

**March 1, 1966**

**M. T. LYBROOK**  
CONTROL AMBIENT DE

**3,238,331**

Filed Oct. 23, 1963

3 Sheets-Sheet 1

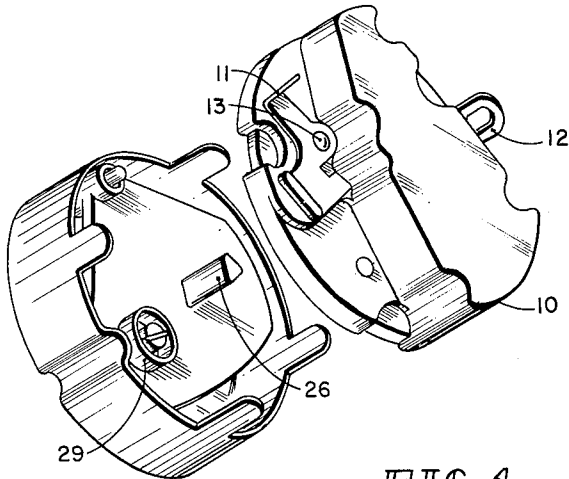


FIG. 1

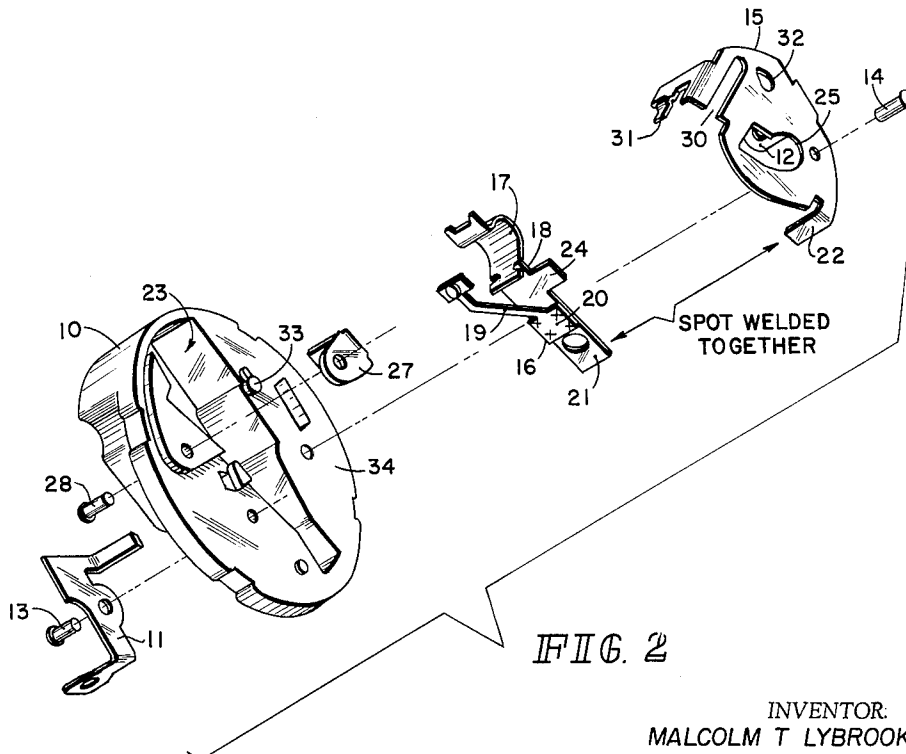



FIG. 2

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CIRCUIT BREAKER AND CONTROL AMBIENT TEMPERATURE COMPENSATOR  
INCLUDING WEAKENING SLOT ADJUSTING MEANS

