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Stendig et al.

[11] **3,781,857**

[45] **Dec. 25, 1973**

[54] **CONDITION RESPONSIVE RECEPTACLES**

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[52] **U.S. Cl.** **340/420,** 340/227, 340/280

[51] **Int. Cl.** **G08b 19/00**

[58] **Field of Search** ..... 340/280, 227, 228, 340/420, 253 A, 227.1

[56] **References Cited**

UNITED STATES PATENTS

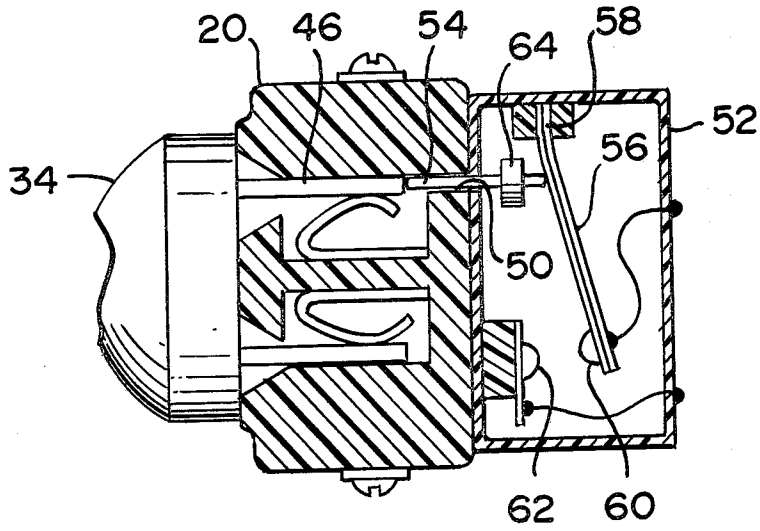
3,090,948	5/1963	Cremer	340/280
3,320,601	5/1967	Yankus	340/227.1
3,530,337	9/1970	Moore	340/253 A X
3,192,518	6/1965	Sliman	340/280
3,411,150	11/1968	Schulein	340/280 X

Primary Examiner—John W. Caldwell
Assistant Examiner—Scott F. Partridge
Attorney—Edward J. Brenner et al.

[57] **ABSTRACT**

Power receptacles having an exterior appearance of that of a conventional receptacle and including a switching device responsive both to insertion and/or removal of a plug and to an external condition such as heat or electrical current. An alarm device may be mounted on the receptacle for cooperation with the switching device to signal the occurrence of predetermined conditions sensed by the switching device.

