United States Patent [19]

Kersman

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[54] **PROTECTIVE ELECTRIC COUPLING**

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[52] **U.S. Cl.** ..... **339/12 R,** 200/51 R, 200/51.09, 339/41 R

[51] **Int. Cl.** **H01r 13/44**

[58] **Field of Search** ..... 200/51 R, 51.07, 51.08, 200/51.09; 339/40–44, 75 R, 75 M, 12 R

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Primary Examiner—David Smith, Jr.
Attorney, Agent, or Firm—Karl F. Ross; Herbert Dubno

[57] **ABSTRACT**

Two complementary couplers, i.e., a socket and a plug, are provided with mating connectors whose interengagement completes a circuit connection between a supply line and a load, the connectors of the socket being normally made ineffectual or inaccessible by a safety mechanism which is deactivated only upon the approach of one or more magnets carried by the plug. The safety mechanism may include one or more blocking plates normally obstructing the socket connectors or a detent preventing manual displacement of conductive extensions of these connectors into engagement with coating supply terminals; in another embodiment, this mechanism comprises a circuit breaker which is moved by the approaching magnet or magnets to close both the main circuit and an ancillary circuit to energize a solenoid which intensifies the contact pressure between the connector extensions and the supply terminals, on the one hand, and respective bridge pieces on the circuit breaker.

9 Claims, 13 Drawing Figures

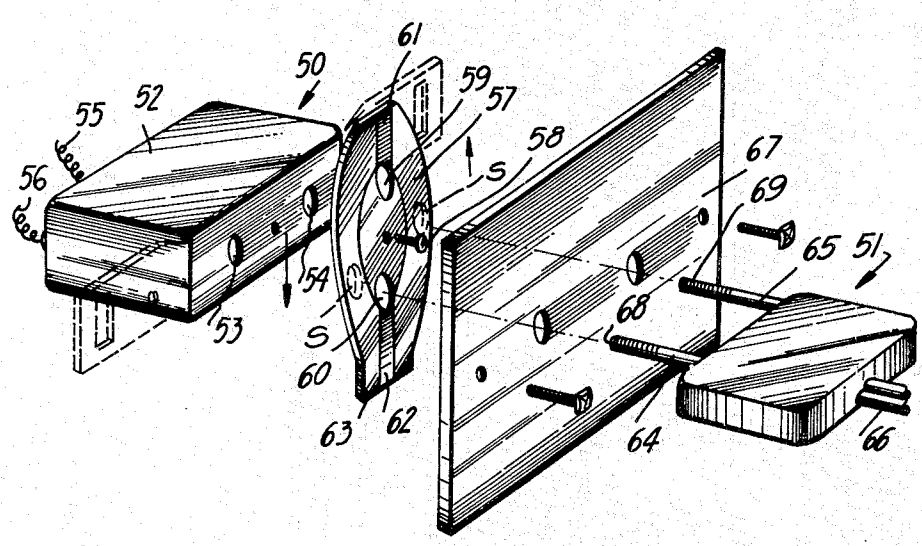
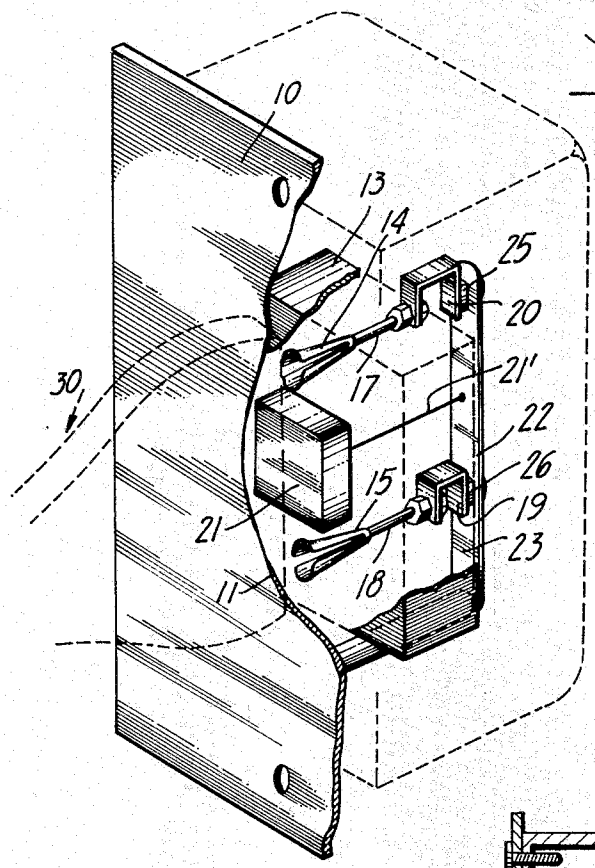


Fig. 1



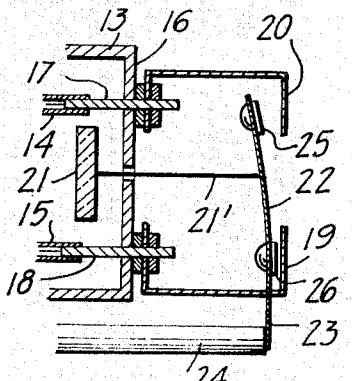


Fig. 3

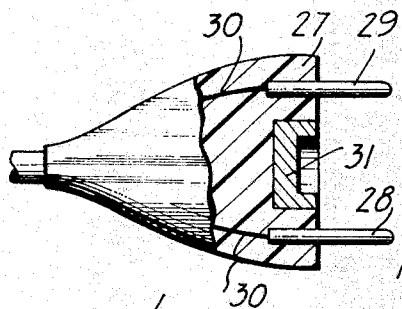
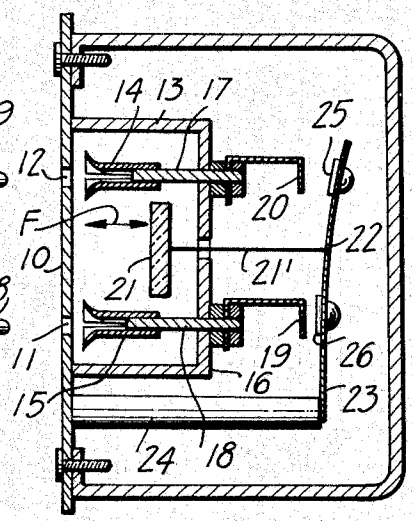