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3 Sheets-Sheet 2

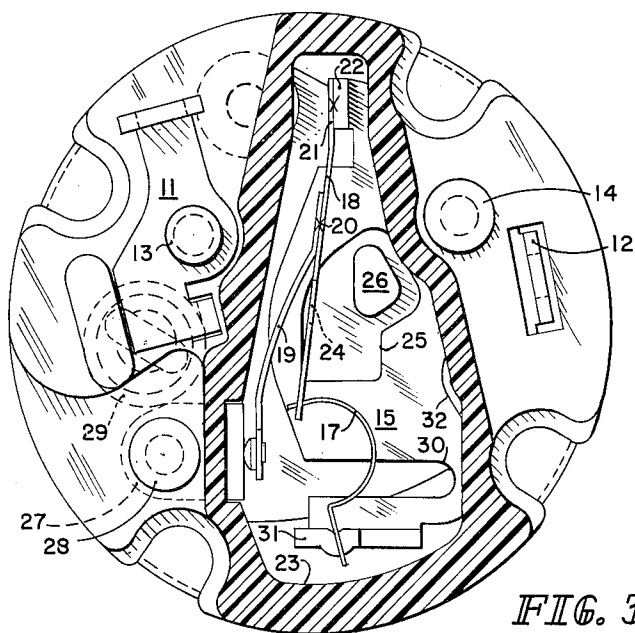


FIG. 3

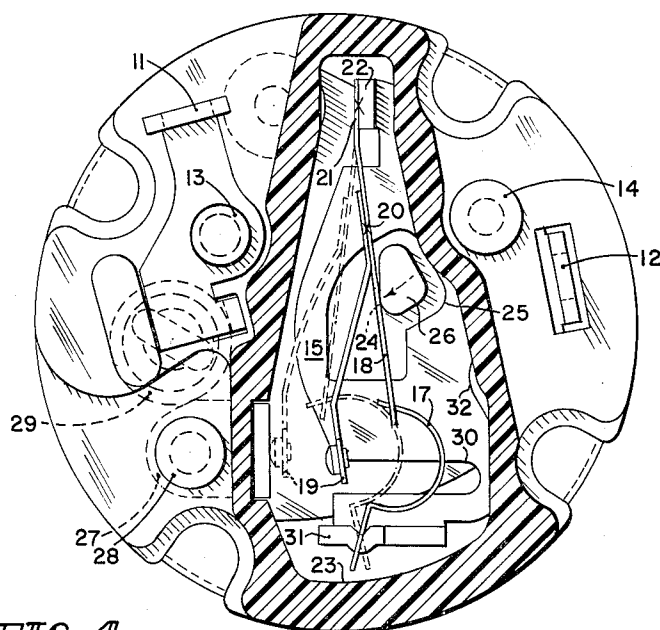


FIG. 4

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CIRCUIT BREAKER AND CONTROL AMBIENT TEMPERATURE COMPENSATOR  
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3 Sheets-Sheet 3

