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Morrison et al.

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[54] **ELECTRICAL SAFETY SOCKET WITH MONABLE CONTACT ELEMENTS**

[75] Inventors: **Howard J. Morrison**, Deerfield; **Albert G. Keller**, Chicago; **Donald F. Nix**, Hanover Park, all of Ill.

[73] Assignee: **Marvin Glass & Associates**, Chicago, Ill.

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[52] **U.S. Cl.** **200/51.07**; 200/51.1; 339/34

[51] **Int. Cl.**[2] **H01R 19/52**

[58] **Field of Search** ..... 200/42 R, 51 R, 51.09, 200/51.1, 51.07, 297, 153 LA; 174/53; 339/34

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Primary Examiner—Gerald P. Tolin

Attorney, Agent, or Firm—Coffee & Sweeney

[57] **ABSTRACT**

An electrical safety socket construction which includes a housing having fixed electrical contacts mounted therein. An insulating carrier member is positioned within an outwardly opening cavity in the housing for rectilinear movement relative thereto. The insulating member has movable electrical contacts mounted thereon and receptacle apertures therein for receiving the prongs of an electrical plug. The insulating member and movable contacts normally are held in an inner inoperative locked position with the movable contacts spaced from the fixed contacts. On insertion of the plug prongs into the receptacle apertures of the insulating member so as to completely "bottom out", the locking arrangement is released and the movable contacts are brought into engagement with the fixed contacts by rectilinear movement with the carrier member as the carrier member and electrical plug are partially withdrawn outwardly relative to the housing. The prongs are friction fit into the receptacle apertures and a spring, in the housing bears against the prongs to effect said withdrawal of the plug, carrier member and movable contacts. A second spring biases the insulating member and movable contacts back to their inner inoperative and locked position upon withdrawal of the plug and its prongs completely out of the receptacle apertures in the insulating member.

