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ELECTRIC CIRCUIT BREAKER WITH COMBINED PLUG-IN
TERMINAL AND CONTACT SUPPORT
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FIG. 1

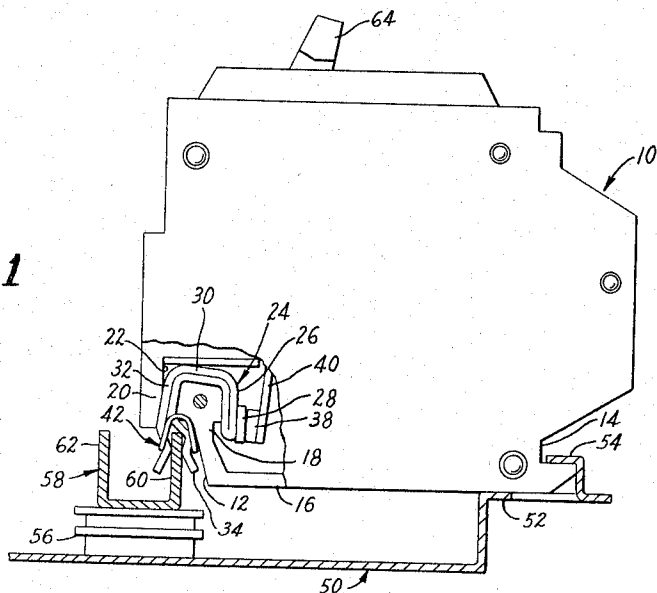


FIG. 2

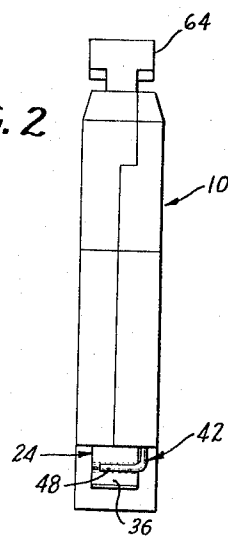
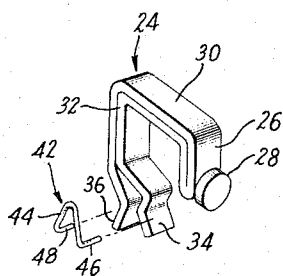


FIG. 3



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ELECTRIC CIRCUIT BREAKER WITH COMBINED PLUG-IN TERMINAL AND CONTACT SUPPORT

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ABSTRACT OF THE DISCLOSURE

A molded insulating casing type circuit breaker includes a combined socket and contact support member formed of a pair of elongated strips of metallic material joined at one end. A contact is attached to the strips adjacent their joined ends and the opposite ends diverge to facilitate entry of a conductive blade member. The joined strips are bent into a generally U-shaped configuration to facilitate arc blowout.

The present invention relates to current-interrupting devices and, more particularly, to a plug-in type current-interrupting device with a novel socket construction for receiving a contact blade.

In various electrical distribution systems such as panel boards and load centers, it is common to employ busbars with contact blades extending therefrom onto which the current-interrupting device is seated by engaging a portion of the interrupting device with a portion of the supporting panel of the distribution system and rotating it about its point of engagement into plug-in electrical engagement with the contact blade.

Current-interrupting devices such as circuit breakers are usually commercially manufactured in a board variety of amperage ratings and customarily have an exterior housing or enclosure of generally rectangular form with a relatively large length and a width which may vary depending upon the performance characteristics. Accordingly, the insulating housings are made in several modular sizes and each modular size will accommodate circuit breakers with a commensurate range of ampere ratings. Generally, the basic modular size for small circuit breakers is nominally a one-inch-wide housing and smaller modular circuit breakers are nominally of one-half inch width.

Proposals have been made for varying the configuration of the contact blades with which the current-interrupting devices enter into plug-in type engagement so as to avoid improper loading and assembly. For example, it has been proposed to provide a contact which has a central blade portion extending normally to the busbar and at least one pair of transverse blades extending perpendicularly thereto on either side thereof. Thus, a high rating circuit breaker, with a socket providing jaw extending parallel to its longitudinal axis might be plugged onto the central blade portion. Alternatively, two smaller circuit breakers may be assembled upon the same type of contact blade in side-by-side relationship by having sockets which enter into plug-in type engagement with the transverse blades to either side of the central blade.