9 Claims, 9 Drawing Figures



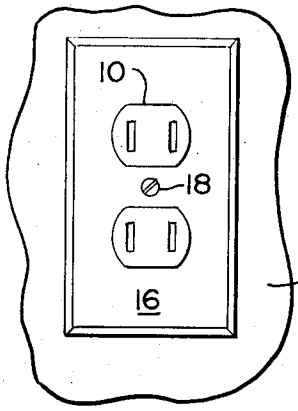


FIG. 1

FIG. 2

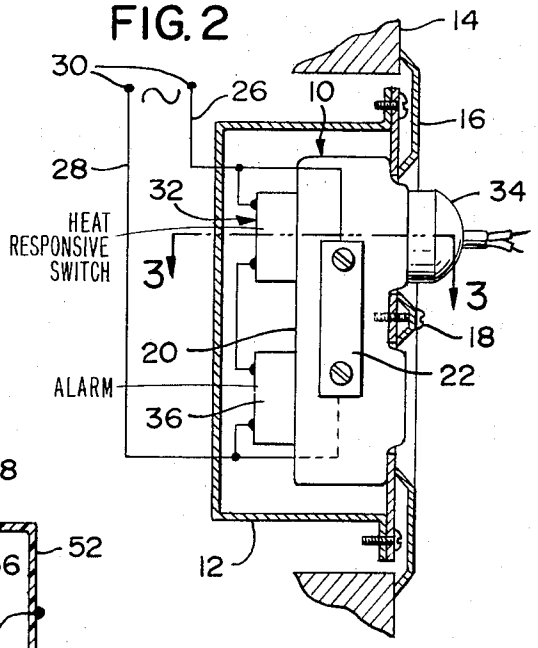
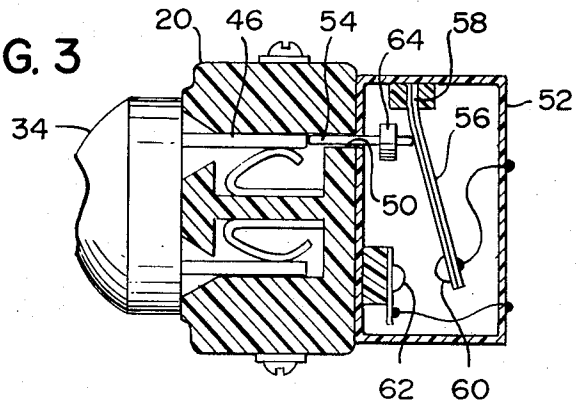


