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(54) LOCKING ELECTRICAL RECEPTACLE

(57) A method and apparatus ('utility') for securing an electrical connection formed by a mating structure including prongs of a male assembly (50) and receptacles of a female assembly (20) are provided. The utility includes a clamping mechanism (40) whereby the very focus that would otherwise tend to pull the connection apart serve to actuate the clamping mechanism (40), thereby securing the mated pair. The apparatus may be integrated into a standard receptacle, or retrofitted to work with existing devices. In one embodiment, the clamping mechanism (40) acts solely on the ground prong (54) of the standard male assembly (50), so that it is unnecessary to consider electrical potentials applied to the clamped prong (54) in relation to the design of the clamping mechanism (40). Further, the withdrawing movement of the prong (54) of the male assembly (50) may be translated into a rotational movement of a portion of the clamping mechanism (40) into an abutting relationship with the clamped prong (54).

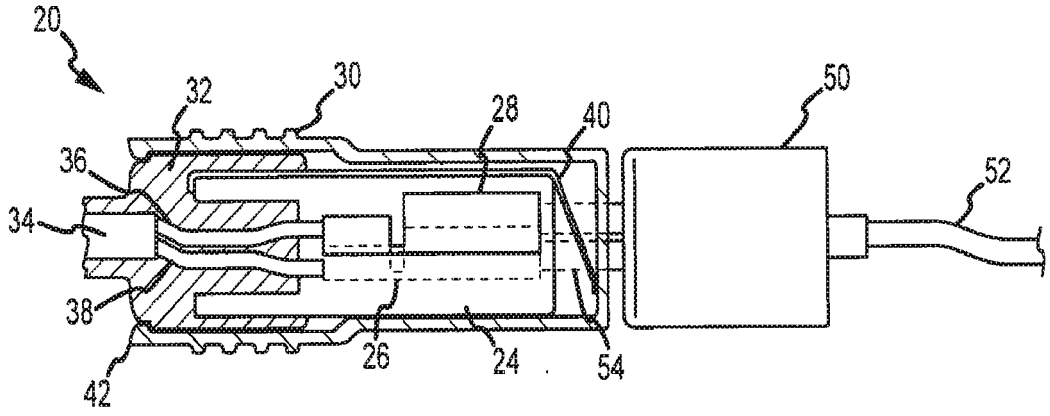

FIG.3B

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority under 35 U.S.C. 119 to U.S. Provisional Application No. 60/894,849, entitled: "LOCKING ELECTRICAL RECEPTACLE," filed on March 14, 2007, the contents of which are incorporated herein as if set forth in full.

BACKGROUND

[0002] A wide variety of electrical connectors are known to provide electrical contact between power supplies and electrical devices. Connectors typically include prong type terminals, generally referred to as plugs, and female connectors designed for receiving the prong type terminals, generally referred to as receptacles, often described as electrical outlets, or simply outlets. The most common types of outlets include a pair of terminal contacts that receive the prongs of a plug that are coupled to "hot" and "neutral" conductors. Further, outlets include a terminal contact that receives a ground prong of a plug.

[0003] The design of aforementioned plug and receptacle system generally incorporates a friction only means of securing the two in the mated position. The frictional coefficient varies depending on a variety of conditions, including, but not limited to, manufacturing processes, foreign materials acting as lubricants, and wear and distortion of the assemblies. This characteristic results in a non-secure means of interconnecting AC power between two devices. It is arguably the weakest link in the power delivery system to electrical or electronic devices utilizing the system. However, it has been adopted worldwide as a standard, and is used primarily due to low cost of manufacture, ease of quality control during manufacture, and efficient use of space for the power delivery it is intended to perform.

[0004] The primary limitation of this connection technique is simply the friction fit component. In some applications where the continuity of power may be critical, such as data or medical applications, a technique to secure the mated connection may be desirable to improve the reliability. This may especially be true in mechanically active locations, such as where vibration is present, or where external activity may cause the cords attached to the plugs and receptacles to be mechanically deflected or strained in any manner.

[0005] It is against this background that the locking electrical receptacle of the present invention has been developed.

SUMMARY

[0006] The present invention is directed to securing an electrical connection. In some cases, mating plug and socket electrical connections may be the least secure link in the power delivery system. Conventionally, these connections are secured only by means of a friction fit. A number of factors may affect the security of this connection. The present invention provides a clamping mechanism whereby the very forces that would otherwise tend to pull the connection apart serve to actuate the clamping mechanism thereby securing the mated pair. The invention is of simple construction and highly reliable in operation. Moreover, the invention can be implemented simply in connection with new or retrofitted receptacle devices. Thus, the system is compatible with existing plugs and other infrastructure.

[0007] In accordance with one aspect of the present invention, an apparatus is provided for use in securing an electrical connection. The electrical connection is formed by a mating structure including prongs of a male assembly and receptacles of a female assembly (e.g., a cord cap or outlet receptacle) where the connection is broken by withdrawal of the prongs from the receptacles. It is noted that a wall outlet receptacle is female, while cord caps may be either male or female. The apparatus includes a clamping element movable between a clamping configuration, where the clamping element holds the mating structure in a connected state, and a release configuration. An activating element urges the clamping element into the clamping configuration responsive to a force tending to withdraw the prongs from the receptacles. In this manner, a force that would otherwise tend to pull the connection apart will now cause the apparatus of the present invention to clamp the connection in a secure state.

[0008] A variety of structures are possible to implement the noted clamping functionality. Such structure may be associated with the male assembly and/or the female assembly. In one implementation, the apparatus is implemented solely in the female assembly. For example, the clamping element may act on one or more of the prongs of the male assembly. In a particular implementation the clamping element acts on a ground prong, maintained at ground potential, such that it is unnecessary to consider potentials applied to the clamped prong in relation to the design of the clamping element. This also enables or facilitates compatibility with safety body/code regulations.

[0009] As noted above, the clamping element may include a contact surface for contacting one of the prongs in the clamping configuration. In this regard, the activating element may translate movement of the prong in relation to the receptacle into movement of the contact surface into the clamping configuration. For example, movement of the prongs may be translated into rotational movement of the contact surface into an abutting relationship with the clamped prong. The apparatus may further include a release element for moving the clamping element into the release configuration. For example, the release element may be operated by a user by squeezing or sliding an element of the plug housing.

[0010] In accordance with another aspect of the present invention, a method for using a securing device

is provided. The securing device includes a clamping element and an activating element as described above. The user can activate the securing device by inserting the prongs of the male assembly into the receptacles of the female assembly. In this mated arrangement, the electrical connection is secured as described above. The user can further deactivate the securing device by forcing the clamping element into the release configuration, for example, by squeezing the housing of the male assembly. In this manner, the electrical connection can be simply secured and released as desired by the user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Figures 1A-1C illustrate the operation of an embodiment of a clamping mechanism.
Figures 2A-2B illustrate an embodiment of a locking electrical receptacle.
Figures 3A-3B illustrate an application for the locking electrical receptacle shown in Figures 2A-2B.
Figures 4A-4C illustrate an apparatus for providing a locking feature for a standard receptacle.
Figure 5 illustrates an embodiment of a standard duplex locking receptacle.
Figures 6A-6B illustrate an embodiment of a locking receptacle that includes a cam lock.
Figures 7A-7D illustrate an embodiment of a device for locking a mating assembly of a plug and receptacle.
Figures 8A-8B illustrate an embodiment of plug that includes a locking mechanism.
Figures 9A-9B illustrate another embodiment of a plug that includes a locking mechanism.