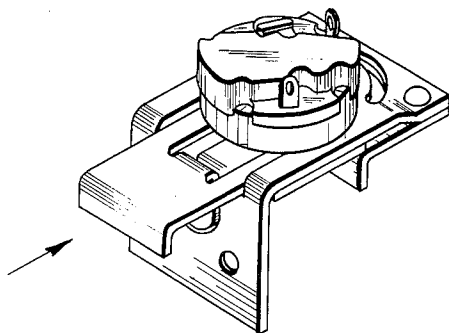


FIG. 5

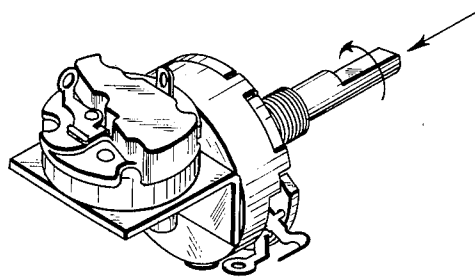


FIG. 6

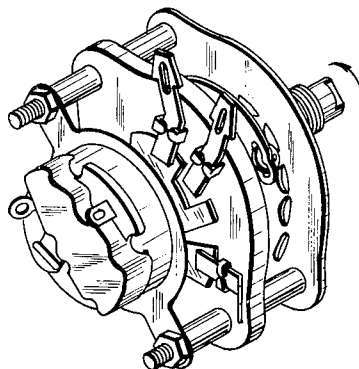


FIG. 7

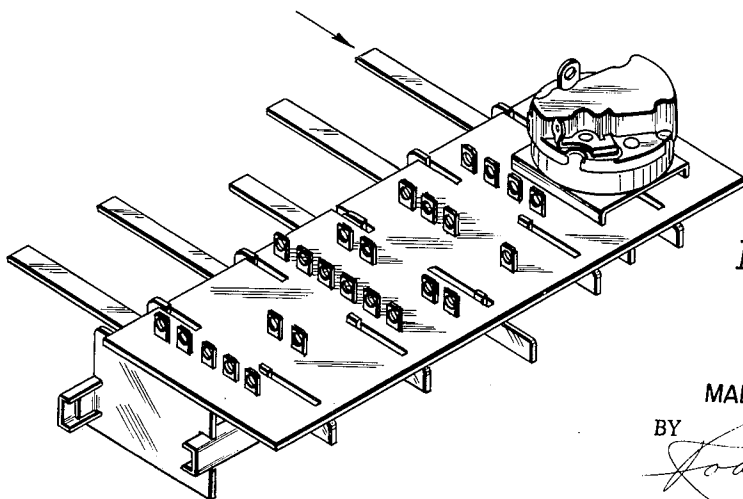
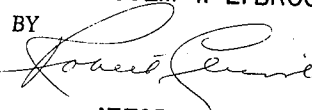


FIG. 8

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3,238,331

**CIRCUIT BREAKER AND CONTROL AMBIENT TEMPERATURE COMPENSATOR INCLUDING WEAKENING SLOT ADJUSTING MEANS****Malcolm T. Lybrook, Frankfort, Ind., assignor to P. R. Mallory & Co., Inc., Indianapolis, Ind., a corporation of Delaware**

Filed Oct. 23, 1963, Ser. No. 318,258

13 Claims. (Cl. 200—114)

This invention relates to electric controls and particularly to fast break snap switches of the type usually found in radio and television receivers in combination with variable resistors, as well as other electrical apparatus. The present invention is a modification of the device described in application Serial No. 272,309, filed April 11, 1963, entitled "Thermal Safe Power Switch for Controls."

As pointed out in assignee's application Serial No. 272,309, the use of fuses and other separate thermal safe devices, some of which are independently mounted and actuated, is presently known and the aforementioned application provides a circuit breaker which tolerates limited current fluctuations under ordinary circumstances while the present improvement allows for ambient temperature changes, keeping the circuit closed during temporary current surges, the intensity of which would not be great enough to cause damage to components or the appliance itself.

Certain circuit breakers without ambient temperature compensation inherently have several undesirable operating characteristics for example; any heat rise introduced into the bi-metal strip invariably reduces contact pressure, and at times to the point where premature contact opening will occur; the slow displacement of the contact element induces contact welding or sticking and, of course, the possibility of intermittent opening and closing of the contacts is ever present.

The present invention precludes these possibilities by means of a compensator which maintains contact pressure up to the instant of opening. I have thus provided a resettable circuit breaker having considerable advantage over the use of separate fuses and circuit breakers as safety devices for example, the natural reaction to a cessation of power to any appliance is to turn the unit off by means provided thereon whether it be a knob, push button, lever, etc. The act of opening the switch contacts in the present invention resets the circuit breaker in preparation for a return to normal conditions.

It is therefore an object of the present invention to provide an improved snap switch for operation under fluctuating current conditions.

It is another object of the present invention to provide a new and novel snap switch having an integral temperature responsive circuit breaker which will not be falsely tripped or opened due to normal momentary surges of current.

It is another object of the present invention to provide a circuit breaker having a means for holding back the opening action of the circuit breaker against a transient harmless overload.

It is still another object of the present invention to provide a combination snap switch and circuit breaker.

A further object of the present invention is to eliminate the need for a separate fuse or circuit breaker in numerous electrical appliances.

A further object of the present invention is to provide a temperature responsive circuit breaker capable of being

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reset manually by normal manipulation of a control knob.

It is still a further object of the present invention to provide a circuit breaker which can be adjusted to various critical ranges of thermal response.

It is still another object of the present invention to provide a compact power switch and circuit breaker combination which is small in size and economical to manufacture.

Other objects will become apparent when the following description is taken in conjunction with the drawings in which:

FIG. 1 is a perspective view showing the general configuration of the present invention as it cooperates with a metal cup containing an insulative rotor movably carrying a floating contact ring and an actuating projection for the present circuit breaker.

FIG. 2 is an exploded perspective view showing the cooperative relationship of the component parts of the present invention.

