July 22, 1958 D. A. LOMBARDO 2,844,690

CIRCUIT BREAKER FOR INDIVIDUAL CIRCUITS

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Fig. 2.

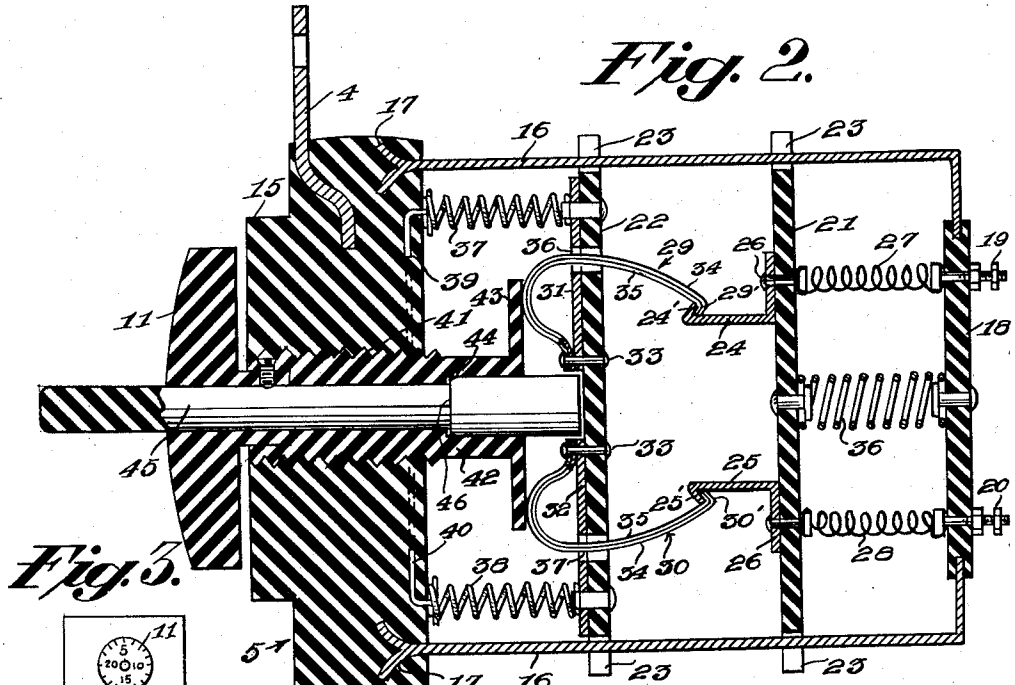


Fig. 3.

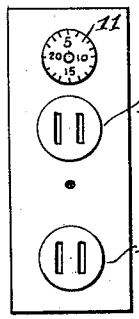


Fig. 1.

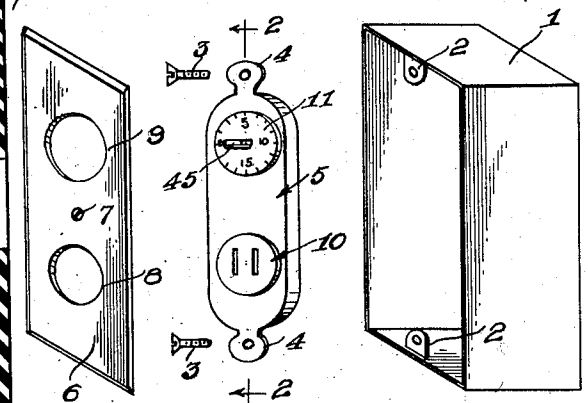
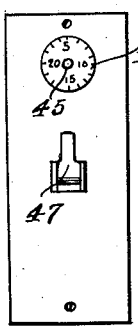


Fig. 4.



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CIRCUIT BREAKER FOR INDIVIDUAL CIRCUITS

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7 Claims. (Cl. 200—116)

This invention relates generally to electric circuit interrupters and more particularly to a protective device adapted to automatically interrupt an individual circuit upon the passage therethrough of overload currents of preselected values.