Fig. 2



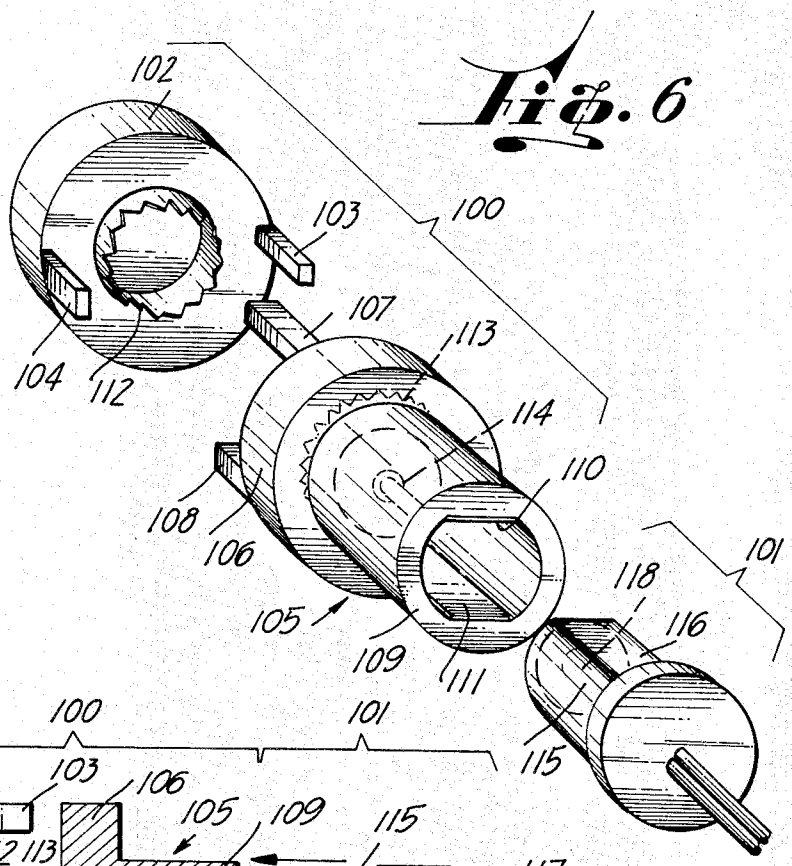


Fig. 6

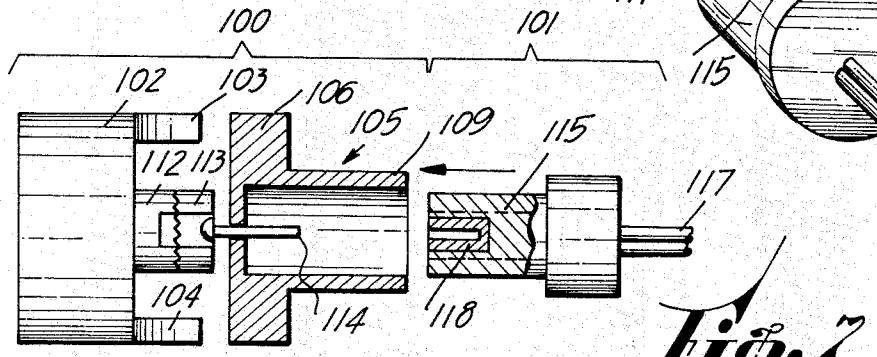


Fig. 7

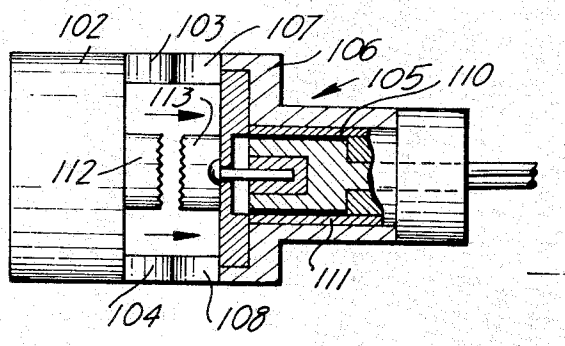
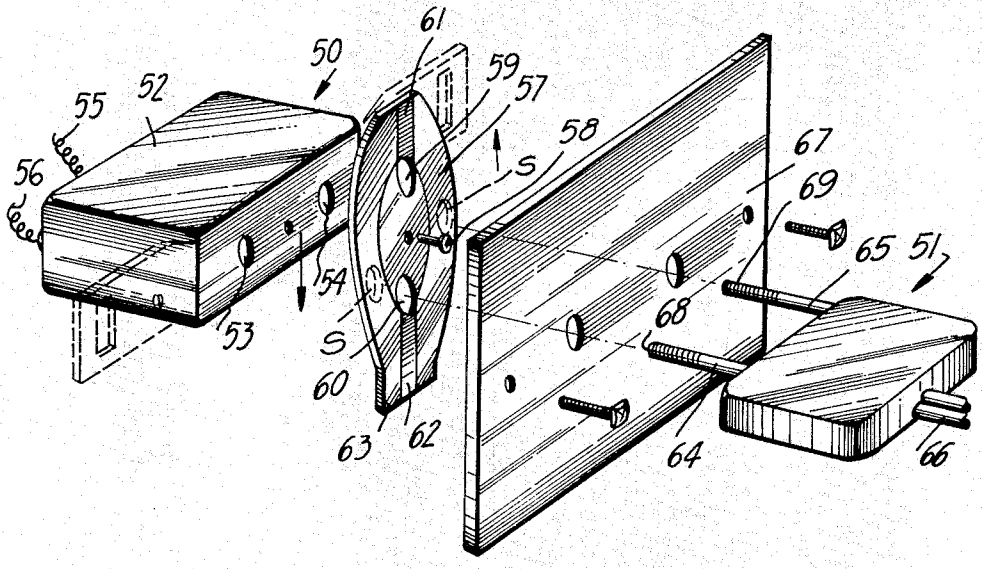


Fig. 8

Fig. 4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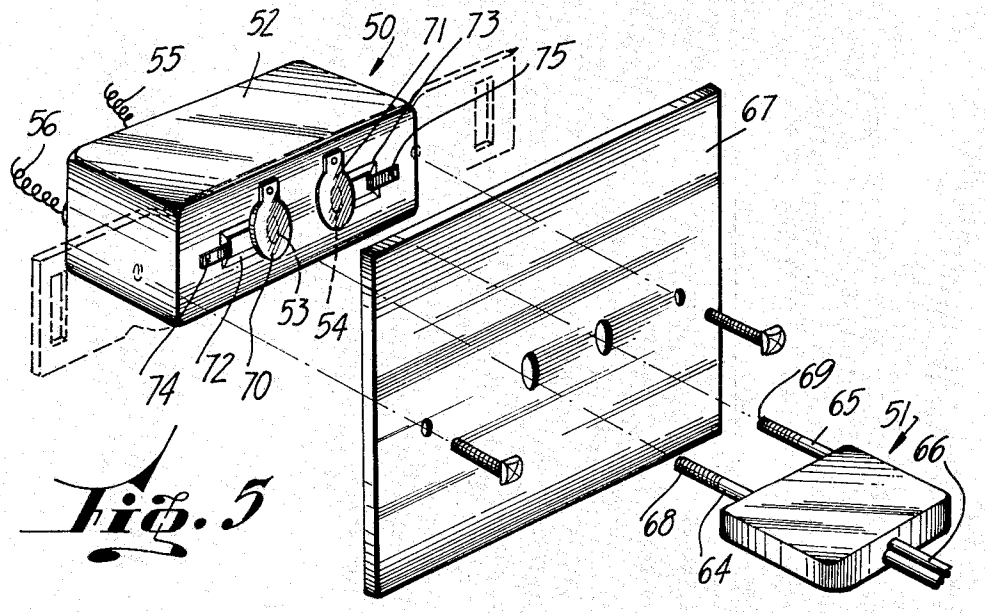
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Fig. 5