FIG. 3 is a top view of the switch-circuit breaker assembly with the top of the upper chamber removed showing the components in the operating, current-carrying position.

FIG. 4 is the same as FIG. 3, except the bow spring, conductive leaf and bimetal contact spring are shown as they would appear after a thermal overload had been introduced placing the conductive leaf spring in a cocked position for resetting.

FIGS. 5, 6, 7 and 8 represent typical applications for the present invention such as a push-push switch; a variable resistor in which the operating shaft moves both radially, to regulate resistance, and axially to manipulate the switch and circuit breaker; a conventional rotary switch and a multi-plunger pushbutton switch.

Generally speaking, the basic unit consists of a housing of insulative material adapted to be attached to a circular cup containing a movable rotor which carries a floating ring type contact and an integral actuator for resetting a bimetal circuit breaker assembled in a cavity in the insulative housing. The switch proper is manipulated manually from one position to another through an over-center spring while the circuit breaker only responds to a pre-determined thermal condition in one direction and is manually reset in the other direction. The circuit breaker is capable of withstanding normal ambient temperatures as well as brief current surges without opening the contacts or permitting contact pressure to diminish until just prior to breaking. The housing provides a base for the power switch contacts and a chamber on a different level for the overload mechanism. An adjustment is also provided whereby the thermal resistance of the circuit breaker can be increased or decreased depending on the temperature operating range desired.

Referring initially to FIGS. 1 and 2, there is shown at 10 a generally circular housing made of insulating molding material carrying a plurality of wire connecting terminals 11 and 12 securely fastened to a housing 10 by rivets 13 and 14. Terminal 12 is an integral part of contact frame 15 which serves as a carrier for circuit breaker assembly 16 comprising a bow spring 17 and a bimetal spring 19 welded to conductive leaf spring 18 as shown at 20. Tab 21 of spring 18 is welded to tab 22 of contact frame 15. The assembly consisting of bow spring 17, conductive leaf spring 18, bimetal contact spring 19 and contact frame 15, is inserted into cavity 23 of housing 10 and secured thereto by rivet 14. An actuating tab 24 projects through aperture 25 of contact

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frame 15 and is actuated into reset position by rotor projection 26, shown in FIG. 1. As described in application Serial No. 272,309, a three point contact is necessary to complete an active circuit. Therefore, when terminal 11 and contact 27 are assembled to housing 10 by rivets 13 and 28, a nest is formed to receive contact ring 29 shown in FIG. 1. A three point contact between terminal 11, terminal 12 and contact 27, completes the circuit with two terminations. A weakening slot 30 is provided in contact frame 15 in order that the bow spring pivot arm 31 may be adjusted to increase or decrease the mechanical stress of the bimetal leaf thereby changing the range of currents to be tolerated by the circuit breaker.

Contact frame 15 is prevented from rotating around rivet 14 when aperture 32 is assembled over projection 33 extending above the surface 34 of housing 10.

As can be more clearly seen in FIG. 3 (normal "on" position), a live circuit is formed through contact frame 15 and integral terminal 12, contact ring 29, terminal 11 and contact 27. When an overload current is introduced, circuit breaker assembly 16 snaps into open position as shown by solid lines in FIG. 4, thereby isolating terminal 11, contact ring 29 and contact 27 for which there is no wire connection. When the appliance is turned off, as indicated by the arrow in FIG. 4, contact ring 29 opens the connection between contact 27 and terminal 11, cutting off the power supply and at the same time resetting the circuit breaker in preparation for a return to normal conditions when reverse manipulation of the switch shaft to the "on" position places the rotor projection back to the position shown in FIG. 3. Until a subsequent overload is again encountered the projection is ineffective in both positions.

While I have described a single embodiment of the present invention, it is to be understood that modifications may be made without departing from the spirit thereof. I claim as my invention:

1. In a combination an electric switch and overload mechanism adjustable so as to respond to a particular overload current of a plurality of overload currents comprising: a housing carrying a plurality of terminals; a first level formed within said housing; a means carrying a contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; and a second level formed in said housing, said second level including an adjustable contact frame means containing a weakening slot for mounting an overcenter snap action circuit breaker means, the position of said adjustable contact frame determinative of said overload current of said range of overload currents, said circuit breaker means including a contact carrying bimetal spring means having a contact carrying end normally biased into engagement with one of said terminals, said contact remaining in engagement with said one terminal as an initial flow of said overload current flows therethrough, continued flow of said overload current displacing said circuit breaker means so as to store energy therein, said circuit breaker means releasing said stored energy after said overcenter condition is exceeded thereby displacing said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion.