The electric wiring customarily installed in houses or buildings provides as many as a dozen parallel circuits for lamps or appliances protected by only one fuse, usually rated at fifteen or twenty amperes. The individual circuits or outlets usually draw much less current. A table lamp plugged into an outlet, for example, draws one to two amperes, while a vacuum cleaner, toaster or electric iron draws between three and ten amperes. Regardless of these varying needs, if a short circuit occurs in any one of the parallel circuits, or if an overload occurs by reason of simultaneous use of too many lamps and appliances on the parallel circuits sufficient to blow the fuse, power to all of the circuits is interrupted until the fuse is replaced. Such replacement is, at the minimum, an inconvenience and frequently represents an unnecessary expense, as when the blowing is caused by excessive overload or shorting in only one of the parallel circuits. An additional disadvantage exists in the lack of safety in such conventional wiring, since an appliance may develop a minor fault which will draw too much current and seriously damage that or other appliances without exceeding the rated current of the fuse.

It is the primary object of this invention to overcome the above enumerated disadvantages of conventional wiring by provision of a novel circuit interrupter which may be employed in one or more of several parallel circuits protected by a single fuse to supplement that fuse and thereby increase the safety of the wiring system.

Another object of this invention is to provide a novel circuit interrupter which may be installed in a conventional electric wall outlet or wall switch for the protection of the circuit served thereby.

Still another object of the invention is to provide a novel circuit interrupter which may be adjusted and preset to break the circuit at a selected current rating as deemed desirable for the safety needs of the particular appliance or appliances to be connected in that circuit.

A further object of the invention is to provide a novel circuit interrupter employing a bimetallic, latching, contact element which may be tensioned in varying degree to change the current value at which the interrupter will operate to unlatch said contact element and open the circuit.

A still further object of the invention is to provide a novel circuit interrupter of the type described which may be quickly and easily reset to close the circuit after interruption thereof.

Yet another object of the invention is to provide a circuit interrupter especially adapted for individual circuit protection and having simplicity of design, economy of construction and efficiency in operation.

The novel features that are considered characteristic

of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings, wherein like reference characters indicate like parts throughout the several figures and in which:

Fig. 1 is a perspective view of an electric wall outlet constructed in accordance with the invention and in which the parts have been exploded for clarity of illustration;

Fig. 2 is an enlarged section taken along line 2—2 of Fig. 1 centrally of the molded connector insert embodying the novel circuit interrupter;

Fig. 3 is a front view of an electric wall outlet embodying the novel circuit interrupter in conjunction with a plurality of appliance sockets, and

Fig. 4 is a front view of an electric wall switch embodying the novel circuit interrupter.

The embodiments of the invention which are disclosed herein are illustrated as being mounted and contained within a standard receptacle **1** usually flush mounted in a wall. A pair of aperture lugs **2** is provided for reception of screws **3** which secure the mounting ears **4** of a combination interrupter and socket insert **5** to the receptacle **1**. The assembly is closed by a cover plate **6** secured to the insert **5** by screw **7**. The usual cover plate **6** is provided with two openings **8** and **9**, the former of which receives the socket protrusion **10**, while the latter receives the interrupter control knob **11** and its support boss **15**.

The combination socket and interrupter insert **5** comprises a block **12** of insulating material having a socket **10** molded therein for electrical connection of an appliance or other apparatus. The socket may be of the usual type fitted with a pair of spring female contact members **13**, preferably molded therein. Centrally of block **12** is the usual threaded insert **14** adapted to receive the cover plate mounting screw **7**. In the upper part of block **12** is a circular boss **15** which fits into opening **9** of the cover plate and supports the control knob **11**. Mounting lugs **4** at each end are preferably embedded at their support ends in the block **12**.

A pair of interrupter mounting brackets **16** are each also embedded at one end **17** in block **12**. The brackets **16** comprise L-shaped strips of metal which are fastened in any desired manner at their other ends to a strip **18** of insulating material. Strip **18** supports the spaced terminals **19** and **20** for connection of power leads.