DETAILED DESCRIPTION

[0012] While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and are herein described in detail. It should be understood, however, that it is not intended to limit the invention to the particular form disclosed, but rather, the invention is to cover all modifications, equivalents, and alternatives falling within the scope and spirit of the invention as defined by the claims.

[0013] Figures 1A-1C illustrate the operation of an embodiment of a clamping mechanism for securing a mated electrical connection that may be included in a locking receptacle of the present invention. In each of the Figures 1A-1C, the bottom portion represents a side view of a prong 16 and a clamping mechanism 12, while the top portion represents a perspective view. Referring first to Figure 1A, the prong 16 of a plug is shown prior to insertion into a receptacle 10. The prong 16 may be a ground prong of a standard plug (e.g., an IEC 320 plug, a NEMA 5-15, or the like) and may be various sizes and shapes. Further, the receptacle 10 may be the ground receptacle of a standard outlet (e.g., a NEMA standard cord cap, an IEC 320 cord cap, or the like) that is operative to receive a standard plug. The receptacle 10 also includes the clamping mechanism 12 that is coupled to a pivot 14. The clamping mechanism 12 includes an aperture that is sized to be slightly larger than the prong 16, such that the prong 16 may only pass through the aperture when the length of the clamping mechanism is substantially perpendicular to the length of the prong 16. That is, the design of the clamping mechanism 12 is such that a simple slide on and capture technique is utilized.

[0014] Figure 1B illustrates the prong 16 when inserted into the receptacle 10. As shown, the prong 16 passes through the aperture in the clamping mechanism 12 and into the receptacle 10, such that the corresponding plug and outlet are in a mated position. The clamping mechanism 12 further may include a stop (not shown) to prevent the clamping mechanism 12 from pivoting during the insertion of the prong 16. In this regard, during insertion of the prong 16, the length of the clamping mechanism 12 will remain substantially perpendicular to the length of the prong 16, which permits the passage of the prong through the aperture of the clamping mechanism 12.

[0015] Figure 1C illustrates the gripping function of the clamping mechanism 12 in reaction to a force on the prong 16 that tends to withdrawal the prong 16 from the receptacle 10. In reaction to a withdrawal of the prong 16, the clamping mechanism 12 angularly deflects (i.e., rotates) about the pivot 14, causing the aperture in the clamping mechanism 12 to grip the prongs 16. Thus, the very force that tends to withdraw the prong 16 from the receptacle acts to actuate the clamping mechanism 12 to engage the prong 16, thereby preventing the withdrawal of the prong 16, and maintaining the electrical connection of the mated assembly. The clamping mechanism 12 may be constructed of any suitable material, including a high strength dielectric with an imbedded metallic gripping tooth. An all-metallic clamping mechanism may also be used if the prong 16 is a ground prong.

[0016] Figures 2A-2B illustrate a cross section of one embodiment of a locking electrical receptacle 20. The receptacle 20 is an IEC type 320 cord cap receptacle that includes a locking mechanism. The receptacle 20 includes an inner contact carrier module 24 that houses contact sockets 26 and 28. Attached to the contact sockets are wires 36 and 38 that extend out of the receptacle 20 though a cord 34. The carrier module 24 may be attached to a cord strain relief 32 that functions to prevent the breaking of the electrical connections when a force is applied to the cord 34. A spring prong retainer 40 is disposed adjacent to a surface of the carrier module 24, and extends across a prong-receiving portion 44 of the receptacle 20. One end of the spring prong retainer 40 bent around the end of the inner contact carrier module 24, which secures it in the assembly. The other end is connected to a lock release grip 22. Similar to the clamp-

ing mechanism 12 shown in Figures 1A-1C, the spring prong retainer 40 includes an aperture sized to permit the passage of the ground prong of a plug into the socket 26. The aperture in the spring prong retainer 40 may be sized to be slightly larger than one prong (e.g., the ground prong) in a standard plug such that the aperture may function as the clamping mechanism for the locking receptacle 20. The operation of the clamping feature of the spring prong retainer 40 is discussed in detail below.

[0017] Figure 2A illustrates the locking receptacle 20 when there is little or no strain on the cord 34. As shown, the portion of the spring prong retainer 40 disposed in the prong-receiving portion 44 of the receptacle 20 is not in a substantially vertical position. Similar to the operation of the clamping mechanism 12 shown in Figures 1A-1C, the apertures of the spring prong retainer 40 in this configuration will allow the prongs of a plug to pass freely into the socket 26 when the prong is inserted. This is due to the unrestricted change of position of the spring prong retainer 40 to the substantially vertical position as the prongs of a plug acts upon it.

[0018] Figure 2B illustrates the locking receptacle 20 when a force is applied to the cord 34 of the receptacle 20 in the opposite direction of the grip release handle 30. This is the "release position" of the receptacle 20 and is shown without the mating prongs for clarity of operation. Actions that initiate this position are illustrated in Figures 3A and 3B.

[0019] Figure 3A illustrates the operation of the locking electrical receptacle 20 shown in Figures 2A-2B. When a prong 54 of a plug 50 first enters the receptacle 20 via an aperture in the lock release grip 22, it encounters the spring prong retainer 40, which is not in the perpendicular orientation at that time. Upon additional insertion, the spring prong retainer 40 is deflected into the perpendicular position by the force applied to it by the prong 54. The prong 54 passes through the aperture in the spring prong retainer 40 and into the contact socket 26, making the electrical connection as required. Upon release of the insertion force, and when no axial strain is applied to the mated plug 50 and receptacle 20, the spring prong retainer 40 is only partially displaced from the perpendicular axis.

[0020] Figure 3B illustrates in an exaggerated manner the condition of applying axial tension to the cord 34 of the receptacle 20. The slight retraction motion pulls on the spring prong retainer 40, thereby increasing the angle of grip and subsequent tightening of the offset angle of the spring prong retainer 40 and prong 54. The receptacle 20 and the plug 50 are then fully locked in this condition. Upon application of axial tension between the release grip handle 30 and the plug 50, the position of the spring prong retainer 40 is returned to the near-perpendicular position as illustrated in Figure 3A, thereby releasing the spring prong retainer 40 from the prong 54. Upon release, the receptacle 20 is easily separated from the plug 50.

[0021] By utilizing a clamping mechanism (e.g., the spring prong retainer 40) that captures the ground prong of the plug 50 only, the safety of the receptacle 20 may be greatly improved. In this regard, the effect of the application of various electrical potentials to clamping mechanism of the assembly is avoided, which may simplify the manufacturing of the receptacle, as well as improve its overall safety.

[0022] Figures 4A-4C illustrate a locking device 60 for providing a locking feature for a standard receptacle. As shown in Figure 4A, the locking device 60 includes a top holding member 62 and a bottom holding member 64 for positioning the locking device 60 onto a standard receptacle. The locking device 60 also includes a portion 66 that couples the holding member 62, 64 in relation to each other to provide a secure attachment to a receptacle. The locking device 60 also includes a clamping mechanism 68 that is coupled to a pivot 70. The operation of the clamping mechanism 68 is similar to that of the clamping mechanism 12 illustrated in figures 1A-1C. The locking device 60 may also include a release mechanism 72 that is operative to enable a user to disengage the clamping mechanism 68 when it is desired to remove a receptacle from a plug.