FIG. 3



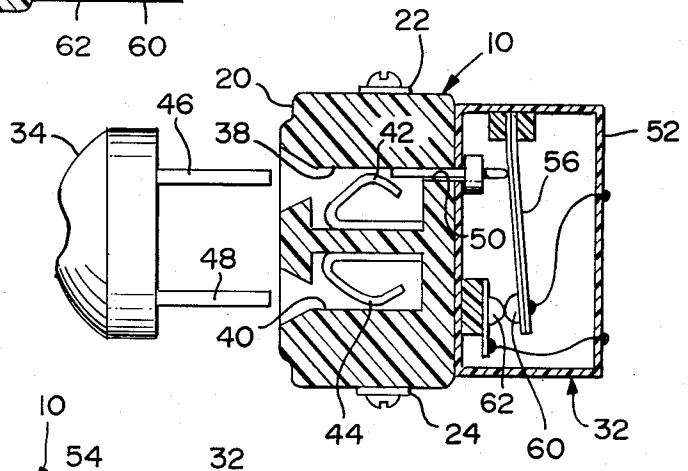


FIG. 4

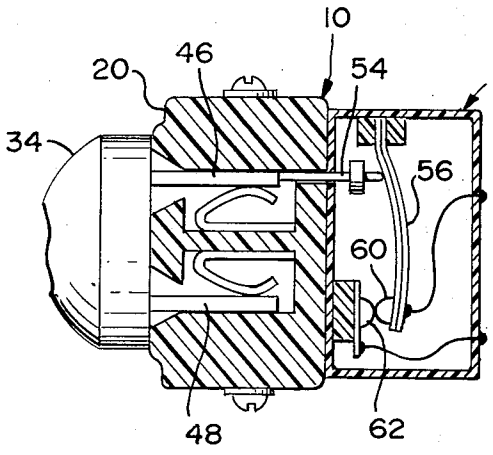


FIG. 5

FIG. 6

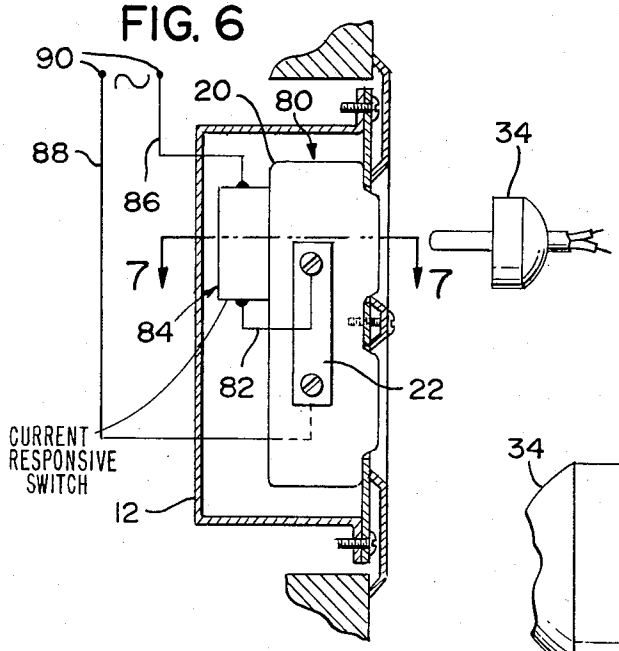


FIG. 7

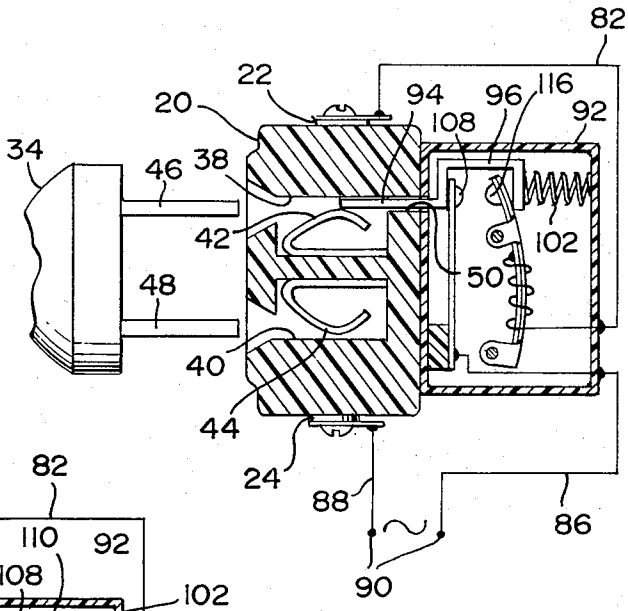


FIG. 8

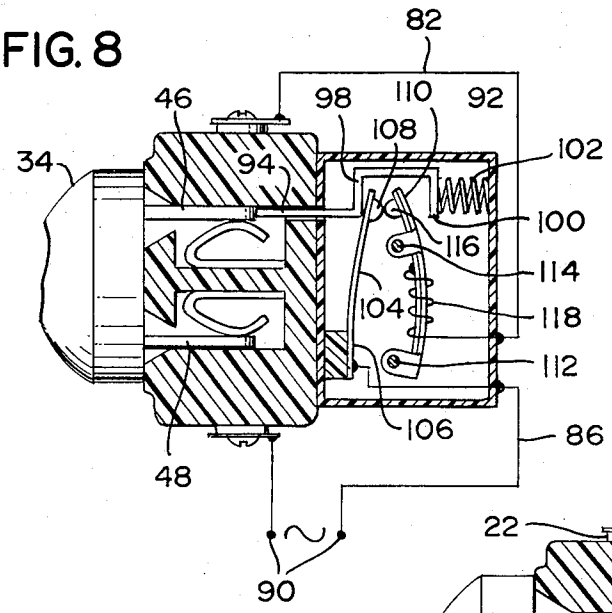
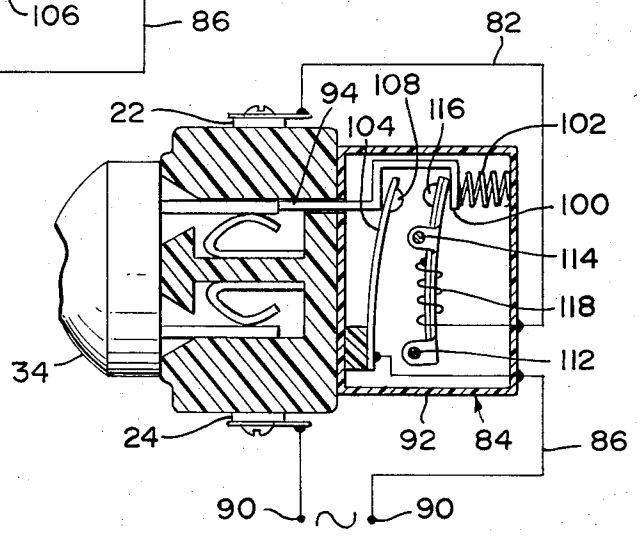


FIG. 9



CONDITION RESPONSIVE RECEPTACLES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to power receptacles and more particularly to power receptacles which are responsive to the occurrence of predetermined conditions.