Between the brackets are slidably mounted two insulating strips **21** and **22** which function to movably support the interrupter contacts. Strips **21** and **22** are notched at each end as indicated at **23**, to receive the brackets **16** as guides or tracks for their sliding movement.

A pair of contacts **24** and **25** of brass or other suitable conducting material are fastened in spaced relation to strip **21** by rivets **26** or other appropriate means. The fastening means also serve to electrically connect the contacts to flexible insulated wire coils **27** and **28** which respectively extend and are connected to terminals **19** and **20**. Contact members **24** and **25** have flanges angled away from support strip **21** and which are, in turn, provided with angled hook ends **24'** and **25'**.

A pair of similar bimetal contacts **29** and **30** together with flat metal contact plates **31** and **32** are riveted to insulating strip **22**, as indicated at **33**. Each bimetal contact is formed in the usual manner of a pair of laminations **34** and **35** of different metals or alloys secured together as by welding or the like. Outer lamination **34** of each bimetal contact should be of a material having a

relatively lower coefficient of thermal expansion than the material comprising inner lamination 35, so that upon heating of the bimetal contacts the leg portions thereof will tend to spread apart and unlatch from the hooks 24' and 25'.

The bimetal contacts 29 and 30 are initially formed to curve rapidly away from each other and from their supporting strip 22 for a purpose to be later described. Each contact is then turned inwardly in leg portions which pass through spaced, circular openings 36 and 37 through plate 31 and strip 22. The leg portions of the bimetal contacts then converge slightly toward each other and terminate in angular hook ends 29' and 30' which respectively latch over the mating hook ends 24' and 25' of contacts 24 and 25.

Fixedly attached to insulating members 21 and 18 in any desired manner is a tensioned coil spring 36 which urges slide member 21 toward fixed member 18. Similarly tensioned coil springs 37 and 38, each fastened to block 12 and member 22, urge slide member 22 away from slide member 21, thus securely retaining the bimetal contacts 29 and 30 latched to complementary contacts 24 and 25. The springs 37 and 38 together exert greater force than does spring 36 so that the slide members 21 and 22 occupy the positions shown in Fig. 2 with slide 22 abutting the end of pin 45 when the contacts are latched. The springs 37 and 38, in addition to their biasing function, serve to conduct current from plates 31 and 32 to conductors 39 and 40 which are embedded in block 12 and lead to the female terminals of socket 10.

Centrally of boss 15 and passing through block 12 is a threaded aperture 41 which receives the mating threaded sleeve 42 integrally formed with adjusting knob 11. The inner end of sleeve 42 has affixed thereto an annular ring 43 which engages the outwardly curved surfaces of bimetal contacts 29 and 30. Turning knob 11 in one direction or the other will increase or lessen the pressure exerted by ring 43 on the bimetal contacts, tending to deform them from their original shape and thus vary the current required to complete the deformation and unlatching from contacts 24 and 25. The maximum pressure exerted by ring 43 to deform the bimetal contacts is far less than the biasing pressure exerted by springs 37 and 38 so that during adjustment of knob 11 to select a desired current rating for operation of the interrupter, the slide member 22 is prevented from moving any substantial amount toward member 21 and the latched contacts are retained firmly locked together. The outer surface of adjusting knob 11 is calibrated to show appropriate positions of the knob to correspond with given current ratings for operation of the interrupter. These indicia are illustrated by lines and numerals, such as 5, 10 and 15, which are visible in Fig. 1.

The sleeve 42 is provided with an axial opening of greater diameter at its inner end, as marked by shoulder 44. A reset pin 45 seats in sleeve 42 and protrudes through an opening in the knob portion 11. The inner end of pin 45 abuts against slide member 22 and is adapted to move it against the pressure of springs 37 and 38 in order to reengage and latch the bimetal contacts 29 and 30 over contacts 24 and 25 after operation of the circuit interrupter has separated the contacts. A shoulder 46 on pin 45 limits outward movement of reset pin 45 by engagement with sleeve shoulder 44.