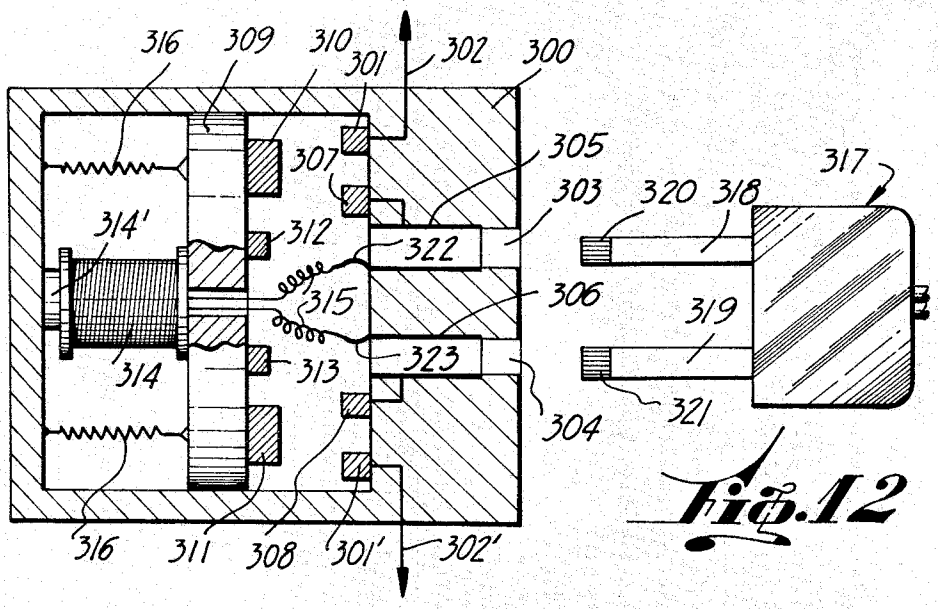
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Fig. 12

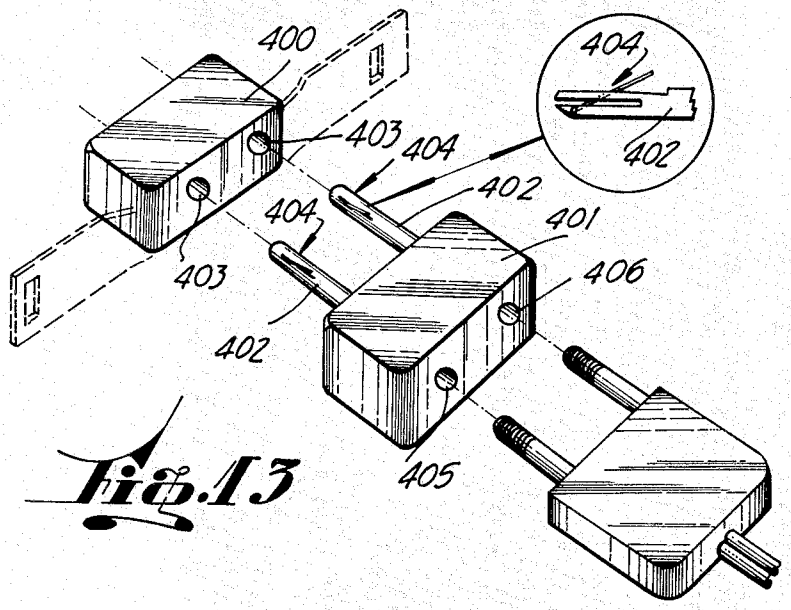
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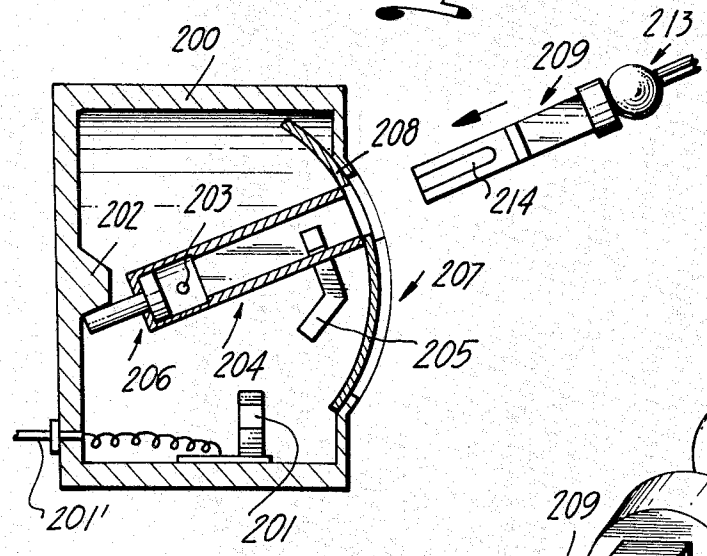
Fig. 13

Fig. 9



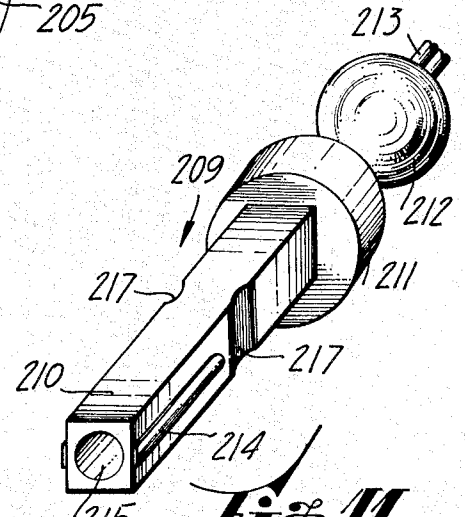


Fig. 11

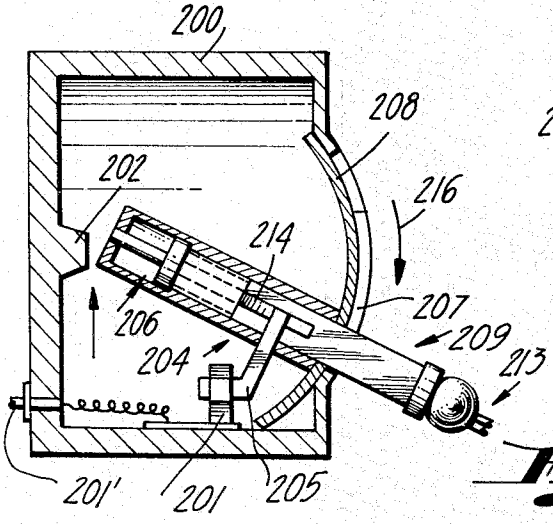


Fig. 10

PROTECTIVE ELECTRIC COUPLING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a protective coupling for establishing an electric connection between two electric circuits, between two branches of an electric circuit, or between a power-supply network and an electric power-consuming device or load.

2. Description of the Prior Art

The danger which surrounds household current-outlet sockets is well known, not only to those skilled in the electrical art, but also to the layman. This danger becomes particularly evident when there are children around who, with their natural tendency to explore the unknown, attempt to insert extraneous objects, some of which may be good electrical conductors, such as pins, needles, hair clips, scissors, etc., into the small holes which provide access to the contacts of the socket. The consequences of such mischief are even better known and therefore no further details appear to be necessary.