2. Description of the Prior Art

In various diverse applications, the need often arises for a conventional-like alternating current receptacle which is responsive both to the insertion and removal of a plug and to the occurrence of a predetermined external condition to perform a control function. Heretofore, receptacles of this general type have been found to be complex, bulky, expensive to manufacture, and dissimilar to conventional receptacles in appearance and size and thus have not proven to be fully satisfactory under most operating conditions. Exemplifying the prior art is U. S. Pat. No. 3,370,141, which discloses a receptacle having a circuit breaker which is reset by movement of the plug acting through a complex mechanical assembly. As illustrated by this patent, the prior art structures are intricate and costly and usually require special, oversized mounting boxes to accommodate the numerous parts included in the receptacle assembly. The specialized nature of the prior art devices as well as other factors partially noted above have proven to be material disadvantages in practice and have restricted the use and acceptance of condition responsive receptacles in general in the past.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to perform a control function in response to the insertion and/or removal of a standard alternating current plug from a receptacle and further in response to a predetermined sensed condition.

Another object of this invention is to construct a simple condition responsive power receptacle having a conventional exterior appearance and adapted to be housed within a standard wall-box.

This invention has a further object in the provision of a power receptacle responsive to a plurality of conditions for performing a control function.

The present invention is summarized in that an electrical receptacle includes a housing having slots adapted to receive the prongs of an electrical plug, contacts in the slots adapted to be connected with a source of electricity and engaging the prongs of the plug when inserted into the slots, at least one of the slots extending completely through the housing, a switch on the housing having an electrically insulated, linearly movable actuating arm extending into that one slot from the rear of the housing, the actuating arm movable by the removal and insertion of the plug prongs from the slots to change the state of the switch, and a sensor on the housing cooperating with the switch to change the state thereof in response to the occurrence of a predetermined condition whereby the switch is responsive both to plug insertion and removal and to the predetermined condition.

Other objects and advantages of the present invention will be more fully apparent from the following description of the preferred embodiments when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial elevational view of a receptacle according to the present invention;

FIG. 2 is a side elevational view, partially in section, of one embodiment of the receptacle of FIG. 1;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2 showing the receptacle of FIG. 2 in one operative position;

FIGS. 4 and 5 are sectional views similar to FIG. 3 showing the receptacle of FIG. 2 in two other positions;

FIG. 6 is a side elevational view, partially in section, of another embodiment of the receptacle of FIG. 1;

FIG. 7 is a sectional view taken along line 7—7 of FIG. 6 showing the receptacle of FIG. 6 in one operative position; and

FIGS. 8 and 9 are sectional views similar to FIG. 7 showing the receptacle of FIG. 6 in two other positions.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a preferred embodiment of a condition responsive power receptacle according to the present invention is shown generally at 10 in its operative position within a conventional wall-box 12 mounted flush with the exposed surface of a wall 14. A cover plate 16 is secured to the receptacle 10 by any suitable means such as a screw 18 to close the wall-box 12 and complete the installation.

Receptacle 10 includes a main body member or housing 20 having a pair of contact terminals 22 and 24 which are connected by lines 26 and 28, respectively, to a source of alternately current represented schematically by terminals 30. Affixed to a rear surface of body member 20 is a single-pole, single-throw, heat-responsive switch 32 which is additionally responsive to insertion and removal of a conventional power plug 34 as will be described more fully below. An audible alarm such as a small buzzer 36 is also affixed to the rear surface of body member 20, with the buzzer and switch 32 connected in series across lines 26 and 28 as shown in FIG. 2.

