

May 12, 1942.

A. KEEFE

2,282,967

ELECTRICAL CONNECTION CIRCUIT BREAKER

Filed Feb. 11, 1938

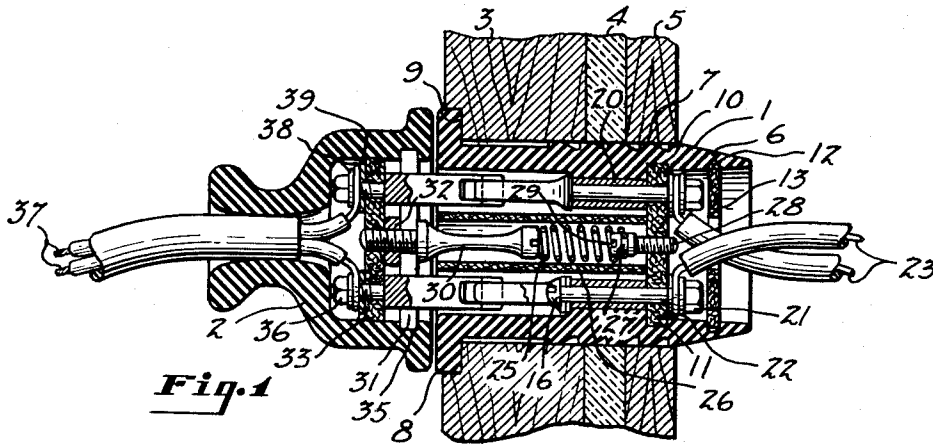


Fig. 1

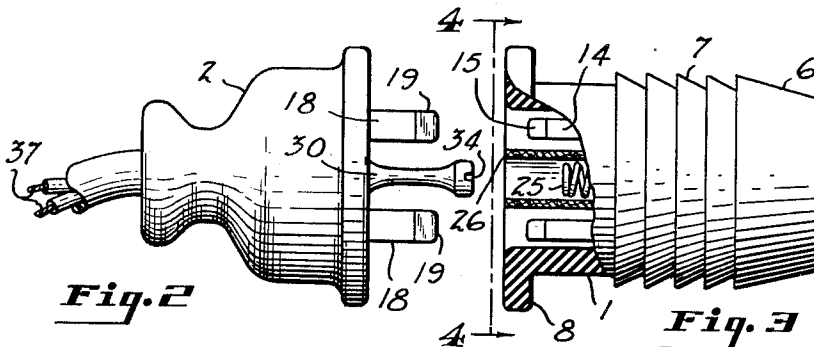


Fig. 2

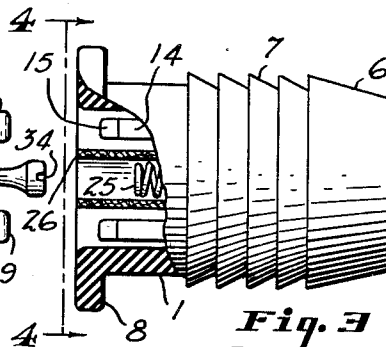


Fig. 3

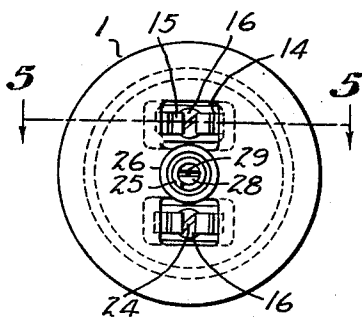


Fig. 4

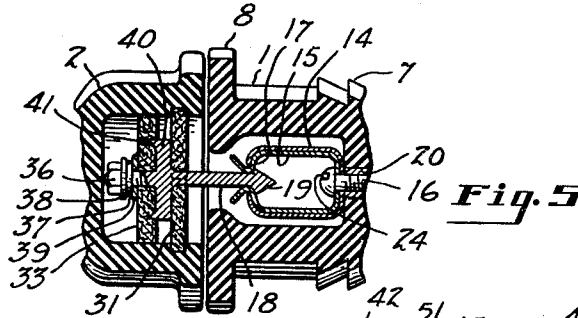


Fig. 5

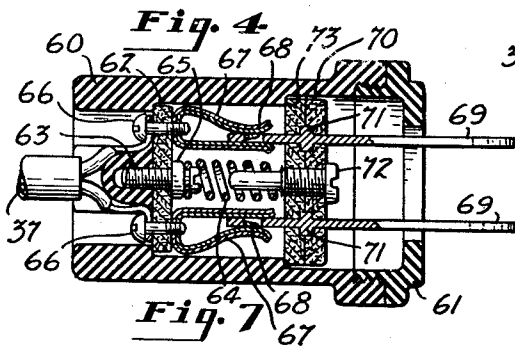


Fig. 6

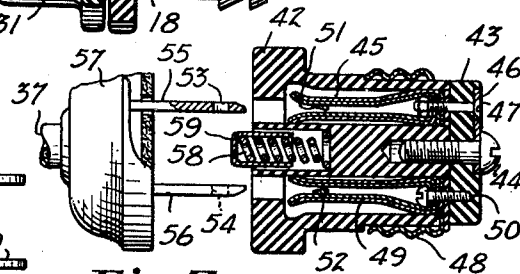


Fig. 7

INVENTOR
Arthur Keefe
BY
O. Z. McCoy
ATTORNEY

UNITED STATES PATENT OFFICE

2,282,967

ELECTRICAL CONNECTION CIRCUIT
BREAKER

Arthur Keefe, Akron, Ohio

Application February 11, 1938, Serial No. 190,088

10 Claims. (Cl. 200—115.5)

This invention relates to circuit breakers and more particularly to means in the form of electrical connecting devices for replaceably interrupting an electrical circuit in the event of a current overload.

An object of the present invention is to provide a circuit breaker in the form of electrical connections that are of simple and inexpensive construction and assembly, safe and dependable in operation, and of long life and durability.

A further object is to provide a circuit breaker that is adapted for either house or plant circuits and that may be made in small dimensions to provide a compact and practical structure.

A further object is to provide a circuit breaker that embodies an adjustable release means.

Another object is to provide a circuit breaker that comprises self-acting release members that are simply and easily re-engaged.