In recent years many safety arrangements for avoiding the insertion of extraneous objects into the access holes of sockets, or for automatically disconnecting the power supplied to the socket when an improper load (the human body) is applied thereto, have been conceived on the basis of different principles of operation. However, most of such known arrangements are of a complex nature and therefore costly whereby the possibility of purchasing them is available only to a minority of the population in spite of the fact that the problem affects all income brackets.

I believe that other, simpler arrangements have also been conceived, such as manually operated covers normally obstructing the socket, which must be rotated so as to permit ingress of the plug. This type of protector, although simple, has the disadvantage of being removable by hand and, therefore, not absolutely "child-proof."

The lack of widespread use of safety arrangements for rendering household sockets harmless, in spite of the danger involved, shows that there is a great necessity for providing a simple safety arrangement which overcomes the problems mentioned.

Although so far reference has only been made to the danger which is permanently present in houses, it will be evident to those skilled in the art that the same considerations apply also in other fields of activity. In this respect it is often necessary to provide a male-female connector arrangement of a specific configuration when it is indispensable that one electric circuit be connected only to one other electric circuit with exclusion of any possibility of establishing an erroneous connection (e.g. from a loudspeaker system to a 220-V. supply network). In addition, it is also convenient for certain applications (household as well as industry) to automatically disconnect an outlet socket from the supply line to which it is coupled when its corresponding plug is withdrawn whereby the contacts of the socket do not remain "alive."

Accordingly, it is the object of the present invention to provide a protective coupling for establishing an electric connection between two electric circuits, or two branches of an electric circuit, or between a power-supply network and an electric power-consuming device or load, which does not suffer from the disadvantages of the arrangements and devices known in the art, and which offers a solution to those problems that are not yet satisfactorily solved.

More particulary, it is a further object of the present invention to provide an electric coupling comprising a safety socket and an associated plug, wherein the insertion of extraneous objects into the socket entails no harm either to the person inserting the object or to the circuit connected thereto.

It is a still further object of the present invention to provide a coupling designed to prevent the erroneous connection of two circuits, or two branches of a circuit.

It is an additional object of the present invention to provide a simple and cheap protective coupling for both household and general use.

It is yet another object of the present invention to provide a household safety current-outlet socket which can be mounted in place of a conventional socket and which does not require any preliminary modification of the box housing such conventional socket to adapt it to my improved socket.

It is still a further object of the present invention to provide a safety plug for use with such a safety socket.

It is yet a further object of the present invention to provide a safety cover plate for connecting conventional sockets into a safety coupling.

A further object of the present invention is to provide a socket adapter for converting a conventional socket into a safety socket.

Yet another object of the present invention is to provide a safety socket-and-plug arrangement whereby the power-supply line attached to the socket becomes automatically disconnected from the externally accessible contacts of the socket when the plug is withdrawn therefrom.

A still further object of the present invention is to provide a safety socket-and-plug arrangement wherein access to the connectors of the socket is prevented upon the plug being withdrawn from the socket.

Still another object of the present invention is to provide a safety socket-and-plug arrangement wherein no adverse effects are caused by any contact between the pins of the plug and the hand of the user upon inserting the plug into the socket.

A still further object of the present invention is to avoid the formation of external electric arcs between the plug and the socket upon the former being withdrawn from the latter.

It is an additional object of the present invention to provide a wall-mounted safety socket over which a damp rag can be passed without any danger.

It is another object of the present invention to provide a polarity-selective safety socket-and-plug arrangement.

One of the two complementary couplers of my improved coupling, specifically the socket, is provided in the usual manner with at least one concealed first electrical (female) connector matingly engageable by a second (male) connector on the other coupler i.e., the plug, through an access opening whenever the two couplers are operatively interengaged; the female connector is energizable from a power supply whereas the male connector is adapted to be tied to a load as is well known per se. However, energization of an extraneous object other than the associated male connector, introduced through the access opening into contact with the female connector, is prevented by safety means

adapted to be deactivated, upon incipient interengagement of the two couplers, by coacting first and second magnetic means on the socket and on the plug, respectively, to facilitate energization of the load via the two mating connectors. Full operative interengagement to effect such energization is inhibited, according to a feature of my invention, by a mechanism forming part of the aforementioned safety means. The two magnetic means are preferably an active element (magnet) on the plug and a passive element of ferro-, para- or diamagnetic character on the socket.

More specifically, the engagement-inhibiting mechanism according to this invention may comprise a blocking member which normally obstructs the female connector and carries the first magnetic means so as to be deflectable into a nonobstructing position by magnetic interaction with the second magnetic means on the approaching plug. This blocking member is advantageously mounted behind a front plate, provided with the access opening, for swinging in a plane parallel thereto.

Alternatively, the socket may contain a carrier for the female connector which has an extension normally spaced from a supply terminal in the housing, the carrier being movable jointly with the plug from this normal position into an alternate position upon release of detent means by magnetic interaction of the two aforementioned magnetic elements as the plug engages the socket; this movement of the plug jointly with the carrier, which may be a pivotal motion, effectively completes the interengagement operation.

The aforedescribed safety means may be included in an adapter for a socket rather than in the socket itself, the adapter being provided with retaining means for preventing its detachment from the socket.

According to another embodiment of my invention, the coacting first and second magnetic means on the two couplers cause the displacement of a circuit breaker, such as a piston within the housing of the socket, to complete a working circuit from a supply terminal to the load via the mating connectors by placing a bridge piece thereon in contact with that terminal and with an extension of the female connector normally insulated therefrom. An ancillary circuit within the socket, completed at the same time, includes electromagnetic means acting upon the circuit breaker in a sense intensifying the contact pressure of the bridge piece upon the supply terminal and the associated connector extension, thereby making that contact pressure independent of the strength of the coacting magnetic elements.

BRIEF DESCRIPTION OF THE DRAWING

The above and other features of my invention will now be described in detail with reference to the accompanying drawing in which:

FIG. **1** is a perspective view of one embodiment of a protective coupling comprising a safety socket and plug, the latter having been shown in phantom lines;

FIG. **2** is a schematic vertical cross-sectional view through the protective coupling shown in FIG. **1** but with the plug spaced from the socket;

FIG. **3** is a schematic partial cross-sectional view similar to that shown in FIG. **2** but representing a modification;

FIG. **4** is a schematic exploded perspective view of an advantageous embodiment of a safety connector according to the present invention;

FIG. **5** is a schematic exploded perspective view of a further embodiment of the present invention;

FIG. **6** is a schematic exploded perspective view of an additional embodiment;

FIG. **7** is a diametral cross-sectional view of the embodiment shown in FIG. **6** with the safety socket in connection-preventing position and the plug ready to be introduced into the socket;

FIG. **8** is a diametral cross-sectional view of the embodiment of FIG. **6** but showing the plug inserted into the socket and with the latter in its connection-enabling position;

FIG. **9** is a schematic illustration, partially in vertical cross-section, of another embodiment of my improved coupling wherein the plug has been shown ready to be inserted into the socket while the socket has been shown in "connection-preventing position";

FIG. **10** is a schematic illustration, partially in vertical cross-section, of the embodiment of FIG. **9** but with the plug seen inserted in the socket and with the socket in connection-establishing position;

FIG. **11** is a perspective view of the plug of the embodiment shown in FIGS. **9** and **10**;

FIG. **12** shows, partially in cross-section, a further embodiment of the present invention with the plug ready to be inserted into the socket and with the socket in its normal connection-preventing position; and

FIG. **13** is a schematic exploded perspective view of yet a further embodiment of the present invention.