2. In combination an electric switch and overload mechanism responsive to an overload current of a range of overload currents comprising: a housing carrying a plurality of terminals; a first level formed within said housing; a means carrying a contact ring and mounted within said first level, said means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said housing, said second level including an adjustable contact frame means containing a weakening slot for pivotally mounting an overcenter snap action circuit breaker means, the position of said

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adjustable contact frame determinative of said overload current of said range of overload currents, said circuit breaker means including a contact carrying bimetal spring means having a contact carrying end normally biased into engagement with one of said terminals, said contact remaining in engagement with said one terminal as an initial flow of said overload current flows therethrough, continued flow of said overload current displacing said circuit breaker means so as to store energy therein, said circuit breaker means releasing said stored energy after said overcenter condition is exceeded thereby displacing said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

3. In combination an electric switch and overload mechanism adjustable so as to respond to a particular overload current of a plurality of overload currents comprising: a housing carrying a plurality of terminals; a first level formed within said housing; a means carrying a contact ring and mounted within said first level, said means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said housing, said second level including an adjustable contact frame means for pivotally mounting an overcenter snap action circuit breaker means, said adjustable contact frame including a slot whose width is determinative of said overload current of said plurality of overload currents, said circuit breaker means including a contact carrying bimetal spring means having a contact carrying end normally biased into engagement with one of said terminals, said contact remaining in engagement with said one terminal as an initial flow of said overload current flows therethrough, continued flow of said overload current displacing said circuit breaker means so as to store energy therein, said circuit breaker means releasing said stored energy after said overcenter condition is exceeded thereby displacing said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

4. In combination an electric switch and overload mechanism responsive to an overload current of a range of overload currents comprising: a housing carrying a plurality of terminals; a first level formed within said housing; a means carrying a contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said housing, said second level including an adjustable contact frame means for pivotally mounting an overcenter snap action circuit breaker means, said adjustable contact frame including a slot whose width is determinative of the longitudinal compression under which said circuit breaker means is mounted, said circuit breaker means including a contact carrying bimetal spring means having a contact carrying end normally biased into engagement with one of said terminals, said contact remaining in engagement with said one terminal as an initial overload current flows therethrough, continued flow of said overload current displacing said circuit breaker means so as to store energy therein, said circuit breaker means releasing said stored energy after said overcenter condition is exceeded thereby displacing said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

5. In combination an electric switch and overload mechanism adjustable so as to respond to a particular

overload current of a plurality of overload currents comprising: a housing having a base, said base carrying a plurality of terminals; a first level formed within said housing by said base; a rotor means carrying a floating contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said base, said second level including an adjustable contact frame means for pivotally mounting an overcenter snap action circuit breaker means, said adjustable contact frame including a slot whose width is determinative of the longitudinal compression under which said circuit breaker means is mounted, said circuit breaker means including a contact carrying bimetal spring means having a free contact carrying end normally biased into engagement with one of said terminals, said contact remaining in engagement with said one terminal as an initial overload current flows therethrough, continued flow of said overload current displacing said circuit breaker means so as to store energy therein, said circuit breaker means releasing said stored energy after said overcenter condition is exceeded thereby displacing said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

6. In combination an electric switch and overload mechanism adjustable so as to respond to a particular overload current of a plurality of overload currents comprising: a housing having a base, said base carrying a plurality of terminals; a first level formed within said housing by said base; a rotor means carrying a floating contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said base, said second level including an adjustable contact frame means for pivotally mounting an overcenter snap action circuit breaker means, said adjustable contact frame including a slot whose width is determinative of the longitudinal compression under which said circuit breaker means is mounted, said circuit breaker means including a contact carrying bimetal spring means having a free contact carrying end normally biased into engagement with one of said terminals, said contact remaining in engagement with said one terminal as an initial flow of said overload current flows therethrough, continued flow of said overload current displacing said circuit breaker means so as to store energy therein, and increasing the contact pressure exerted by said contact carrying bimetal spring against said one terminal, said circuit breaker means releasing said stored energy after said overcenter condition is exceeded thereby displacing said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