With the above and other objects in view that will be apparent to those familiar with the art to which the present invention pertains from the following description, suitable illustrative embodiments of the invention are disclosed in the accompanying drawing, wherein:

Fig. 1 is an elevational section with parts broken away, of the circuit breaker applied to an electrical connection combination of a plug and a plug receptacle that is mounted in a wall;

Fig. 2 is an elevation of the plug that is shown in Fig. 1;

Fig. 3 is an elevation that is partly broken away, of the plug receptacle that is shown in Fig. 1;

Fig. 4 is an elevational end view taken from the line 4—4 of Fig. 3;

Fig. 5 is a transverse section taken along the line 5—5 of Fig. 4;

Fig. 6 is an elevation of a modified plug receptacle in section and a plug partly broken away; and

Fig. 7 is an elevational section of a modified plug that embodies the invention.

The circuit breaker may be housed in any suitable fittings that conform to its functional requirements, such as the plug receptacle 1 and the plug 2 combination. The plug receptacle 1 is mounted in any suitable support, such as in an aperture in the wall that is shown and that comprises the base board 3, the plaster 4 and the lath 5.

The plug receptacle 1 may be of any suitable insulating material, such as conventional polymerized resins, porcelain, rubber, or the like, and of any suitable form or configuration. The re-

silient rubber plug receptacle 1 that is shown is advantageous in that it may be simply and firmly installed in its aperture by merely pressing it thereinto.