[0023] Figure 4B illustrates the locking device 60 positioned on to a standard receptacle 80. To facilitate the installation of the locking device 60, the holding members 62 and 64 may be made of an elastic material such that a user may bend them outward and position the device 60 onto the receptacle 80. For example, the holding members 62, 64 may be made of plastic. Further, as shown, the holding members 62, 64 are shaped such that once installed onto the receptacle 80, the device 60 is not easily removed without a user deforming the holding members 62, 64. That is, the holding members 62, 64 may be shaped to closely fit onto standard receptacle, such that normal movements will not disengage the device 60 from the plug 80.

[0024] Figure 4C illustrates the operation of the locking device 60 when the receptacle 80 is mated with a standard plug 84. The ground prong 86 of the plug 84 passes through an aperture in the clamping mechanism 68 and into the receptacle 80. If a withdrawing force tending to break the mated connection is applied to either the cord of the standard plug 84 or the cord of the receptacle 80, the clamping mechanism 68 will rotate, causing it to grip the ground to prong of the standard plug 84, thereby maintaining the electrical connection. If the user desires to break the connection, the user may engage to release element 72, which is operative to maintain the clamping mechanism 68 in a substantially perpendicular position relative to the ground prong 86, thereby permitting the prong 86 of the standard plug 84 to be withdrawn from the receptacle 80. It should be appreciated that although one particular embodiment of a locking device 60 has been illustrated, there may be a variety of ways to implement a locking device that may be retrofitted to a standard receptacle that uses the techniques of the present invention.

[0025] Figure 5 illustrates an embodiment of a stand-

ard duplex locking receptacle 100. In this embodiment, clamping mechanisms 112 and 114 are integrated into the receptacle 100. The top portion of the receptacle 100 includes sockets 102, 104 for receiving the prongs 128, 130, respectively, of a standard plug 126. Similarly the bottom portion of the receptacle 100 includes sockets 106, 108 for receiving a second standard plug. The clamping mechanisms 112, 114 are each pivotable about the pivots 116, 118 respectively. Further the receptacle 100 also includes release elements 120, 122 that are operative to permit a user to break the connection when desired. The operation of the clamping mechanism 112, 114 is similar to that in previously described embodiments. That is, in response to a force tending to withdraw the plug 126 from the receptacle 100, the clamping mechanism 112 rotates in the direction of the plug 126, and engages the ground prong 130, preventing the mated connection from being broken. If a user desires to intentionally removed the plug 126 from the receptacle 100, the user may activate the release mechanism 120 and withdraw the plug 126.

[0026] Figures 6A-6B illustrate side views of a receptacle 150 that includes a cam lock 152 for locking the prong 162 of a plug 160 to preserve a mated connection between the receptacle 150 and the plug 160. Figure 6A illustrates the receptacle prior to the insertion of the plug 160, and the cam lock 152 may hang freely from a pivot 153. In this regard, an end of the cam lock 152 is positioned in the opening of the receptacle 150 that is adapted for receiving the prong 162 of the plug 160.

[0027] Figure 6B illustrates the mated connection of the plug 160 and the receptacle 150. As shown, in the mated position the prong 162 has deflected the cam lock 152 about the pivot 153, causing the cam lock 152 to be angled away from the plug 160 and abutted with the prong 162. Thus, when an axial strain is applied to the plug 160 or the receptacle 150, the friction between the cam lock 152 and the prong 162 will tend to force the cam lock 152 downward toward the prong 162, which functions to retain the plug 160 in its mated position. If a user desires to intentionally remove the plug 160 from the receptacle 150, they may press the actuating mechanism 154, which may be operable to rotate the cam lock 152 out of the way of the prong 162, thereby enabling the user to freely withdraw the plug 160 from the receptacle 150. It should be appreciated that the cam lock 152 and the actuating mechanism may be constructed from any suitable materials. In one embodiment, the cam lock 152 is constructed out of metal, and the actuating mechanism 154 is constructed from an insulating material, such as plastic.

[0028] Figures 7A-7D illustrate a device 170 that may be used to secure a mated connection between a plug and a receptacle. As shown, the device 70 includes a top surface 173, a bottom surface 175, and a front surface 171. The three surfaces 171, 173, 175 are generally sized and oriented to fit around the exterior of a standard receptacle 178 at the end of a cord (i.e., a cord cap). The top and bottom surfaces 173 and 175 each include hooks 174 and 176, respectively, that are used for securing the device 170 to the receptacle 178 (shown in Figure 7D). The operation of the hooks 174 and 176 is described herein in reference to Figure 7D, which shows a side view of the device 170 when it is installed around the exterior of the receptacle 178. The hooks 174, 176 may be bent inward towards each other, and wrapped around an end 179 of the receptacle 178 to secure the device 170 to the receptacle 178. The other end of the receptacle 178 (i.e., the end with the openings 181 for receiving the prongs of a plug) may be abutted with the face surface 171 of the device 170.

[0029] The device further includes tabs 172 that are used to securing the prongs of a plug in place. The operation of the tabs 172 is best shown in Figure 7B, which illustrates the device 170 when installed over the prongs 182, 184 of a plug 180. The plug 180 may be any plug that includes prongs, including typical plugs that are disposed in the back of electrical data processing equipment. As shown, when the device 170 is installed by sliding it axially toward the plug 180, the tabs 172 deflect slightly toward the ends of the prongs 182, 184. In this regard, if an axial force that tends to withdraw the device 170 from the plug 180 is applied, the tabs 172 will apply a downward force against the prongs 182, 184. Since the openings in the device 170 are only slightly larger than the prongs 182, 184, this downward force retains the prongs 182, 184 in their position relative to the device 170. Further, because the device 170 may be secured to a standard receptacle as illustrated in Figure 7C, the tabs 172 prevent the connection between the receptacle 178 and the plug 180 from being broken. The device 170 may be constructed of any suitable material. In one embodiment, the device 170 is constructed from a semi-rigid plastic. In this regard, the device 170 may a single use device wherein a user must forcefully withdraw the installed device 170 from the prongs 182, 184 of the plug 180, thereby deforming the plastic and/or breaking the tabs 172. It should be appreciated that if a user desired to unplug the receptacle 178, they may simply unwrap the hooks 174, 176 from the end 179 and separate the mated connection, leaving the device 170 installed on a plug.

[0030] Figures 8A-8B illustrate a plug 190 that includes a locking mechanism prior to insertion into a receptacle 210. As shown in a simplified manner, the receptacle 210 includes recesses 212 and 214. Most standard receptacles include a recess or shoulder inside the openings that are adapted to receive the prongs of a plug. This recess may be present due to manufacturing requirements, such as the molding process used to manufacture the receptacles. Further, the need to include various components (e.g., electrical connections, screws, etc.) in the receptacles may cause the need for the small recesses.

[0031] The plug 190 uses the recess 214 to assist in creating a locking mechanism. As shown, a hollow prong 194 (e.g., the ground prong) of the plug 190 includes a tab 196 that is pivotably attached to an inner portion of

the prong 194. A spring 198 and an actuating mechanism 200 function together to enable the tab 196 to be oriented in a lock configuration (shown in Figures 8A-8B), and a release configuration. In one embodiment, the spring 198 acts to bias the tab 198 in the release position, which may be a substantially horizontal position inside the prong 194. Furthermore, the actuating mechanism 200 may be operable to rotate the tab 196 into the lock position (shown in Figures 8A-8B) where the tab 196 protrudes outside the prong 194 at an angle towards the body of the prong 190. A user may control the actuating mechanism 200 through a control switch 202, which may be positioned on the front of the plug 190.

