of said lever in one direction, said insulating member having a latching lug projecting downwardly therefrom, a second molded insulating base having a recess opening to the upper surface thereof, an electro-thermally responsive overload member positioned within said last mentioned recess and having a latching lug normally overlappingly engaged with said first mentioned latching lug in the last mentioned position of said insulating member, said switch when closed affording a circuit through said overload member, the latter when subjected to a predetermined overload being adapted to release said insulating member to thereby effect automatic opening of the switch, manually adjustable means associated with said second base and said overload member to vary the degree of overlapping engagement of said latching lugs with each other, whereby the time period of response of the device to a given overload condition is predetermined, said manually adjustable means comprising a screw having threaded engagement with said second base, and said overload member comprising a bimetallic strip one end of which is clamped by said screw to a yieldable support of suitable form.

23. In a manually operable, non-free-tripping, overload circuit breaker for aircraft service, in combination, an upper molded insulating base having recesses opening respectively to the upper and lower surfaces thereof with an opening therebetween, a switch mechanism positioned within the first mentioned recess, said mechanism including a manually operable lever projecting above said base, said lever having a pair of spaced parallel lugs extending downwardly therefrom through said opening, a molded insulating member slidable within the second mentioned recess, a coiled spring associated with said insulating member to normally bias the latter toward one extreme position in the recess, said insulating member having shoulders and said lever lugs being engageable with said shoulders to effect movement of said insulating member toward its opposite extreme position against said bias, as an incident to manual movement of said lever in one direction, said insulating member having a latching lug projecting downwardly therefrom, a second molded insulating base having a recess opening to the upper surface thereof, an electro-thermally responsive overload member positioned within said last mentioned recess and having a latching lug normally engaged with said first mentioned latching lug in the last mentioned position of said insulating member, said switch when closed affording a circuit through said overload member, the latter when subjected to a predetermined overload being adapted to release said insulating member to thereby effect automatic opening of the switch, said switch being manually operable to open or closed position by said lever independently of said overload member after initial resetting of said insulating member, and said switch mechanism being adapted for retention thereof in closed position by continued manual engagement of said lever regardless of the condition of said overload member.

24. In a manually operable, non-free-tripping, overload circuit breaker for aircraft service, in combination, an upper molded insulating base having recesses opening respectively to the upper and lower surfaces thereof with an opening therebetween, a switch mechanism positioned within the first mentioned recess, said mechanism including a manually operable lever projecting above said base, said lever having a pair of spaced parallel lugs extending downwardly therefrom through said opening, a molded insulating member slidable within the second mentioned recess, a coiled spring associated with said insulating member to normally bias the latter toward one extreme position in the recess, said insulating member having shoulders and said lever lugs being engageable with said shoulders to effect movement of said insulating member toward its opposite extreme position against said bias, as an incident to manual movement of said lever in one direction, said insulating member having a latching lug projecting downwardly therefrom, a second molded insulating base having a recess opening to the upper surface thereof, an electrothermally responsive overload member positioned within said last mentioned recess and having a latching lug normally engaged with said first mentioned latching lug in the last mentioned position of said insulating member, said switch when closed affording a circuit through said overload member, the latter when subjected to a predetermined overload being adapted to release said insulating member to thereby effect automatic opening of the switch, said switch being manually operable to open or closed position by said lever independently of said overload member after initial resetting of said insulating member, said switch mechanism being adapted for retention thereof in closed position by continued manual engagement of said lever regardless of the condition of said overload member, a pair of wiring terminals accessible at the lower surface of said sec-

ond base, one of said terminals being electrically connected with a part of said switch mechanism, and the other terminal being electrically connected with said overload member.

25. In a manually operable, non-free-tripping, overload circuit breaker for aircraft service, in combination, an upper molded insulating base having recesses opening respectively to the upper and lower surfaces thereof with an opening therebetween, a switch mechanism positioned within the first mentioned recess, said mechanism including a manually operable lever projecting above said base, said lever having a pair of spaced parallel lugs extending downwardly therefrom through said opening, a molded insulating member slidable within the second mentioned recess, a coiled spring associated with said insulating member to normally bias the latter toward one extreme position in the recess, said insulating member having shoulders and said lever lugs being engageable with said shoulders to effect movement of said insulating member toward its opposite extreme position against said bias, as an incident to manual movement of said lever in one direction, said insulating member having a latching lug projecting downwardly therefrom, a second molded insulating base having a recess opening to the upper surface thereof, an electro-thermally responsive overload member positioned within said last mentioned recess and having a latching lug normally engaged with said first mentioned latching lug in the last mentioned position of said insulating member, said switch when closed affording a circuit through said overload member, the latter when subjected to a predetermined overload being adapted to release said insulating member to thereby effect automatic opening of the switch, said switch being manually operable to open or closed position by said lever independently of said overload member after initial resetting of said insulating member, said switch mechanism being adapted for retention thereof in closed position by continued manual engagement of said lever regardless of the condition of said overload member, a pair of wiring terminals accessible at the lower surface of said second base, one of said terminals being electrically connected with a part of said switch mechanism, the other terminal being electrically connected with said overload member, and said overload member being electrically connected with another part of said switch mechanism.

26. In an electro-thermally responsive overload circuit breaker, in combination, a normally flat bimetallic strip of predetermined caliber, means for connecting said strip in an electric circuit to provide for response thereof to a given overload condition in the circuit, a switch for controlling said circuit, said switch being manually operable to open or closed position onder all conditions, spring means for biasing said switch toward open position, a latch member attached to said strip and normally engaging a part of said switch when closed to restrain the action of said biasing spring, means for supporting said strip at each end, and the supporting means for one end of said strip being manually adjustable to move said end of the strip to vary the normal plane of the latter, whereby the initial position of said latch member is correspondingly varied to thereby predetermine the period of latch-tripping response of said bimetallio strip to a given overload condition, the supporting means for the other end of said strip permitting the aforementioned adjustment of the plane thereof without bending.

27. In an electro-thermally responsive overload circuit breaker, in combination, a manually operable switch mechanism all parts of which are normally biased to circuit interrupting position, a normally flat bimetallic strip of predetermined caliber included in the circuit controlled by said switch, a latch member carried by said strip and cooperating with said switch to normally hold the latter, when closed, in circuit completing position against said bias, normally fixed means at each end of said strip for supporting the same in a predetermined plane, manual adjusting means at one end of the strip, said means when manually adjusted being adapted to vary the initial plane of said strip and the corresponding initial position of said latch, to thereby vary the time element of response of said bimetallic strip for tripping of said switch under a given overload condition, and said switch being adapted for manual retention in circuit completing position independently of said latch.

28. In an electro-thermally responsive overload circuit breaker, in combination, a switch biased to open position and adapted for manual movement to and retention in closed position at will, a normally flat bimetallic strip of predetermined caliber, means for connecting said strip in the circuit controlled by said switch to normally provide for response of the former to a given overload condition in said circuit, a latch member attached to said strip and projecting therefrom, normally fixed means at each end of said strip for supporting the same, the supporting means for one end of said strip being manually adjustable to move said end of the strip to vary the normal plane of the latter, whereby the initial position of said latch member is correspondingly varied to thereby predetermine the period of latch-tripping response of said bimetallic strip to a given overload condition, and means comprising a heating element associated with said bimetallic strip and also included in said circuit, said heating element acting under given overload conditions to modify the operating characteristics of said bimetallic strip under overload conditions.

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