The plug receptacle may or may not, as desired, be provided with the frustro-conical lead edge 6 that facilitates the advance of the plug receptacle past irregularities in the face of the aperture in which it is installed. The resilient, circumferentially extending retaining flanges 7 that are shown are substantially frustro-conical in form so that they present an inclined surface to the face of the receptacle receiving aperture as the plug receptacle is advanced into its aperture, and a yielding, sharp edge in engagement with the face of its receiving aperture to resist its being easily dislodged from its installed position. The retaining flanges 7 yieldingly provide a plurality of circumferential zones of maximum contact pressure on the face of the aperture in which the receptacle is installed and thereby improve the grip of the periphery of the plug receptacle on the aperture face.

In many forms of mounting the face of the receptacle receiving aperture may be sufficiently rough so that a considerable variety of surface configuration may be substituted satisfactorily for the particular illustrative form that is shown here. The flanges or surface configuration may be omitted entirely, if desired, and the retention of the plug receptacle be accomplished by the resilience of its body portion.

The plug receptacle face flange 8, that seats in the board groove 9, is an optional structure and serves to countersink the plug receptacle in the board 3 in conventional manner and also controls the degree of insertion of the plug receptacle in its aperture.

The body of the plug receptacle 1 is apertured for the accommodation of those parts of the circuit breaker that are housed therein. The insulating washer groove 10 in the inner surface of the plug receptacle 1, releasably receives the peripheral edge of and provides support for the insulating, parts supporting heavy washer 11. The guard washer groove 12 in the plug receptacle releasably receives the peripheral edge of the insulating guard washer 13.

The plug receptacle electrical contacts comprise thermally sensitive strips of suitable material, such as the bi-metallic strips of iron 14 and copper 15 that are shown, or other similarly functioning strips of conventional material. The iron and copper strips are welded together adjacent their free ends. The thermally sensitive

strips are resiliently mounted, as by being of U-shape as shown and apertured at their base for the reception of the headed screw 16. The U-shaped bi-metallic strips have opposed shoulders 17 adjacent their free ends to receive and releasably grip a suitable plug contact 18. The plug contacts 18 terminate in any suitable engageable head structure, such as the arrow-shaped barbed tip 19 that is shown. The shoulders 17 may or may not, as desired, be surfaced with platinum, silver or the like, in conventional manner for make and break contacts.

The pointed end of the plug contact tip 19 is advantageous in that in its engagement with the oppositely inclined free tips of the bi-metallic strips during the engagement of the plug with the plug receptacle it centers the plug contact and directs the arrow-shaped plug contact tip 19 between the free ends of the U-shaped bi-metallic strip until the shoulders 17 of the strip engage the plug contact tip 19 back of the barbs thereof to provide for the normal retention of the engagement and for the conducting of current of normal magnitude therebetween. In the event of a temperature increase, as caused by a short circuit thru the thermally responsive strip, the strip shoulders 17 move away from each other sufficiently to release the plug contact tip 19 from therebetween.

The headed screw 16 is disposed within the screw tube 20, extends thru the parts supporting washer 11 and is threaded along its end to receive the nut 21. The pair of metal washers 22 are disposed on either side of the line wire 23 and are interposed between the nut 21 and the insulating, parts supporting washer 11. The nut 21 on the screw 16 tightly secures the bi-metallic spring contact between the head of the screw 16 and the end of the screw tube 20. The end of the screw tube 20 that is remote from the bi-metallic spring contact is supported by the insulating washer 11.

This union secures the line wire 23 in close electrical connection thru the screw 16 with the plug receptacle contact bi-metallic strip. The metal washers 22 assist in the perfection of this electrical contact in conventional manner and also serve to distribute the compression force between the screw 16 and the nut 21 over an adequate area of the washer 11 to prevent substantial injury to the washer 11. Means for making it possible to prevent the rotation of the screw 16 with respect to the nut 21 is provided, as by having the screw head slotted at 24 for the reception of a screw driver blade or the like, or in other suitable conventional manner.