[0032] Figure 8B illustrates the plug 190 when in a mated position with the receptacle 210. As shown, the tab 196 has been placed in the lock position by the actuating mechanism 200. In this configuration, the tab 196 will resist any axial force that tends to withdraw the plug 190 from the receptacle 210. This is the case because the recess 214 acts as a stop for the tab 196. Therefore, the plug 190 may be securely fastened onto the receptacle 210. When a user desires to remove the plug 190 from the receptacle 210, they may toggle the control switch 202 on the front of the plug 190, which causes the actuating mechanism 200 and the spring 198 to rotate the tab 196 into the release position.

[0033] Figures 9A-9B illustrate another embodiment of a plug 220 that includes a locking mechanism prior to insertion into a receptacle 240. Similar to the plug 190 shown in Figures 8A-8B, the plug 220 may be adapted to work with the standard receptacle 240 that includes recesses 242 and 244. The plug 220 may include a hairpin spring 226 that is disposed inside a hollow prong 224 (e.g., the ground prong). In a release position, the ends 227 of the spring 226 are disposed inside of the prong 224 and adjacent to openings in the prong 224. The plug 220 may further include an actuating mechanism 228, couple to a control switch 230 on the front of the plug 220, for biasing the spring 226 into a lock position, where the ends 227 of the spring 226 protrude outside of openings in the prong 224 (see Figure 9B).

[0034] Figure 9B illustrates the plug 220 when installed into the standard plug 240. As shown, the actuating mechanism 228 has been moved axially toward the spring 226, causing the ends 227 to spread apart and out of the openings in the prong 224. The openings of the prong 224 are aligned with the recesses 242 and 244 such that the ends of the spring 226 are disposed in the recesses 242 and 244 when in the lock position. Thus, as can be appreciated, when an axial force that tends to withdraw the plug 220 from the receptacle 240 is applied, the ends 227 of the spring 226 are pressed against the recesses 242 and 244, which prohibits the prong 224 from being removed from the receptacle 240. When a user desires to remove the plug 220 from the receptacle 240, they may operate the control switch 230 which causes the actuating mechanism to axially withdraw from the spring 226. In turn, this causes the ends 227 of the spring 226 to recede back into the prong 224, such that the user may then easily remove the plug 220 from the receptacle 240.

[0035] The foregoing description of the present invention has been presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the form disclosed herein. Consequently, variations and modifications commensurate with the above teachings, and skill and knowledge of the relevant art, are within the scope of the present invention. The embodiments described hereinabove are further intended to explain best modes known of practicing the invention and to enable others skilled in the art to utilize the invention in such, or other embodiments and with various modifications required by the particular application(s) or use(s) of the present invention. It is intended that the appended claims be construed to include alternative embodiments to the extent permitted by the prior art.

Clauses

[0036]

1. An apparatus for use in securing an electrical connection, said electrical connection being formed by a mating structure including prongs of a male assembly and receptacles of a female assembly, wherein said electrical connection is broken by withdrawal of said prongs from said receptacles, said apparatus comprising:

    a clamping element moveable between a clamping configuration and a release configuration, wherein said clamping element holds said mating structure in a connected state in said clamping configuration; and
    an activating element for urging said clamping element into said clamping configuration responsive to a force tending to withdraw said prongs from said receptacles.

2. The apparatus of clause 1, wherein said clamping element is operative to exert a clamping force on at least one of said prongs.

3. The apparatus in clause 1, wherein said clamping element is operative to exert a clamping force on a ground prong maintained at ground potential.

4. The apparatus in clause 1, wherein said activating element urges said clamping element into said clamping configuration responsive to withdrawing movement of said prongs, said withdrawing movement being smaller than required to break said connection.

5. The apparatus of clause 4, wherein said clamping

element includes a contact surface for contacting one of said prongs in said clamping configuration, and said activating element is operative to translate said withdrawing movement of said prongs into movement of said contact surface.

6. The apparatus of clause 5, wherein said activating element translates said withdrawing movement of said prong into movement of said contact surface having a component transverse to said movement of said prong.

7. The apparatus of clause 5, wherein said activating element translates said withdrawing movement of said prong into rotational movement of said contact surface.

8. The apparatus of clause 1, further comprising a release element for moving said clamping element into said release configuration.

9. The apparatus of clause 8, wherein said release element is adapted for operation by a user so as to break said connection when desired.

10. The apparatus of clause 9, wherein said release element is operated by movement in substantially the same direction as withdrawing movement of said prongs.

11. The apparatus of clause 1, wherein said apparatus is integrated into a standard receptacle.

12. The apparatus of clause 1, wherein said apparatus is integrated into a standard duplex receptacle.

13. The apparatus of clause 1, wherein said apparatus is adapted to fit onto a standard wall receptacle.

14. The apparatus of clause 1, wherein said apparatus is integrated into a standard cord cap receptacle.

15. The apparatus of clause 1, wherein said apparatus is adapted to fit onto a standard cord cap receptacle.

15. A method for use in securing an electrical connection, said electrical connection being formed by a mating structure including prongs of a male assembly and receptacles of a female assembly, wherein said connection is broken by withdrawal of said prongs from said receptacles, comprising the steps of:

providing a securing device including a clamping element, moveable between a clamping configuration, wherein said clamping element holds said mating structure in a connected state, and a release configuration, and an activating element, for urging said clamping element into said clamping configuration responsive to a force tending to withdraw said prongs from said receptacles; and

activating said securing device by inserting said prongs into said receptacles.

16. The method as set forth in clause 15, further comprising the step of deactivating said securing device by forcing said clamping element into said release configuration and breaking said connection by withdrawing said prongs from said receptacles.

17. The method as set forth in clause 16, wherein said step of deactivating includes pulling said securing device in substantially the same direction as said withdrawal of said prongs.

18. The method as set forth in clause 15, wherein said clamping element is operative to exert a clamping force on at least one of said prongs.

19. The method as set forth in clause 15, wherein said clamping element is operative to exert a clamping force on a ground prong maintained at ground potential.

20. The method as set forth in clause 15, wherein said clamping element includes a contact surface for contacting one of said prongs in said clamping configuration, and said activating element is operative to translate said withdrawing movement of said prongs into movement of said contact surface.

21. The method as set forth in clause 20, wherein said activating element translates said withdrawing movement of said prong into movement of said contact surface having a component transverse to said movement of said prong.

22. The method as set forth in clause 20, wherein said activating element translates said withdrawing movement of said prong into rotational movement of said contact surface.

23. The method as set forth in clause 15, further comprising a release element for moving said clamping element into said release configuration.

24. The method as set forth in clause 15, wherein said release element is adapted for operation by a user so as to break said connection when desired.

25. The method as set forth in clause 15, wherein said release element is operated by movement in substantially the same direction as withdrawing

movement of said prongs.