In FIGS. **1** to **3**, I have shown two complementary couplers, i.e. an electric wall socket and a complementary plug. The socket includes a body with a face or cover plate **10** having two openings **11, 12** extending therethrough. Plate **10** is secured by suitable means to a case **13** within which there are mounted two female connector members **14, 15** electrically extended through the back portion **16** of case **13** by means of a pair of screws **17, 18** whose outer ends have fixed contacts **19** and **20** secured thereto.

Within case **13** there is movably mounted a magnetic member **21** movable in the directions of double arrow F. Magnetic member **21** can be either a permanent magnet, an electromagnet or a body of ferromagnetic, paramagnetic or diamagnetic material. Magnetic member **21** is mechanically connected by a link **21'** to a support member **22** secured to or integral with one end of an elastic member **23** whose other end is mounted on a support **24** rigid with plate **10** and case **13**. Support member **22**, made of electrically insulating material, has mounted thereon two contacts **25, 26** which are movable therewith. Contacts **25** and **26** face fixed contacts **19** and **20** and are connectable thereto.

The plug associated with this socket comprises a body **27** of insulating material to which there are secured electrically conductive pins **28, 29** extending outwardly therefrom, one for each female connector member or jack **14, 15**.

The plug also includes magnetic means **31** secured to or integral with body **27**, preferably a permanent magnet.

Contacts **25** and **26** are connectable to a first electric circuit while pins **28** and **29** are connectable by means of wires **30** to a second electric circuit. More particularly, contacts **25** and **26** are connectable to an electric

power-supply network while pins **28** and **29** are connectable to an electric power-consuming device or load.

The socket and plug described are interengageable by relative movement one toward the other.

If a permanent magnet **31** is mounted within the plug and member **21** is a permanent magnet or is of ferromagnetic material, insertion of the plug into the socket by such relative movement establishes an electric connection between the electric power-supply network connected to contacts **25** and **26** and the load connected to wires **30.** Such connection is caused by the attraction between complementary magnetic means **31** and **21** which cause contacts **25** and **26** to move into engagement with fixed contacts **20** and **19.**

Obviously, if the position of circuit breaker **19, 20,** 25, 26 is reversed as shown in FIG. **3,** it is necessary to invert the relative polarities of magnetic elements **21** and **31** so as to cause repulsion instead of attraction therebetween in order to connect mobile contacts **25** and **26** with fixed contacts **20** and **19.**

If elements **21, 31** were designed as two U-shaped permanent magnets (one in the plug and one in the socket), an electric connection between the power supply and the load could be completed only if the plug were inserted in the socket in a predetermined relative position, inasmuch as in any other position the magnetic interaction between elements **21** and **31** would not cause contacts **25** and **26** to approach contacts **19** and **20.**

In order to indicate the correct relative position between the plug and the socket required for closing the electric circuit, the former could be, for example, of nonsymmetric configuration or the diameter of pin **28** could be made substantially different from the diameter of pin **29.**

It will be seen from the foregoing that if contacts **25** and **26** are connected to a power-supply network, the insertion of any extraneous electrically conducting object such as a hair pin, a needle, etc. into the socket through openings **11** or **12** and into contact with female connector members **14** and **15** will not cause the person inserting such object to receive an electric shock inasmuch as jack **14,** screw **17,** fixed contact **20** and jack **15,** screw **18** and fixed contact **19** are not "alive," i.e. not connected to the power supply. However, if it is the plug shown that approaches the socket, contacts **25** and **26** are moved into engagement with fixed contacts **20** and **19,** thereby closing the electrical circuit.

The socket of this embodiment, as well as that of other embodiments, could be encapsulated, if desired, in an inert atmosphere so as to avoid any problems derived from the formation of sparks or arcs.

The elastic properties of contact carrier **23** assure that mobile contacts **25** and **26** become disconnected from fixed contacts **20** and **19** when the plug is withdrawn from the socket. This elastic member can obviously be replaced by any other means providing the same effect, that is to say, the return movement of safety link **22** to its normal position in which it prevents any electric connection between the electric circuit associated with the socket and an extraneous object.

A particular advantage of the embodiments just discussed, in addition to those already pointed out, is that all possibility of the formation of an electric arc between the plug and the socket is eliminated, inasmuch as the electric circuit is broken between contacts **25, 26** and **20, 19,** when the socket and plug are separated.

FIG. **4** shows an embodiment of the present invention also comprising two complementary coupling devices, i.e. a wall socket **50** and a plug **51.** The socket **50** comprises a body **52** having unilaterally mounted therein two female connector members (not shown) accessible from the front of body **52** through perforations **53** and **54** and connectable to an electric power supply which has been schematically represented by wires **55** and **56.** The socket described can be of any conventional type. On body **52** there is mounted a safety plate **57** freely rotatable around a pivot pin **58** which extends through an orifice in safety plate **57** and is held by body **52.** Safety plate **57** has two perforations **59** and **60** which are aligned with its geometric axis of rotation (i.e. the axis of mounting pin **58**) and are equidistant therefrom. Mounting pin **58** is secured to body **52** at a location which is also equidistant from perforations **53** and **54** and aligned therewith.

Safety plate **57** has two permanent magnets **61** and **62** secured thereto and is biased by a counterweight **63** into a position in which perforations **59** and **60** are not aligned with perforations **53** and **54.** The magnetic axes of permanent magnets **61** and **62** are aligned with perforations **59** and **60.** However, different relative positions are possible without departing from the spirit and scope of the present invention. Safety plate **57** may itself be of magnetic material with poles suitably positioned so that it would not be necessary to have separate magnets **61** and **62** mounted thereon. Also, counterweight **63** can be replaced by other biasing means such as a spring having the same effect.

Plug **51** includes a pair of male connector members or pins **64, 65** spaced apart a distance equal to the spacing between perforations **53** and **54** and between perforations **59** and **60.** The pins **64, 65** are electrically insulated from plug **51** and internally connected to a pair of wires **66.** The free ends of connector members **64** and **65** have permanent magnets **68** and **69** mounted thereon.

The arrangement further comprises a face or covering plate **67** provided with perforations which in its wall-mounted position register with perforations **53** and **54** so as to permit the insertion of male connector members **64** and **65** into perforations **53** and **54** of socket **50.**

In the position shown in FIG. **4,** and with safety plate **57** movably mounted on body **42,** safety plate **57** will normally adopt a position in which perforations **59** and **60** are not aligned with perforations **53** and **54.** In such a position, if it is attempted to introduce an electrically conductive extraneous object such as a hair pin into perforations **53** or **54** through the corresponding perforations in face plate **67,** safety plate **57** will prevent such extraneous object from entering into body **52** whereby it is impossible to establish an electric connection between the electric circuit (wires **55, 56**) associated with socket **50** and such object. However, by means of plug **51** which incorporates the means necessary to rotate safety plate **57** (for example through 90°), it is possible to interconnect the conductors **55,** 56, and **66.** This rotation is caused by complementary magnetic means **61, 62, 68** and **69** which cause safety plate **57** to rotate when pins **64** and **65** commence penetrating the perforations in covering plate **67** whereby the fields of permanent magnets **68** and **69** and of per-

manent magnets **61** and **62** interact until perforations **59** and **60** coincide with perforations **53** and **54**. The end positions of safety means **57** can, if desired, be determined by means of abutments (not shown) present, for example, on body **52** and/or on the inner face of plate **67**.