It is an object of the present invention to provide an improved construction for current-interrupting devices which will provide highly effective plug-in type engagement with a contact blade extending normally to the longitudinal axis of the housing of the current-interrupting device.

Another object is to provide such current-interrupting devices which ensure a highly effective electrical path and a high degree of trouble-free operation.

It is also an object to provide such a current-interrupt-

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ing device which facilitates drawing of the arc away from the contacts upon current interruption and provides a high degree of breakdown protection for the device.

Still another object is to provide a novel contact socket for use in electric current-interrupting devices which may be readily formed, which possesses excellent electrical characteristics and which will provide highly effective contact with the blade of a current distribution device.

Other objects of the invention will in part be pointed out in the following detailed description and in part will become obvious from the following detailed description of specific embodiments of the invention, and the scope of the invention will be pointed out in the appended claims.

It has now been found that the foregoing and related objects may be readily attained in a current-interrupting device having a housing of relatively narrow width and relatively large length with a recessed corner and an aperture opening into the recess normally to the longitudinal axis of the housing. Seated in the housing adjacent the recessed corner is a metallic socket of generally U-shaped configuration defined by a pair of arm portions and a base portion extending therebetween along the longitudinal axis of the housing. One arm portion of the socket extends outwardly through the aperture in the recessed corner and is comprised of a pair of resiliently deflectable fingers having free ends providing a contact blade receiving channel therebetween extending in the width dimension of the housing normally to the longitudinal axis. The other arm portion of the socket provides a contact surface on its outer surface within the housing which cooperates with a movable contact, also located within the housing. The movable contact is movably mounted by suitable means for movement into electrical contact with the contact surface of the socket and away therefrom. In addition, the movable mounting means provides current flow from the movable contact in a direction generally parallel to the other arm portion of the socket and toward the base portion thereof so that the arc will be drawn toward the base portion of the socket upon opening of the contacts.

Although the socket may be fabricated in a number of forms, the most desirable structures are comprised of a pair of strip-like elements which are secured together adjacent the free end of the other arm portion. In this manner, the strip-like elements each provides one of the deflectable fingers and may be dimensioned and constructed so as to provide equivalent current paths with a resultant high degree of efficiency and conductivity. In addition, the parallel flow of the current through the strip-like elements tends to provide clamping action therebetween during conduction in operation of the device.

Although the strip-like elements may be separate and joined together by welding, brazing or other suitable means, the preferred structure utilizes an elongated strip which is bent upon itself at the free end of the other arm portion inwardly of the casing so as to provide the two parallel extending strip-like elements from a single piece of metal. Although the contact surface may be provided simply by the outer surface of the socket, it is desirable to employ a separate button-like contact which is secured to the outer surface of the other arm portion of the socket by any suitable means such as brazing, welding or the like.

The socket may be constructed of an alloy and heat treated so as to provide the desired degree of contact pressure in the deflectable fingers, and this contact pressure may be enhanced by suitable configuration of the contact fingers. However, the preferred structures employ a separate spring to enhance the pressure upon the contact blade. In its simplest and most advantageous form, this spring has a generally U-shaped body portion extending

generally parallel to the deflectable fingers and opening toward the channel therebetween. At the end of its body portion, the spring has a pair of legs which extend generally normally to the body portion along the outer surface of the fingers, and the spring is formed and heat treated so as to apply a high degree of biasing pressure upon the fingers to ensure effective clamping contact with the blade recessed in the channel.

With the present invention, the socket may be substantially surrounded by insulating material so as to provide a high degree of protection against breakdown through arcing at current interruption. More particularly, the housing provides a shoulder at the recessed corner and aperture and the front wall of the housing extends downwardly beyond the upper end of the shoulder so as to provide a channel between it and the shoulder receiving the one arm of the socket. In addition, the front wall ideally has an inwardly projecting portion overlying at least the base portion of the socket which in turn is seated upon the shoulder, thus substantially enclosing this portion of the socket. In addition, the other, or inner, arm portion has its inner surface closely adjacent the shoulder, thus making the channel defining portion of the fingers and the contact surface the only unenclosed portions of the socket.