16 Claims, 8 Drawing Figures

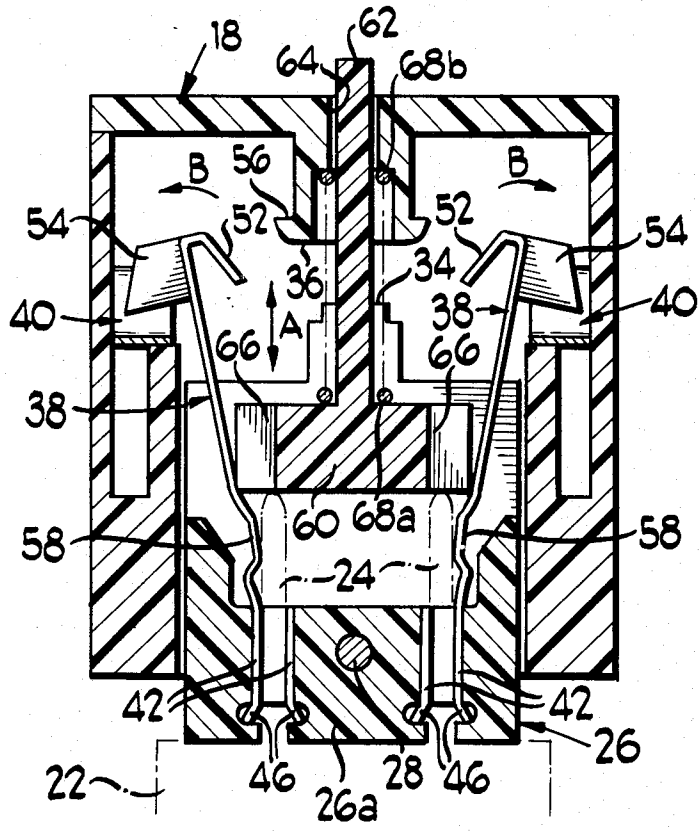


Fig 1

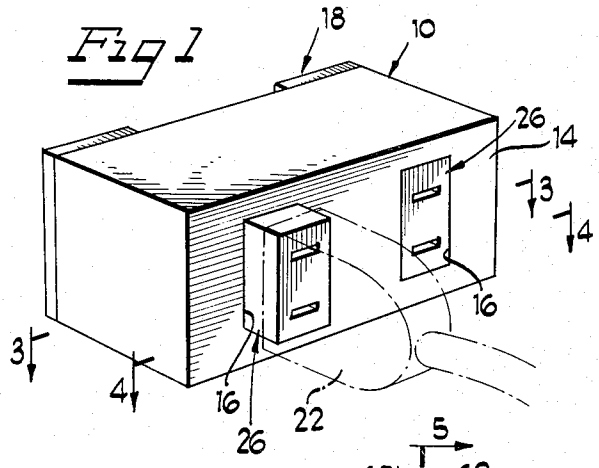


Fig 2

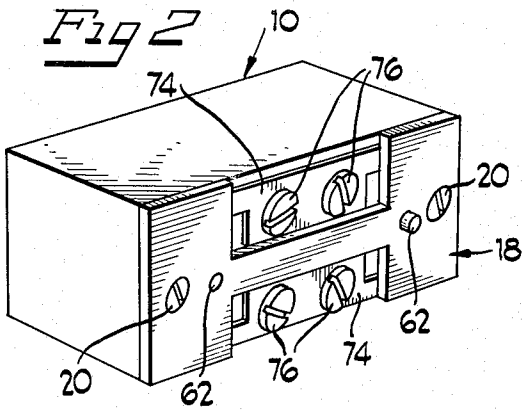


Fig 3

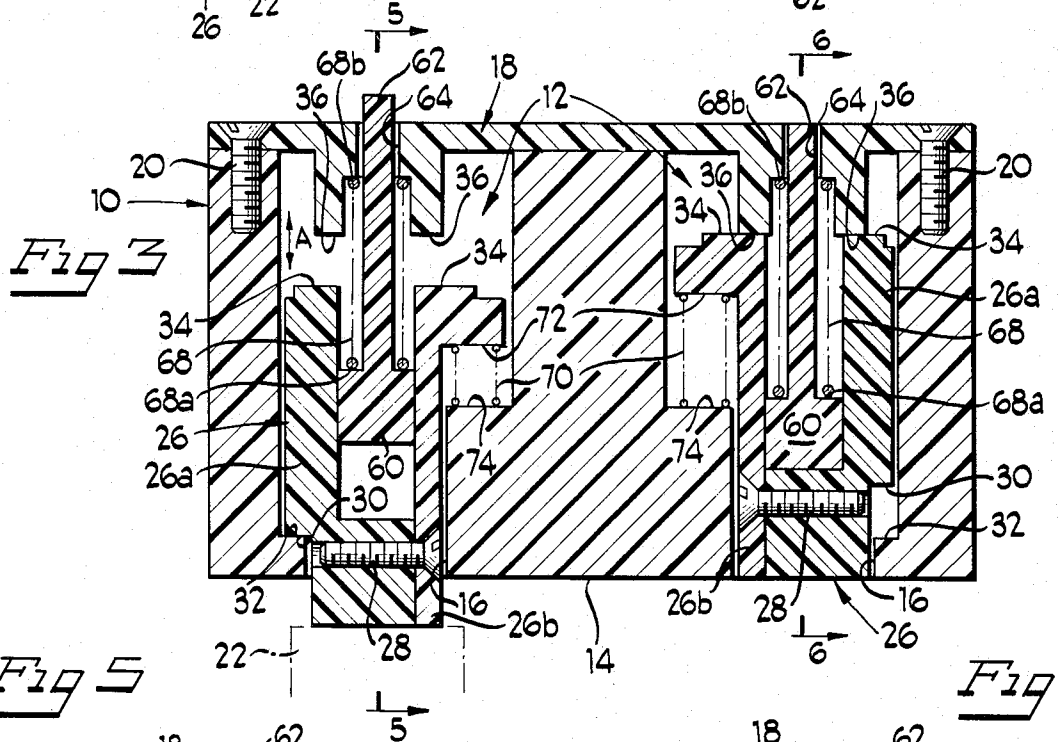


Fig 5

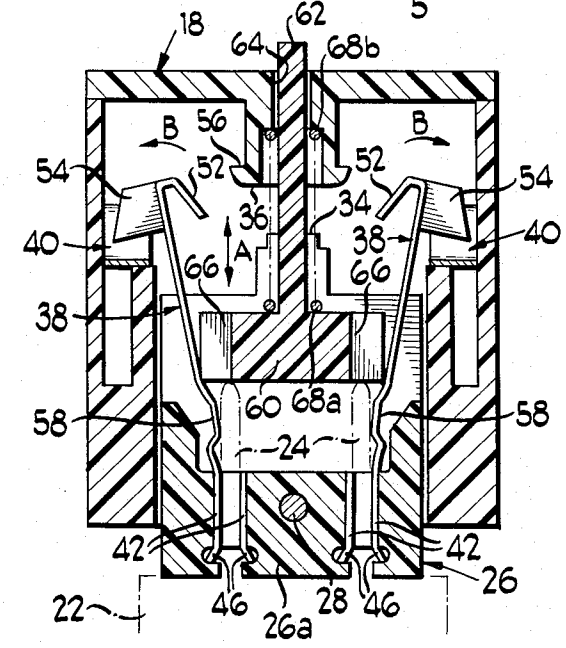


Fig 6

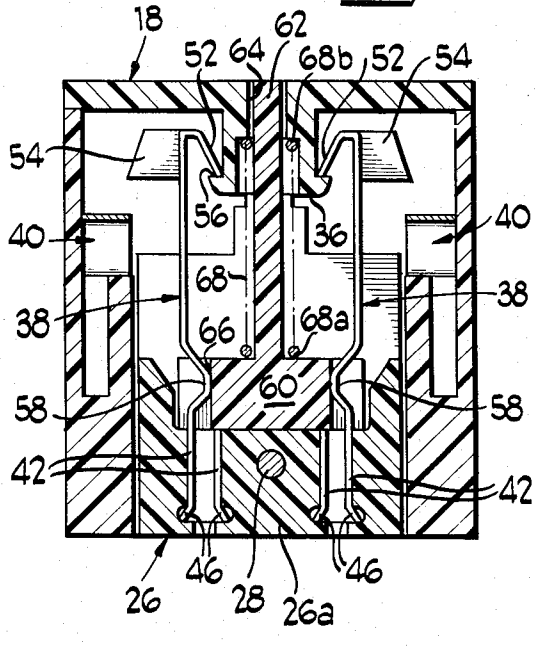


Fig 4

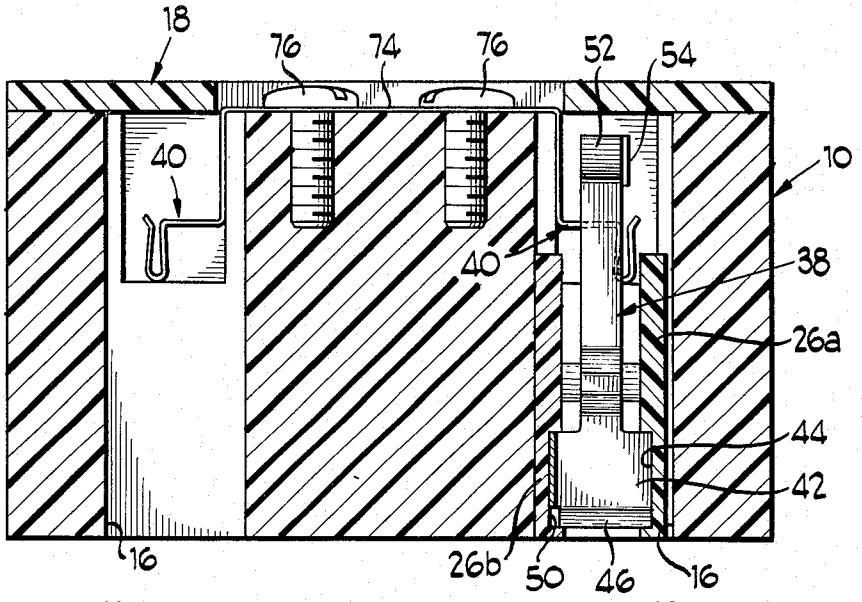


Fig 7

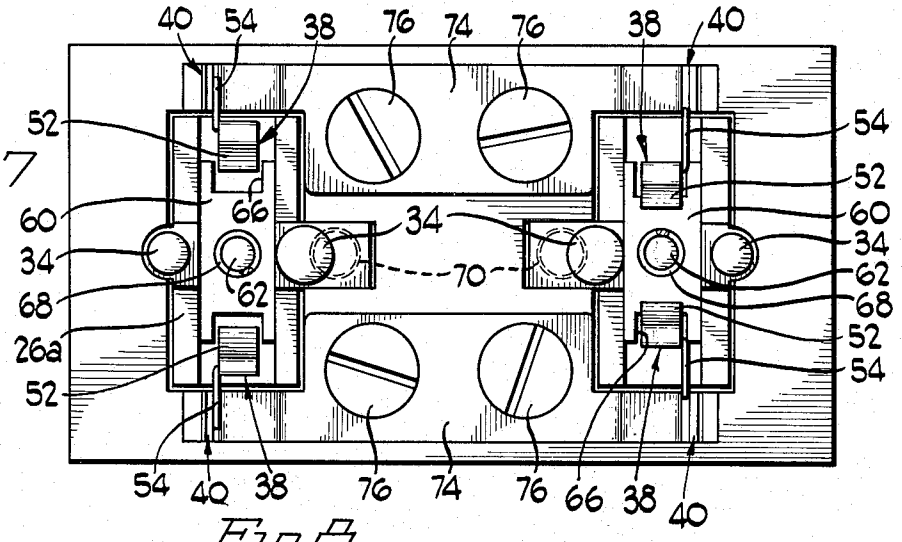
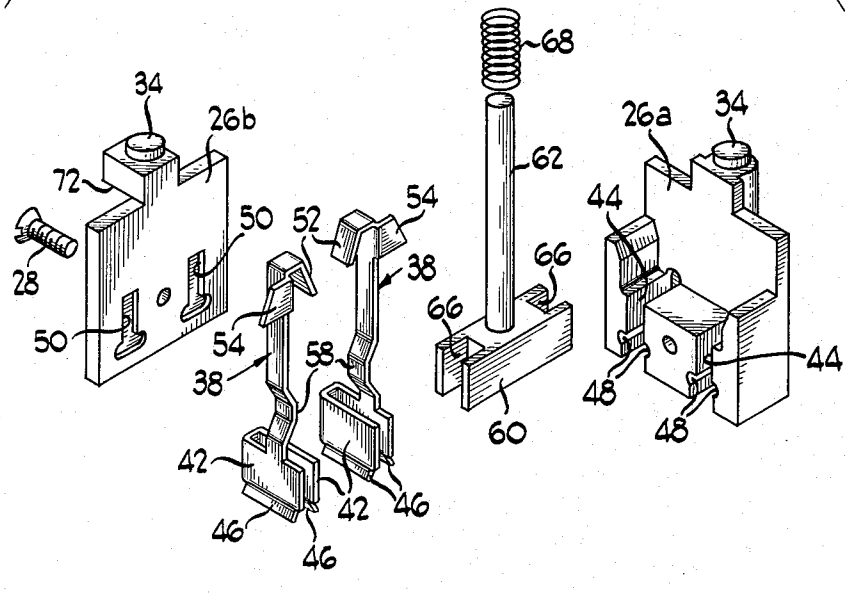


Fig 8



ELECTRICAL SAFETY SOCKET WITH MONABLE CONTACT ELEMENTS

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a new and improved electrical safety socket construction designed so as to prevent electrical shocks due to the placing of foreign objects into the apertures of a wall socket, as well as during the insertion and removal thereinto of an electrical plug.

There are various known electrical safety socket constructions which employ various features such as switching means within the socket which must be actuated by the insertion of prong-like objects into the socket to close the switching means before an electrical circuit will be completed. However, in most instances, the insertion of foreign objects such as screwdrivers, finger nail files, or the like, would be effective to close the switching means and pose the possibility of considerable electrical harm, particularly to children. This invention is directed to providing a new and improved electrical safety socket construction which is practically fool-proof to prevent such unfortunate accidents.

Furthermore, additonal features are provided such as the provision of means requiring all of the prongs of an electrical plug to be inserted into the socket before the switching means can be closed to complete the circuit. This is important because it is extremely difficult for a child to manipulate two or more objects, particularly objects such as screwdrivers with their large handles, in such a manner as to insert such items simultaneously into the socket receptacle apertures. Furthermore, the invention incorporates a particular size and shape of receptacle apertures which must establish a friction fit with the prong members of an electrical plug before the switching means can be actuated. Thus, screwdrivers, nail files or other objects which are not of the specific size and shape of the prong members of an electrical plug cannot close the circuit.