Referring to FIGS. 3–5, body member 20 includes a pair of spaced, parallel plug-prong receiving slots 38 and 40 and a pair of contact blades 42 and 44 which are partially folded over upon themselves to extend laterally into slots 33 and 40, respectively. Contact blades 42 and 44 are electrically interconnected internally of body member 20 with terminals 22 and 24 to feed operating potential from source 30 to plug 34 through a set of prongs 46 and 48.

Slot 38 of body member 20 extends completely therethrough by means of an aperture 50 formed in a rear wall of the body member. As shown in FIGS. 3–5, switch 32 has an insulated housing 52 and is mounted onto body member 20 such that an actuating arm 54 of switch 32 extends through aperture 50 into slot 38. Arm 54 is adapted to be engaged by prong 46 of plug 34 and moved linearly thereby along the elongate axis of slot 38. A thermal sensing element such as a bimetal spring member 56 is affixed at one end 58 to the switch housing 52 and carries a movable contact 60 at its distal end. A fixed contact 62 is attached to housing 52 for cooperation with movable contact 60. As shown in the drawings, arm 54 engages bimetal 56 at a point near end 58 such that movement of arm 54 into housing 52 causes contact 60 to move away from its normal spring-

biased position in engagement with fixed contact 62. A collar 64 on arm 54 prevents the arm from inadvertently becoming dislodged from its operative position within switch housing 52. It is also noted that bimetal 56 preferably is oriented with its low-expansion side facing fixed contact 62 such that contact 60 will be moved into engagement with contact 62 as the bimetal becomes heated.

In operation, the receptacle 10 is supported within conventional wall-box 12 such that the exterior appearance thereof resembles that of an ordinary power receptacle as shown in FIG. 1. Referring to FIG. 3, when a plug 34 is inserted into the slots 38 and 40 of housing 20, arm 54 of switch 32 is engaged by prong 46 and moved linearly thereby such that contact 60 of bimetal 56 is moved away from fixed contact 62. The switch is thus open and alarm 36 is isolated from the electrical source 30.

If plug 34 is removed, however, the withdrawal of prong 46 frees actuating arm 54 and bimetal 56 springs back to its normally-biased position with contacts 60 and 62 engaged (FIG. 4). Electrical potential is thereafter fed from source 30 through lines 26 and 26 and the now closed switch 32 to alarm 36 causing actuation thereof. A similar result is obtained if plug 34 is left inserted into the receptacle and the temperature sensed by bimetal 56 reaches a predetermined excessive value.

As shown in FIG. 5, as bimetal 56 is heated, its differential expansion causes contact 60 to gradually move toward contact 62 whereupon the switch 32 will become closed when a predetermined excessive temperature has been reached. The bimetal pre-adjusted, as by bending, to cause the closure of switch contacts 60 and 62 at any desired temperature. Thus, the switch may be preset to respond to any temperature above that which would normally be encountered, such that an emergency condition, such as a fire, may be detected and readily signalled by alarm 36.

It can be appreciated that receptacle 10 has utility in any number of applications and is particularly advantageous when used as an economical, hidden local alarm for hotels, motels, hospitals and the like. For example, in a motel, a receptacle 10 may be used in each room to receive the plug of a television receiver located therein. An attempted theft of the television receiver, resulting in the removal of plug 34 from the receptacle, would close switch 34 and produce the energization of alarm 36. The local alarm signal generated by alarm device 36 would not only alert the people in the vicinity of the attempted theft but would also surprise the thief. This is especially true in view of the important fact that the receptacle 10 is outwardly indistinguishable from an ordinary, unprotected receptacle and does not require the use of an unusual or recognizable plug. Furthermore, in the event of a fire near receptacle 10, and in particular a fire or pre-ignition, high temperature condition within the walls of the motel, bimetal 56 will respond as illustrated in FIG. 5 to close contacts 60 and 62, again signalling an emergency to those in the vicinity of the receptacle.