From the foregoing, it will be evident that safety plate **57** is movable with respect to body **52** between a first position preventing any electric connection from being established between the electric circuit associated with socket **50** and an extraneous object, and a second position enabling the establishment of an electric connection between supply wires **55, 56** and a load connected to wires **66**.

Naturally, the number of perforations required in the safety plate **57** of FIG. **4** depends on the number of pairs of mating connectors in socket **50** and plug **51**. Furthermore, safety plate **57** could also incorporate in place of permanent magnets **61** and **62** two passive bodies of paramagnetic or diamagnetic material so that, upon insertion of plug **51** (with magnets **68** and **69**) through the perforations in plate **67**, the magnets **68** and **69** will cause movement of these bodies, thereby rotating safety plate **57** and enabling the establishment of an electric circuit.

Although, by way of example, it has been stated that safety plate **57** rotates through 90°, it is obvious that any other extent of rotation is acceptable as long as plate **57** in its normal position blocks access to body **52** and in its alternate position gives access thereto. The angle of rotation of safety plate **57** can be varied, for example, by modifying the relative position of magnetic means **61** and **62** with respect to perforations **59** and **60**.

The embodiment of FIG. **4** has been conceived in such a way that a conventional socket can be converted into a safety socket. To this end, safety plate **57** would be mounted on the front face of socket **50**. However, it is obvious that, if desired, safety plate **57** could also be mounted within body **52** or even on the inner face of covering plate **67**.

In FIG. **5** a further embodiment is shown which is similar to the embodiment represented in FIG. **4** and wherein corresponding reference numerals have been used to designate identical or equivalent parts.

The basic difference between the two embodiments is that safety plate **57** with its perforations, magnets and counterweight has been replaced in FIG. **5** by a pair of plates **70, 71**, pivoted with respect to body **52** and normally in a position covering perforations **53** and **54**. Each plate **70** and **71** is connected by means of a bracket **72** and **73**, respectively, to an associated magnetic element **74, 75** preferably consisting of a permanent magnet.

By means of this arrangement, if anyone were to attempt to insert an extraneous object into perforations **53** or **54**, which provide access to the contact or connector members of socket **50**, such attempt would be frustrated by safety plates **70** or **71**. However, in order to establish an electric connection between conductors **55, 56** and **66**, it is sufficient to insert plug **51** through the perforations in face plate **67** so that permanent magnets **68** and **69** come within the field of permanent magnets **74, 75**, whereby causing safety plates **70** and **71** to rotate and enable plug **51** to be further inserted into socket **52** to establish the required electric connection. It is preferable that magnets **68, 69, 74** and **75** act by repulsion so as to avoid the possibility of an object of ferromagnetic material being inserted into perforations **53** and **54** by virtue of the interaction of magnets **74** and **75** with the ferromagnetic material of the extraneous object. A further way to avoid this problem is that magnetic elements **74, 75** simply be two passive bodies of ferromagnetic, paramagnetic or diamagnetic material, and magnetic elements **68, 69** be permanent magnets.

It is evident that safety plates **70** and **71** need not be mechanically connected by means of brackets **72** and **73** to the magnetic means **74, 75** but could also be integrated therewith.

With the scope of the embodiment shown in FIG. **5** it would also be possible to provide a plug **51** incorporating two conventional pins and a third pin, connectable to ground, with a magnet arranged at its free end. In this case, its corresponding socket would require three perforations, two of which (the conventional ones) would be normally blocked by safety plates **70, 71** while the third perforation would be free so as to enable the insertion of the grounded third pin of plug **51**. In this case, a single magnet arranged on the free end of the third or "ground" pin of plug **51** would serve to move (preferably by repulsion) magnets **74** and **75** along with safety plates **70** and **71**, thereby enabling the establishment of an electric contact between the socket and the plug when one is moved toward the other.

The third pin would then become connected to a normally grounded third contact or connector member in socket **50**.

In practice, it has been found that in all the embodiments of the present invention incorporating safety plates (see FIGS. **4** and **5**) it is possible, although very difficult, to cause the rotation of safety plate **57, 70** or **71** by inserting, for example, a screwdriver through the perforations or access holes in covering plate **67** and wiggling its flat end resting against the safety plate. In order to avoid such a possibility, I prefer to incorporate in safety plate **57** or plates **70** and **71** additional safeguards for preventing such exteriorly caused movement of the safety plate towards its connection-enabling position. Such safeguards may comprise a recess S, aligned with these access holes as seen in FIG. **4**, whereby it is virtually impossible to move safety plate **57** by inserting, for example, a screwdriver and rotating it around a geometric axis variably inclined with respect to a perpendicular to safety plate **57**, or **70** or **71**.

This same effect could be obtained by other means such as, for example, two straps secured in spaced relationship over safety plate **57** or plates **70**, or **71** and defining a channel therebetween aligned with the perforations in covering plate **67** when these plates are in their connection-preventing positions.

In the embodiments so far described, the operation of connecting a power-supply network, or a first electric circuit, to a load, or a second electric circuit, is carried out by a single mechanical operation inasmuch as the conditioning of the socket occurs automatically upon the manual interengagement of the two complementary devices.

Certain embodiments will now be described in which the user must perform these operations in two successive steps.

In this context I shall now refer to FIGS. **6, 7** and **8** wherein a socket-and-plug arrangement **100, 101** has been shown. The socket **100** comprises a body **102**

which has mounted thereon two stationary contacts or prongs **103, 104,** insulated from each other and from that body. Contacts **103** and **104** are connectable to an electric circuit, such as a power-supply network, and may therefore be described as supply terminals. Body **102** has a first protruding crown-shaped portion or serrated annular boss **112** integral therewith. Socket **100** also comprises an intermediate carrier member **105** rotatably mounted with respect to body **102.** Intermediate member **105** comprises a first cylindrical portion or sleeve **106** having two external prongs or contacts **107,** 108 mounted thereon and a second hollow cylindrical portion or sleeve **109** carrying therein two conductor members **110, 111** each electrically connected to a respective prong **107, 108** serving as an extension thereof. A second protruding crown-shaped member or serrated annular boss **113** is axially slidable with respect to member **105,** although barred from any rotational movement with respect thereto by means for example, of a keyed or splined mounting (not shown).