Generally, the safety socket construction of the present invention requires a plurality of properly shaped and properly sized prong members of an electrical plug to be inserted completely into the receptacle apertures of the socket so as to bottom out. This releases locking means for movable contact members so that the movable contact members can be moved into engagement with fixed contact members to establish an electrical circuit therethrough. However, the movable contact members can be moved into engagement with the fixed contact members only in response to partial withdrawal of the electrical plug outwardly of the socket, which moves the movable contact members therewith, after unlocking, into engagement with the fixed contact members.

More particularly, a socket housing is provided with an outwardly opening recess of an interior cavity within which is positioned an insulating carrier member mounted for rectilinear movement in a direction inwardly and outwardly of the housing. Abutment surfaces are provided between the housing and the carrier member to define inner and outer limit positions therefore. The movable contact members are mounted on the carrier member and are self spring biased into a locked position whereat the carrier member and movable contact members are in their innermost inoperative position out of engagement with the fixed contact members. On insertion of all of the prong members of

an electrical plug into receptacle apertures in the carrier member, the movable contact members are moved out of their locking position and, due to a friction fit between the prong members and the carrier member, the carrier member and movable contacts are moved rectilinearly outwardly of the housing to their outer limit position on partial withdrawal of the plug member until the movable contacts engage the fixed contact within the housing. Thus, it can be seen that not only must the proper number and size of electrical plug prongs be employed, but the prongs must bottom out and then be partially withdrawn before an electrical circuit can be established.

In addition, a first spring biasing member bears against the plug prongs when inserted in the receptacle aperture. The spring member, due to the friction fit of the prongs in the apertures, moves the carrier member, movable contacts, and electrical plug toward the outer operative limit position automatically in response to unlocking the movable contacts. A second spring biasing member is effective upon complete withdrawal of the plug from the socket to move the carrier member and movable contacts back to their inner inoperative and locked position.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front perspective view of a dual electrical safety socket construction in accordance with the present invention;

FIG. **2** is a rear perspective view of the socket construction of FIG. **1**;

FIG. **3** is a horizontal section, on an enlarged scale, taken generally along the line **3—3** of FIG. **1**;

FIG. **4** is a horizontal section, on an enlarged scale, taken generally along the line **4—4** of FIG. **1**;

FIG. **5** is a vertical section taken generally along the line **5—5** of FIG. **3**;

FIG. **6** is a vertical section taken generally along the line **6—6** of FIG. **3**;

FIG. **7** is a rear elevational view of the socket construction, with the rear plate removed; and

FIG. **8** is an exploded perspective view of the carrier member, movable contacts, and spring biasing means described in greater detail hereinafter.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings in greater detail, the electrical safety socket construction of the present invention includes a housing, generally designated **10,** having a pair of interior cavities, generally designated **12** (FIG. **3**) which are open through a front wall **14** of the housing defining recess openings **16.** The rear of the cavities **12** generally are closed by a rear I-shaped cover plate, generally designated **18** (FIGS. **2** and **3**), which is secured to the rear of the housing by a pair of screws **20.** The cavities **12** house the various socket components of the present invention for receiving an electrical plug **22,** shown in phantom in FIGS. **1, 3** and **5.** For the purposes of this illustration, the plug is a standard household electrical plug having a pair of standard prong members **24** shown in phantom in FIG. **5.** Since the socket components within each cavity **12** are identical to provide a double socket type construction as is most

conventional for home use, only one socket assembly will be described and like numerals will be applied where applicable.

Each socket assembly for mounting within the cavities **12** includes an insulating carrier member, generally designated **26,** which includes two parts **26***a* and **26***b* which are secured together by a screw **28.** The carrier member parts **26***a*, 26*b* are shown in perspective in FIG. **8.** The carrier member **26** is mounted within a respective cavity **12** for rectilinear movement in the direction of double-headed arrow A (FIGS. **3** and **5**) generally in the direction of insertion and removal of the electrical plug **22.** Abutment shoulders **30** on the carrier member and **32** on the housing define an outer limit position of movement of the carrier member, as seen in FIG. **5** and the left socket in FIG. **3.** Abutment shoulders **34** on the carrier member and **36** on the inside of the back plate **18** define an inner limit position of movement of the carrier member, as seen in FIG. **6** and the right socket in FIG. **3.**