It can be seen that the receptacle 10 according to the present invention has other advantages in that the switch-sensor assembly 32 and the main body member 20 are operatively independent. In this manner, failure of the switch does not necessitate replacement of the main body member and vice versa. Also, by constructing the switch 32 separately from the main body member 20, mass-produced standard receptacles may be used for main body member 20 with the minor modification of the forming of aperture 50 in a rear wall thereof. As a result, the receptacle of the present invention is extremely economical, has a conventional exterior appearance, and is capable of responding not only to the removal of a standard plug therefrom but also to the occurrence of a predetermined excessive temperature condition within heating proximity of the receptacle.

Referring now to FIGS. 6–9, there is illustrated another embodiment of the condition responsive receptacle according to the present invention in which the receptacle is responsive to plug insertion and removal and to electrical current. For the sake of brevity, structure identical to that described with respect to the embodiment of FIGS. 2–5 is identified with identical numbers and is not described again.

In FIG. 6, the receptacle of the present invention, illustrated generally at 80, includes a main body member or housing 20 having terminal 22 thereof connected by a line 82 to one side of a current responsive, resettable switch 84 affixed to a rear wall of the housing. The other side of switch 84 and the terminal 24 of housing 20 are connected by lines 86 and 88, respectively, to a suitable source of electricity represented by terminals 90.

As shown in FIGS. 7–9, switch 84 has an insulated casing 92 and is suitably attached to a rear surface of housing 20 such that an actuating arm 94 extends through aperture 50 into slot 38. Arm 94 is adapted to be engaged by prong 46 of plug 34 and moved linearly thereby along the elongate axis of slot 38. Arm 94 includes an offset member 96 which is joined at its ends to a pair of parallel members 98 and 100 to form a generally U-shaped structure on that end of arm 94 within housing 92. A coil spring 102 is disposed in compression between member 100 and a wall of housing 92 so as to bias actuating arm 94 to the position shown in FIG. 7.

A flat spring member 104 is mounted at one end 106 to the housing 92 and carries a movable contact 108 on its opposite end. As shown in FIGS. 7–9, spring 104 is positioned such that its distal end cooperates with member 98 of actuating arm 94 for movement thereby. A bimetal 110 is constrained in an arcuate configuration by a pair of ears 112 and 114 which are pivotally mounted within housing 92. A contact 116 is disposed on the distal end of bimetal 110 for cooperation with contact 108 of spring member 104. A resistive heating coil 118 is wound about bimetal 110 and is connected at one end to the bimetal and at its other end to terminal 22 via line 82. It is noted that bimetal 110 is preferably positioned with its high-expansion side facing spring member 104.

As shown, contacts 108 and 116 are connected in series with the contact blades 42 and 44 of main body member 20 whereby power is supplied thereto only when contacts 108 and 116 are in engagement. Also, since winding 118 is in series with the switch contacts 108–116, the current flowing therethrough is directly proportional to the current drawn by whatever appliance is connected with plug 34.

In operation, as plug 34 is inserted into slots 38 and 40, prong 46 engages arm 94 and moves the same linearly from the position shown in FIG. 7 to that of FIG. 8. This movement causes member 98 to engage and

move the free end of spring **104** toward bimetal **110** whereupon contacts **108** and **116** become engaged. Current thereafter flows from source **90** through contacts **108** and **116** and heater coil **118** to contact blades **42** and **44**, and thence to prongs **46** and **48** of the plug **34**. It should be noted that as arm **94** is moved to the position shown in FIG. **8**, member **100** thereof moves away from the free end of bimetal **110** to permit movement thereof in the event of an overload, as will be explained more fully below.