26. The method as set forth in clause 15, wherein said apparatus is integrated into a standard receptacle.

27. The method as set forth in clause 15, wherein said apparatus is integrated into a standard duplex receptacle.

28. The method as set forth in clause 15, wherein said apparatus is adapted to fit onto a standard receptacle.

29. An apparatus for use in securing an electrical connection, said electrical connection being formed by a mating structure including prongs of a male assembly and receptacles of a female assembly, wherein said electrical connection is broken by withdrawal of said prongs from said receptacles, said apparatus comprising:

a locking element positioned inside a housing of said female assembly and extending into a receptacle of said female assembly, said locking element being pivotable between a locking configuration and a release configuration, wherein said locking element holds said mating structure in a connected state in said locking configuration; and
an activating element for urging said locking element into said locking configuration responsive to a force tending to withdraw said prongs from said receptacles, wherein said activating element comprises friction between said locking element and a prong of said male assembly.

30. The apparatus as set forth in clause 29, further comprising a release element that is adapted to pivot said locking element from said locking configuration to said release configuration.

31. The apparatus as set forth in clause 29, wherein said locking element comprises metal.

32. An apparatus for use in securing an electrical connection, said electrical connection being formed by a mating structure including prongs of a male assembly and receptacles of a female assembly, wherein said electrical connection is broken by withdrawal of said prongs from said receptacles, said apparatus comprising:

a locking element for securing said apparatus to said prongs of a male assembly, said locking element including apertures sized to receive said prongs, and at least one tab disposed adjacent to at least one of said apertures, wherein said at least one tab is adapted to exert a force on said prongs responsive to a force tending to withdraw said prongs from said apparatus; and
a coupling element, attached to said locking element, for selectively coupling said apparatus to said standard female assembly.

33. A male assembly for use in securing an electrical connection, said electrical connection being formed by a mating structure including prongs of said male assembly and receptacles of a female assembly, wherein said electrical connection is broken by withdrawal of said prongs from said receptacles, said male assembly comprising:

a prong that includes a locking element in a hollow portion of said prong, said locking element being selectively positionable between a locking configuration and a release configuration, wherein a portion of said locking element protrudes outside of said prong when in said locking configuration and said portion is disposed inside of said prong in said release configuration; and
a control mechanism for selectively positioning said locking element into said locking configuration and said release configuration;
wherein said locking element is adapted to secure an electrical connection between said male assembly and said female assembly by contacting a portion of said female assembly in response to a force tending to withdraw said male assembly from said female assembly.

34. The male assembly as set forth in clause 32, wherein said locking element comprises a tab that is rotatable between said locking configuration and said release configuration.

35. The male assembly as set forth in clause 32, wherein said locking element comprises a hairpin spring.

Claims

1. An apparatus for use in securing an electrical connection, said electrical connection being formed by a mating structure including prongs of a male assembly and receptacles of a female assembly, wherein said electrical connection is broken by withdrawal of said prongs from said receptacles, said apparatus comprising:

a first housing portion of said female assembly, said first housing portion housing at least a first receptacle having an end at a stationary first front surface of said first housing portion said stationary first front surface having an opening

formed therein in alignment with said first receptacle such that a prong can be inserted into said first receptacle via said opening;
a clamping element including first and second clamping surfaces moveable between a clamping configuration wherein said first and second clamping surfaces clamp on first and second opposite sides respectively, of one of said prongs of said male assembly, and a release configuration;
wherein said clamping element holds said mating structure in a connected state in said clamping configuration, and a withdrawal force tending to withdraw said prongs from said receptacles causes angular deflection of said clamping element such that said withdrawal force concomitantly urges said first clamping surface against said first side of said prong and urges said second clamping surface against said second side of said prong; and
a release element extending from said first front surface at a location spaced from said opening such that said release element is accessible by a user when said male and female assemblies are in a connected state;
wherein said release element is moveable in relation to said first front surface portion relative to an axis of said first receptacle between a clamping configuration and a release configuration and said mating structure is secured in a connected state in said clamping configuration.

2. The apparatus of claim 1, wherein said clamping element comprises a deflectable plate.

3. The apparatus in claim 1, wherein said clamping element is operative to exert a clamping force on a ground prong maintained at ground potential.

4. An apparatus as set forth in claim 1, wherein said release element includes a user activation element that extends from said front surface.

5. A method for use in securing an electrical connection, said electrical connection being formed by a mating structure including prongs of a male assembly and receptacles of a female assembly, wherein said electrical connection is broken by withdrawal of said prongs from said receptacles, said method comprising:

1) providing a receptacle unit, comprising:

a) a first housing portion of said female assembly, said first housing portion housing at least a first receptacle having an end at a stationary first front surface of said first housing portion said stationary first front surface having an opening formed therein in alignment with said first receptacle such that a prong can be inserted into said first receptacle via said opening;
b) a clamping element including first and second clamping surfaces moveable between a clamping configuration wherein said first and second clamping surfaces clamp on first and second opposite sides respectively, of one of said prongs of said male assembly, and a release configuration, wherein said clamping element holds said mating structure in a connected state in said clamping configuration, and a withdrawal force tending to withdraw said prongs from said receptacles causes angular deflection of said clamping element such that said withdrawal force concomitantly urges said first clamping surface against said first side of said prong and urges said second clamping surface against said second side of said prong; and
c) a release element extending from said first front surface at a location spaced from said opening such that said release element is accessible by a user when said male and female assemblies are in a connected state, wherein said release element is moveable in relation to said first front surface portion relative to an axis of said first receptacle between a clamping configuration and a release configuration and said mating structure is secured in a connected state in said clamping configuration;

2) plugging said male assembly into said receptacle unit, wherein said male assembly is locked in said connected state by said clamping element of said receptacle; and
3) operating said release element to remove said male assembly from said receptacle unit.

6. The method of claim 5, wherein said clamping element comprises a deflectable plate and said operating comprises moving said deflectable plate

7. The apparatus in claim 5, wherein said clamping element is operative to exert a clamping force on a ground prong maintained at ground potential.

8. An apparatus as set forth in claim 5, wherein said release element includes a user activation element that extends from said front surface and said operating comprises moving said activation element relative to said front surface.