A pair of movable contact members, generally designated **38,** are mounted on the carrier member **26** for rectilinear movement therewith to make and break an electrical circuit through a pair of fixed contacts **40** mounted on the housing **10** within the cavity **12.** More particularly, and referring particularly to FIGS. **5, 6** and **8,** the movable contacts **38** are mounted on the carrier **26** by sandwiching the same between the carrier parts **26***a* and **26***b*. The movable contacts have a pair of resiliently spaced ears **42** which are positioned within slots **44** formed in the carrier part **26***a*, as best seen in FIG. **8.** Flared flange portions **46** at the base of the ears **42** are disposed in notches **48** to facilitate properly positioning the movable contacts. Generally complementary inverted T-shaped apertures **50** (FIG. **8**) are formed in the carrier part **26***b* for further facilitating the positioning of the movable contacts **38.** The movable contacts **38** further have locking flanges **52** and contact ears **54** at the inner ends thereof.

Turning now to FIG. **6,** the carrier **26** and movable contacts **38** are shown in their innermost limit position where the locking flanges **52** of the movable contacts are seated behind locking shoulders **56** on the interior of the rear plate **18** behind the abutment shoulders **36.** In this position, the contact ears **54** of the movable contact members **38** are spaced out of engagement with the fixed contacts **40** in an inoperative or circuit breaking position. The movable contacts **38** are made of resilient spring type conductive metal material and are self biased toward the locking position shown in FIG. **6.**

In order to unlock the movable contact members **38** to permit rectilinear movement thereof outwardly with the carrier **26** and into engagement with the fixed contacts **40,** both prongs **24** of the plug member **22** must be inserted into the spacing between the ears **42** of the movable contact members and the surrounding portions of the carrier **26.** By doing so, and referring particularly to FIG. **5,** the prongs **24** engage offset portions **58** of the movable contact members **38** and move the inner ends of the movable contacts outwardly in the direction of arrows B until the locking flanges **52** thereof become unseated from behind the locking shoulders **56** of the rear plate **18.** Preferably, the offset portions **58** of the movable contact members **38** should be spaced lengthwise of the movable contacts in proper relation to the length of the prongs **24** so that the plug and prongs must bottom out before the movable contact members are released from their locked disposition so as to prevent a child from inserting his finger between the body portion of the plug **22** and the front face of the carrier **26** when the prongs are "live".

After the movable contact members **38** have been released from their locking disposition described above, the plug **22** is pulled or biased forwardly or outwardly relative to the socket housing **10.** This pulls the carrier **26** and movable contacts **38** outwardly therewith, due to the friction fit of the plug prongs, until the abutment shoulders **30** on the carrier and **32** on the housing engage at which position the contact ears **54** of the movable contacts **38** will be in engagement with the fixed contacts **40** establishing an electrical circuit therethrough. To this end, it should be pointed out that the receptacle means or apertures defined between the ears **42** of the movable contact members must be of a size and shape to establish the aforementioned friction fit with the prongs **24** of the electrical plug **22.** Without such friction fit, the carrier **26** and movable contacts **38** could not be moved to their outer limit position to establish the electrical circuit therethrough. In other words, screwdrivers, fingernail files, and other like foreign objects cannot be utilized to operate the socket construction of the present invention because, even if the movable contacts somehow are unlocked, there is no way to grasp and move the insulating member outwardly because it is made flush with the front of the housing when in its inner locked position.

In addition, it is noted that both movable contacts **38** are self-biased toward the locked disposition and, consequently, the same number of prongs as the particular electrical plug for which the socket is designed must be utilized simultaneously or else the movable contacts cannot be released. This is yet a further safety feature of the present invention. Of course, although the exemplary embodiment is shown for usage with a standard two-prong household electrical plug, any other type of plug with various numbers of prongs are contemplated.