In accordance with conventional circuit breaker construction, the movable contact is desirably carried at one end of a movable contact arm. The contact arm in turn has its other end pivoted at a point spaced on the opposite side of the base portion of the socket so that, upon opening, it will move outwardly from the contact surface and toward the base portion of the socket. In this manner, the looped current path will tend to force the arc away from the movable contact and contact surface upon current interruption.

The socket may be formed from a wide variety of conductive metals including copper, aluminum, silver and alloys thereof. Ideally, the metal should not only be a good conductor but should also be capable of developing a substantial degree of spring-like action upon proper heat treating so as to facilitate clamping action with the contact blade. The spring may be formed of various metals, preferably one which affords a high degree of spring action such as steel wire. Thus, the components may be readily fabricated from relatively economical materials to provide a highly effective assembly.

The invention will be more fully understood from the following detailed description and its scope will be pointed out in the appended claims.

In the drawing:

FIGURE 1 is a side elevational view of a circuit breaker embodying the present invention with a portion thereof broken away to reveal internal construction and shown mounted upon a panel board which is fragmentarily illustrated in section;

FIGURE 2 is a front end elevational view of the circuit breaker of FIGURE 1; and

FIGURE 3 is a perspective view to an enlarged scale of the socket in the circuit breaker of FIGURES 1 and 2, with the spring shown in disassembled position.

Turning now in detail to FIGURES 1 and 2 of the attached drawing, the present invention is shown as embodied in a circuit breaker having an insulating housing or casing generally designated by the numeral 10 with a recessed or notched out corner designated by the numeral 12 at one end thereof and a notch 14 at the other end thereof. The bottom wall 16 of the housing 10 has an abutment or shoulder 18 extending upwardly therefrom with an enlarged free end, and the front wall 20 extends below the upper end thereof at a distance spaced forwardly thereof so as to provide an aperture 22 in the housing 10 and a channel therebetween which are perpendicular to the longitudinal axis of the housing 10 and open into the recess at the corner 20.

Seated on the shoulder 18 is a socket generally design-

nated by the numeral 24 which is formed of an elongated strip of metal bent upon itself into a generally U-shaped configuration. The bend is at the free end of the inner arm portion 26 which also carries a contact button 28 affixed to its outer surface by brazing or other suitable means. The socket 24, and particularly its base portion 30, are dimensioned so that the socket 24 fits snugly onto the enlarged free end of the shoulder 18 with the inner arm portion 26 and the outer arm portion 32 extending along the opposite surfaces thereof.

The strip-like elements of the socket 24 extend in parallel contact in the inner arm portion 26, base portion 30 and through a distance of the outer arm portion 32 adjacent the base portion 30 in the channel between the shoulder 18 and front wall 20. However, the strip-like elements then diverge adjacent the free ends thereof in a suitable configuration to provide deflectable fingers or jaws 34, 36 which define a contact blade receiving channel therebetween. As illustrated, the outer finger 36 has a generally V-shaped configuration and the inner finger 34 has a more complex configuration provided by two reverse bends so that it initially extends toward the shoulder 18 to provide the desired spacing. However, its outer bend, and the bend in the finger 36, are generally aligned to ensure a high degree of clamping pressure therebetween.

A movable contact 38 is carried by one end of the contact arm 40 for movement into and outwardly from electrical contact with the button 28. As can be seen, the contact arm 40 extends generally parallel to the inner arm portion 26 of the socket 24 and toward the base portion 30. In addition, the contact arm 40 is pivoted adjacent its other end (not shown) so that, upon operation of the circuit opening mechanism (not shown), it will pivot away from the button 28 and in the direction of the base portion 30. Thus, current flow from the movable contact 38 along the contact arm 40 is generally parallel to the inner arm portion 26 and toward the base portion 30.

The clamping pressure of the fingers 34, 36 is enhanced by a spring generally designated by the numeral 42 with a generally U-shaped body portion 44 extending along the sides of the fingers 34, 36 parallel thereto and opening toward the channel between the fingers 34, 36. At the ends of the body portion 44 are leg portions 46, 48 which extend normally thereto along the outer surfaces of the fingers 34, 36 at their aligned bends so as to bias them together.