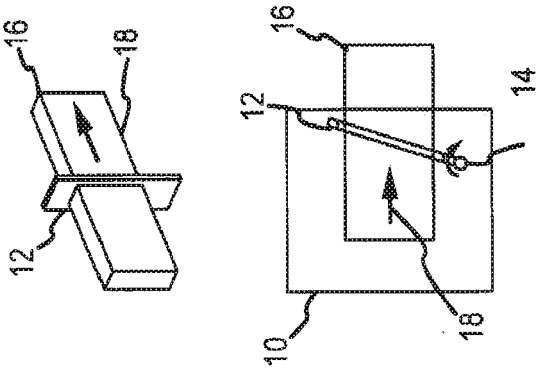

FIG.1C

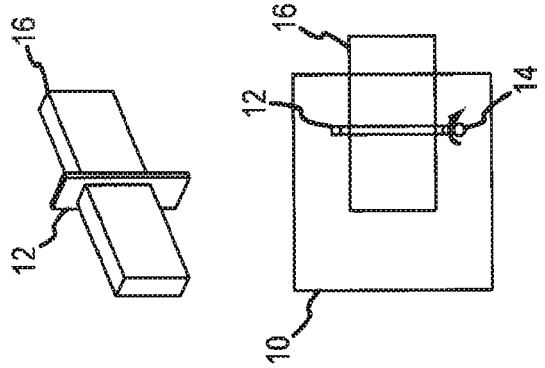

FIG.1B

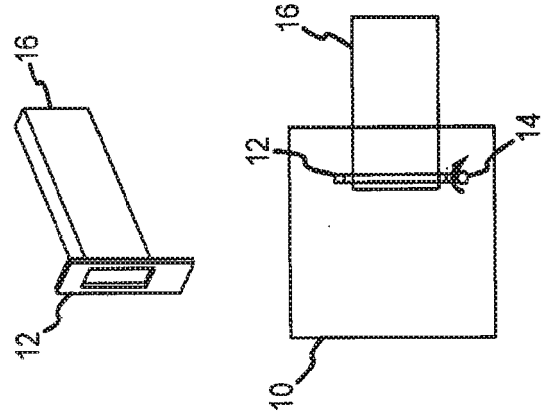

FIG.1A

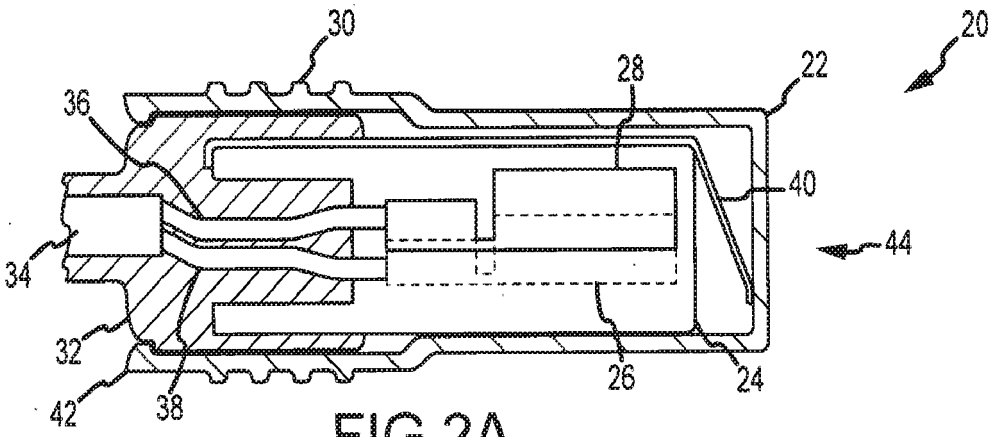
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FIG.2A

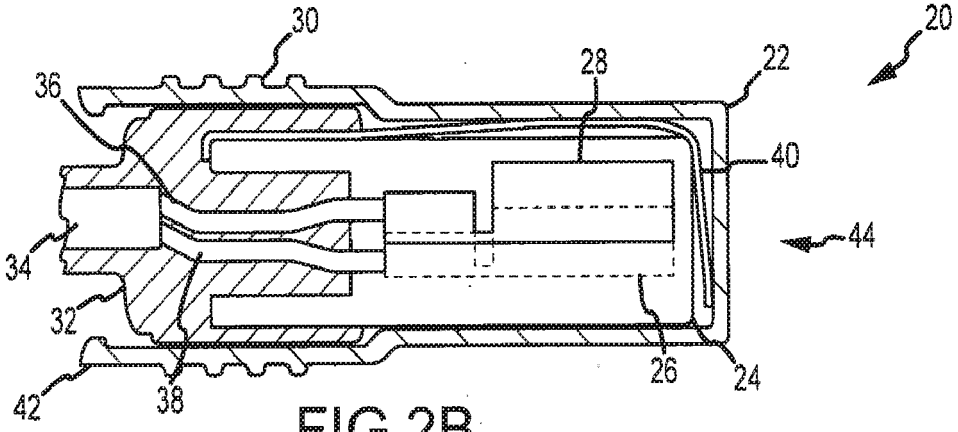
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FIG.2B

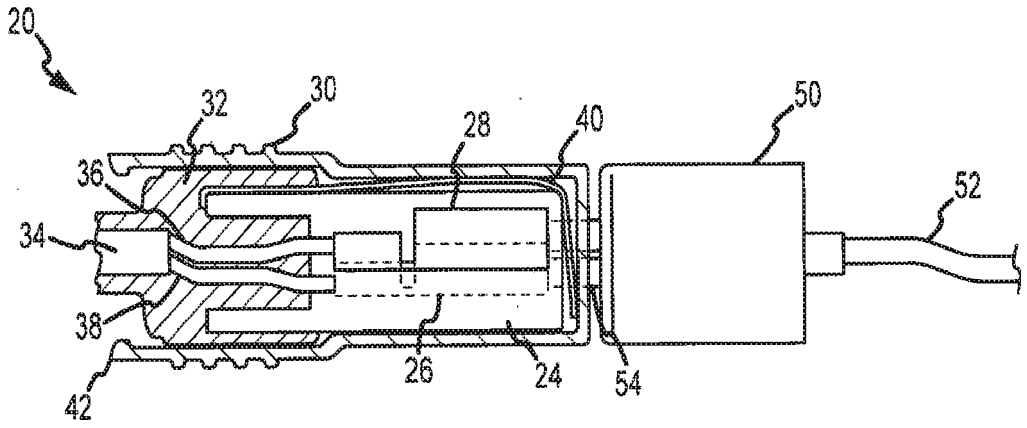
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FIG.3A

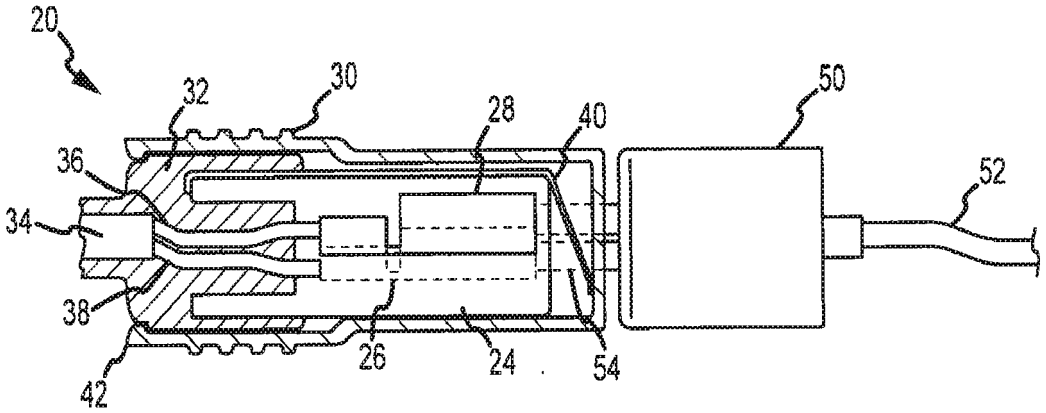
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FIG.3B