The circuit through the interrupter illustrated in the drawings, extends from one power line, which may be grounded, to terminal 19, through wire 27, contact 24, bimetal contact 29, plate 31, spring 37, embedded lead 39 to one socket terminal 13. When the circuit is completed by plugging an appliance into the socket 10, the return is made through the appliance to the other socket terminal 13, embedded conductor 40, spring 38, plate 32, bimetal contact 30, contact 25, wire 28, terminal 20 and return to the other power line.

Having set the adjustable knob to an indicated current rating suitable for the apparatus or appliance plugged into socket 10, the flow of an excessive current exceeding the value preselected will cause the bimetal contacts 29 and 30 to be heated and deform sufficiently to disengage the hook ends 29' and 30' from mating contacts 24 and 25. Such disengagement permits slide member 21 with its assembled contacts urged by spring 36 to move away from slide 22, thereby completely separating the interrupter contacts and drawing out any existing arc between them. A moment or two later when the bimetal contacts have sufficiently cooled to approach their normal shape, the reset pin 45 may be pushed inwardly forcing slide 22 and its assembled contacts toward slide 21 against the pressure of spring 37 and 38 until the angled end surfaces of contacts 24' and 25' strike the complementary surfaces of contacts 29' and 30'. Further pressure on pin 45 causes the bimetallic contacts to be cammed outwardly and then snap inwardly into locking engagement with the contact hook ends 24' and 25'. The greater tension of springs 37 and 38 then overcomes the tension of spring 36 and upon release of pin 45 both slides 21 and 22 with their contacts move toward base 12 and come to rest in the positions shown in Fig. 2.

When this has occurred the circuit interrupter is again ready to operate as a protective device in the described circuit. The circuit will be broken again at both bimetal contacts as many times as the faulty overload condition persists but the main fuse protecting a plurality of parallel circuits will not be blown. Repeated operation of the circuit interrupter to break the circuit is an indication that the knob 11 has been set at an improper value for the particular appliance plugged in, or that the appliance or its connecting cord requires repair. The latter indication will frequently result in preventing serious damage to the appliance by continued use under excessive overload conditions. When a different appliance is plugged into socket 10, the adjusting knob 11 obviously should be reset to a different current rating for operation of the interrupter suitable to the maximum current applicable to the new device.

The circuit interrupter portion of the embodiment described may be applied to various types of outlets, plugs, switches or other connecting devices. In Fig. 3 is illustrated its use in combination with a wall outlet having a plurality of sockets 10 and 10' for connection of more than one appliance in the protected circuit. In this instance, the circuit interrupter contacts would be paralleled with those of sockets 10 and 10' and knob 11 would be set to operate for the sum of the maximum permissible currents to be drawn by both appliances.

Fig. 4 illustrates the application of a circuit interrupter substantially as described, combined with a toggle switch 47 in a flush wall receptacle. In this instance the circuit interrupter contacts would be paralleled with those of switch 47 similar to the connections previously described to socket terminals 13. The operation of this form of the invention is identical with that previously explained in connection with Fig. 1 except that the circuit interrupter would be adjusted to safeguard those lighting circuits or appliances whose energy is controlled by the on-off switch 47.

It should be obvious from the foregoing that the invention provides a novel type of circuit breaker which may be installed as a supplement to existing fused systems for the better protection of an individual or several circuits not fully or adequately protected by the existing fusing. Furthermore, the invention provides an interrupter which is readily adjustable to a wide range of operating current values and which is easily resettable from the exterior without need for replacement of internal parts or fuse wire. It should be apparent also that the interrupter may be installed in a circuit in a variety of different ways, as by inclusion in an appliance or appliance cord, as well as in outlets or switches which may or may not be flush mounted in a wall.