Boss **113** has magnetic means in the shape of a magnetic pin **114** integral therewith and extending into sleeve **109** through a perforation in sleeve **106.**

Although intermediate member **105** is rotatable with respect to body **102,** prongs **103** and **104** can be brought into electric contact with prongs **107** and **108** only when the serrated bosses or detents **112** and **113** are in the axially separated positions shown in FIG. **8;** if they are closely juxtaposed as shown in FIG. **7,** intermediate member **105** is prevented from rotating with respect to body **102** by the engagement of their serrations and by the nonrotatable mounting of pin **114** with respect to intermediate member **105.**

Plug **101** comprises a substantially cylindrical portion or stem **115** having two diametrically opposite flattened faces (only one shown) carrying conductor members **116** adapted to establish conductor with contact members **110** and **111** upon plug **101** being inserted into sleeve **109.** The terminals of plug **101** are electrically connected to wires **117** connectable to a load circuit such as an electric appliance. Within stem **115** of plug **101** there is mounted a magnetic element such as a permanent magnet **118** adapted to cooperate, upon insertion of plug **101** into intermediate member **105,** with magnetic pin **114.** Preferably, pin **114** is a permanent magnet, although for example a passive body of paramagnetic material will also be suitable. Obviously, pin **114** does not necessarily have to be made in its entirety of magnetic material as it is sufficient that the end thereof remote from boss **113** have magnetic character. By means of the components described with reference to FIGS. **6** and **8,** there is provided a safety arrangement adapted to operate as follows:

With prongs **103, 104** of socket **100** permanently connected to an electric power supply, if it is desired to energize the wires **117** it is necessary to insert plug **101,** and more particularly cylindrical stem **115** thereof, into the cylindrical sleeve **109** of socket **100.** In this way, conductors **116** of plug **101** come into conductor with contact members **110** and **111,** which in turn are connected to contacts **107** and **108.** In the normal, connection-preventing position of plug **100,** contacts **107** and **108** are angularly offset from contacts **103** and **104.** Unless it is plug **101** that is inserted into socket **100,** it is not possible to rotate intermediate member **105.** However, if plug **101** is so inserted, magnetic element **118** attracts magnetic element **114** to disengage the serrated boss **112** from the coacting boss **113** and allow the intermediate member **105** to be manually rotated with respect to body **102,** whereby movable prongs **107** and **108** come into electric contact with stationary prongs **103** and **104** as has been shown in FIG. **8.**

In the event that an extraneous object is placed in contact with conductors **110** and **111,** no damage can be caused inasmuch as these conductors are not normally connected to the electric power supply. Moreover, it is normally impossible to rotate, by using extraneous means, intermediate member **105** with the aim of placing prongs **107, 108** in contact with prongs **103,** 104, inasmuch as much extraneous means would not disengage the two bosses **112, 113** from each other.

Obviously, means are provided, such as a spring (not shown), to return the boss **113** to its engaging position with the boss portion **112** upon plug **101** being withdrawn from socket **100.** Similarly, means are also provided to enable plug **101** only to be withdrawn from socket **100** when prongs **107** and **108** are free from electric contact with prongs **103** and **104.**

From the foregoing, it will be seen that boss **113** and magnetic pin **114** (safety means) have a normal first position preventing the establishment of an electric connection between the electric circuit associated with socket **100** and an extraneous object, and are movable to a second position enabling the establishment of an electric connection between the power supply network connected to socket **100** and the load connected to plug **101.**

Thus, in the embodiment of FIGS. **6, 7,** and **8** the operations which must be performed are first the insertion of the plug into the socket (whereby the socket is conditioned to allow the electric connection to be established) and then a predetermined manipulation for mechanically establishing the required connection.

Reference will now be made to FIGS. **9** to **11** which show a further embodiment of my invention.

In accordance with this embodiment, the socket comprises a body or housing **200** having mounted therein two stationary contacts **201** (the other one is not seen in this Figure) insulated from each other and from body **200.** Body **200** is internally formed with an abutment **200.** Swingable about a pivot pin **203** within body **200** is a carrier member **204** having two contacts **205** (only one being visible) mounted thereon and arranged so that upon member **204** rotating in a clockwise direction about pivot point **203,** contacts **205** come into engagement with contacts **201.** Contacts **201** are connectable to an electric circuit (not shown), such as an electric power supply, by means of conductors **201'.**

Member **204** is hollow and its inner end defines an opening through which there extends a plunger **206** of magnetic material having an enlarged head positioned within member **204** to prevent its disengagement therefrom. The other end of member **204** is open and accessible from the outside. Normally, magnetic member **206,** which constitutes a detent forming part of the safety means of this embodiment, projects from member **204** and because of its engagement with abutment **202** prevents the rotation of member **204** and thereby the possibility of any circuit closure between movable contacts **205** and stationary contacts **201.**

Body **200** includes a curved front plate **207** provided with a vertical slot, while member **204** carries a shield

208 which is slidable relative to curved plate 207 on the inner face thereof. Shield 208 has an opening coextensive with the opening of member 204, providing access thereto from outside.

The arrangement comprises a complementary plug 209 engageable with the socket just described.

Plug 209 comprises a prismatic stern 210 capable of being inserted into the correspondingly shaped hollow portion of member 204 through curved plate 207 and shield 208. The plug has a shoulder 211 and a knob 212. The shoulder 211 serves to limit the inward movement of plug 209 into member 204.

Plug 209 is electrically connectable to an electric load circuit by means of wires 213 each connected to one of two conductors 214 positioned on opposite faces of stem 210. With this arrangement, upon plug 209 being inserted into the socket, conductors 214, 214' come into engagement with a corresponding contact 205.

In addition, plug 209 has at its free end magnetic means 215, for example, a permanent magnet, which, upon plug 209 being inserted into the socket, will attract the plunger 206, thereby carrying it to a releasing position, enabling the establishment of a connection between contacts 205 and 201, by rotation of member 204 in a clockwise direction as shown by arrow 216. Such rotation must be effected by the user by pressing downwardly on knob 212.

In order to prevent plug 209 from being withdrawn when the arrangement is in the operating position shown in FIG. 10, channel-shaped recesses 217 are provided which engage the sides of the vertical slot defined in curved plate or front wall 207 which thus acts as a locking means for the plug. This vertical slot has an enlarged portion at its upper end through which plug 209 can be inserted and withdrawn from the socket. In this way, plug 209 can be withdrawn only when member 204 is in the normal or blocking position shown in FIG. 9, being otherwise held in place by the constricted slot portion. Similarly, plug 209 can be inserted into its corresponding socket only when the socket is in the position shown in FIG. 9. It will be seen that upon inserting an extraneous object into the socket positioned as shown in FIG. 9 and more particularly into member 204, such extraneous object, even if it should come into contact with contacts 205, will not be electrically connected to the power supply inasmuch as their downward extensions are not in engagement with supply terminals 201. Similarly, it is impossible to cause rotation of member 204 by means of such an extraneous object, in view of the interlocking between magnetic member 206 and abutment 202. It will accordingly be seen that the normal position shown in FIG. 9 prevents the establishment of any electric connection between the electric circuit associated with the socket and an extraneous object, whereas upon a forward shift of magnetic member 206 within member 204 (off-normal position) it is possible to establish an electric connection between, for example, a power supply and a load, connected to wires 213, by swinging the member 204 about its pivotal axis.

Obviously, when member 204 is in the upwardly inclined position shown in FIG. 9 and the plug is not inserted thereinto, the magnetic plunger 206 will be driven by gravity into locking engagement with abutment 202. If additional safeguards are needed, plunger 206 could be placed under the effect of a biasing spring tending to move it rearwardly toward its blocking position. Both the effect of this spring as well as the effect of gravity are overcome by the magnetic attraction existing between plunger 206 and magnetic means 215 upon the plug being inserted into member 204.