If a short circuit or the like should develop, causing the current drawn through winding **118** to exceed a predetermined safe level, bimetal **110** will be heated to such a degree that its differential expansion will cause the bimetal to snap from the arcuate, constrained position of FIG. **8** to that of FIG. **9**. As a result, contact **116** moves away from contact **108**, opening the series circuit thereby to cut-off the supply of operating potential to the plug **34**. With the current flow path thus interrupted, winding **118** will cool and the bimetal will attempt to revert to its initial position. However, bimetal **110** when cooled is designed not to have sufficient resilience to snap back to the position shown in FIG. **8** without the application of an additional force. Thus, it can be appreciated that once the switch formed by contacts **108** and **116** responds to an excessive level of current flow, as sensed by bimetal **110** and winding **118**, it assumes a fail-safe position (FIG. **9**) which will be maintained until the bimetal is reset.

The resetting of bimetal **110** to the position shown in FIG. **7** is accomplished by the removal of plug **34**. As the plug is removed actuating arm **94** of switch **84** is permitted to move linearly to the left, as visualized in the drawings, under the force of compression spring **102**. This movement causes member **100** to engage the free end of bimetal **100** and force the same toward contact **108**. Since heating coil **118** is deenergized and the bimetal has cooled, this additional force causes the bimetal to snap back to its initial position as shown in FIG. **7**.

It can be appreciated that the receptacle **80** of FIGS. **6–9** is responsive both to insertion and removal of plug **34** and to the sensing of a predetermined excessive current condition to cause actuation of the switch contacts **108** and **116**. All of the advantages previously noted with respect to the embodiment of FIGS. **2–5** apply equally with respect to the embodiment of FIGS. **6–9** and will not be repeated for the sake of brevity. However, it should be recalled that both embodiments of the condition responsive receptacle of the present invention are simple in design, economical in manufacture and effective in the provision of a conventional-like receptacle responsive to a plurality of sensed conditions.

Inasmuch as the present invention is subject to many variations, modifications and changes in detail, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An electrical receptacle comprising

a housing,

slots in said housing adapted to receive the prongs of an electrical plug,

contact means in said slots adapted to be connected with a source of electricity and engaging the prongs of the plug when inserted into said slots,

at least one of said slots extending completely through said housing,

switch means on said housing including a pair of switch contacts relatively movable between open and closed states and an actuating arm extending into said one slot from the rear of said housing and being movable by the removal and insertion of the plug prongs from said slots to change the state of said switch contacts, and

sensing means on said housing including a bimetal carrying one of said switch contacts to change the state of said switch contact pair in response to the occurrence of a predetermined thermal condition whereby said switch means is responsive both to plug insertion and removal and to said predetermined thermal condition.

2. The invention as recited in claim **1** wherein said actuating arm is electrically insulated and movable in a direction parallel to the elongate axis of said one slot.

3. The invention as recited in claim **1** further including alarm means on said housing, said alarm means and said switch contacts being connected in series across said contact means.

4. The invention as recited in claim **1** wherein said switch contacts assume an open state upon movement of said actuating arm in response to insertion of the plug into said slots, and wherein said switch contacts assume a closed state either upon movement of said actuating arm in response to removal of the plug from said slots or upon the heating of said sensing means above a predetermined temperature.

5. The invention as recited in claim **1** wherein said actuating arm is mounted for selective engagement with said bimetal.

6. The invention as recited in claim **1** wherein said sensing means is responsive to a predetermined thermal condition due to excess electrical current flow and is connected in series with said contact means, and said series combination is adapted to be connected with the source of electricity.

7. The invention as recited in claim **6** wherein said sensing means includes a resistive winding in heat transfer relationship with said bimetal.

8. The invention as recited in claim **7** wherein said bimetal is a snap-acting type and said actuating arm engages said bimetal to reset said bimetal from an operative position in response to removal of the plug from said slots.

9. The invention as recited in claim **7** wherein said switch contacts assume a closed state upon movement of said actuating arm in response to insertion of the plug into said slots, and wherein said switch contacts assume an open state either upon movement of said actuating arm in response to removal of the plug from said slots or upon heating of said bimetal above a predetermined temperature due to excess current flow through said resistive winding.

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