Two spring biasing features are provided with the present invention: (1) to bias the carrier **26,** movable contacts **38** and electrical plug **22** to their outer operative limit position only in response to the proper sized and shaped prongs **24** releasing the movable contacts from their locked disposition; and (2) to bias the carrier and movable contacts back to their locked inoperative position in response to complete withdrawal of the plug and prongs from the socket assembly. Turning to the first enumerated feature, an inner plug member **60,** having a rearwardly directed stem **62,** is provided within the cavity **12.** The stem **62** protrudes through a hole **64** in the rear plate **18** to accommodate rectilinear movement of the stem and plug member **60.** As best seen in FIG. **8,** the plug member **60** is generally H-shaped so as to have recesses or slots **66** within which the movable contacts **38** are freely movable in the direction of arrows B (FIG. **5**) so that rectilinear movement of the plug member **60** is independent of and does not interfere with lateral movement of the movable contacts. A coil spring **68** is disposed about the stem **62** and abuts at one end **68***a* against the rear of the plug member **60** and at the other end **68***b* against the rear plate **18.** When the carrier **26** is in the position shown in FIG. **6** with the movable contacts **38** in their locked disposition, the coil spring **68** generally is uncompressed or in a relaxed condition. However, when the

prongs **24** of the electrical plug **22** are inserted between the ears **42** of the movable contacts, the inner ends of the prongs, due to their widths, will engage the outer side of the plug member **60**, notwithstanding the notches **66**, and move the plug member **60** against the biasing of spring **68** to compress the same and store energy therein. As the prongs continue to be inserted into the socket, the spring will continuously be compressed until the prongs engage the offset portions **58** of the movable contacts and move the contacts outwardly in the direction of arrows B to unlock the same. When the movable contacts are released, the spring **68** is sufficiently strong to automatically force the plug **22**, the carrier **26** and the movable contacts **38** to their outer operative position establishing a circuit through the fixed contacts **40**. It should be noted that since the member **60** bears against the inner end of the prongs rather than the carrier member or movable contacts, the spring **68** would be ineffective unless the proper sized and shaped prongs establish their friction fit to move the carrier member and movable contacts outwardly therewith. Of course, if the spring **68** is omitted, a positive withdrawing action by pulling on the plug **22** would be required by a user, which might further enhance the safety capabilities of the construction.

The second spring biasing feature referred to above, for returning the carrier **26** and movable contacts back to their inoperative locked condition, comprises a spring **70** (FIG. 3) which is sandwiched between a shoulder **72** on the carrier **26** and a shoulder **74** on the interior of the housing. The lefthand socket assembly shown in FIG. 3 is in position where the electrical plug has been inserted into the socket assembly and the carrier member and movable contacts have been moved to their outer position. In this position, the spring **70** has been compressed due to the fact that the spring has considerably less strength than the spring **68**. When the plug **22** is removed to completely withdraw the prongs **24** from the socket assembly, the energy remaining in spring **68** is released so that the plug member **60** may be moved back outwardly to the position shown in FIG. **6**, with the spring **68** relaxed. At this time, the spring **70** of lesser strength takes over and moves the carrier member and movable contacts back to their inner, locked inoperative position, all of which results automatically from the complete withdrawal of the plug **22** and its prongs **24**.

FIGS. 2 and 4 show the rear portions of the fixed contacts **40** as comprising plate members **74** which have screws **76** therethrough for connecting the socket assemblies to lead wires in an appropriate electrical circuitry. The housing **14** may be adapted for mounting directly onto a wall or be received in custom or standard wall receptacles. The device may be made in the form of an adapter, with electrical prongs on the back side thereof for insertion into already installed wall sockets, for instance. The adapter then could be held in place by long central or side screws through the housing and threaded into the conventional threaded openings of standard wall mountings. Of course, the novel electrical switching means requiring both insertion and withdrawal of the electrical plug prongs is readily adaptable for many electrical connection purposes.

The foregoing detailed description has been given for clearness of understanding only and no unnecessary limitations should be understood therefrom as some modifications will be obvious to those skilled in the art.

We claim:

1. An electrical plug safety socket construction for use in combination with a standard electrical plug having a pair of prong members for conducting electricity, comprising: a housing, fixed electrical contact means in said housing, movable receptacle means in said housing for receiving the prong members of the electrical plug and movable between an inner limit position and an outer limit position relative to the housing, movable electrical contact means carried by said receptacle means and disposed within said housing and normally disposed out of engagement with the fixed contact means when said receptacle means is in said inner limit position and disposed in engagement with the fixed contact means when said receptacle means is in its outer limit position, and means on said receptacle means for holding at least one of said prong members when the prong member is inserted into the receptacle means whereby partial withdrawal of the plug member out of the housing causes the receptacle means to move therewith to said outer limit position moving the movable contact means therewith into engagement with the fixed contact means to complete an electrical circuit therethrough.