Suitable resilient means is provided for opposing the retention of the plug contacts by the plug receptacle contacts, as by the compression spring 25. The spring 25 is shown to be disposed within the spring sleeve 26 that is supported laterally by contact with portions of the resilient plug receptacle 1 and that is disposed substantially centrally thereof. The inner end of the spring sleeve 26 rests against the parts supporting washer 11.

The magnitude of the force that opposes the retention of the plug contacts by the receptacle contacts is preferably adjustable. In the construction shown, a turn of one end of the compression spring 25 is disposed in the circumferential slot 27 in the head of the spring carrying screw 28. The screw 28 makes adjustable threaded engagement with the parts supporting washer 11 and its screw driver blade receiving

slot 29 permits the rotation of the screw so that the spring 25 may be caused to advance toward or be withdrawn from the parts supporting washer 11 and the degree of its pressure on the plug 2 be adjusted to a desired value.

The plug 2 is provided with suitable means for engaging the free end of the spring 25, as by the plug screw 30 that is disposed substantially centrally of the plug 2 and that is guided and centered in its engagement with the end of the spring 25 by the sleeve 26 that is preferably of insulating material. The plug screw 30 is firmly mounted in the plug 2 in any suitable manner, as by being threaded at its inner end into the plug outer insulating split washer 31, the spacer 32, and the plug parts mounting inner insulating washer 33. Provision for causing the rotation of the plug screw 30 is provided, as by the screw driver blade receiving slot 34 in its head portion, or the like.

The peripheral edge of the plug outer washer 31 is removably seated in the circumferential slot 35 that extends circumferentially of the inner face of the plug 2. The plug inner washer 33 is maintained firmly in position, as by being of proper diametrical proportion to seat snugly within the plug that may be grooved for its reception or not as desired. The washer 33 is preferably maintained in diametrical compression by the contraction of the resilient body portion of the plug 2. The spacer 32 is held firmly and securely in position between the outer washer 31 and the inner washer 33 in a convenient manner, as by being provided with rough and irregular surfaces, or the like.

The plug contacts 18 are also firmly supported in the plug 2 in any suitable manner, as by extending back thru the plug washers 31 and 33 and terminating in a threaded portion on which the nuts 36 are removably mounted. The washer 31 is a split washer preferably, for purposes of ease of assembly, as is shown in unsectioned elevation in Fig. 1 and in dotted section in Fig. 5. The nuts 36 also secure the appliance cord wires 37 in electrical contact with the plug contacts 18 by compressing the wires 37 between the small metal washers 38 and the larger washers 39. A firm mounting is provided for the plug contacts 18, as by having their laterally extending legs 40 compressed between the outer washer 31 and the inner washer 33. The legs 40 may, if desired, terminate in the axially extending prongs or spurs 41 that are embedded in the inner washer 33 and that further improve the stability of the plug contacts in the plug 2. The washer 31 may be omitted where the washer 33 is seated in a groove, as is the washer 31, or otherwise firmly anchored in the plug 2.

In operation the electrical connection combination transmits electrical current of normal magnitude from the line wires 23 thru the thermally reactive contacts in the plug receptacle and thru the plug contacts 18 to the appliance cord wires 37.

In the event of a current overload being imposed on this connection combination, however, the heat generated in the thermally reactive strips by the flow of excess current causes the moving apart of the opposed shoulders 17 of the thermally reactive plug receptacle contacts and the release of the arrow-shaped head of the plug contacts 18. The adjusted force that is exerted by the compression spring 25 against the head of the plug screw 30 then kicks the plug 2 away from the plug receptacle 1 and the circuit be-

tween the plug and its receptacle is broken. The circuit is resumed on the reinsertion of the plug contacts into the plug receptacle.