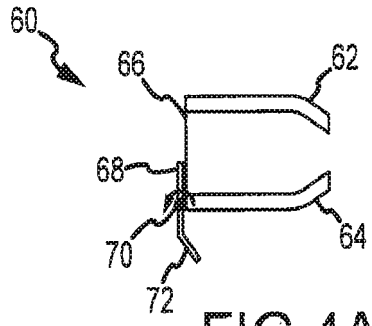

FIG.4A

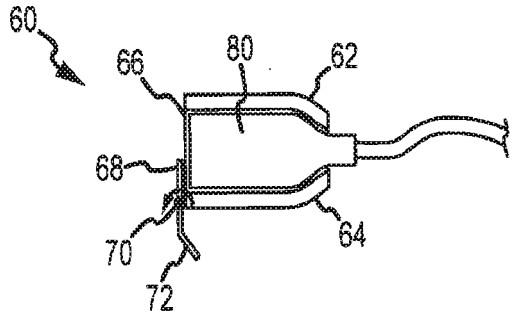

FIG.4B

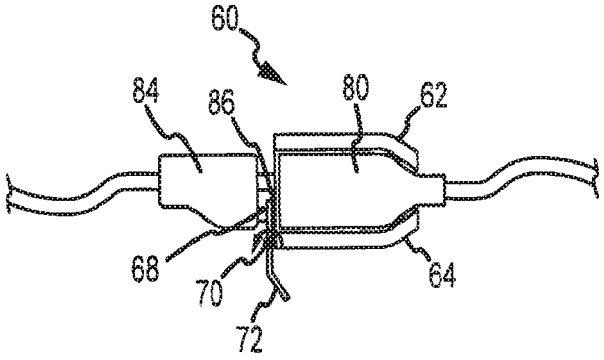

FIG.4C

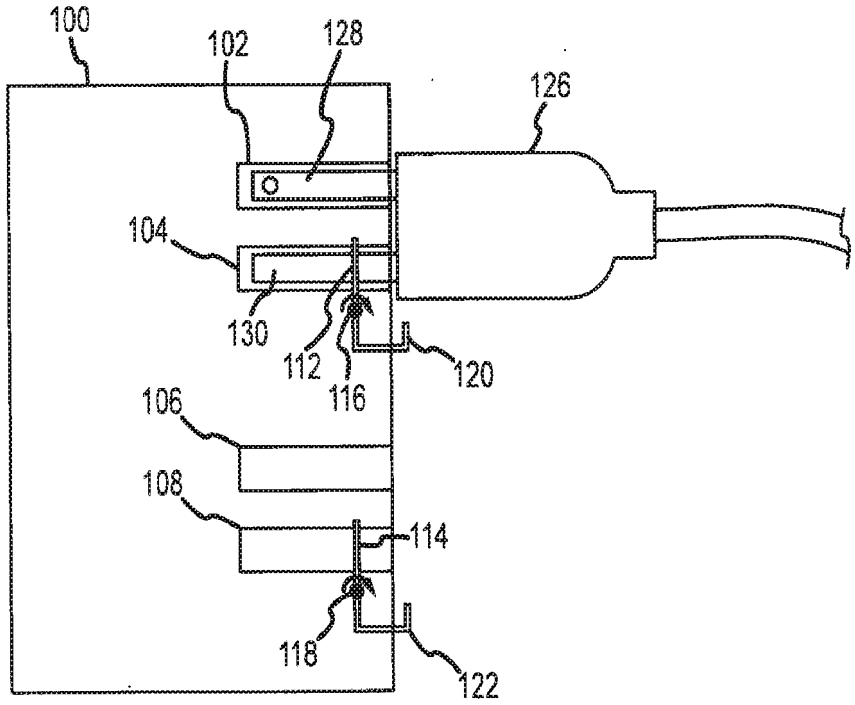

FIG.5

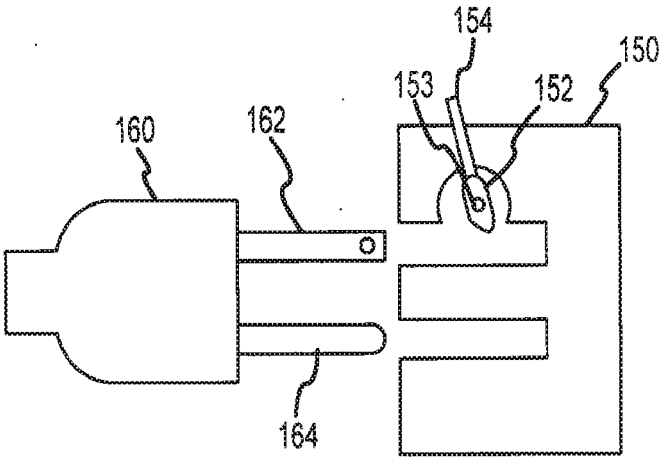

FIG.6A

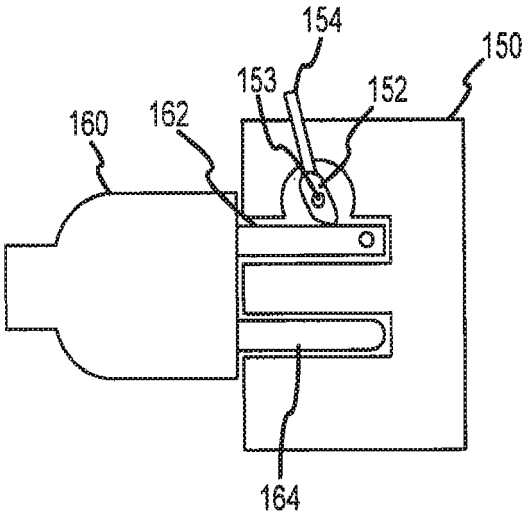

FIG.6B

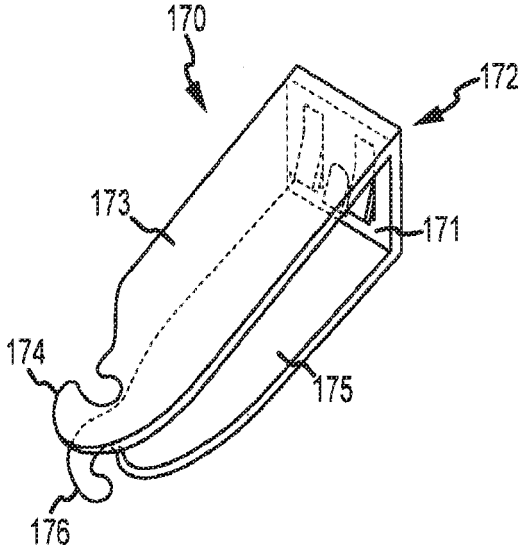

FIG.7A

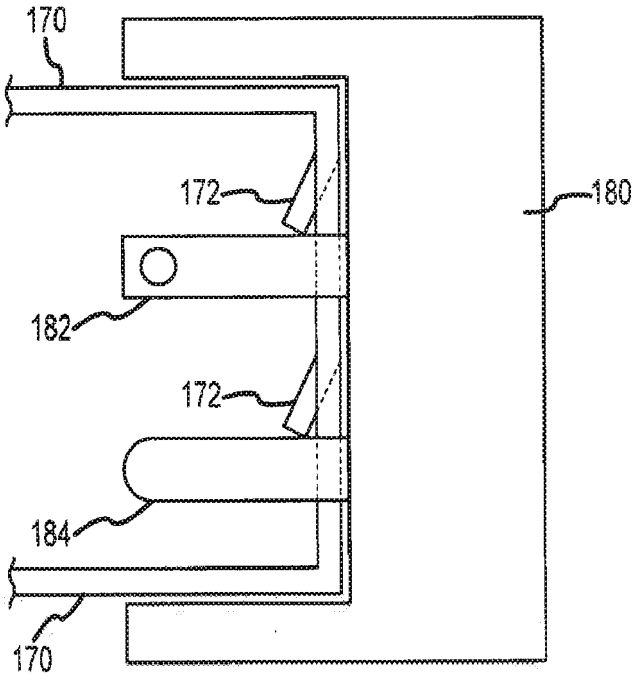

FIG.7B

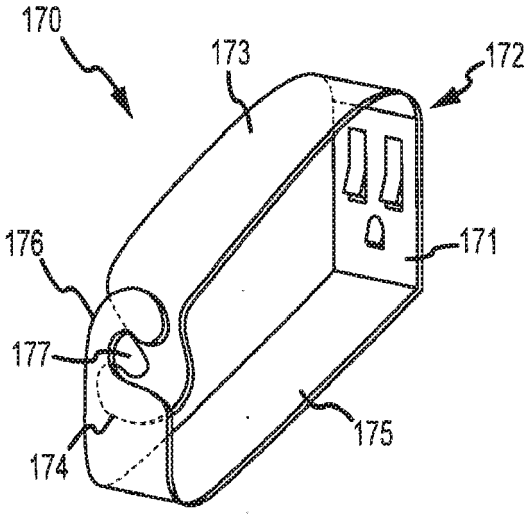

FIG.7C

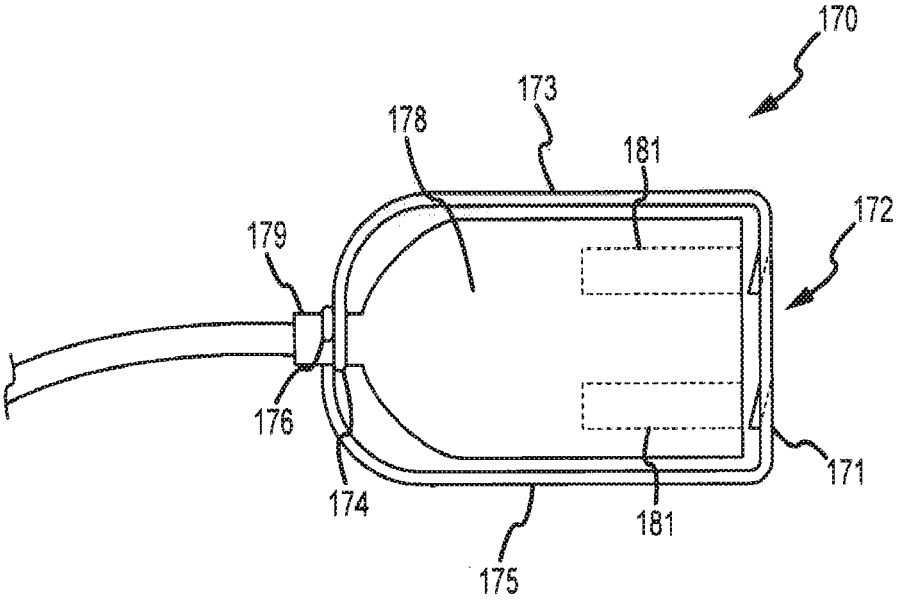

FIG.7D

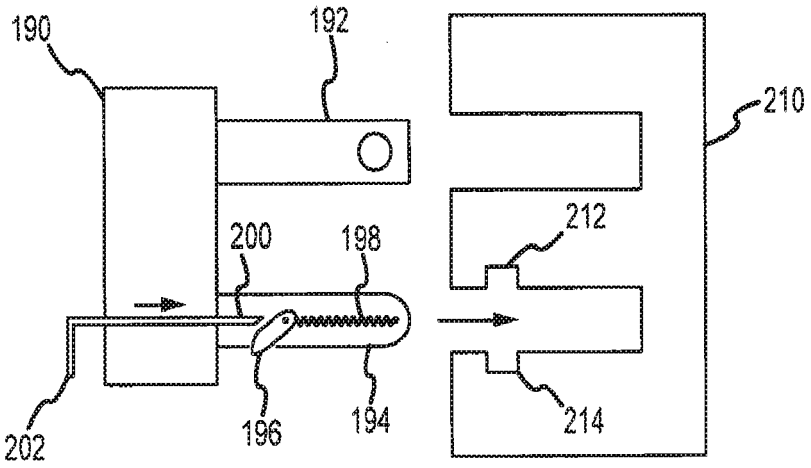
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FIG.8A

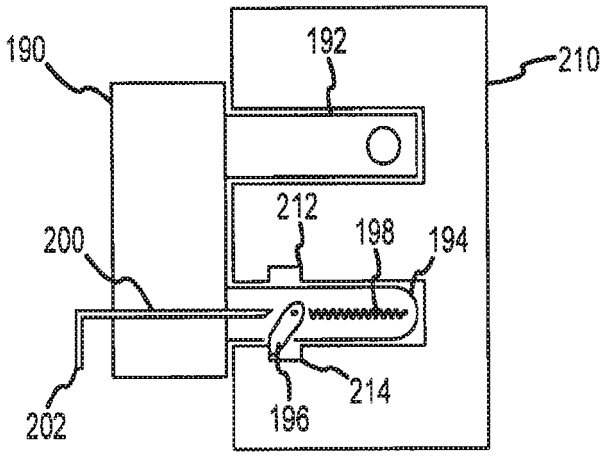
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FIG.8B