7. In combination an electric switch and overload mechanism comprising: a housing carrying a plurality of terminals; a first level formed within said housing; means carrying a contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; and a second level formed in said housing, said second level including an adjustable means containing a weakening slot for mounting an overcenter snap action circuit breaker means, said circuit breaker means including a leaf spring means having an end coupled to said mounting means, a contact carrying bimetal spring means having one end coupled to said leaf spring, said bimetal spring extending angularly with respect to said leaf spring to normally

bias said contact into engagement with one of said terminals, a bowed spring having one extremity coupled to the other end of said leaf spring and said other extremity of said bowed spring coupled to said mounting means, said contact of said bimetal spring remaining in engagement with said one terminal as in initial overload current flows therethrough, continued flow of said overload current straightening said bimetal spring thereby displacing said leaf spring and said bowed spring so as to store energy in said bowed spring, said bowed spring releasing said stored energy after said overcenter condition is exceeded so as to displace said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion.

8. In combination an electric switch and overload mechanism adjustable so as to respond to a particular overload current of a plurality of overload currents comprising: a housing carrying a plurality of terminals; a first level formed within said housing, a means carrying a contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; and a second level formed in said housing, said second level including an adjustable contact frame means containing a weakening slot for mounting an overcenter snap action circuit breaker means, the position of said adjustable contact frame determinative of said overload current of said range of overload currents, said circuit breaker means including a leaf spring means having an end coupled to said mounting means, a contact carrying bimetal spring means having one end coupled to said leaf spring, said bimetal spring extending angularly with respect to said leaf spring to normally bias said contact into engagement with one of said terminals, a bowed spring having one extremity coupled to the other end of said leaf spring and said other extremity of said bowed spring coupled to said mounting means, said contact of said bimetal spring remaining in engagement with said one terminal as an initial overload current flows therethrough, continued flow of said overload current straightening said bimetal spring thereby displacing said leaf spring and said bowed spring so as to store energy in said bowed spring, said bowed spring releasing said stored energy after said overcenter condition is exceeded so as to displace said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion.

9. In combination an electric switch and overload mechanism responsive to an overload current of a range of overload currents comprising: a housing carrying a plurality of terminals; a first level formed within said housing; a means carrying a contact ring and mounted with said first level, said means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said housing, said second level including an adjustable contact frame means containing a weakening slot for pivotally mounting an overcenter snap action circuit breaker means, the position of said adjustable contact frame determinative of said overload current of said range of overload currents, said circuit breaker means including a leaf spring means having an end coupled to said mounting means, a contact carrying bimetal spring means having one end coupled to said leaf spring, said bimetal spring extending angularly with respect to said leaf spring to normally bias said contact into engagement with one of said terminals, a bowed spring having one extremity pivotally coupled to the other end of said leaf spring and said other extremity of said bowed spring pivotally coupled to said mounting means, said contact of said bimetal spring remaining in engagement with said one terminal as an initial flow of said overload current flows therethrough, continued flow of said overload current straightening said bimetal spring

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thereby displacing said leaf spring and said bowed spring so as to store energy in said bowed spring, said bowed spring releasing said stored energy after said overcenter condition is exceeded so as to displace said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

10. In combination an electric switch and overload mechanism adjustable so as to respond to a particular overload current of a plurality of overload currents comprising: a housing carrying a plurality of terminals; a first level formed within said housing; a means carrying a contact ring and mounted within said first level, said means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said housing, said second level including an adjustable contact frame means for pivotally mounting an overcenter snap action circuit breaker means, said adjustable contact frame including a slot whose width is determinative of said overload current of said plurality of overload currents, said circuit breaker means including a leaf spring means having an end coupled to said mounting means, a contact carrying bimetal spring means having one end coupled to said leaf spring, said bimetal spring extending angularly with respect to said leaf spring to normally bias said contact into engagement with one of said terminals, a bowed spring having one extremity pivotally coupled to the other end of said leaf spring and said other extremity of said bowed spring pivotally coupled to said mounting means, said contact of said bimetal spring remaining in engagement with said one terminal as an initial flow of said overload current flows therethrough, continued flow of said overload current straightening said bimetal spring thereby displacing said leaf spring and said bowed spring so as to store energy in said bowed spring, said bowed spring releasing said stored energy after said overcenter condition is exceeded so as to displace said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