The plug receptacle 42 that is shown in Fig. 6, preferably, for ease of assembly, has the separate base 43 that is secured to the receptacle by the center contact screw 44 that threads into the core of the receptacle. The center contact 44 is connected for electrical transmission to suitable concealed thermally reactive contacts, such as the bi-metallic strip contacts 45, and thru suitable connecting means, such as the strap 46 and the bolt 47 that secures the strip contacts 45 to the receptacle base 43.

The outer contact threaded screw base 48 of the plug receptacle or screw base plug, provides contact with the concealed thermally reactive or bi-metallic strip contacts 49 that are secured within the receptacle by the screw 50 that threads into the base 43. Suitable means, such as the prongs 51 and 52 on the thermally reactive plug receptacle contacts that seat in the aperture 53 and 54, respectively, of the exposed contacts 55 and 56 of the plug 57, are provided to engage the exposed plug contacts and to retain them in the plug receptacle against the pressure of the spring 58 that yieldingly resists the engagement. The outer end of the spring 58 is covered by the cup 59 to provide a suitable cover therefor and to improve the external appearance of the plug receptacle. The cup 59 is preferably of insulating material.

In operation the thermally reactive plug receptacle contact prongs 51 and 52 remain seated in the apertures of the exposed plug contacts and maintain the electrical engagement between the plug and the plug receptacle while normal current loads are being conducted therebetween. When an overload of current is imposed on the connection, however, the spaced ends of the thermally reactive strips separate from each other sufficiently to permit the withdrawal of the prongs 51 and 52 from the apertures in the exposed plug contacts and the pressure of the spring 58 kicks the plug away from the plug receptacle thereby breaking the electrical connection. The re-insertion of the plug exposed contacts in the plug receptacle re-establishes the electrical connection.

An electrical connector circuit breaker in the form of a push in plug is shown in Fig. 7 of the accompanying drawing. In this construction the thermally reactive releasable connector is disposed in any suitable housing, such as the plug shell 60, on the end of which the removable plug cap 61 threads. A suitable mounting is provided within the housing for the rigid operative parts of the connector, such as the parts supporting washer 62 that is secured to a portion of the plug shell 60 by the central screw 63. The screw 63 also supports the compression spring 64, as by having a turn of the spring interposed between the head of the screw and the metal washer 65.

The radially outer screws 66 secure the line wires 37 and the thermally reactive concealed contact strips 67 to the washer 62. The prongs 66 on the thermally reactive contacts removably seat in suitable apertures in the inner end of the movable exposed contacts 69, that are carried on a suitable mounting, such as on the split washer 70. The parts of the split washer are disposed on opposite sides of the shoulders 71 on the movable contacts 69 and are secured together by suitable means, such as by the screw 72, that may,

if desired, have a reduced end portion extending into the spring 64, as shown.

The movable contact carrying washer 70 is mounted for arrested reciprocating action inwardly of the housing to permit the engagement and the release of the prongs 68 in the apertures in the inner ends of the movable contacts 69 so that the movable contacts are free to reciprocate in and out of engagement with the thermally reactive contacts 67. In the illustrative structure shown, the inner wall of the shell 60 is recessed for the movable contact carrying washer 70 so that the peripheral edge of the washer is engaged by a shoulder 73 of the shell 60 at one extremity of its motion and by the inner face of the cap 61 at the opposite end of its motion.

When this plug is inserted in a plug receptacle, the contacts 69 make engagement with the thermally responsive contacts 67 against the pressure of the spring 64. When a current overload is imposed on this plug the spaced ends of the thermally responsive contacts 67 separate sufficiently to remove the prongs 68 from the apertures in the contacts 69 and the spring 64 kicks the plug shell and its rigidly mounted parts away from the split washer 70 to break the connection.

In all of the disclosed constructions the thermally reactive strip will also function from externally applied heat, as where the connection is used to disconnect a circuit in the event of fire, the overheating of an adjacent part, or the like.