As seen in FIGURE 1, the circuit breaker is plugged onto a fragmentary illustrated distribution panel having a generally channel-shaped supporting pan generally designated by the numeral 50 with a flange 52 providing an upstanding and inwardly extending lug 54 which engages in the notch 14 in the housing 10. Upon the pan 50 is suitable insulating means 56 which serves to insulate therefrom the busbar which is generally designated by the numeral 58. For simplicity of illustration, the busbar 58 is shown as a simple channel configuration providing a pair of upstanding contact blades 60, 62 extending therealong which are perpendicular to the longitudinal axis of the housing 10 of the circuit breaker. However, various other configurations may be employed to provide contact blades with similar orientation perpendicular to the longitudinal axis including blades which provide both central blade portions extending parallel to the longitudinal axis and transverse blade portions extending normally thereto for use with breaker socket constructions of both orientations.

In assembling the apparatus, the circuit breaker is tilted to engage the leg 54 in the notch 14, and then its other end is pivoted towards the pan 50. The contact blade 60 is forced into the channel between the fingers 34, 36 springing them apart. Firm clamping pressure is ensured by the spring 42, the body portion 44 of which fits over the blade 60 by reason of its U-shaped configuration.

During operation, the current flow through the fingers 34, 36 enhances the clamping engagement therebetween and continues to the contact button 28 and thence to the

movable contact 38 and along the contact arm 40. Upon operation of the breaker by the manual operating handle 64, or by the internal tripping mechanism (not shown) in response to an overload condition, the contact arm 40 and movable contact 38 pivot away from the contact button 28 and upwardly toward the base portion 30 of the socket. Thus, an arc drawn between the button 28 and contact 38 tends to move towards the base portion 30 away from the contact 38 and button 28 because of the looped path to minimize possible damage to the components. In addition, it can be seen that the socket 24 has the outer arm portion partially enclosed in the channel between the front wall 20 and shoulder 18, and the base portion thereof is enclosed between an inwardly extending portion of the front wall 20 and the top of the shoulder 18. Thus, the exposure of the surface of the socket 24 is minimized.

Thus it can be seen that the present invention provides a current-interrupting device for highly effective plug-in type engagement with a contact blade extending normally to the longitudinal axis of the housing. It can be seen that the device provides a highly effective electrical path and facilitates drawing of the arc away from the contacts upon current interruption. In addition, it provides a high degree of breakdown protection so as to afford relatively trouble-free operation.

Accordingly, it is therefore intended by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by United States Letters Patent is:

1. In a current interruption device, the combination comprising:

- (a) a generally rectangular insulating casing;
- (b) an electrical socket member supported in said insulating casing adjacent one corner of said casing;
- (c) said socket member being of generally U-shaped configuration and comprising a pair of generally parallel arm portions and in intervening base portion, one of said arm portions extending outwardly of said casing and the other of said arm portions extending inwardly of said casing;
- (d) said socket member comprising two elongated strip portions, said strip members being connected together only at the end of said socket member comprising the end of said inwardly extending other arm portion;

(e) an electric contact member mounted on said socket member at said end of said inwardly extending portion;

(f) said ends of said strip portions at said outwardly extending one end of said socket member being outwardly diverging for receiving a cooperating contact member;

(g) a movable contact in said housing;

(h) means supporting said movable contact for movement within said casing between engaging and disengaging positions with respect to said contact member carried by said socket member, said supporting means including a contact arm carrying said movable contact at one end thereof and extending in a direction generally parallel to said other of said arm portions of said socket member when said movable contact is in said engaged position, said contact arm extending from said movable contact in the same general direction as said other portion of said socket member, whereby an arc drawn between said contacts upon opening movement of said movable contact is moved away from said contact arm and said other arm portion of said socket, and

(i) said insulating casing including an abutment portion extending between said one arm portion of said socket member and said other arm portion thereof whereby to shield said one arm portion from the effects of an arc drawn between said contacts.

2. In a current interrupting device, the combination as set forth in claim 1 wherein said combination also includes a generally U-shaped reinforcing spring member straddling said outwardly diverging end portions of said socket member, and wherein said diverging portions of said strip portions include mutually confronting indentations cooperating with said spring member to retain said spring member in place.

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