11. In combination an electric switch and overload responsive to an overload current of a range of overload currents mechanism comprising: a housing carrying carrying a plurality of terminals; a first level formed within said housing; a means carrying a contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said housing, said second level including an adjustable contact frame means for pivotally mounting an overcenter snap action circuit breaker means, said adjustable contact frame including a slot whose width is determinative of the longitudinal compression under which said circuit breaker means is mounted, said circuit breaker means including a leaf spring means having an end coupled to said mounting means, a contact carrying bimetal spring means having one end coupled to said leaf spring, said bimetal spring extending angularly with respect to said leaf spring to normally bias said contact into engagement with one of said terminals, a bowed spring having one extremity pivotally coupled to the other end of said leaf spring and said other extremity of said bowed spring pivotally coupled to said mounting means, said contact of said bimetal spring remaining in engagement with said one terminal as an initial overload current flows therethrough, continued flow of said overload current straightening said bimetal spring thereby displacing said leaf spring and said bowed spring so as to store energy in said bowed spring,

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said bowed spring releasing said stored energy after said overcenter condition is exceeded so as to displace said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

12. In combination an electric switch and overload mechanism adjustable so as to respond to a particular overload current of a plurality of overload currents comprising: a housing having a base, said base carrying a plurality of terminals; a first level formed within said housing by said base; a rotor means carrying a floating contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said base, said level including an adjustable contact frame means for pivotally mounting an overcenter snap action circuit breaker means, said adjustable contact frame including a slot, whose width is determinative of the longitudinal compression under which said circuit breaker means is mounted, said circuit breaker means including a leaf spring means having an end coupled to said mounting means, a contact carrying bimetal spring means having one end coupled to said leaf spring, said bimetal spring extending angularly with respect to said leaf spring to normally bias said contact into engagement with one of said terminals, a bowed spring having one extremity pivotally coupled to the other end of said leaf spring and said other extremity of said bowed spring pivotally coupled to said mounting means, said contact of said bimetal spring remaining in engagement with said one terminal as an initial overload current flows therethrough, continued flow of said overload current straightening said bimetal spring thereby displacing said leaf spring and said bowed spring so as to store energy in said bowed spring, said bowed spring releasing said stored energy after said overcenter condition is exceeded so as to displace said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

13. In combination an electric switch and overload mechanism adjustable so as to respond to a particular overload current of a plurality of overload currents comprising: a housing having a base, said base carrying a plurality of terminals; a first level formed within said housing by said base; a rotor means carrying a floating contact ring and mounted within said first level, said rotor means for actuating said ring from a disengaged position to an engaged position with said terminals so as to allow current to pass therethrough; a second level formed in said base, said second level including an adjustable contact frame means for pivotally mounting an overcenter snap action circuit breaker means, said adjustable contact frame including a slot whose width is determinative of the longitudinal compression under which said circuit breaker means is mounted, said circuit breaker means including a leaf spring means having an end coupled to said mounting means, a contact carrying bimetal spring means having one end coupled to said leaf spring, said bimetal spring extending angularly with respect to said leaf spring to normally bias said contact into engagement with one of said terminals, a bowed spring having one extremity pivotally coupled to the other end of said leaf spring and said other extremity of said bowed spring pivotally coupled to said mounting means, said contact of said bimetal spring remaining in engagement with said one terminal as an initial flow of said overload current flows therethrough, continued flow of said overload current straightening said bimetal spring thereby displacing said leaf spring and said bowed spring so as to store energy in said

5 bowed spring and increasing the contact pressure exerted by said contact carrying bimetal spring against said one terminal, said bowed spring releasing said stored energy after said overcenter condition is exceeded so as to displace said contact of said bimetal spring from said engaged position with said one terminal with a snap action motion; and means for resetting said circuit breaker means, said circuit breaker means resettable only when said ring is disengaged from said terminals.

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