The invention adapts itself to various structural changes without material change in function. Where a substantially conventional plug is desired to avoid the presence of the plug screw 30, the spring 25 can be longer than shown to resemble the spring 58 with or without its sheath cap 59. The plug contacts 18 can be riveted or screwed into supporting washers, if desired, as is the plug screw 30. The plug shell 60 can be of resilient rubber material and can be grooved internally to receive parts supporting washers and the like, as is plug 2. The plug cap 61 can be closed, if desired, between the movable contacts 69 because with the washer 70 against the cap 61 there is no obstruction to prevent the rotation of the cap 61 with respect to the shell 60. In the engagement between the thermally responsive strip and the slide contacts the engaging parts could be reversed or altered in design somewhat without material change in function. Both spaced pairs of strips 45 and 49 may be capable of moving away from each other instead of but one strip being movable, as is shown, if desired.

It is to be understood that the particular embodiments of the invention that are shown and described herein are cited for purposes of illustration and explanation and that, with the development of industrial equipment having similar functions, various modifications, substitutions and changes in the parts, constructions and adaptations may be made without departing from the invention as defined in the appended claims, such as the substitution of thermally reactive or responsive single layer strips for the bi-metallic strips 14 and 15, 45, 49 and 67 shown herein, and the like.

What I claim is:

1. An electrical connector adapted for making interchangeable attachment with house wall sockets and attachment sockets and the like, comprising in combination, a plug shell for housing the contact of an electrical plug, a thermally responsive contact in said housing for engaging said plug contact, a substantially inclined end

part of said housing contact for guiding said plug contact into engagement with said housing contact, means on said plug receptacle contact for retaining said plug contact, and spring means opposing the retention of said plug contact by said plug receptacle contact.

2. An electrical connection adapted for making interchangeable engagement with house wall sockets and attachment sockets and the like, comprising in combination, a plug having a shell, a thermally reactive contact in said plug shell, an exposed contact having a portion releasably engaging said thermally reactive contact and having another portion projecting from said plug shell, a spring yieldingly resisting the engagement between said thermally reactive contact and said exposed contact, a shoulder on said exposed contact, an exposed contact mounting means having portions disposed on opposite sides of said exposed contact shoulder and free for limited axial movement in said plug shell, and exposed contact movement arresting means normally preventing the separation of said exposed contact from said shell.

3. An electrical connection adapted for making interchangeable union with house wall sockets and attachment sockets and the like, comprising in combination, a plug having a shell, a thermally reactive contact mounted in said plug shell, an exposed contact having one portion releasably engaging said thermally reactive contact and another portion projecting from said shell and said exposed contact being capable of reciprocating action axially of said shell, means substantially operatively preventing the separation of said exposed contact from said shell, a mounting supporting said exposed contact and limiting the axial movement thereof by its engagement with said means for preventing the separation of said exposed contact from said shell, and a resilient means yieldingly opposing the engagement between said thermally reactive contact and said exposed contact.

4. An electrical connection for interchangeably engaging house wall sockets and attachment sockets and the like, comprising in combination, a plug shell, a thermally reactive contact mounted in said shell, an exposed contact partly disposed within said shell and having another part extending therefrom and said exposed contact being movable axially of said shell, a movable exposed contact supporting means in said shell, releasable interengaging means between said thermally reactive contact and the part of said exposed contact in said shell, removable means for preventing the separation of said exposed contact from said shell, and spring means yieldingly urging said thermally reactive contact and said exposed contact apart.

5. An electrical connector adapted for making interchangeable electrical connection with electrical outlets and attachment sockets and the like, comprising in combination, a plug receptacle housing apertured for the admission of electrical connections, a blade contact that is operatively mounted in said plug receptacle housing, a thermally responsive contact in said housing, means for releasably retentively joining said blade contact with said thermally responsive contact, and spring means opposing the retention of said blade contact by said thermally responsive contact.