Advantageously, plunger 206 should not be designed as or incorporate a permanent magnet, but should be a passive member of ferromagnetic material, as in this way there is avoided the possibility of an extraneous object of ferromagnetic material being able to withdraw the plunger from its blocking position.

In FIG. 12 a further embodiment has been shown which has been conceived particularly for interconnecting two electric circuits or two branches of an electric circuit, designed to carry a large current, requiring the exertion of considerable contact pressure between a movable contact and a stationary contact.

In the embodiment of FIG. 12, the socket comprises a hollow body or housing 300 of insulating material which has mounted therein a pair of supply terminals 301, 301' connected to a power source schematically represented by arrows 302. Body 300 defines two perforations 303, 304 lined at least in part by electrically conductive bushings 305, 306. These busings 305, 306 are electrically connected to contacts 307, 308 serving as extensions thereof. Within body 300 there is slidably mounted a circuit breaker in the form of a nonconductive piston member 309 having bridge pieces 310, 311 mounted thereon. These bridge pieces 310, 311 are arranged in such a way that, upon member 309 sliding toward the right (as viewed in FIG. 12), bridge piece 310 interconnects the contacts 301 and 307 while bridge piece 311 interconnects the contacts 301' and 308, whereby an electric connection is established between power source 302 and conductive bushings 305, 306.

In addition, member 309 carries magnets 312, 313 substantially aligned with perforations 303, 304. Member 309 is secured to a movable coil 314 of an electromagnetic device whose armature 314' is secured to body 300. Armature 314' is a suitably oriented permanent magnet so polarized as to cause member 309 to move to the right upon energization of coil 314. Coil 314 is permanently connected (in an ancillary circuit schematically represented by wires 315) to tabs 322, 323 of jacks or bushings 305, 306. Piston member 309 is normally biased toward its retracted or connection-preventing position (i.e., the position shown in FIG. 12) by springs 316.

The arrangement further comprises a plug 317 which is conventional in most aspects except that the free ends of pins 318, 319 incorporate permanent magnets 320, 321. If desired, these magnets 320, 321 could be replaced by a single permanent magnet in the body of the plug as shown, for example, in the embodiment of FIG. 2; obviously it would then be necessary to slightly modify the positioning of magnets 312, 313.

Upon inserting pins 318, 319 of plug 317 into perforations 303 and 304, the mutual attraction of magnets 320, 321, 312, 313 draws the piston 309 to the right (as viewed in FIG. 12), whereby bridge pieces 310, 311 will interconnect contacts 301 and 307 as well as contacts 301' and 308. Upon the supply leads 302, 302' becoming connected to contacts 322 and 323, electromagnet 314 will be energized, thereby intensifying the contact pressure between contacts 301, 307 and bridge piece 310 as well as between contacts 301', 308 and bridge piece 311.

If an extraneous object were to be inserted into perforations **303, 304,** it would be most difficult for such an object to reach the contacts **301, 301'** inasmuch as the latter are hidden and inaccessible from outside.

It will be obvious to those skilled in the art that the present invention is not limited to incorporating safety means into the combination of a plug with a socket or a cover plate therefor, inasmuch as it is also possible to incorporate the novel features of any of the sockets described and claimed into an adapter capable of converting a conventional socket into a protected one. In this case the adapter may be semi-permanently connectable to a conventional socket. This has been shown in FIG. **13** where reference **400** designates a conventional wall socket while reference **401** denotes an adapter in accordance with the present invention. The adapter **401** comprises two pins **402** insertable into perforations **403** of the convention socket **400.** Adapter **401** has internal conductors electrically connected one to each pin **402** and accessible from outside through perforations **405** and **406.** In addition, adapter member **401** incorporates magnetically controlled safety means in accordance with any of the preceding embodiments, preferably those of FIGS. **1** to **5.**

In order to avoid the risk of adapter socket **401** being withdrawn from conventional socket **400,** once it has been inserted thereinto, retaining means **404** are provided which, for example, can comprise a pair of elastic blades **404** mounted at the ends of pins **402** and which, once pins **402** have been inserted into perforations **403,** prevent the adapter **401** from being withdrawn. Obviously, the particular construction of retaining means **404** is not an important aspect of the present invention and a large number of different structures can be conceived to the same end.

It will be understood that the embodiments described by way of example are susceptible of modifications as to their construction and materials without departing from the scope of the invention as specifically defined in the following claims.

I claim:

1. A protective electric coupling comprising:

a first coupler provided with at least one concealed first electrical connector adapted to be tied to a source of electrical energy;

a second coupler complementary to said first coupler provided with a second electrical connector adapted to be tied to a load, said second connector being matingly engageable with said first connector through an access opening in said first coupler upon operative interengagement of said couplers;

safety means in said first coupler for preventing the energization of an extraneous object other than said second connector introduced through said access opening into contact with said first connector; and

coacting first and second magnetic means on said first and second couplers for deactivating said safety means upon incipient interengagement of said couplers to facilitate energization of the load via said connectors, said safety means including mechanism effective prior to deactivation thereof for inhibiting full operative interengagement of said couplers.

2. A protective electric coupling as defined in claim **1** wherein said first and second magnetic means comprises a passive magnetic element on said first coupler and an active magnet on said second coupler.

3. A protective electric coupling as defined in claim **1** wherein said first and second magnetic means are a pair of magnets polarized to repel each other.

4. A protective electric coupling as defined in claim **1** wherein said mechanism comprises a blocking member normally obstructing said first connector and carrying said first magnetic means, said blocking member being deflectable into a nonobstructing position by magnetic interaction of said first and second magnetic means.

5. A protective electric coupling as defined in claim **4** wherein said second magnetic means is mounted on said second connector for introduction into said access opening.

6. A protective electric coupling as defined in claim **4** wherein said first coupler includes a front plate provided with said access opening, said blocking member being swingable behind said front plate in a plane parallel thereto.

7. A protective electric coupling as defined in claim **6** wherein said blocking member is provided with a depression normally in line with said access opening for preventing a displacement of said blocking member by a tool inserted therethrough.

8. An adapter for a socket provided with a jack connected to a source of electrical energy and engageable by a pin of a plug connected to a load, comprising a body, a male connector extending from said body for insertion into said jack, a female connector on said body adapted to receive said pin, circuitry in said body for extending an electrical connection from said jack through said connectors and said pin to the load upon operative interengagement of said plug with said body, safety means in said body for preventing the energization of an extraneous object other than said pin introduced into said female connector, magnetic means in said body displaceable by a magnet on said plug for deactivating said safety means upon incipient interengagement of said plug with said body, said safety means including mechanism effective prior to deactivation thereof for inhibiting full operative interengagement of said plug and said body, and retaining means on said body for preventing its detachment from a socket engaged thereby.

9. A wall socket having a body provided with an access opening and a concealed electrical connector contactable through said access opening by a mating pin of an associated plug and adapted to be tied to a source of electrical energy, said socket comprising:

a blocking member between said access opening and said connector for normally obstructing the latter to prevent energization of an extraneous object other than said pin inserted into said access opening; and

magnetic means on said blocking member positioned to interact with a magnet on said plug upon incipient penetration of said access opening by said pin to displace said blocking member into a nonobstructing position.

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