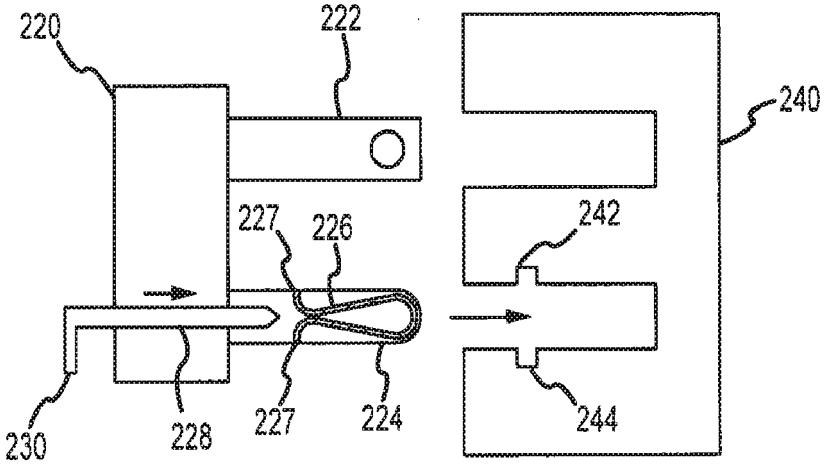
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FIG.9A

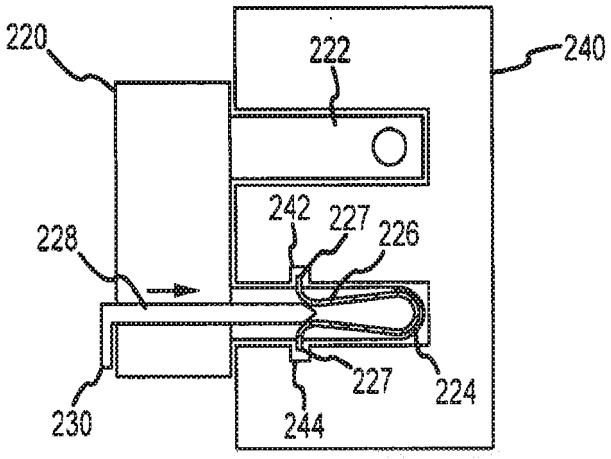
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FIG.9B

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 0632

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 383 202 A (RATCLIFFE ANTHONY BROTHERTON [GB]; GEN DISTRIB LTD [GB]) 18 June 2003 (2003-06-18) * abstract * * page 8, line 1 - page 9, line 27 * * figures 1-5b * -----	1-8	INV. H01R13/639 H01R43/26 H01R13/20 ADD. H01R103/00

TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 August 2019	Pugliese, Sandro

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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