6. An electrical circuit interrupting means, comprising in combination, a plug shell, a plug cap removably mounted on said plug shell, a

parts supporting means rigidly disposed substantially within said plug shell, a spring disposed within said plug shell and having one end rigidly secured with respect thereto, a thermally reactive concealed contact strip disposed within said plug shell and having a part rigidly secured with respect to said plug shell, a movable contact having one end disposed within said plug shell and having an opposite end extending away from said plug shell and outwardly thereof and said movable contact being capable of reciprocating in and out of engagement with said thermally reactive contact, a prong carried by said thermally reactive contact and capable of releasably retentively engaging a part of the end of said movable contact that is disposed within the plug shell against the action of said spring tending to move said movable contact out of engagement with said thermally reactive contact, and a movable contact mounting carrying said movable contact and capable of reciprocating movement substantially within said plug shell and prevented from separation from said plug shell by engagement with said removable plug cap.

7. An electrical circuit interrupting means, comprising in combination, a plug shell, a plug cap removably mounted on said plug shell, a spring within said plug shell and having one end secured immovably with respect to said plug shell, a thermally reactive concealed contact disposed within said plug shell and secured in rigid relation with respect to said plug shell and terminating in an unattached end, a movable contact having one end adapted for engaging and being releasably retained by the unattached end of said concealed contact against the force of said spring and having an opposite end projecting to outside of said plug shell for engagement with a house wall electrical outlet and the like, and a movable contact mounting adapted for reciprocating movement within said plug shell that is limited in one direction by engagement with a part of said plug shell and in the opposite direction by engagement with said plug cap.

8. An electrical circuit interrupting means, comprising in combination, a plug shell, a spring disposed within said plug shell and having one end mounted in rigid relation therewith and its other end free for the application of pressure thereagainst, a thermally reactive concealed contact disposed within said plug shell and having one part rigidly secured with respect to said plug shell and another unattached part capable of movement on sufficient temperature change in said concealed contact, a movable contact having one end releasably engageable by said unattached part of said concealed contact and another end extending to outwardly of said plug shell for engaging an electrical outlet and the like, a movable contact mounting carrying said movable contact intermediate the ends thereof and adapted for reciprocating movement within said plug shell, and means for limiting the movement of said movable contact mounting within said plug shell.

9. An electrical circuit interrupting means, comprising in combination, a plug shell, a thermally reactive concealed contact in said plug shell and having a part rigidly secured with respect thereto and terminating in an unattached end, a movable contact engageable by said thermally reactive concealed contact and partly disposed in said shell and partly extending therefrom, a mounting carrying said movable contact and substantially floating in said shell, a resilient means

yieldingly opposing the engagement between said movable contact and said thermally reactive concealed contact, and means for limiting the movement of said movable contact mounting within said plug shell.

10. An electrical circuit interrupting means adapted for making interchangeable slip flat blade contact with house wall electrical outlets and attachment sockets and the like, comprising in combination, a shell, a cap removably mountable on said shell, a parts supporting means disposed within said shell in rigid relation therewith, a thermally reactive contact securely mounted on said parts supporting means and having an unsecured end, a movable contact substantially floating in said shell for axial movement therein and having a blade portion extending to outwardly of said shell, a shoulder on said movable contact spaced from said outwardly ex-

tending blade portion thereof, a split washer having a part disposed on either side of said movable contact shoulder to provide a mounting for said movable contact, a shoulder on said shell engageable by said split washer to arrest the movement thereof axially of said shell in one direction and said cap arresting the movement of said washer axially of said shell in the opposite direction, a spring having an end mounted on said parts supporting means and an opposite end adapted for engagement by said washer to resist the engagement between said thermally reactive contact and said movable contact, and interengaging means between said thermally reactive contact and said movable contact whereby said movable contact is maintained in engagement with said thermally reactive contact against the pressure of said spring.

ARTHUR KEEFE.