Although certain specific embodiments of the invention have been shown and described, it is obvious that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

That which is claimed as new is:

1. A combination electric wall outlet and circuit interrupter comprising a receptacle having a cover plate, an insulating base member mounted in said receptacle and having a circuit interrupter adjustment knob and a socket portion protruding through said cover plate, separable contacts mounted on said base having interlocking portions, one of said contacts comprising bimetallic elements so shaped as to disengage said interlocking portions upon flow of a given current through the contacts, said adjustment knob having means for varying the value of said given current necessary to disengage the contacts, and means connecting said separable contacts to a socket terminal and a power terminal.

2. The combination outlet and circuit interrupter described in claim 1 wherein said separable contacts are mounted on insulating slide members guided by brackets supported on said base, and in which spring means are provided for urging said slide members apart to separate the contacts mounted thereon.

3. A combination electric wall switch and circuit interrupter comprising a receptacle having a cover plate, an insulating base member mounted in said receptacle and having a circuit interrupter supporting portion and a switch-supporting portion protruding through said cover plate, separable contacts biased apart and mounted on said base having interlocking portions, one of said contacts comprising bimetallic elements so shaped as to disengage said interlocking portions upon flow of excessive current through the contacts, an adjustment knob supported outside of the cover plate to vary the current necessary to disengage said contacts, and means connecting said separable contacts to a switch terminal and a power terminal.

4. A circuit interrupter comprising a pair of spaced, fixed, insulating base members, a pair of slides of insulating material mounted between said fixed base members and biased apart toward said base members, the bias of one slide toward one member being greater than the bias of the other slide toward the other base member, a contact supported on each of said slides, one of said contacts being of bimetallic material and shaped to bow away from its supporting slide and then curved toward its supporting slide to pass through an opening therein so as to engage its end portion in latching engagement with the contact supported by the second slide, said bimetallic contact being deformable upon flow of excessive current through the contact to release said latching engagement of the contacts, means on one of said fixed base members passing therethrough and engaging the bowed portion of the bimetallic contact to vary the curvature thereof, said means exerting less pressure on the bimetallic contact than is exerted by the bias urging of the bimetallic contact supporting slide toward said one fixed base member, and additional means extending through said one fixed base member to engage the bimetallic contact supporting slide and move it against its bias toward said other slide member to reengage the contacts in latching arrangement after separation thereof.

5. A circuit interrupter comprising, separable contacts biased apart and latched to each other by interlocking hook shaped portions, one of said contacts being subjects to deformation upon flow of excessive current through said contacts whereby to separate said interlocking hook shaped portions and break the circuit through the contacts, and adjustable means for varying the current necessary to deform said one contact operatively associated therewith, said adjustable means including means for reengaging said hook shaped portions of the contacts after disengagement thereof.

6. A combination electric wall outlet and circuit interrupter comprising a receptacle having a cover plate, an insulating base member mounted in said receptacle and having a circuit interrupter adjustment knob and a socket portion protruding through said cover plate, separable contacts biased apart mounted within said receptacle, said contacts being latched to each other by interlocking hook shaped portions, one of said contacts being subject to deformation upon flow of excessive current therethrough whereby to separate said interlocking hook shaped portions and break the circuit through the contacts, means for varying the current necessary to deform said one contact operatively associated with said adjustment knob, a reset pin slidably mounted in said adjustment knob and accessible from the exterior of said receptacle and cover plate, said pin being operable to move the said contacts when separated against the bias to reengage said hook shaped portions of the contacts and means connecting said separable contacts to a socket terminal and a power terminal.

7. A circuit interrupter comprising a pair of spaced, fixed, insulating base members, a pair of slides of insulating material mounted between said fixed base members and biased apart toward said base members, a contact supported on each of said slides, one of said contacts being subject to deformation on flow of excessive current therethrough, said one contact being bowed and having a hook shaped portion in latching engagement with said other contact to hold said contacts together against the bias to separate their supporting slides, means on one of said fixed base members passing therethrough and engaging the bowed portion of the bimetallic contact to vary the curvature thereof, and additional means extending through said one fixed base member to engage the deformable contact supporting slide and move it against its bias toward said other slide to reengage the contacts in latching arrangement after separation thereof.

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