2. The socket construction of claim **1** including latch means to hold the receptacle means and movable contact means in said inner limit position and means to release the latch means only when said prong member is inserted completely into said receptacle means to prevent movement of said movable contact means into engagement with said fixed contact means unless said prong member is inserted completely into said receptacle means so as to bottom out before said partial withdrawal of the plug and prong member outwardly relative to said housing.

3. The socket construction of claim **1** wherein said movable contact means is mounted in said housing by means providing for rectilinear movement thereof in the same direction as the insertion and withdrawal movement of said prong member.

4. The socket construction of claim **3** including means for locking said movable contact means in said inner limit position out of engagement with said fixed contact means, said prong member being engageable with said locking means to release the same on insertion of the prong member into said receptacle means to permit movement of the movable contact means to said outer limit position into engagement with the fixed contact means on said partial withdrawal of the plug member.

5. The socket construction of claim **4** wherein said lock means has release means engageable with both prong members of the electrical plug and independently operable thereby to prevent release of the lock means unless all prong members are inserted in said receptacle means.

6. The socket construction of claim **4** wherein said movable contact means has a receiving portion of a size and shape so as to receive said prong member by a friction fit to effect said movement of the movable contact means and so as to prevent operative association of foreign sized objects with the movable contact means.

7. The socket construction of claim **1** wherein said receptacle means comprises a rectilinearly movable insulating member mounted in said housing with said prong member receiving means formed therein and

said movable contact means mounted thereon for movement therewith.

8. The socket construction of claim **7** including means for locking said movable contact means and insulating member in said inner limit position, said prong member being effective to release the lock means on insertion of the prong member into said receptacle means and to move the movable contact means and insulating member to said outer limit position on said partial withdrawal of the plug member.

9. The socket construction of claim **8** including abutment means between said housing and said insulating member defining said inner and outer limit positions of the insulating member and movable contact means.

10. The socket construction of claim **8** wherein said prong member receiving means is of a size and shape so as to establish a friction fit with said prong member when the latter is inserted into the receptacle means so that the prong member moves the insulating member and movable contact means, through said fit, to said outer position on said partial withdrawal of the prong member.

11. The socket construction of claim **10** including biasing means in said housing operatively associated with the prong member when inserted into said receptacle means to move said prong member, receptacle means and movable contact means outwardly to said outer operative limit position automatically when said lock means is released.

12. The socket construction of claim **11** wherein said biasing means is generally relaxed when the prong member is removed from said receptacle means, and including second biasing means for returning the receptacle means and movable contact means back to said inner locked position on complete withdrawal of said prong member.

13. The socket construction of claim **8** including biasing means in said housing for moving said insulating member and movable contact means back to said inner locked position on complete withdrawal of said prong member.

14. An electrical plug safety socket construction for use in combination with a standard electrical plug having a pair of prong members for conducting electricity, comprising: a housing having an interior cavity with an opening to the outside of the housing, fixed contact means mounted in said cavity, a carrier member mounted within said cavity for rectilinear movement relative thereto with a portion of the carrier member exposed through said opening, movable contact means mounted on said carrier member and movable therewith between an inner inoperative limit position where the movable contact means is out of engagement with said fixed contact means and an outer limit position wherein said movable contact means is in engagement with said fixed contact means for completing an electrical circuit therewith, receiving means at the exposed portion of said carrier member for receiving the prong members of the electrical plug, lock means for locking said movable contact means and carrier member in said inner inoperative position including release means engageable by at least one of said prong members when inserted in said receiving means for releasing said lock means in response to said engagement, and means on said carrier member for holding at least one of the prong members of the electrical plug when the prong member is inserted into the receiving means whereby partial withdrawal of the plug member out of the housing causes the carrier member to move therewith to said outer limit position moving the movable contact means therewith into engagement with the fixed contact means to complete an electrical circuit therethrough.

15. The socket construction of claim **14** wherein said receptacle means is of a size and shape complementary to the size and shape of said prong member to establish a friction fit therebetween providing said prong member holding means to effect said outward movement of the carrier member and movable contact means with movement of the prong member and plug.

16. The socket construction of claim **14** including biasing means in said housing for moving said carrier member and movable contact means back to said inner locked position in response to complete withdrawal of said prong member from said receptacle means.

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